Neural Mechanisms of Hierarchical Planning during Navigation

FMRIB Research In Progress,
October 30th 2013

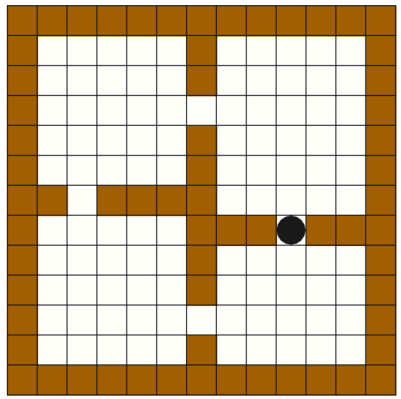
J. Balaguer, D. Hassabis, H. Spiers, and
C. Summerfield.

Motivation

Machine Learning:

Use of *options*

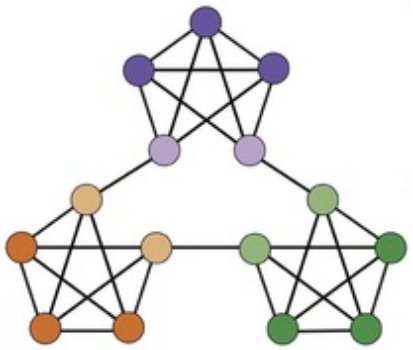
(Sutton et al, 1998)



Neuroscience:

Emergence of *communities*

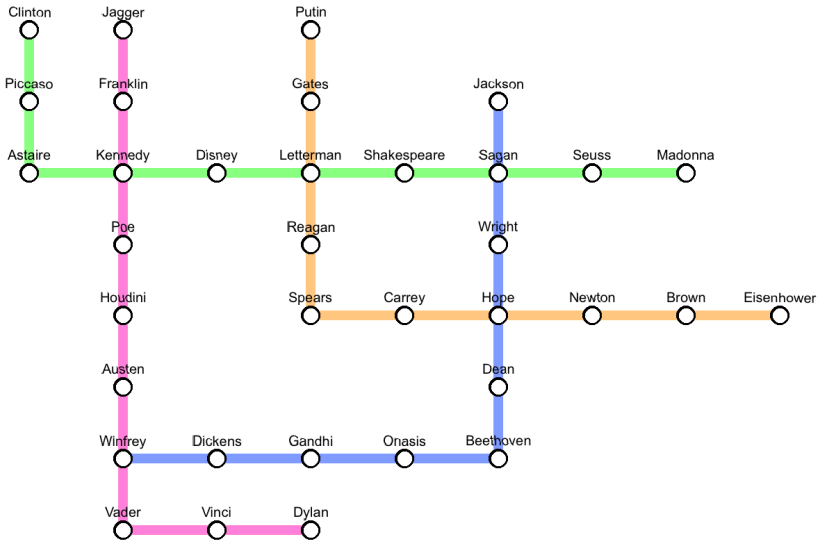
(Schapiro et al, 2013)



Task

Navigate through a familiar subway

– Minimum steps
– Bailing out
– Two levels of reward



Task

Departure from

Wright Station

Your first meeting is at

Onasis Station

Task

meeting at

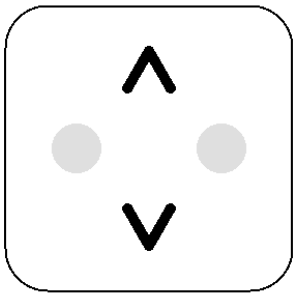
Onasis Station

reward is 1 coin

this is

Wright Station

exchange for



Task

meeting at

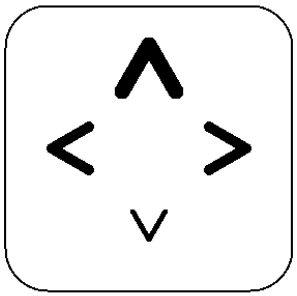
Onasis Station

reward is 1 coin

this is

Sagan Station

exchange for



Task

«Sorry, I had to go! Could we meet at Gates Station instead?»

Task

meeting at

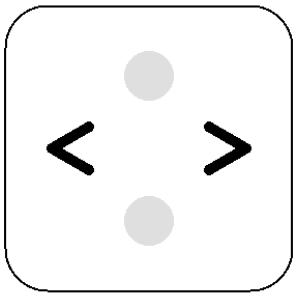
Gates Station

reward is 1 coin

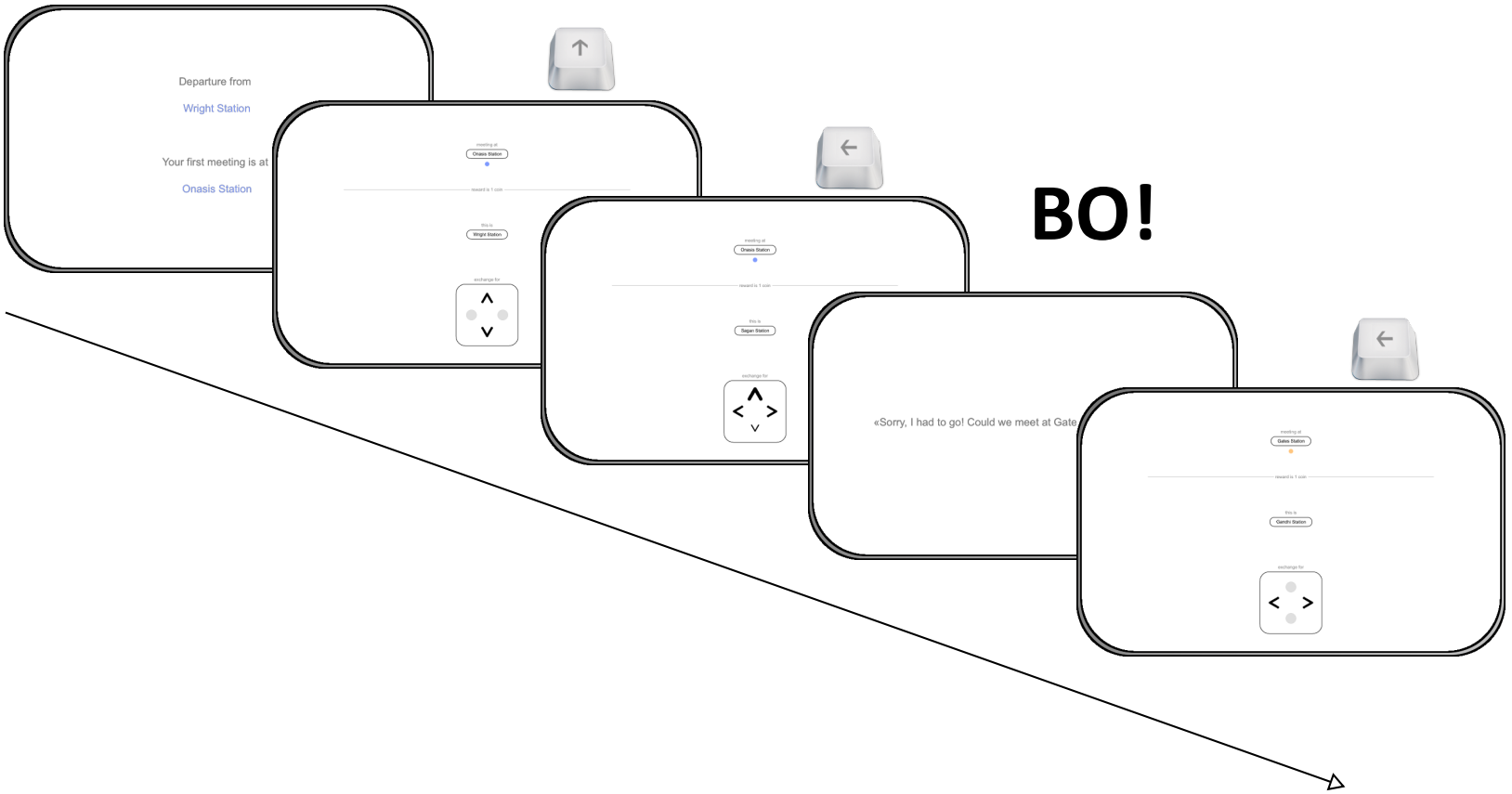
this is

Gandhi Station

exchange for



Task


Departure from
Wright Station
Your first meeting is at
Onasis Station
BO!
«Sorry, I had to go! Could we meet at Gate

Training

Differences

- Map shown at start
- Current line always shown (colour)
- Switching lines waiting time
- No rewards, no BO
- Evaluation of learning

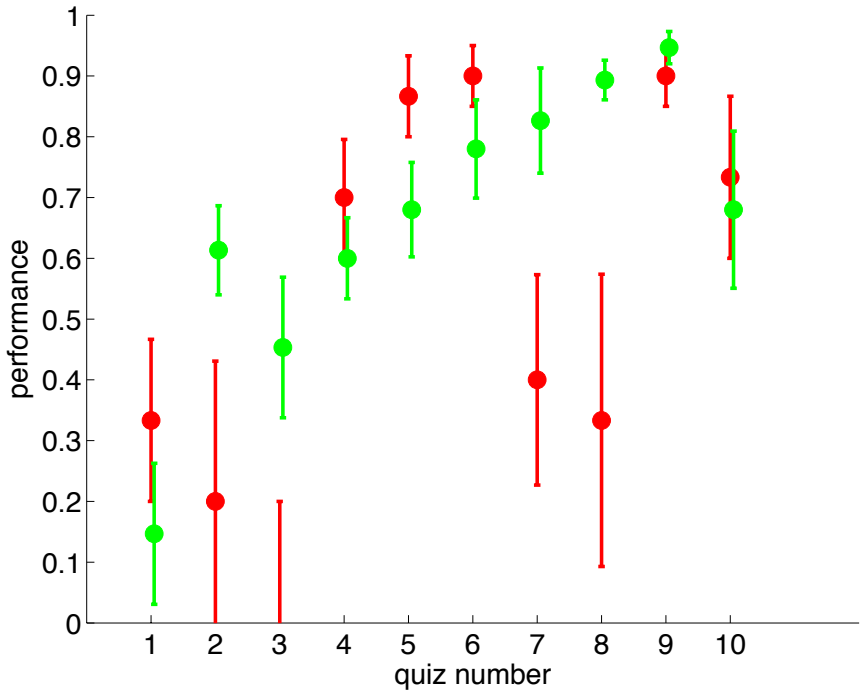
Training pilot

N = 9 (5 males, 20-28 years old)

departure from

regular stations

exchange stations

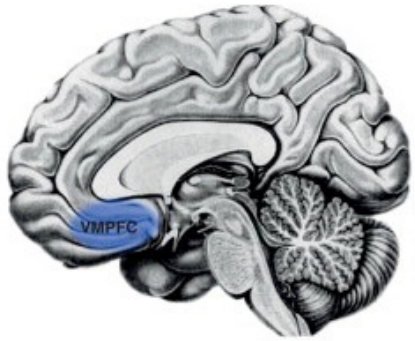


Neural Predictions

Background

vmPFC expected value of chosen option [Boorman, 2013]

dACC selection/maintenance of options [Holroyd and Yeung, 2012]

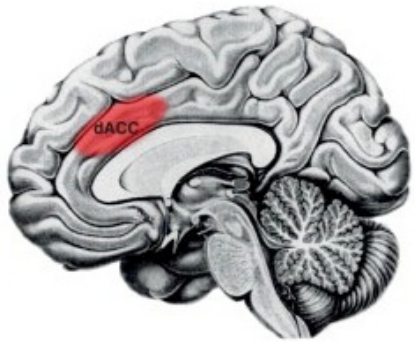


Predictions

reward modulated

vmPFC distance to goal

dACC distance to change



Scanner parameters

- VERIO 3T
- Standard EPI sequence
- TR = 2s
- TE = 30ms
- 64 x 64 x 36 voxels
- Fieldmap & T1 structural image
  for normalisation

Thank you.