PSY/NEU338
From Animal Learning to Changing People’s Minds

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Spring 2022, Tue & Thu 3-4:20 ET
Introductions: learning, decision making and me

[www.menti.com code 8971 3344]
How many people in this class do you already know?
Do you have background in psychology?

Yes | Some | No
---|---|---
19 | 11 | 3

Do you have background in neuroscience?

Yes | Some | No
---|---|---
23 | 4 | 6

Do you have background in computer science?

Yes | Some | No
---|---|---
12 | 8 | 14
What are you most excited about regarding this course?
What are you most worried about regarding this course?

- Python. I have no experience with Python and have found learning R was difficult but rewarding.
- I do not have a background in NEU. I am not sure how self-grading will work.
- My procrastination might lead to less internal motivation.
- the learning without grades component, I’m just not sure what to expect.
- Coding skills, as I do not have a strong background in coding.
- Keeping up with the neuro/psych material I'm not familiar with.
- I am concerned that my lack of knowledge of coding may affect my performance.
- workload
- The unconventional structure compared to all my other engineering courses.
<table>
<thead>
<tr>
<th>A little bit worried about biting off more than I can chew.</th>
<th>Coding</th>
<th>It is not very clear to me what the standards will be giving the &quot;teaching without grades&quot; format</th>
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<tbody>
<tr>
<td>I don't know how to do coding stuff that's not R. Sometimes, study designs from cellular neuroscience experiments confuse me.</td>
<td>Not having a background in college psychology</td>
<td>Computer science applications</td>
</tr>
<tr>
<td>Python</td>
<td>coding</td>
<td>Programming because I am bad at it</td>
</tr>
<tr>
<td>Coding</td>
<td>NA</td>
<td>programming in Python</td>
</tr>
<tr>
<td>lack of preparation in psychology</td>
<td>Not really understanding the learning without grades method + not doing well in the course</td>
<td>the grades (the confusion around it)</td>
</tr>
<tr>
<td>The coding problem sets</td>
<td></td>
<td>The programming side of the course. I have limited experience with coding/computational modeling</td>
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</table>
You are clearly worried about coding/python. This is understandable. But also: we know you can do this! We will help you, and your colleagues (half of which are not new to coding) will help you. You can do it!
who am I?

Professor of Neuroscience and Psychology, Israeli, mom of 2

Background: computational neuroscience, animal & human learning, decision making

I am interested in understanding learning and behavior as we know them in daily life: how is it that we adapt so well to a complex, changing environment? What computations does our brain need to do for that?

Methods I use in my research: computational modeling, human behavior and fMRI experiments (rodent experiments)

NEW! Clinical interests and training, work with patient populations and with large varied cohorts online
there are many ways of knowing and learning
Write something that you learned in life that is important to you: from your experience, community, family, ancestors (you can sign it or not, up to you)

(see results on Canvas)
what is the point of this course?

Thinking of what you want to get out of your college education and this course, which of the following is most important to you?

A. Acquiring information (facts, principles, concepts)

B. Learning how to use information and knowledge in new situations

C. Developing lifelong learning and analytical skills
Learning about learning

All three goals are clearly important... but how best to accomplish them?

Learning is not a spectator sport—it takes work (this includes work in the classroom and work that you do outside of the classroom)

So, of these three goals, which do you think you can make headway on outside of class by your own reading and studying, and which do you think would be best achieved in class working with your classmates and me?
Teaching without grades

- Grades are bad for learning (internal motivation will take you farther)
- Three principles: choice, feedback, a chance to act on the feedback
- “Specs grading” — you choose what components you want to invest in
- You will get from this course what you decide you want to get from it.
- Homework (on Google Classroom): Set your SMART goals
course materials & resources

• handouts will be made available before class for taking notes/class prep
• oftentimes I purposefully leave things out
• sometimes we don’t cover all the slides in the handouts
• don’t let that stress you out!
• slides true to what we actually discussed will be posted online after class on Canvas
• office hours - me: Thursday after class; Rachel: Wednesday afternoon; please take advantage of these!
FAQ: do we have a textbook? (short answer: no)

- Learning and Memory/Gluck et al., 2nd edition
- Well-written, interesting book (learning in everyday life, clinical perspectives etc.), but doesn’t cover everything we cover in class. Mostly lays out the psych and neuro background (Ch 1-5)
- Additional “tutorial” readings that can support class learning:
  - Niv & Schoenbaum (2008) - Dialogues on Prediction Errors
  - Niv (2009) - Reinforcement learning in the brain
  - Drummond & Niv (2020) - Model-based decision making and model-free learning
  - (Niv (2019) - Learning task-state representations)
- These, and background neuroscience readings on Canvas
why do we have a brain?

My answer: To behave

Example: the sea squirt (tunicate)

larval stage: primitive brain & eye, swims around, attaches to a rock
adult stage: digests brain. sits.

Credits: Daniel Wolpert
why do we have a brain?
The brain: a mile high view
(expressed through a doodle)
the ultimate goal

brain

behavior
unfortunately...

- The brain is an extremely complex (and messy) dynamic biological system
- \(~8.6^{11}\) neurons communicating through \(10^{14}\) synapses
- And, to boot, behavior is really messy and complex!
- We haven’t got a chance...
- What to do??

“No matter how closely you examine the water, glucose, and electrolyte salts in the human brain, you can’t find the point where these molecules became conscious.”

Dr. Deepak Chopra
New Idea:

- The brain is a computing device
- Computational models can help us talk about functions of the brain in a precise way
- Abstract and formal theory can help us organize and interpret data
$\delta(S_t) = r(S_t) + V(S_{t+1}) - V(S_t)$
computational models: descriptive versus normative

how do animals behave? how does the brain work?

how should animals behave if they were optimal? (or: what is this behavior optimal for?)

How? -> Why?
summary: a good starting point

• we want to understand how the brain generates adaptive behavior
• that is, how it learns from experience to choose the right action at the right time
• it is not going to be easy…
• … but we have computational models at our side!
Homework
(on Google Classroom)

• For Thursday: ILS questionnaire + google form
• By Sunday: draft your SMART goals (explanation on Google Classroom)