Changing decisions: Interventions in decision-making

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Judgment and Decision Making
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1. Work on the decision model on the basis of the new information that Jake has provided and use the information that Chris recently presented from his presentation. You could also look at the parts of the presentation that Chris did not have time to present. His presentation is on the course webpage.

About the discussion of the model, I have thought a lot about our course evaluation discussion. For the Mondays of weeks 8 and 9, I will use that class time to have a more structured discussion about concepts, models, and examples that illustrate and clarify central issues in decision-making related to the readings. This means that we will put the model construction activity, as previously carried out, on hold. We are still working on the model, but from a different pedagogical angle.

2. You could use the class time to look at the following video material from the BBC on decision making. This is excellent material that illustrates the ecological validity of the phenomena that we have been discussing. It also raised some new issues of, for example, choice blindness.

The links to the other four parts can be found by accessing Part One.

3. You could also go to the Ted Talks on decision making and choose one (or more) to watch. Dan Gilbert's talk, although dated, is quite good. There is even a talk by Malcolm Gladwell. Surprise!

4. Discuss the final assignment amongst yourselves in order to develop some interesting topics and to gain a common understanding of the nature of the assignment.
Decision Making

- List as many time/money tradeoffs or in other words what are ways that we give up time for money or money for time

- Would you rather have $100 Now or ...
  - $150 in 3 dog years
  - $120 in 1400 centids
  - $115 in 7000 millids
  - $140 in 5,184,000 jiffies
  - $1,000,000 in ¼ Galactic Year

- Would you rather have $100 For Sure or ...
  - $170 with the Raptor’s winning percentage chance
  - $395 with the Laker’s winning percentage chance
  - $225 with the Blue Jay’s winning percentage chance
  - $110 with the chance a bank note has traces of drugs
Delay and Probability Discounting

• Temporal Discounting
  – Choices differing in the timing of their consequences
  – Requires a tradeoff between the value of one outcome closer in time and a second outcome further away
  – Humans (and animals) tend to prefer immediate over delayed rewards
    • This effect is correlated with real-world behavior – Impulsivity

• Probability Discounting
  – Choices differ in their probability of occurring
  – Requires a tradeoff between the value of one outcome with a higher probability and a second outcome lower in probability
  – Humans tend to prefer higher probability outcomes over lower probability outcomes
Objectives

Deficits in episodic memory/future thinking

Deficits in social interaction/ToM

Decision Making

Alzheimer Society

Dementia
Alzheimer’s Disease
bvFTD

Stroke Patients
PFC
TPJ
Neural Correlates of Decision Making
Decision Making – Cognitive Contributions

**EXECUTIVE FUNCTIONS**

**Working Memory**
- Including mental math, re-ordering items, or relating one idea or fact to another
  - Verbal Working Memory
  - Visual-Spatial Working Memory
- Maintaining your goal, or what you should and shouldn't do, in working memory is critical for knowing what to inhibit.
- Inhibiting environmental & internal distractions is critical for staying focused on the working memory contents of interest.

**Inhibitory Control**
- **Interference Control**
  - Inhibition of thoughts and memories (Cognitive Inhibition)
  - Inhibition at the level of attention (Selective or Focused Attention)
- **Response Inhibition**
  - Inhibition at the level of behavior (Self-Control & Discipline)

**Self-Regulation**
- Effortful Control refers to the innate temperamental predisposition to exercise better or worse self-regulation.

**Cognitive Flexibility**
- Including being able to “think outside the box,” see something from many different perspectives, quickly switch between tasks, or flexibly switch course when needed.
- Supports creativity and theory of mind.

**Higher-Level Executive Functions**
- **Reasoning**
- **Problem-Solving**
- **Planning**
- Fluid Intelligence is completely synonymous with these.

**Diamond, A. 2013 “Executive Functions” Annu Rev Psychol. 64:135-168.**
Neural Contributions to Future Thinking

"...this core brain system functions adaptively to integrate information about relationships and associations from past experiences, in order to construct mental simulations about possible future events."

Schacter, Addis, Buckner, 2007
Hippocampal Contributions

Event Construction > Control

Future > Past Construction

Episodic Details

Semantic Details

Addis et al., 2007; Race et al., 2011
Frontal Lobe Characteristics

- The equilibrium or balance, so to speak, between his intellectual faculties and animal propensities, seems to have been destroyed.
  
  – Harlow, 1868

- Certain alterations in personality are common: diminished anxiety and concern for the future; impulsiveness, facetiousness and mild euphoria; lack of initiative and spontaneity. ... finally, inability to plan and follow through on a course of action and to take into account the probable future consequences of one's actions, a deficit which is perhaps closely related to some of the observed personality changes as well as to the impairment in recent memory.
  
  – Benton, 1968

- Myopia for the future

  – Bechara et al., 1994
Frontal Lobe Characteristics

![Brain maps showing activation patterns in different regions of the frontal lobe.]

- **Time-based**
- **Event-based**
- **Ongoing**

**References**:
- Okuda et al. 2007
- Burgess et al. 2001
- Simons et al. 2006
- Gilbert et al. 2009
- den Ouden et al. 2005
- Benoit et al., in prep.
- Reynolds et al. 2009
- Okuda et al. 1998
- Hashimoto et al. 2010
- Okuda et al. Submitted
- Burgess et al. 2003
- Simons et al. 2006
- Benoit et al., in prep.
- Okuda et al. 2007

Burgess et al., 2011
Decision Making – Neural Contributions

Environment – Decision Space
Constantly Changing

Past Performance/Knowledge
Future Consequences

Alternatives

Needs
Values
Preferences

Perception
Emotion

Hippocampus is necessary for the binding of arbitrary relations (relational memory binding) and for mediating their flexible expression; and can do so on-line or in the moment.

Frontal lobes are necessary for the inclusion of self vs other individuals.
Black Boxes to Networks

Satterhwaite et al., 2013; Tomasi & Volkow, 2012
Theory of Mind (ToM)
Understanding other’s mental states

Cognitive ToM
Understanding other’s beliefs and intentions

Affective ToM
Understanding other’s emotions and feelings

Dorsolateral PFC

Ventromedial PFC

Wood & Grafman, 2003
Spreng, Mar, & Kim
Project Aims

- Correlations of EM/future imagining and ToM performance with volumetric and connectivity analysis in focal lesion (dementia) patients, together with providing patients with greater structure/context when making a decision, will help to determine if different processes account for EM/ToM loss in these populations.
Background – EM/Future thinking

• Previous research suggests that MTL and VMPFC damage results in impaired EM and imagining of future events, but for different reasons, a possibility that may emerge more clearly when personal and social cueing and non-temporal (probability) discounting are considered.
Background – ToM

• The shared neural circuitry, combined with the often social nature of DM would suggest that ToM is critical for DM.

• However, the research is mixed regarding the relationship between ToM and DM (Krueger et al., 2008; Lee, 2008; Torralva et al., 2007; Torralva et al., 2013; Xi et al., 2011)
Decision Making Manipulations

• Episodic cueing
  – Reduce discounting when cued to think of the future

• Social Decision Making
  – Discounting for close others similar to participant discount rates

Peters & Buchel, 2010; Kwan et al., submitted; Albrecht et al., 2010; Andersson et al., 2013
Experiments Outline

• Decision making (future/episodic memory)
• Decision making (ToM)
• Decision making (non-temporal)
• ToM (non-decision)
Experiment - Delay Discounting

• Condition 1 - Baseline
  – 2 future amounts $100 and $2000
  – Seven Delays – 1, 4, 12, 24, 52, 156, 520 weeks

• Condition 2 – Episodic Cueing

• Condition 3 - Social

$1000 Now or $2000 in 52 weeks

Green & Myerson, 2004
Hypotheses

• AD/MTL
  – No effect of episodic cuing
  – Show steep discounting for close and unknown other

• bvFTD/VMPFC
  – Steep discounting even with episodic cueing
  – Steep discounting for self and close other