ERP Credit Assignment Study

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Background

- In many daily scenarios, the feedback we receive about our behaviour is inferred only from the presence or absence of reward - with a myriad of factors potentially causing the observed outcome.
- Consider a tennis player who, mid-game, must rapidly determine whether losing the most recent point was the result of a selection or execution error. If the opponent had just delivered a crushing overhead smash to win the point, our player might have unwisely attempted a lob rather than a passing shot (action selection error).
  Alternatively, the lob may have been appropriate, but hit without sufficient force (execution error).
- Importantly, the way in which the player assigns credit to these sources will drive subsequent behaviour; e.g. adapting sensorimotor response for the latter, but changing choice of stroke for the former. Such problems are not restricted to the sporting arena and can be a matter of life and death e.g. a surgeon in the operating theatre must quickly determine whether an unexpected bleed was the result of a clumsy incision or the wrong choice of procedure.

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Experimental Task

- 3 arm bandit task created by Sam, adapted for EEG study

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Behavioural Data

- Behavioural expereiment n = 21, Pilot tested 10 participants for EEG + 25 EEG experiment
- Pooling all gives n = 56 (and increasing)

Figure 1: Systematic bias towards selecting miss targets- emerges early on

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Behavioural Data contd.

- Also interested in the idea that sensorimotor competence modulates this effect
- Pilot tested with non-preferred hand (all right handers with EHI >80)
- Plan to run a within subjects design. Thoughts?

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Feedback Related Negativity

- Central to this research is the examination of a putative neural correlate of reinforcement learning (RL), the feedback-related negativity (FRN).
- This EEG event-related potential is characterised by a rapid (maximal 250-350ms post-feedback presentation) medial frontal negative deflection and is most likely generated by the anterior cingulate cortex (ACC).
- The ACC has dense connections to regions responsible for sensorimotor control and reward processing, but understanding how these systems interact to evaluate outcomes is poorly understood.

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FRN and some early predictions

Fig. (A) The canonical FRN (inset shows topographical distribution of the component), adapted from Mushtaq et al. 2016: (B) A strong form of the Execution Gating Hypothesis predicts the FRN should be smaller in response to execution errors (blue). An alternative, where executions are weighted more heavily than selection, is represented in orange.

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Grand Averaged ERPs per outcome

- mass univariate approach shows statistically reliable differences between conditions from ~200-300ms. This effect is also frontally distributed- where we would expect the FRN. But clearly there are differences in peak latency for the break vs. miss

- peak-to-peak calculations show that the miss and break have equivalent relative negativities

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Time management theory

- "Getting Things Done: The Art of Stress-Free Productivity" David Allen
- Cited 574 times
- Practical steps to time management
- Limited cognitive resources
- off-load tasks to systems and software
- Check out GTD website for more information

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Time management theory

5 basic GTD Principles

1. Capture- collect what has your attention
2. Clarify- process what it means- do I need to act, archive, save, trash?
3. Organise- put things where they belong e.g. add item to checklist
4. Reflect- look over your lists regularly
5. Use your systems to perform actions

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Thinking

Conflict in today's academic world

Shallow

- Not about who you find attractive...
- Things you can do without effort
- Phone calls- whilst waking/talking
- The majority of emails- more next
- Some journal articles

Deep

- Anything that is (a) difficult; and (b) takes more than 10 minutes to do
- The dichotomy comes from the fact that deep is what we should be getting paid for- yet shallow takes up most of our time

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1. Capture

How do you capture things that grab your attention for later?

Note taking apps

- Evernote for information rich content- papers, presentations, audio recording and hand-written notes
- Simplenote for short text based notes
- Multi-platform sync and free
- Whenever you have a good idea- jot it down and "tag it" so you can find later- otherwise you WILL forget
- Physical and electronic lab notebook for experiments

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2. Clarify

- Most amount of information and noise in your inbox

Inbox

- Get good habits now- because you will never have less email than you do now
- Save everything! (If you don't have enough space- find out how to export to gmail etc- e.g. via MailStore
- If coming to end of PhD- Set up email forwarding before your account expires

Inbox Zero

- David Allen's "Getting Things Done" book
- 2 minute rule
- Archive generously

- Use Folders- lots of them
- Unsubscribe! Or set rules up... from: joebloggs@leeds.ac.uk > "Department_Emails" Folder

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3. Organise

File Accessibility

- Replace your documents folder- delete it or vow never to use it
- Dropbox/OneDrive/Google Drive etc- Desktop, Web, Mobile App
- Remote Desktop - access to "always on" server and files from anywhere
- Partition hard drive where possible- making clear seperation between OS (superfluous) vs Data (essential)
- Automate data partition back ups and create image of OS after apps installation

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File Structure

- Whatever you choose- by systematic

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File Structure

- Desktop = Working Memory- not LTM or file dump
- Automate cleaning desktop- e.g. Hazel on Mac, File Juggler on Windows

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4. Reflect and plan

- After capturing and organisation, you need to reflect to process
- Checklists- not just for surgeons and pilots...
- Wunderlist (others available- make sure cross-platform)
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- Be your own project manager:
- MeisterTask
- TeamGantt

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5. Perform actions

- You are a thinking- not doing- machine
- This is why we have computers
- If you need to do something more than once- automate it

Repetition is for robots

- Keyboard Shortcuts, aText on Mac, AutoHotKey on Windows
- Forget using cognitive resources on memorising things- LastPass for password management (caution: possible MCI in later years)
- If This, Then That

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Deep Thinking

- Is really hard!
- Make time for it (utilising GTD or similar)
- "Outsourcing work" to automatons for shallow thinking
- Protect your time from external distractions- block out time on your calendar
- Work in "batches"-fractal:throughout the day, week, year
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- Pomodoro Technique- 25 min on- 5 min off

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Essential Reading * Productivity Ninja * www.lifehacker.com Pre-2014 Articles * www.43folders.com * IFTT

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Show and Tell

- Laptop tour