

Brain Code Camp week 2

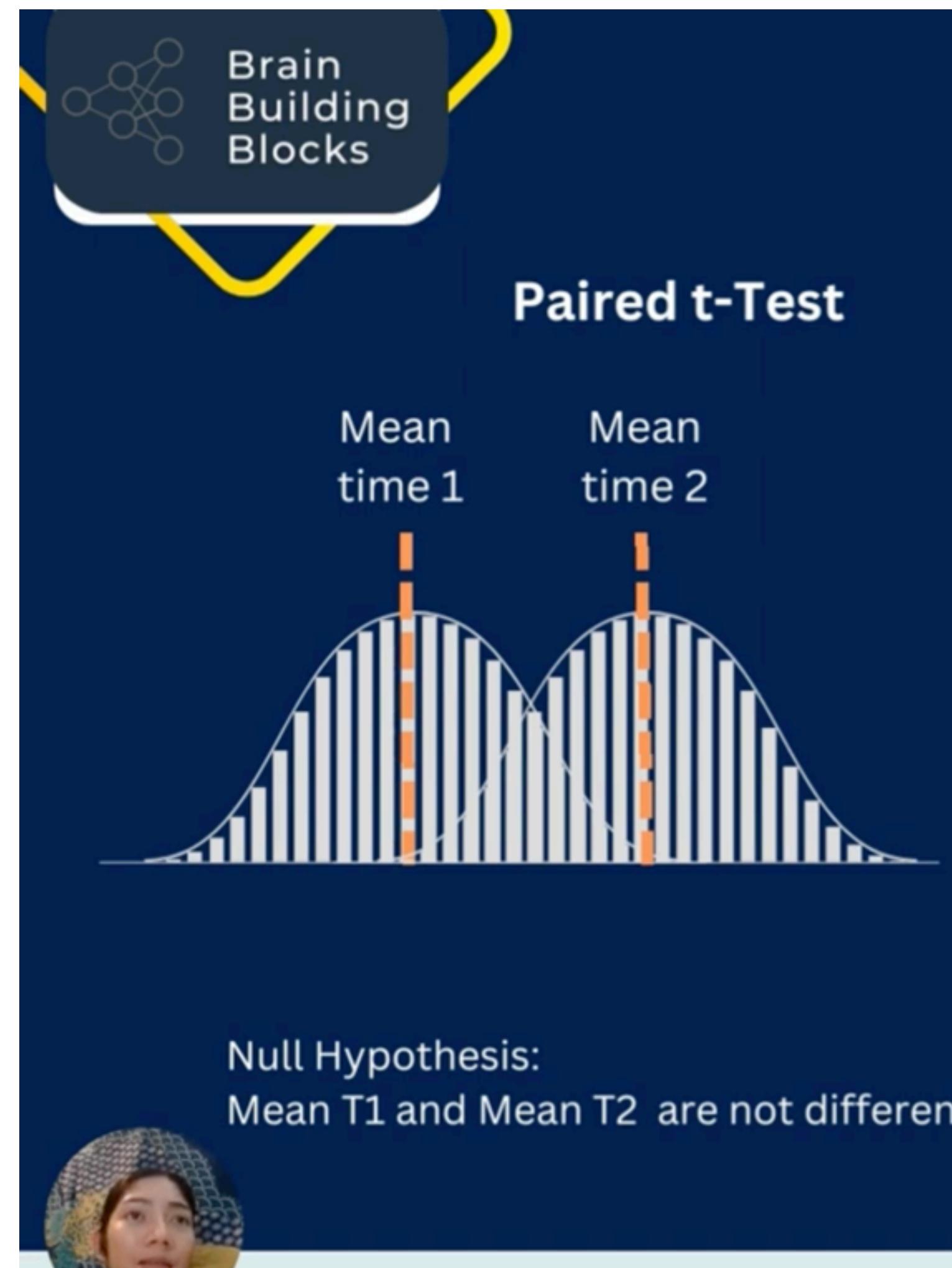
Prerequisites &

Project Idea Exploration

Prerequisites

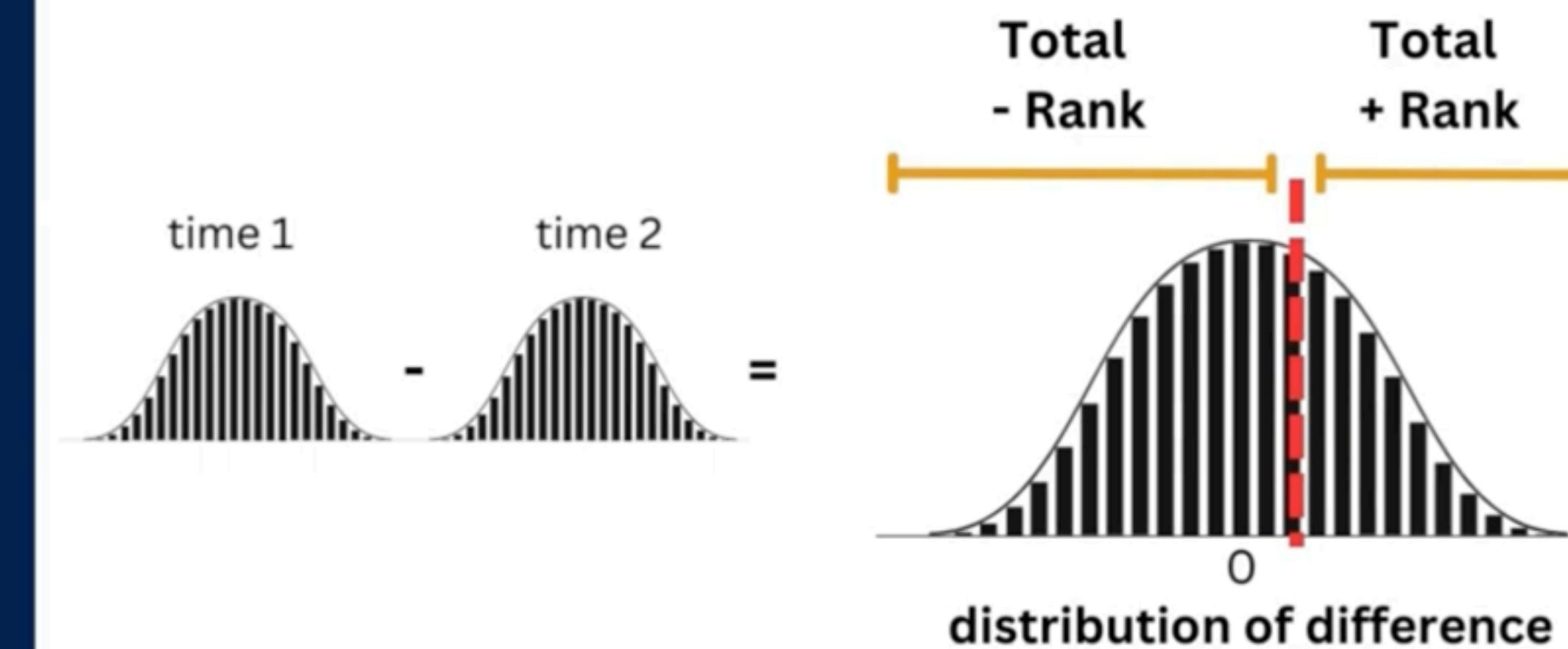
- Non parametric statistics *
- Data preprocessing and preparation *
- Data visualization *
- Special technique: Dimensionality reduction, RL, DL

Non parametric statistics



Two Related-Samples Analysis

Wilcoxon Sign-ranked Test



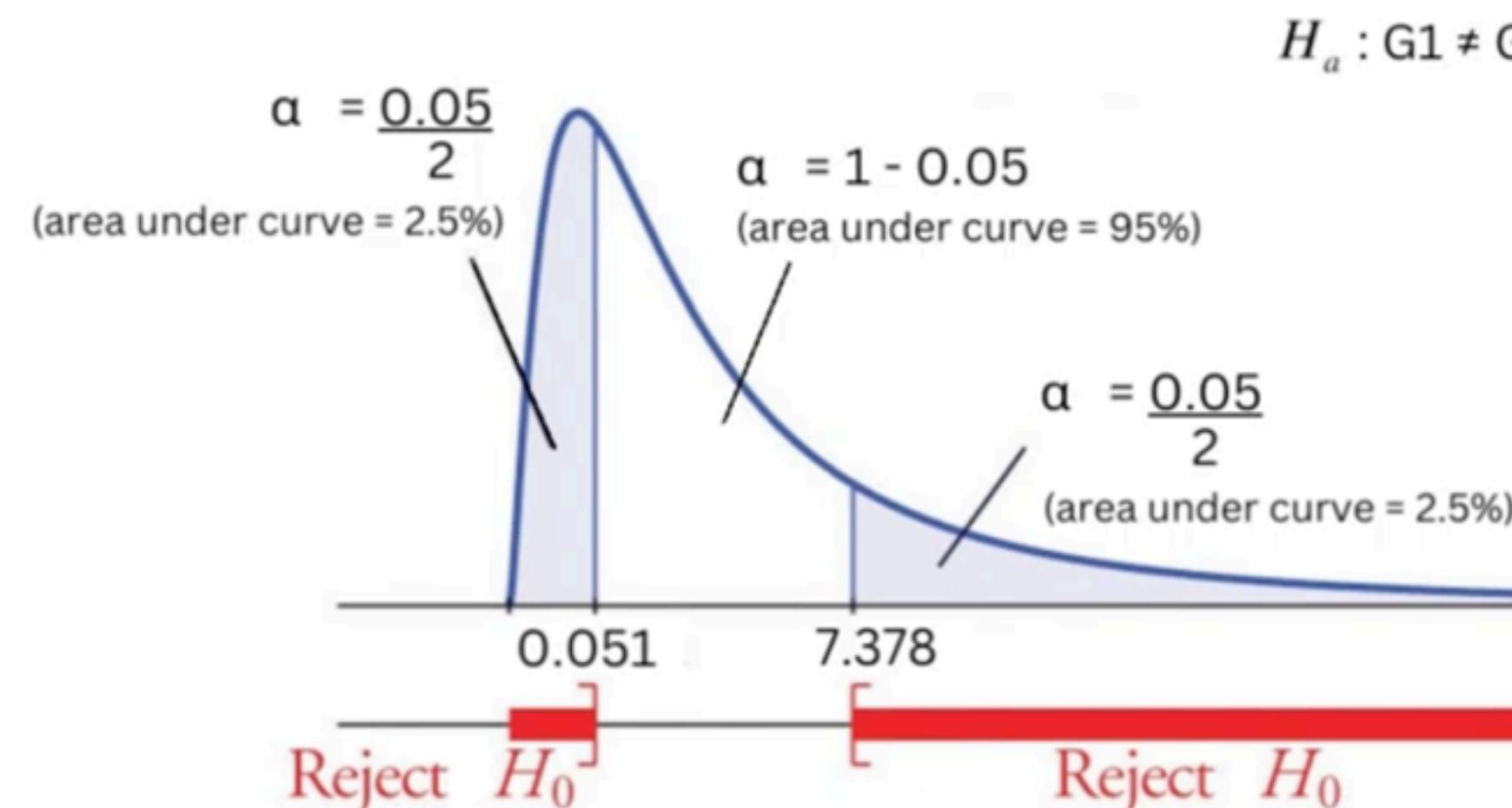
Null Hypothesis: Sum of positive & negative ranks are not different

Non parametric statistics



> Two Related-Samples Analysis

Degrees of Freedom (df)	Chi-Square (χ^2) Distribution Area to the Right of Critical Value									
	0.995	0.99	0.975	0.95	0.90	0.10	0.05	0.025	0.01	0.005
1	—	—	0.001	0.004	0.016	2.706	3.841	5.024	6.635	7.879
2	0.010	0.020	0.051	0.103	0.211	4.605	5.991	7.378	9.210	10.597
3	0.072	0.115	0.216	0.352	0.584	6.251	7.815	9.348	11.345	12.838
4	0.207	0.297	0.484	0.711	1.064	7.779	9.488	11.143	13.277	14.860



Saylor Academy, 2012



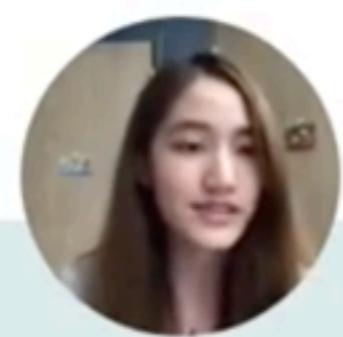
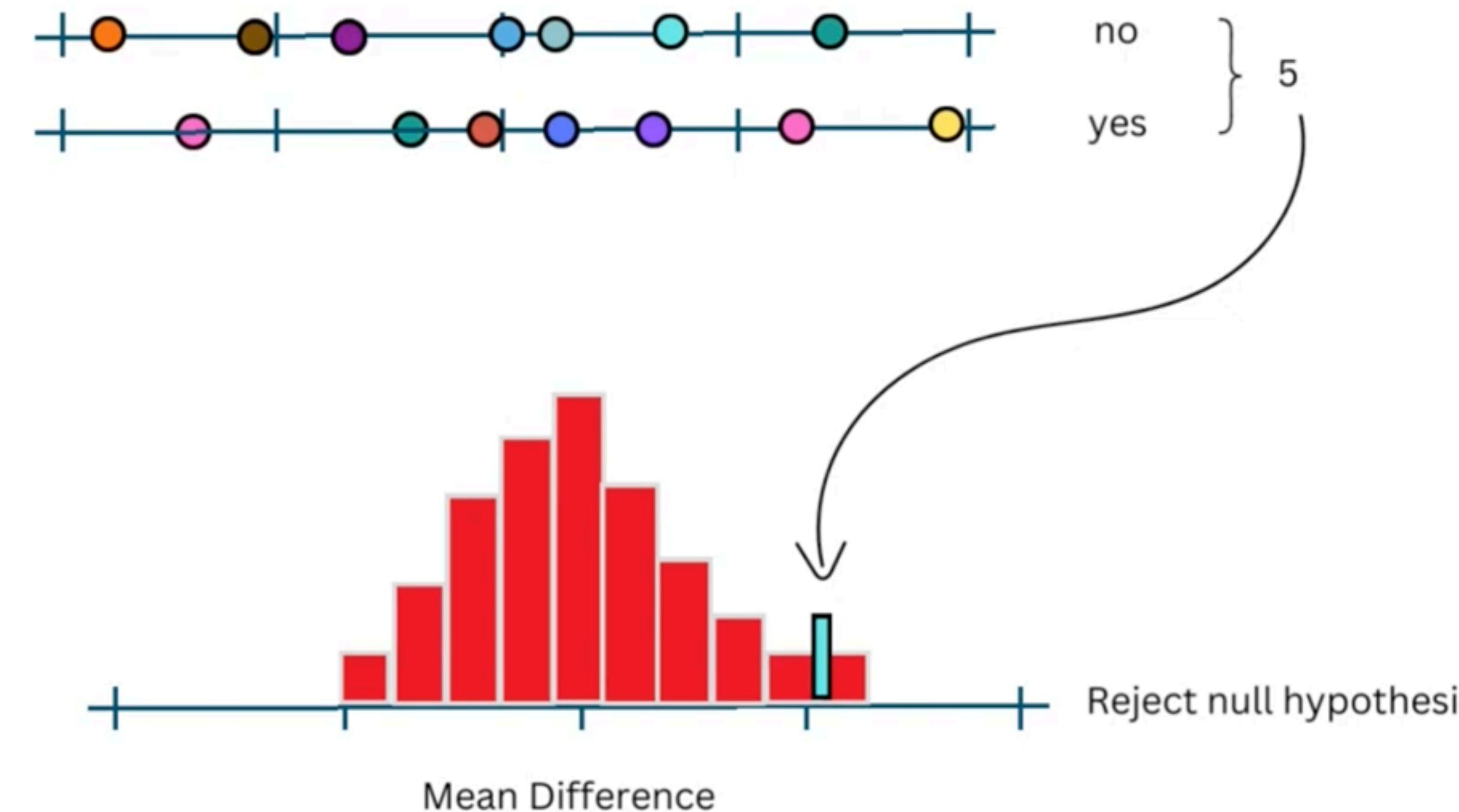
Speaker: Anantaporn Sena

Module : Non-Parametric Statistical Tests

Non parametric statistics



Permutation

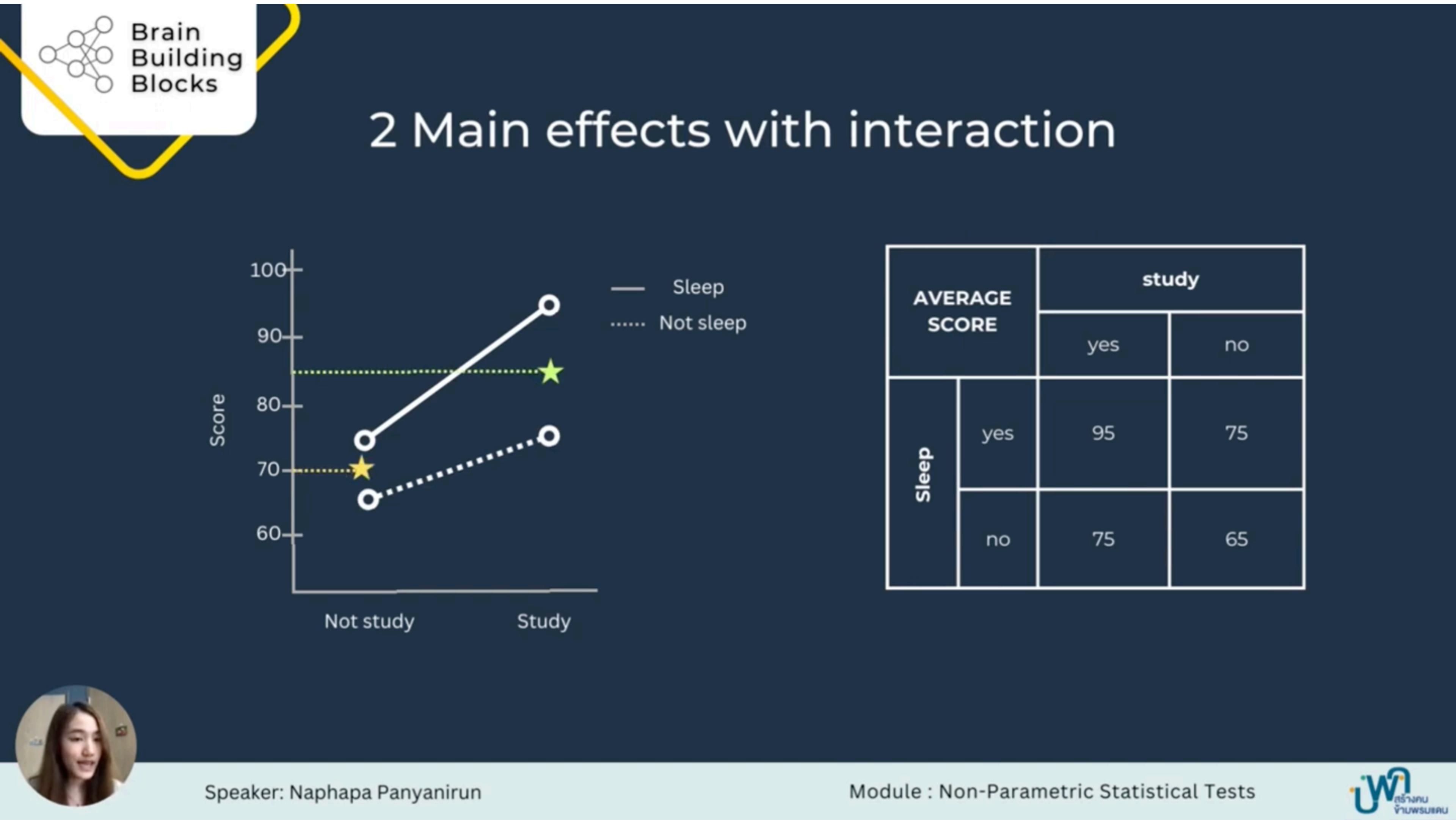


Speaker: Naphapa Panyanirun

Module : Non-Parametric Statistical Tests



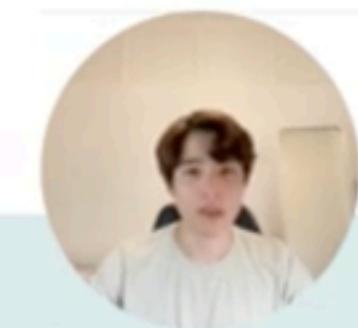
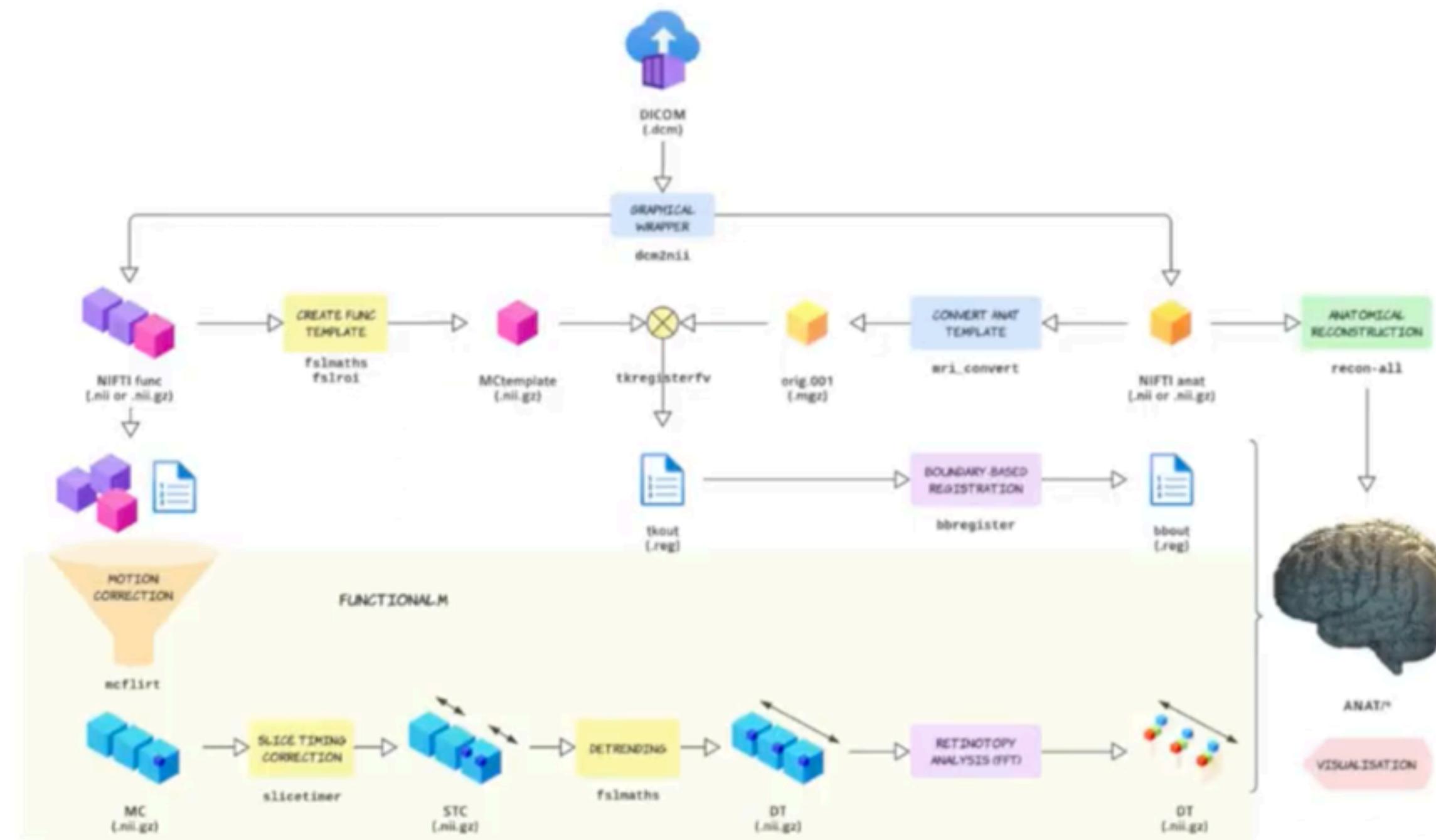
Non parametric statistics



Data preprocess and preparation



Functional pipeline



Speaker: Kanathip Jongmekwamsuk

Prerequisites

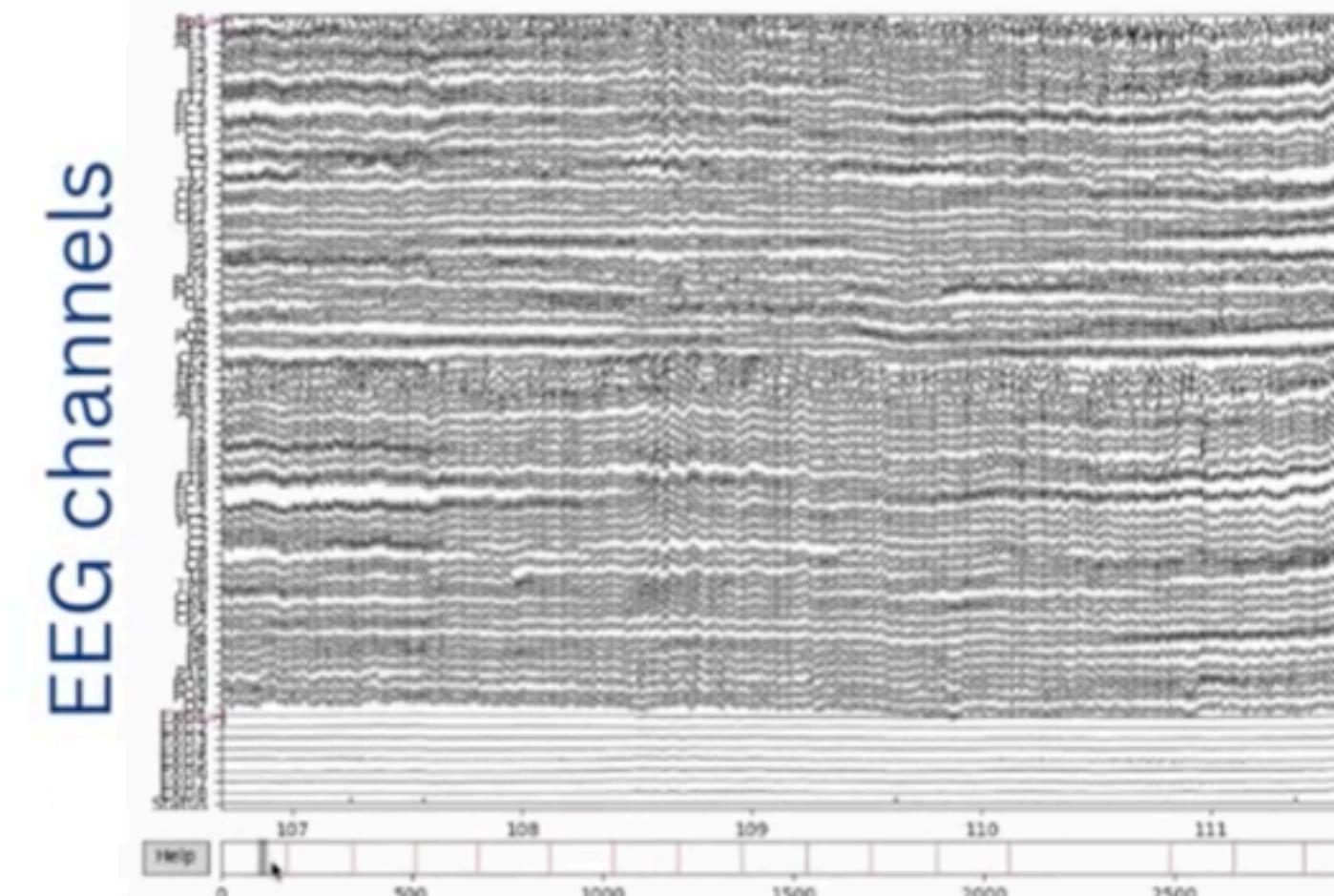
Introduction to fMRI

Data preprocess and preparation

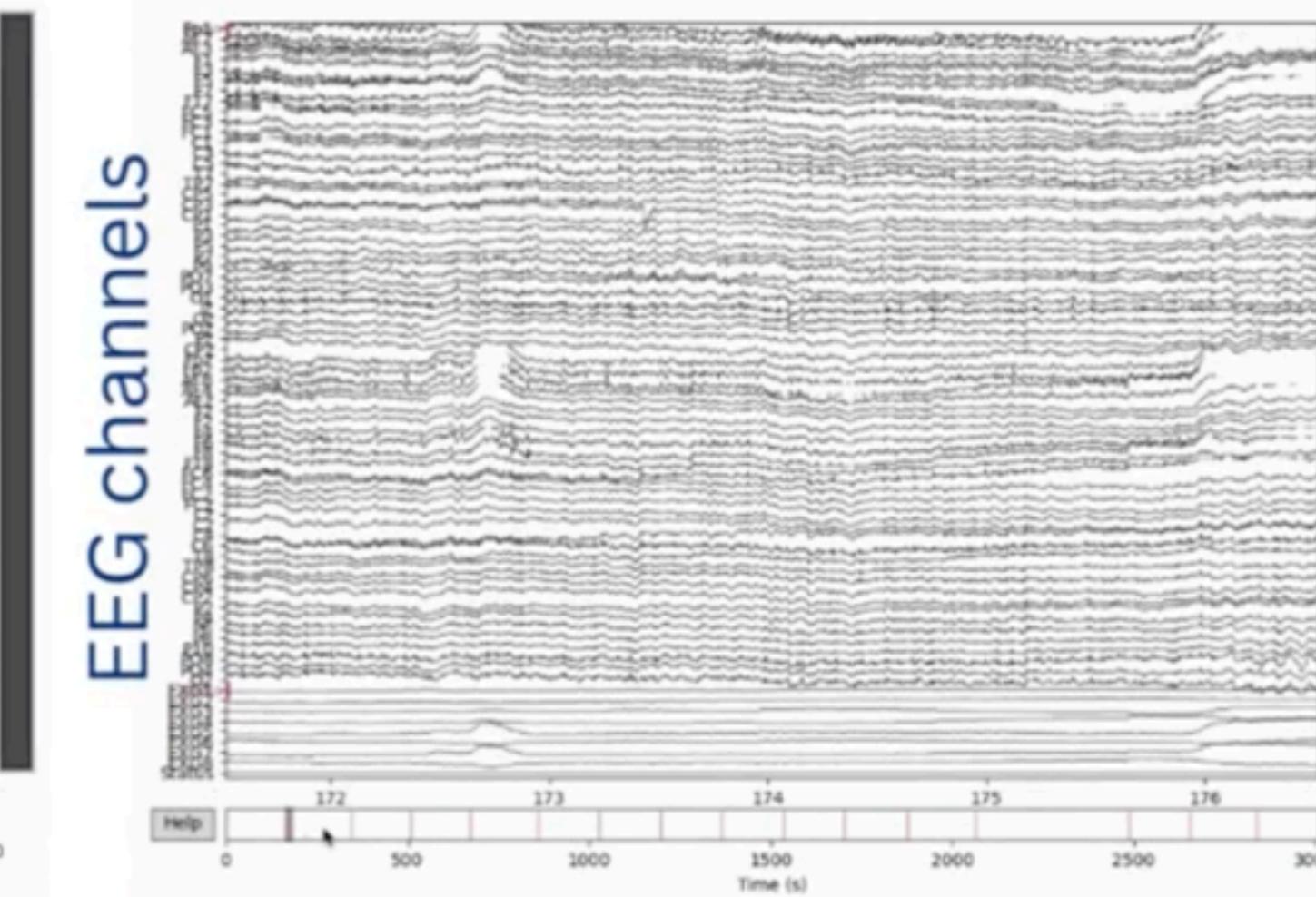


Re-reference

raw



re-reference



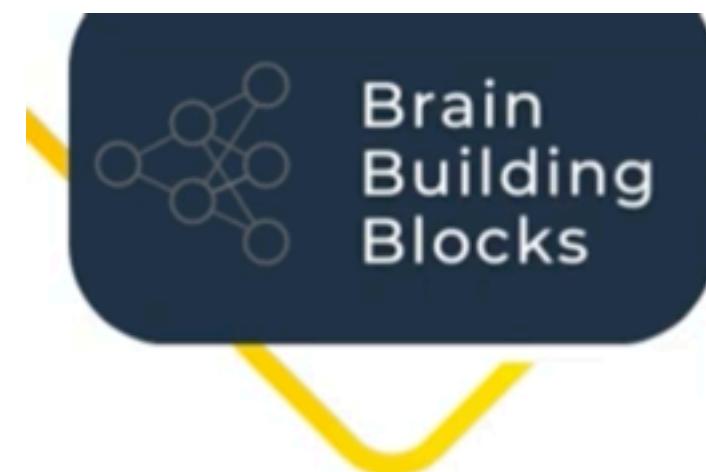
Sirikanya Benjasupawan

Prerequisite

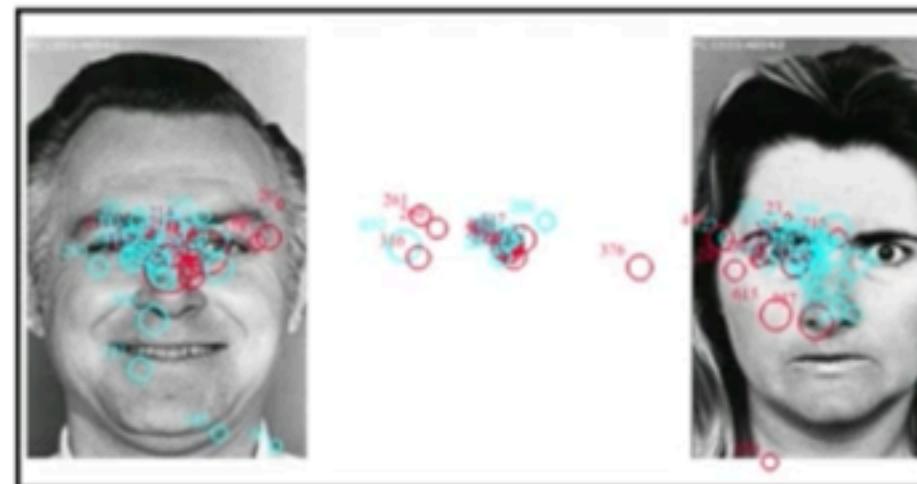
EEG



Data preprocess and preparation



Pre-processing depends on...



Buck did not read the newspapers, or he would have known that trouble was brewing, not alone for himself, but for every tide-water dog, strong of muscle and with warm, long hair, from Puget Sound to San Diego. Because men, groping in the Arctic darkness, had found a yellow metal, and because steamship and transportation companies were booming the find, thousands of men were rushing into the Northland. These men wanted dogs, and the dogs they wanted were heavy dogs, with strong muscles by which to toil, and furry coats to protect them from the frost.

Buck lived at a big house in the sun-kissed Santa Clara Valley. Judge Miller's place, it was called. It stood back from the road, half hidden among the trees, through which glimpses could be caught of the wide cool veranda that ran around its four sides.



Suphasiree Chantavarin

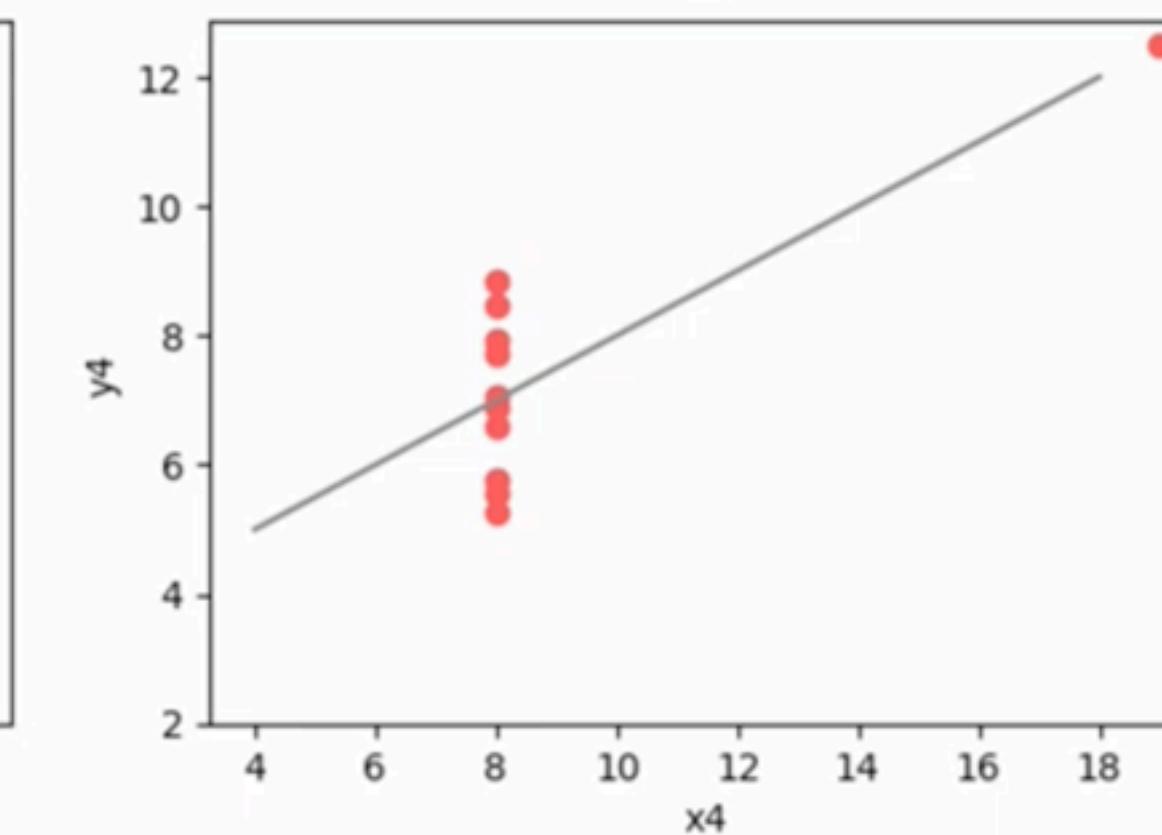
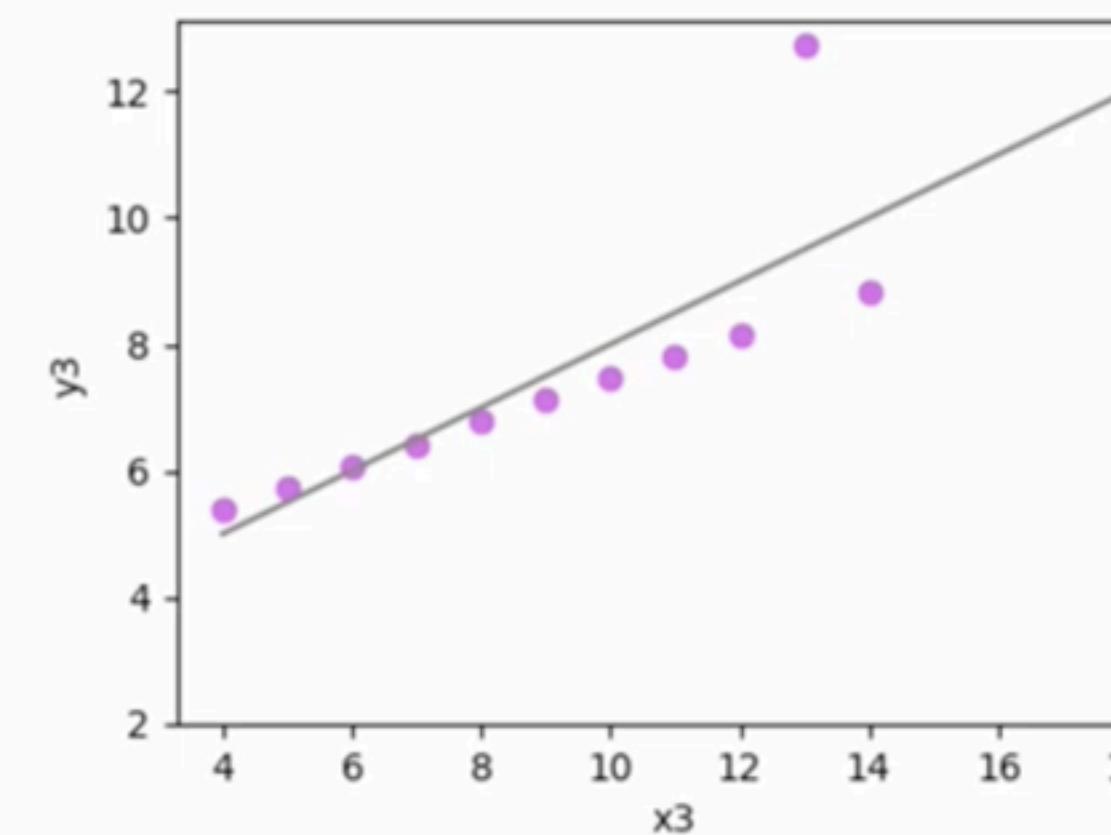
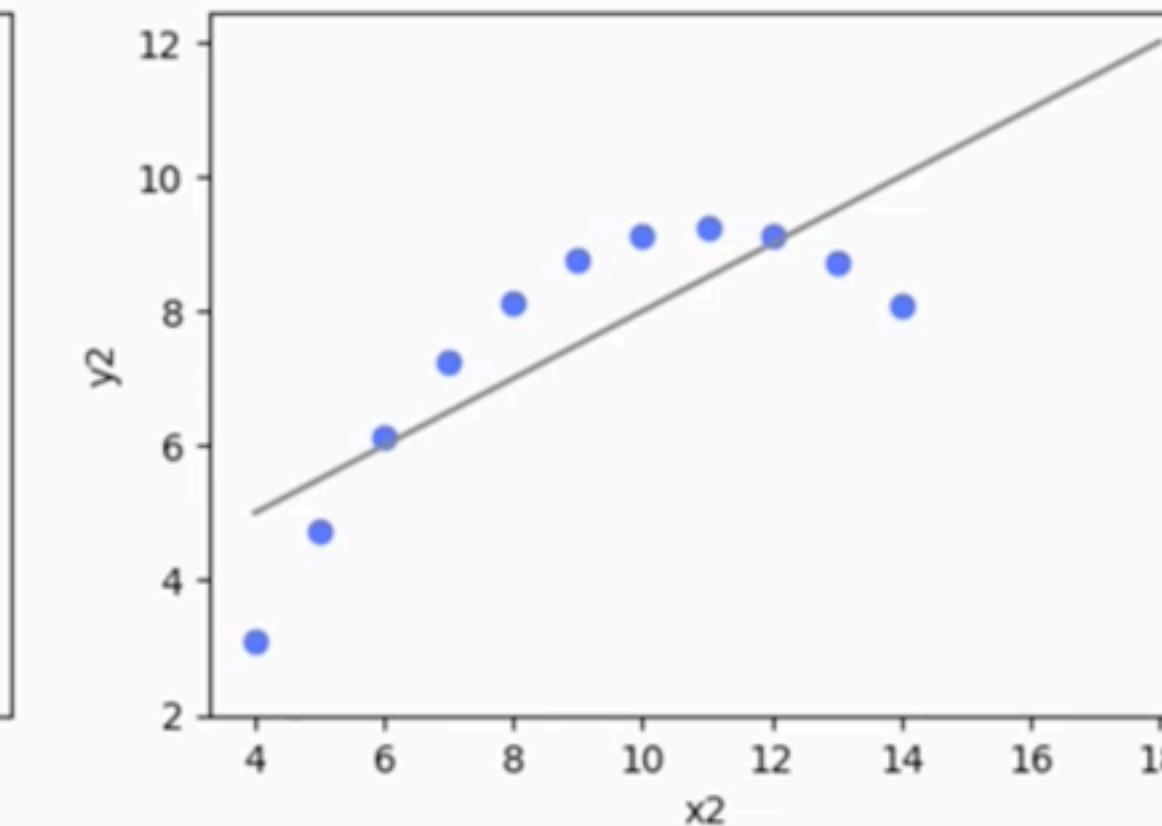
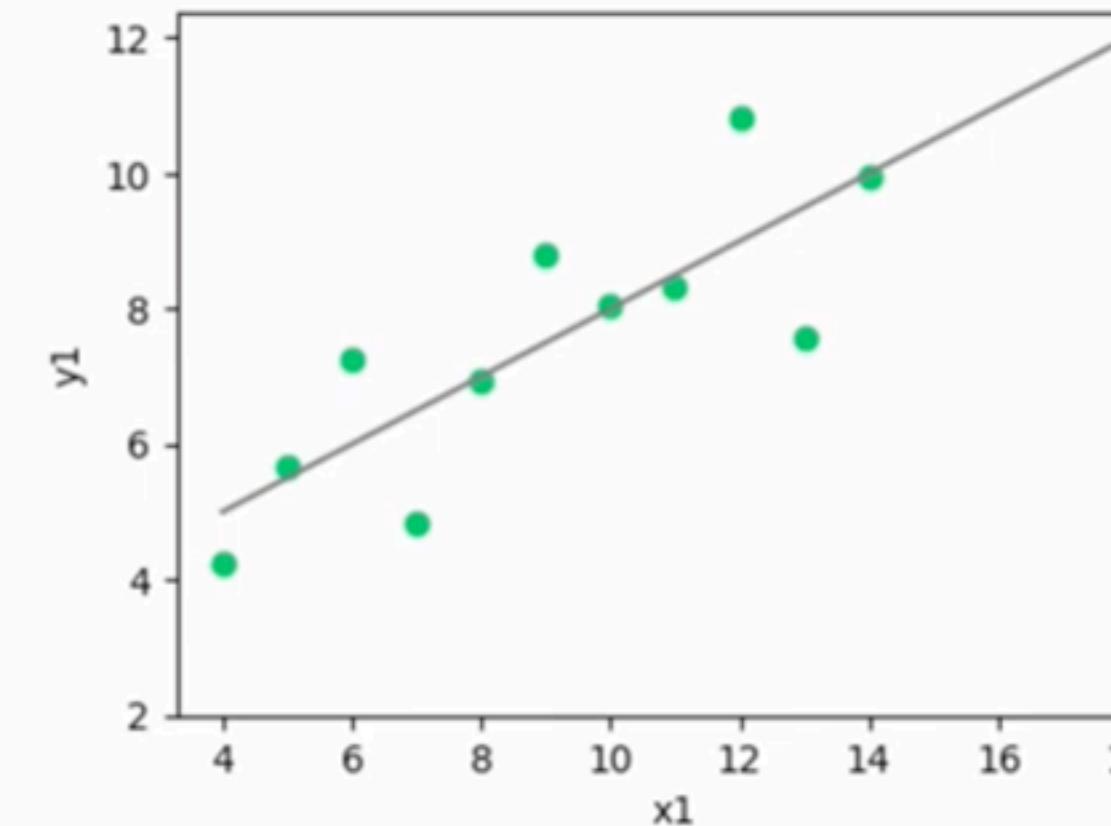
Pre-requisite

Module: Eye tracking



Data visualization

Anscombe's quartet



Language: Python Library: Matplotlib

Anscombe, F. J. (1973). "Graphs in Statistical Analysis." *The American Statistician* 27(1): 17-21.

Speaker: Tanupat Boonchalermvichien, MD.

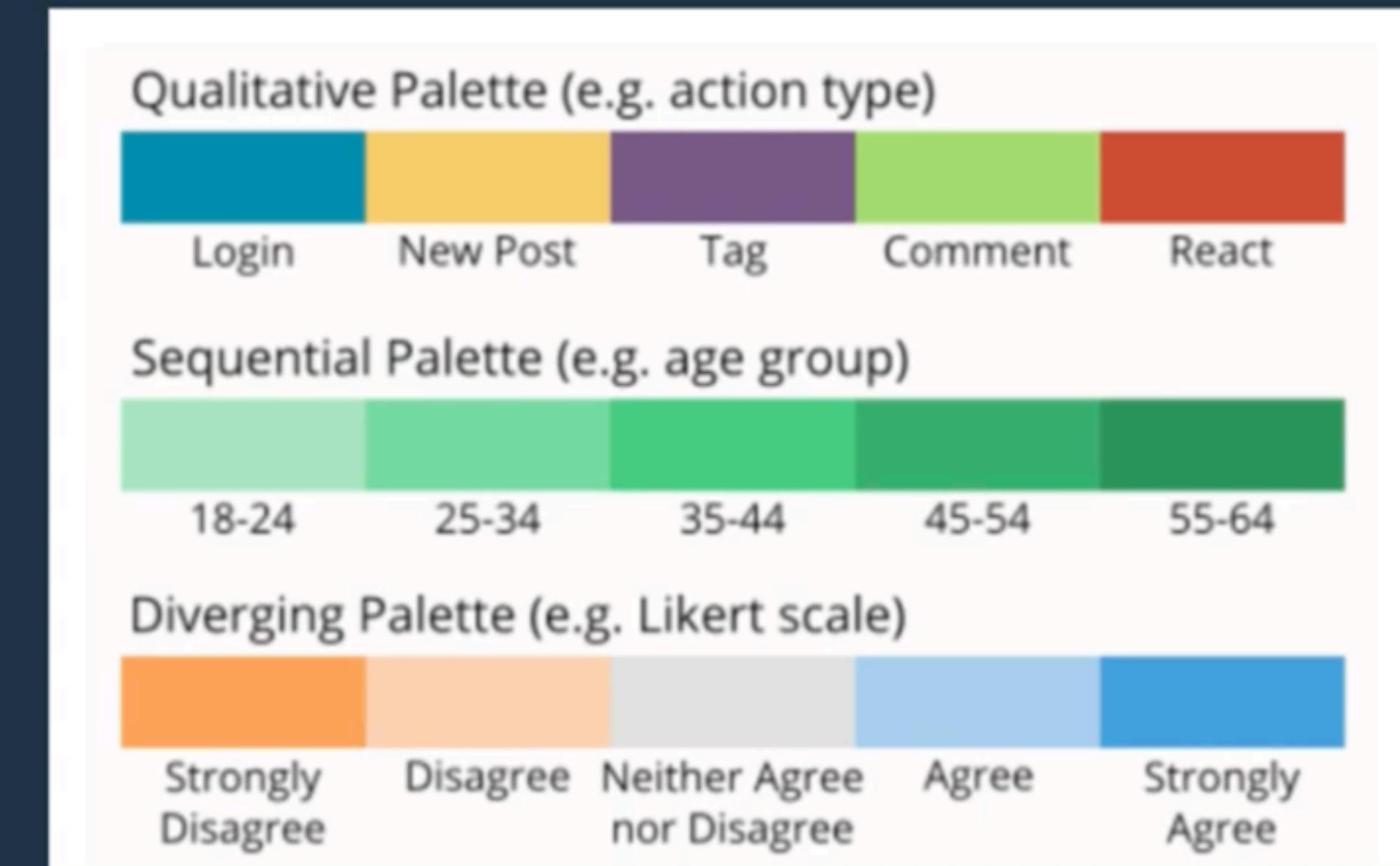
Module : Data Visualization

Why Data Viz?



Data visualization

Color and Contrast



Open datasets

- OpenNeuro (<https://openneuro.org/>)
- Nature Scientific data (<https://www.nature.com/sdata/>)
- Kaggle (<https://www.kaggle.com/>)
- Open Science Foundation (OSF) (<https://osf.io>)
- More...
 - Alzheimer Disease Neuroimaging Initiatives* (ADNI, <https://adni.loni.usc.edu/>)
 - Human Connectome Projects* (<https://db.humanconnectome.org/>)
 - Neurodata without borders (<https://www.nwb.org/>)
 - National Alzheimer's Coordinating Center* (<https://naccdata.org/>)
 - Brain/MINDS DATA PORTAL (<https://dataportal.brainminds.jp/>)
 - Neuroscience Information Framework (<https://neuinfo.org/>)

(*permission needed)

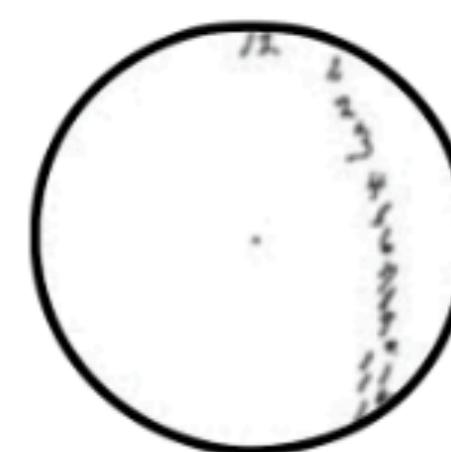
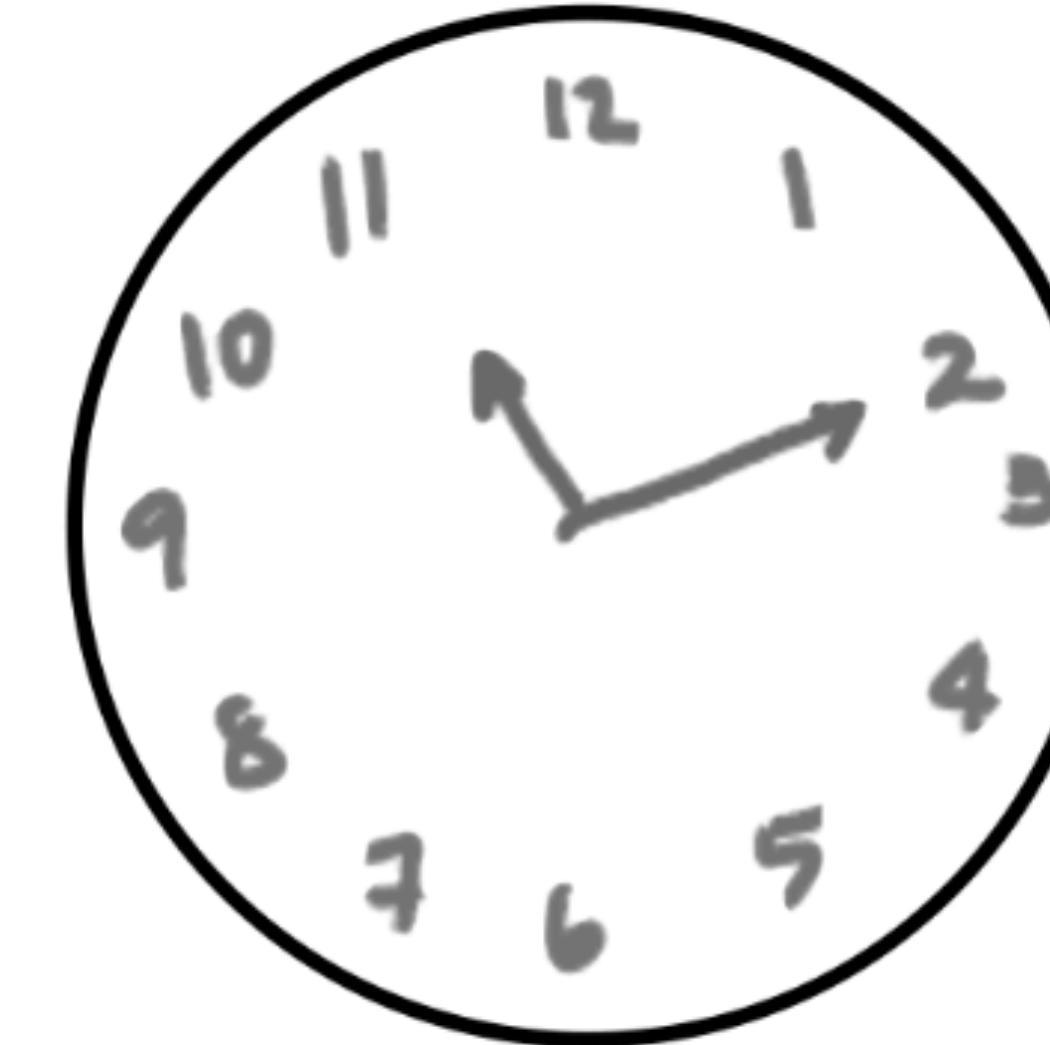
BCC datasets

Medical problem



Project	Data	Concept
Clock_drawing_MCI	time series	Classification, CNN
Clock_drawing_PD	time series	Classification
Parkinson Posture	time series	Classification

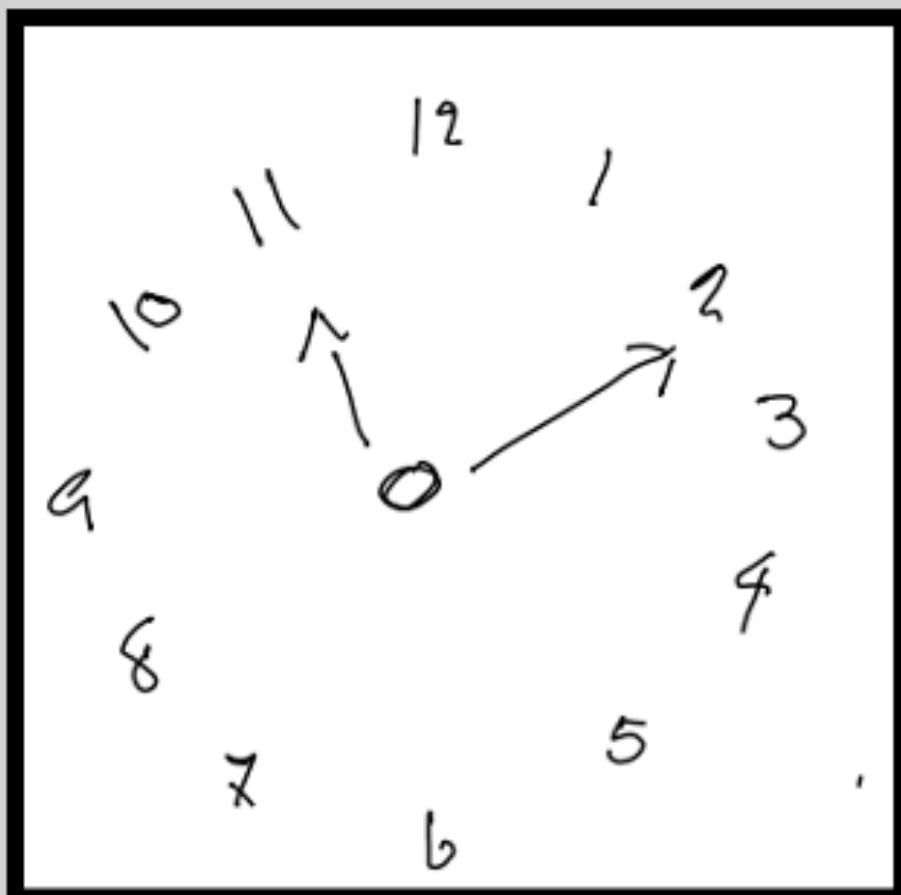
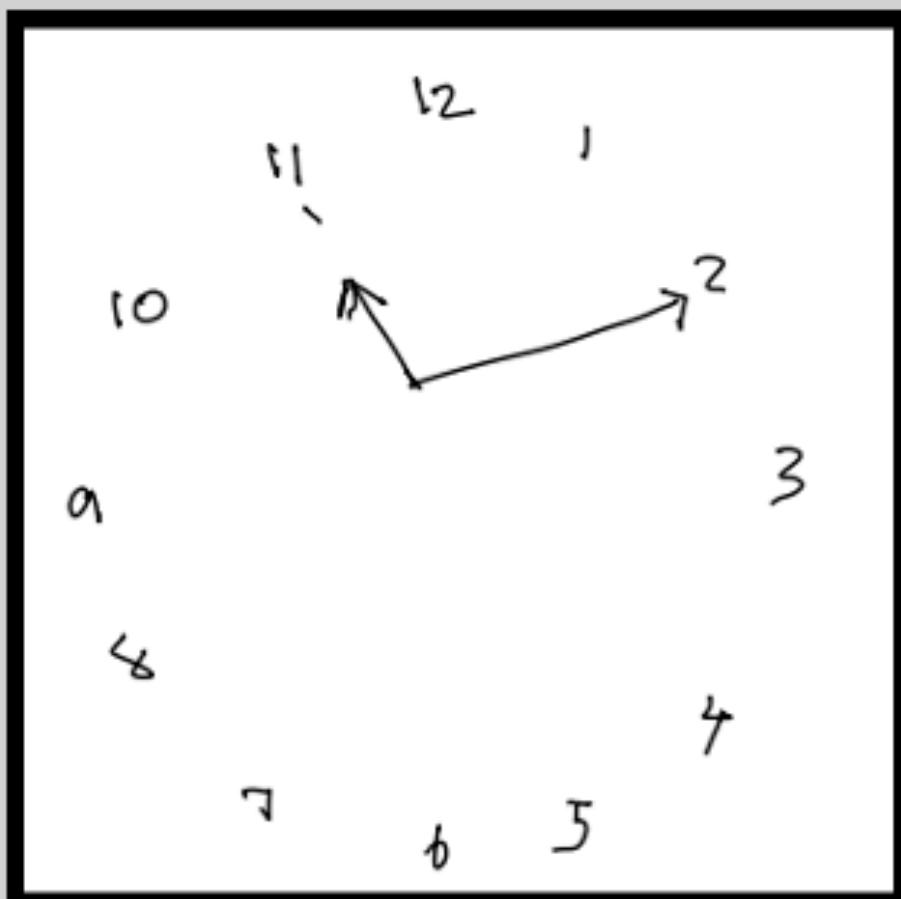
Clock drawing task

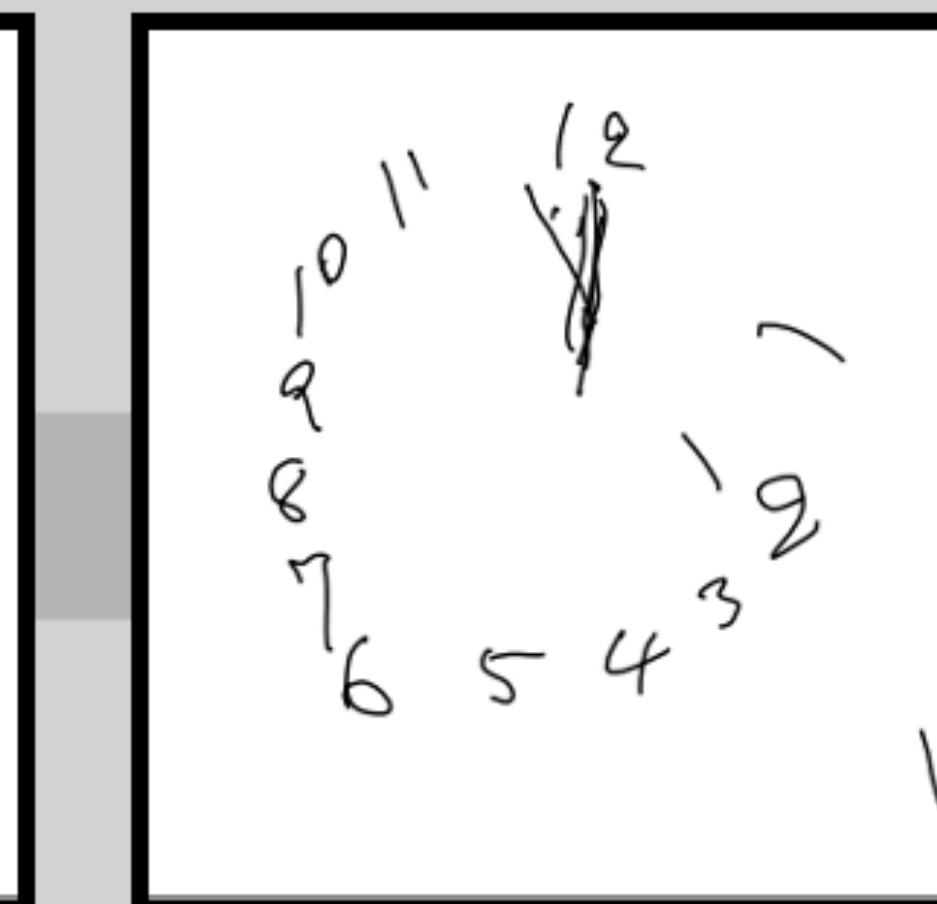
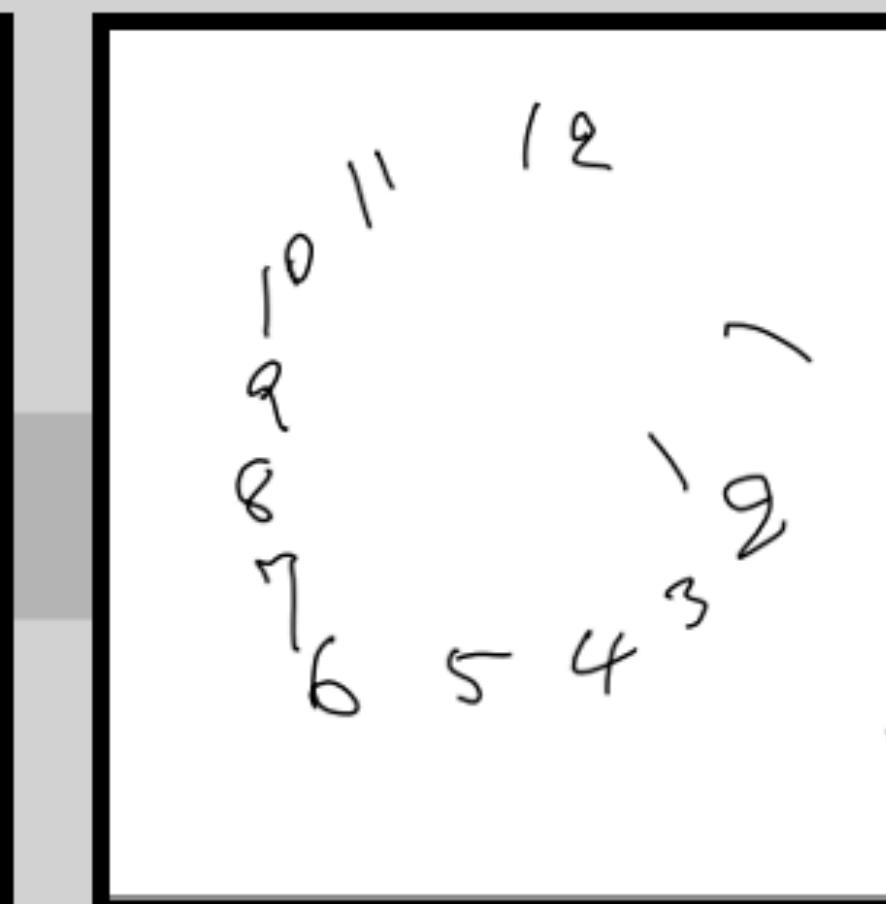
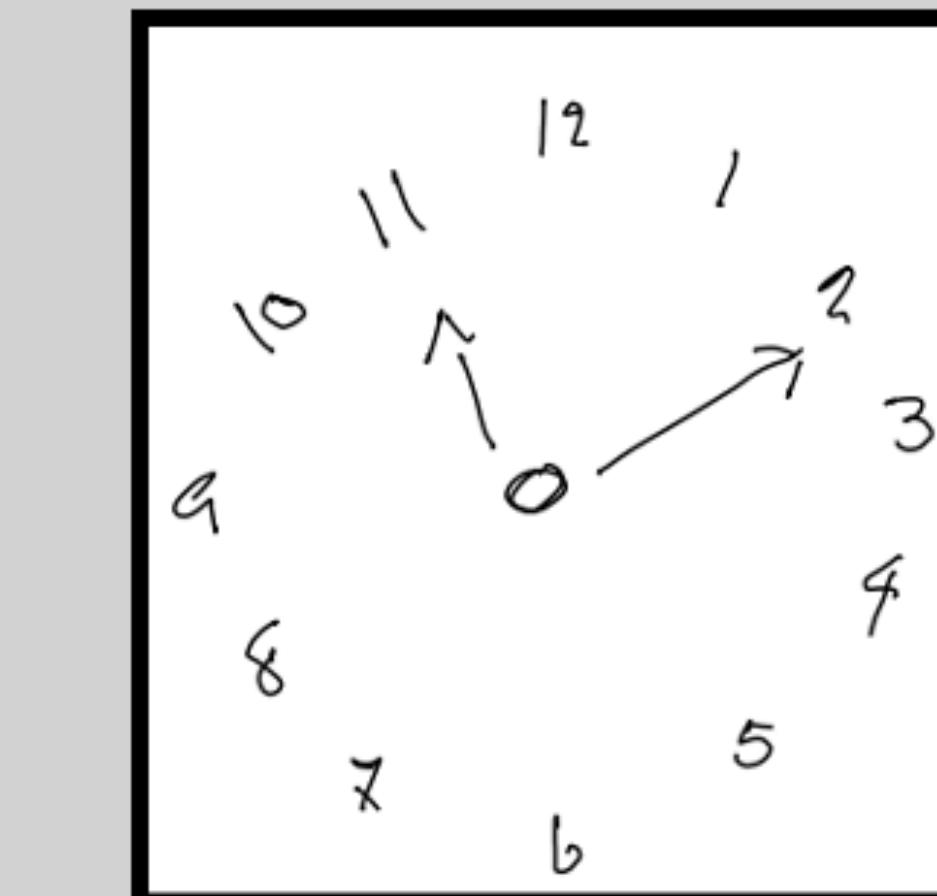
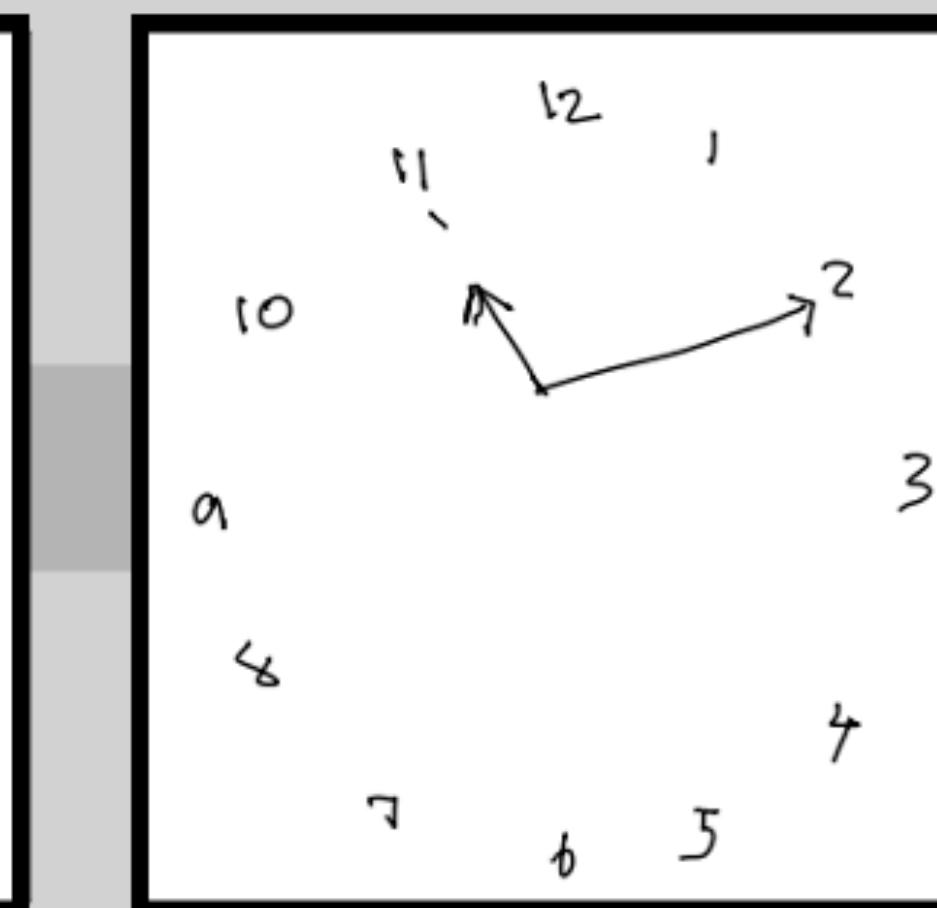
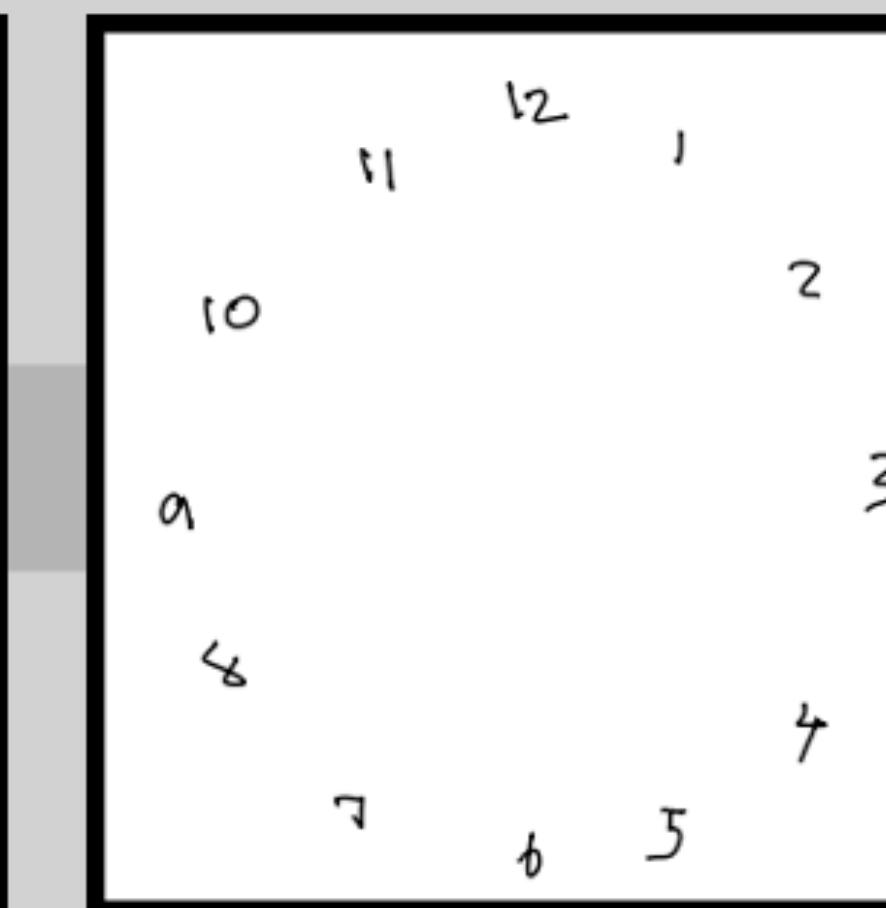
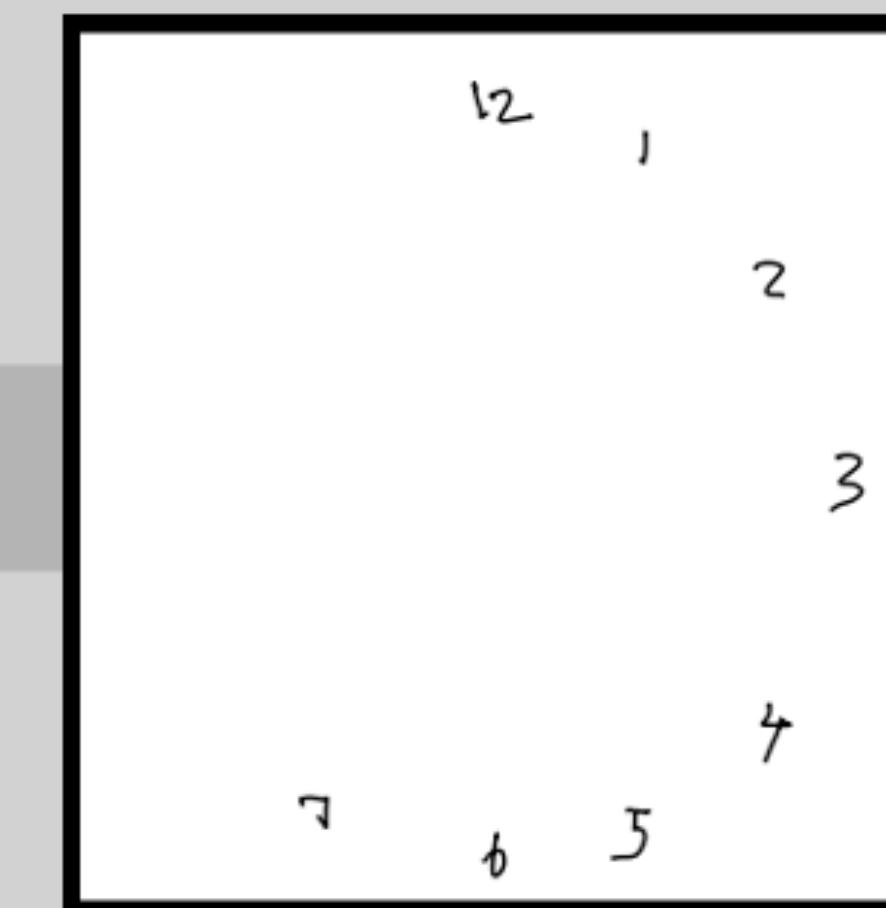
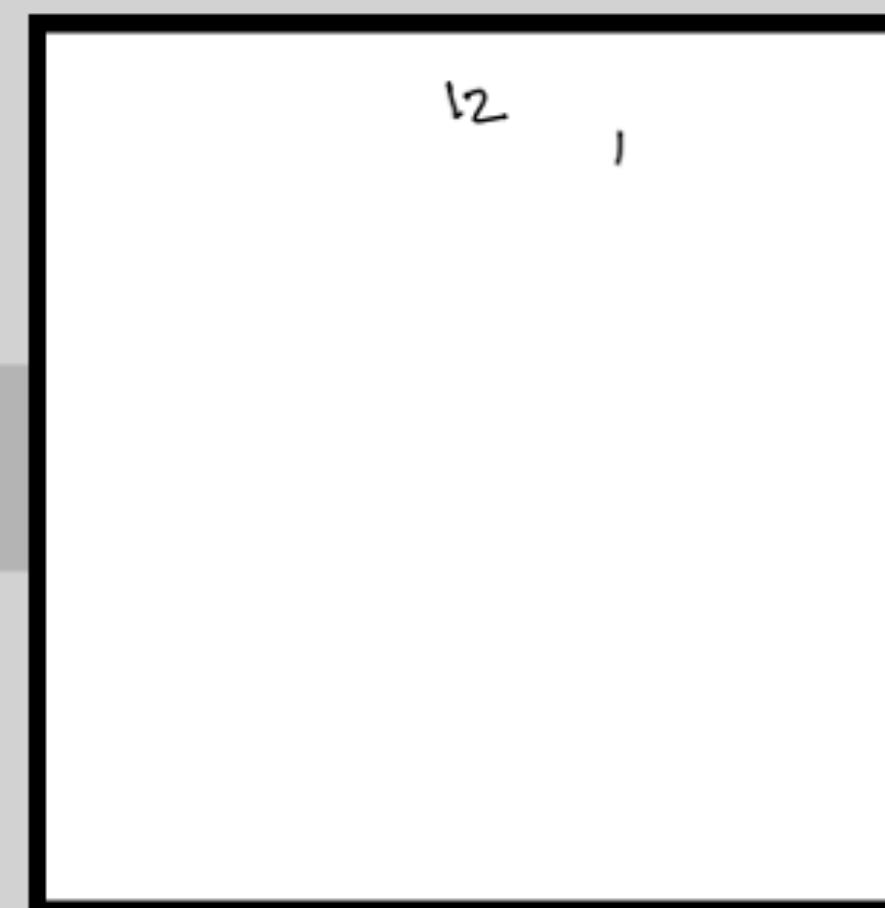


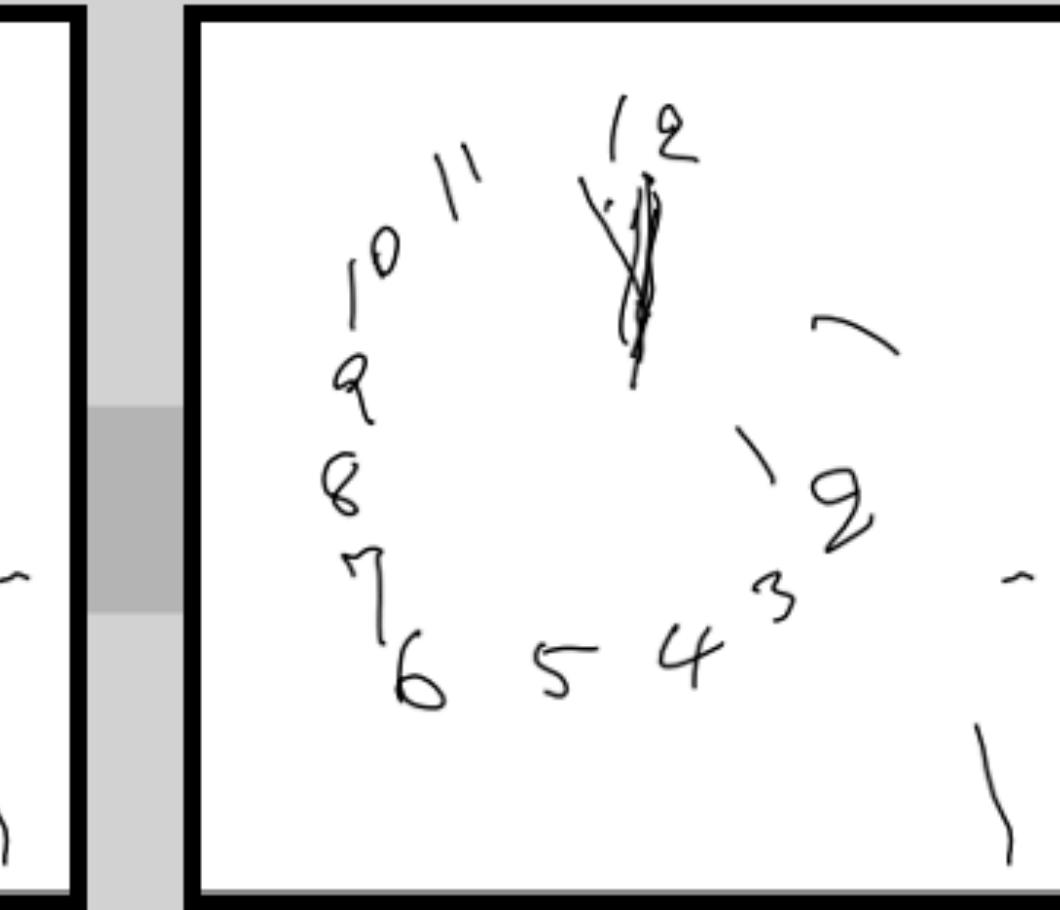
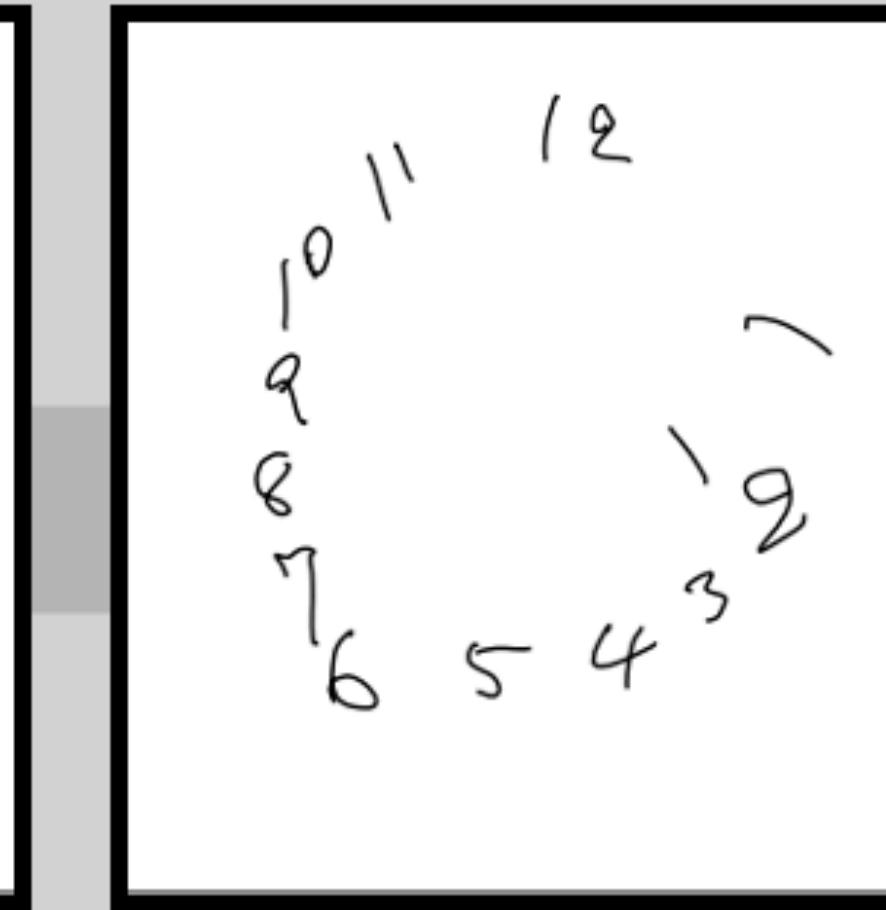
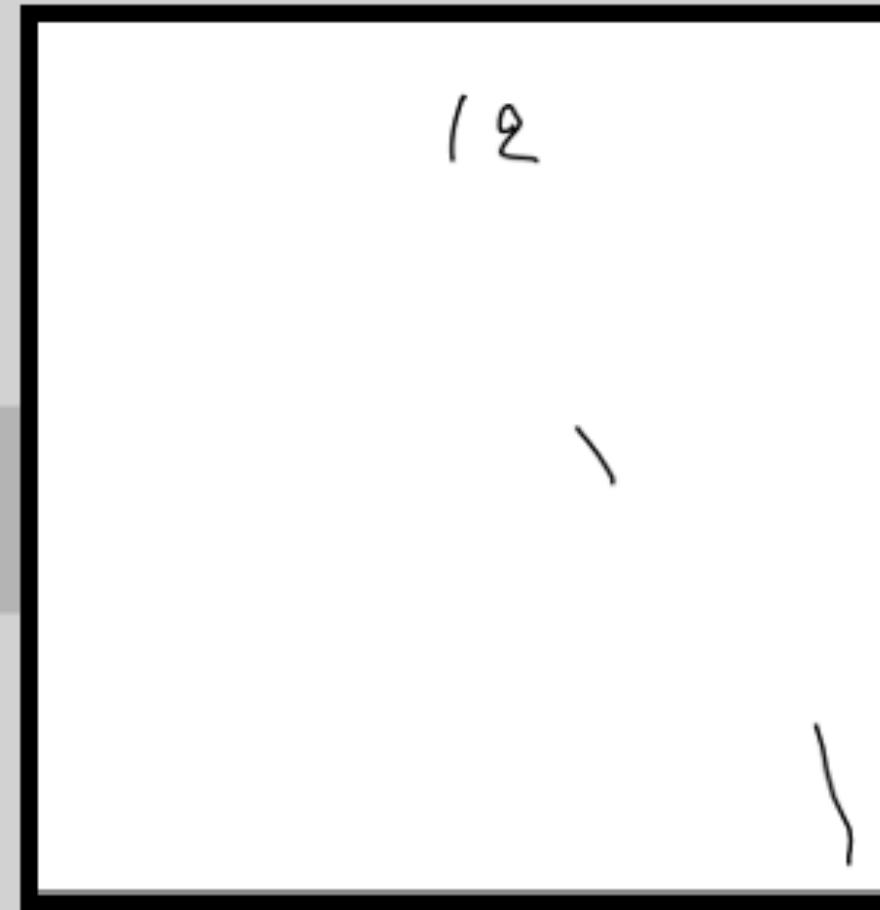
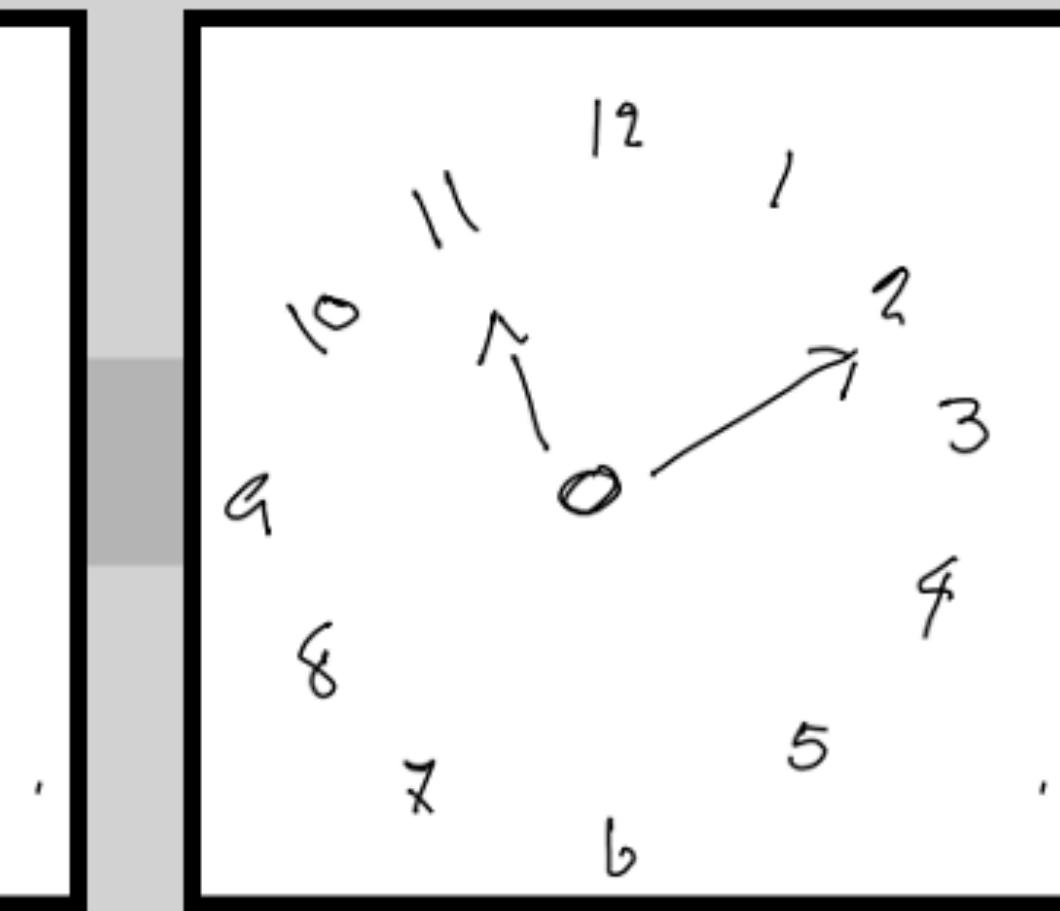
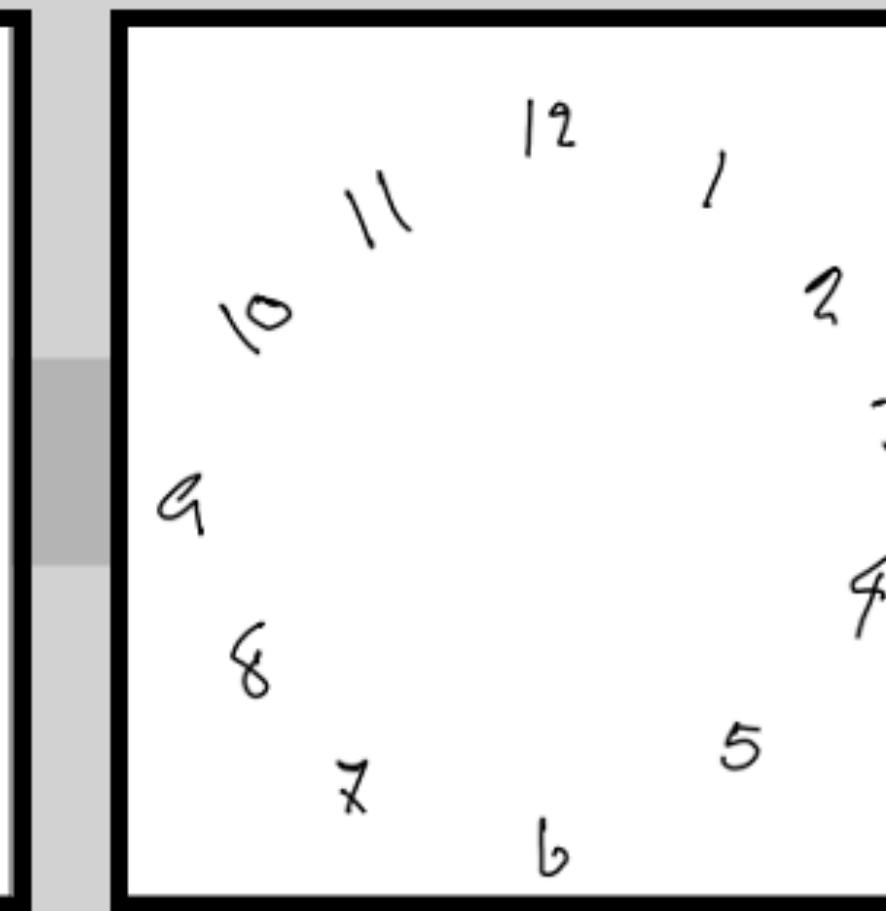
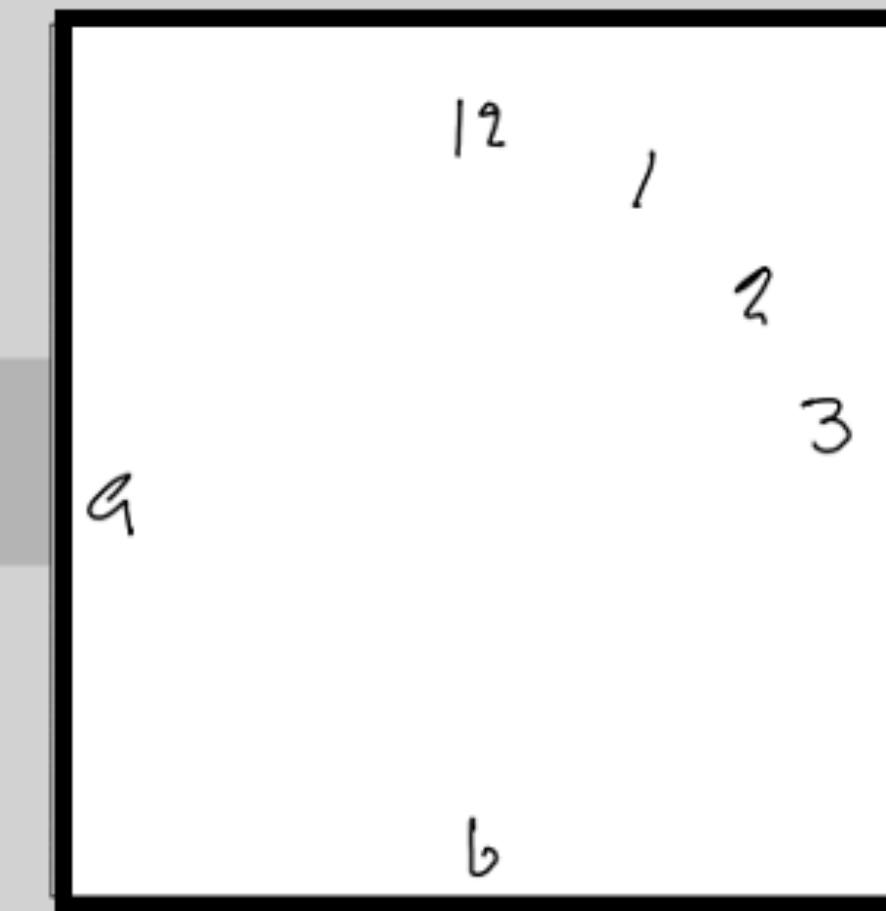
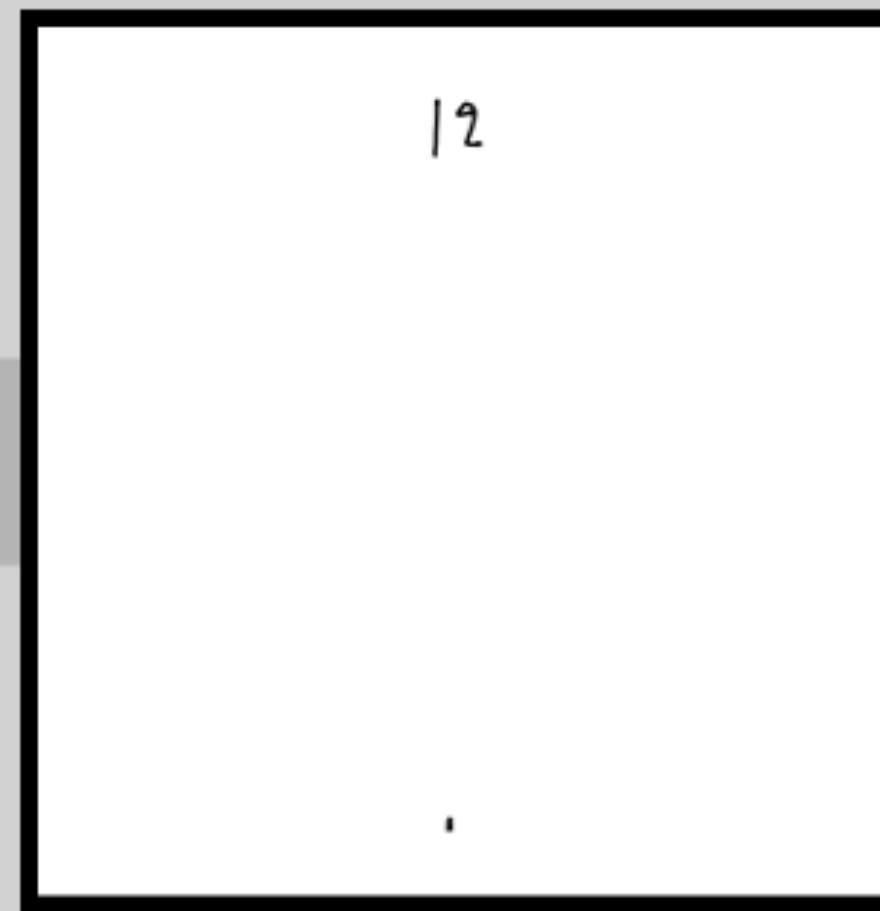
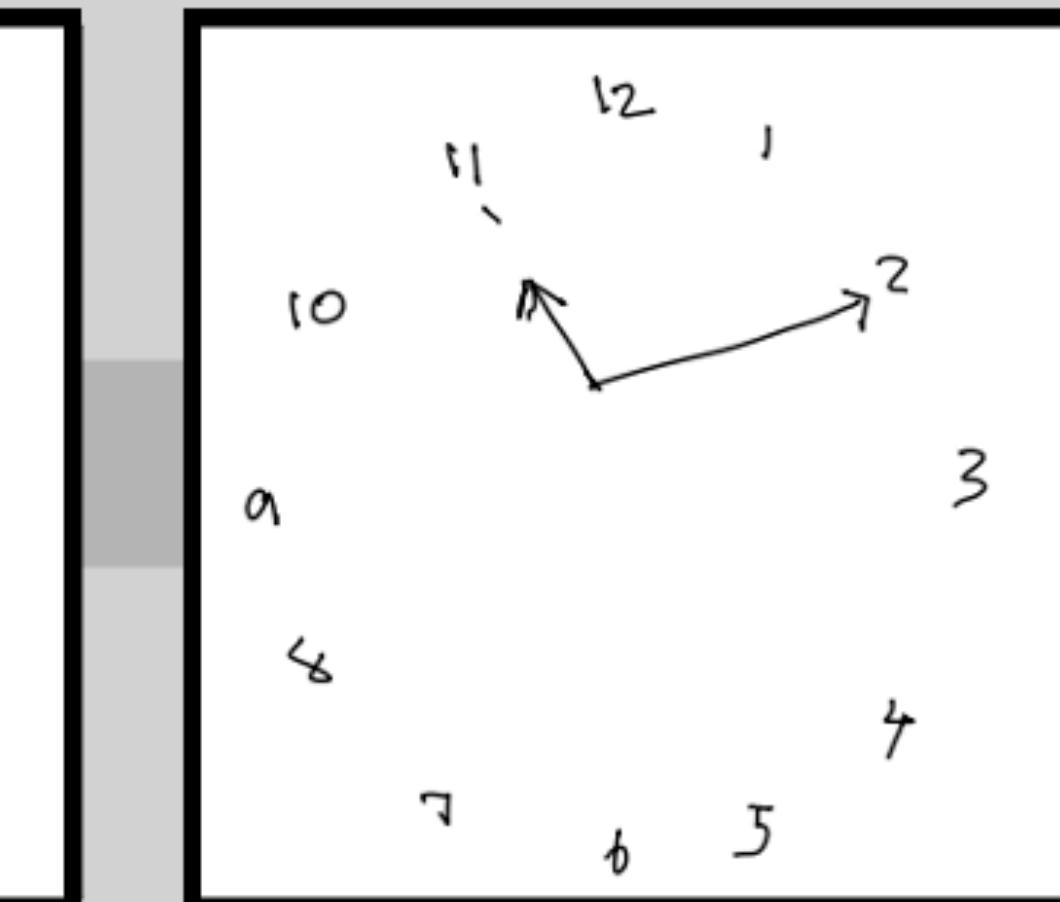
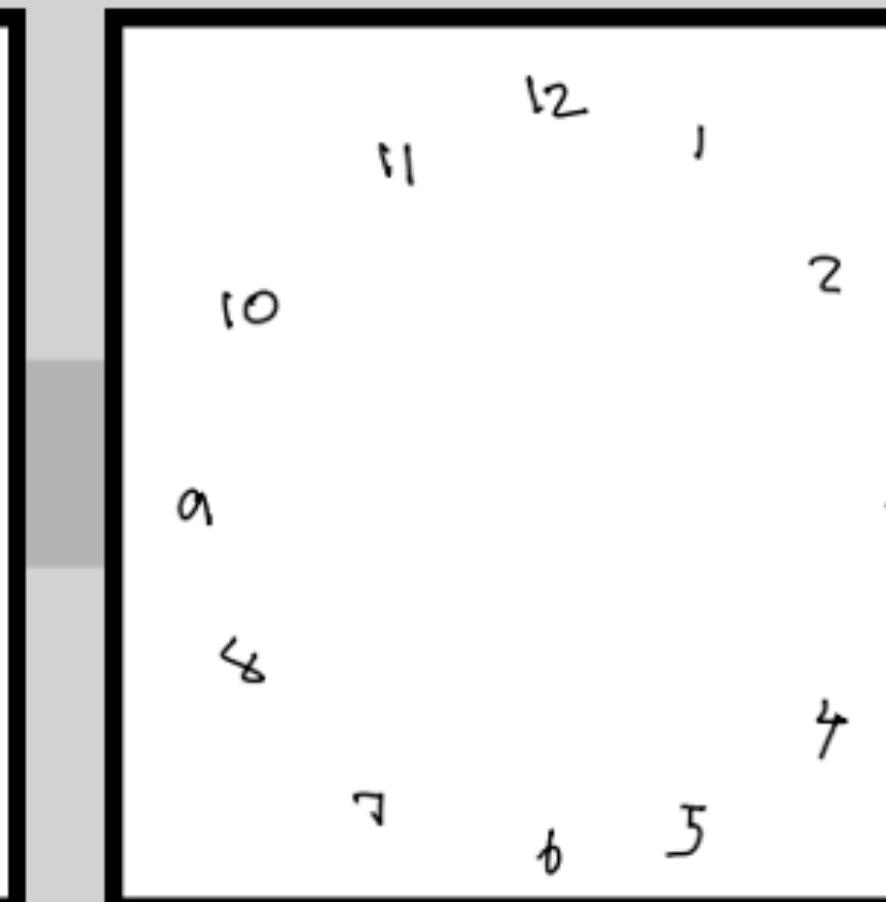
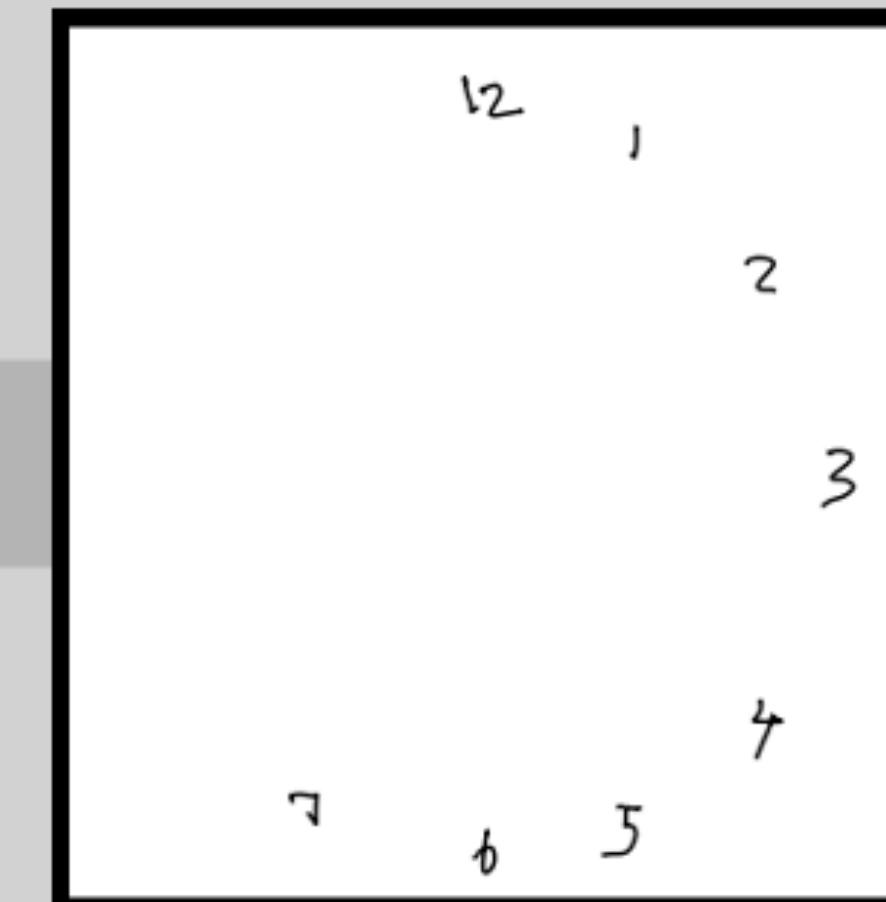
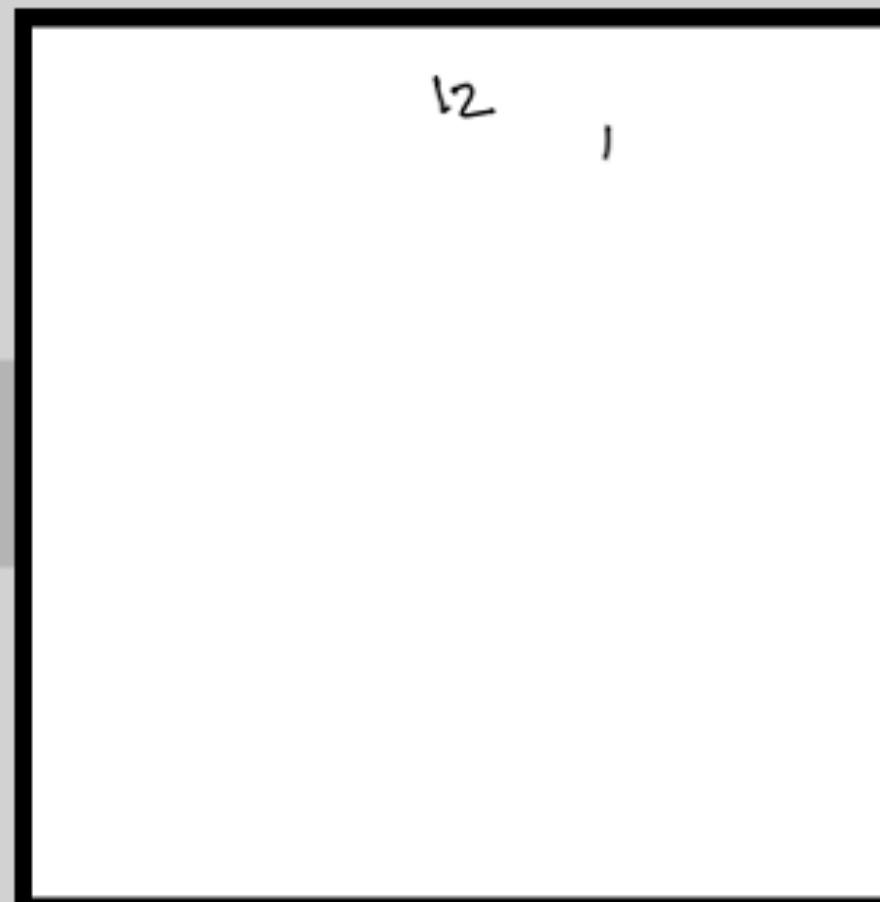
MONTREAL COGNITIVE ASSESSMENT (MOCA)		คะแนนทั้งหมด : _____	
ระดับการคิด : _____			
วันพุธที่ _____ เดือน _____ ปี _____			
ชั้นที่ _____ ห้อง _____			
เวลาที่เข้ามาหาครั้งแรกที่ 11.10 น. (๑ คะแนน)			
VISUOSpatial / EXECUTIVE		คะแนน : _____	

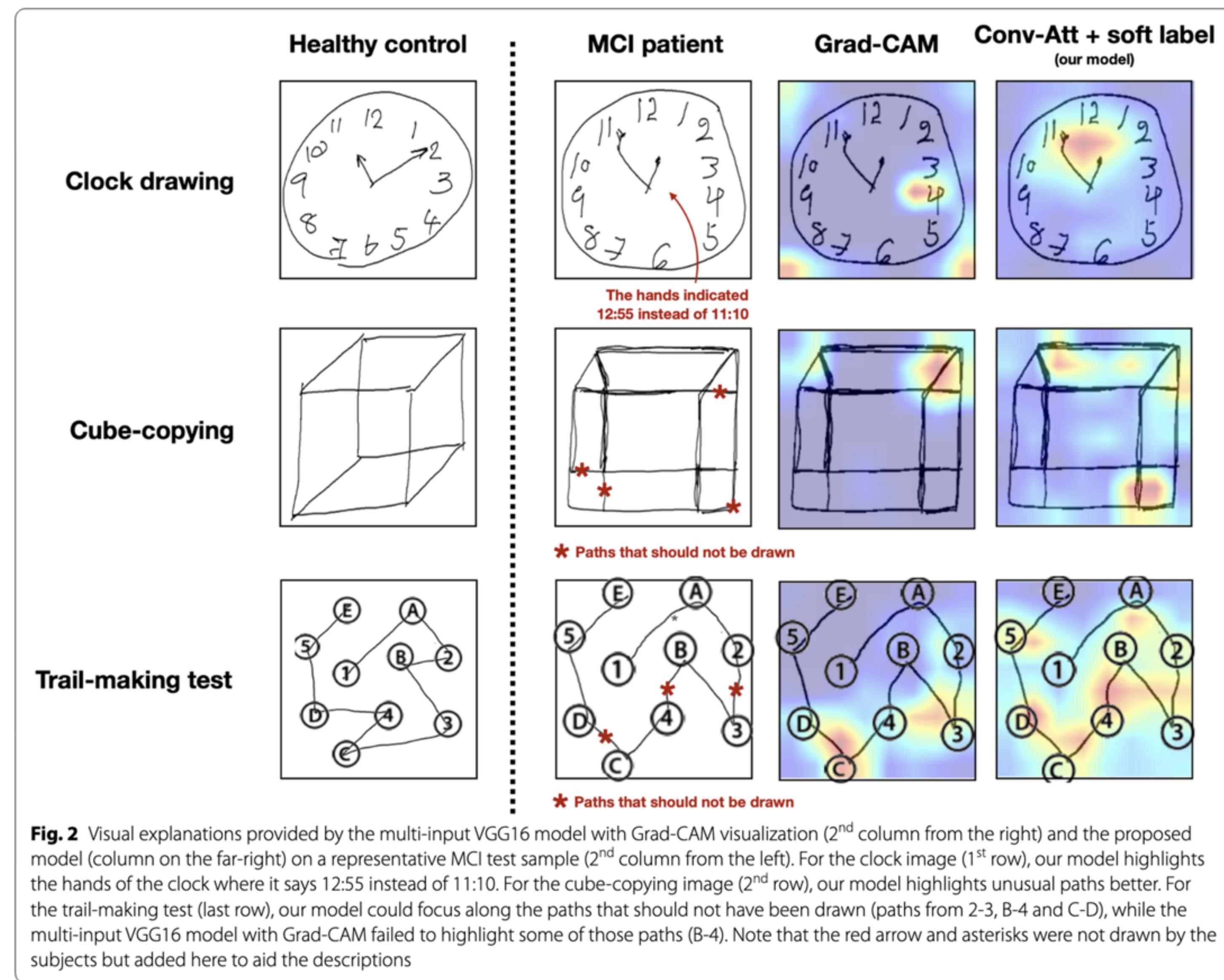
NAMING		คะแนน : _____	

MEMORY		คะแนน : _____	
จำชุดตัวอักษรที่ให้มาโดยลำดับ ภาษาไทย 2 ตัว ภาษาอังกฤษ 5 ตัว ผู้ทดสอบ : _____ ผู้ตรวจ : _____		พลับ _____ พลับ _____ คำสั่ง _____ คำสั่ง _____ คำสั่ง _____ คำสั่ง _____	
ATTENTION		คะแนน : _____	
จำตัวอักษรที่ให้มาโดยลำดับ (๑ ตัว/วินาที) ไทยและภาษาอังกฤษ ๒ ตัว/วินาที ภาษาไทยและภาษาอังกฤษ ๓ ตัว/วินาที ภาษาไทยและภาษาอังกฤษ ๔ ตัว/วินาที ภาษาไทยและภาษาอังกฤษ ๕ ตัว/วินาที		_____ _____ _____ _____ _____ _____ _____ _____ _____ _____	
LANGUAGE		คะแนน : _____	
Repeat: บัญชีความรู้ทางภาษาไทยที่คุณฟังมาแล้ว _____ เช่นเดียวกันในภาษาอังกฤษ _____ เช่นเดียวกันในภาษาไทย _____		_____ _____	
Fluency /		คะแนน : _____	
บอกตัวอักษรตัวหนาตัวอักษรตัวเล็ก _____ ตัวอักษรที่คุณรู้ _____ เช่นเดียวกันในภาษาอังกฤษ _____		_____ _____	
ABSTRACTION		คะแนน : _____	
บอกความต่างระหว่าง 2 ตัวเลข ตัวอักษร แม่ข่ายใน _____ ภาษา - ภาษา _____ ภาษา _____ - ภาษา _____		_____ _____	
DELAYED RECALL		คะแนน : _____	
ให้ความคิดเห็นว่าตัวอักษรที่ให้ไว้ในช่วง _____ นาที ไม่ได้ใช้ในช่วง _____ นาที ไม่ได้ใช้ในช่วง _____ นาที		_____ _____ _____ _____	
Optional		คะแนน : _____	
Category cue _____ Multiple choice cue _____		_____ _____ _____ _____	
ORIENTATION		คะแนน : _____	
วันที่ _____ เดือน _____ ปี _____ ชั้นที่ _____ ห้อง _____		_____ _____ _____ _____	
<small>© Z.Nasreddine MD Version November 7, 2004 Thai version 15 March 2007 translated by Sosainen Hemmungsroj, MD. www.mocatest.org</small>			
		คะแนนรวม : _____	
		ผลลัพธ์ > 26 / 30	
		คะแนนรวม < 26 / 30	
		ผลลัพธ์ < 12	









BCC datasets

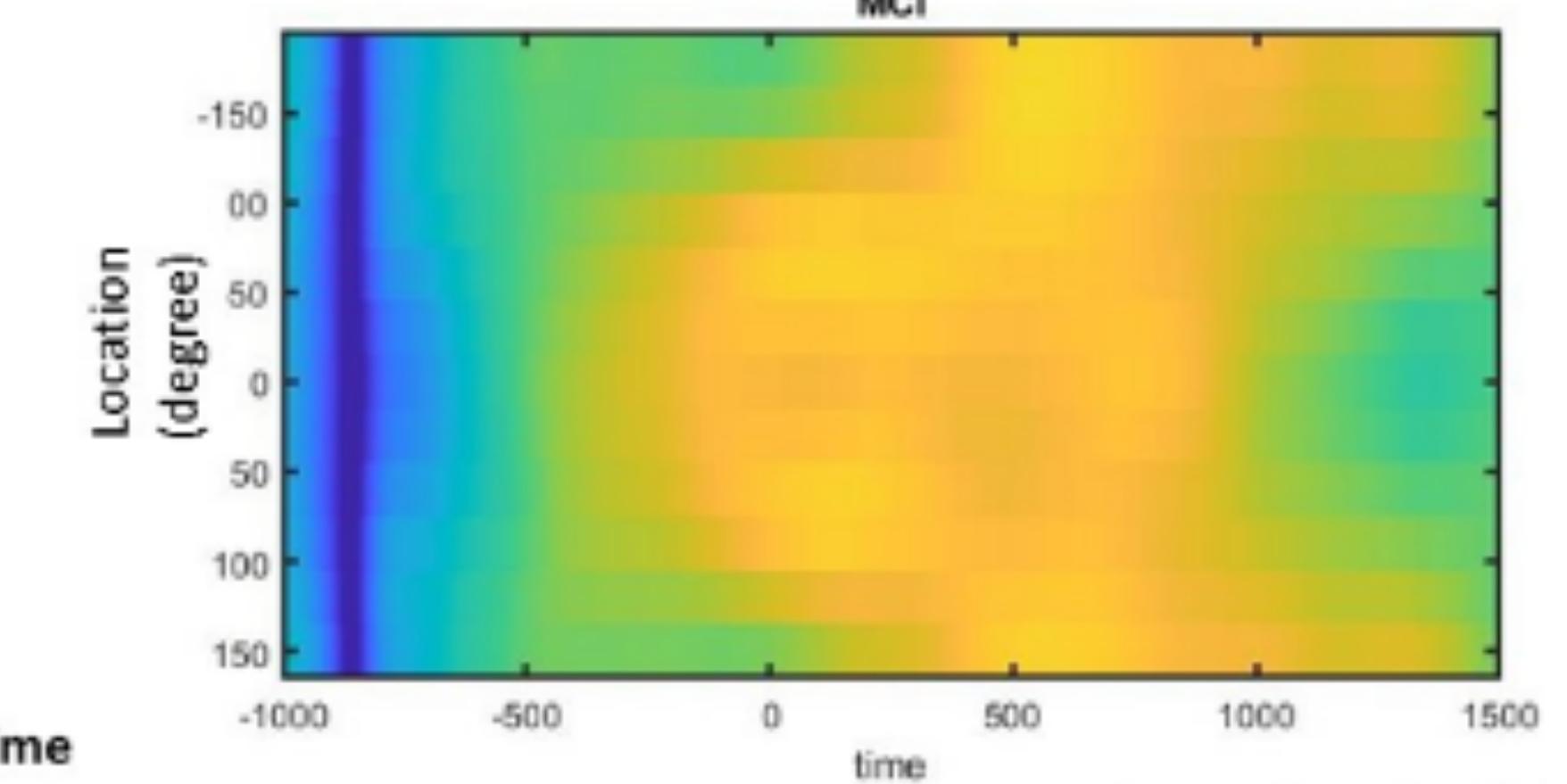
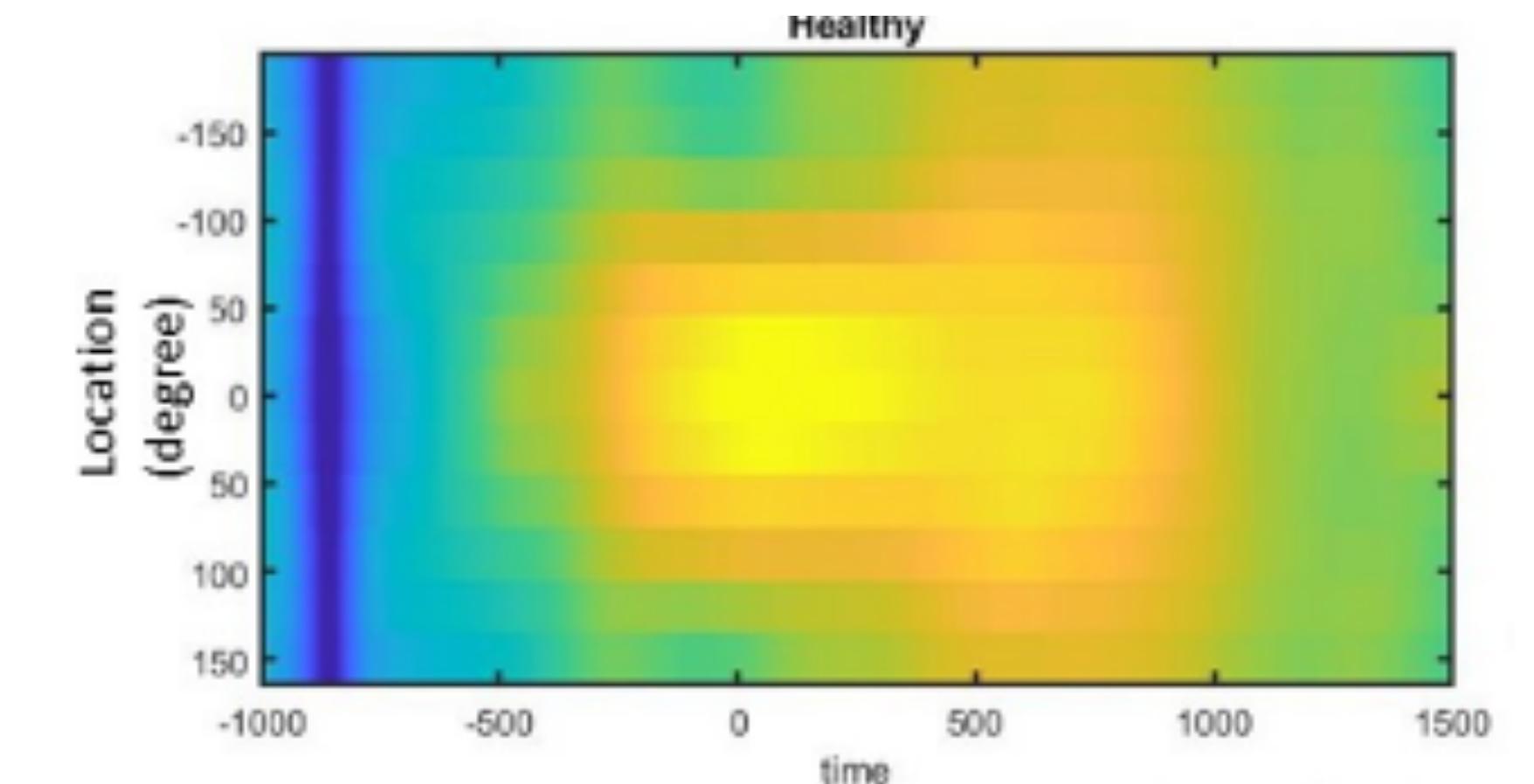
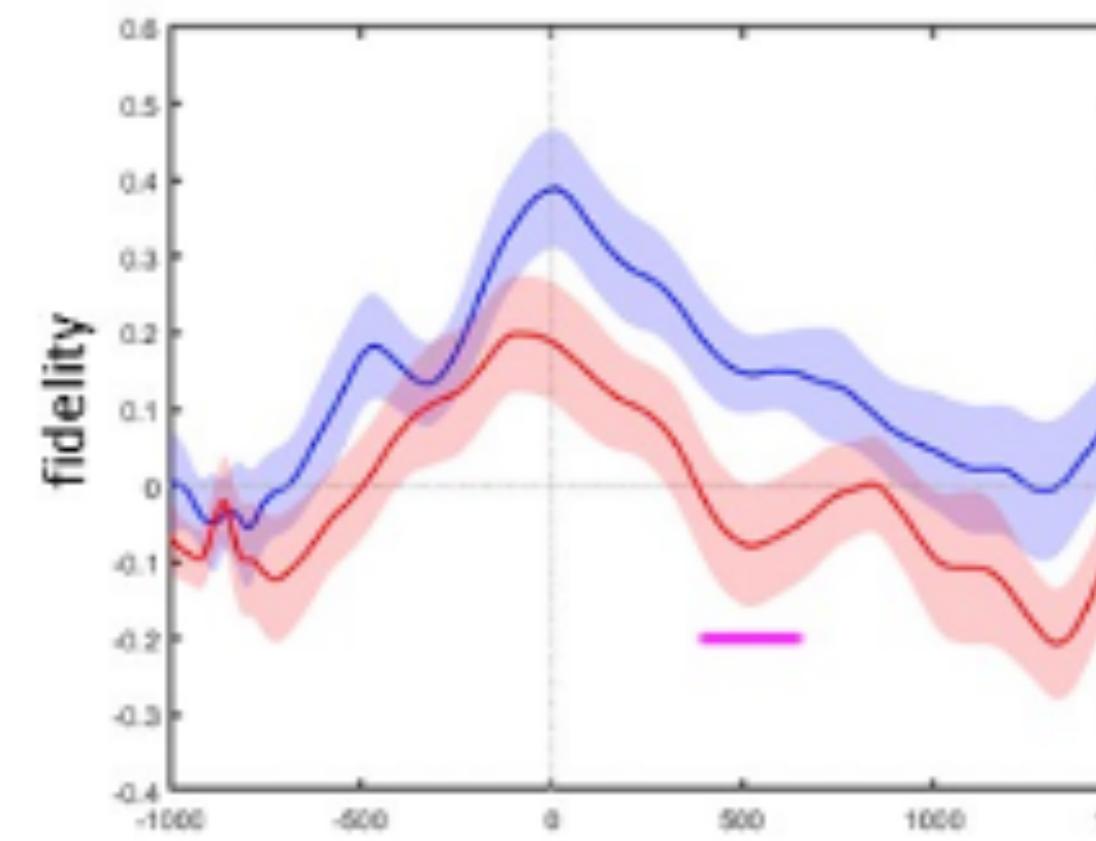
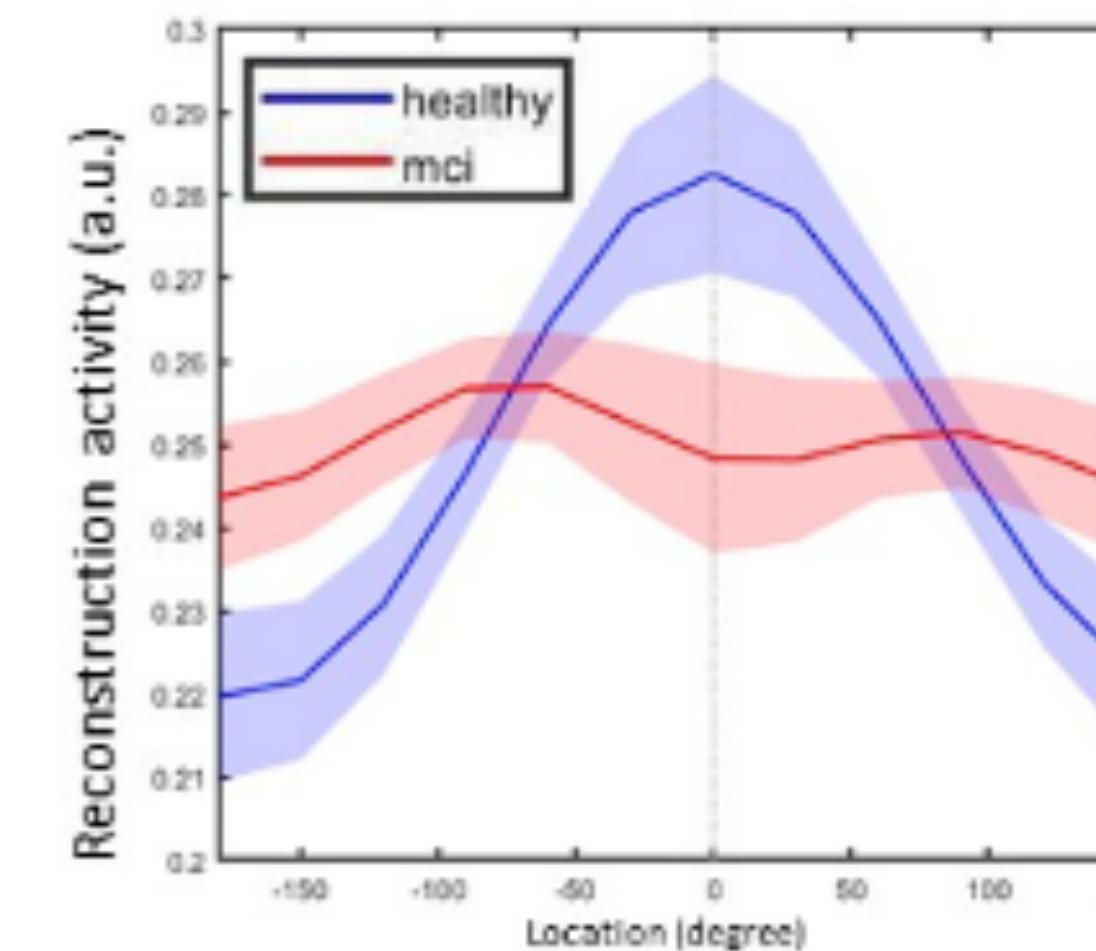
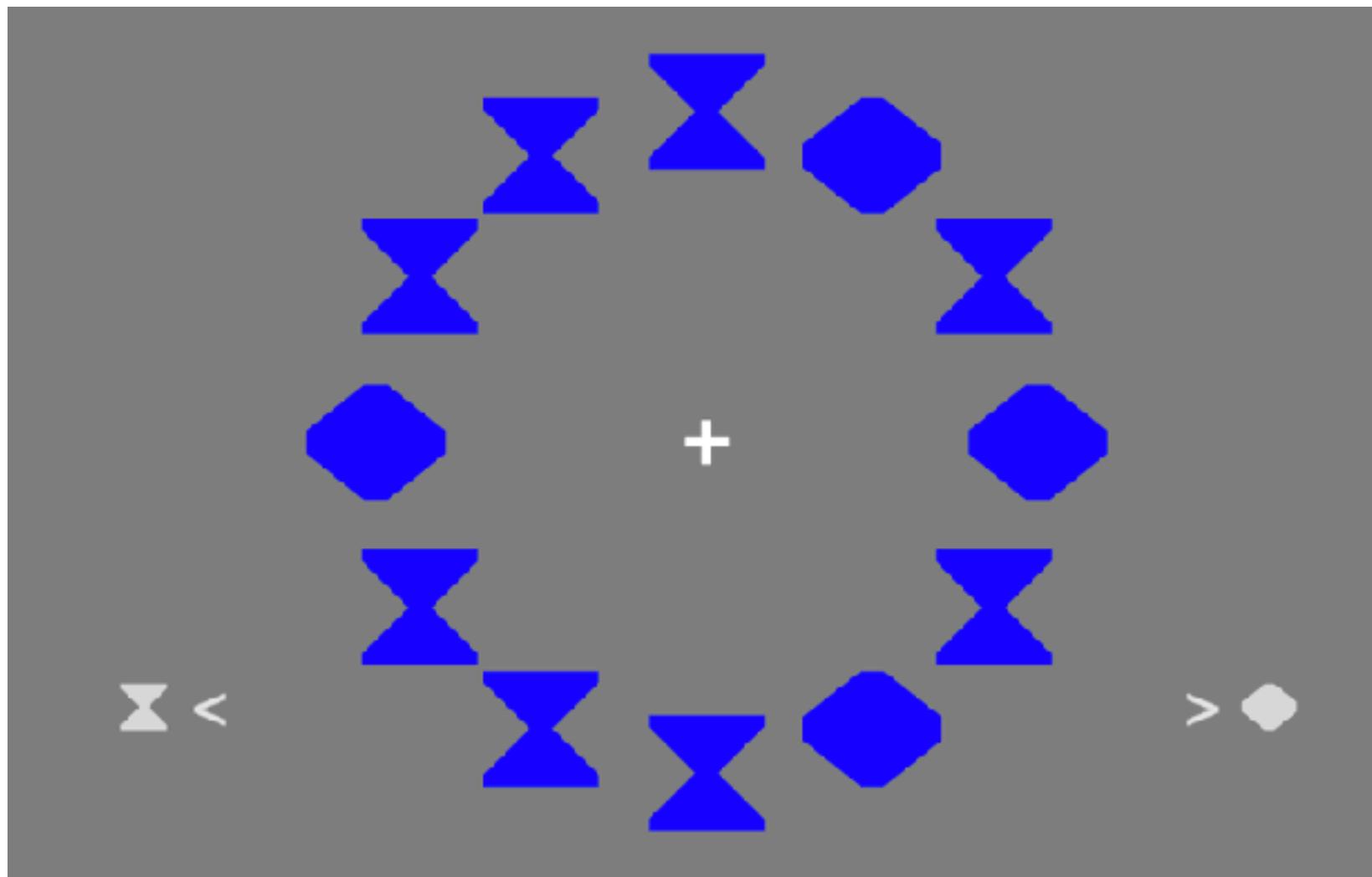
Medical problem



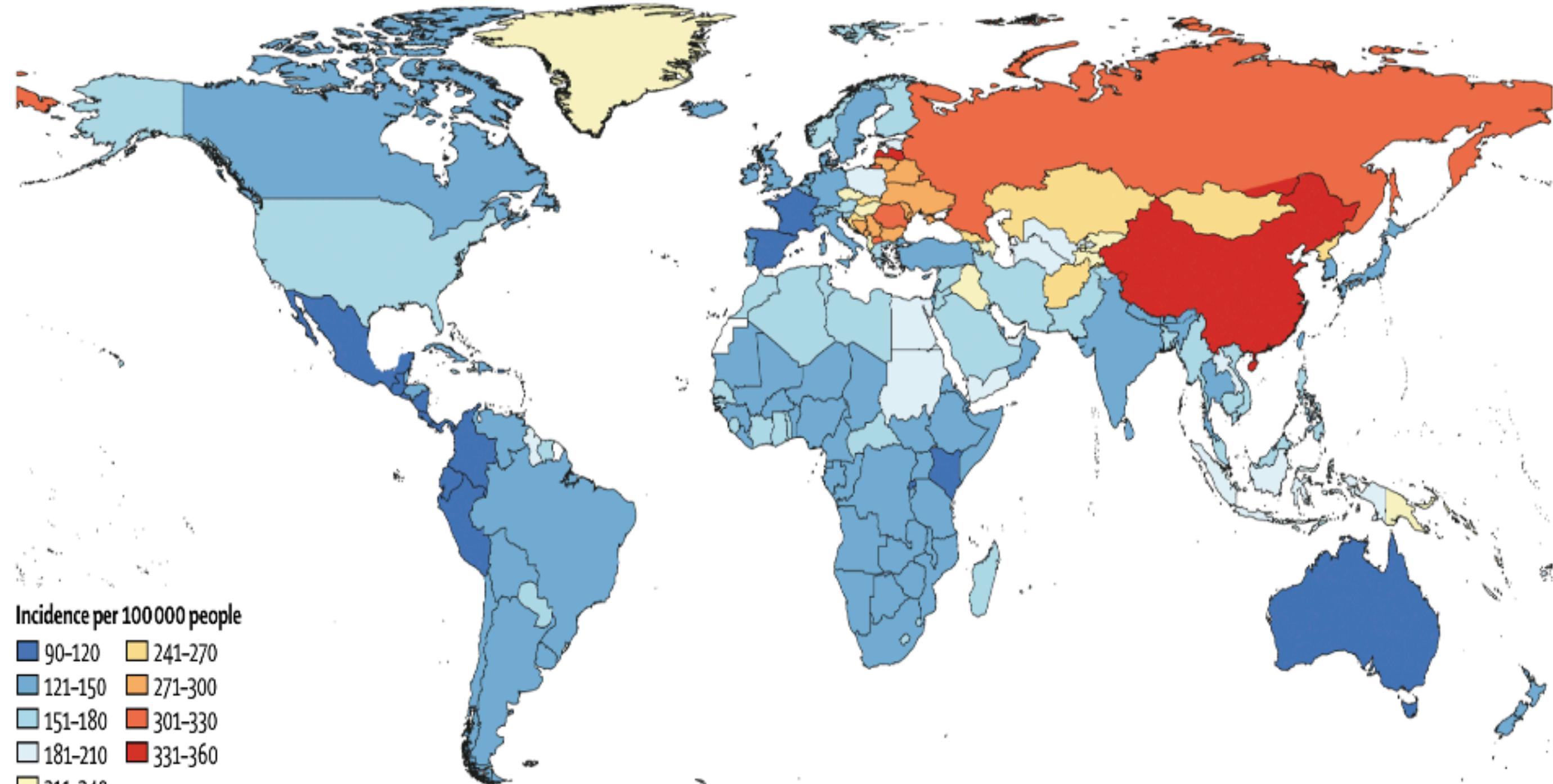
Project	Data	Concept
Attention impairment in MCI	EEG	FFT, Decoding
Stroke classification using MRI	MRI	Classification, Segmentation

Spatial attention representation reconstruction by inverted encoding model

Attentional behavior task



Stroke 2nd cause of death in Thailand



- Communicable, maternal, neonatal, and nutritional diseases
- Non-communicable diseases
- Injuries

	2009	2019	% change, 2009-2019
Stroke	1	1	35.0%
Ischemic heart disease	2	2	27.7%
Road injuries	3	3	77.1%
Chronic kidney disease	4	4	50.0%
Lower respiratory infect	5	5	40.2%
Liver cancer	6	6	32.9%
COPD	7	7	72.6%
Lung cancer	8	8	28.2%
HIV/AIDS	9	9	58.2%
Cirrhosis	10	10	-2.8%
Alzheimer's disease	11	11	9.9%
Diabetes	12	12	3.8%

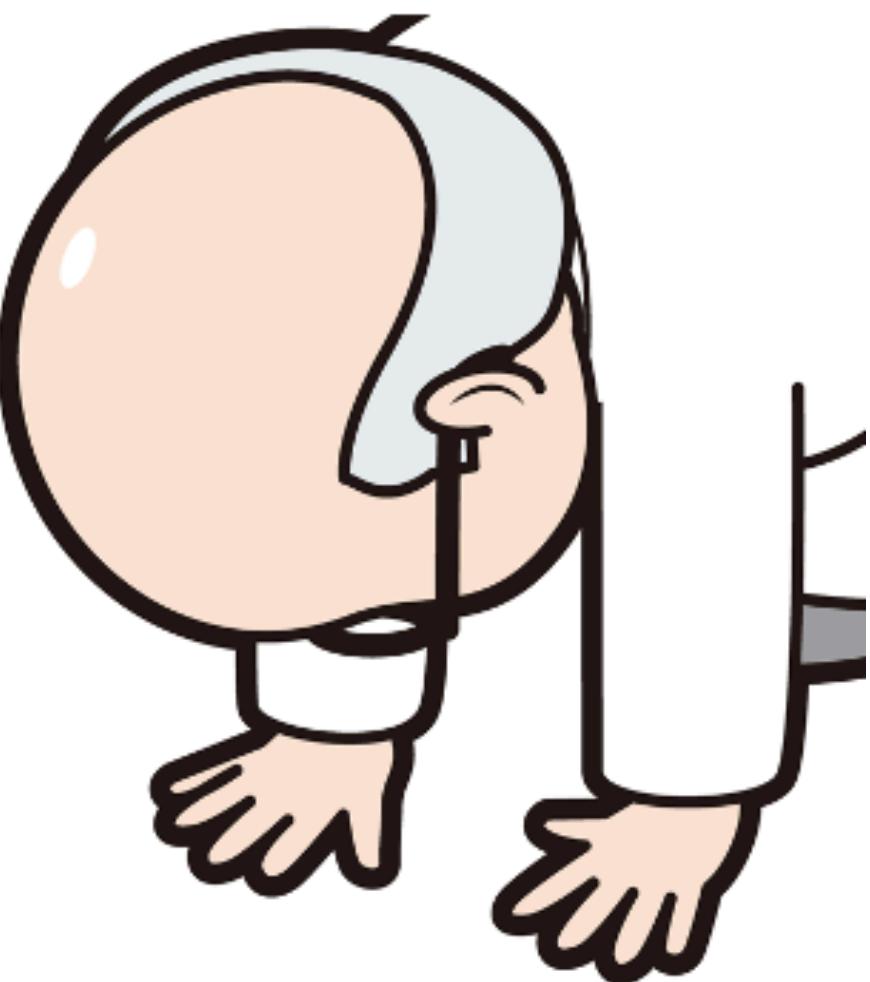
250,000 new cases each year

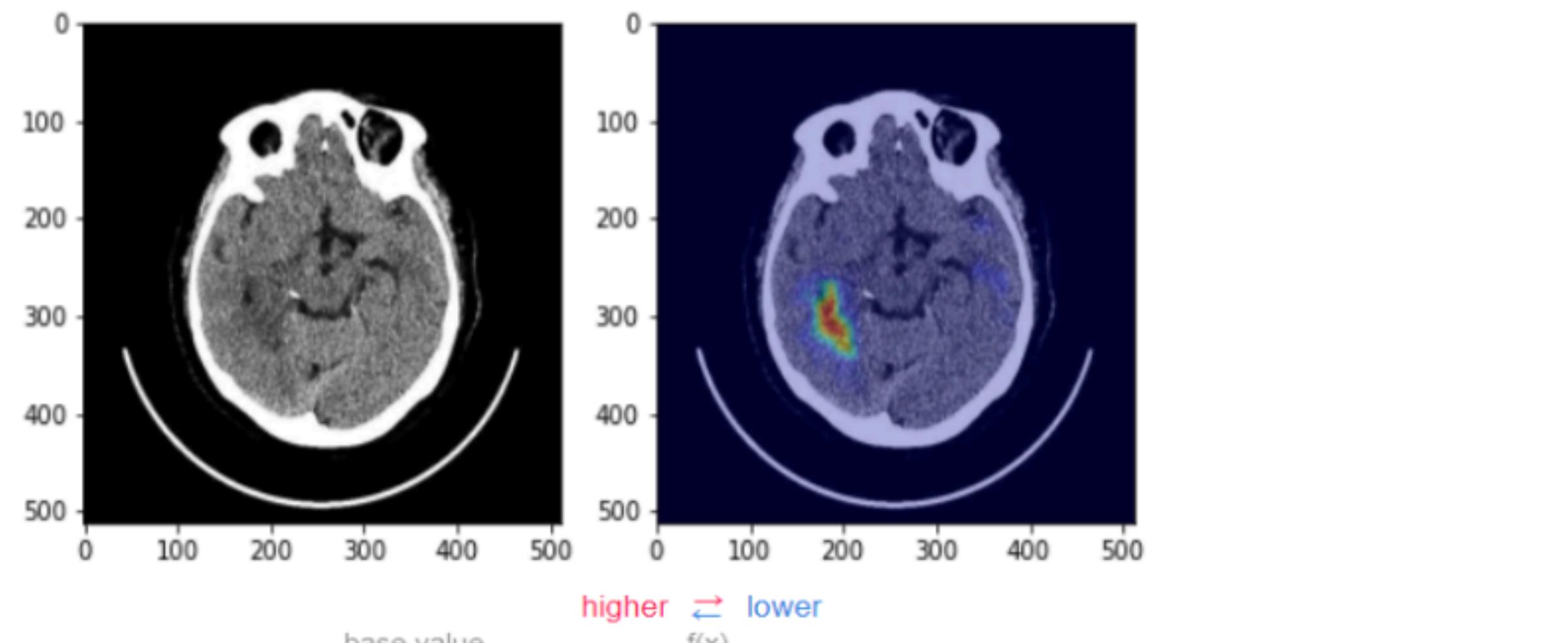
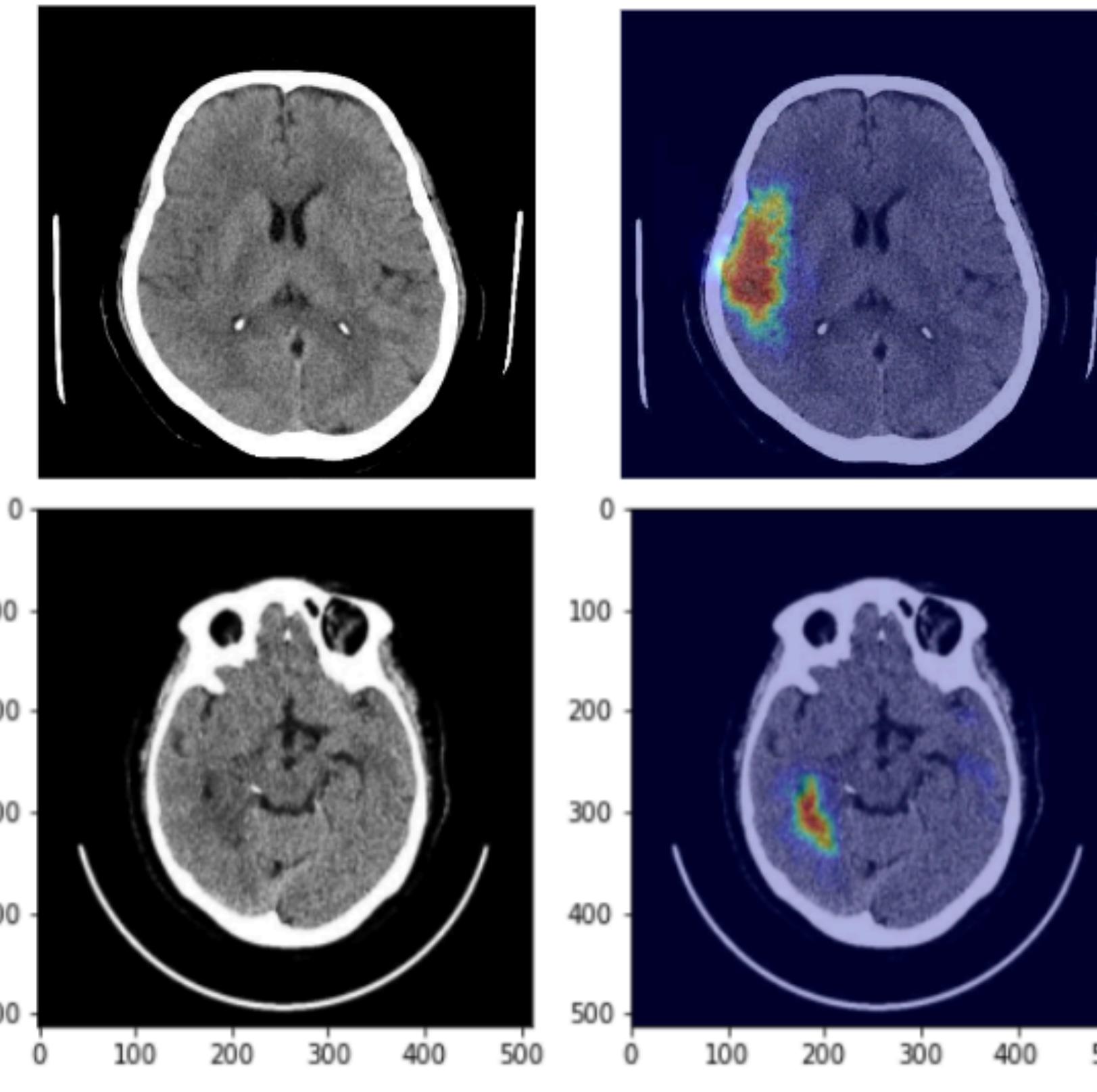
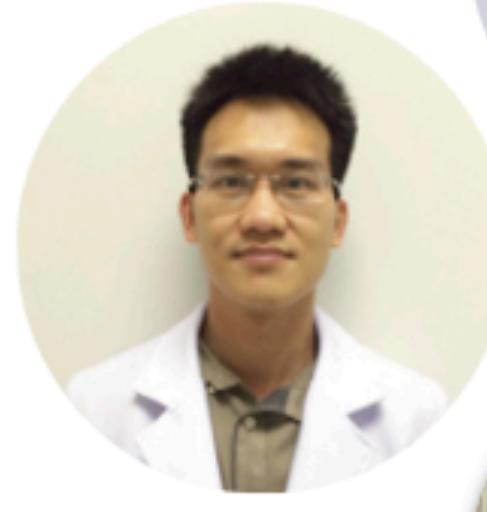
20% mortality rate

30% left paralyzed



Ahhhhh.....Who should I send
for further investigation?





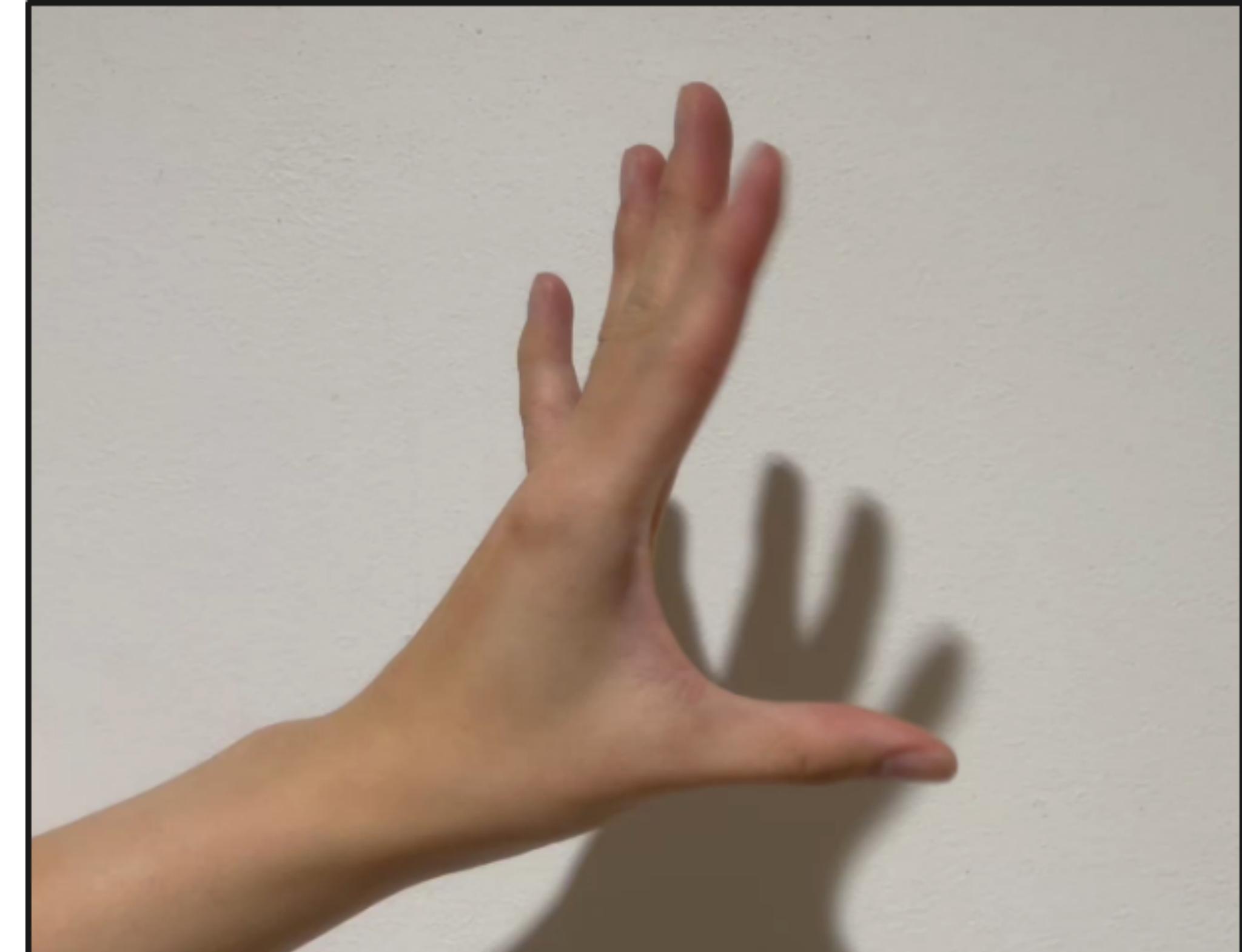
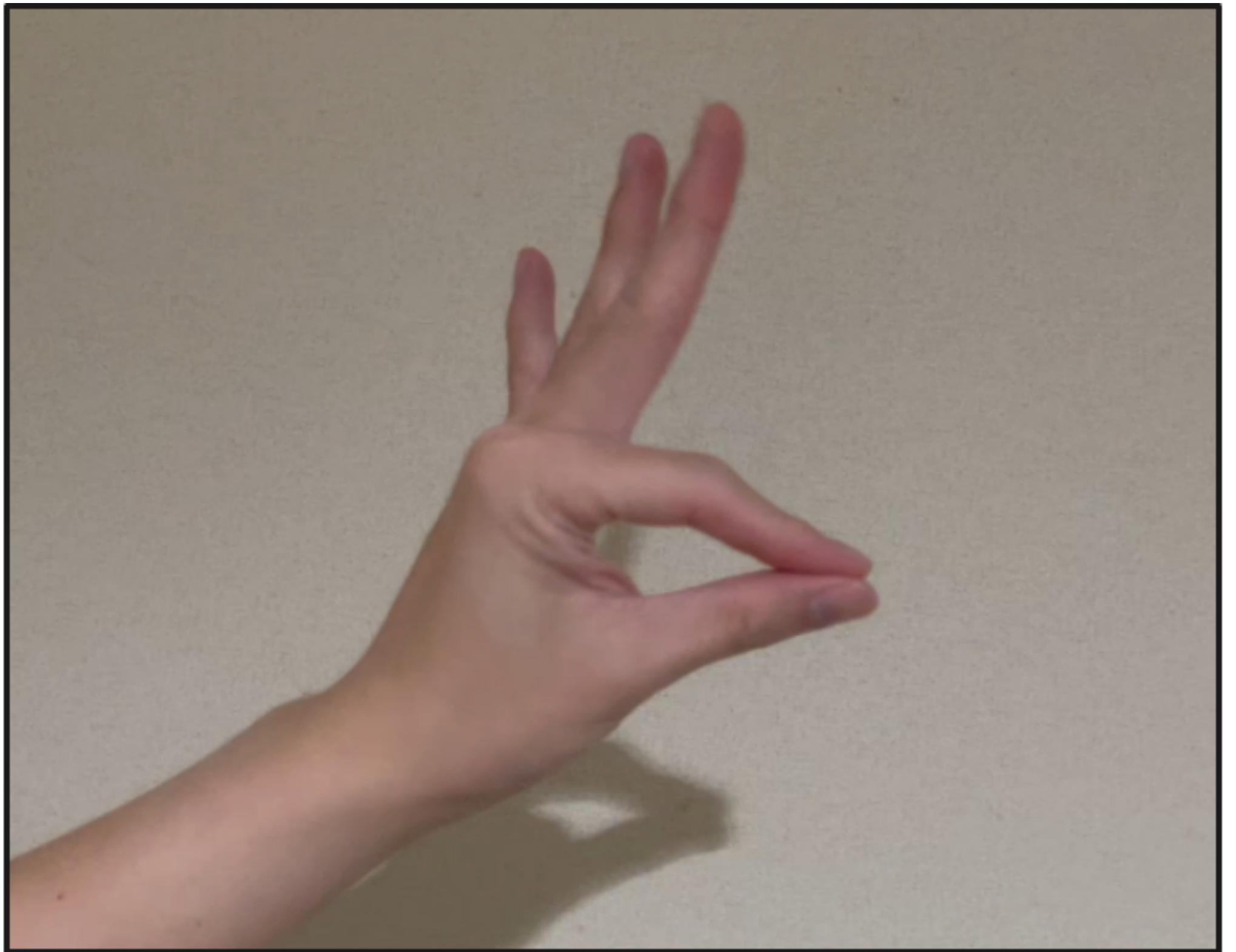
AI for Stroke Subtype Classification

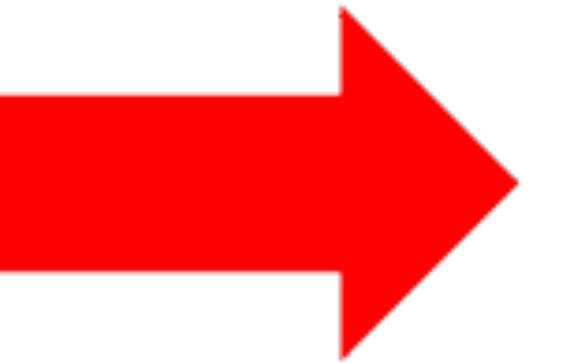
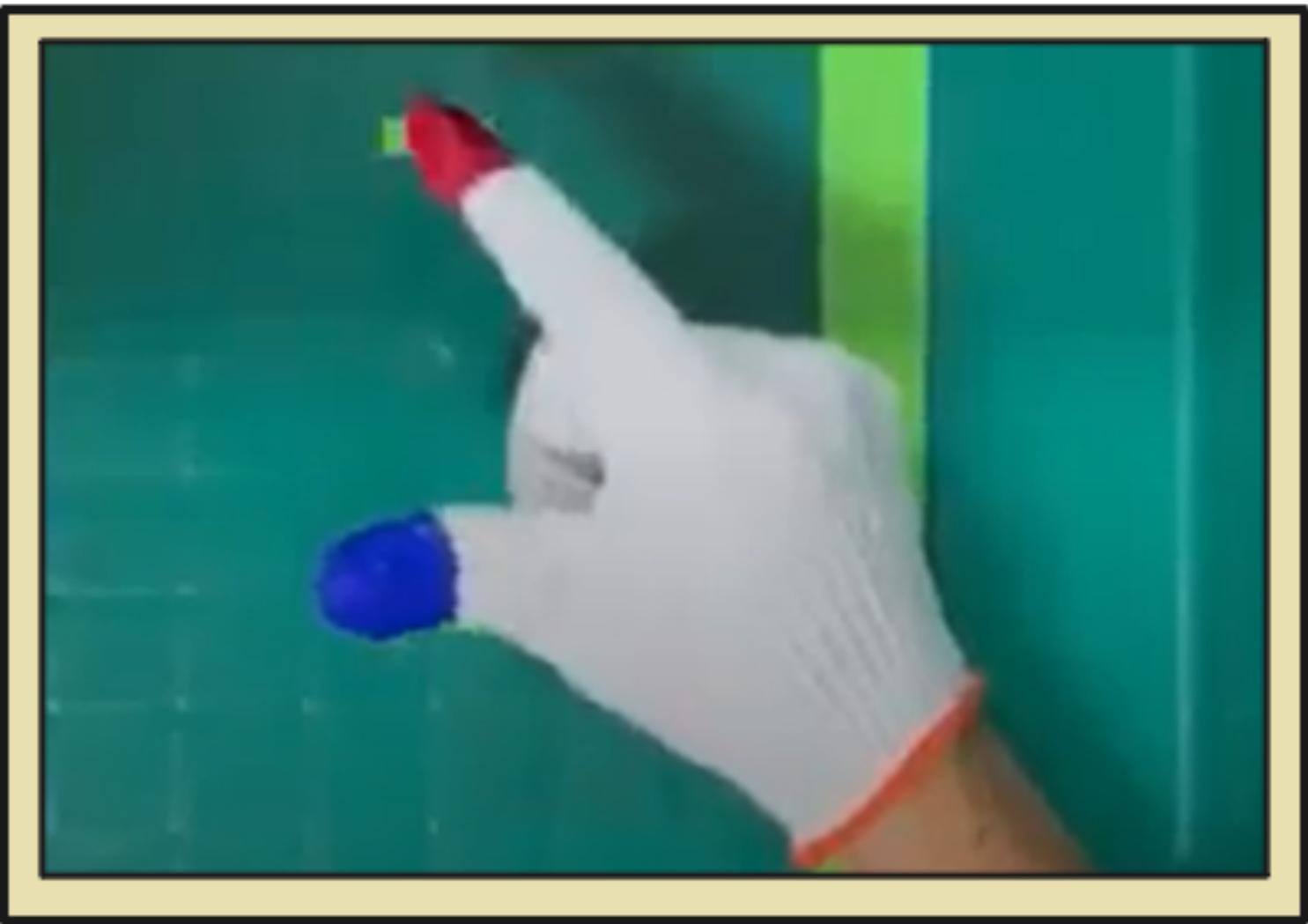
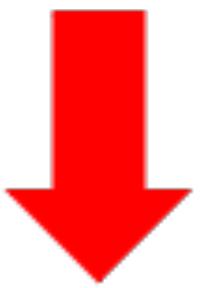
BCC datasets

Medical problem



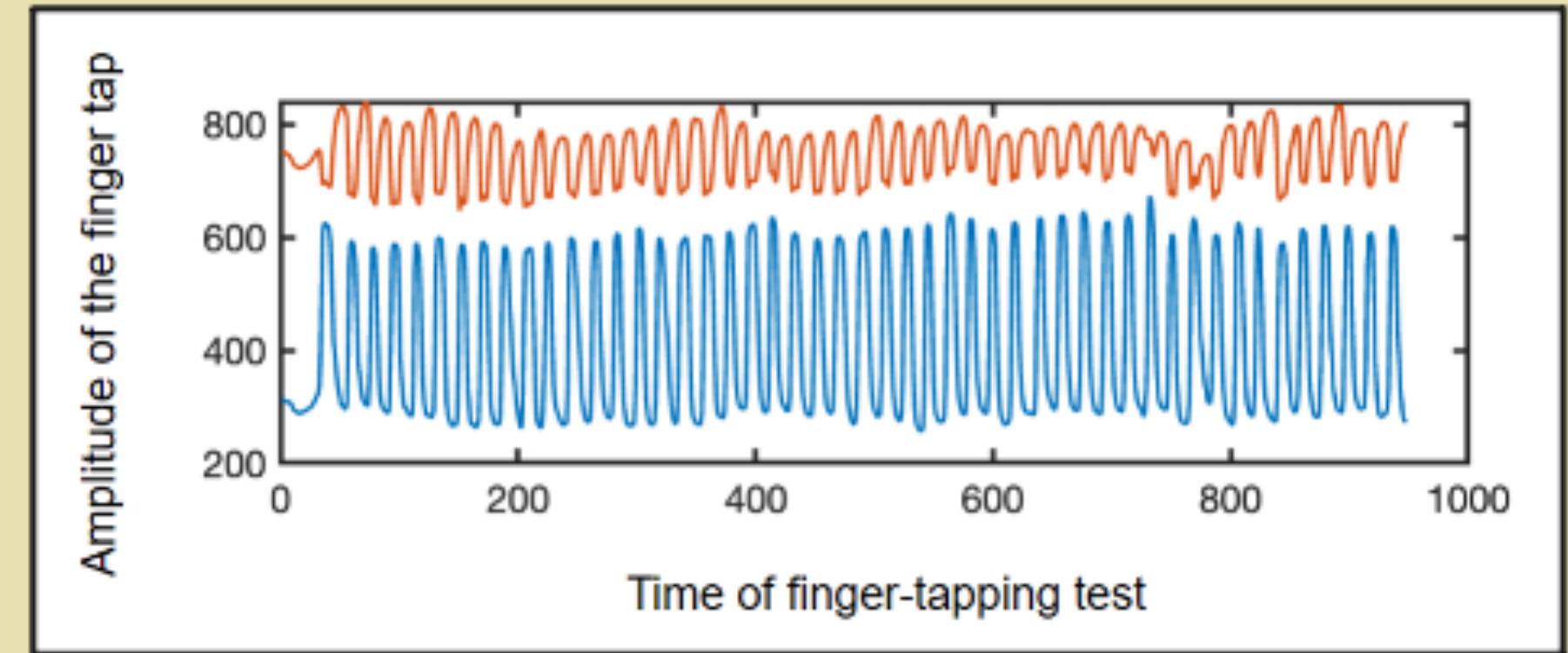
Project	Data	Concept
FingerTap	Image	AI, CNN, Feature selection
SpeechDysarthria	Speech	Classification, CNN
KorKai	Cognition	Clustering, Classification



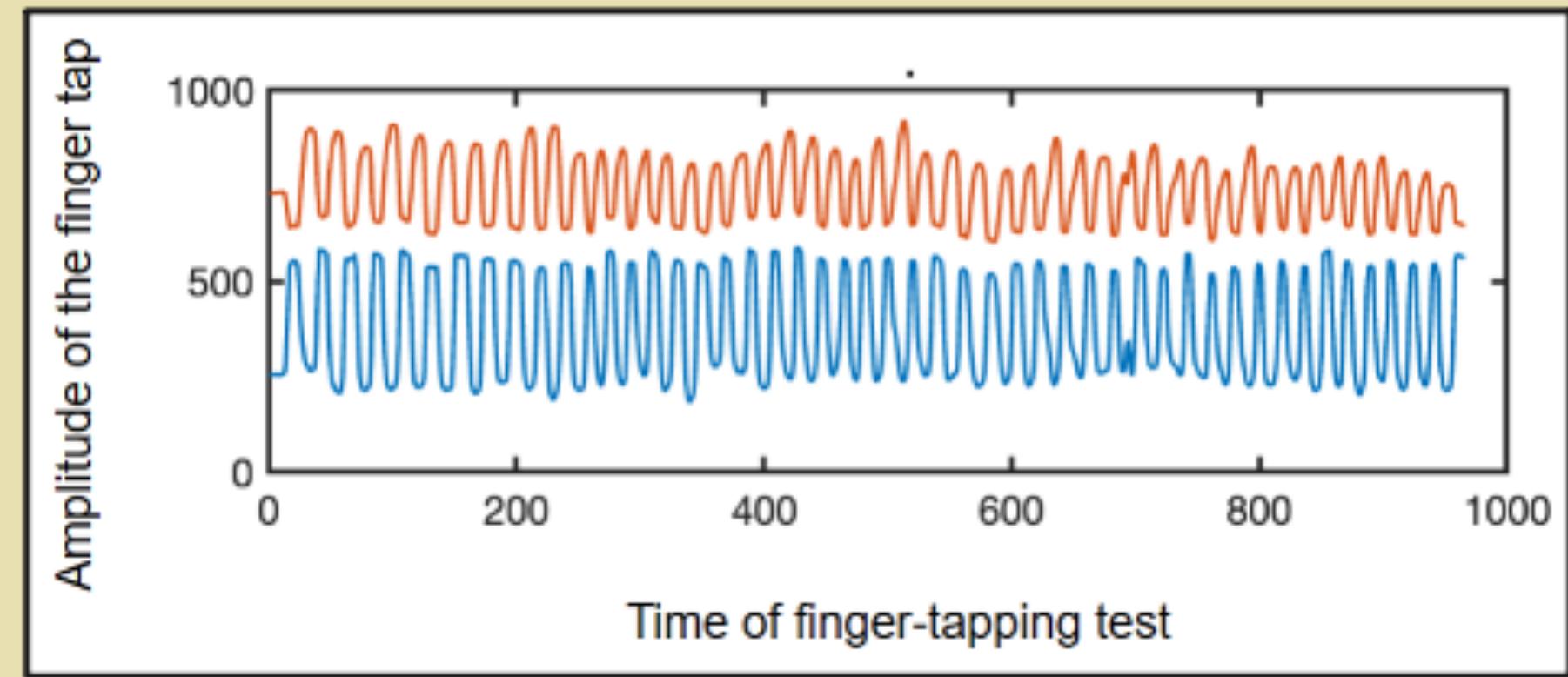


Amplitude-Time Graph

Left Hand



Right Hand



BCC datasets

Medical problem



Project	Data	Concept
Digital MoCA	Cognition	Classification
Lumos Cognition	Cognition	Clustering, Classification



12:57 Tue 24 Nov

MoCA — Cognitive Assessment แบบทดสอบประเมินภาวะสมองเสื่อม

พูดคำที่ขึ้นต้นด้วย “ก” ให้ได้มากที่สุดในเวลา 1 นาที (ห้ามใช้ชื่อคนและไปค้วรใช้คำขึ้นต้นช้า ๆ)

บันทึกแล้ว

1 กิน	4 นก	7 กล้า	12 กรง	17 กระถาง
2 กลับ	5 แก้	8 กรอง	13 ก่อน	18 กอง
3 กำหนด	6 กวย	10 หวาน	14 กลัว	19 กบ
		11 กบ	15	20
			16	21

บันทึกเพิ่มเติบ
(**เหลือเวลา 0 วินาที**)

บันทึก

5/1470



A large blue circle with the word "เริ่ม" (Start) in the center. The circle is divided into two concentric rings, with the text centered in the inner ring.

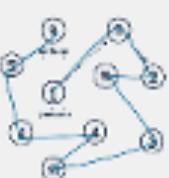
13:01 Tue 24 Nov 95% 52%

MoCA — Cognitive Assessment แบบทดสอบประเมินภาวะทางจิตเวช

สรุปผลการประเมิน

ต่อไป →

วันที่เข้ารับการประเมิน 24 พฤศจิกายน 2563
 ผู้เข้ารับการประเมิน 4329225072139 ระดับการศึกษา ปริญญาตรี (Bachelor degree),
 อาชญากรรมที่เข้ารับการประเมิน โรงพยาบาลจุฬาลงกรณ์

Visuospatial/Executive	คะแนน : 5/5	
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<input checked="" type="radio"/> <input type="radio"/>		

คะแนนทั้งหมด 21/30 คะแนน

Mild cognitive impairment subtype from electronic MoCA

MONTREAL COGNITIVE ASSESSMENT (MOCA)

วันที่ : _____ วัยรุ่น : _____ อายุ : _____ วัยผู้สูงอายุ : _____

VISUOSPATIAL / EXECUTIVE

_____ / 5

NAMING

_____ / 3

MEMORY

ความจำที่ดูดซึมได้ดีที่สุด	หน้า	ตัวอักษร	เสียง	น้ำเสียง	สี
ความจำที่ดูดซึมได้ดีที่สุด	หน้า	ตัวอักษร	เสียง	น้ำเสียง	สี

_____ / 3

ATTENTION

_____ / 2

_____ / 1

_____ / 3

LANGUAGE

Repeat: _____ / 2

Fluency: _____ (N = 20 words) / 1

ABSTRACTION

_____ / 2

DELAYED RECALL

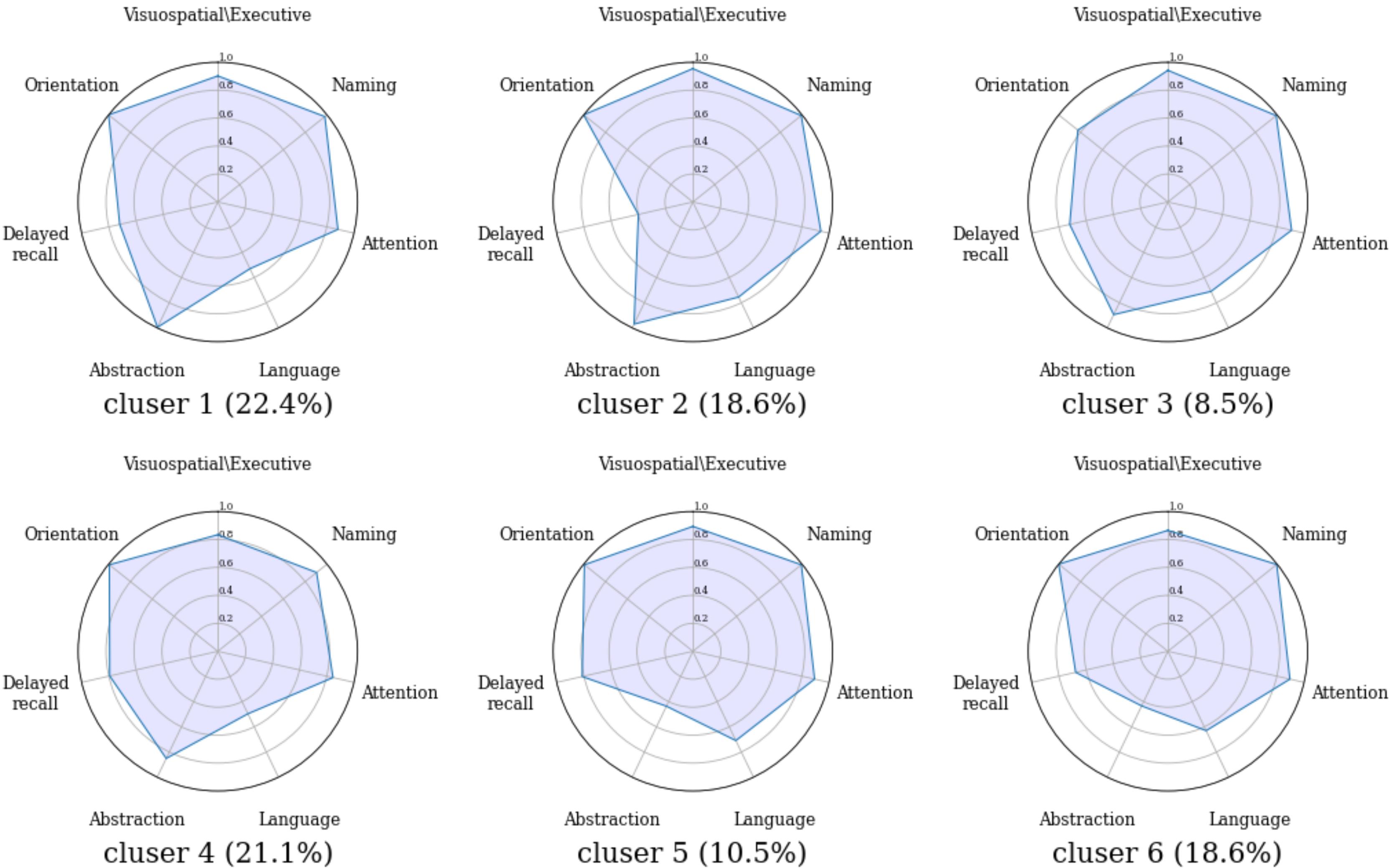
_____ / 5

Orientation

_____ / 6

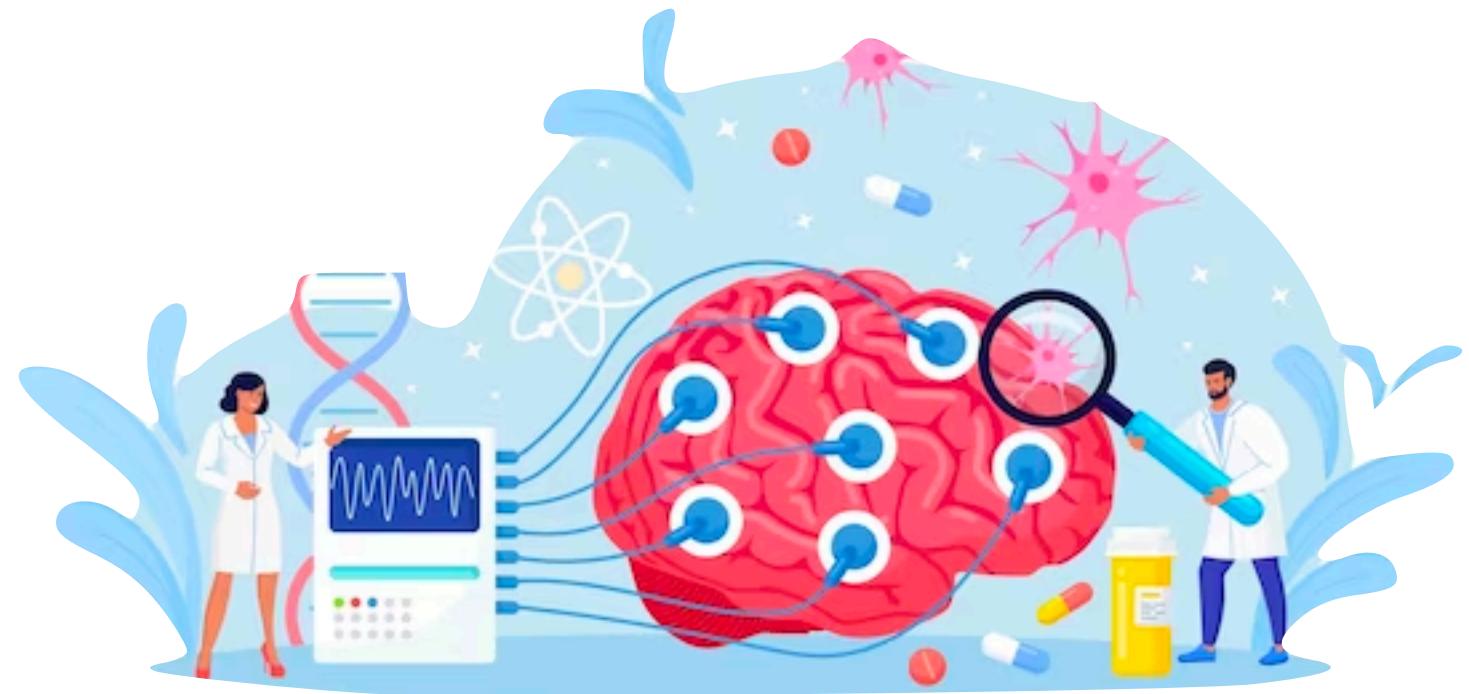
Translated by Sopaphet Hemmognon MD
Trial version 01 Updated August 31, 2011
© Dr Nasreddine MD
www.mocatest.org

คะแนนรวม : _____ / 30
ค่าเฉลี่ย : _____
ค่ามาตรฐาน : _____



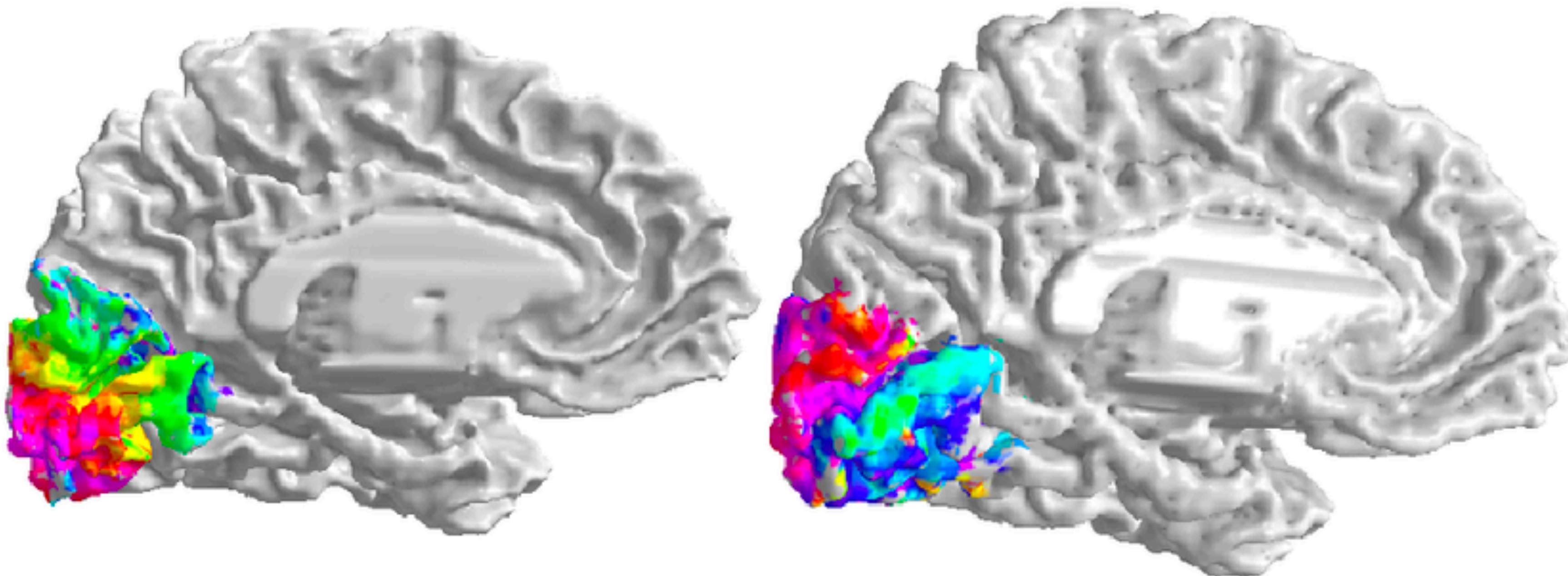
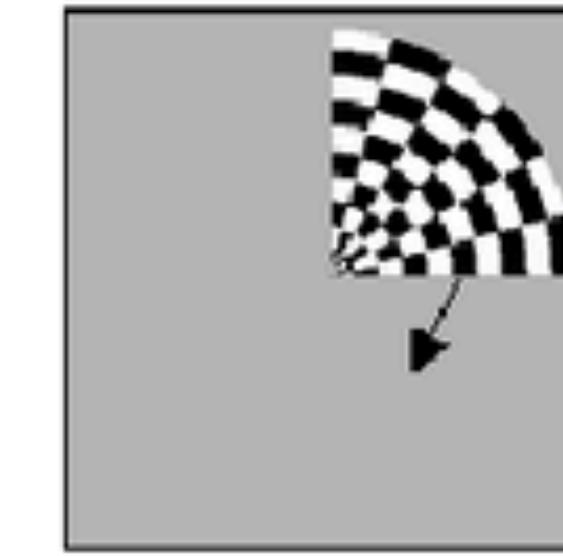
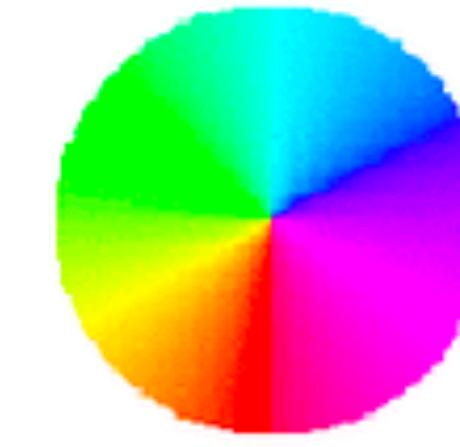
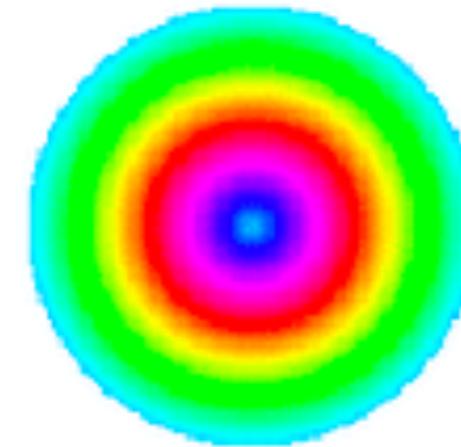
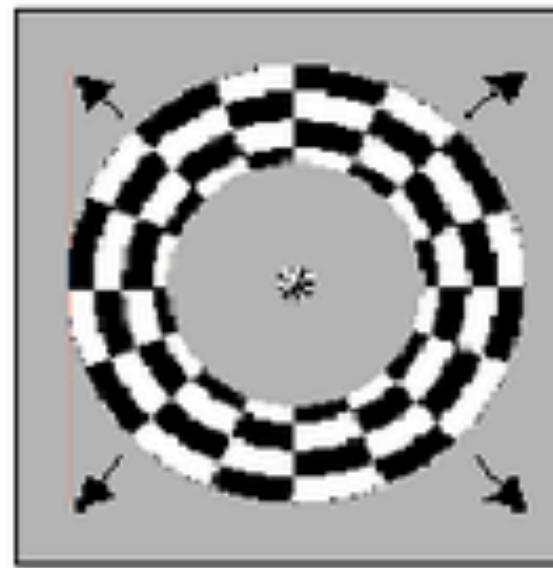
BCC datasets

Neuroscience problem



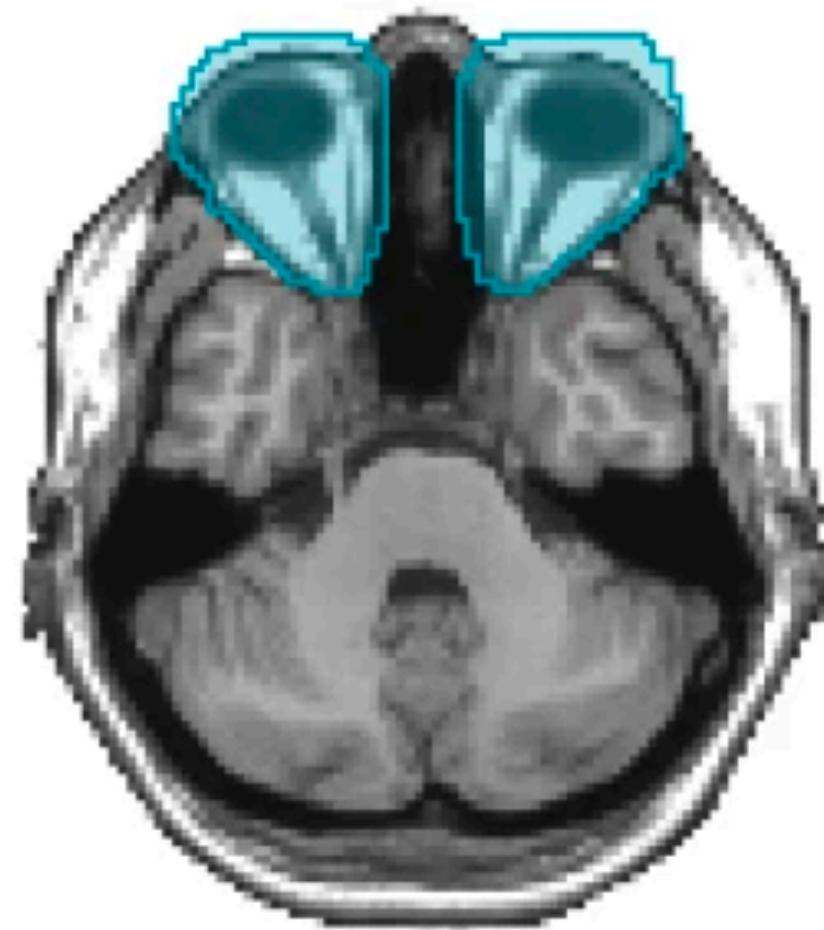
Project	Data	Concept
Retinotopic mapping of visual cortex	fMRI	FFT
Deep MRI eye	fMRI	eye track, time series
Attention development across life span	fMRI	IEM, decode

Retinotopic mapping of visual cortex

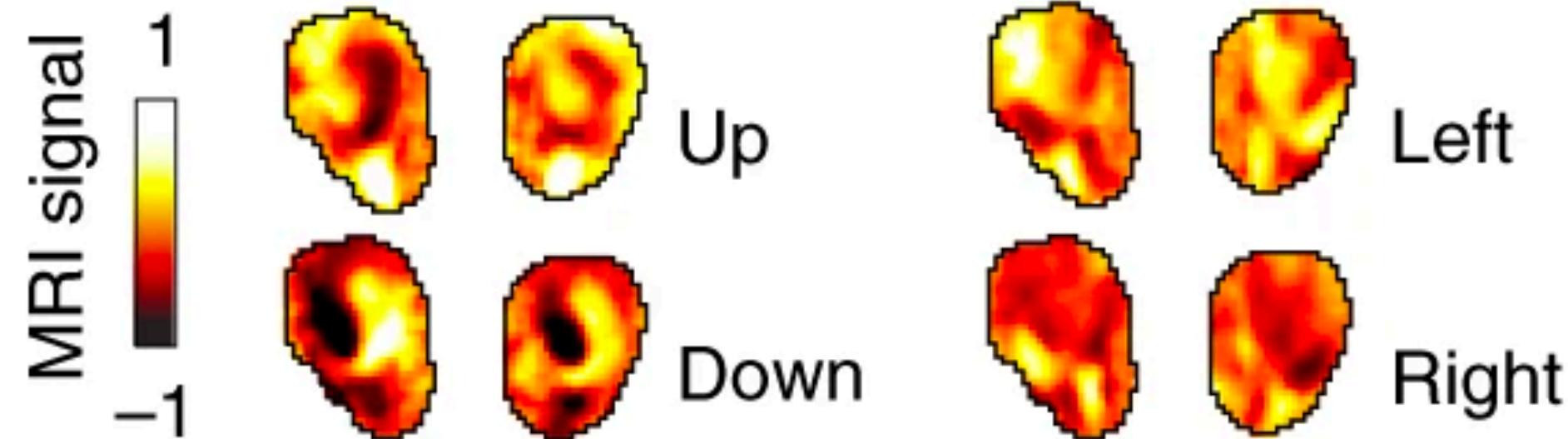


Model input

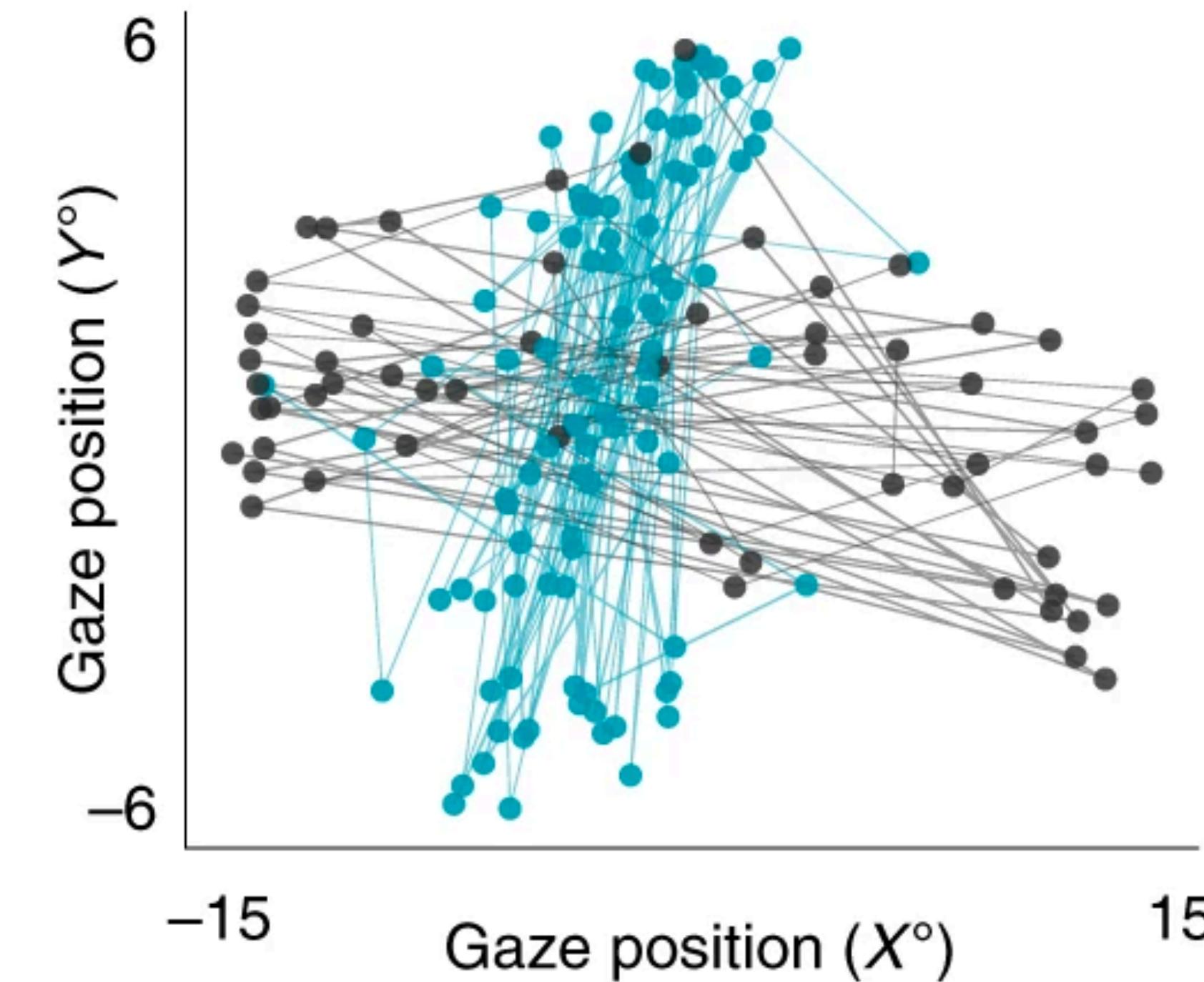
Eyeball voxels



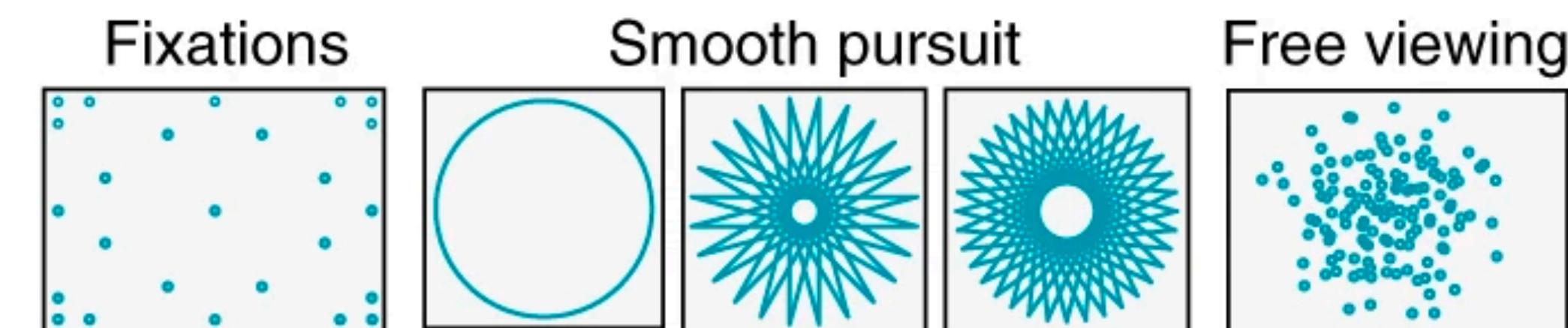
Eyeballs reflect gaze direction



Eyes-closed eye tracking

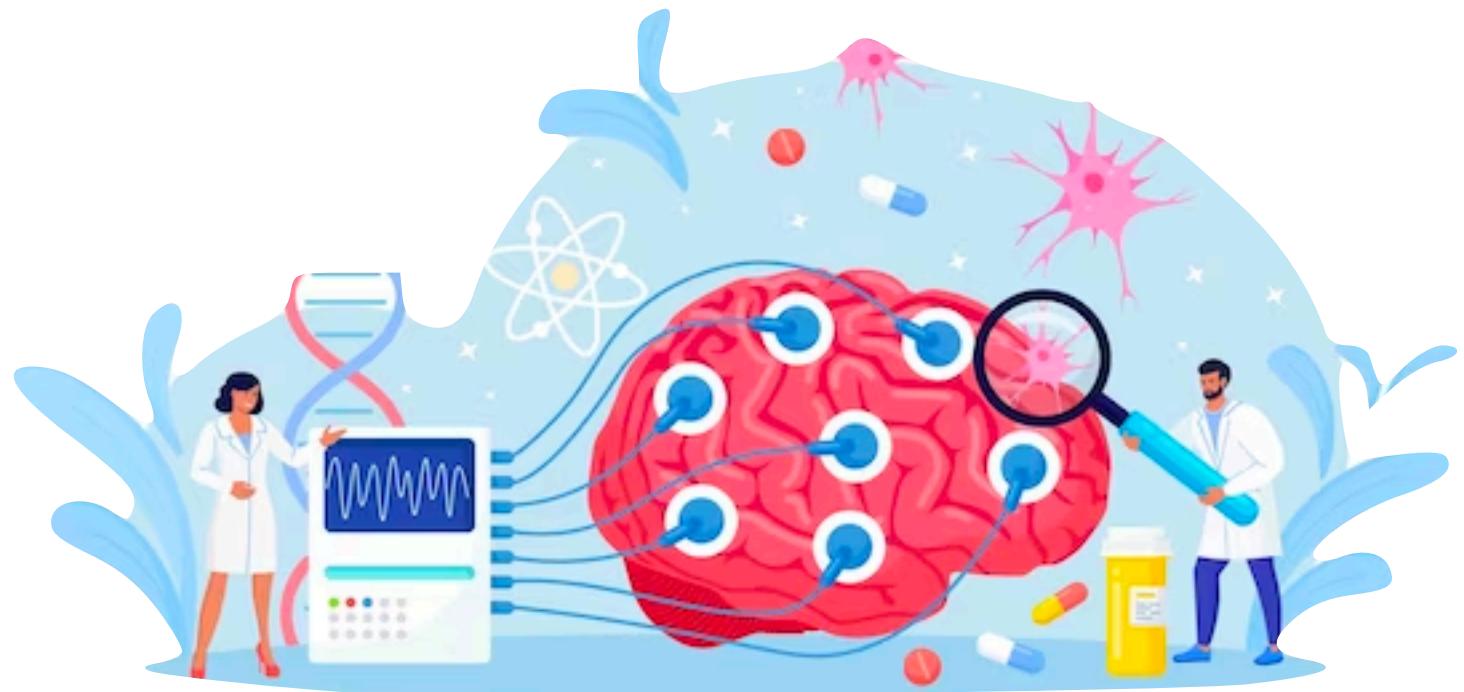


Eyes move up–down or left–right



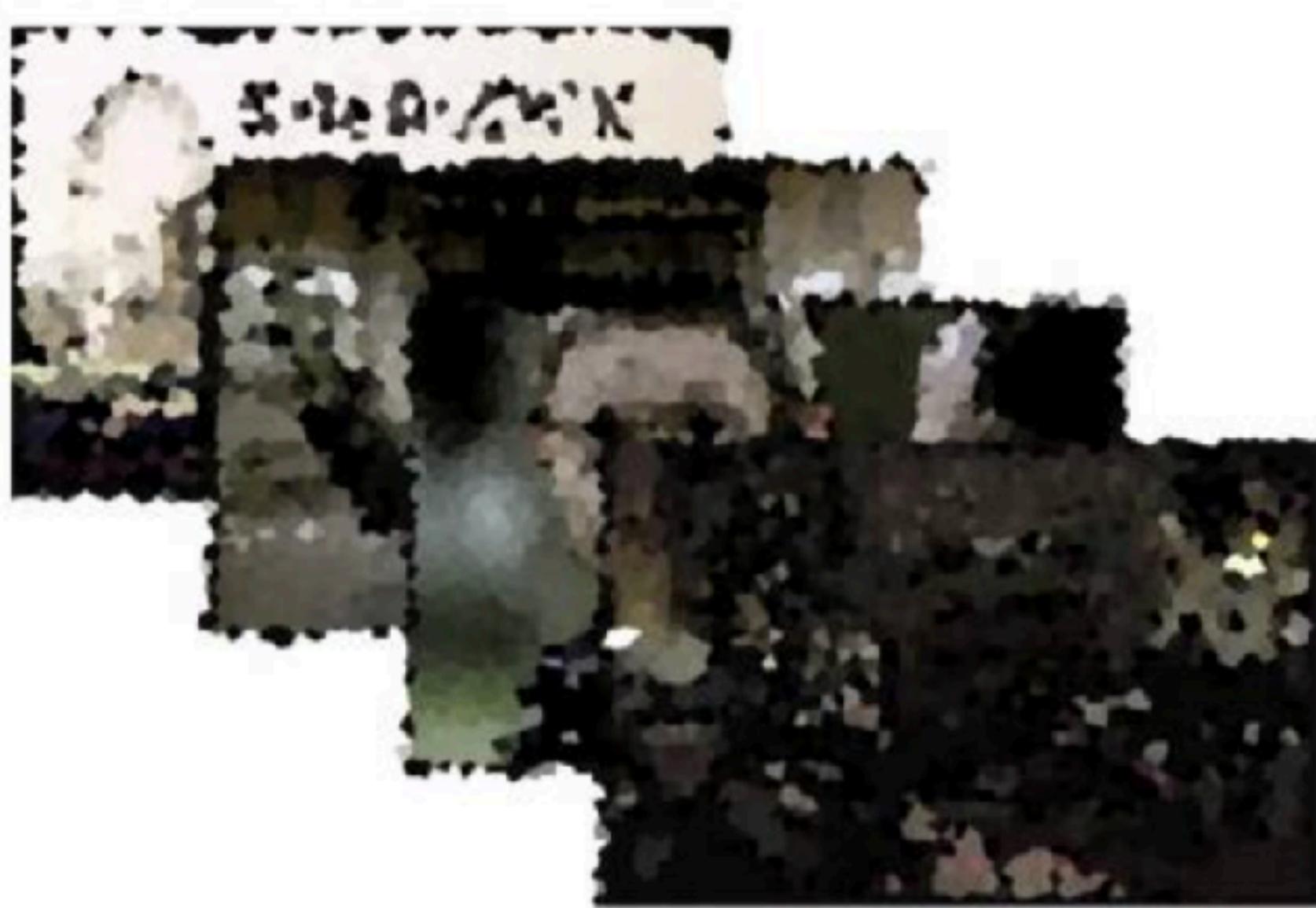
BCC datasets

Neuroscience problem

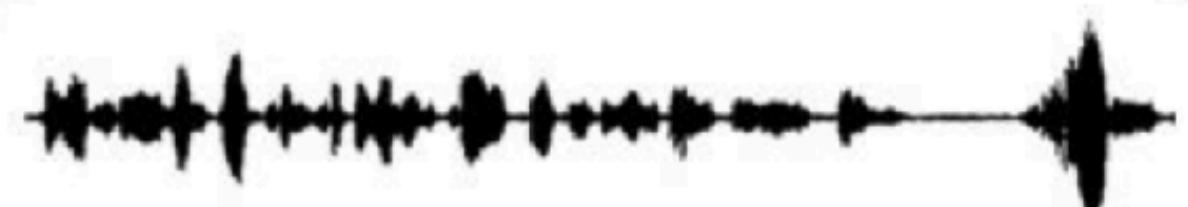


Project	Data	Concept
Coexisting representations of sensory and mnemonic information in human visual cortex	fMRI	RSM, dimensionality reduction
Restoring Latent Visual Working Memory Representations in Human Cortex	fMRI	Modeling
Shared memories representation	fMRI	RSM, decoding
Resolving human object recognition in space and time	fMRI-MEG	RSM, fMRI-MEG

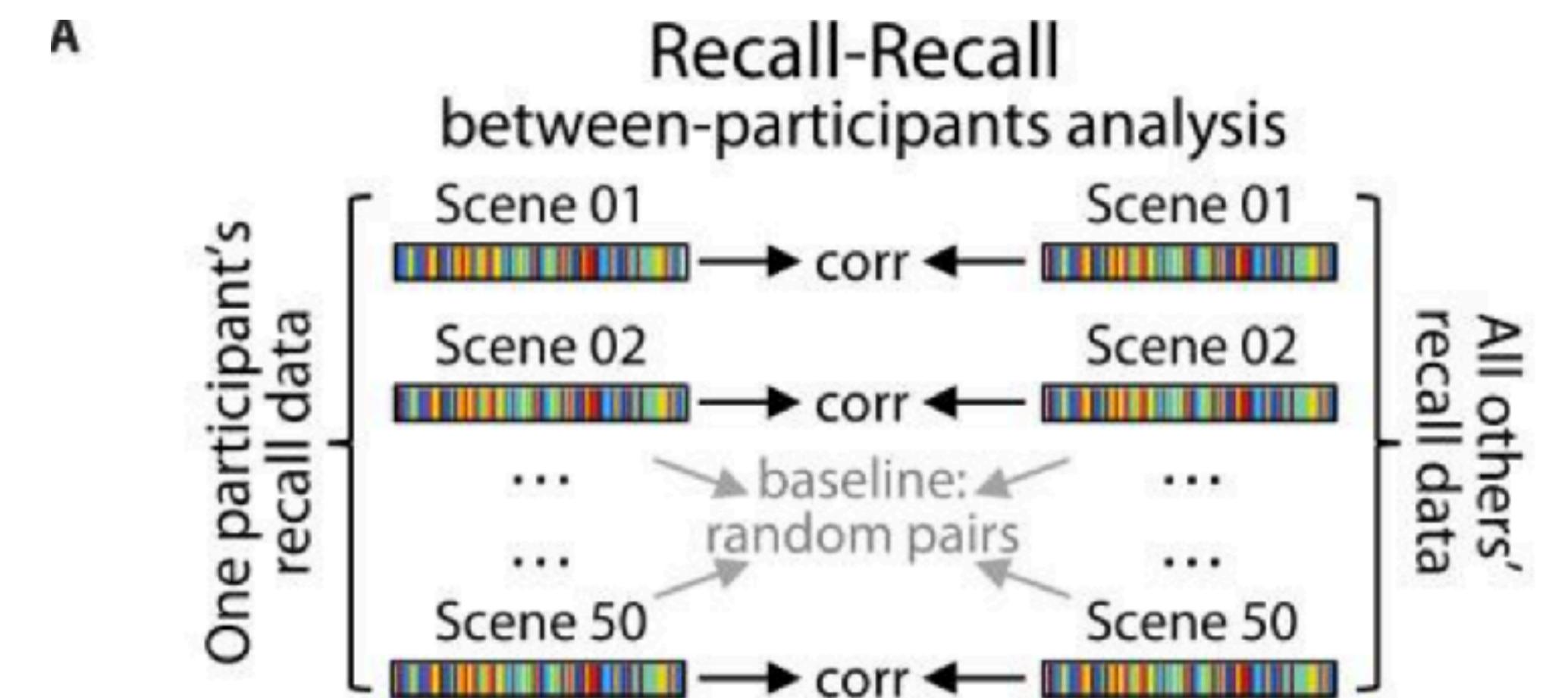
Audio-visual movie viewing



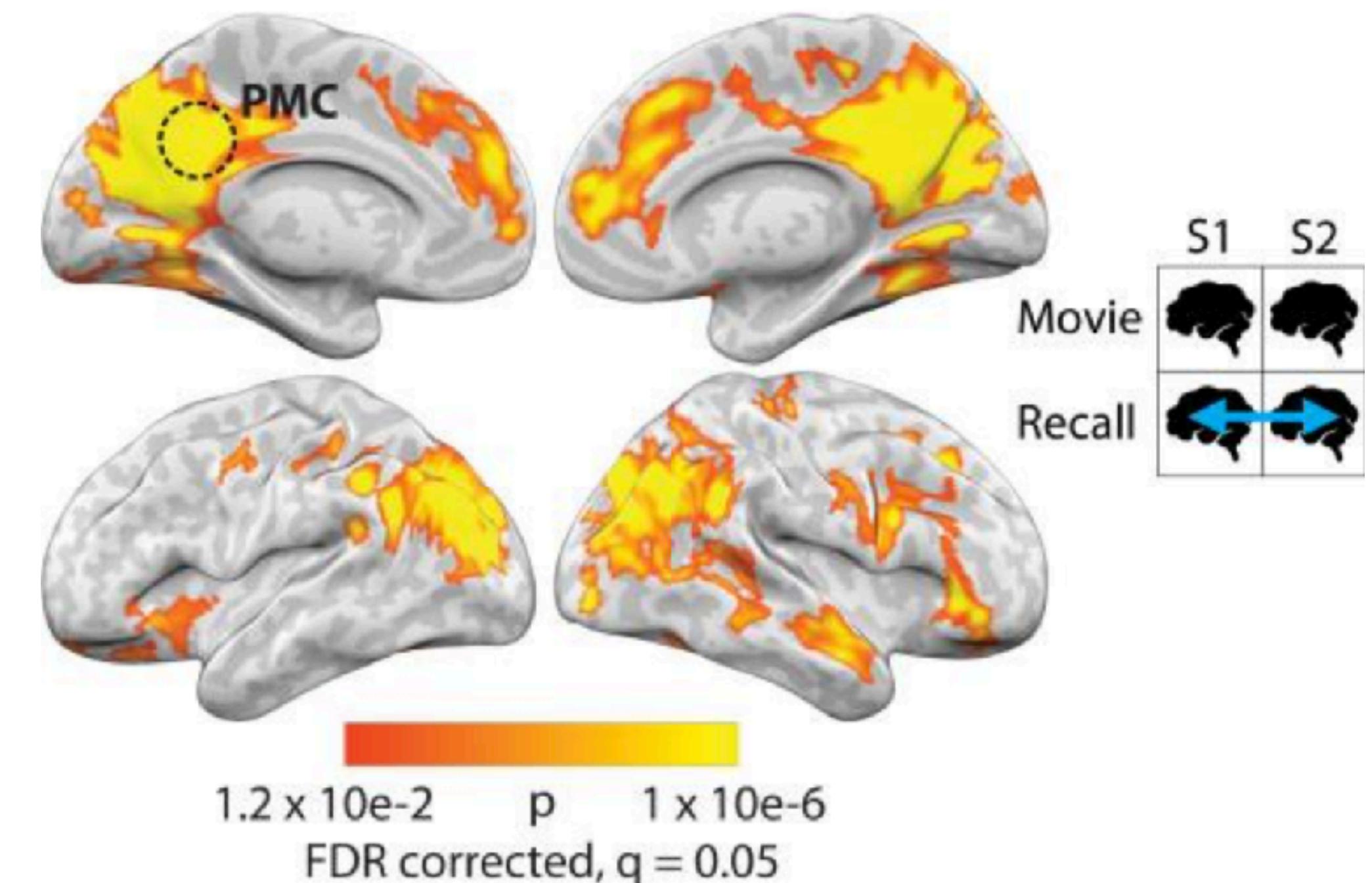
Spoken recall
no cues, no auditory or visual input



"... Next Watson goes to a warehouse where he meets a man that says he is the closest thing to a friend that Sherlock has. This man says ..."

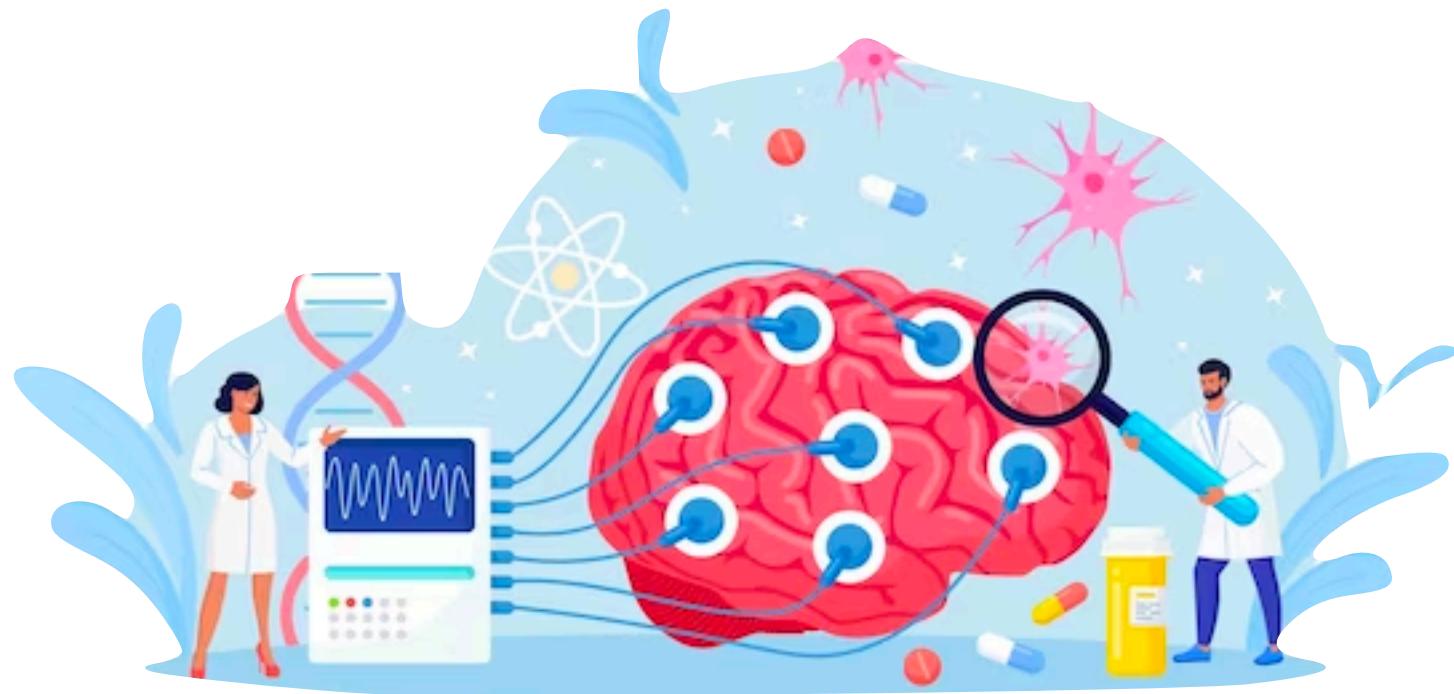


B Recall-Recall pattern similarity searchlight



BCC datasets

Neuroscience problem



Project	Data	Concept
Face170 ERP	EEG	ERP
Alpha-Band Oscillations Enable Spatially and Temporally Resolved Tracking of Covert Spatial Attention	EEG	FFT, decoding
ABC prediction	EEG	ERP, decoding

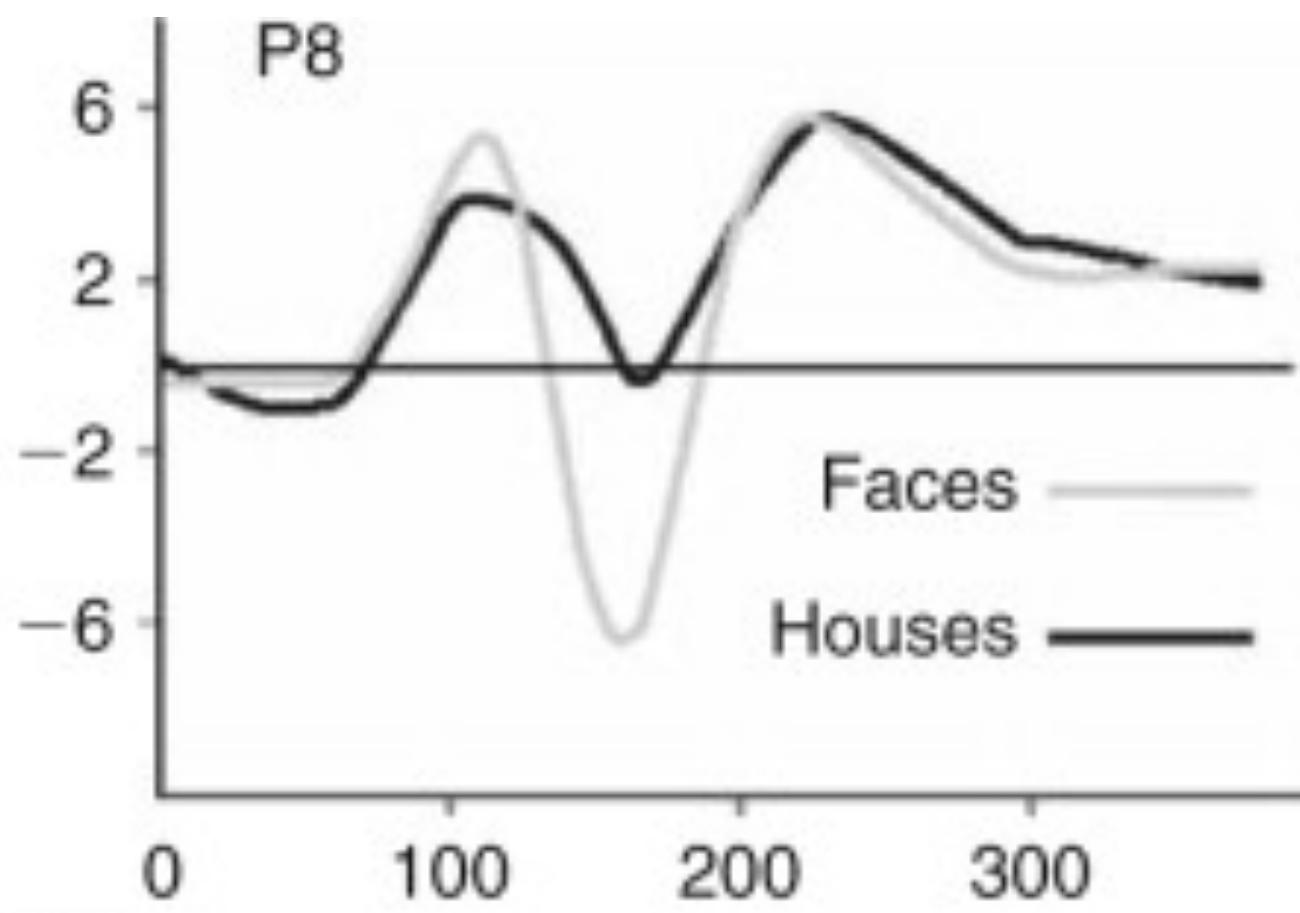
N 170 face ERP



(a)



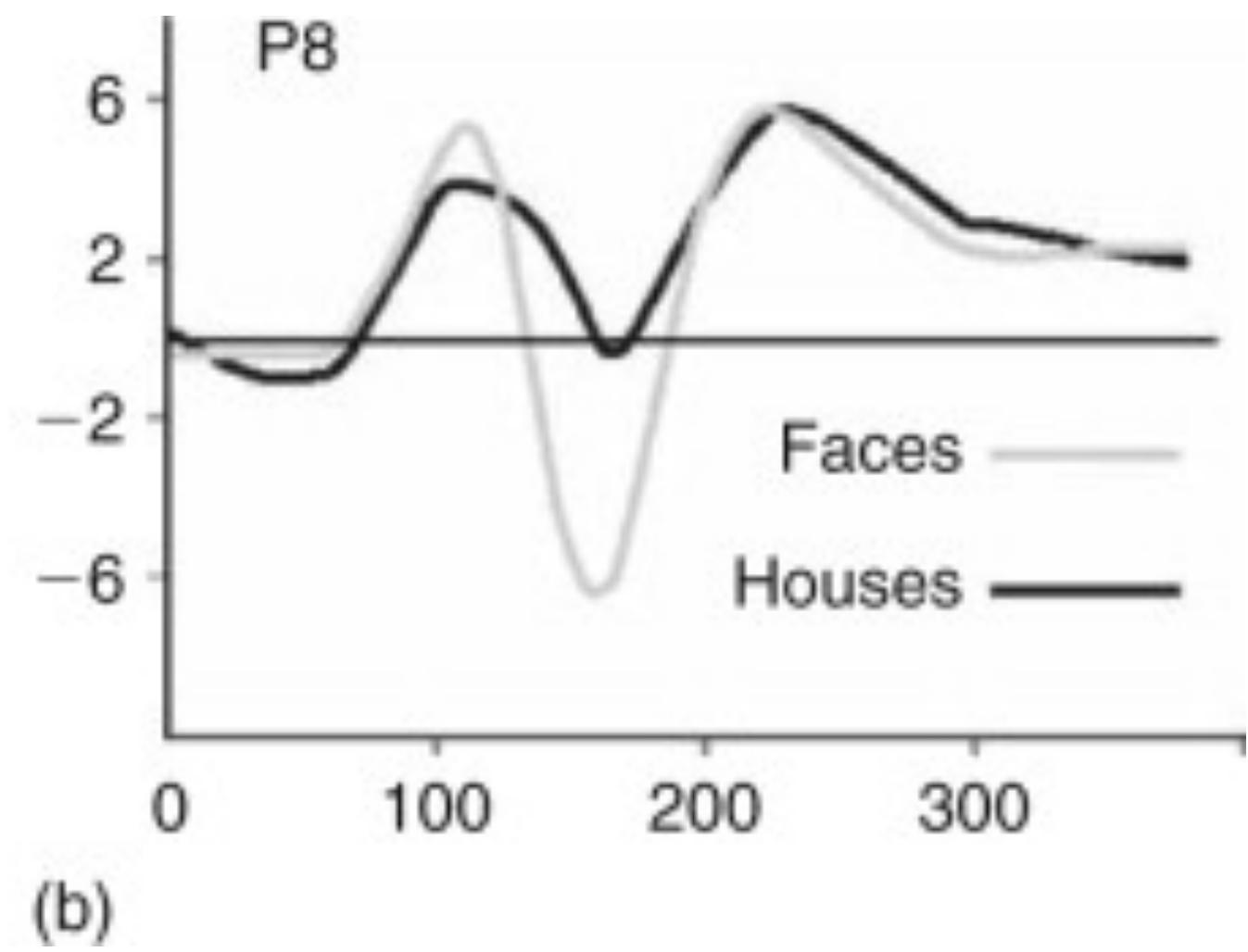
(b)



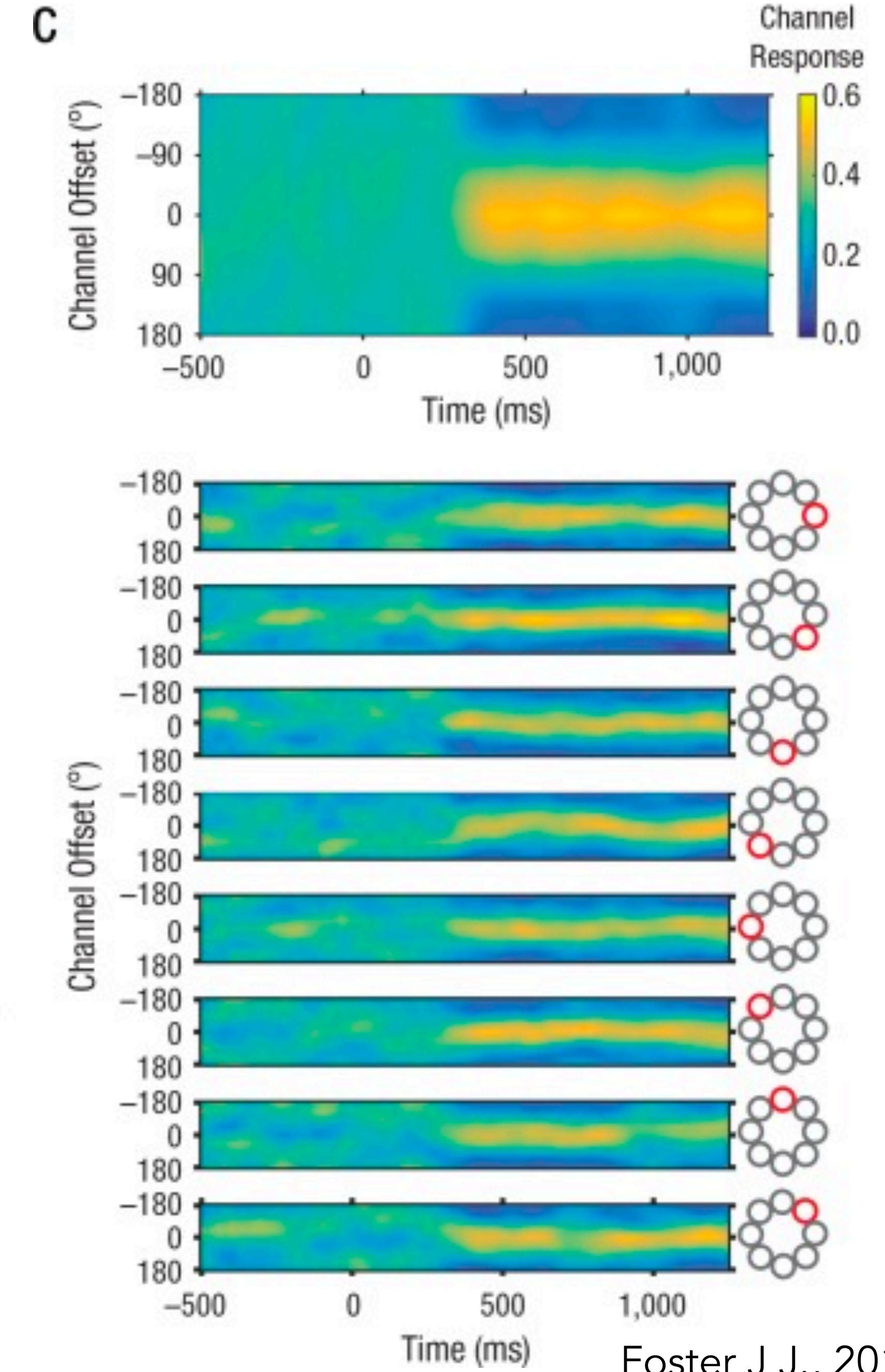
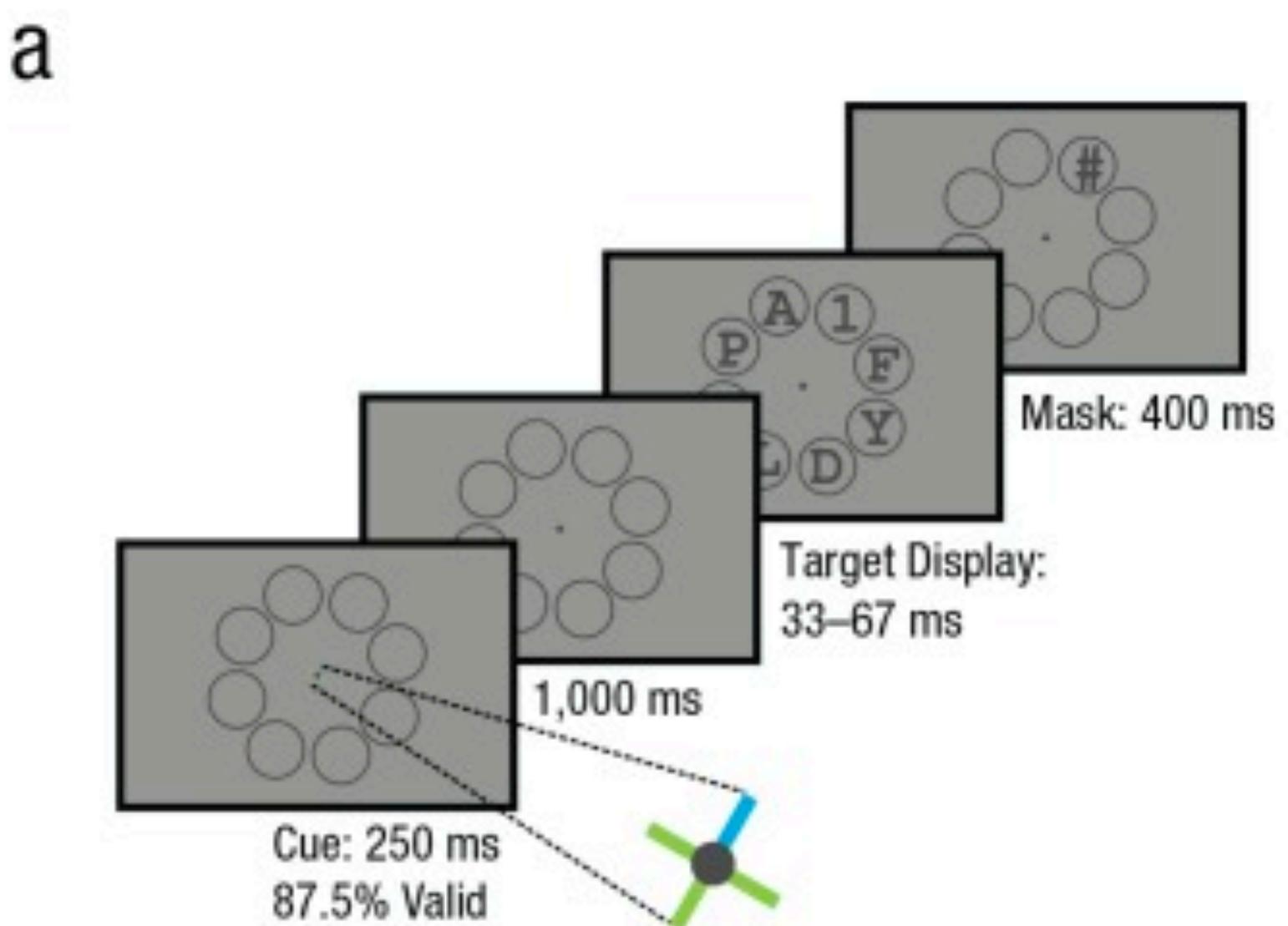
N 170 face ERP



(a)

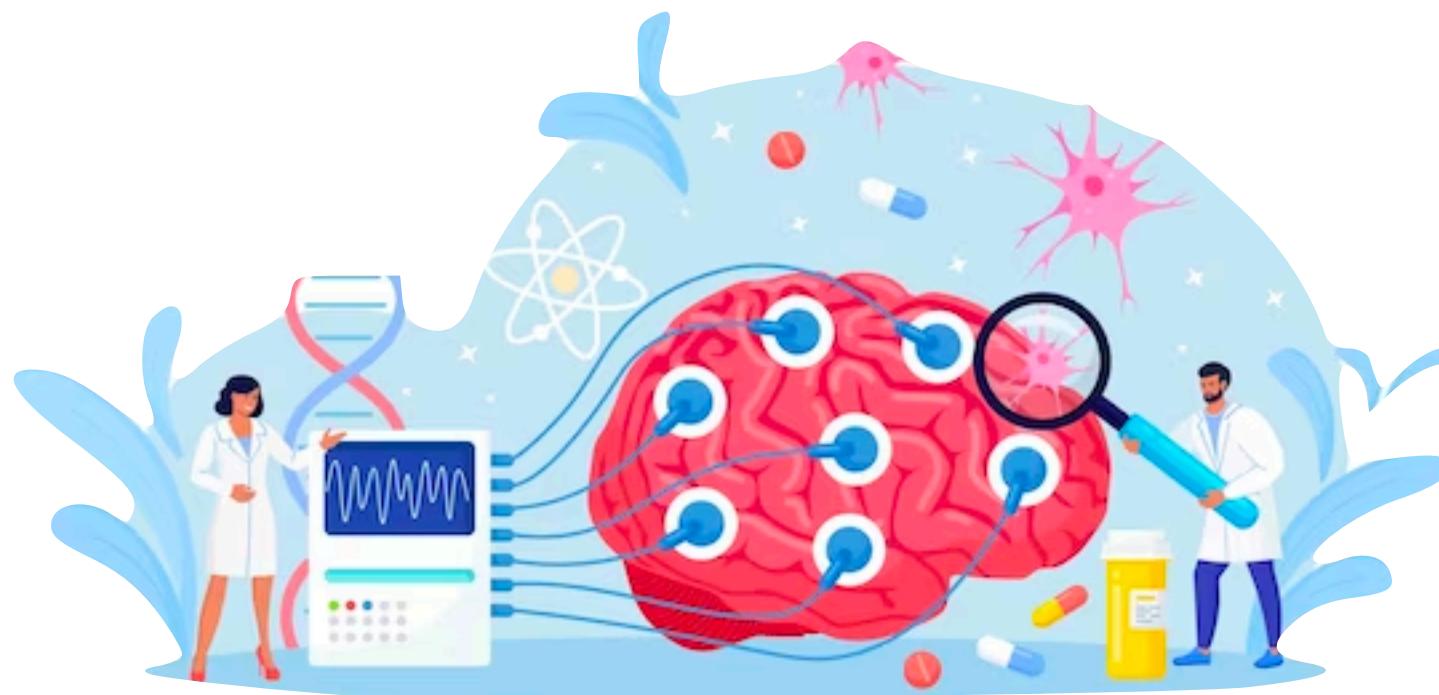


(b)



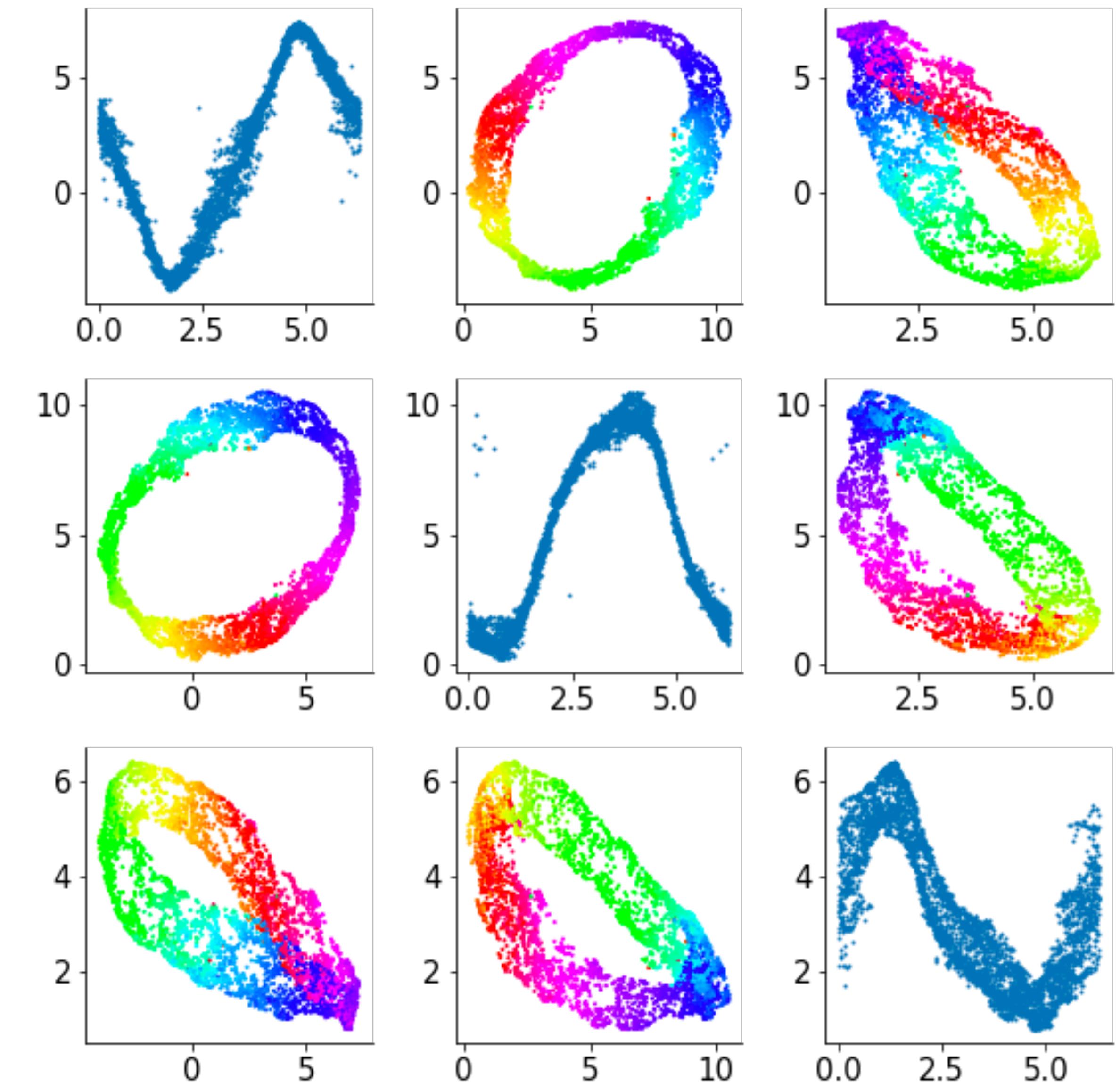
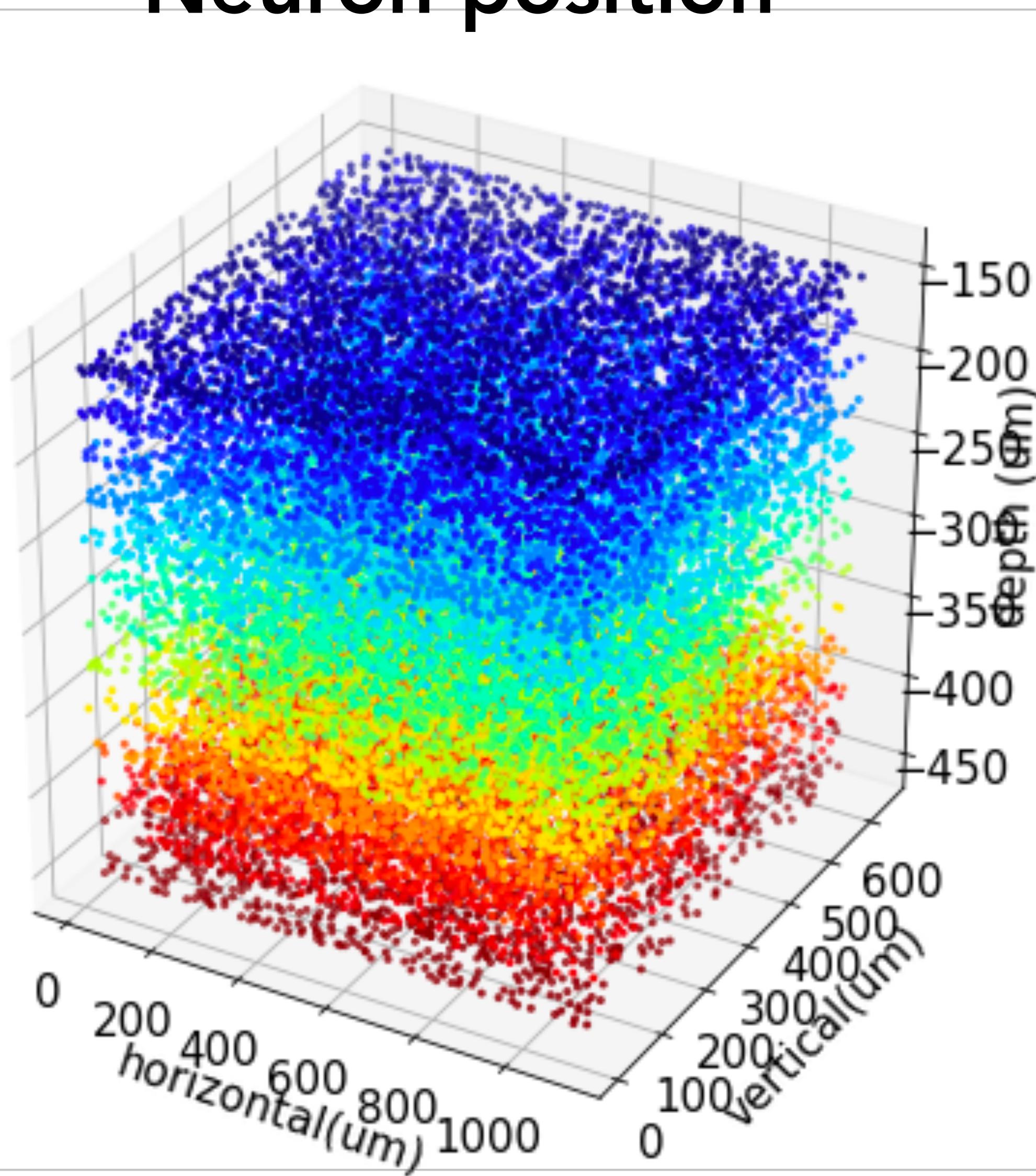
BCC datasets

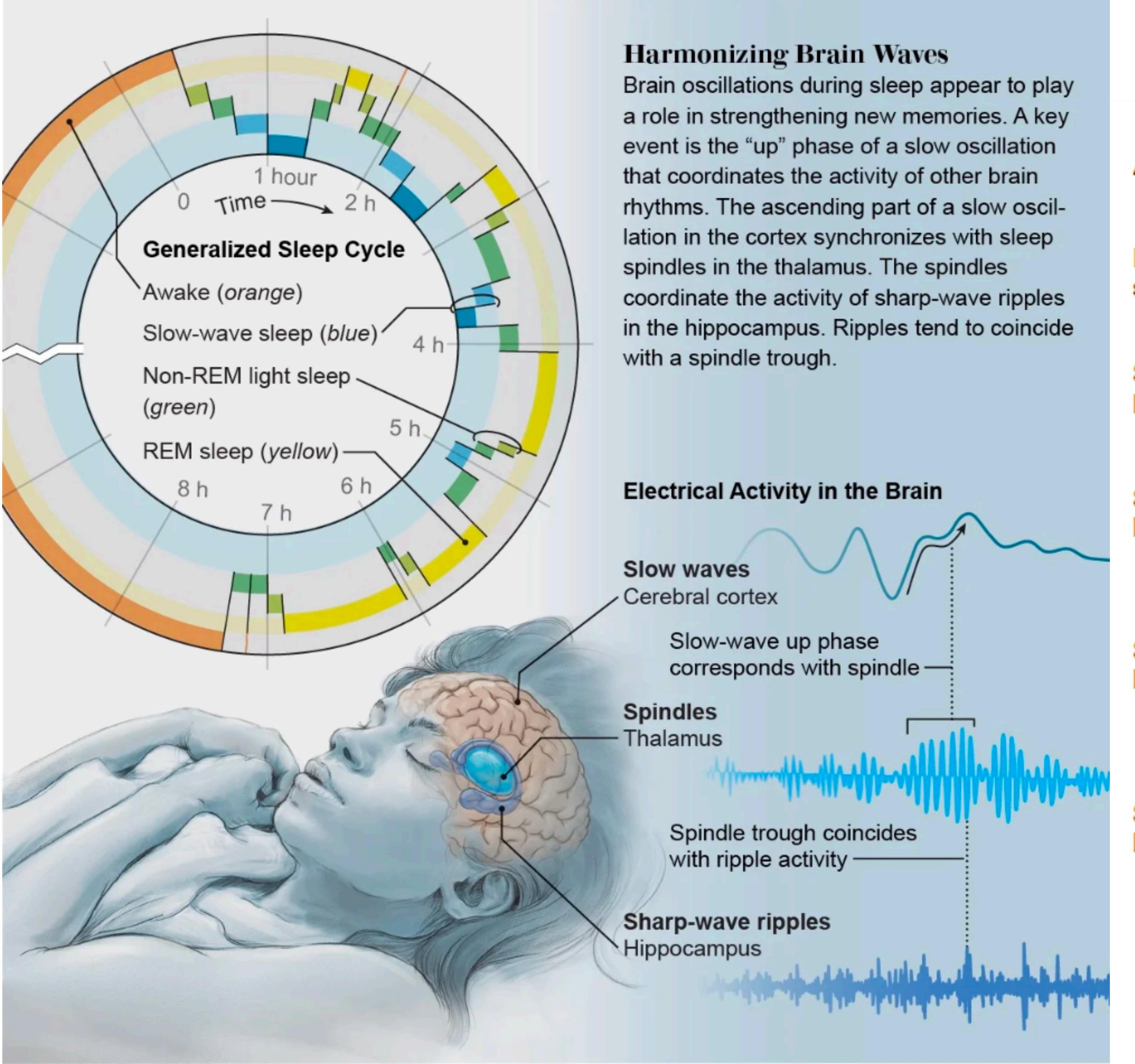
Neuroscience problem



Project	Data	Concept
Face perception neuron	Neuron	Single neuron recording
Orientation perception neuron	Neuron	Single neuron recording, Decoding
Sleep stage classification	PSG	Classification

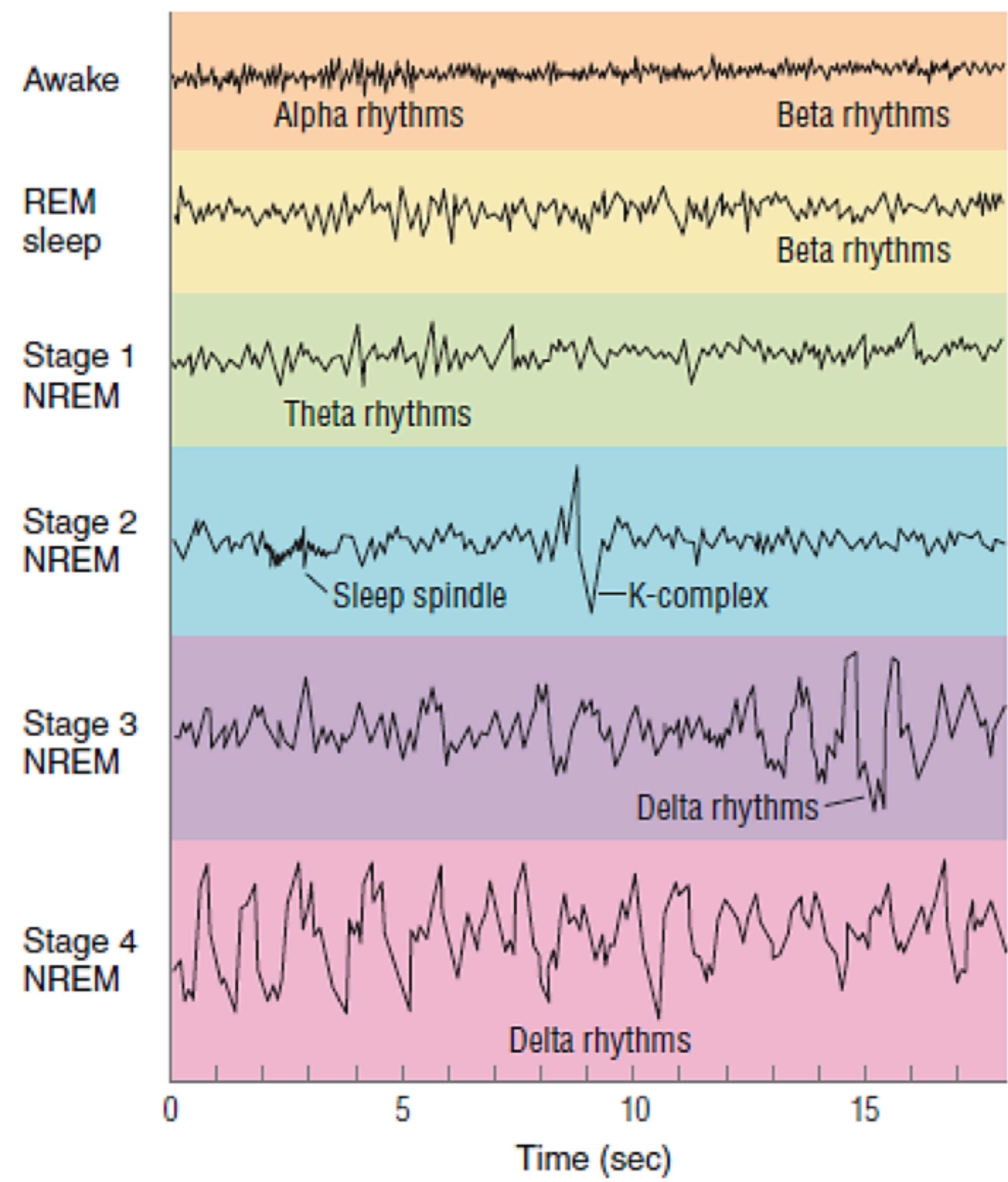
Neuron position



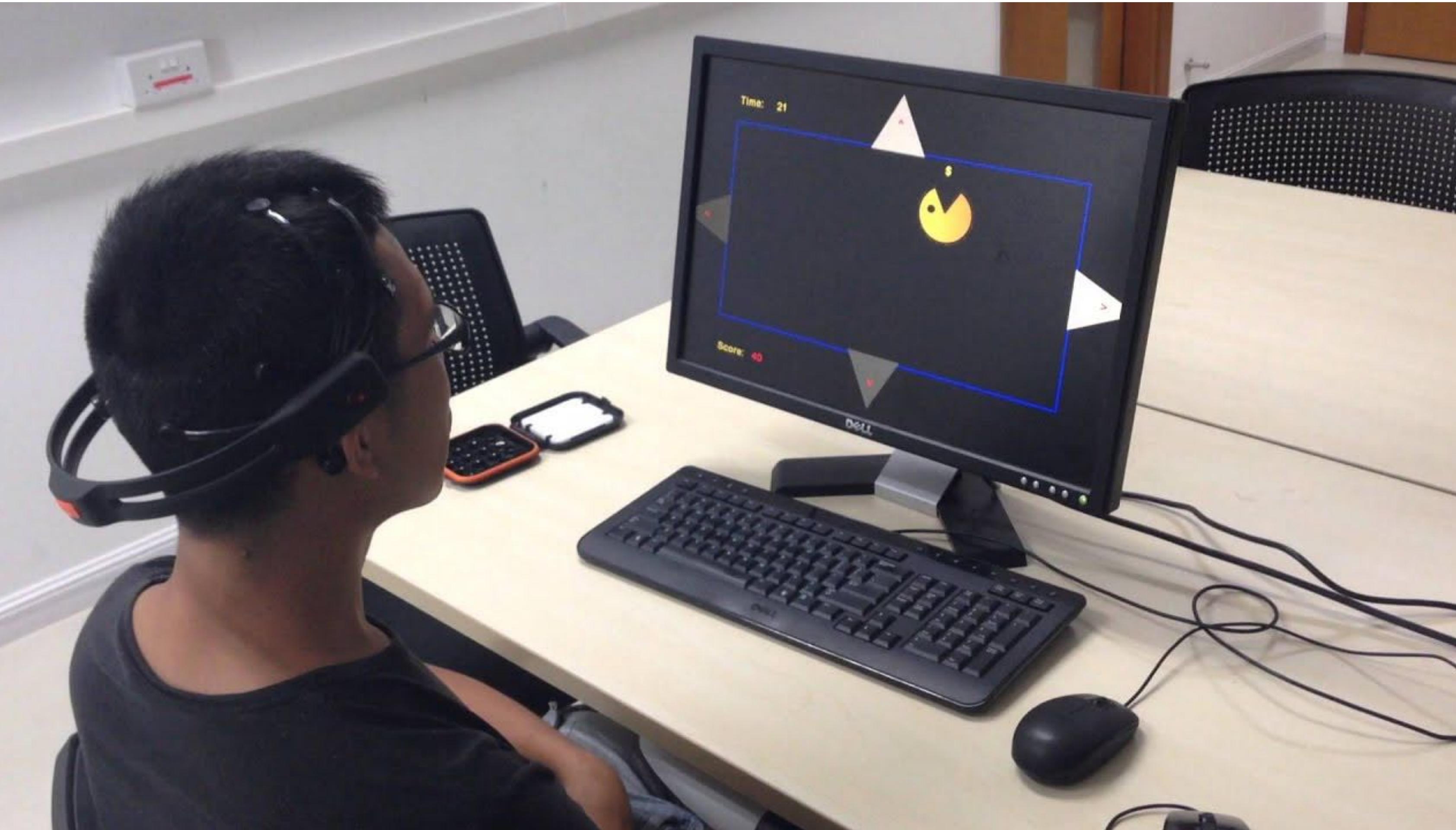


Harmonizing Brain Waves

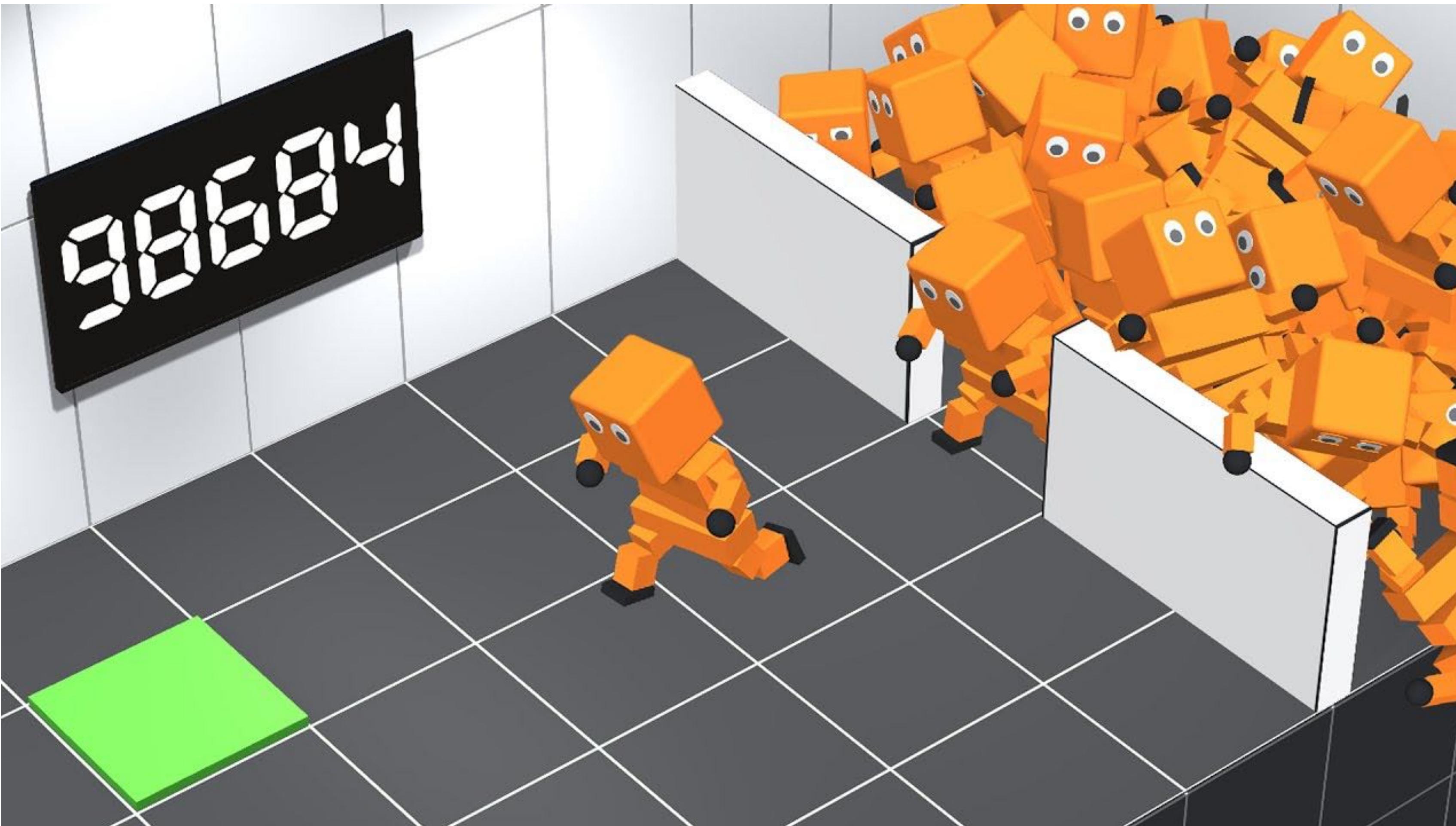
Brain oscillations during sleep appear to play a role in strengthening new memories. A key event is the “up” phase of a slow oscillation that coordinates the activity of other brain rhythms. The ascending part of a slow oscillation in the cortex synchronizes with sleep spindles in the thalamus. The spindles coordinate the activity of sharp-wave ripples in the hippocampus. Ripples tend to coincide with a spindle trough.



Decoding problem -> BCI



Simulation problem





แบบประเมิน



สไลด์ BBB



แบบทดสอบ



กล่องคำถ้า

เพื่อประกาศนียบัตร

Action plan

- ทบทวนบทเรียน Prerequisites โดยเฉพาะบทที่เกี่ยวข้องกับ mini project ที่สนใจ
- พูดคุยกับ TA ประจำกลุ่ม เพื่อสอบถามข้อมูล / ความเห็นเกี่ยวกับ mini project เพิ่มเติม
- เลือก mini project ที่จะทำ ในช่วง Brain code camp
- กำหนดขอบเขตของงานที่จะทำ ในกรณีที่ project มีขนาดใหญ่
- เริ่มศึกษาโครงสร้างและลักษณะของ Dataset ที่ต้องการจะทำ
- ทำความเข้าใจบทเรียนของ Brain code camp ล่วงหน้า