# Week 2: Origins of Cognitive Science

**(A) This Guide**

The goal of this document is to provide information about the readings for this week. The focus will typically be on the major content, rather than who wrote it. But you might wonder why I include information about the authors at all. For example, you might think "It should not matter who the author is! All that matters is the quality of the evidence and argument they put forward!" (and I agree completely). So why will I typically include little bios?

I intend them to (a) emphasize that these readings were written by *someone* (i.e., by a fallible human beings who might be wrong), (b) draw attention to which person wrote it, because sometimes knowing about an argument someone makes in one paper helps you to understand an argument they make in another (a connection you can only draw if you know the name!), (c) draw attention to which person wrote it, because knowing that allows you to recognize the name when someone *else* refers to them and their work (e.g., "In contrast with Haidt, I will claim that..."), (d) knowing the background of the people who did the research (e.g., "what a very international collaboration that was!" or "I see how a background in mathematics would help a biologist come up with these arguments!") is a small but important part of understanding how the research is produced.

**(B) Miller (2003). The cognitive revolution: A historical perspective. *Trends in Cognitive Science.***

George A. Miller (1920-2012) was one of the founders of cognitive psychology, and is most famous for "The Magical Number Seven, Plus or Minus Two" in short-term memory research. During his career, he worked at both Harvard and Princeton.

This short reading provides a historical overview of the "Cognitive Revolution" and thus provides much of the background necessary to place the subsequent readings for this week.

**(C) Chomsky (1959). Review of "Verbal Behavior" by B.F. Skinner. *Language.***

Noam Chomsky (1928- ) is a linguist at MIT, and one of the most cited scholars of all time. He is most famous for the idea of "Universal Grammar" and as one of the initiators of the Cognitive Revolution.

This reading is a critical review of a book ("Verbal Behavior") published by B.F Skinner, in which Skinner argues that language is learned via operant conditioning. Chomsky vehemently disagrees, and his criticisms were part of the beginning of the Cognitive Revolution. Many of the details in this reading may be obscure to you, especially since you have (probably) not read the book that Chomsky is critiquing. It is definitely okay for you to focus more on the general structure of the disagreement rather than the more technical examples.

**(D) Fodor (1985). Precis of "The Modularity of Mind." *BBS.***

Jerry Fodor (1935- ) is a philosopher at Rutgers University, and most famous for his ideas regarding the potentially modularity of the mind.

His book is a classic of Cognitive Science, but to fit this content into a single week,  we will only be reading this 5 page précis of it, published in *Behavioral and Brain Sciences*. Note that we will likely be reading more papers from this journal this semester—it is a cool format (each issue consists of a "target article" with comments from very many experts in the field, followed by a response to the comments by the original authors), and one of the two current co-editors is Yale's own Paul Bloom.

**(E) Frankenjuis & Ploeger (2007). Evolutionary psychology versus Fodor: Arguments for and against the Massive Modularity Hypothesis. *Philosophical Psychology.***

Willem E. Frankenhuis is a developmental psychologist at Radboud University Nijmegen (Netherlands). Annemie Ploeger is a developmental psychologist at the University of Amsterdam (Netherlands).

In this reading, the authors discuss important arguments for and against modularity of different kinds in different areas of cognition. As you read through it, you should focus on the broad possibilities for how the brain is organized, rather than trying to memorize specifics of who said what at what time.

# Week 3: The Future of Cognitive Science

**(A) This Guide**

**(B) Proceedings of CogSci 2016 Paper Titles**

At http://mindmodeling.org/cogsci2016/index.html, go through the "Papers" part of the 2016 CogSci conference (from "Investigating the Effects of Transparency and Ambiguity on Idiom Learning" through "Adults' guesses on probabilistic tasks reveal incremental representativeness biases").

This will be a super boring and not very useful task if you just scan your eyes over the titles. Instead, you should think through questions including (but not limited to): what topics and methods seem to get a lot of coverage? what topics and methods did I think I would see a lot and don't? which papers do I wish I had been involved in producing?

After reading through all the titles, you might be aided in your thinking about them by doing things such as (but not limited to) searching the page for key terms of interest (for instance, based on my interests I search for and find 12 instances of "moral" and 46 instances of "children" and 7 instances of "evolution") and comparing the representation of topics to your perception of cognitive science research by Yale researchers (e.g., does Yale seem to be a representative microcosm of Cognitive Science research, or do we specialize in a subset?).

Finally, based on reading through more than two abstracts (when you click on the title), choose two papers to read. You might choose one solidly within your current interests and expertise and one NOT within your current interests and expertise (or you might choose some other approach).

**(C) First 6 Page Paper of Your Choice.**

Attach the PDF to your e-mail. Quickly summarize it for me—keeping in mind that I have probably not read it and you may know more about the specific topic than me. (Also, there is a good chance you will be verbally describing it in class, so this serves as a chance to think that through as well.) What features of this paper do you think would be of general interest to the class? What questions do you have about this paper that you would like to discuss with the class?

**(D) Second 6 Page Paper of Your Choice**

See above (and remember to attach the PDF!).

**(REC) Last Year's Version of This Week**

Last year, we looked at a 2015 special issue of the journal *Cognition* called "The Changing Face of Cognition" that included a range of articles talking about the recent history and potential future of cognitive science. Students read each abstract and then selected one paper to read in full. Two additional (optional) readings included a criticism of the biased selection of authors included in the special issue, and an apology from the editor. All of these readings are available in the readings folder.

# Week 4: Meta-Issues in Cognitive Science

**(A) This Guide**

**(B). Simmons et al. (2011). False-Positive Psychology.** *Psychological Science*.

Joseph P. Simmons is at Wharton (UPenn's School of Management), though he was at Yale SOM from 2006-2011. Uri Simohnsohn is a social psychologist who is also at Wharton, and Leif Nelson is Chair of Marketing at Haas (Berkeley SOM).

In this paper, the authors use experimental practices that are common in cognitive science research to show that you can change your age by listening to music. Except, as they point out, this effect can't possibly be true. The point is that our current standards for acceptable practice allow many well-intentioned researchers to produce a lot of untrue results. This important paper has been cited more than 1500 times in the last five years.

**(C) Ioannidis (2005). Why Most Published Findings are False.** *PLoS Med*.

John P.A. Ioannidis is a Professor of Medicine at Stanford University. His work is cited a startling amount, totaling nearly 110,000 citations across all of his papers. This particular reading has been cited nearly 4,000 times in the past decade.

Compared to the first reading for this week, this reading is more technical and not as directly focused on cognitive science, but it makes some non-overlapping points and is historically important for our discussion on the replication crisis.

**(D) Bones & Johnson (2007). Measuring the Immeasurable, or: "Could Abraham Lincoln Take the Implicit Association Test?"** *Perspectives on Psychological Science*.

Neither of these author names are real. Navin R. Johnson is the name of the main character in the 1979 Steve Martin movie "The Jerk" and Arina K. Bones is an anagram of Brian A. Nosek, a psychologist at University of Virginia who is the co-founder and director of the Center for Open Science. You can find other excellent papers by "Arina K. Bones" that are similar to this one.

This article parodies many aspects of how cognitive science is often conducted and published. We will spend a lot of our time this week laboriously and seriously deconstructing why this article is hilarious. Note that if you do not already know about the IAT, you should use google (normal search and scholar) to get some sense of what the IAT is and how important it has been in recent research. Note also that I have uploaded a version of the PDF that I highlighted last year while preparing for this class discussion—there are many excellent parts I did not highlight, but if you are stuck trying to locate some important bits, you might think about the bits I've highlighted.

**(E) OSC. Estimating the reproducibility of psychological science.** *Science*.

You can see more about the Open Science Collaboration at the website: https://cos.io/

This 1-page paper is a summary of a MASSIVE undertaking by many research groups to conduct replications of 100 published studies. It generated a ton of discussion and debate, both in published journals and online (e.g., blogs). This paper has been cited nearly 500 times in the past year.

# Week 5: Evolution

**(A) This Guide**

**(B). Cosmides & Tooby. Evolutionary Psychology: A Primer**

Leda Cosmides is a psychologist and John Tooby is an anthropologist. They both work at UC Santa Barbara where they co-founded the Center for Evolutionary Psychology, they are both founders of the field of evolutionary psychology, and they are married to each other.

This primer is quite old (1997), but is still a standard reference for an introduction to applying evolutionary thinking to psychology. There are many key concepts to pay attention to, many of which might be new to you. I want to draw special attention to concepts which may **seem** familiar to you, but which can actually be quite counterintuitive. This includes nature, nurture, innateness, and heritability. See, for example, "more nature allows more nurture," and "innate is not the opposite of learned," and "[heritability] tells you nothing about what caused the development of an *individual*."

**(C) Dunbar & Shultz (2007). Evolution in the Social Brain. *Science*.**

R.I.M. Dunbar is head of the Social and Evolutionary Neuroscience Research Group at Oxford. He is most famous for "Dunbar's Number" (~150) which is the cognitive limit to the number of individuals with whom a human can maintain stable social relationships. Susanne Shultz is a senior research fellow at Manchester.

This review first discusses the puzzle of why some species have such large brains. (You might recall here the idea from James in reading (B) of making the "natural seem strange"—you take for granted that of course there are animals with giant brains, but this really need not have been the case!). They then offer an explanation for why these large brains came about.

**(D) Debove et al (2015). Evolution of equal division among unequal partners.**

Stéphane Debove just finished his PhD at Ecole Normale Superiere (Paris) and is now president of a non-profit organization that communicates scientific results to the public. Nicolas Baumard is co-lead of the Evolution and Social Cognition Group at ENS (and was my postdoc supervisor 2013-2015). Jean-Baptiste André is a research fellow in the Human Evolutionary Biology group at Montpellier.

I included this paper to emphasize that there is a wide variety of methods used by people who identify as evolutionary psychologists. You may choose to dive into the details of how modeling works, but if you only focus on understanding Figure 1 and the highlighted section of the discussion (paragraph #2, spanning pages 5-6).

**(REC) Delton & Robertson. Evolution, computation, and welfare tradeoffs.**

Andrew W. Delton and Theresa E. Robertson are professors at Stony Brook University, former students of Tooby and Cosmides, and are married to each other. This paper is recommended, especially if you want more detail about how internal regulatory variables might work (e.g., the discussion we had earlier about kinship detection, incest avoidance, and kin altruism).

# Week 6: Development and Concepts

**(A) This Guide**

**(B). Carey (2004). Bootstrapping & the Origin of Concepts.** *Daedalus.*

Susan Carey is a professor of psychology at Harvard, a Fellow of the American Academy of Arts and Sciences, a member of the National Academy of Sciences, and has won every important award available to a cognitive scientist. It is hard to overstate her importance, especially within the field of cognitive development. How about… "If an asteroid was about to destroy the Earth, and NASA could only fit 100 people on their top-secret Mars-bound escape craft, Carey is awesome enough that they could just put her and 49 random people in there, leave 50 seats empty, and call it a day."

This paper suggests that humans are able to gain novel concepts via "bootstrapping." It uses numerical concepts for its examples, and therefore also serves as an introduction to the different number systems humans have. Note that the "analog magnitude" system is also called "approximate number system" and tracking individual objects up to three is also referred to as "parallel individuation" or "object tracking system." In describing infant studies, this paper also introduces several important methods using looking time.

The key to understanding the general claim about bootstrapping is the first full paragraph on page 8 (numbered 66). If you are confused after reading the paper in full, you might return to this paragraph and focus your re-reading on understanding it. Note also footnote 5, which refers to the now published book "The Origin of Concepts."

**(C) Rips et al. (2006). Giving the boot to the bootstrap: How not to learn the natural numbers.** *Cognition.*

Lance J Rips is a psychology professor at Northwestern whose research focuses on reasoning, math, and memory. Jennifer Asmuth was a Phd student with Rips, but is now an assistant professor at Susquehanna University. Amber Bloomfield was also a Phd student with Rips, though was at UT Austin when this paper was published, and is now an associate research scientist at University of Maryland.

This paper is a direct response to Carey's proposal in Reading B. It suggests that the process of bootstrapping cannot account for number learning because "In order to work properly, the Bootstrap must somehow restrict the concept of ''next number'' in a way that conforms to the structure of the natural numbers. But with these restrictions, the Bootstrap is unnecessary." Importantly, note the last sentence of footnote 4, which clarifies that bootstrapping may be useful for *other* concepts.

**(D) Tenenbaum et al. (2011). How to Grow a Mind: Statistics, Structure, and Abstraction.** *Science.*

Joshua B. Tenenbaum is professor of cognitive science at MIT, Charles Kemp is at Carnegie Mellon's Psychology department, Thomas L. Griffith's at Berkeley's, and Noah D. Goodman at Stanford. They all study computational models of learning and cognition.

In this review paper, the authors discuss the way "Hierarchical Bayesian models" (HBMs) help our minds "make inferences that appear to go far beyond the data available." If you have not heard of Bayesian approaches before, you might look a bit on google.

The basic idea of Bayesian thinking (laying aside the "hierarchical" for the moment) is that your confidence that a hypothesis is true is a combination of the evidence and your prior expectations. If I show you the results of a single study showing that people can predict with 54% accuracy (p < .05) which way a fair coin will flip, should you conclude "people have some level of ESP"? Bayesian analysis suggests that if you previously thought ESP was SUPER DUPER EXTREMELY unlikely, you should now update your belief to "ESP is SUPER DUPER unlikely."

For the "hierarchical" aspect of HBMs (and the point of the paper as a whole) a key section to focus on is at the top of page 6: "Getting the big picture first—discovering that diseases cause symptoms before pinning down any specific disease-symptom links—and then using that framework to fill in the gaps of specific knowledge is a distinctively human mode of learning. It figures prominently in children's development and scientific progress..."

**(REC) Gopnik (2012). Scientific Thinking in Young Children: Theoretical Advances, Empirical Research, and Policy Implications. *Science*.**

Alison Gopnik is professor of psychology at UC Berkeley, a member of the American Academy of Arts and Sciences, and (like Carey) it is hard to overstate her importance. How about "If NASA had both Gopnik and Carey in their Mars-bound escape craft, NASA would only need 20 additional random people before they could call it a day."

In this review paper, Gopnik describes a huge range of research (a lot by her, her students, and her collaborators) showing that "very young children's learning and thinking are strikingly similar to much learning and thinking in science." Another presentation of her ideas that you might look at is in her TED Talk "What do babies think" in which she says:

> "...one way of thinking about it is that babies and young children are like the research and development division of the human species. So they're the protected blue sky guys who just have to go out and learn and have good ideas, and we're production and marketing. We have to take all those ideas that we learned when we were children and actually put them to use. Another way of thinking about it is instead of thinking of babies and children as being like defective grownups, we should think about them as being a different developmental stage of the same species -- kind of like caterpillars and butterflies -- except that they're actually the brilliant butterflies who are flitting around the garden and exploring, and we're the caterpillars who are inching along our narrow, grownup, adult path."

# Week 7: Consciousness

## (A) This Guide

The main question for this week is "Why are we conscious?" This question can be unpacked in many ways, including "What is going on in the human brain such that we are conscious?" and "What is the evolutionary history of humans such that consciousness is adaptive (if it is)?" Even approaching these two very different questions requires having some sense of what consciousness *is*, and that is difficult by itself! Note that the first three required readings (B, C, and D) are new, whereas the last two required readings (E and F) are perhaps things you have already read before.

## (B). Chalmers (2014). How do you explain consciousness? *TED Talk.*

David Chalmers is a philosophy professor at Australian National University. He is best known for his work on philosophy of mind, including being the editor of the textbook "Philosophy of Mind: Classical and Contemporary Readings."

Bonus fact: When I was a Senior at University of Miami, we used Chalmer's textbook in a graduate seminar I took with Colin McGinn, who has since resigned in disgrace: https://en.wikipedia.org/wiki/Colin_McGinn#Resignation

In this talk, Chalmers provides an introduction to consciousness, including the distinction between "easy" and "hard" problems of consciousness, and a discussion of what both reductionist and "radical" solutions might look like. (Note that the word "reductionist" often gets used pejoratively in some social circles, but here it is used in a non-pejorative sense).

## (C) Wegner (2003) The mind's best trick: how we experience conscious will. *TiCS.*

Daniel Wenger was a professor of psychology at Harvard until his death from ALS in 2013. Along with two other "Daniels" in that department (Schacter and Gilbert), he authored an introductory psychology textbook that might have been used in Introduction to Psychology (if you took it… and depending on what year you took it). He is most famous for the phenomenon where you can't help but think of a white bear if you are told to NOT think of a white bear.

This paper reviews several lines of research suggesting that we might not be nearly as in control of our actions as we think we are. The most extreme form of this claim would be "epiphenomenalism" (i.e., our mental states never cause anything), but Wegner makes a far more moderate conclusion than this.

## (D) Frank Jackson. Epiphenomenal Qualia. *Philosophy Quarterly*.

Frank Jackson is a philosophy professor at Australian National University. (They seem to have a good department for philosophy of mind!) He is best known for the examples in this paper, and the examples in this paper are VERY well-known (especially Mary the vision scientist).

In addition to the examples in this paper, the general idea of qualia is of central importance to any discussion of consciousness.

**(E) Bisson (1990). They're made out of meat. *Omni*.**

Terry Bisson is a science fiction author and this is a Nubula Award-nominated short story. You likely read it for Introduction to Cognitive Science. I include it here to refresh your memory and/or in case you didn't read it originally (there is a chance it was not assigned the year you took Intro).

**(F) Searle. (1980). Minds, Brains, and Programs. *Brain and Behavioral Sciences***

John Searle is a philosophy professor at Berkeley. The "Chinese Room" example is particularly famous, but Searle is famous and influential for a lot of reasons. You might check out his Wikipedia page for some interesting content (e.g., argument with Jacques Derrida). Like the Bisson reading above, this is hopefully a refresher of a paper you read in Intro, but there is a chance you haven't seen this!

**(Optional Readings)**.

A special note about the optional readings: I feel particularly pained at not including the two REC readings (Gazzaniga split brain studies and Nagal's "What is it like to be a bat"). If you are interested in this week's topic, they really are REC'd very strongly. Also, note that one of the SPEC readings is the comments and discussion from the required BBS paper (reading F).

# Week 8: Artificial Intelligence

**(A) This Guide**

**(B) Turing (1950). Computing Machinery and Intelligence. *Mind*.**

Alan Turing can reasonably be called the father of the field of artificial intelligence. In World War II, he made contributions to code-breaking that probably saved millions of lives and shortened the length of the war by years. In 1952, he was prosecuted for homosexual acts and accepted chemical castration. He died (likely suicide) in 1954. In recent years, the British government and the Queen both apologized and pardoned him posthumously.

This classic paper presents what is now known as the "Turing Test." It has many wonderful attributes, but you will no doubt notice many troubling things about it (e.g., pages 13 and 17 both produced strong startle reactions in me, of different types).

**(C) Urmson (2015). How a driverless car sees the road. *TED Talk.***

This is a year-old TED talk by the person who was (at the time) heading Google's driverless car program. Note especially the "unnecessary brakes" against "accident avoidance" graph, and the "picture-in-picture" presentation where how the car "sees" the world is presented with normal camera video in the lower left of the screen.

**(D through F)**

Readings D through F talk about evolutionary robotics. I decided to include a trio of papers about one specific topic (rather than three diverse AI topics) so we could focus on a subset of issues that can hopefully fit within the time limits of just one week. I chose this particular topic because it relates to many other issues within cognitive science, including previous weeks of this class.

Reading D is a review article. No need to focus too much on the details of the modularity evolution, and feel free to skip the embodied cognition bit completely, but note especially the beginning and end, including when the author discusses reading F (citation #46 in this paper). Reading E is the "news and views" coverage of reading F (which is the most technical).

**(Recommended Readings)**
Note that the first recommended reading is about the startling AI success this past year in which a computer beat the world champion in Go (a qualitatively, not merely quantitatively, different feat than AI beating the world champion in chess). The other recommended reading is the same Tenenbaum paper we read two weeks ago—you might take another look at it following our class discussion and the readings for this week!

# Week 9: My Work (by request)

**(A) This Guide**

I did not plan to talk about my own work last year, but the Juniors suggested this week and voted in favor of it. And this year it was voted to be included as well.

Most of my research is in the area of moral psychology. The set of three required readings for this week look at fairness behavior in children. Specifically, the papers discuss ways that children are both fair AND unfair at different ages, and why fairness behavior might change across development.

**(B) Anti-equality: Social comparison in young children. *Cognition*.**

This paper is from my PhD here at Yale, working with Paul Bloom and Karen Wynn.

This paper replicates previous results showing that young children do not like unfair disadvantages (e.g., they prefer "2 each" over "2 for self and 3 for other"), but then also shows that children DO like unfair advantages (e.g., they prefer "2 for self and 2 for other" over "2 each"). Indeed, the preference for advantage is so strong that many young children spitefully prefer "1 for self and 0 for other" over "2 each."

**(C) Some equalities are more equal than others: Quality equality emerges later than numerical equality. *Child Development.***

This paper is from my PhD here at Yale, and includes several undergraduate co-authors.

Whereas most previous research has looked only at *numerical equality* (e.g., reading B), this paper also looks at *quality equality*. The most important result is the pattern of results in the middle age group, where many of them choose "two each" but monopolize BOTH of the better resources.

**(D) Life-history theory explains childhood moral development. *TiCS.***

This paper is from my postdoc in Paris, working with professors Nicolas Baumard and Coralie Chevallier, and their PhD student Stephane Lambert.

This paper provides a proposal for how to think about moral development. Note that "Life-history theory" is a bit of misleading jargon that does NOT mean what the words seem to mean. A very brief summary of the overall claim:

The increase in prosocial motivation over childhood may be like the emergence of adult/permanent teeth: having adult teeth in a 3-year-old would be bad for survival, and having adult levels of prosocial motivation in a 3-year-old would likewise be bad for

survival. Why might high levels of prosocial motivation be beneficial for adults but harmful for young children? A good moral reputation is important for gaining interaction partners for mutually-beneficial cooperative activities. Benefits gained in cooperative activities are important for adults but much less important for children (who are provisioned by adult care-givers). Thus, for young children, the costs of being prosocial are not paid back from benefits gained from cooperation (to say nothing of the fact that a 3-year-old is useless in most cooperative tasks and so not included regardless of moral reputation!).

More generally, just as our physical maturation follows a roughly standard timeline that has been tuned by natural selection, so too might various aspects of our cognitive maturation follow a roughly standard timeline that has been tuned by natural selection. Note that this does not demand an exactly identical timeline for each person: there is interesting research about how the environment can lead to individual differences, including ways in which the evolved system might be "designed" to respond flexibly to environmental variation.

**(REC) A published senior thesis (in *Animal Cognition*)**

The first author on this paper is Amy Skerry, who completed this work for her senior project as a Cognitive Science major at Yale. She then went on to do a PhD in developmental psychology at Harvard.

This paper is on a slightly different topic than the papers above (it is on helping behavior in nonhuman primates). You might be interested in it as an example of what someone else did for their senior project!

# Week 10: Emotion

**(A) This Guide**

**(B) Ekman et al. (1969). Pan-cultural elements in facial displays of emotion.** *Science.*

Paul Ekman has been named as one of Time Magazine's top 100 most influential people. The TV show "Lie to Me" is based on him, and he has served as a consultant to many tv shows and movies, including Pixar's "Inside Out." Wallace V. Friesen is one of the developers (with Ekman) of the widely-sued Facial Action Coding System. And… I don't have any useful information on E. Richard Sorenson beyond what is in the article.

This is one of the foundational articles in the study of emotion. In the description of this course as "10% greatest hits and 90% current trends" this is one of the 10% group.

**(C) Lindquist et al. (2013). The hundred-year emotion war: are emotions natural kinds or psychological constructions? Comment on Lench, Flores, and Bench (2011).** *Psychological Bulletin.*

Kristen Lindquist is the director of the Carolina Affective Science Lab at University of North Carolina. Erika H. Siegel is now a postdoc in psychiatry at UC San Francisco, Karen S. Quigley and Lisa Feldman Barrett both have multiple affiliations, including co-running the Interdisciplinary Affective Science Laboratory, which is primarily at Northeastern University, but also at Mass General Hospital.

This article lays out the central debate in the cognitive science of emotion. Of central importance to understanding it, note that the claim that emotions are not "natural kinds" is *NOT* the claim that they do not have a natural foundation. Instead, it is the claim that they are psychologically real clusters of many other things that are natural kinds. Note also that the Lench et al. (2011) article they are responding to is one of the optional readings for this week.

**(D) Touroutoglou (2015). Intrinsic connectivity in the human brain does not reveal networks for 'basic' emotions.** *SCAN.*

Alexandra Touroutoglou is a research scientist in the Interdisciplinary Affective Science Laboratory (see above), and two of the other authors are profiled above. Bradford C. Dickerson is a neurologist at Mass General and also has a lab at Harvard. This is an example of more recent research following up on the above paper.

**(E) Tracy et al. (2015). The nonverbal communication of emotions.** *Current Opinion in Behavioral Sciences.*

Jessica L. Tracy runs the Emotion & Self Lab at University of British Columbia, Conor M. Steckler is one of her grad students, and Daniel Randles is now a postdoc in social psychology at University of Toronto.

Note also the editors of the theme issue this article is from:
- Molly J Crockett is joining the psychology faculty here at Yale next year.
- Amy Cuddy is at Harvard SOM and gave one of the most popular TED talks of all time (on "power posing"). However, the research on which the TED talk is based has recently come under huge criticism for failures to replicate, with one of the original authors disowning the research.

All of the articles this week touch on both the proximate mechanisms of emotion and potential adaptive/ultimate explanations, but this article is particularly heavy on the latter. There are ways in which information about each of these elements (proximate and ultimate) will give us information about what is likely true about the other.

# Week 11: Judgment and Decision Making

**(A) This Guide**

**(B) Kahneman (2003). A perspective on judgment and choice: mapping bounded rationality.** *American Psychologist.*

In this article, Kahneman provides an overview of his work with Tversky, for which Kahneman received the 2002 Nobel Prize in economics (Wikipedia tells me that Tversky was not a joint winner, because the award is not awarded posthumously.)

I included this as a required reading because it provides an overview of a huge number of important results for this week's topic, and provides some historical framework for them. I was a bit conflicted, however, because I might have alternatively included one or more of the foundational empirical papers by Kahneman and Tversky. For whatever citation counts are worth, this paper has been cited 3,409 times, whereas their 1979 paper "Prospect theory: an analysis of decision under risk" has been cited 42,800 times (!!!). There are very many important pieces of jargon/arguments/methods to note. An incomplete list of the most important are "The Asian Flu," "Prospect Theory," the shape of the value function of prospect theory, and "Linda the Bankteller."

**(C) Evans & Stanovich (2013). Dual-process theories of higher cognition: advancing the debate.** *Perspectives on Psychological Science.*

In this article, Evans and Stanovich provide an overview of dual-process theories (ten years more recent than the coverage in the Kahneman paper), carefully distinguishing different dual-process theories from each other and discussing various criticisms that have been suggested against dual-process theories.

I included this as required reading because it is both highly informative for the current topic, and a wonderful example of a critical overview of a topic. General jargon/arguments/methods to note: "Wason selection task"

**(D) Thaler & Sunstein (2008). Nudge. (excerpt from book)**

In the introduction to their book, Thaler and Sunstein lay out the basic ideas of "choice architecture" and "libertarian paternalism."

I included this as required reading as an example of how JDM research can be applied to the real world, and to raise questions regarding whether (and in which circumstances) certain types of JDM research *should* be used to influence people's decisions. Note that additional chapters are included as recommended reading. General jargon/arguments/methods to note: I'd love for "Carolyn the Cafeteer" to be a common touchstone, but to my knowledge it has not risen to that level, and most certainly not with my idiosyncratic name for it.

**(REC) Leslie et al. (2015). Expectations of brilliance underlie gender distributions across academic disciplines.** *Science.*

In this article, Leslie and colleagues investigate the phenomenon that the gender ratio in different academic disciplines varies widely, with women being the majority in some disciplines (e.g., art history = 75% women) and men being the majority in some disciplines (e.g., music composition = 85% men). They find that there is a strong correlation (r of about .6) between something called "Field-specific ability belief" and the proportion of males in a discipline: the more people have the **impression** that success in a subject relies on an innate talent for the subject, the higher the percent of men.

I included this as recommended reading for three reasons. First, it is an example of how major life decisions (e.g., which career to pursue) can be influenced by factors that we might not even think to think about. Second, it is another example of an important issue in the profession of academia (similar to the week on the replication crisis, or the discussion of metrics such as the H-index to track research productivity). Third, my prediction is that this this topic may be of interest to many of you (and, of the topics voted to be on the syllabus, this week is the one that relates most to this topic).

**(REC) Nieuwenstein et al. (2015). On making the right choice: A meta-analysis and large-scale replication attempt of the unconscious thought advantage.** *Judgment and Decision Making.*

In this article, Niewenstein and colleagues look at whether a famous effect in the literature (some decisions are made after thinking about something else for a while) is real. They do both a meta-analysis of other studies, and a large-scale replication attempt.

I included this as recommended reading for two reasons. First, the specific topic under investigation is of practical importance for judgment and decision making. Second, the specifics of the alternatives they investigate ("reliability" and "moderator"), and the specific tools they use to investigate them, are of general applicability across a wide range of replication attempts.

**(SPEC) Thaler & Sunstein (2008). Nudge. (additional excerpts from book)**

The required reading is a 9 page excerpt, this larger excerpt is 43 pages. It is an excerpt that was included in Tamar Gendler's "Philosophy and the Science of Human Nature" course (cross-listed as a Philosophy and a Psychology course). You might, of course, be interested enough by this excerpt that you choose to buy and read the full book. (I can also temporarily lend out my copy.)

**(SPEC) Blakemore & Robbins (2012). Decision-making in the adolescent brain.** *Nature Neuroscience*, *15*(9), 1184-91.

In this article, Blakemore and Robbins discuss risky decision-making in adolescents, pulling together information from development, lesion and neuroimaging studies, and many other topics that might be of interest to you.

# Week 12: User Interfaces

**(A) This Guide**

Note that, of the 4 required readings this week, 2 are super short (D and E) and 1 is rather short (B). So please consider the REC readings even more recommended than usual (especially RECpalmer2013.pdf).

**(B) Dodson (2014). Using Cognitive Principles and Perpetual Processes to Inform Interface Design. 26th Annual IEEE Software Technology Conference.**

In this powerpoint presentation, Dodson* provides an overview of several ways cognitive science has informed user interface design. I included this reading both because of the usefulness of its content, and to emphasize one way that cognitive science is practiced and applied outside of academia. In fact, the slide I think you should make sure to look at, more than any of the others, is the author bios slide at the end of the presentation.

(*and perhaps a second person: although there is only one name on the title slide, there is a second person with an author bio at the end of the presentation.)

**(C) Dillon (2003). User Interface Design. *MacMillan Encyclopedia of Cognitive Science*, Vol. 4.**

In reading this broad overview of several issues in user interface design, you will likely be struck by two things (1) it has an unfortunate amount of jargon (e.g., on page 2, "convey" = "have") and (2) it is old.

Regarding #1, I would encourage you to just push through the sometimes opaque writing (especially on pages 2 and 3), though note that there are some jargon-seeming words that are important (e.g., "semiotics").

Regarding #2, I would encourage you to see the age of this article as a feature, not a bug (i.e., an advantage, not a problem). It give you an opportunity to consider: If you were updating this for 2015, which aspects would be the same, and which would be different? (See also my notes for Reading E).

**(D) Noyes (2015). Can gamification solve enterprises' engagement problem? *Article in PC World Magazine*.**

In the set of optional readings you will find a more academic publication about gamification. However, for the required readings I just wanted to make sure everyone knew the term, and so I chose this super quick popular press article. In it, Noyes provides an overview of what gamification is and why it might end up being very important— perhaps "so central to the design of software that the term will actually fade away over the next few years." If you have never heard of gamification, then the brief overview in this

reading might not be sufficient, in which case you might look at the optional reading or turn to google.

**(E) Microsoft HoloLens – Transform Your World with Holograms. https://www.youtube.com/watch?v=aThCr0PsyuA**

As you saw in Reading C, user interface design is a very different field now compared to 10 years ago (e.g., before mobile applications on smartphones). Compared to this past decade, will the next decade involve changes that are more radical, or less radical? Trying to predict the future is a good way to look silly (have you seen the predictions of the year 2000 from the 1800s?), but this very short youtube video (showing augmented/mixed/hybrid reality) is my best prediction for what will be the most radical shift (restricted just to the domain of "technology for which people are designing user interfaces"!) in the next 10 years. If you want to see where things have gone in the past 20 months since this was posted, you can see a lot of actual use in more recent youtube videos (including on Microsoft's dedicated HoloLens channel).

**(REC) Palmer & Griscom (2013). Accounting for taste: Individual differences in preference for harmony. *Psychonomic Bulletin Review*.**

This article is not about user interface at all, but rather individual differences in aesthetics. There are many reasons I have included it as a recommended reading:

(1) You might think about how you would apply this cognitive science research to a user interface you were designing, if you had such a job.

(2) We have not much discussed individual differences this semester, but it is an important topic both in itself, and within many other topics (e.g., individual differences in emotion, individual differences in development, etc. etc.).

(3) It touches on several generally important methods/ideas, including the Big 5 Personality Traits and confirmatory factor analysis.

(4) Much of the writing in this article is quite good. Specifically, I think it is a good article for the following:

Sometimes, when I get tripped up on something I don't understand in an article, I skip an entire section (e.g., if the results section starts off saying they run a weird test I have never heard of, I might get discouraged and skip the results section). A better habit is to read such sections closely, paying attention to "what do I have no hope of figuring out right now" vs. "what can I decode with some work" vs. "what can I understand without decoding any of the parts I don't currently understand."

In the results section of this paper, there may be parts that are opaque to you, but the authors have done a good job of always stating in clear English what is going on. For example, after showing a scary equation for calculating their key dependent measure, they

state "scores could thus vary from +100 (maximal preference for harmony) to −100 (maximal preference for disharmony)."

**(REC) Walz & Deterding (2015). An introduction to the gameful world.** *Introduction to "Gameful World" book.*

This book introduction provides an in depth overview of the concept of "gamification" as well as several debates about it. If you read it, you might (based on the description of the chapters that follow) choose to read additional chapters that interest you.

**(SPEC) HoloLens press**

If you found the HoloLens video awesome and want to learn more, then you may enjoy some of the initial in depth coverage of it. This reading is an example.

**(SPEC) Radu & MacIntyre (2012). Using children's developmental psychology to guide augmented-reality design and usability.** *IEEE International Symposium on Mixed and Augmented Reality.*

Depending on your specific interests (e.g., an interest in designing interfaces for augmented reality; or an interest in childhood education) you may find this reading very interesting. However, I also think this paper may be of some general interest as well, as an example of how user interface research proceeds in a more concrete case. (Note that the cognitive science in this paper is sometimes a bit lacking—for example, I think section 7.2.1 was substantially out of date even when this was published in 2012.)

**(SPEC) Hamari et al. (2014). Does gamification work? – A literature review of empirical studies on gamification.** *47th Hawaii International Conference on System Science.*

You may, of course, be interested in the question of whether gamification works! This conference paper tries to answer that question, based on the results of many published papers.