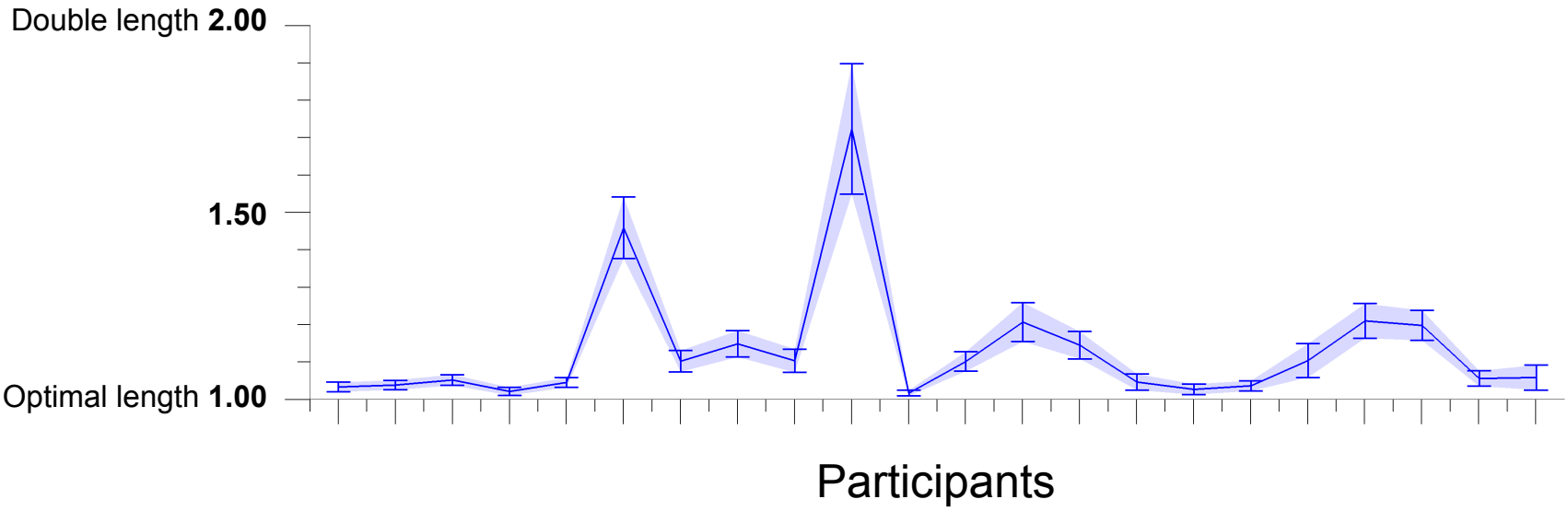
Subway

2014/09/04

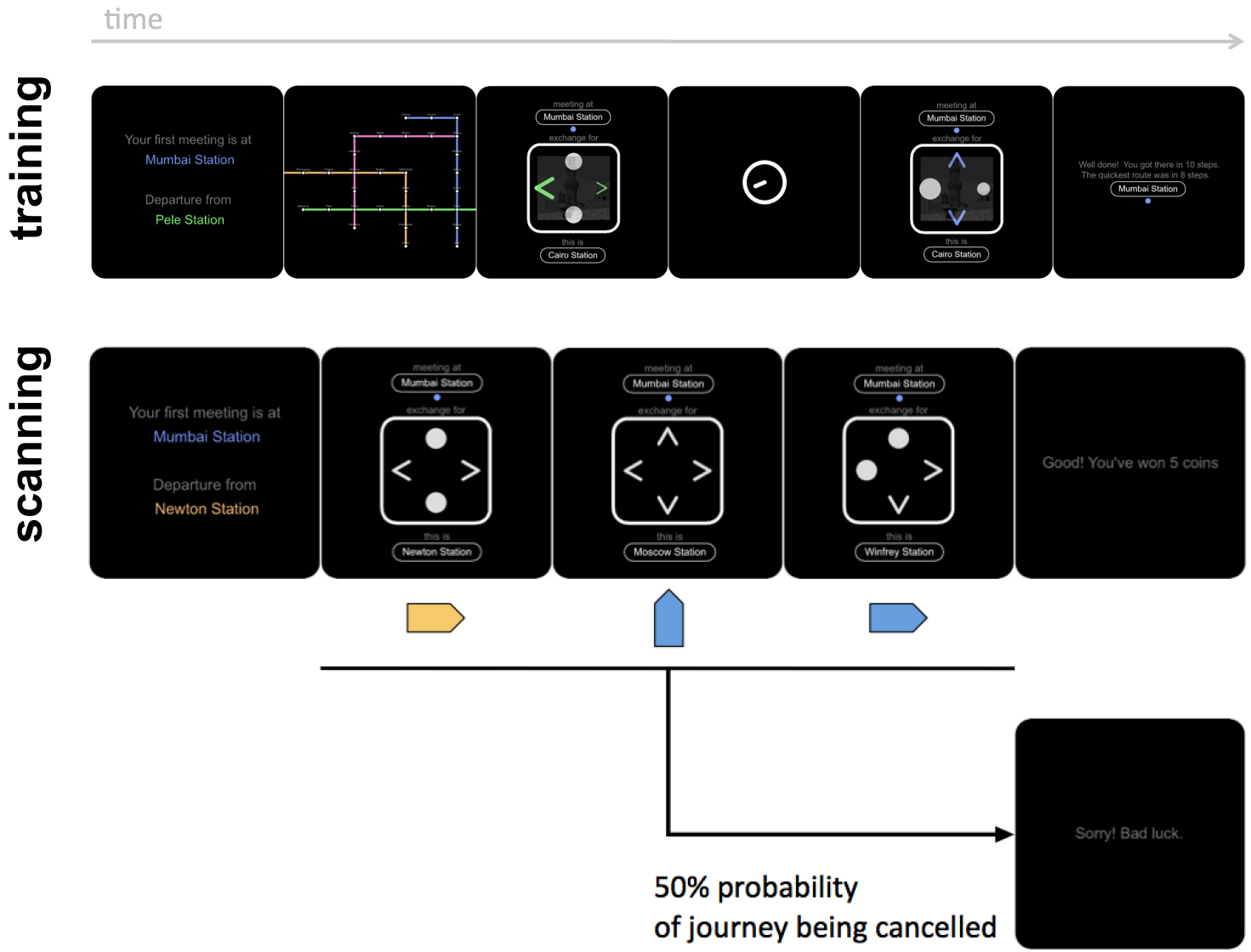
Participants

22 Participants, but :

- 3 participants only had 3 sessions of 15 minutes (instead of 4).
- Two participants, with 4 blocks, have poor performance.
- The graph below shows how much longer participants took to complete journeys, compared to optimal.



Design


time
training
Your first meeting is at
Mumbai Station
Departure from
Pele Station
meeting at
Mumbai Station
exchange for
this is
Cairo Station
meeting at
Mumbai Station
exchange for
this is
Cairo Station
Well done! You got there in 10 steps.
The quickest route was in 8 steps.
Mumbai Station
scanning
Your first meeting is at
Mumbai Station
Departure from
Newton Station
meeting at
Mumbai Station
exchange for
this is
Newton Station
meeting at
Mumbai Station
exchange for
this is
Moscow Station
meeting at
Mumbai Station
exchange for
this is
Winfrey Station
Good! You've won 5 coins
Sorry! Bad luck.
50% probability
of journey being cancelled

Design

Problems with the design :

- It would have been better not to show all the lines in exchange stations (as they give a different perception).
- One (over 4) of the exchange stations has only 3 options.
- 90% of the journeys require changing lines, while 10% don't. This was an error in the implementation, as the intention was to have 50% and 50% to decorrelate elbow stations from changing lines Sorry! 😐

However, it turns up that elbow stations were used in both kinds of block, and since half of the blocks were cancelled, not the 90% of the blocks reached the subgoal. (That was lucky!).

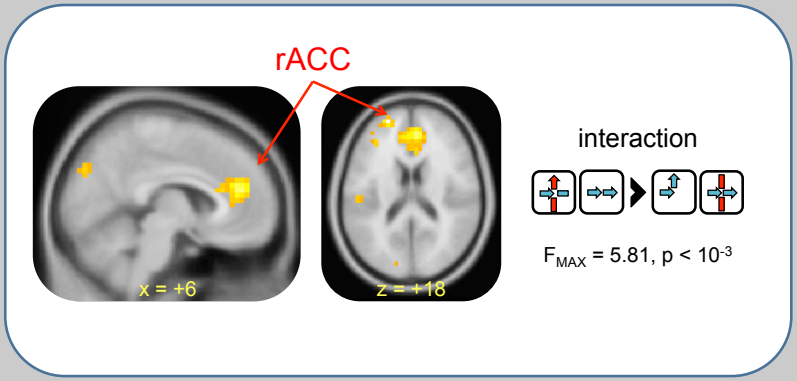
In total, then : 53% of the blocks involve at least an elbow station

81% an exchange station

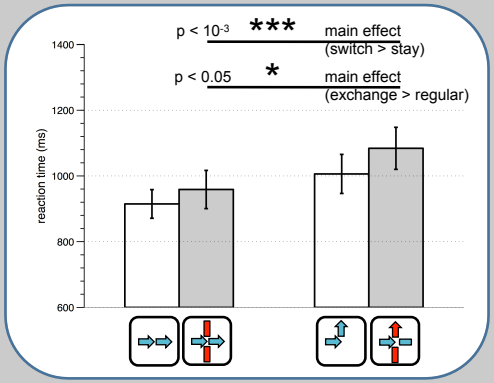
66% a line change

Initial Results

4 Results 1 – rACC signals context switch

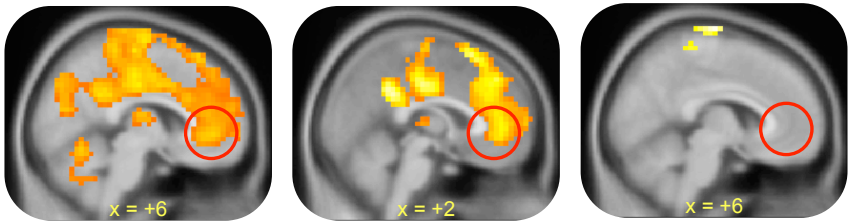


BOLD activity during navigation

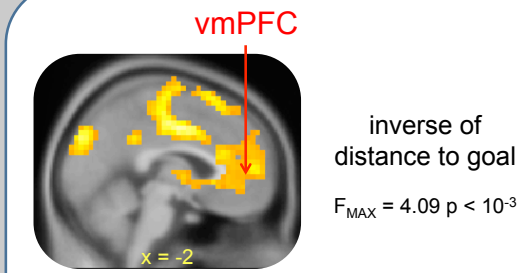


Reaction Times (RT)

5 Results 2 – vmPFC tracks distance to goal but not reward



Feedback



Distance to goal

Initial Results

What has changed since then :

Improvements (Good!)

- We tried improving pre-processing, with no or little effect.
- Now we're pooling the data.

  This is supposed to increase statistical power.
- Most regressors have been recalculated, mainly because the previous data was getting messy.
- The current code to run SPM is slightly more flexible, but based on the initial code for subway. The GLM and stats don't change.

  It's also the one Keno is also using to analyse Boring.

Initial Results

What has changed since then :

Results (Bad)

After adding improvements (all at once) some effects disappeared:

- weaker or no activation in X*S (which was supposed to reflect C)
- activation found in mPFC when reaching the goal
  (we didn't see this before).
- I haven't had a chance to look at distance to subgoal yet.

Results (Good)

- Distance to goal is still present and looks pretty similar.
  Moreover, the statistics within the "vmPFC" has improved (now 5.28)

Complications

I think *Subway* has a much more complicated design than first thought.

There are many reasons why this getting much more complicated, both in analysis and interpretation, than other experiments. Boring doesn't have many of these problems, which makes it a better design (even though it can't address as many questions).

Say you want to look at the effect in a particular kind of station. There will be noise driven by:

Navigation:

- Going backwards, and/or revisit the same station
- Two kinds of journey (within or between lines)
- Sequential effects in response (minority of switches **S**)
- Probability of a journey being cancelled

Map:

- Face/Place stations
- Any effects due to memory

Motivation:

- Two kinds of stake
- Cumulative reward (also in boring)

New results

GLM :

Sessions merged within participants

Regressors :

- **Cue** (beginning of the block)
- **Trial Hard** (block between lines)

  modulation: **X**, **S**, **X*S**, inv(dist_to_goal)
- **Trial Easy** (block within a line)

  modulation: **X**, **S**, inv(dist_to_goal)
- **Feedback** (end of block)

New results

GLM :

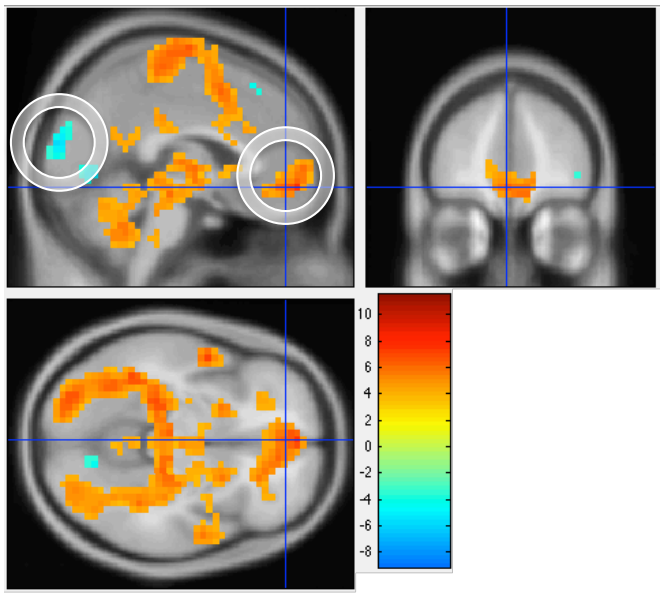
Sessions merged within participants

Regressors :

- **Cue** (beginning of the block)
  - modulation: easy_vs_hard (from a different regression)
- **Trial Hard** (block between lines)
  - modulation: **X**, **S**, **X*S**, inv(dist_to_goal)
- **Trial Easy** (block within a line)
  - modulation: **X**, **S**, inv(dist_to_goal)
- **Feedback** (end of block)
  - modulation: goal_reached

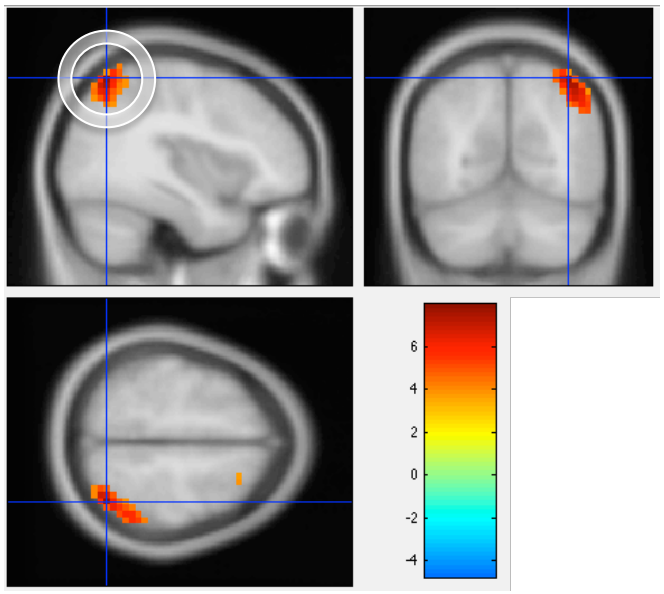
New results

Results : Cue : **Onset** :



vmPFC
occipital
motor
cuneus
temporal

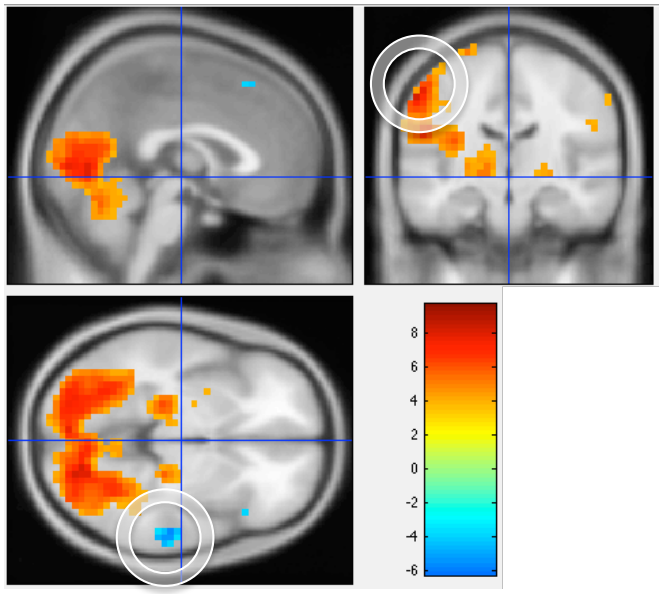
Results : Cue : **Easy vs Hard** :



right angular gyrus +7.90
and no vmPFC activity

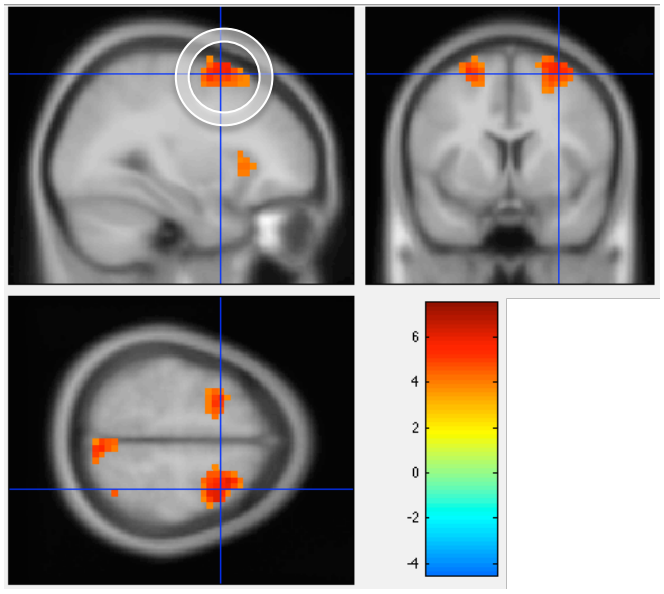
New results

Results : Hard : **Onset** :



occipital	+9.69
left motor	+7.94
right temporal	+5.72
and hippocampus	+ 7.90

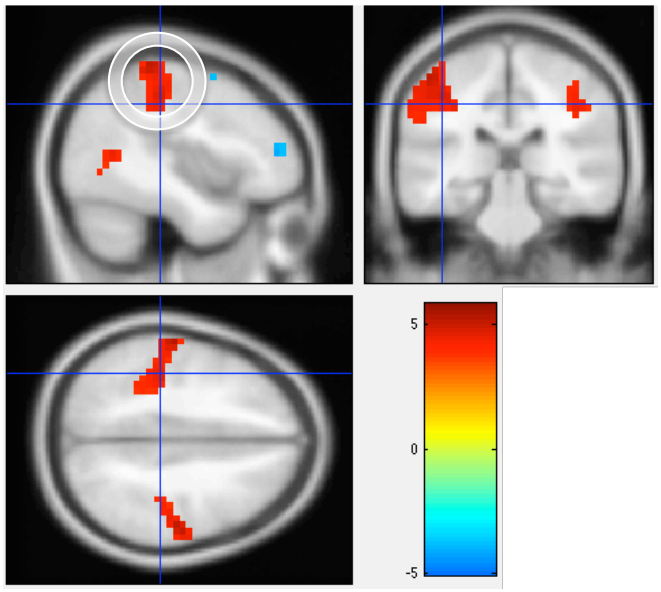
Results : Hard : **Exchange** :



and (pre)cuneus	+5.34
and left occipital	+7.43

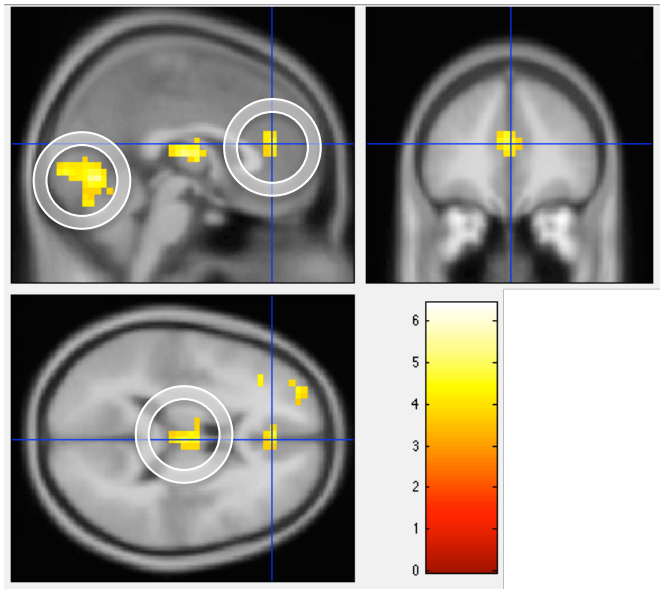
New results

Results : Hard : **Switch**:



motor	+5.80
and SMA	-4.97
and dlPFC	-4.82

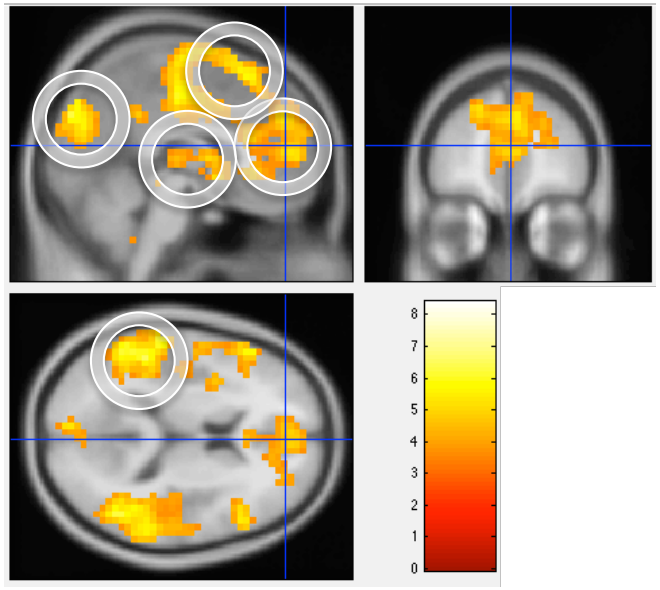
Results : Hard : **X*S** :



rACC	+5.34
cerebellum	+6.43
~thalamus	+5.26

New results

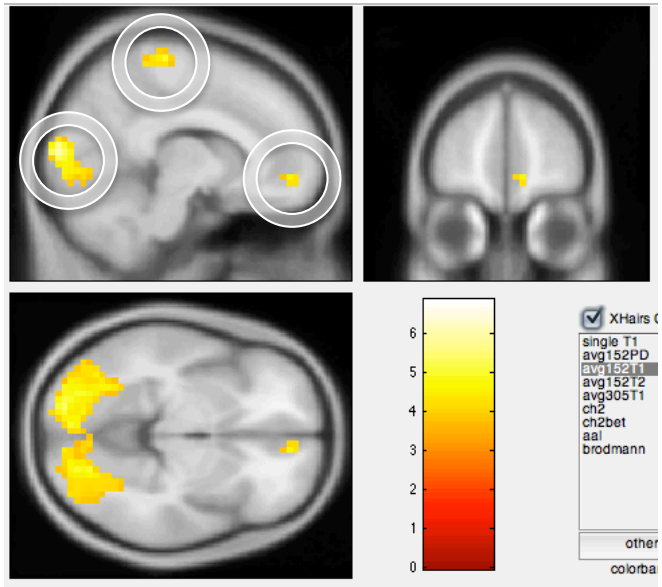
Results : Hard : **Distance to goal**:



mPFC	+5.28
(pre)SMA	+6.12
cuneus	+6.45
temporal	+6.81
thalamus	+4.47
and amygdala	+ 5.39
and right precentral	+8.40

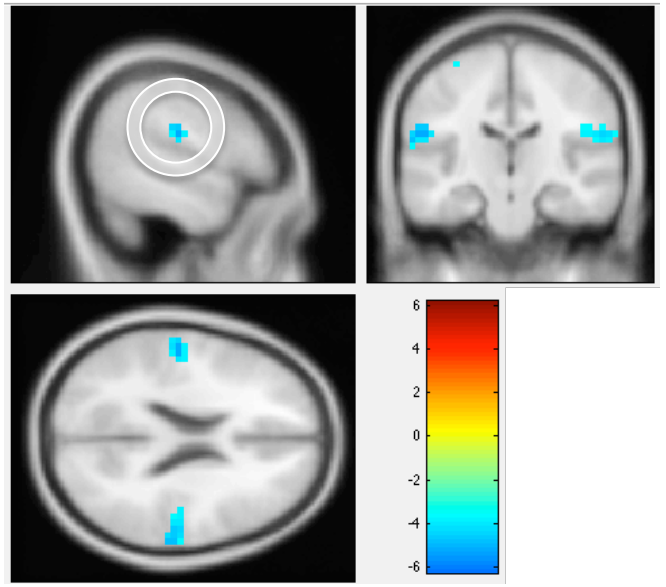
New results

Results : Easy : **Onset** :



mPFC	+4.58
occipital	+6.81
precentral	+6.70
and left insula	+6.15

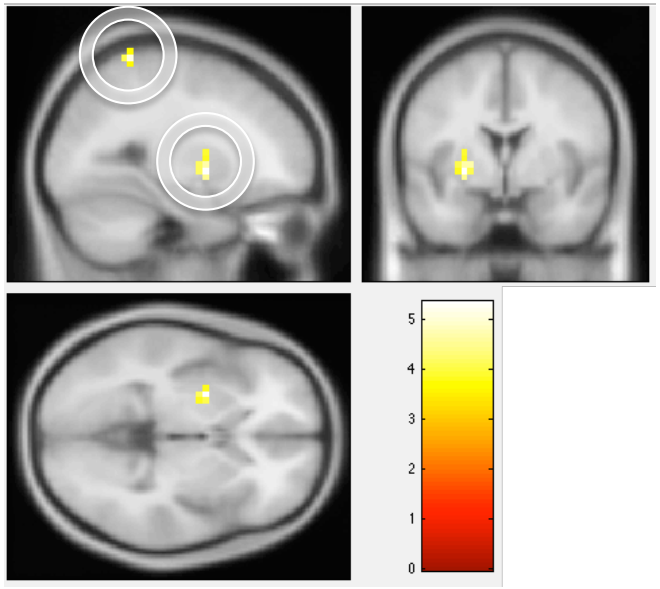
Results : Easy : **Exchange** :



~supramarginal	-5.24
and precuneus	+6.12
and motor	+5.57
and right fusiform	-6.19

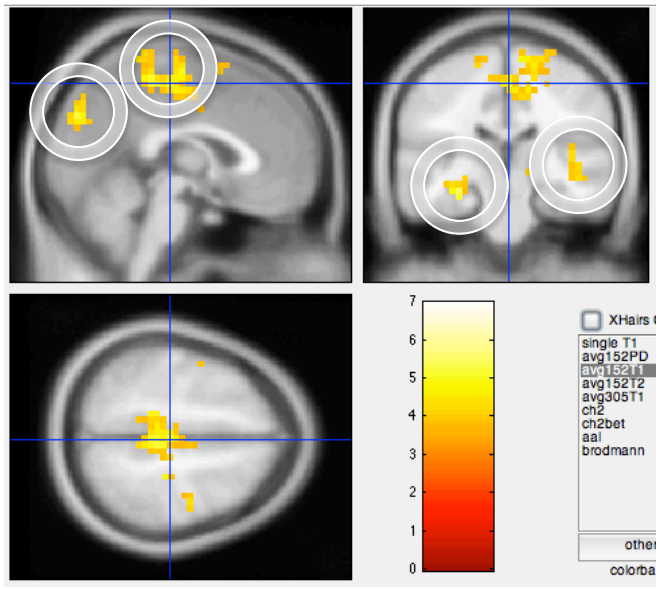
New results

Results : Easy : **Switch** :



left putamen	+5.35
left parietal	+5.24

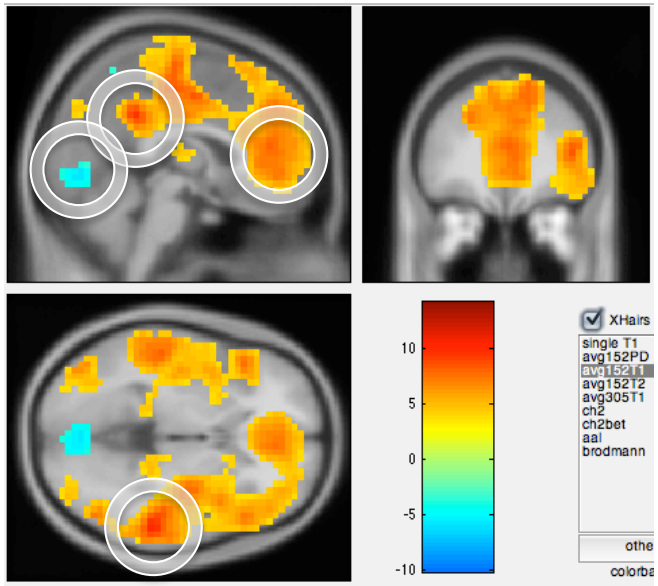
Results : Easy : **Distance goal** :



left hippocampus	+5.28
SMA	+5.14
cuneus	+5.39
temporal	+5.91

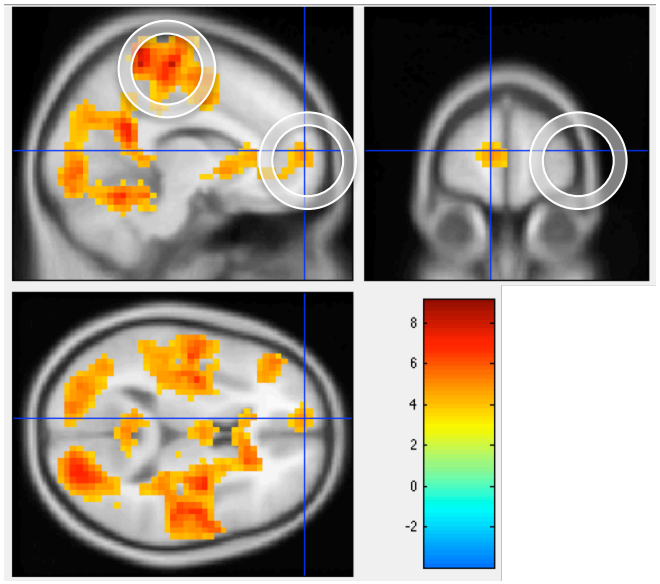
New results

Results : Feedback : **Onset** :



calcarine/lingual	-7.38
temporal	+10.64
mPFC	+7.36
PCC	+9.29
and ...	

Results : Feedback : **Goal** :



~mPFC	+4.92
motor	+8.02

Notation

Stations:

- **R** regular station
- **X** exchange station
- **L** elbow station

Response:

- **S** switching action (in opposition to going straight)
- **C** change line (i.e. **«X** & **S»**)
- **I** exchange and no change line (i.e. **«X & ~S»**)

Exceptions:

- **O** null action (staying in the same station)
- **B** going backwards