



Introduction to Cognitive Science

Welcome! 😊



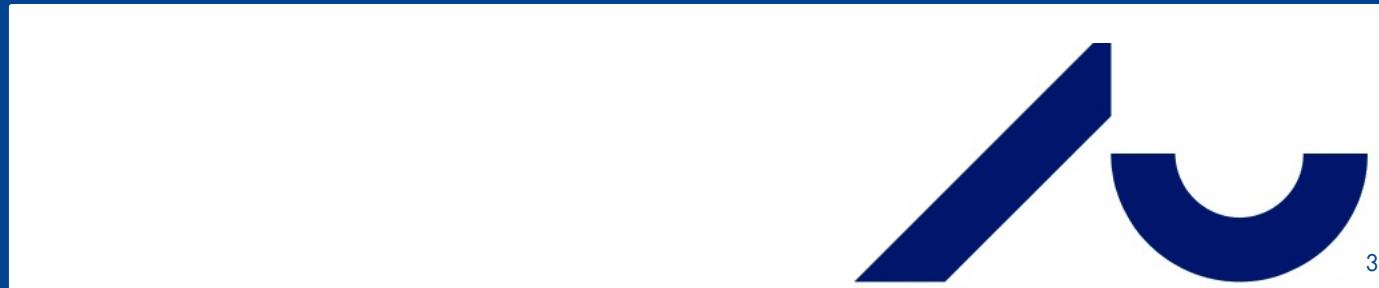


Today's agenda

- › Introductions
- › Course structure and tips
- › BREAK
- › Interdisciplinary science
- › Models in science
- › The Donders Subtraction Method
- › The WEIRDest people in the world?



Introductions



Lecturer

Daina Crafa



Lectures & Classes
Weeks 35-47

Instructor

Matilde Sterup



Some activities
during Classes
most weeks

Examiner

Mikkel Wallentin



Will review course
material with you and
grade the exam



The screenshot shows the Canvas LMS interface for the course 'Introduction to Cognitive Science (E21.147...)'. The top navigation bar includes links for Course Home, Content, Course Tools (with a dropdown arrow), Classlist, Zoom, and Help. On the right side of the header are icons for messaging, notifications, and user profile (Daina Crafa). Below the header, there's a sidebar with a 'Standards' section showing '0%' completion, a '+ New Unit' button, and a gear icon. The main content area displays a syllabus unit titled 'Class 12 (week 48) – Review of Core Topics and Conclusions'. This unit is marked as 'Visible' and has an 'Add Existing' button. The syllabus content indicates 'No readings required – revision time'. A large red text overlay at the bottom left reads 'You will review course with Mikkel in Week 48'.

You will review course with
Mikkel in Week 48

Exam Schedule

Course title	Exam form	Form of co-examination	Exam dates	Assessment deadline	Register / unregister for re-exam	Exam form re-exam	Re-exam dates	Assessment deadline re-exam
BA 1. semester 2020								
Introduction to Cognitive Science / Introduktion til kognitionsvidenskab	Oral Preparation time: 30 min. Exam duration: 30 min.	Internal 7-point grading scale	Oral exam: 17/1 to 21/1	21/1	24/1	Oral Preparation time: 30 min. Exam duration: 30 min.	Oral exam: 21/2	21/2

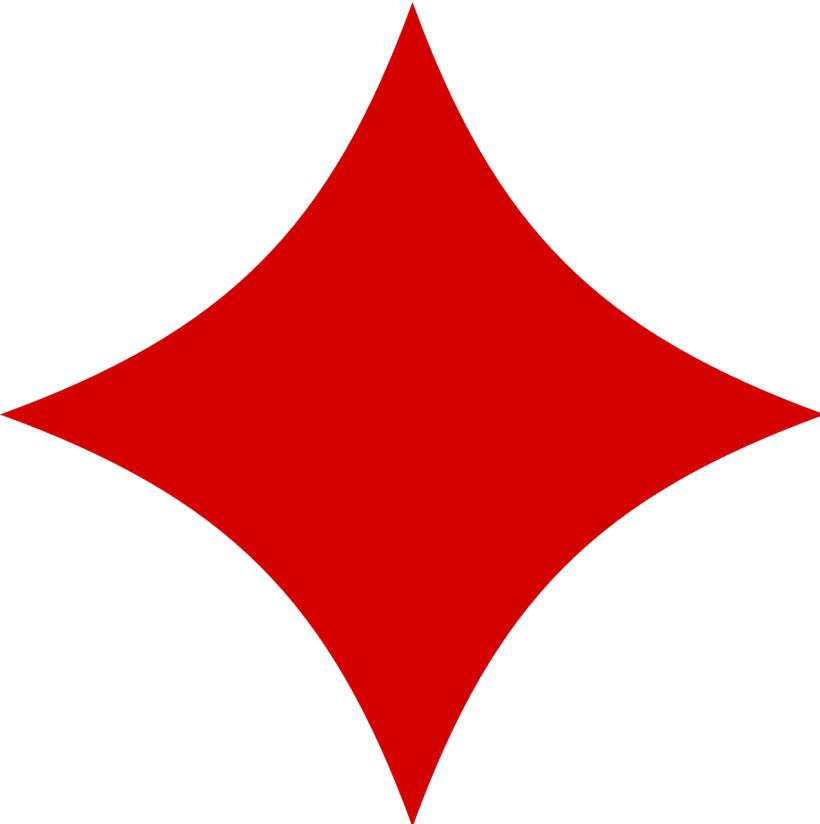
Mikkel will grade exam

Who am I?

BA Philosophy

MSc Cognitive
Science

MSc Cultural
Psychiatry



PhD Neuroscience

What do I research?

- › Social cognition
 - › Social brain processes
 - › Change in cognitive and brain processes during social interaction

 - › Culture: How do humans vary in their social cognition and brain processes?
 - › Psychiatry: What goes “wrong” for patients?
- Specialties in fMRI, EEG, & fNIRS**



Areas of training

Philosophy

Identifies the questions to ask

Anthropology

Describes the progression of societies and cultures

Psychology

Examine mental processes and behaviors

Neuroscience

Studies biological mechanisms of the physical brain

Linguistics

Artificial Intelligence

Uses computational modelling to understand and replicate mental processes

Interacting Minds Centre

Interdisciplinary research centre at AU

Resources for cognitive science students:

- › Weekly talks from local and international experts
- › Opportunities to train with researchers from many topics

News, people, and events here: <https://interactingminds.au.dk/>

Recommended to sign up for the newsletter (at ^this link)

Opened 15 September 2020

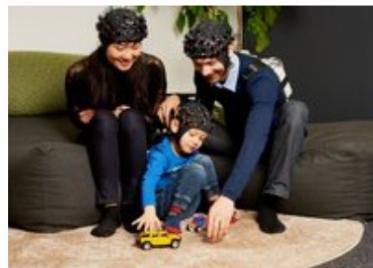
fNIRS & the IMC Lab

The IMC will open Denmark's first All-Ages fNIRS Laboratory

High-quality fNIRS equipment to study human interaction

2020.08.14 | [ANNE-METTE PEDERSEN](#)

New tech ☺



We are very pleased to announce the opening of **Denmark's first all-ages fNIRS laboratory** this September! This addition to the IMC's resources brings new potential for research and collaborations. The fNIRS devices are portable and tolerate movement, so they can be used to study humans interacting with each other and the world around them.



NIRx – and especially high-quality leader in fNIRS development – has been awarded the contract, which is funded by the **CarlsbergFondet**. The fNIRS devices can record up to 3 people simultaneously while they interact with each other or complete solo experiments. They are wireless and wearable so they may be used indoors or in outdoor



Course structure and tips



Course plan

- › This course is structured to have two components
 - › Lectures providing an overview of concepts
 - › Class work exploring (some) concepts in more detail
- › Progression of the course
 - › Low-level to high-level cognitive processes
 - › Primarily implicit to primarily explicit
 - › Consistently a broad introduction to many subjects and their mutual relationships
- › Semester plan for the semester is as follows:

Topic Overview

- › What is Cognitive Science?
- › Cognitive Neuroscience
- › Perception
- › Attention
- › Memory
- › Knowledge
- › Research Ethics
- › Problem Solving
- › Judgement, Reasoning, and Decisions
- › Emotions and Cognition
- › Social Cognition
- › Review

Every week:
Individual and Cultural Differences



The screenshot shows a course management interface. On the left, there's a sidebar with a 'Standards' section (0% completed), a '+ New Unit' button, and a gear icon. Below these are two 'Syllabus' entries, with the top one expanded to show its content. The main area displays a 'Course Outline & Required Readings' page for 'Lecture 1 (week 35) – What is Cognitive Science?'. The page includes a toolbar at the top with a toggle switch for visibility, an 'Add Existing' button, a 'Create New' button, and other icons. The content lists 'Readings' with two items: 1) 'Textbook reading: Goldstein, B., & van Hoof, J.C. (2021). Cognitive Psychology (2nd edition). Cengage. Read Chapter 1 – Introduction to Cognitive Psychology' and 2) 'Individual differences reading: Henrich, J., Heine, S.J., & Norenzayan, A. (2010). Most people are not WEIRD. Nature, 466(7302), 29.' A large, semi-transparent grey arrow points upwards from the bottom of the page towards the header.

Understanding human variation is increasingly important for careers

Lectures vs Classes

Lectures

- › Presentation designed to clarify and build on reading (not repeat it)
- › A chance to ask questions about the reading and core concepts

Classes

- › Activities designed to create “deep learning”
- › A chance to explore, examine, and apply core concepts

Lectures vs Classes

Lectures

- › Presentation designed to clarify and build on reading (not repeat it)
- › A chance to ask questions about the reading and core concepts

Teaching for knowledge and career preparation!

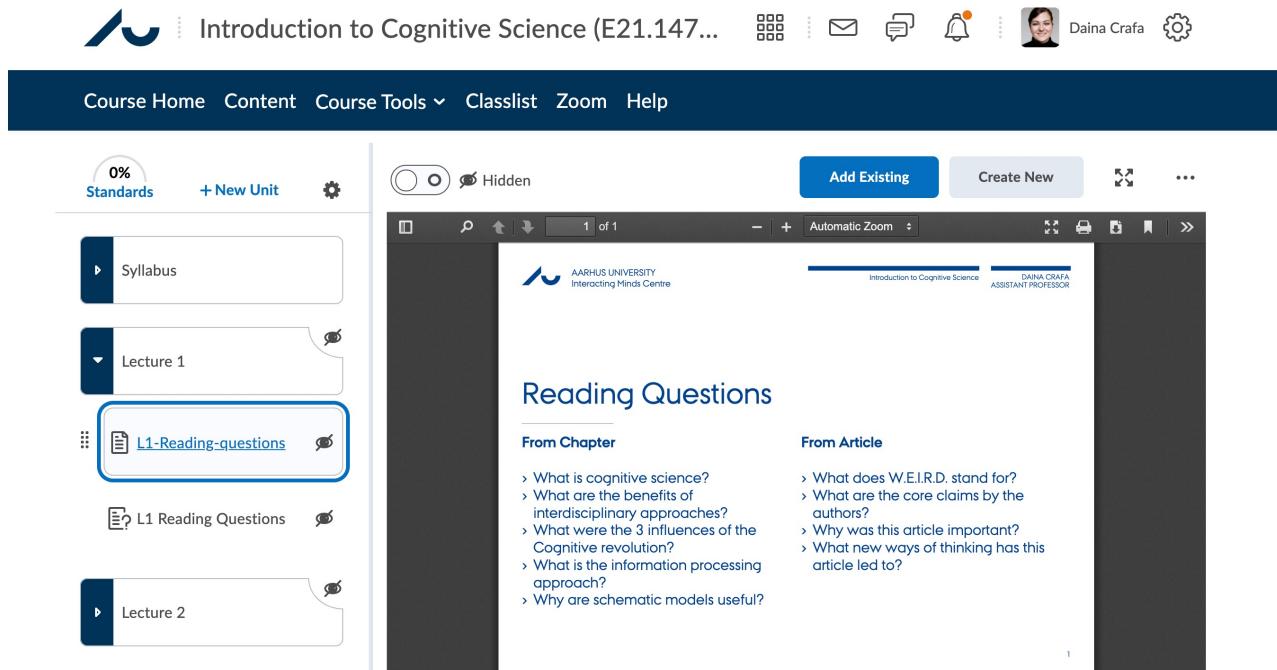
NOT teaching to the exam

Classes

- › Activities designed to create “deep learning”
- › A chance to explore, examine, and apply core concepts

Reading questions

Optional practice



The screenshot shows a course navigation bar with links to Course Home, Content, Course Tools, Classlist, Zoom, and Help. Below the navigation bar is a sidebar with sections for Syllabus, Lecture 1, L1-Reading-questions (which is highlighted with a blue border), and Lecture 2. The main content area displays a reading assignment titled "Reading Questions". The assignment is divided into two sections: "From Chapter" and "From Article". The "From Chapter" section contains the following questions:

- > What is cognitive science?
- > What are the benefits of interdisciplinary approaches?
- > What were the 3 influences of the Cognitive revolution?
- > What is the information processing approach?
- > Why are schematic models useful?

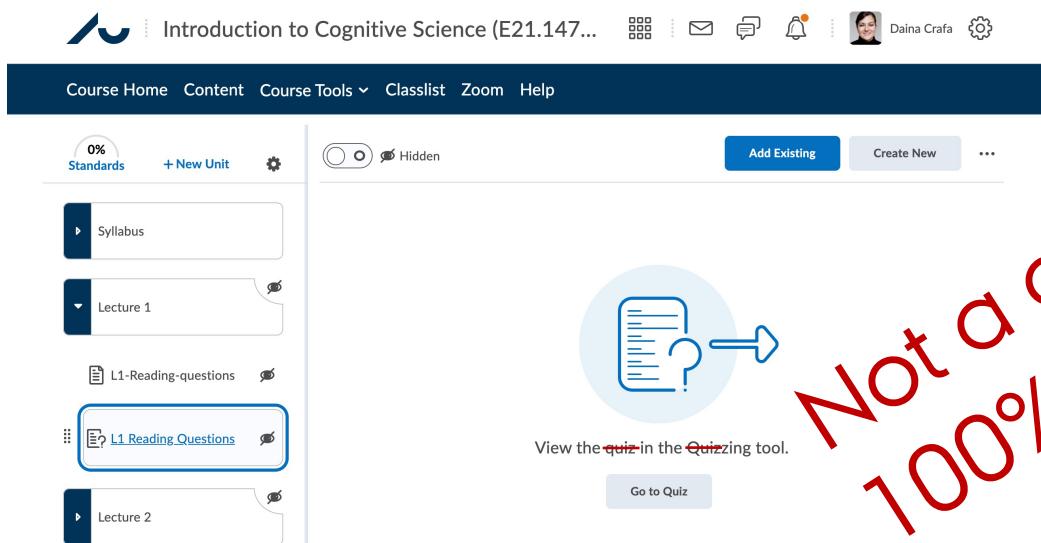
The "From Article" section contains the following questions:

- > What does W.E.I.R.D. stand for?
- > What are the core claims by the authors?
- > Why was this article important?
- > What new ways of thinking has this article led to?

Reading questions form

Not a quiz! Optional **practice**

- > Same questions as PDF
- > Practice answering questions about course content (one approach to exam prep)
- > May help you realize what material you're not confident with
- > Anonymous, but helps me see what students do & don't understand (I can improve)

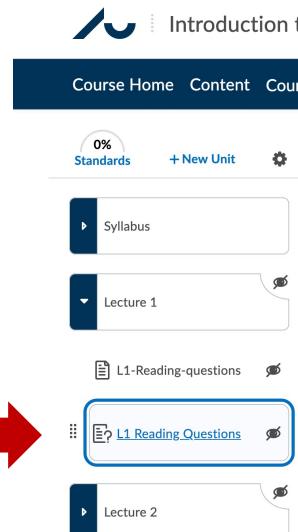


The screenshot shows the Canvas LMS interface. At the top, there's a header bar with the university logo, course name "Introduction to Cognitive Science (E21.147...)", and various navigation links like Course Home, Content, Course Tools, Classlist, Zoom, and Help. Below the header is a dark blue navigation bar with items like "Standards" (0%), "+ New Unit", a gear icon, and a "Hidden" toggle switch. The main content area displays a list of course modules: "Syllabus", "Lecture 1", "L1-Reading-questions", "L1 Reading Questions" (which is highlighted with a blue border), and "Lecture 2". A large red watermark with the text "Not a quiz! 100% optional" is overlaid diagonally across the bottom right of the image. In the center, there's a circular icon with a document and question mark, and text below it says "View the quiz in the Quizzing tool." with a "Go to Quiz" button.

Questions for me

- › Found at end of Reading Questions Form

1. Open Reading
Questions Form



2. Open questions in Quiz tool
(even though it's not a quiz –
100% optional practice)



View the ~~quiz~~ in the ~~Quizzing~~ tool.

Go to Quiz

Questions for me

3. Last question asks: Do you have any questions for me? If you do, you can ask them anonymously here.

- I will read your questions at 5:00 on Wednesday mornings (if you submit a question after that time, I might not see it)
- Vague questions are ok
- Include a page number if you can
- Not all questions can be answered
- Questions about core content **will** be answered by me
- Questions “for fun” or to gain extra knowledge will be answered **only if** there’s time



- 1 Q1. What is cognitive science?
- 1 Q2. What are the benefits of interdisciplinary approaches?
- 1 Q3. What were the 3 influences of the Cognitive revolution?
- 1 Q4. What is the information processing approach?
- 1 Q5. Why are schematic models useful?
- 1 Q6. What does W.E.I.R.D. stand for?
- 1 Q7. What are the core claims by the authors?
- 1 Q8. Why was the assigned article important?
- 1 Q9. What new ways of thinking has this article led to?
- 1 Q10. Do you have any questions for me?



Announcements

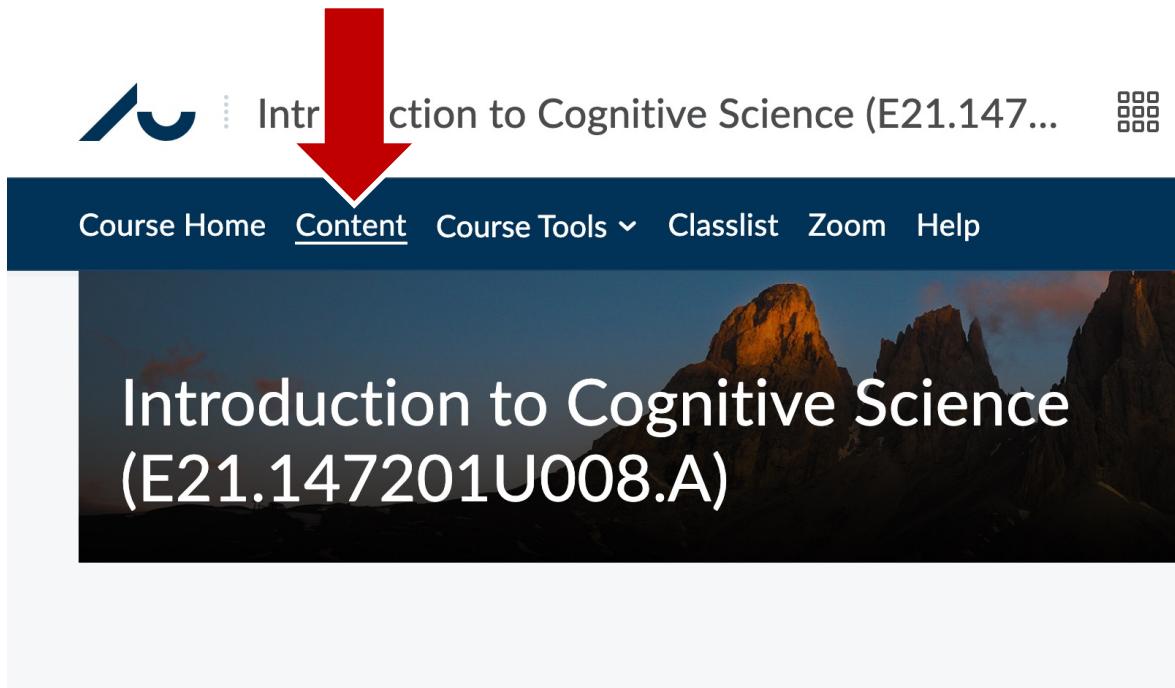
Always check
Bright Space!

The screenshot shows the Brightspace LMS interface. At the top, there's a banner for the course "Introduction to Cognitive Science (E21.147201U008.A)" with a background image of mountains. Below the banner, the main content area has a header "Activity Feed" with a "Create a post..." button. A red arrow points from the text "My announcements will appear here" to this button. To the right of the activity feed, there's a "Calendar" section showing "Wednesday, 1 September 2021" and an "Upcoming events" section stating "There are no events".

My announcements
will appear here

Finding course materials

Course material will be added here



Intr...ction to Cognitive Science (E21.147...)

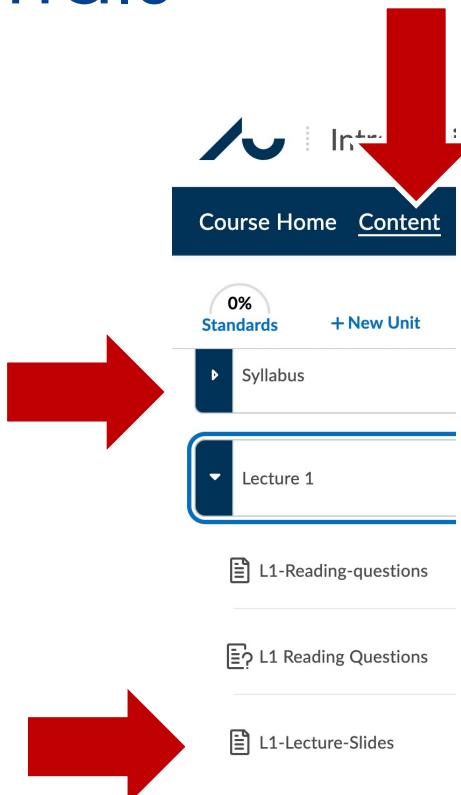
Course Home Content Course Tools ▾ Classlist Zoom Help

Introduction to Cognitive Science
(E21.147201U008.A)

Finding course materials

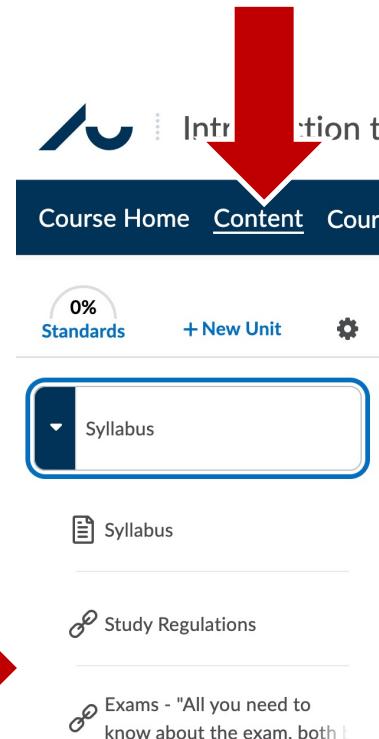
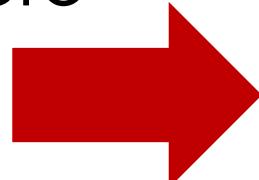
Under “Content” you will find:

- Course syllabus
- Lecture slides and reading questions
- Materials for Classes
 - ✓ Usually uploaded the morning of the Class
- Sometimes extra videos or optional reading suggestions
 - ✓ Only when relevant



Useful links

If you have questions about the course or exam, you can find some answers here



Intr...ation t

Course Home Content Cour...

0% Standards + New Unit

Syllabus

Syllabus

Study Regulations

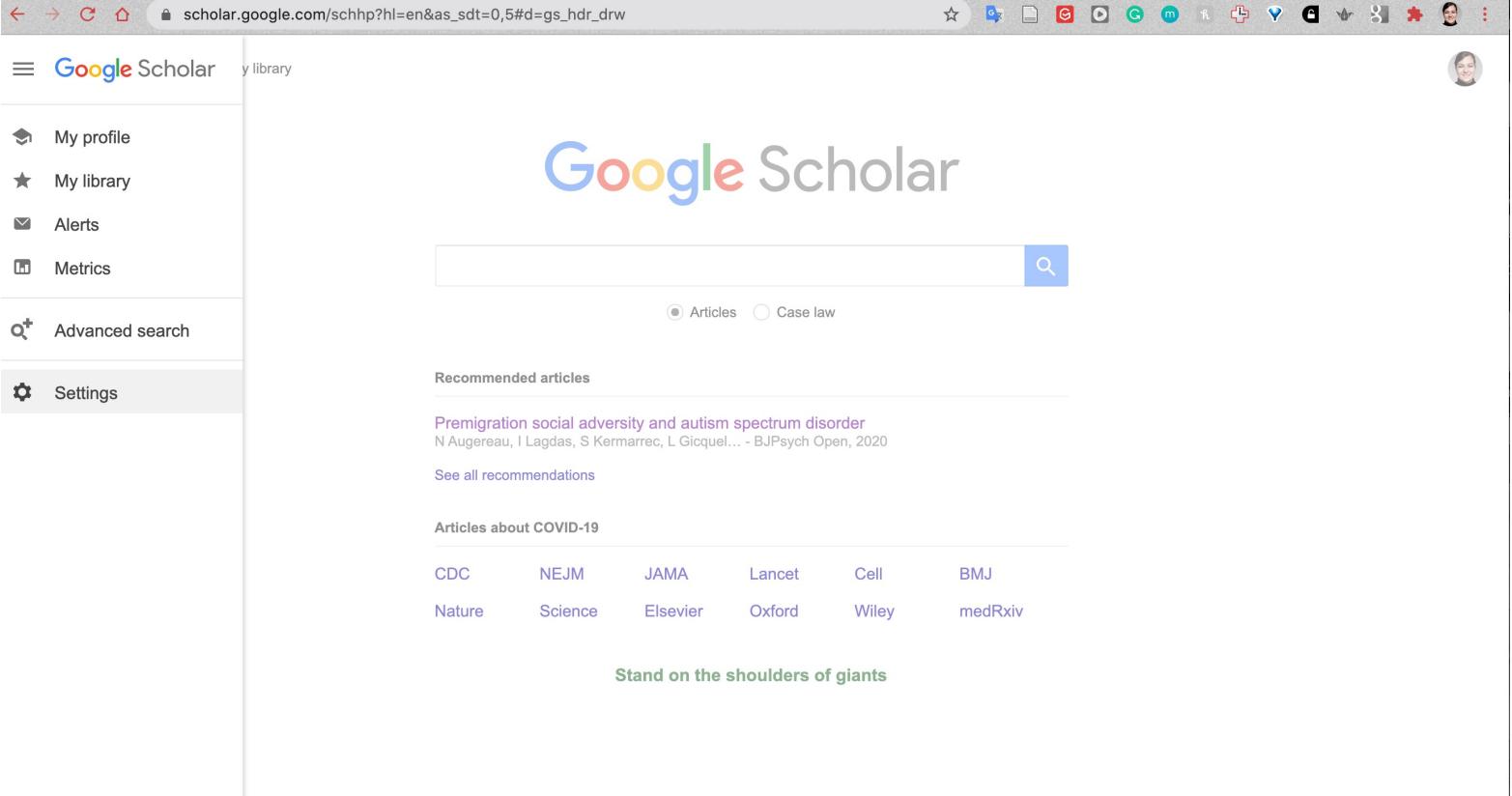
Exams - "All you need to know about the exam, both l

My BrightSpace looks different from yours!

I can't see what you see on BrightSpace

› Please tell me if you can't find something where I said it is!

Add libraries to Google Scholar



The screenshot shows the Google Scholar homepage. On the left, there is a sidebar with the following options:

- ≡ Google Scholar
- My profile
- My library
- Alerts
- Metrics
- Advanced search
- Settings (selected)

The main content area features the "Google Scholar" logo and a search bar. Below the search bar are two radio buttons: "Articles" (selected) and "Case law".

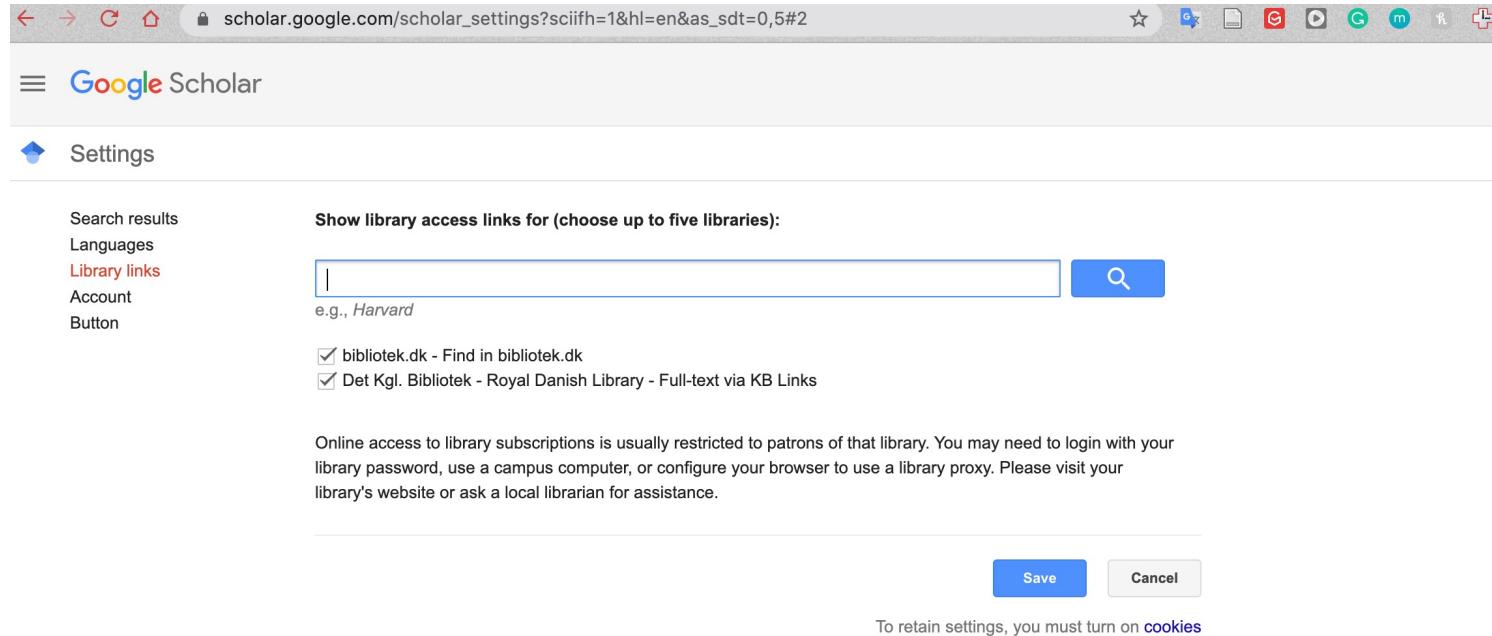
Under the search bar, there is a section titled "Recommended articles" with a link to "See all recommendations".

Below that is a section titled "Articles about COVID-19" with links to various publishers and sources:

CDC	NEJM	JAMA	Lancet	Cell	BMJ
Nature	Science	Elsevier	Oxford	Wiley	medRxiv

At the bottom of the page is the tagline "Stand on the shoulders of giants".

Add AU to Google Scholar



The screenshot shows the 'Settings' page of Google Scholar at scholar.google.com/scholar_settings?sciflh=1&hl=en&as_sdt=0,5#2. The left sidebar includes options like 'Search results', 'Languages', 'Library links' (which is red), 'Account', and 'Button'. The main area is titled 'Show library access links for (choose up to five libraries):' with a search bar containing 'bibliotek.dk' and a magnifying glass icon. Below the search bar is the placeholder text 'e.g., Harvard'. Under the search bar, two checkboxes are checked: 'bibliotek.dk - Find in bibliotek.dk' and 'Det Kgl. Bibliotek - Royal Danish Library - Full-text via KB Links'. A note below explains that online access is restricted and requires login or a proxy. At the bottom are 'Save' and 'Cancel' buttons, and a note about cookies.

scholar.google.com/scholar_settings?sciflh=1&hl=en&as_sdt=0,5#2

≡ Google Scholar

Settings

Search results
Languages
Library links
Account
Button

Show library access links for (choose up to five libraries):

|
e.g., Harvard

bibliotek.dk - Find in bibliotek.dk
 Det Kgl. Bibliotek - Royal Danish Library - Full-text via KB Links

Online access to library subscriptions is usually restricted to patrons of that library. You may need to login with your library password, use a campus computer, or configure your browser to use a library proxy. Please visit your library's website or ask a local librarian for assistance.

Save Cancel

To retain settings, you must turn on [cookies](#)

Future Scientists and Researchers

- › Courses are broadly applicable to **academia** and **industry**
- › Cognitive Science courses provide relevant background whether you're going into academia or industry
- › Terms like “scientists” and “researchers” refer to everyone in this room!

It's all science!



Engage in Science Outside Uni

Participate in an experiment!

Experiment participation was required in the past

- › Gain an insider's perspective into science
- › Experience different approaches to research
- › Understand what your research participants will be going through



BREAK



Think about: What is Cognitive Science?





Interdisciplinary science





The Science of Cognition

WHAT IS COGNITIVE SCIENCE?



The Science of Cognition

WHAT IS COGNITIVE SCIENCE?

- › The science of how the mind is organized to produce intelligent thought and how it is realized in the brain

Interdisciplinary

The Science of Cognition

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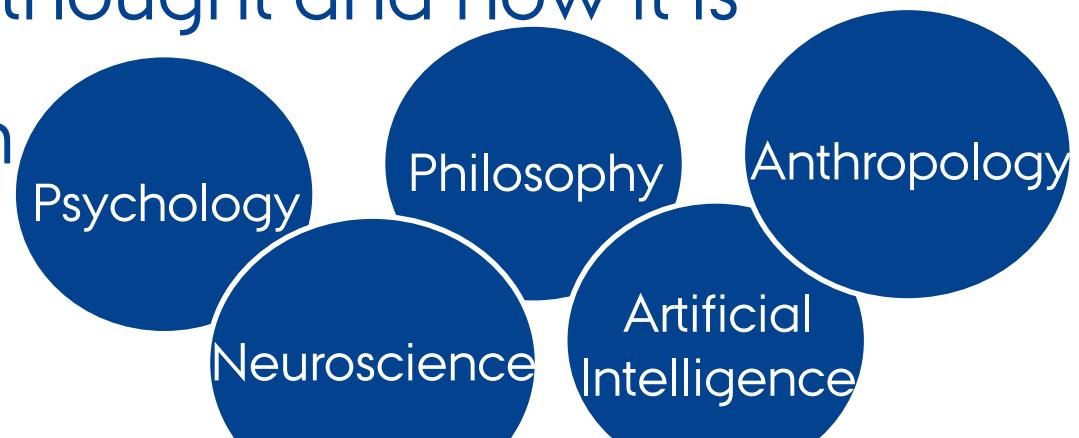


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Interdisciplinary

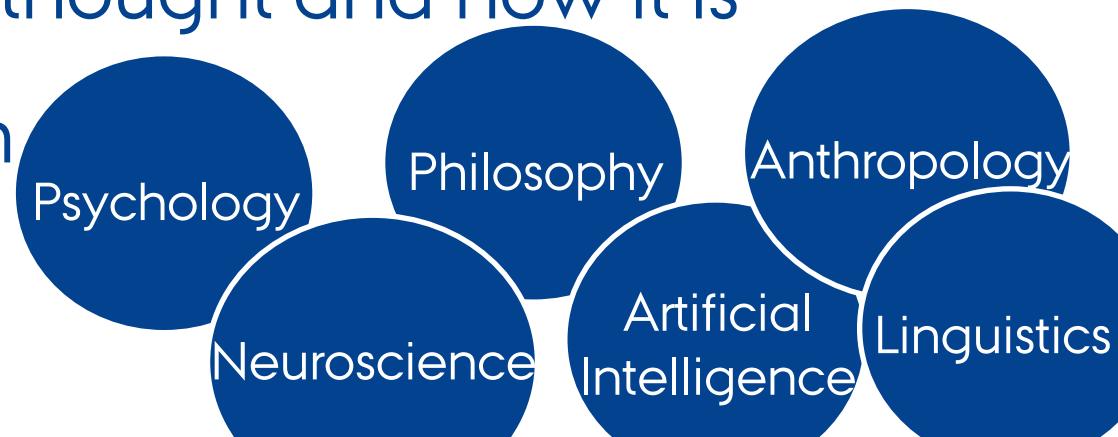


The Science of Cognition

WHAT IS COGNITIVE SCIENCE?

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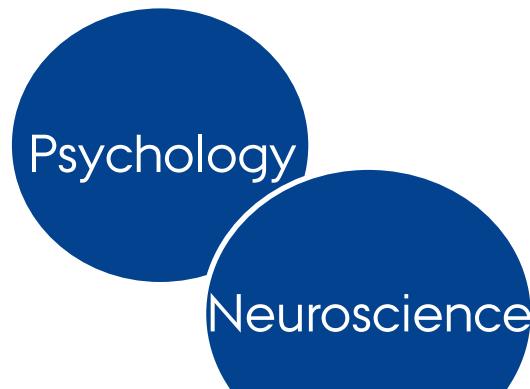
Interdisciplinary



The Science of Cognition



Identifies the
questions to ask



The Science of Cognition

Philosophy

Identifies the
questions to ask

Anthropology

Describes the progression
of societies and cultures

Psychology

Neuroscience

Artificial
Intelligence

Linguistics

The Science of Cognition

Philosophy

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Examine mental processes and behaviors

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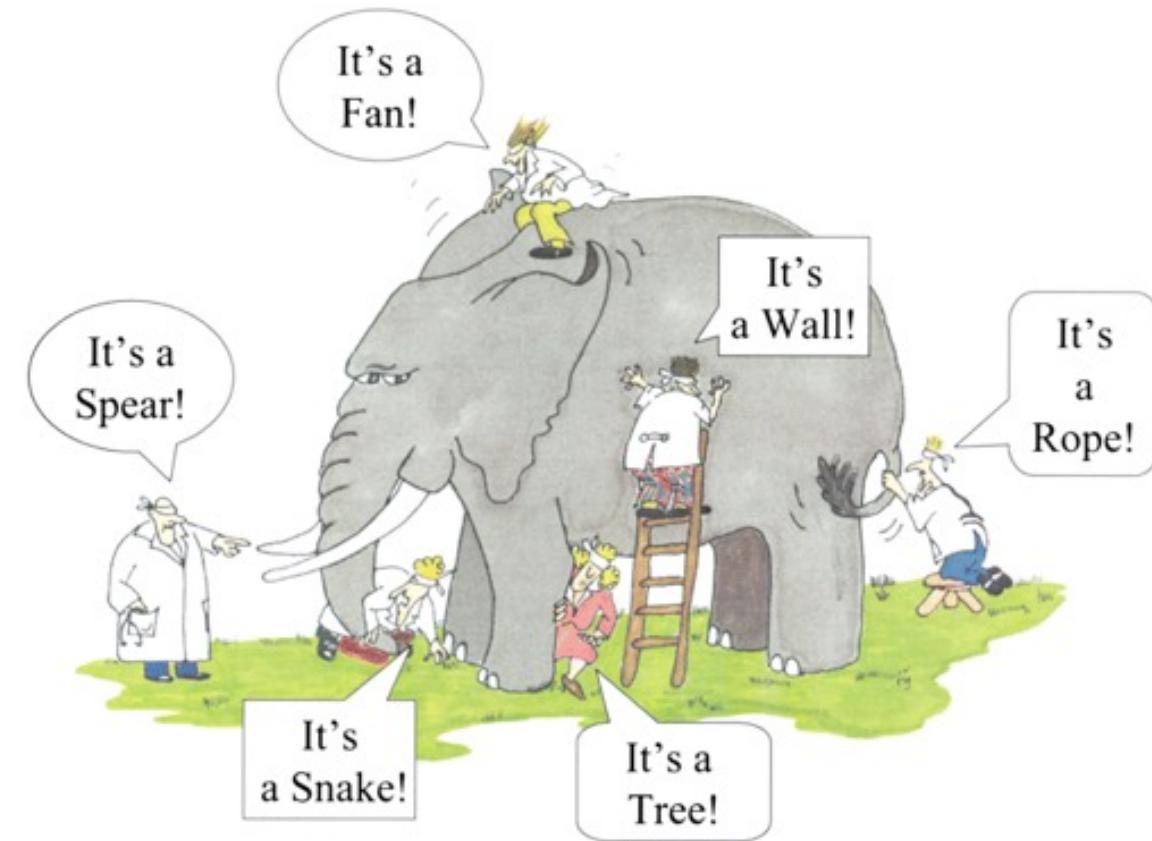
Studies biological mechanisms of the physical brain

Linguistics

Artificial Intelligence

Uses computational modelling to understand and replicate mental processes

The blind scientists and the elephant

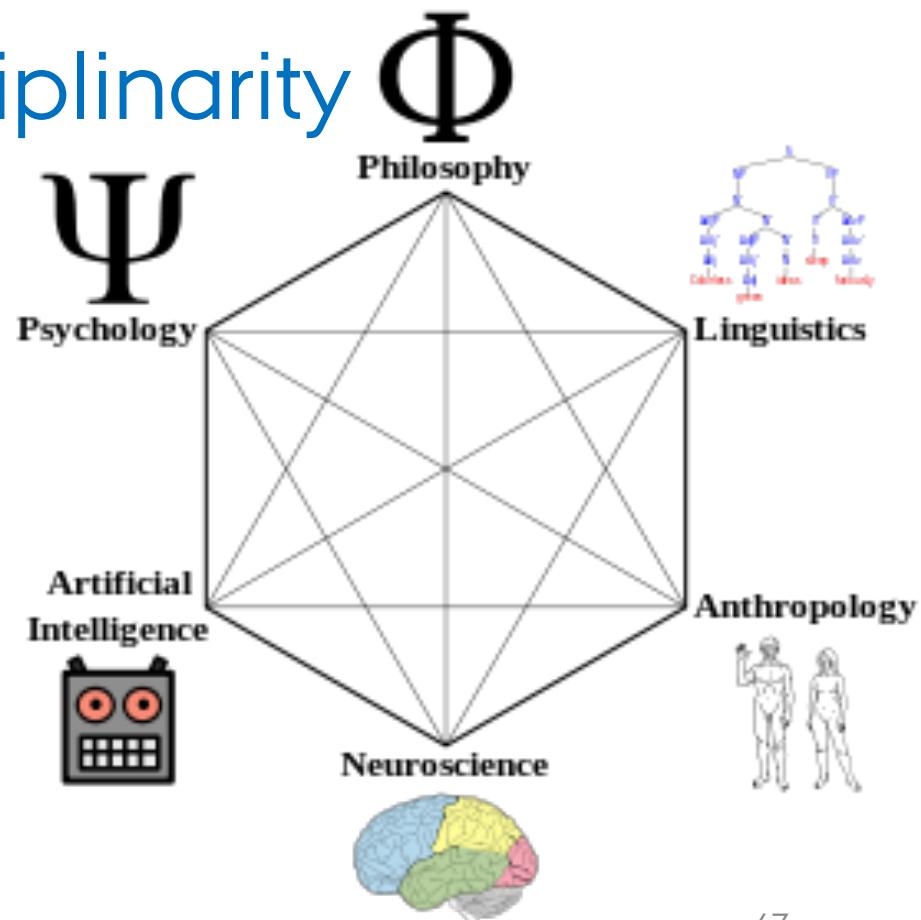


Specialized scientists may see the mind according to their methods

For example, is depression an unbalance in the serotonin system or an unbalance in society?

The solution: Interdisciplinarity

- › “Cognitive science” as an umbrella term
- › *Cognitive Psychology* provides an appropriate basis for an introduction
 - › Fairly broad integration

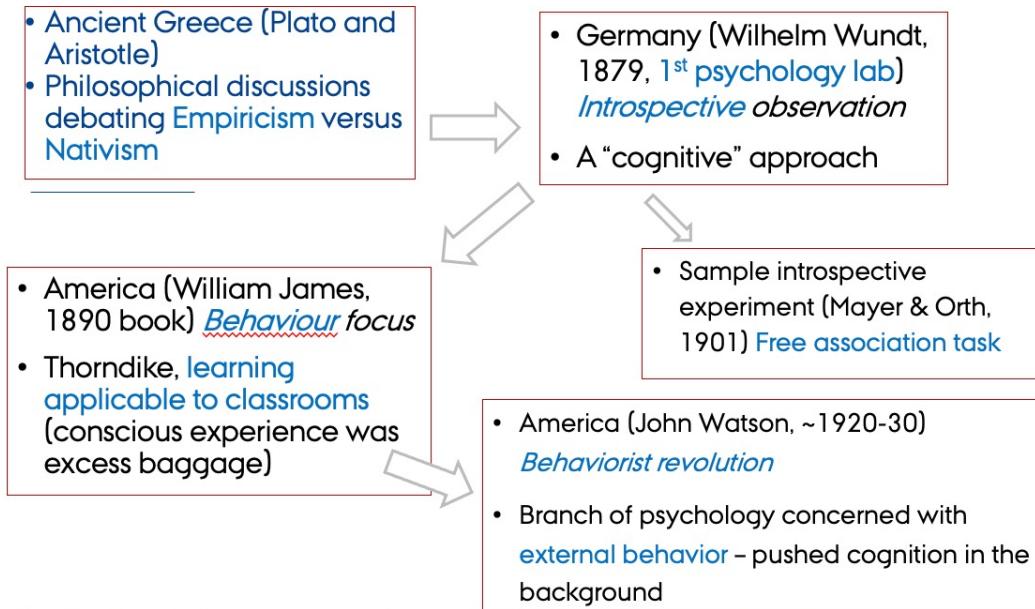


The solution: Interdisciplinarity

- › “Cognitive Science” first time used in 1973 in a report on artificial intelligence by Christopher Longuet-Higgins
- › The Cognitive Science Society founded in 1979



Historically, Cognitive Science began with a shift in Psychology



A brief history of cognitive psychology

- Ancient Greece (Plato and Aristotle)
- Philosophical discussions debating Empiricism versus Nativism



- Germany (Wilhelm Wundt, 1879, 1st psychology lab)
Introspective observation
- A “cognitive” approach



- America (William James, 1890 book) *Behaviour focus*
- Thorndike, learning applicable to classrooms (conscious experience was excess baggage)



- Sample introspective experiment (Mayer & Orth, 1901) *Free association task*

- America (John Watson, ~1920-30)
Behaviorist revolution
- Branch of psychology concerned with *external behavior* – pushed cognition in the background

A brief history of cognitive psychology

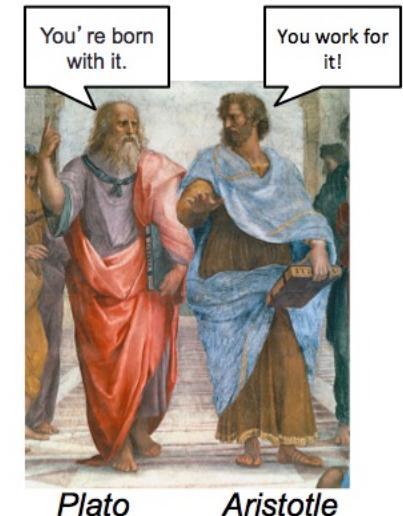
Ancient Greece

Nativism vs. Empiricism

Similar to the nature / nurture debate

- > Nativism = some knowledge is innate
- > Empiricism = all knowledge is derived from experience

Human behavior is influenced by both



Early 1900s

Introspective observation

Observing one's own inner mental states and processes

- › Interesting but not always useful
- › Not sufficiently systematic
- › Still used sometimes (e.g., biofeedback, user experience surveys)

Suggested reading if you want to learn more:

<https://plato.stanford.edu/entries/introspection/>

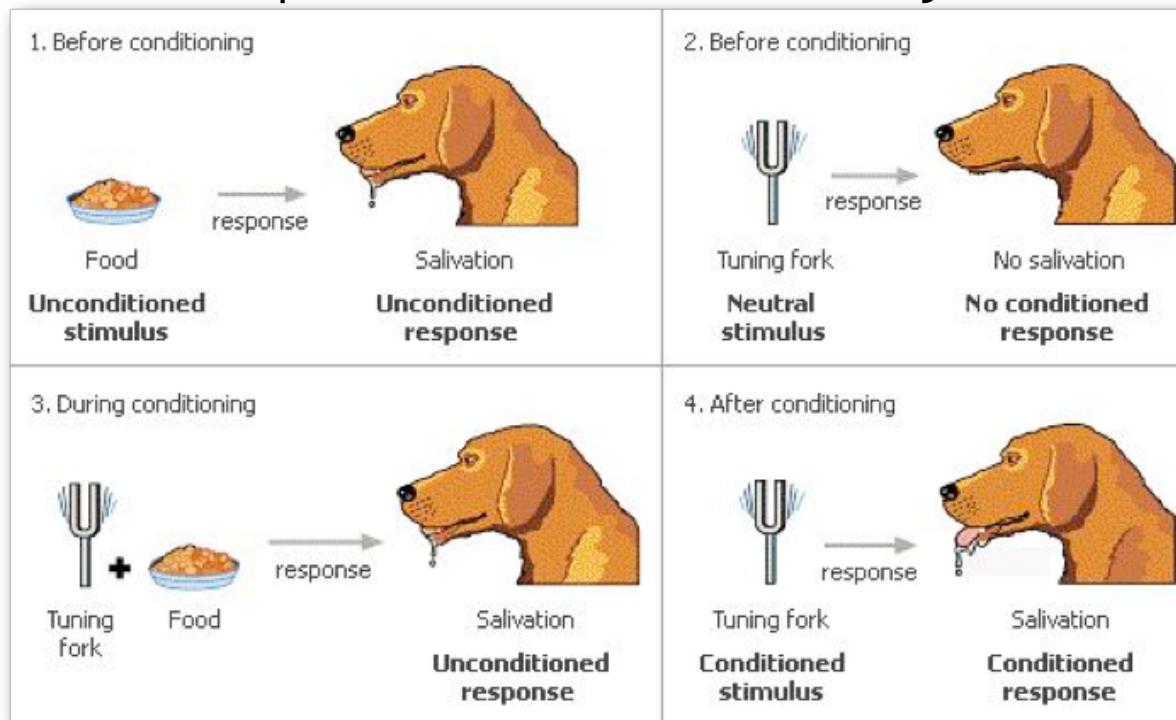
Early to mid 1900s



Behaviorism

- Conscious thinking is unknowable, i.e. the mind is a **black box**
- All psychological processes are learned **associations**
 - e.g “scheduled reinforcement”
- Dominant until the 50s

For example, classical conditioning:



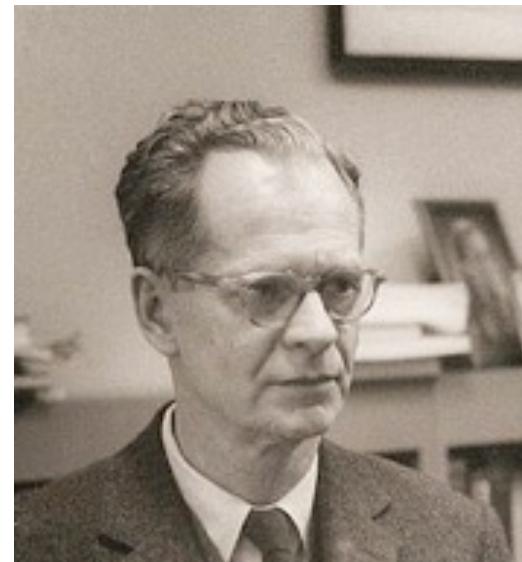
Still a valid *method* but not
the dominant *paradigm**

*paradigm = scientific model – a perspective/way of thinking

Behaviorist thinking

An illustrative quote:

"The present argument is this: mental life and the world in which it is lived are inventions. They have been invented on the analogy of external behavior occurring under external contingencies. Thinking is behavior. The mistake is in allocating the behavior to the mind."



B. F. Skinner

3 main influences that led to the cognitive revolution



Computer science: Artificial Intelligence (AI) development

Linguistics:
Chomsky and
the structure of
language

Research on human
performance (WW II)
and the inadequacy
of behaviorism

The dominant *paradigm**

*paradigm = current model for cognitive science – the main perspective/way of thinking

Information-processing approach

Opening up the box: Cognition is information processing

- › Pervasive approach in cognitive science today

Brain processes information

- › Many different types of methods can be used to access this information
- › Shift from psychology to interdisciplinary science

Classic experimental design for Information-processing approach

For example

First Cognitive Psychologists

- Donders (1868) reaction time experiment
first **well-documented** cognitive experiment
 - Simple RT and Choice RT
 - Inference: decision took 0.1 second



(a) Press J when light goes on.



(b) Press J for left light, K for right.

©2011 Cengage Learning

Many other experimental designs are used

- › Behavioral
- › Observational
- › Subjective
- › Brain imaging
- › Others...

Usually **2 or more approaches** are combined for better data interpretation



Using models in science



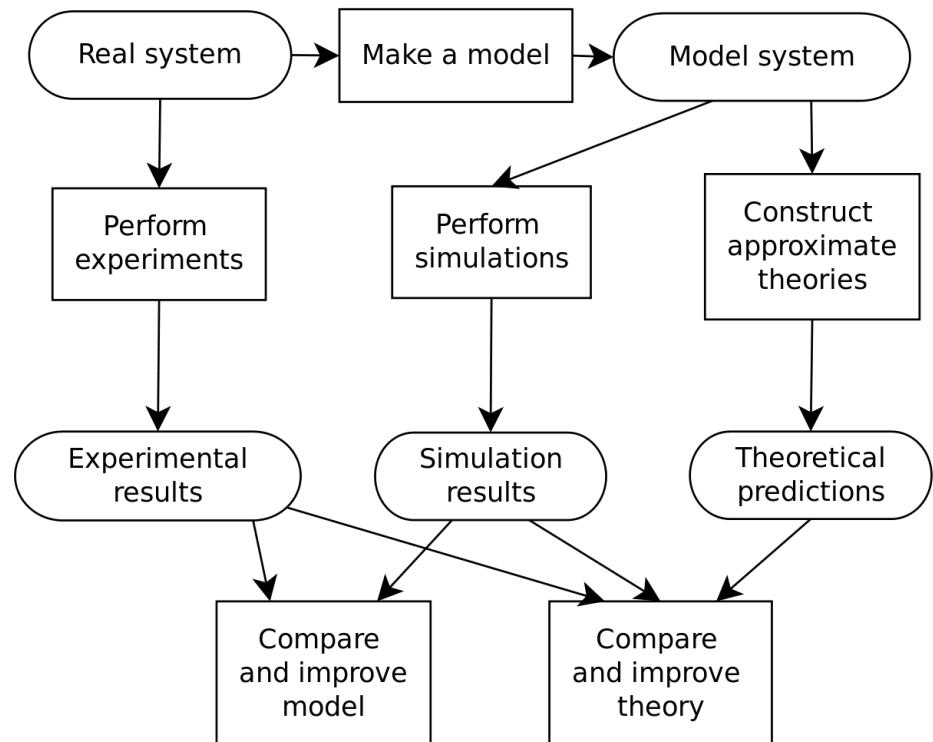
Why do we use models?

To represent complex structures and processes

- › Structural models
 - › Physical
- › Process models
 - › Connections between events

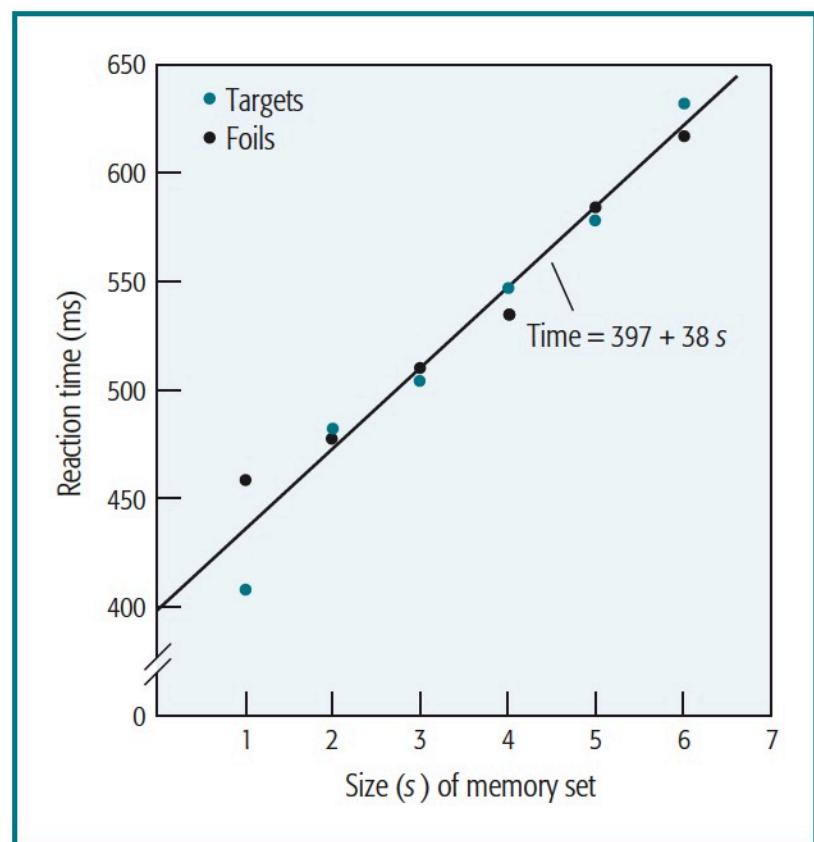
Forms of scientific models

- › Visual images
 - › Figures and flow charts
- › Mathematics / statistics
 - › Commonly represented by p-values
- › Computer models
 - › Start with what is known
 - › Enter variables to estimate outcomes

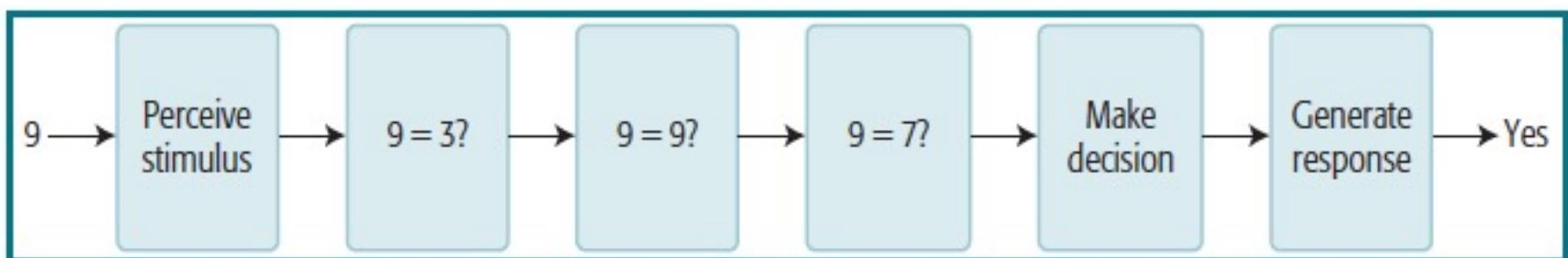


Steinberg Memory Search

- › Classic example of a an information processing account
- › The time needed to recognize a digit increases with the number of items in the memory set.
- › The straight line represents the linear function that fits the data best.



Steinberg's analysis of the sequence of information-processing stages:



4 key features in this account:

- › No reference to the brain
- › Highly symbolic, not explicit about representation/comparing #s
- › Comparable to how computers process information
- › Time as critical variable, processing in stages

However, these also reflect a **narrowness** in classic approaches.

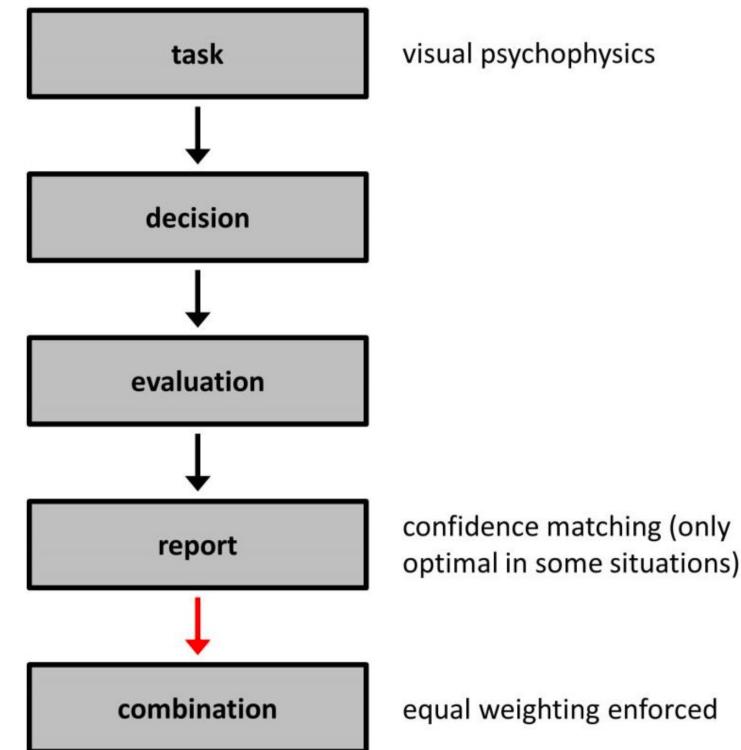
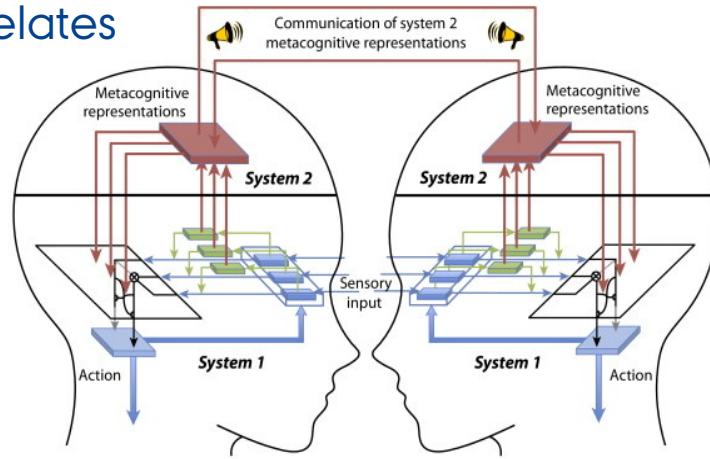
Recently, more attention to **complex** phenomena and the nature of info processing in the brain

Information processing approach

Not always to be taken literally

- › A schematic model (i.e., a way to divide a problem, you are trying to describe, into sub-components)

Useful for the formal modelling of the process – and for predictions regarding neural correlates





The Donders Subtraction Method



Why use subtraction?

- › Donders subtraction method
- › Assumes that, if we subtract common behaviors or events, then what's left is caused by the experimental condition

- › Can you think of an example?



The weirdest people in the world?



Most people are not WEIRD

White Educated Industrialized Rich Democratic

- › Behaviors and brains are not all the same
 - › Diseases/disorders
 - › Accidents
 - › Human variability
 - › Etc.
- › Arose because psychologists were testing their students
- › Solutions
 - › Reproduce data through a non-student cohort



Thanks for listening!

