

Figurative SSVEP-based BCI

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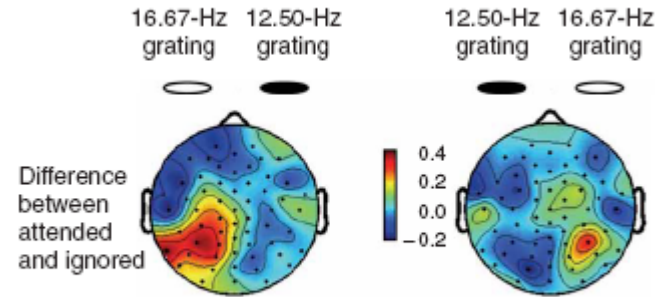
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Outline

1. Background
2. Scope
3. Stimuli
4. Paradigm
 - Presentation Code
 - Python Code
5. Bugs
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1. Background

- Visual perception of stimuli which change contrast at a certain oscillating frequency elicit visual evoked potentials at the same frequency in EEG (SSVEP) (Regan, 1977)
- Recent studies show amplitude modulations of SSVEP by selective and covert visual attention. (Di Russo, 2007; Kim, 2007)
- 'Gestalt' principle: “the whole is different from the sum of it's parts” (Wertheimer, 1912)



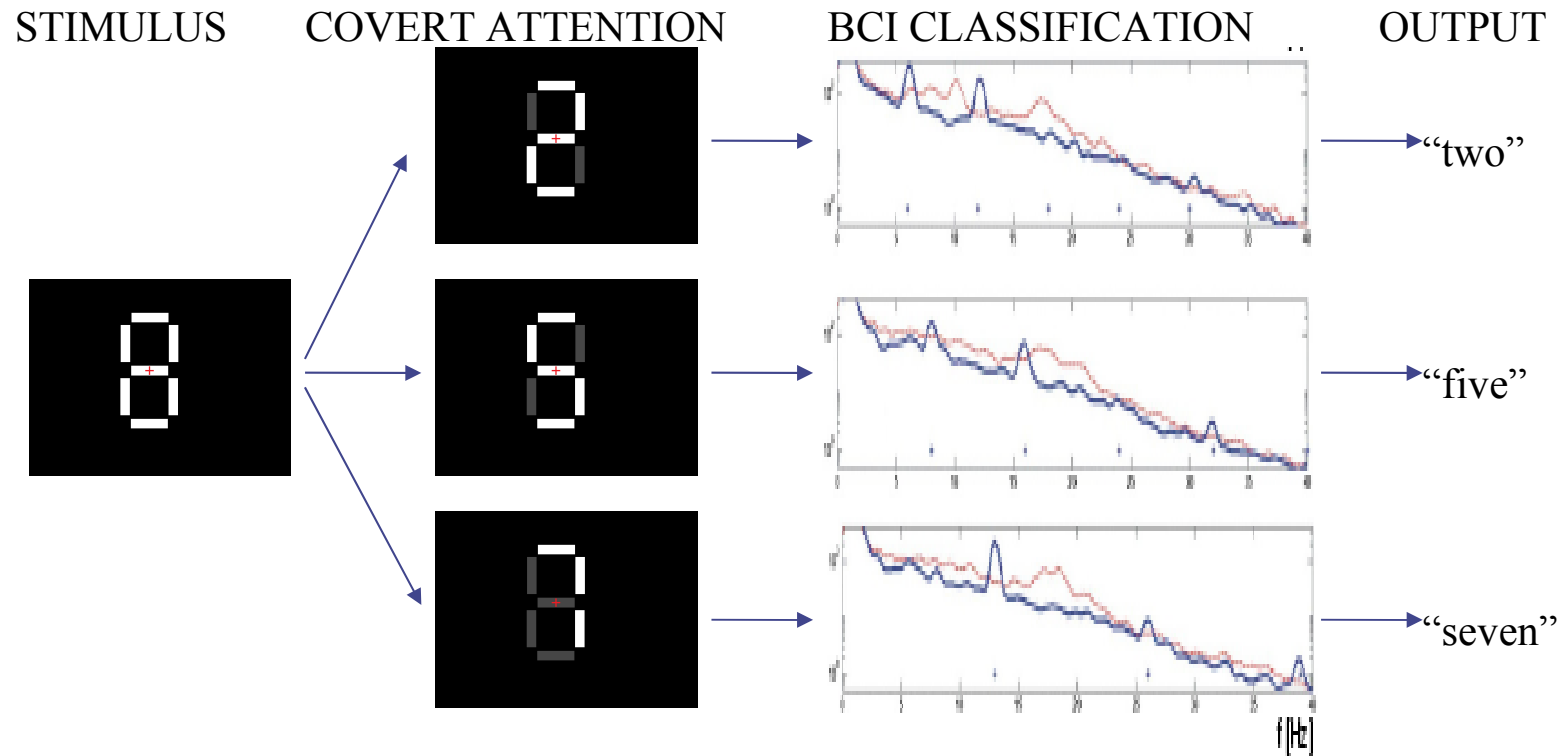
Kim (2007)



www.wikipedia.org

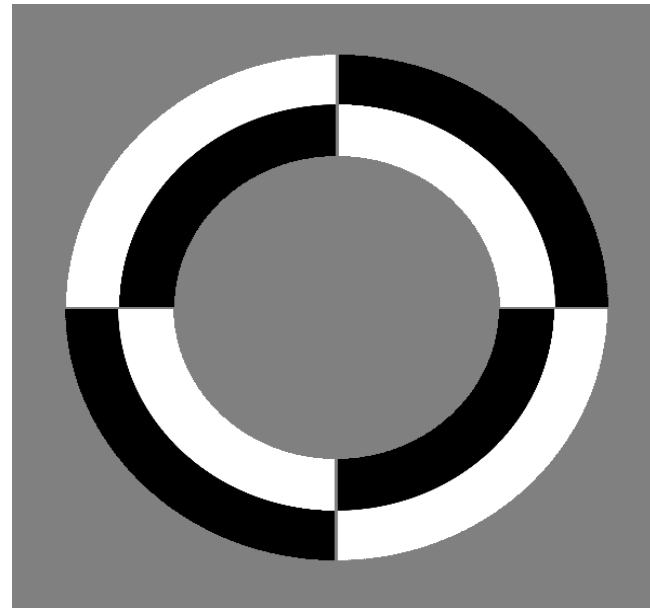
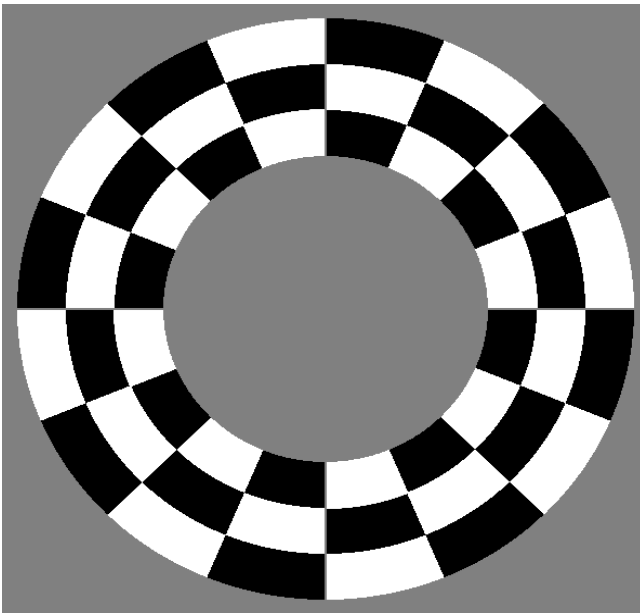
2. Scope

- Development of a BCI paradigm using frequency tagged stimuli for online classification.



3. Stimuli

- Stimulus generation with VisionEgg (a Python-based library) allows to modulate:
 - number and diameter of rings
 - number of sectors within a quadrant
 - diameter of central hole
 - black-white pattern per quadrant
 - gap between wedges



4. Paradigm

24 conditions – 100sec per condition – total of 40min task

Condition	Stimuli	Locus of Attention	Task
1.- 4.	one wedge flickers	attention at the center	count target stimuli
5.	all wedges flicker	attention at the center	count target stimuli
6.-9.	one wedge flickers	covert attention on the wedge	count flicker-stops
10.-13.	all wedges flicker	covert attention to one wedge	count flicker-stops
14.-19.	all wedges flicker	covert attention to two wedges	count flicker-stops
20.-23.	all wedges flicker	covert attention to three wedges	count flicker-stops
24.	all wedges flicker	covert attention to four wedges	count flicker-stops

4. Paradigm

- Presentation Version

Pro's : - presents stable flicker

- transparent sequential code

Con's: - stimuli have to be jpg or bmp, no flexible adjustment of stimulus parameter

- 1000(+) lines of code

- when running, access to other processes is blocked

- Python Version

Pro's : - less than 500 lines of code

- stimuli are generated by python, flexible adjustment of stimulus parameter

- when running, access to other processes is possible

Con: - BUG! instable flicker presentation

5. Python Code - Bug

A - B - C - D - E-H - J - K - L

Computer – Physical RF – Python RF – TrialDur - WedgeDur – NumOfFrames – MeanIFI - MaxIFI

[illegible]

6. Next Steps

- Using 170hz monitor, 2 computer and Presentation Program Version to run a pilot testing series.
- Control for subliminal eye movements (eye tracker?)

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Thank You!