The Creativity Code

Marcus du Sautoy

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Oxford Professor of Mathematics

Professor of Public Understanding of Science

Perspective of a mathematician

Acts as historian of AI developments

Image Wikimedia: https://upload.wikimedia.org/wikipedia/commons/3/3e/Professor_Marcus_du_Sautoy_OBE_FRS.jpg

Subjects

What is Creativety

Examples of algorithms and AI

History of Algorithms and AI

Application in the Arts

Application in Music

Focus on humans

Image Amazon: https://www.amazon.de/Creative-Code-Marcus-Du-Sautoy/dp/0008296340

The Lovelace Test

To Charles Babbage's Analytical Engine:

“You couldn't get more out than you put in.”

Marcus du Sautoy proposes the Lovelace Test:

“To pass the Lovelace Test, an algorithm must originate a creative work of art such that the process is repeatable (not a hardware error) and yet the programmer is unable to explain how the algorithm produced its output.”

Image Wikimedia: https://upload.wikimedia.org/wikipedia/commons/a/a4/Ada_Lovelace_portrait.jpg

Creativety

Margaret Boden

Philosopher, psychologist, physician, cognitive scientist, AI expert

3 Types of Creativity

differentiated by approach

Image Nature: https://www.nature.com/articles/d41586-025-02548-0

Explorative Creativity

Exploring possibilities within rules

Example:

Monet's Water Lilies

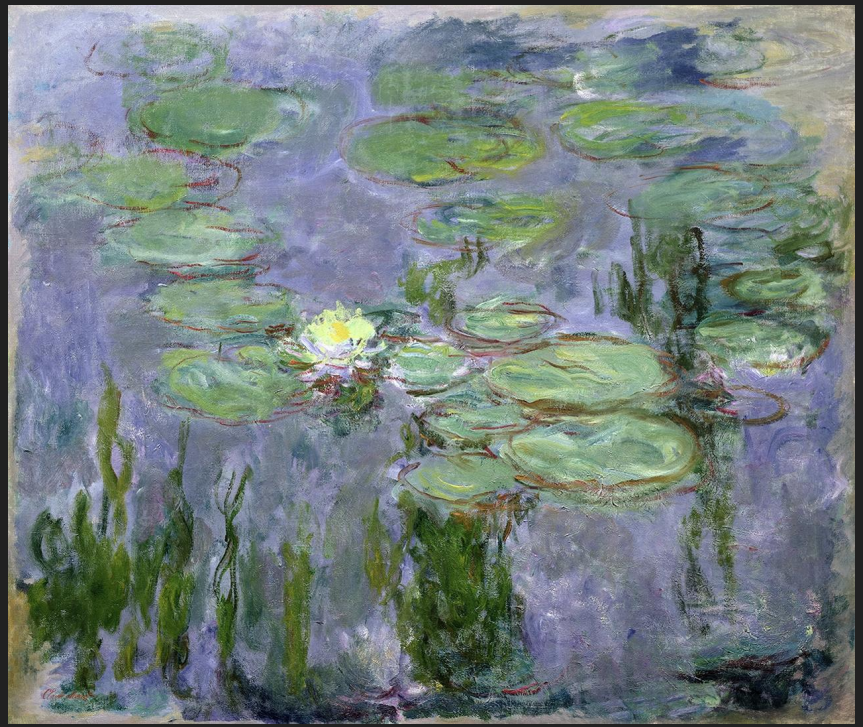

Image Wikimedia: https://upload.wikimedia.org/wikipedia/commons/c/cb/Claude_Monet_Nympheas_1915_Musee_Marmottan_Paris.jpg

Combinational Creativity

Combining different subjects into a new idea

Examples:

Fusion-Kitchen

Zaha Hadid inspired by Kasimir Malewitsch

Image 1 Wikimedia: https://upload.wikimedia.org/wikipedia/commons/1/13/Suprematist_Composition_-_Kazimir_Malevich.jpg

Image 2 Wikimedia: https://upload.wikimedia.org/wikipedia/commons/f/f0/Vitra_fire_station%2C_full_view%2C_Zaha_Hadid.jpg

Transformational Creativity

Breaking what has been established or redefining the rules

Examples:

Picasso and Cubism

Theory of Evolution

Quantum Theory

Image BBC: https://www.bbc.co.uk/bitesize/articles/zmncdnb#z3hd239

Mathematicians and Go

Mathematicians hide behind chess

Now they hide behind go

10^120 possible chess games

10^1048 possible Go games

10^80 atoms in the universe

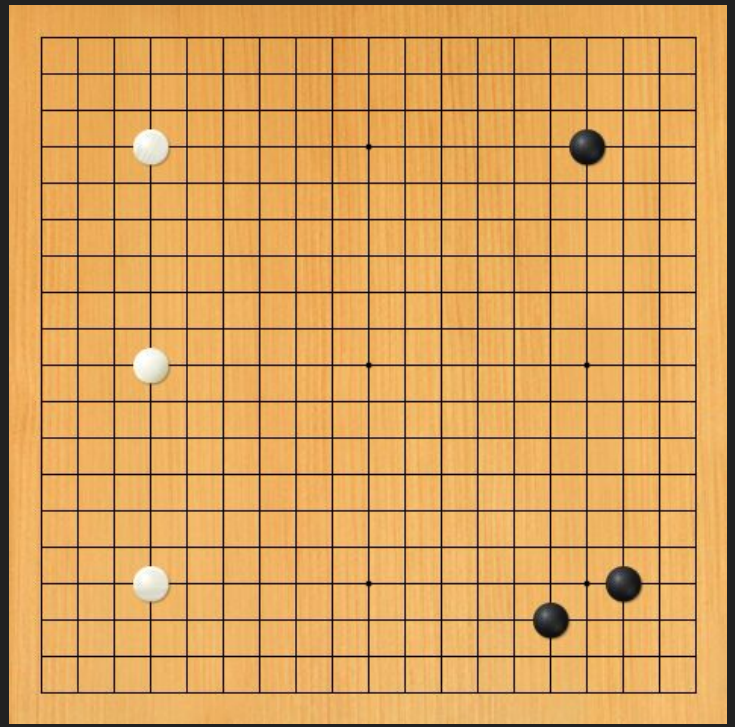

Image Wikimedia: https://upload.wikimedia.org/wikipedia/commons/6/61/Fuseki.png

Go and AI

You place pieces to capture territory

The process is additive

Google DeepMind

AlphaGo

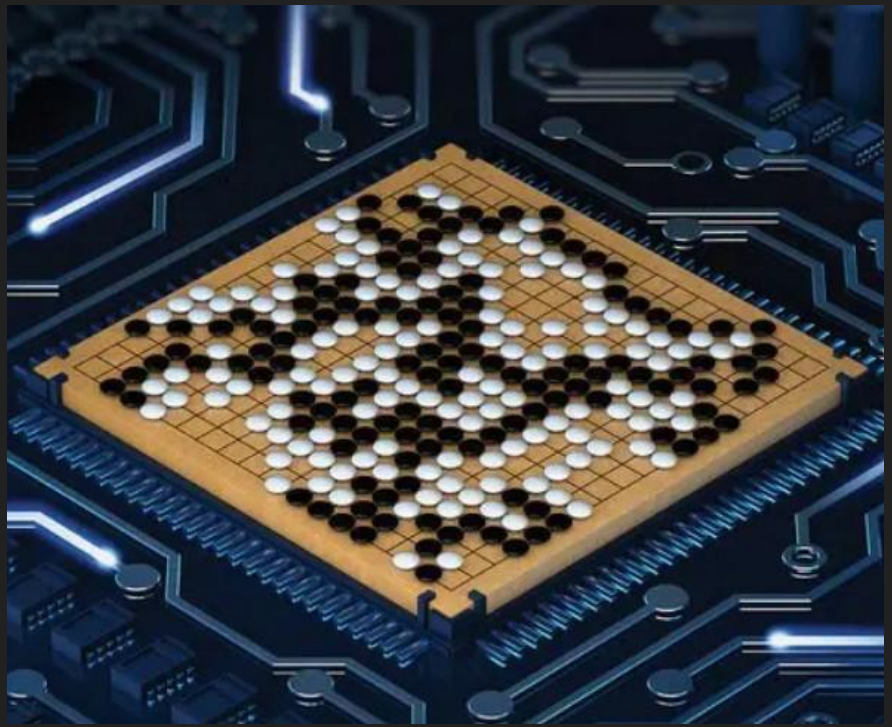

Image Heise: https://www.heise.de/news/Kuenstliche-Intelligenz-AlphaGo-Zero-uebertrumpft-AlphaGo-ohne-menschliches-Vorwissen-3865120.html

Game 1

Lee Sedol mocked previous players

1 million prize money

Lee Sedol vs. AlphaGo

Sedol uses unusual opening

AlphaGo is not like other Go-Computers

Image Wikimedia: https://upload.wikimedia.org/wikipedia/commons/9/99/Lee_Se-Dol.jpg

Game 2

AlphaGo and Sedol start on an even point

AlphaGo makes move 37

You would never place on the 5th line at that time

Commentators mock it

DeepMind employees think it's a bug

Sedol takes 12 minutes to respond

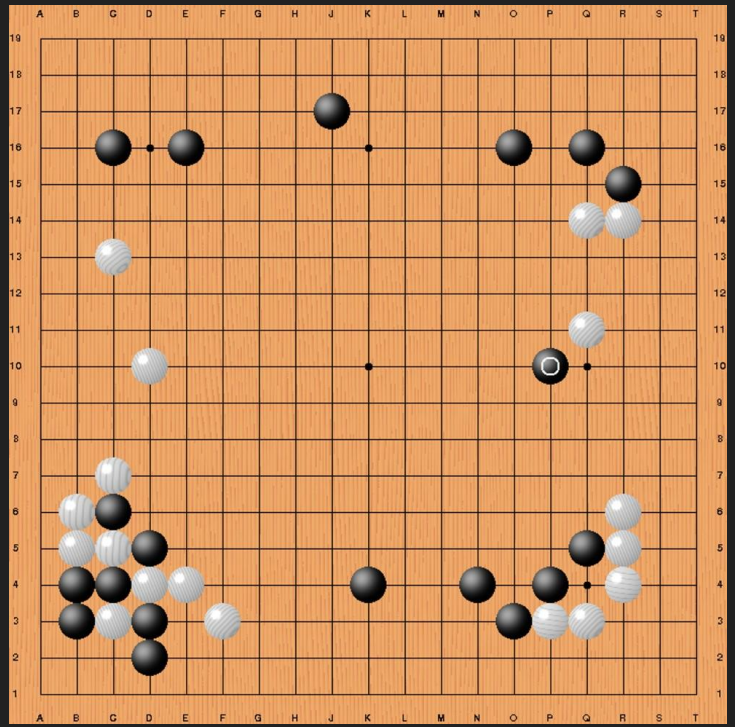

Image Huffington Post: https://www.huffpost.com/entry/move-37-or-how-ai-can-change-the-world_b_58399703e4b0a79f7433b675

Game 3

AlphaGo comes ahead

It plays lazily

Image NewYorker :https://www.newyorker.com/tech/annals-of-technology/alphago-lee-sedol-and-the-reassuring-future-of-humans-and-machines

Game 4

Sedol Plays aggressive

Sedol makes an unusual move

AlphaGo clings to its playstyle

Image BBC: https://www.bbc.com/news/technology-35797102

Game 5

AlphaGo wins this game

Sedol apologizes to players he mocked

It gains an honorary rank as 9th Dan

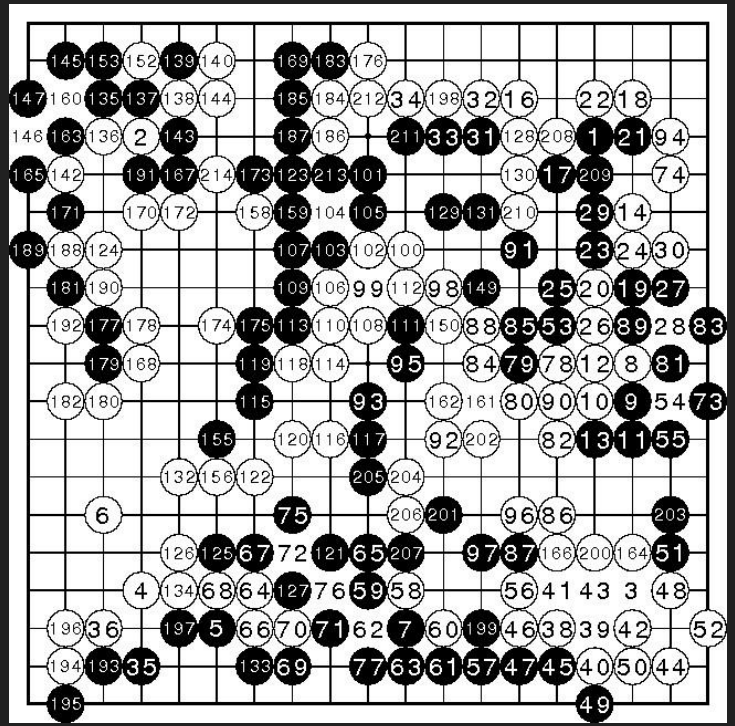

Image Wikimedia: https://upload.wikimedia.org/wikipedia/commons/5/55/FHvAG5.jpg

What that means

AlphaGo won: Computers are now better at go than the best humans

Move 37 as **Explorative Creativity**

No prejudice, no restraints by conventions

Not a human move

Fresh air in the game, new strategies emerge

Move 37 might have been **Transformational Creativity**

Mathematicians and Computers

Computer assisted proofs are a slippery slope

All steps must be checked

But we have to trust a computer calculation

Keplers Conjecture (accepted 8 Years later)

There are many examples of proofs being wrongfully accepted at first

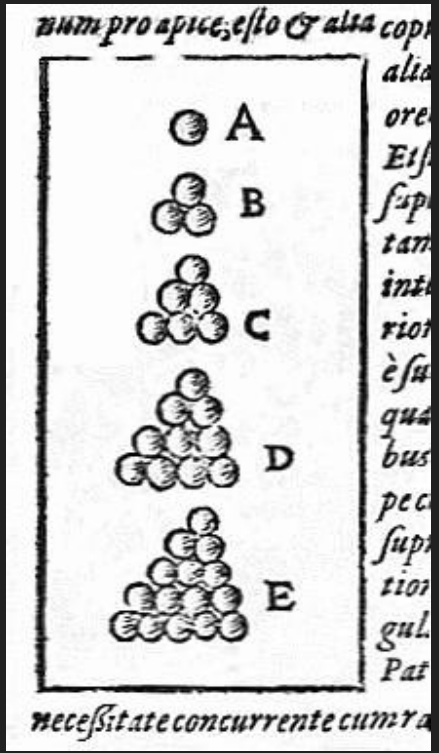

Image Wikimedia: https://upload.wikimedia.org/wikipedia/commons/f/fe/Kepler_conjecture_2.jpg

Mathematicians and AI

AI gives even less clear insight

Proofs become more and more complex

Mathematicians fear:

That we accept falsehoods and build our future theorems on sand

That we will stop comprehending difficult subjects and experts might die out

Induction Method

We test something to find general laws.

A+B = B+A

Safety net:

We give programs solved proofs

Then we check if their answers are correct

Every subsequent proof lessens the likelihood of bugs

David Cope

In 1981 he was commissioned to write an opera

But he felt stuck and had composer's block

So he created EMI (or Emmy for legal reasons)

(Experiments in Musical Intelligence)

This took him around 8 Years

He finished the opera in 2 days

Image Crescendo: https://crescendo.de/david-cope-experiments-in-musical-intelligence/

Emmy

Is an algorithm that studied his work and the work of others

He used the algorithm whenever he was stuck

Later he created pieces with Emmy in the style of others

Bach by Design

Combinational Creativity

Exemplary use of AI for Sautoy

Recommendation

Simple explanations to hard topics

Beginner friendly

Interesting anecdotes

Tells human storys

Perspectives of a Mathematician, Enthusiast, and Reporter/Historian

Made me realize mathematics is a creative field

Algorithms are everywhere and always have been

Image Amazon: https://www.amazon.de/Creative-Code-Marcus-Du-Sautoy/dp/0008296340

Criticism

Some of his opinions just stand as facts

He wont reflect too much on pessimistic approaches

He uses sensational approaches but rectifies this in the end

Criticism

"To pass the Lovelace Test, an algorithm must originate a creative work of art such that the process is repeatable (not a hardware error) and yet **the programmer is unable to explain** how the algorithm produced its output."

Discussion

Do you think the Lovelace test is disproven by AI?

“You could not get more out than you put in.”

Regarding the programmer and the prompter

Does this change?

Does this change when you consider:

The programmer, the prompter, and the training data?

Which of the 3 forms of creativity do we find in AI we use in our lives?

Explorative Creativity

Combinational Creativity

Transformational Creativity

Do you think AI will make us worse in the categories we deploy it in?

Mathematicians will no longer understand proofs

People won't choose to become illustrators/photographers/writers

We will get worse at thinking/writing/spelling

Experts will die out

Pages

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195-207 David Cope and Emmy