Some Moral and Technical Consequences of Automation

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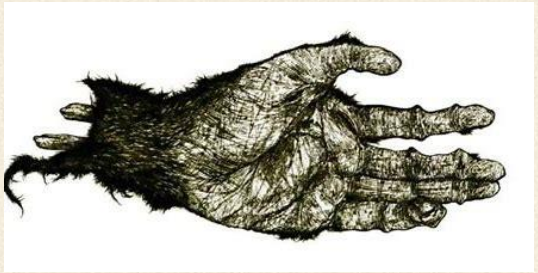
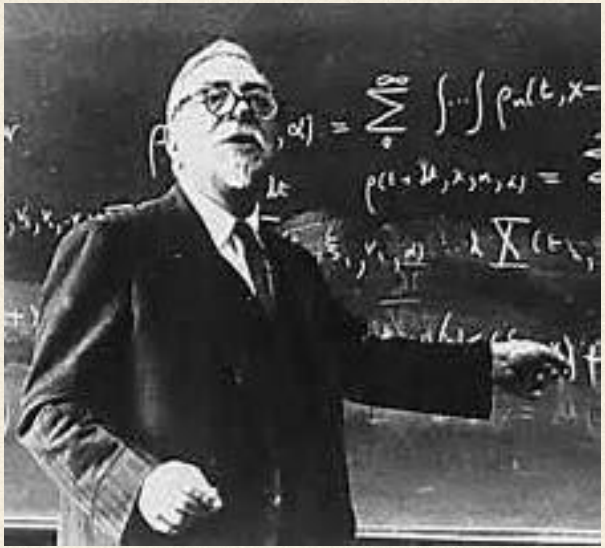


Norbert Wiener (1894-1964)

Background and Research Focus:

- Former child prodigy and MIT Professor
- Won the National Medal of Science in 1963
- *Cybernetics, or the Control and Communication in the Animal and the Machine* (1948)
- Cybernetics: study of contolling flow of information in systems with feedback loops (biological, mechanical, social, etc.)



Expressed concern that many believe machines to be **unoriginal,** and **subservient to man.**

- Many scoffed at theories of Samuel Butler (connected Darwin's ideas to machines)

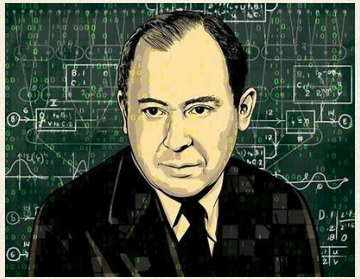
"It is my thesis that machines can and do **transcend some of the limitations of their designers**, and that in doing so, they may be both **effective** and **dangerous**."

— Norbert Wiener

Why Games? And Why Chess?

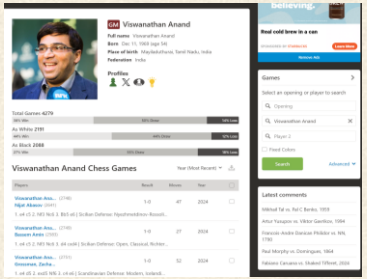
- Cultural importance (hundreds of millions of players over centuries)
- Requires strategy, creativity, pattern recognition, logical reasoning
- Symbolism (evokes warfare or other competitive activities)
- Long history of fascination with chess machines (The Turk, Alan Turing, and more)

◆Game-Playing: Understanding Machine Intelligence◆



Von-Neumann

Each player chooses a move depending on the opponent's best response, and then their own, and so on



Past History

Examining previous record, looking at games played by opponent, self, or other players

Theory-Based

Examining previous theory, looking at how game was played in prior stages

First Examination: How a Machine May Play Chess

Emphasis on **rigidity:**

- Strict numerical weights based upon piece value, mobility, etc.

Playing with a determined, inflexible policy for the length of the game.

Wiener rejects this strategy as one inaccurate to real life and cites great strategists like Napoleon and Nelson.

Pieces and Point Value		
Pawn		1
Knight		3
Bishop		3
Rook		5
Queen		9
King		priceless

Second Examination: How a Machine May Play Chess

Emphasis on **previous record:**

- Examining which weighting of factors allowed for wins
- More successful; won't fall for earlier tricks
- Highly successful at checkers; successful only at amateur level for chess
- Develops original, strong strategies, with one exception: Endgame

Evolving Strategies: Another Concern

Wiener notes current game-playing machines play high-level checkers at most stages and amateur level chess.

Opening

End Game

Middle Game

Wiener then questions the impact of machines in a **push-button war**, drawing comparisons between how a machine might be trained to win a game.

- Would it be effective? Would it hold to our morals?

Chess in the Age Since Wiener

Kasparov vs. IBM's Deep Blue (1997)

- "The Brain's Last Stand"
- Developed out of Deep Thought, CMU computer first to beat a grandmaster
- Developed library of moves; played matches to determine weaknesses
- Could search up to 200 million options per second
- Inspired creation of supercomputers who analyzed finance, molecular dynamics, and mining data

Deep Blue in IBM's headquarters in Armonk, N.Y. PHOTO: YVONNE HEMSEY/GETTY IMAGES

Chess in the Age Since Wiener

AlphaZero (Chess, Shogi, and Go)

- Began training from random play, only knowing rules of game
- Developing via game-specific rules (taking account of any potential position) vs. neural network
- Considers only 60,000 positions per second
- Shows unique intuition and strategy

"I thought AlphaGo was based on probability calculation and it was merely a machine. But when I saw this move I changed my mind. Surely AlphaGo is creative."

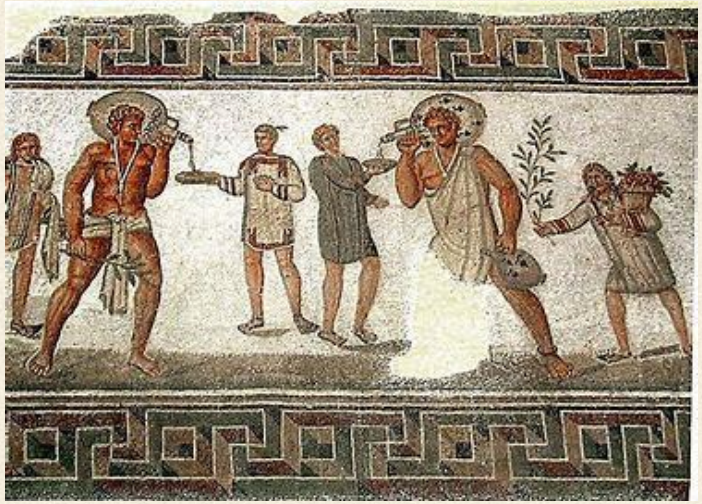
- Lee Sodol

AI and Slavery: A Moral Question

Wiener presents our use of machines as a kind of master and slave relationship:

- Inherent contradiction- combining **subservience** and **intelligence**
- Beginning to develop away from machines with “rigid policies” to “learning machines”

Claims that, for a long time still, the human mind is still better than the machine (though the machine operates much faster)



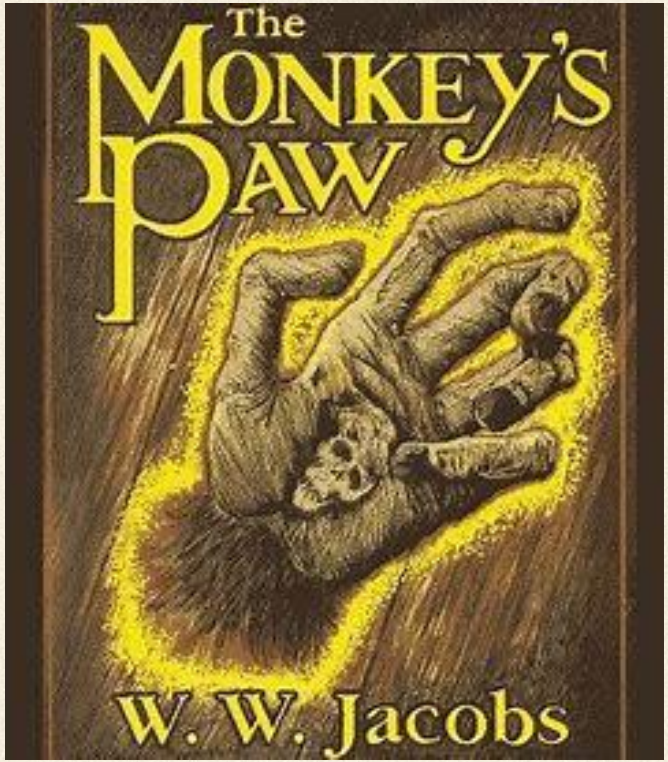
◆ Primary Cause of Conflict: Speed of Machine ◆

Major problem originates from different **time scales.**

Moral Question: Impact of humans working in spheres of study that operate on a much slower time scale (ex: Science)
- The scientist must **examine critically** whether study of science is benefitting humanity
- Completing incomplete knowledge vs. **blindly rushing** ahead

"We **must always** exert the full strength of our imagination to examine where the full use of our new modalities may lead us."
- Norbert Wiener

Monkey's Paw

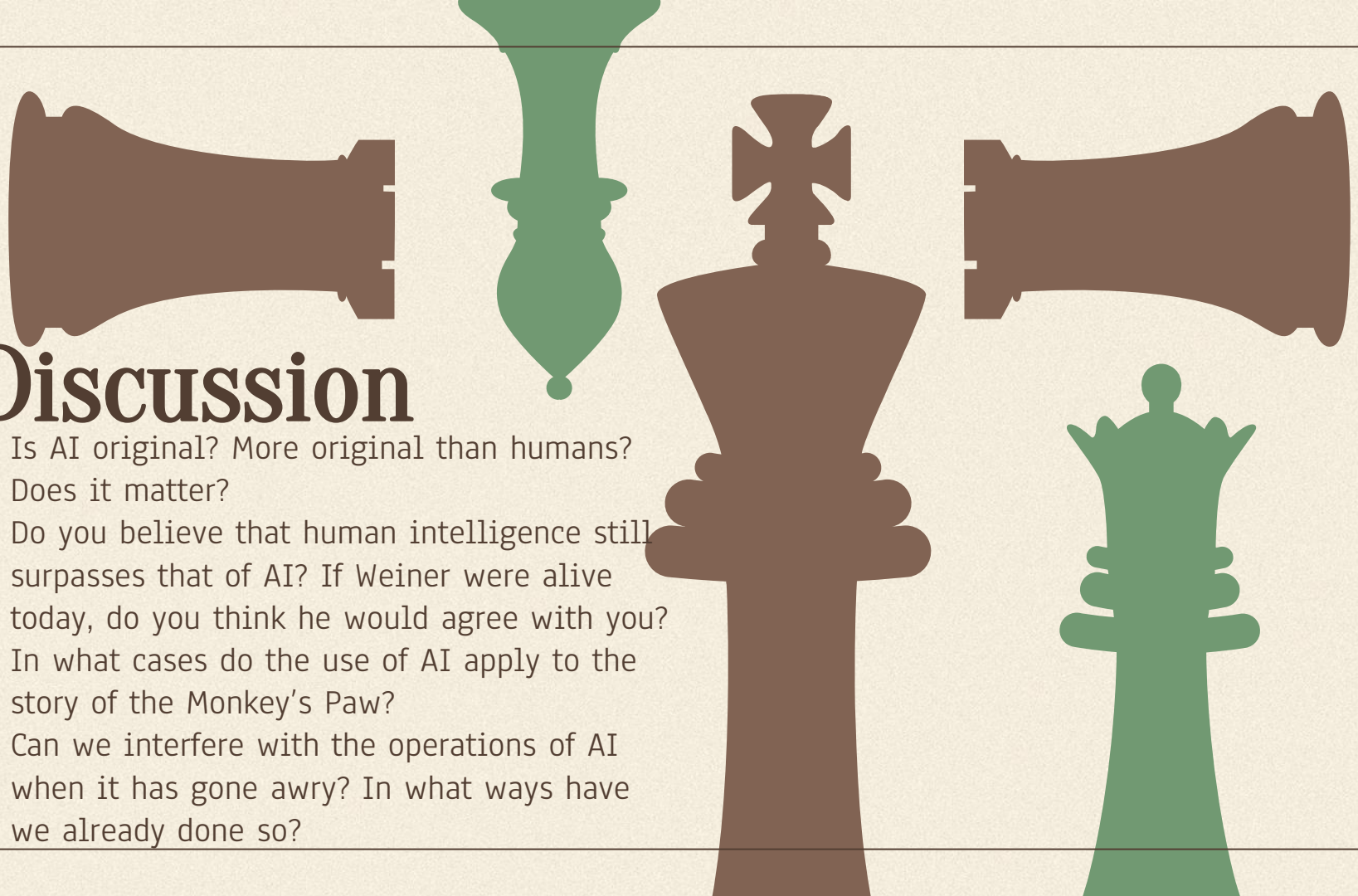


A tool, with powers beyond our understanding, with consequences that we may not be able to undo.

"Similarly, when a machine constructed by us is capable of operating on its incoming data at a pace which we cannot keep, we may not know, **until too late**, when to turn it off."
- Norbert Wiener

"**Disastrous results** are to be expected not merely in the world of fairy tales but in the real world wherever **two agencies essentially foreign to each other** are coupled in an attempt to achieve a common **purpose**."

— Norbert Wiener



Discussion

1. Is AI original? More original than humans? Does it matter?
2. Do you believe that human intelligence still surpasses that of AI? If Weiner were alive today, do you think he would agree with you?
3. In what cases do the use of AI apply to the story of the Monkey's Paw?
4. Can we interfere with the operations of AI when it has gone awry? In what ways have we already done so?