THE UNIVERSITY of EDINBURGH

Postgraduate Virtual
Open Days

Cognitive Science MSc

Dr. Maithilee Kunda
Cognitive Science MSc Programme Director

EDINBURGH
Extraordinary futures await

This year's CogSci MSc staff

- **Maithilee Kunda**
  Reader in Computational Cognitive Science
  CogSci MSc Program Director
- **Benjamin Peters**
  Lecturer in Computational Cognitive Science
  CogSci MSc Cohort Lead
- **Chloe Downing**
  CogSci MSc Student Adviser

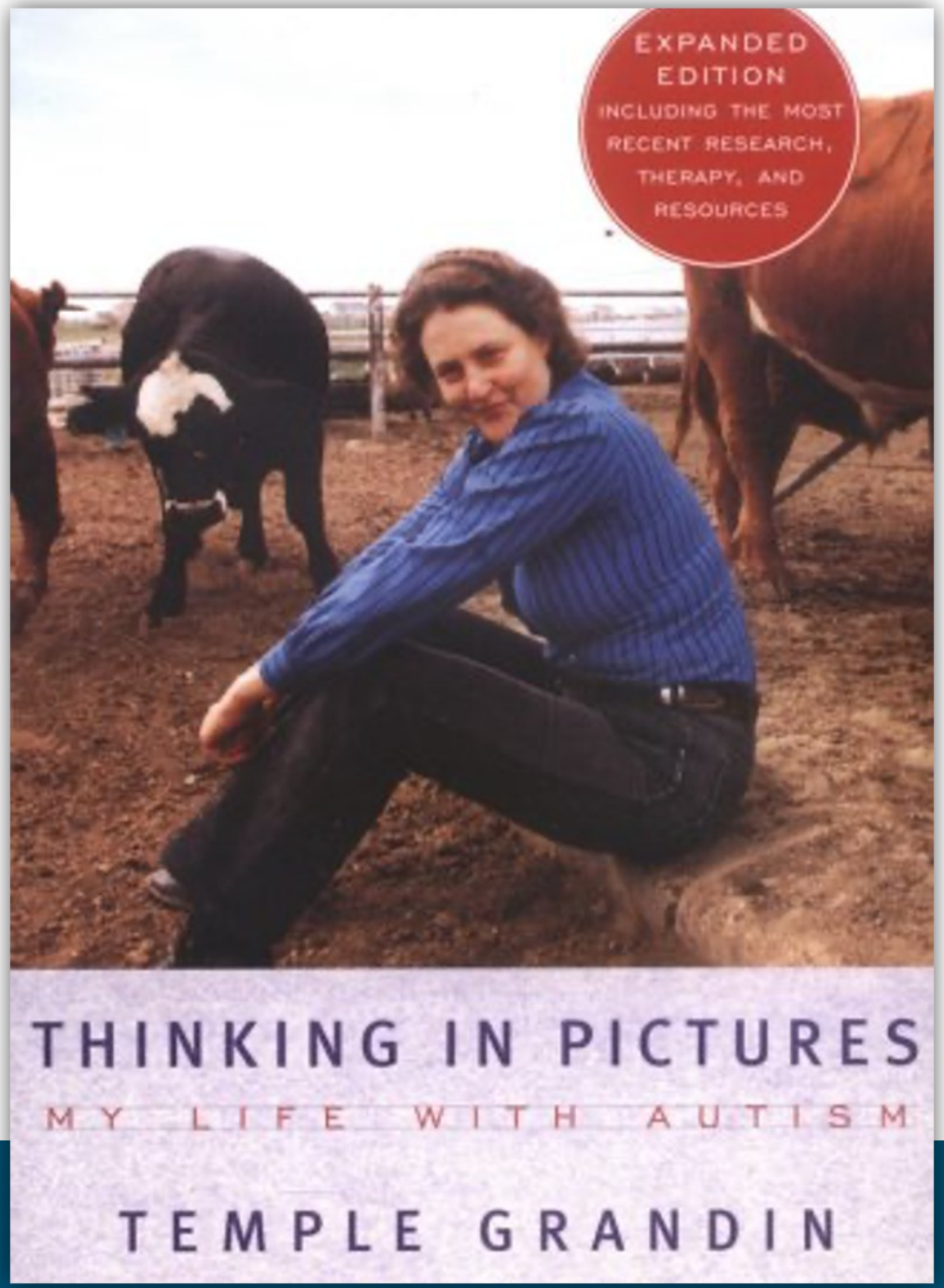
Maithilee Kunda

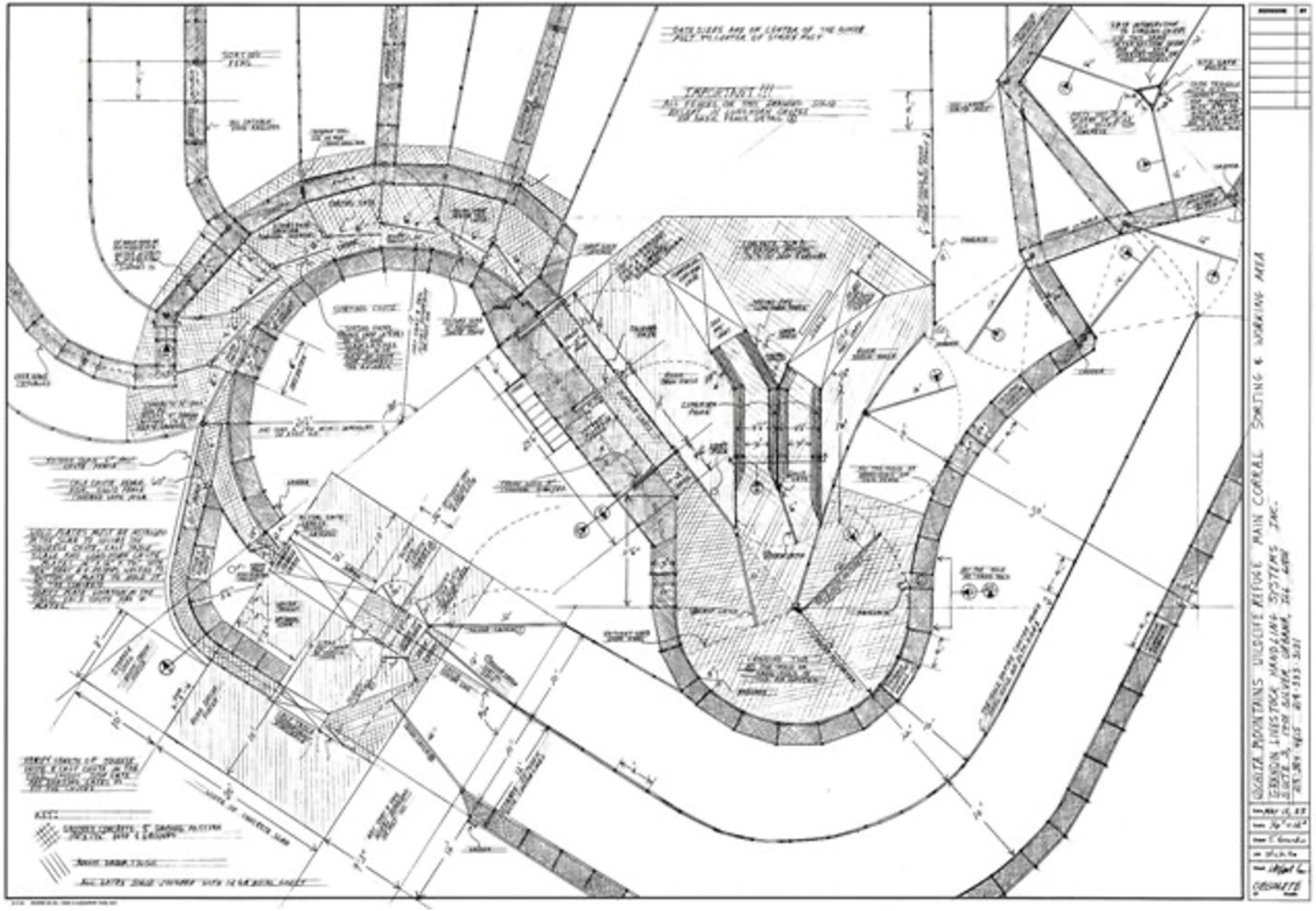
- New here myself! Moved to Edinburgh in 2024.
- Previously, spent 8 years on the computer science faculty at Vanderbilt University in the USA.

- I am the CogSci MSc programme director, which means I'm involved with overall programme requirements, organization, courses, etc.
- And fun events like this one to meet you all!
- I've been co-teaching Seminar in Cognitive Modelling (a required course for the CogSci MSc).

My origin story

- In college, one of my AI professors said, "Using AI, we can unlock the mysteries of the human mind!
- In grad school, I read a book for a class:
- Been doing this type of research now for almost 20 years!



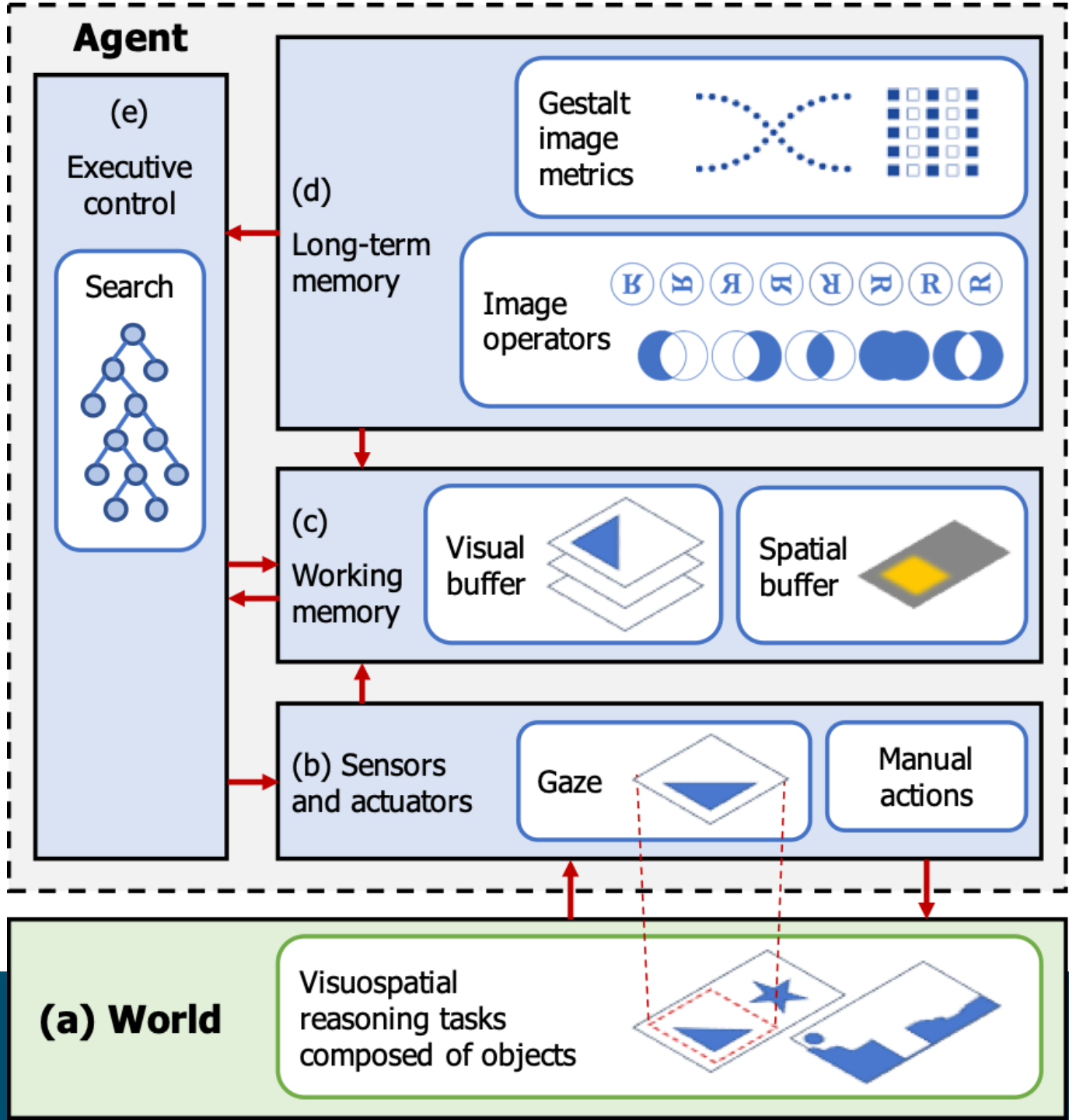


http://www.grandin.com

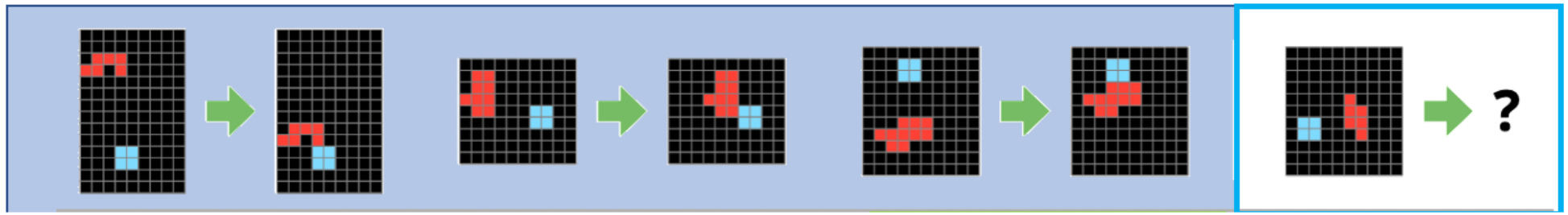
AI systems that "think" in pictures

- NOT LLMs like ChatGPT
- Not even machine learning systems!

- (If it surprises you to hear that there can be AI systems that DO NOT learn from data... this is in fact a core part of AI!)



Sample tasks from Chollet's Abstraction & Reasoning Corpus (ARC)



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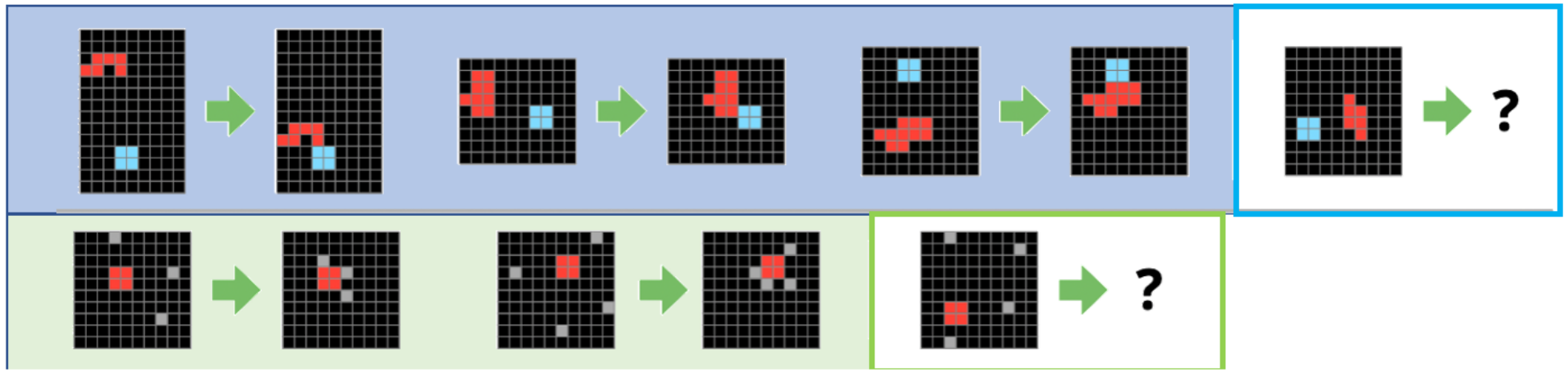

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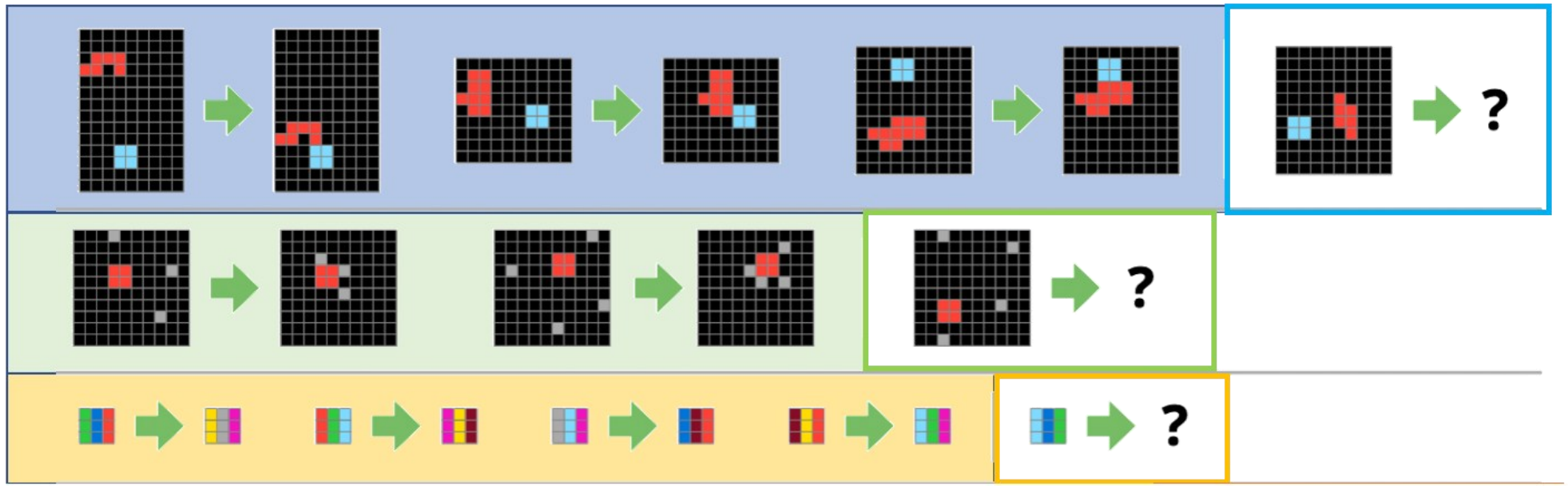

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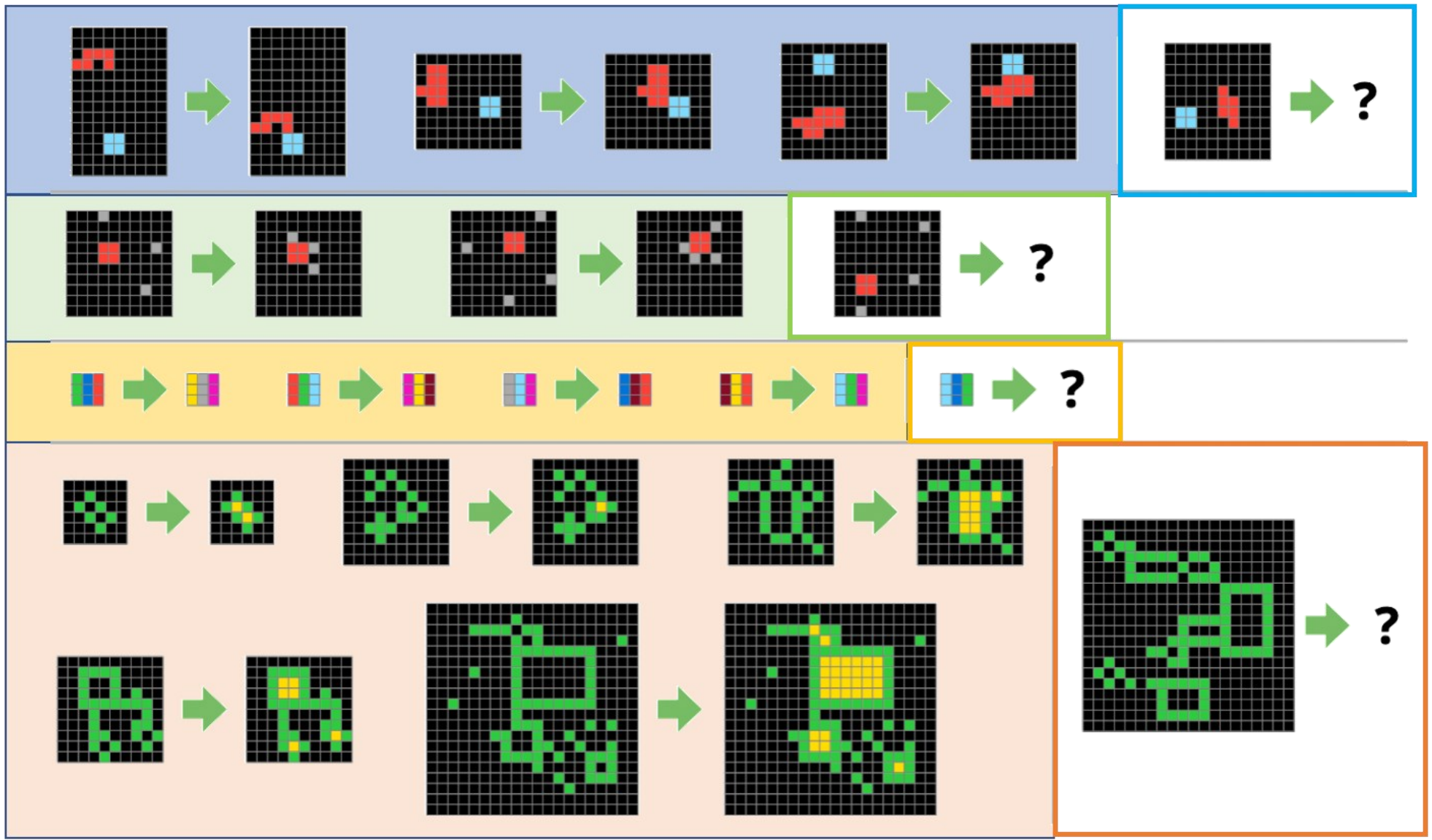
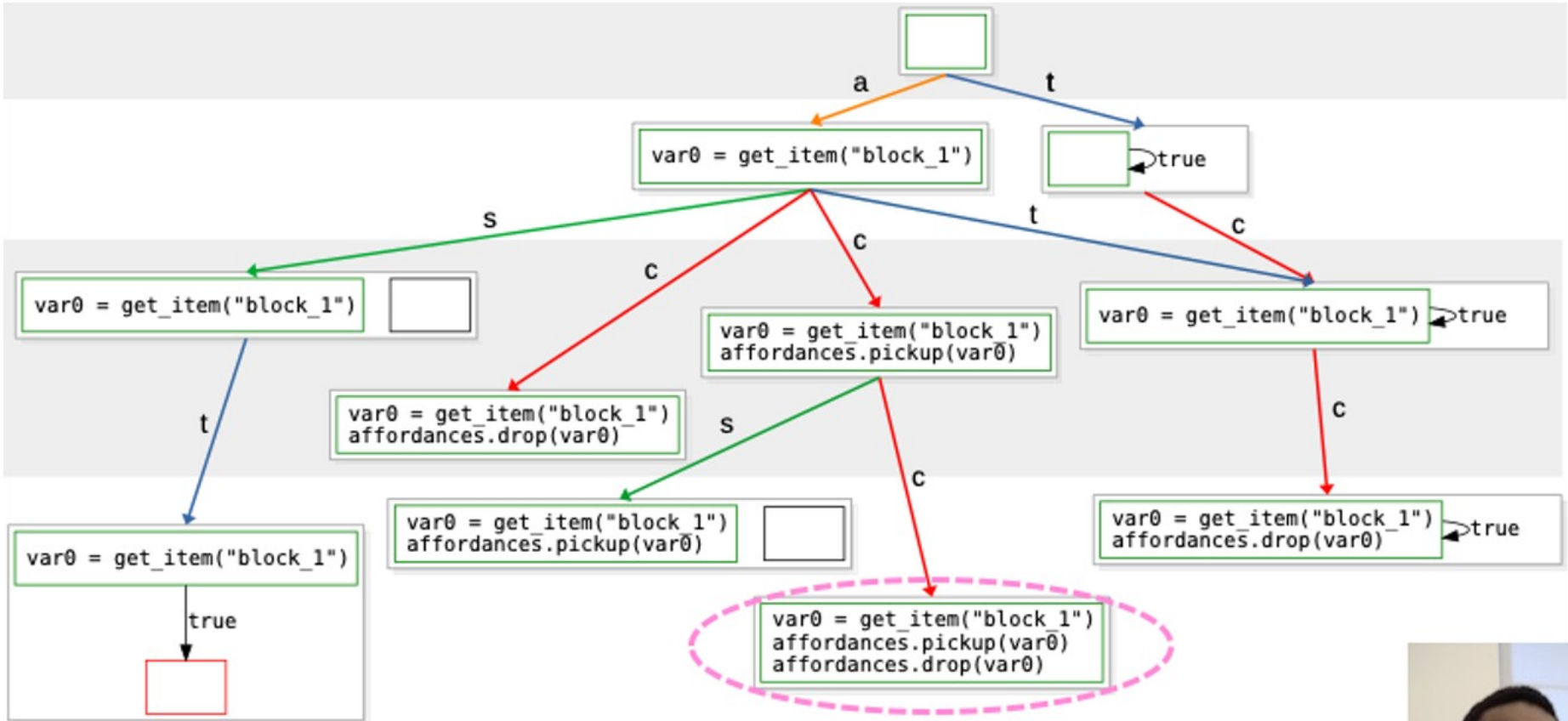
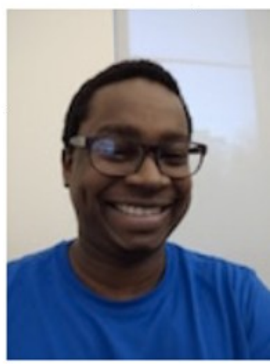


Program synthesis w/ Visual Imagery Reasoning Language + Tree search



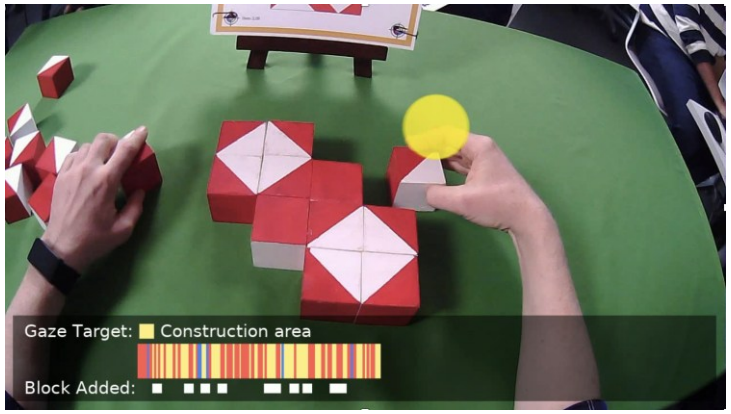
James Ainooson et al. (arXiv, 2023) A Neurodiversity-Inspired Solver for the Abstraction & Reasoning Corpus (ARC) Using Visual Imagery and Program Synthesis

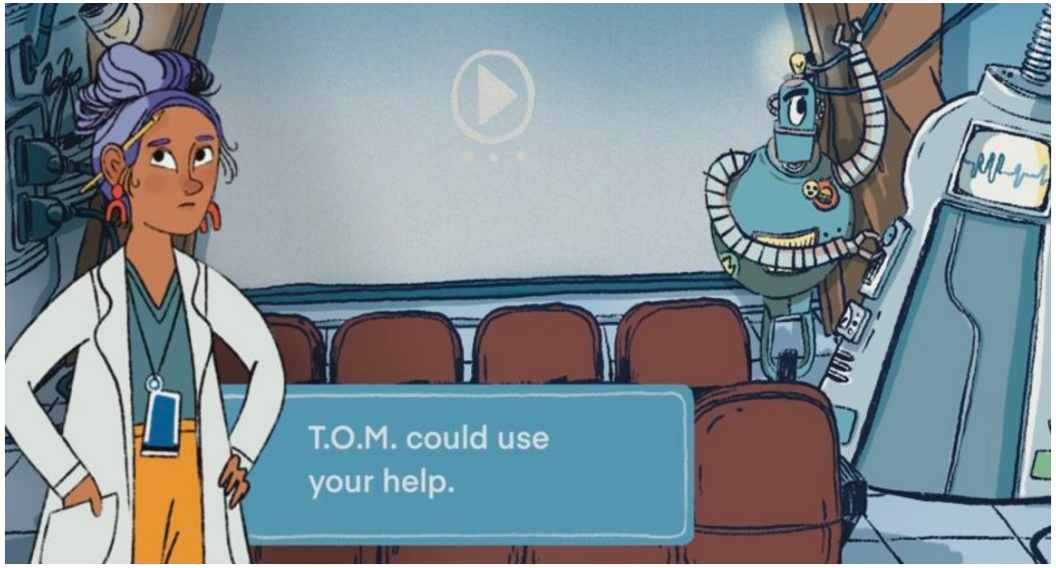


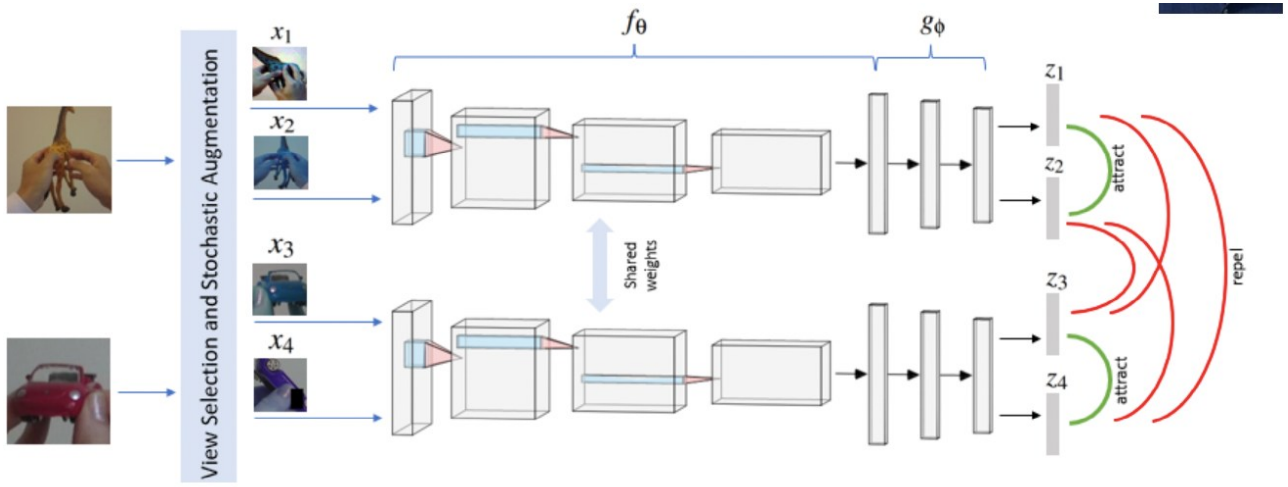
Domain knowledge

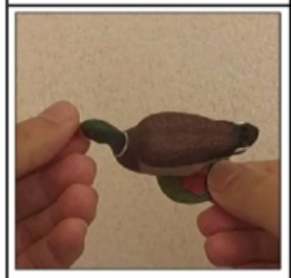
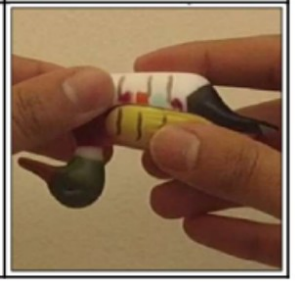
add (N, O)	attract (G, O)	change_color (O)	color_sorted (N, O)
complete_pattern (T)	connect_grid_cells (G)	connect_pixels (G)	copy (O)
create (T)	difference (N)	draw (T)	find_central_object (O)
find_enclosed_patches (O)	find_objects (O)	find_objects_in_context (O)	find_odd_object (O)
first_image (O)	first_object (O)	flip_horz (O, T)	flip_vert (O, T)
get_color (T)	get_grid (T)	get_grid_cells (T)	grid_as_image (T)
grid_cells_as_image (T)	grid_get_color	invert (O)	last_image
last_object	map (N)	map_image (N)	recolor_image
recolor_objects (O)	repeat (G, O)	reset_background (T)	rotate_180 (O, T)
rotate_270 (O, T)	rotate_90 (O, T)	scale_2x (O, T)	scale_3x (O, T)
scale_4x (O, T)	scale_5x (O, T)	scale_half (O, T)	scale_quart (O, T)
scale_third (O, T)	segment_objects (O)	self_scale (O, T)	sort_by_color (N, O)
sort_by_color_frequency (N, O)	sort_by_holes (N, O)	sort_by_size (N, O)	trim (O, T)

Legend (N) Numbers and counting (O) Objectness (G) Goal Directedness (T) Geometry and Topology







Anchor Image	Positive pair in different settings			
	Self	Transform	Object	Class
				

Very recently I've been getting into.....

PLANT COGNITION!!!

Wut.

(I know!!)

Welcome live and direct from Edinburgh!

- Audio Check
- Recording of the session

- **Introductions**

- What is cognitive science?
- Overview of the Cognitive Science MSc programme
- Questions & Answers – please save questions for the end!

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What is cognitive science?

- Casually... understanding how minds work!
- More formally, for the last 75 years or so...
- "The central hypothesis of cognitive science is that thinking can best be understood in terms of representational structures in the mind and computational procedures that operate on those structures.
- While there is much disagreement about the nature of the representations and computations that constitute thinking, the central hypothesis is general enough to encompass the current range of thinking in cognitive science."
- Paul Thagard, Stanford Encyclopedia of Philosophy: https://plato.stanford.edu/entries/cognitive-science/

Haven't we figured it all out by now? Am I too late???

- No, we have not... and no, you are not!
- There is SO MUCH THAT WE DON'T KNOW.

- One example: Emotions!
  - Only taken "seriously" across cognitive science in the past... 20 years or so (this is my guesstimate, don't quote me)
  - And even so, not taken thaaaaaat seriously (yet)

How do we study minds?

- Logo of the Cognitive Science Society
- 7 different disciplines
- Cognitive science is fundamentally an interdisciplinary science

- I personally think we need cognitive science more than ever, with how quickly technology and society is changing us & how we think, learn, communicate, etc.

Fast examples….

- Psychology

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CogSci @ University of Edinburgh

- We are so excited that you are interested in our CogSci programme!

- Cognitive Science at the University of Edinburgh is vibrant, interdisciplinary, and active
  - MANY staff across several schools and departments
  - Studying all kinds of interesting topics
  - You will get a chance to take classes across different areas
  - AND also do a dissertation project on something that interests you.
- Plus, a ton of seminars, panels, workshops, student events, etc.....

- Edinburgh is also a gorgeous and fun city. I have LOVED being here.
  - Activities inside & outside university. Beautiful walks. Great food. Etc.

Informatics	PPLS (Philosophy, Psychology, & Language Sciences)	Social & Political Science (with Anthropology)	Education	Edinburgh Futures Institute
• Natural language • Visual perception • Human-computer interaction • Machine reasoning • Insect cognition (for robotics!) • Neuroscience and neural computation • Social networks	• Causal reasoning • Infant neuroscience • Scientific reasoning • Philosophy of ethics • Philosophy of mind • Bilingualism • Memory, aging, and Alzheimer's • Language evolution	• Epidemiological reasoning • Neuro-politics • Social cognition • Cognition and culture of artifacts • History of AI • Inequalities in education • Sports data science	• Child and adolescent psychology • Inclusive education • Responsible AI in schools • Digital literacy • Performance psychology • AI for public good	• AI ethics • Data civics • Digital education • Creativity in humans and machines • Digital cultural heritage • Game worlds • Biomedicine and society

<u>This list is neither organized nor exhaustive!</u>

- It is just a random sampling of various cognitive-flavored research here.
- You can find research areas + people on each school/department's website.
- This MSc programme lives within Informatics, with a more computational focus.

Graduate attributes for the CogSci MSc

- Build and evaluate computational models of cognition
- Work confidently and collaboratively across disciplines
- Demonstrate proficiency in behavioural/computational research skills
- Communicate (oral and written) effectively to diverse stakeholders
- Demonstrate deep understanding of at least one specialist area of cognition

Cognitive Science MSc (180 credits)

Mandatory Courses (110 credits)

Regular Courses (30 credits)

Seminar in Cognitive Modelling (S1+S2, 20 credits)

Computational Cognitive Science (S1, 10 credits)

Your dissertation (80 credits)

Informatics Project Proposal (S2, 20 credits)

MSc Dissertation (Summer, 60 credits)

Electives (50 credits)

Cognitive Science Courses (at least 20 credits)

Computational Neuroscience (S1, 10 credits)
Computational Cognitive Neuroscience (S2, 10 credits)

Automatic Speech Recognition (S2, 10 credits)
Advanced Topics in NLP (S2, 20 credits)
Accelerated Natural Language Processing (S1, 20 credits)
Speech Processing (S1, 20 credits)
Speech Synthesis (S2, 10 credits)

Human-Computer Interaction (S1, 10 credits)
Case Studies in Design Informatics (S1, 20 credits)
The Human Factor: Working with Users (S2, 10 credits)

Electives (up to 50 credits, with different amounts of credits in different "buckets")

More **core CogSci** courses from the above list, and/or other courses from **Informatics** (AI, systems, etc.), **PPLS** (Philosophy, Psychology, & Language Sciences), and **Maths**

Programming Courses

- Programming Skills
- Computer Programming for Speech and Language

PPLS Electives

- Cognitive Linguistics
- First Language Acquisition
- Origins and Evolution of Language CogLab 1 and 2
- Brain Imaging in Cog. Neuroscience
- Clinical Neuropsychology
- Neuroscience of Language
- Psychology of Language 1 and 2

Other Informatics Courses

- Applied Machine learning
- Case Studies in AI Ethics
- Computer Graphics: Geometry and Simulation Computer Graphics: Rendering
- Computer Vision
- Reinforcement Learning
- ML and Pattern Recognition
- Machine Learning Practical
- Machine Learning Theory
- Methods for Causal Inference
- Text Technologies for Data Science

Plus many many other courses!

These are just a sampling; check programme info online for exact listings.

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Q&A

please type your questions into the chat!

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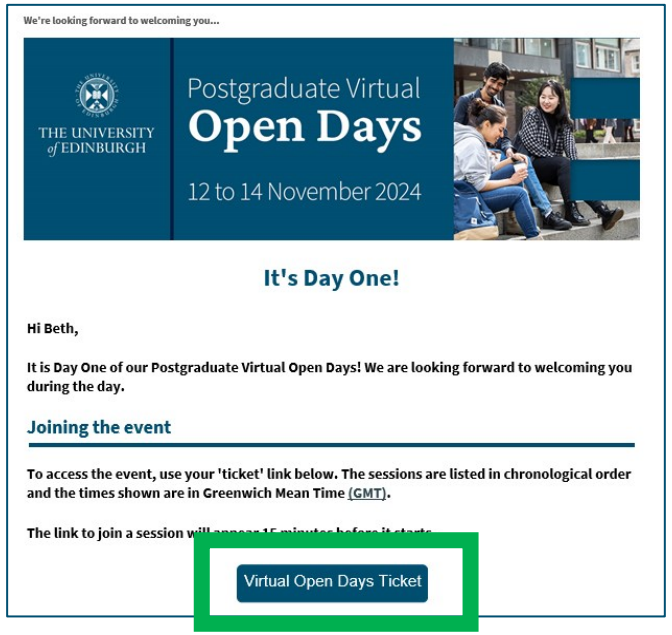
Did you get the info you were looking for?

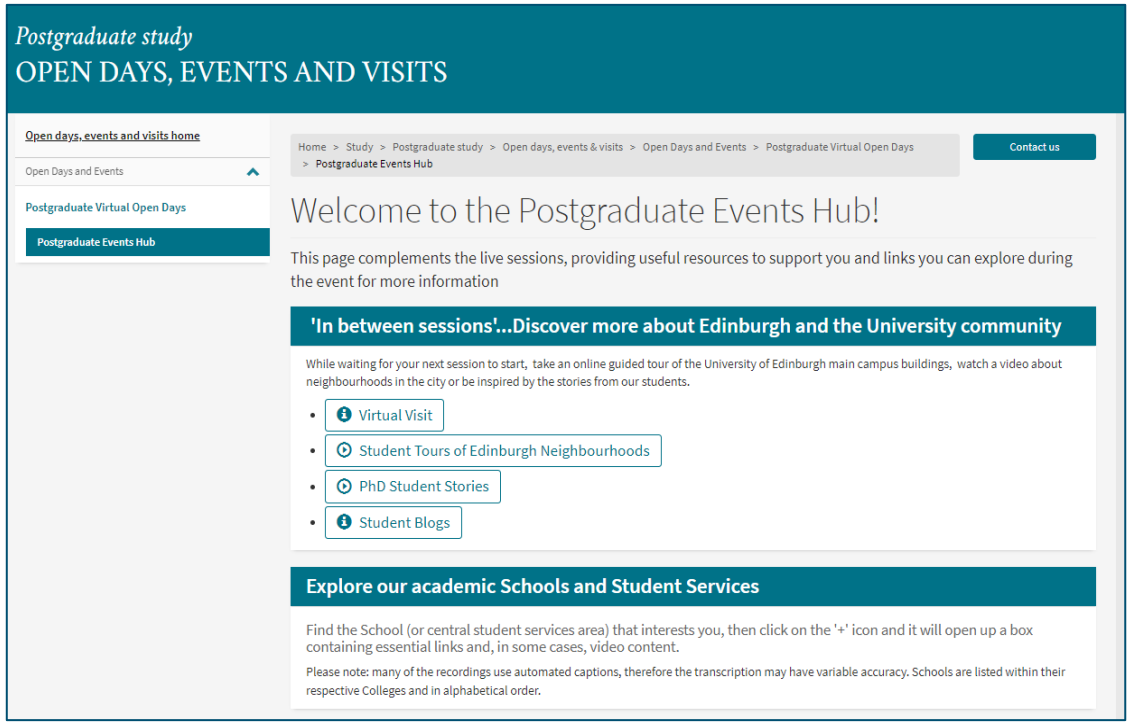
- Programme-specific info: https://postgraduate.degrees.ed.ac.uk/
- Chat to our Students: https://edin.ac/student-chat-pg
- Any other questions (including, Fees & Admissions) email: futurestudents@ed.ac.uk
- Read our students' blogs at https://blogs.ed.ac.uk/studentstories/

Thank you – click ‘Leave’ when the session ends

- Return to your ‘e-ticket’ to find and attend other sessions you’ve booked – by clicking on the button in the email we sent you…



- …and visit the events hub: https://edin.ac/4gZuP3G



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Thank you!
Have a great rest of your day!!!

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