Neurofunctional impact of chronic cannabis use on emotion
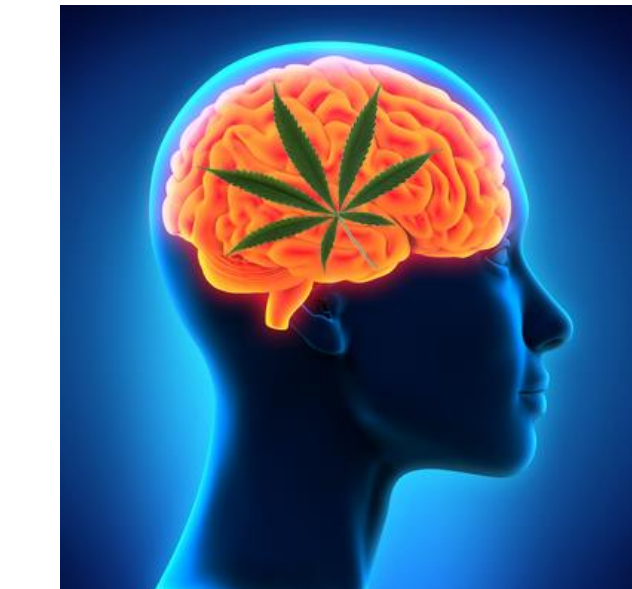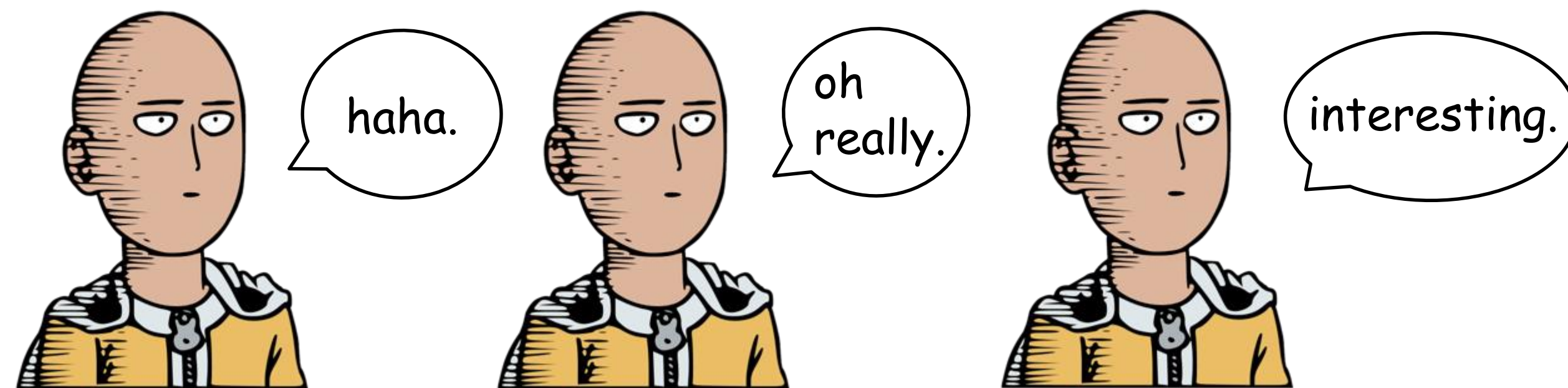
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Cannabis & Emotion

Does long-term use of cannabis impact our emotional responses?


- Cannabis (psychoactive ingredient THC) is the most frequently used illicit drug worldwide

- Cannabis were shown to affect emotional responses both during and after intoxication[1,2]

- In acute intoxication, THC bind to CB1 receptors, which are abundant in the brain's emotion processing center

- The neural mechanism of residual effects of chronic cannabis use remains unknown

Source of Data & Methods

Human Connectome Project (HCP)
- An international project to generate a map of the human anatomical and functional brain network.
- We downloaded pre-analyzed task-fMRI data from the HCP database. Group analysis was performed according to HCP guidelines
- Functional MRI
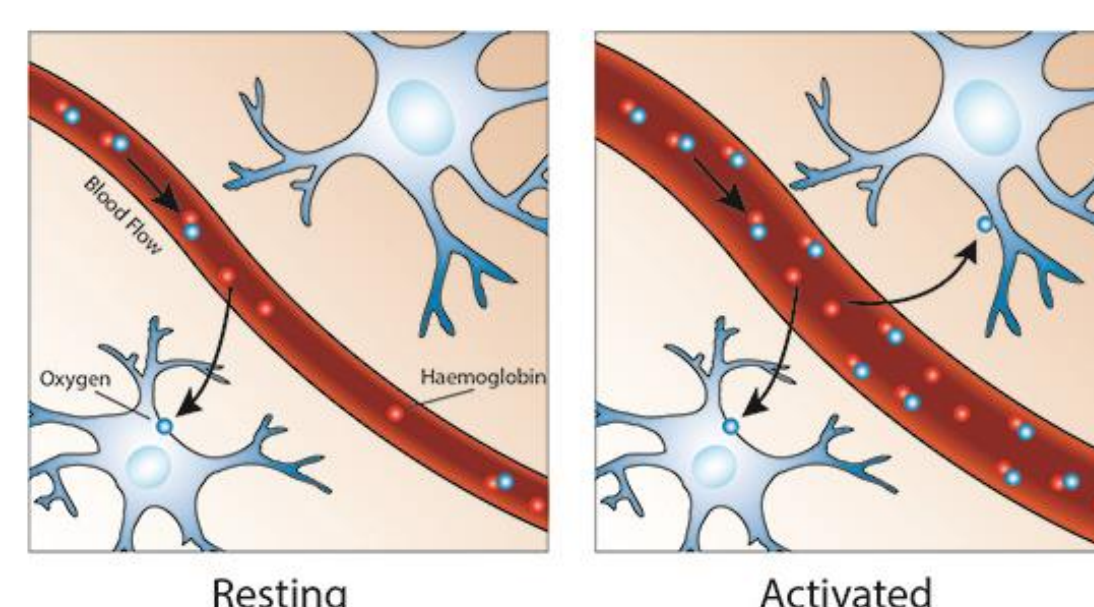
- Task-dependent fMRI data:
  - Blood Oxygen Level Dependent (BOLD) signal

State-of-the-art Data quality
- New gradient hardware used for 3T:
  - increased G_{max} : Gap between neural excitation and image acquisition is shortened[3]
- Dual phase-encoding
  - To cancel out noises from one-directional scans, a left-to-right and a right-to-left run were acquired for each task[4]

Participants

Participants in the HCP database:
- Non-related healthy adults aged 22-35 from HCP S900 release
- Substance use recorded based on self-report in the Semi-Structured Assessment for the Genetics of Alcoholism (SSAGA)

Participant Selection:
- 3 groups of 64 participants (N = 192) matched on age, gender, and educational attainment.
- Chronic users: reported cannabis-related life problems
- Intermediate users: did not report such problems

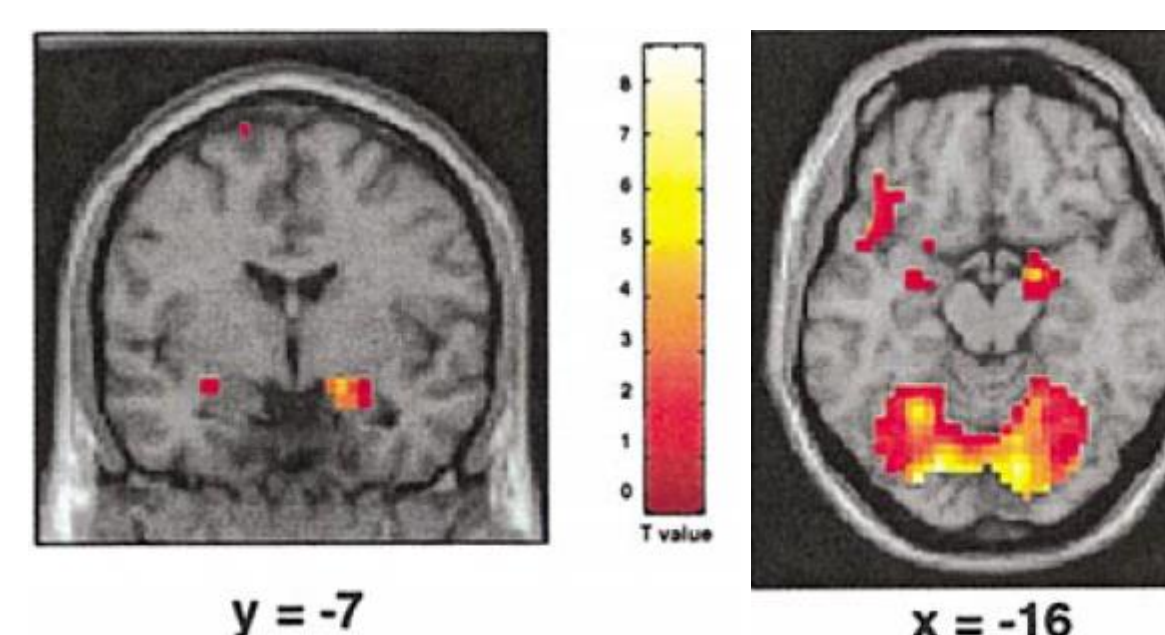|	Chronic users	Intermediate users	Non-users
Mean Age	28.3	28.0	28.6
Educational Attainment	M=14.3 Min=11 Max=17		
Gender	47 M / 17 F		

Experimental Task

- Participants matched the top image to one of the two bottom images
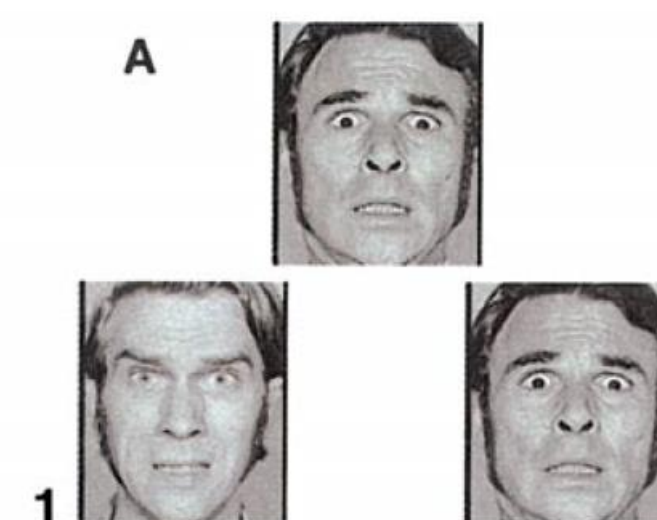
- Angry and fearful faces taken from the International Affective Picture System (IAPS)
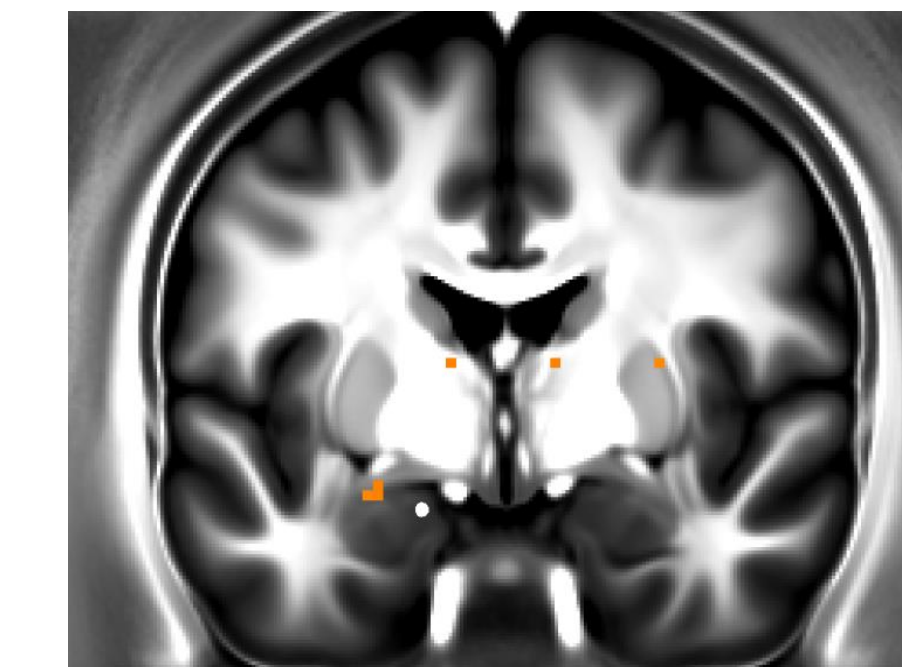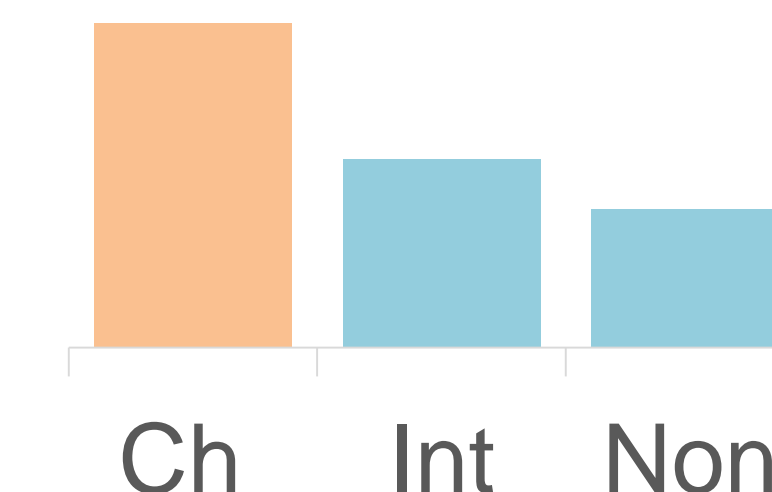- 2 runs of 6 blocks (3 face blocks and 3 shape blocks)
- Each block has 6 trials
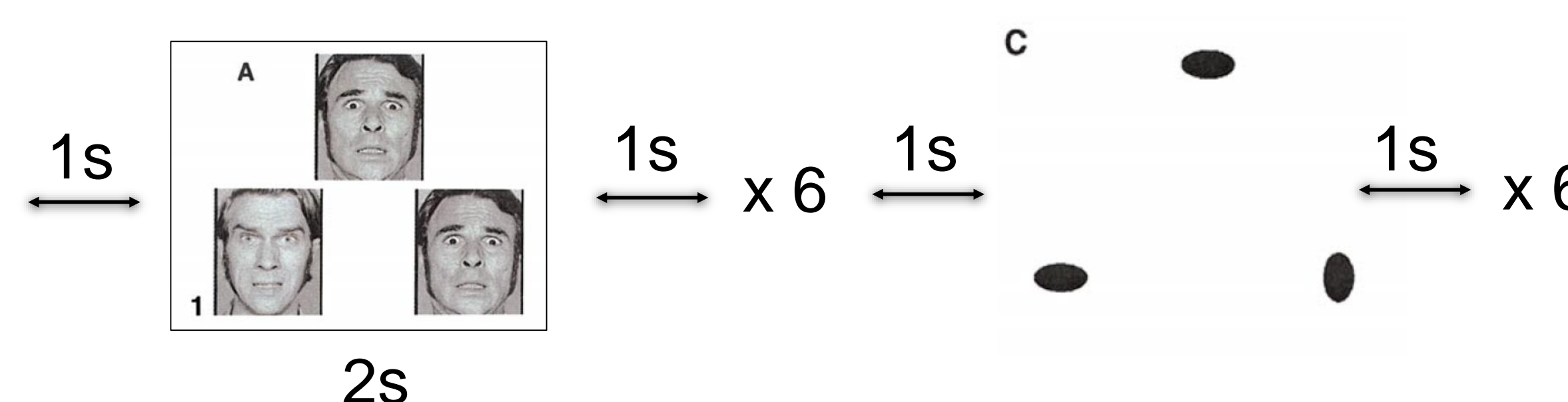
- Hariri face-matching task
  - Consistently engages the amygdala during evaluation of faces
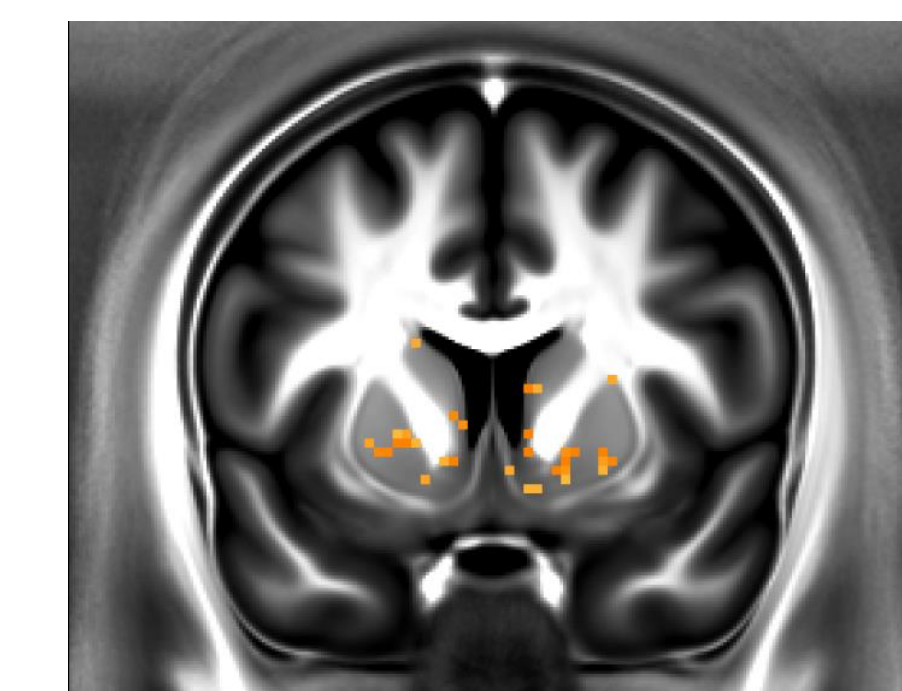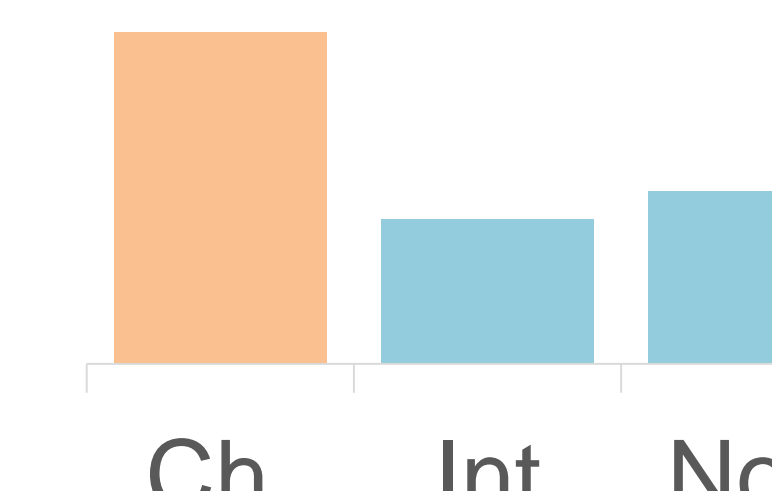

Subcortical Results

- Chronic user > Intermediate user = Non-user
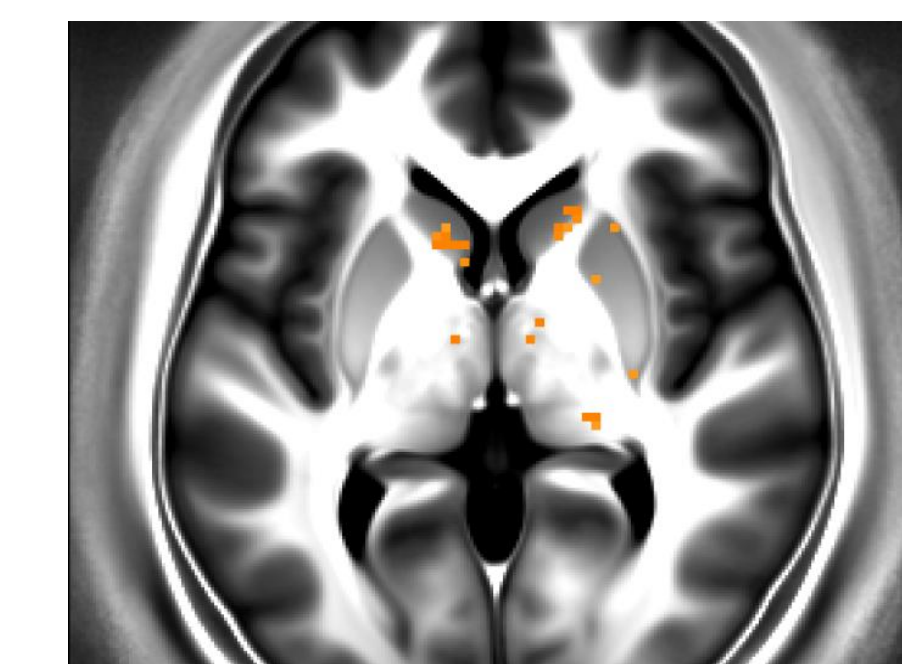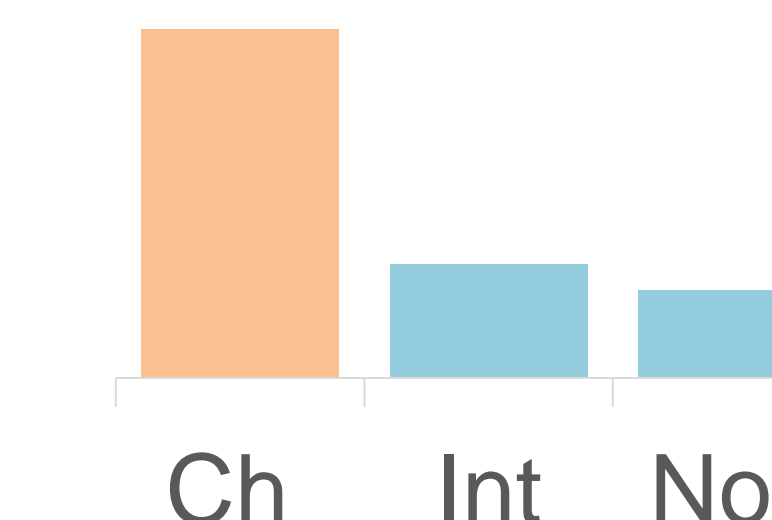
Left amygdala

t > 2.214

Bilateral putamen

t > 1.811

Bilateral caudate

t > 2.052

Discussion & Prospects

Discussion and implication
- Acute THC impairs threat-based emotion recognition[5] and reduces amygdala activity in response to threatening faces[6]
- Chronic Use → hypersensitivity when not intoxicated?
- Behavioural Prediction → Chronic Users more excitable

Limitation and Future Direction
- Preliminary analysis lacking in family-wise error correction
- Group definition depended upon self-declared problematic use
- Examine Chronic Use effects directly based on
  - Duration of Use
  - Intensity of Use
- To generate a larger sample-size (N = 495), we will include
  - Siblings and their genetic-relatedness

Reference
1. Dorard, G., Berthoz, S., Phan, O., Corcos, M., & Bungener, C. (2008). Affect dysregulation in cannabis abusers. *European child & adolescent psychiatry, 17*(5), 274-282. **2.** Hindocha, C., Wollenberg, O., Carter Leno, V., Alvarez, B. O., Curran, H. V., & Freeman, T. P. (2014). Emotional processing deficits in chronic cannabis use: a replication and extension. *Journal of psychopharmacology, 28*(5), 466-471. **3.** Uğurbil, K., Xu, J., Auerbach, E. J., Moeller, S., Vu, A. T., Duarte-Carvajalino, J. M., ... & Strupp, J. (2013). Pushing spatial and temporal resolution for functional and diffusion MRI in the Human Connectome Project. *Neuroimage, 80*, 80-10. **4.** Barch, D. M., Burgess, G. C., Harms, M. P., Petersen, S. E., Schlaggar, B. L., Corbetta, M., ... & Nolan, D. (2013). Function in the human connectome: task-fMRI and individual differences in behavior. *Neuroimage, 80*, 169-189. **5.** Ballard, M. E., Bedi, G., & de Wit, H. (2012). Effects of delta-9-tetrahydrocannabinol on evaluation of emotional images. *Journal of psychopharmacology, 26*(10), 1289-1298 **6.** Phan, K. L., Angstadt, M., Golden, J., Onyewuenyi, I., Popovska, A., & de Wit, H. (2008). Cannabinoid modulation of amygdala reactivity to social signals of threat in humans. *Journal of neuroscience, 28*(10), 2313-2319.