AMC Paradigm

A new paradigm for computing sciences that is not AI or robotics or sci-fi but very much to do with true AMC.

1.1 Creativity, Intelligence and Ethics

A more theoretical aspect of this analysis is concerned with what was already discussed to an extent in chapter **??** (specifically sections **??**, **??**, **??** and **??**), namely the parallel between artificial creativity and **AI!**.

Computer creativity falls into the same overarching category as computer intelligence (**AI!** (**AI!**)) and computer ethics.

1.1.1 Artificial Creativity

Cohen argument against artif. creat? AARON

1.1.2 Artificial Intelligence

Searle against strong ai (watson example...), does that apply to strong artificial creaticiity? Chinese Room, Turing Test

1.1.3 Artificial Ethics

Bernd Stahl and responsible computing..

ethics in machines: protocols, networking? is in unethical for a computer to crawl my server without asking? only because it causes traffic which causes delays which impact on me the human.

ethics in humans because we are social beings and need to coexist

1.2 Brain vs Machine

brain argument against artificial anything?

John Searle talk at Google (**Searle2015**)

epistemic (knowledge) ontological (existence)

epistemically objectivity (Picasso DOB) epistemically subjectvity (Picassos value)

ontologically objectivity (material world) - observer-independent ontologically subjectivity (money, itch, consciousness) - observer-relative

we can study consciousness (ontological subject) in an epistemically objective way.

Syntax is not semantics. Simulation is not duplication.

Natural intelligence is observer-independent, intrinsic, conscious!

Computer intelligence is observer-relative, not intrinsic

'Computer' as in its original meaning: a person who computes, ie the programmer rather than the machine

"All observer relative phenomena are created by human and animal consciousness but the human or animal consciousness that creates them is not itself observer relative."(**Searle2015**)

"Computation is not a fact of nature. It's a fact of our interpretation."(**Searle2015**)

"And insofar as we can create artificial machines that carry out computations, the computation by itself is never going to be sufficient for thinking or any other cognitive process because the computation is defined purely formally or syntactically. Turing machines are not to be found in nature, they are found in our interpretations of nature."(**Searle2015**)

"Programs are formal or syntactical. Minds have a semantics. The syntax by itself is not sufficient for the semantics."(**Searle2015**)

Human are more likely to call something AI than they would call something comp creat. people project human values onto machines, and human desires

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too. so the big bad robot uprising is a fear of what humans would do if they feel superior.

> Well, if computation isn't sufficient for thinking, then what is? What is the relation between the mind and the brain, if it is not the same as the relation of the computer program to the hardware? At least the computational theory of the mind has a solution to the mind-body problem. The mind is to the brain as the computer program is to the computer hardware. If you are rejecting that solution, you owe us an alternative solution. (**Searle1998**)

> All of our mental states, everything from feeling pains to reflecting on philosophical problems, is caused by lower level neuronal firings in the brain. Variable rates of neuron firing at synapses, as far as we know anything about it, provide the causal explanation for all of our mental life. And the mental processes that are caused by neurobiological processes are themselves realized in the structure of the brain. They are higher level features of the brain in the same sense that the solidity of this paper or the liquidity of water is a higher level feature of the system of molecules of which the table or the water is composed.
>
> To put this in one sentence, the solution to the traditional mind-body problem is this: Mental states are caused by neurobiological processes and are themselves realized in the system composed of the neurobiological elements. (**Searle1998**)

"Cohen is the author of AARON, perhaps the longest-lived and certainly the most creative artificial intelligence program in daily use. Cohen viewed AARON as his collaborator. At times during their decadeslong relationship AARON was quite autonomous, responsible for the composition, coloring and other aspects of a work; more recently, AARON served Cohen by making drawings that Cohen would develop into paintings. Cohen's death is the end of a lengthy partnership between an artist and an artificial intelligence."**(Cohen2016)**

"Cohen had no patience for the "is it art?" question. He showed AARON's work in the world's galleries, museums and science centers – the Tate, the Stedelijk, the San Francisco Museum of Art, Documenta, the Boston Computer Museum, the Ontario Science Center, and many others. His audiences might have been drawn in by curiosity and the novelty of computer-generated art, but they would soon

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ask, how can a machine make such marvelous pictures? How does it work? The very questions that Cohen asked himself throughout his career."(**Cohen2016**)

aaron stuff

http://collections.vam.ac.uk/name/cohen-harold/6433/

> ...we'll be seeing an increasing number of artists turning to robotic art of one sort or another in the next five or ten years. We're already seeing some. It's also a pretty safe bet that for the most part they'll be using off-the-shelf robots; that the "art" will be manifested in dreaming up contexts they were never intended for; and the culture's definitions of art will change accordingly. (**Cohen2007**)

> Shouldn't it be possible, I wondered, to write the rules for generating material for a painting and then simply follow the rules? In this way, it would be almost as if the painting was painting itself; and I would be relieved of the uncertain task of inventing on a day-to-day basis.
>
> That was a little naïve, of course; it simply shifted the burden of invention to another place, another level. I'm still inventing on a day to day basis, but now it's likely to be algorithms for doing particular tasks that I'm inventing. (**Cohen2007**)

> I'd like to end with a couple of observations about AARON's algorithm. Firstly; I think it's fair to say that nothing of what has happened could have happened unless I had drawn upon a lifetime of experience as a colorist. I've evidently managed to pack all that experience into a few lines of code, yet nothing in the code looks remotely like what I would have been doing as a painter, and AARON's algorithm isn't something a human artist could apply by hand, so to speak. (**Cohen2007**)

> It's twenty years since I first realized that I could never turn AARON into a colorist by having it emulate my own expertise; in that case simply because it lacked the hardware upon which that expertise depended. Now I have AARON exercising an algorithm that couldn't be emulated by human colorists, presumably because they lack the hardware to do what AARON does. (and by hardware, in this case I mean the intellectual machinery that can build a stable enough representation and juggle enough variables, as AARON does in running the algorithm.) (**Cohen2007**)

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> None of this would be interesting if AARON were an indifferent colorist. But I think I can claim, without undue immodesty, that AARON is a world-class colorist, significantly more inventive and infinitely more productive than I ever was myself. And I conclude that, after decades of expert systems built to simulate human expertise, AARON has emerged as an expert in its own right. That marks a significant change of state, a change of level, in the never-ending pursuit of autonomy, not merely an incremental change in what the program is able to do.
>
> (**Cohen2007**)

> If I were writing AARON's biography today, I might almost say that AARON was a twinkle in its parent's eye in 1963; it was conceived in 1972 but not born until 2006. It has been a long gestation, and right now the parent is struggling to direct an unruly child, keeping it fed and changing its diapers. He has no idea when the child will be potty-trained, much less how long it will be before it reaches adulthood. (**Cohen2007**)

Where does this project stand in the wider world and the progress of computing, **AI!** and creativity? **AI!** and robotics is alluring as a research topic because it is so prevelant in Science Fiction. Computer creativity rarely plays a centrol role though. We can regularly read headlines that tell us that yet another kind of **AI!**-bot has won some game against a human player. Or we see videos of some innovative ground-breaking kind of new robot which claims to be near human-like (and yet cannot walk up stairs easily or hold a decent conversation). There are many examples of advances that are hailed as the next big thing which aren't all that great in the grand scheme of things.

1.2.1 AI

What about IBM's Watson[1], Microsofts Twitter **AI!** chatbot Tay[2], Google's AlphaGo[3] and Hanson Robotics Sophia robot[4]? How does this relate to my work?

[1] See http://www.ibm.com/watson/

[2] See https://web.archive.org/web/20160414074049/https://www.tay.ai/ for an archived version of the original website which is now offline. See also https://twitter.com/tayandyou, https://www.theguardian.com/technology/2016/mar/24/tay-microsofts-ai-chatbot-gets-a-crash-course-in-racism-from-twitter, and https://www.theguardian.com/technology/2016/mar/30/microsoft-racist-sexist-chatbot-twitte
Wikipedia also has a good article and sources on Tay: https://en.wikipedia.org/wiki/Tay_(bot)

[3] See https://deepmind.com/alpha-go

[4] See http://www.hansonrobotics.com/

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Practially of course they are all unrelated. On a deeper level though we can start asking interesting questions.

https://www.engadget.com/2016/08/07/ibms-watson-ai-saved-a-woman-from-leukemia/ https://xkcd.com/1619/ XKCD WATSON http://www.wsj.com/articles/SB100

IBM Watson

Watson is a question answering expert system. It famously won against human Jeopardy! champions in 2011.

Microsoft Tay

Google AlphaGo

AlphaGo is a system for playing the game Go. It won against a top human professional player in 2015.

Hansen Sophia

I think these are interesting examples to study since they are supposedly on the forefront of **AI!** development. Life-like robots like Sophia still live in the 'uncanny valley'. Her voice is creepy and unhuman, her intelligence or her capabilities if understanding conversations are clearly flawed (as shown by her viral remark about supporting genocide).

check

Watson is clever and fast in finding answers for specific questions but he still had problems with humour (e.g. BLAHBLA

find example

) but information lookup is arguably fairly easy and straightforward process within **IR!** (**IR!**)—sure, it requires processing power and memory storage or access but it is based on simple matching of keywords, not any fancy heuristic algorithms. Microsofts twitter chatbot went viral and users 'taught' it nasty swearwords

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quickly and Microsoft had to take the bot down. It has since apologised although any official documentation on it has disappeared

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. Google's AlphaGo has been hailed as a breakthrough in **AI!** but similar to Watson it is a very targeted and limited program.

To me it seems the real breakthrough happens when (and if) the first robots appears which isn't as big as a house, can play Go, Chess and hide-and-seek, geniunely manages to get around he uncanny valley effect, has vast knowledge in his memory for instant information lookup, can hold a normal conversation without causing a war, etc, etc—you get the picture. General **AI!** is where it's at. Humans can do all the things we do. Children aren't born with only a single function. Imagine a world where humans only have one specialism and can;t do anything else. Mary is a Chess player but can't move her arms. Bob is a medical diagnosis expert but he can't hold a conversation. Movement, speech, memory—they are all vastly complex systems. And I haven't even touched creativity yet.

whats the point im making? how does this relate to my work?

Perhpas this 'uncanny valley' exists in creativity too. If a robot who looks vaguely human but not quite well enough, or he/she/it sounds almost human but not quite—perhaps if a robot can crack a joke like a human but not quite—perhaps this could be considered uncanny valley too? The philosphical zombies I mentioend in chapter **???** live in this uncanny valley?

p and H creativity for computers?

1.3 Brains

I'm not talking about the beer or the zombie food but rather research into the human brain (or animal brains) and attempts to model it on a computer.

The motivation here is that once we understand how the brain works, perhaps we can understand how certain cognitive processes really work and this of course include creativity.

This is no easy task of course. Chris Chatham talks about ten "important Differences Between Brains and Computers"[5] which give a good overview of some of the dificulties of trying to model a brain as is. We can't just do a 1-1 copy.

1. Brains are analogue; computers are digital
2. The brain uses content-addressable memory

[5] http://scienceblogs.com/developingintelligence/2007/03/27/why-the-brain-is-not-like-a-co/

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3. The brain is a massively parallel machine computers are modular and serial
4. Processing speed is not fixed in the brain; there is no system clock
5. Short-term memory is not like RAM
6. No hardware/software distinction can be made with respect to the brain or mind
7. Synapses are far more complex than electrical logic gates
8. Unlike computers, processing and memory are performed by the same components in the brain
9. The brain is a self-organising system
10. Brains have bodies
11. The brain is much, much bigger than any (current) computer

Chris Chatham

To bring this into perspective Ray Kurzweil claims the brain is capable of 10^{16} operations per second (**Kurzweil2013**). Japan's K-computer (the worlds largest super computer as of 2016) currently has that power—10 petaflops. The "Blue Brain Project" is aiming to model $10^{1}7$ bytes of memory and 10^{18} flops by 2023 (**Kurzweil2013**).

find k-computer reference

There are currently some major research projects going on. One of them is the "Human Brain Project" (**Walker2012**).

quotes:

Our brain consumes about 30W, the same as an electric light bulb, thousands of times less than a small supercomputer. (**Walker2012**)

For environmental and business reasons, vendors have set themselves the goal of containing energy consumption to a maximum of 20 megawatts (**Walker2012**)

the 1 PFlop machine at the Jülich Supercomputing Centre could simulate up to 100 million neurons – roughly the number found in the mouse brain. (**Walker2012**)

Cellular-level simulation of the 100 billion neurons of the human brain will require compute power at the exascale (1018 flops). (**Walker2012**)

2017 petascale 50petabytes memory + 50 petaflops + <=4MW power

2021 exascale 200petabyte memory + 1exaflop

A second, equally important goal will be to prepare the procurement of the HBP Pre-exascale-supercomputer. By 2017/18, Jülich plans to procure a Big Data-centred system with at least 50 PBytes of hierarchical storage-class memory, a

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peak capability of at least 50 PFlop/s and a power consumption <= 4 MW. The memory and computational speed of the machine will be sufficient to simulate a realistic mouse brain and to develop first-draft models of the human brain. (The rest of the hardware roadmap targets an exascale machine in 2021/2022 with a capability of 1 EFlop/s and a hierarchical storage-class memory of 200 PB).[6]

Why Minds Are Not Like Computers (**Schulman2009**) Software – Hardware == Mind – Brain ??? analogy

"The power of the computer derives not from its ability to perform complex operations, but from its ability to perform many simple operations very quickly."

Layers of abstraction in computers:
1. user interface
2. high level programming language
3. machine language
4. proessor microarchitecture
5. Boolean logic gates
6. transistors

layers of abstraction in brain:
1. personality?
2. Thinking?
3. Chemical /electrical signals/activity?
4. Divided Brain regions/structure
5. Neurons
6. Dendrites (input) and axons (output)?

Computers are faster and better than humans in many tasks already.

> "The weaknesses of the computational approach include its assumption that cognition can be reduced to mathematics and the difficulty of including noncognitive factors in creativity." (**Mayer1999**)

find references

neural networks and other models based on the brain

[6] https://www.humanbrainproject.eu/high-performance-computing-platform

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Perhaps we need to have that complete picture of how the brainw orks in order to understand human creativity. I would argue computer creativity is part of general **AI!**, and for general **AI!** we need massive amounts of general knoweldge.

common sense research

again talk about how this is relevant for my project

Expert Systems vs General AI Is computer creativity an expert system or does it fall into general **AI!**?

Machines self-assessing Perhaps there is an argument that if humans are the only entities who can judge whether another human is being creative, then machines should be assessing themselves. This is a paradoxical concepts though. Since machines are products made my humans, they can never be autonomous in that sense. If machines had evolved like other animals besides us this argument might hold but obviously that is not the case.

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