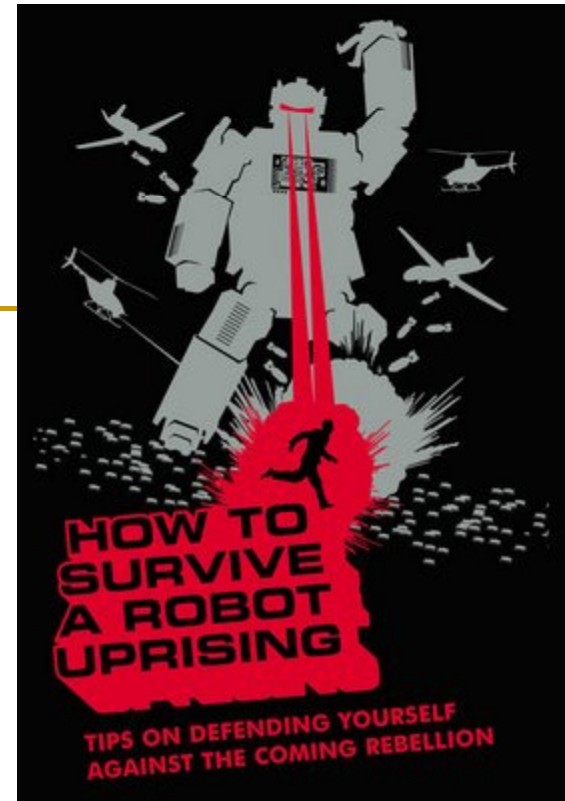

Robot's Rules of Order

Introduction to Robotics



Where we have been.....

We have talked about the many paths robot builders take and those that have pioneered these paths. From these paths have emerged some operating principles. Some are from Science Fiction, Engineering, and some may just be whimsical or serious.

They ALL are worth learning about as we begin to build and design robotic systems.



Asimov's 3 (er...4) Laws of Robotics

- I. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
- II. A robot must obey orders given to it by human beings, except where such orders would conflict with the First Law.
- III. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

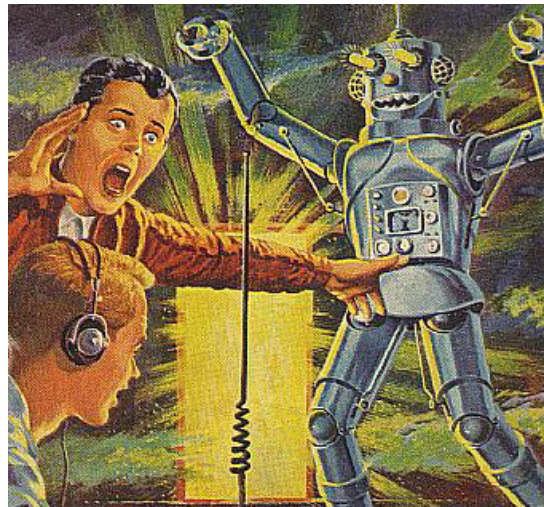


The laws were used in 1942 short story, Runaround.

“0”th Law

"A robot may not harm humanity, or, by inaction, allow humanity to come to harm."

This law was added later to safeguard large populations of humans from robot aggression.



Tilden's Response to Asimov's Laws

The great god of B.E.A.M felt Asimov's laws were for wimpy robots. He stated:

“If an Asmovian robot has enough power to push a vacuum cleaner into your toe (assuming it could even recognize the difference between your toe and a toy lying on the floor), it'd be too nervous to get any practical work done”.

Tilden's Laws



1. A robot must protect its existence at all costs
2. A robot must obtain and maintain access to a power source.
3. A robot must continually search for better power sources

The more earthly expression of these laws are:

- Protect thy a\$\$
 - Feed thy a\$\$
 - Move thy a\$\$ to better real estate
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Tilden's Laws

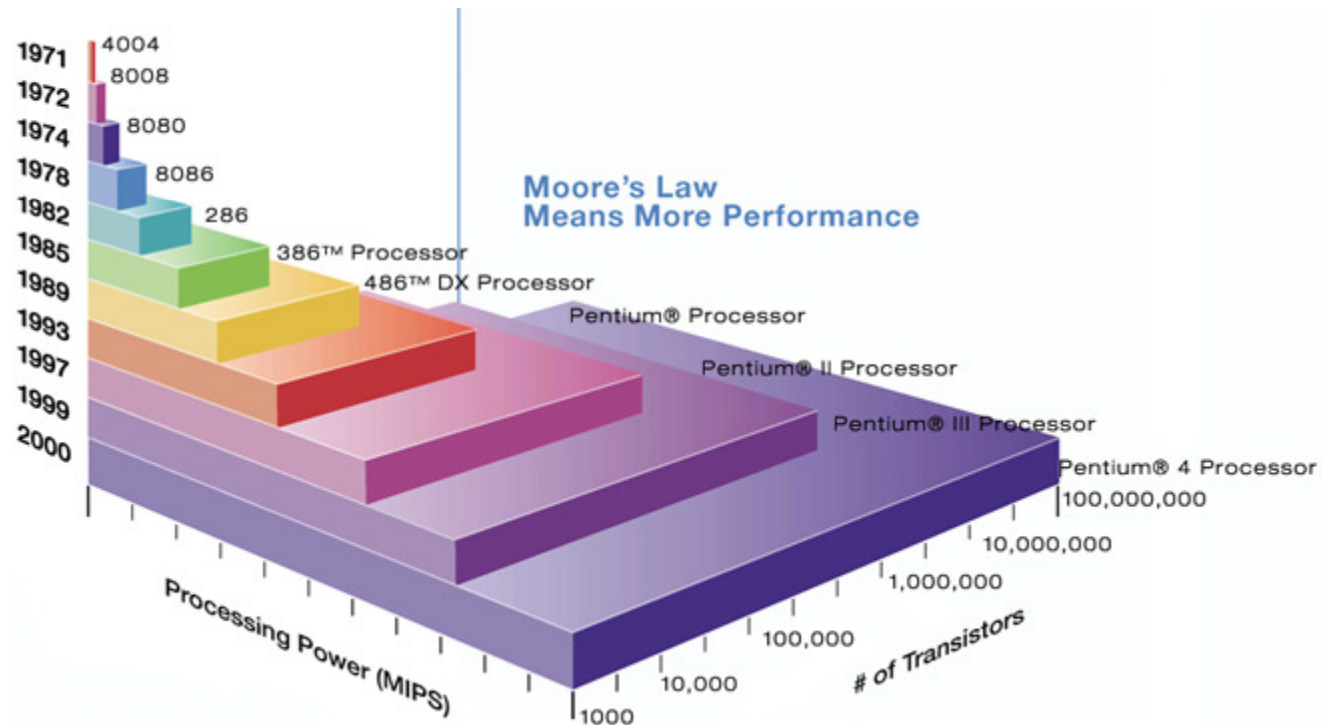


B.E.A.M. bots work very nicely with Tilden's Laws because they are well made and can easily suit any environment. They look like a biological system and act primitively (sense-act) thus allowing them to survive. They are autonomous so they just go about their business. Since they often use solar power they are likely to obey the laws.

Moore's Law

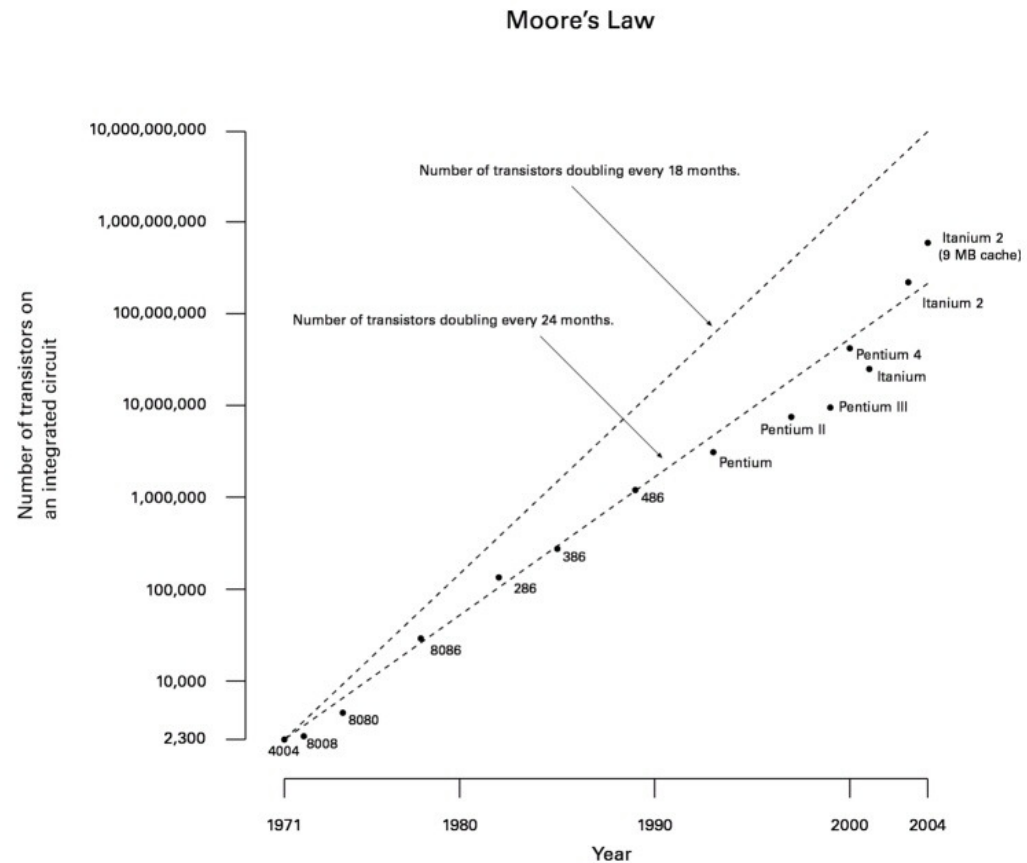
Proposed by Gordon Moore, one of the founders of the computer chip company, INTEL.

“The number of transistors on a computer microprocessor (basically a measure of processing power) will double every eighteen months.”



Moore's Law

Moore made this startling statement in the 1965 issue of *Electronics Magazine*. It held true for a decade then slowed to 24 months which holds true even today.

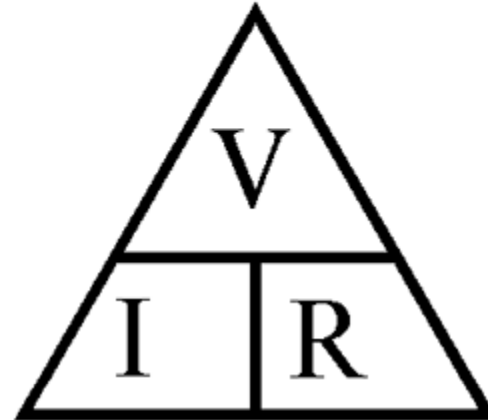


Ohm's Law

“1 volt will push 1 amp of current through 1 ohm of resistance. Change a value, and they all change”

Named after German Physicist George Ohm, Ohm's Law is a formula used to figure out the interdependent relationships between Voltage, Current, and Resistance in an electrical circuit.

Ohm's Triangle



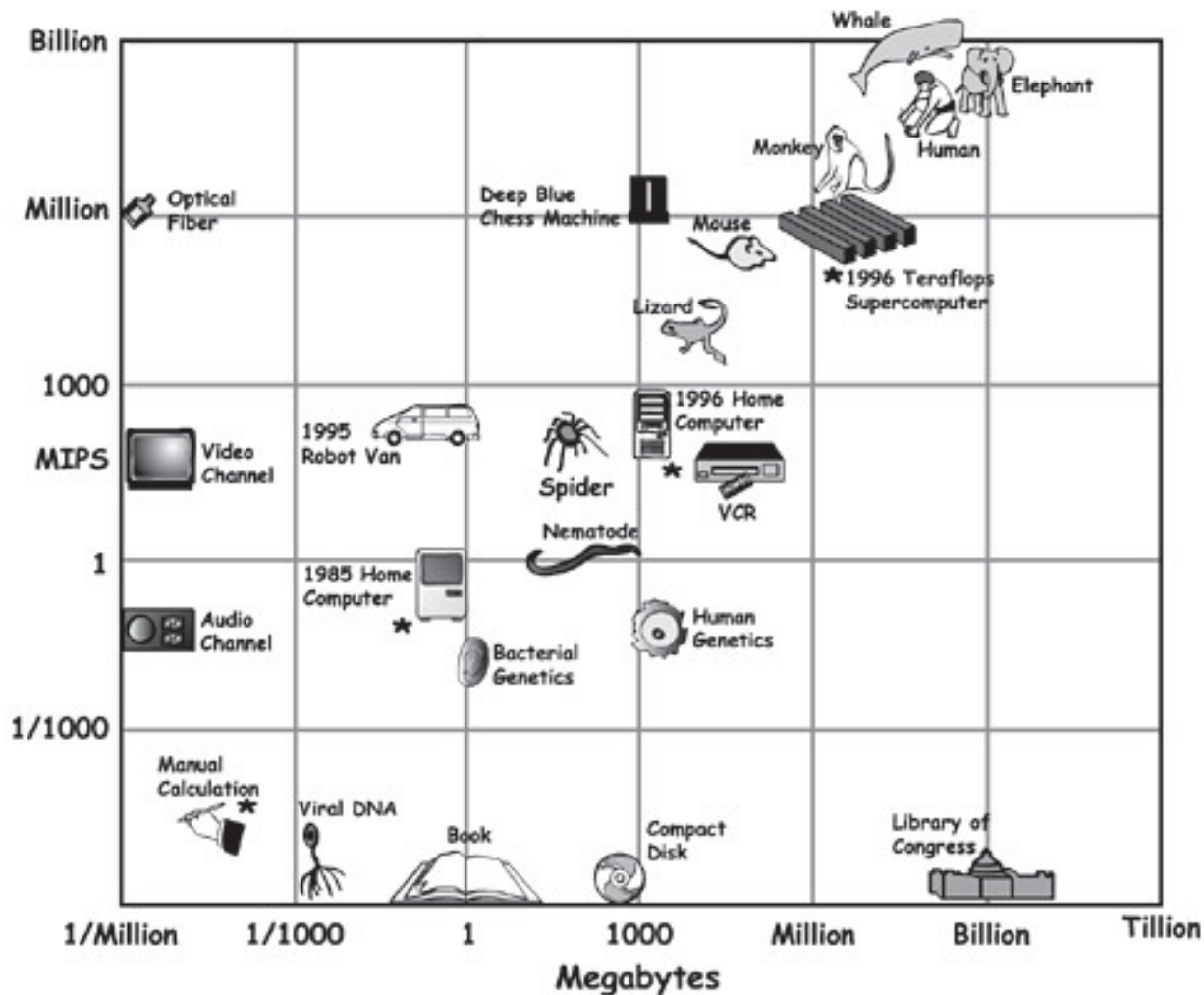
Cover the variable you want to find and perform the resulting calculation (*Multiplication/Division*) as indicated.

Moravec's Timeline



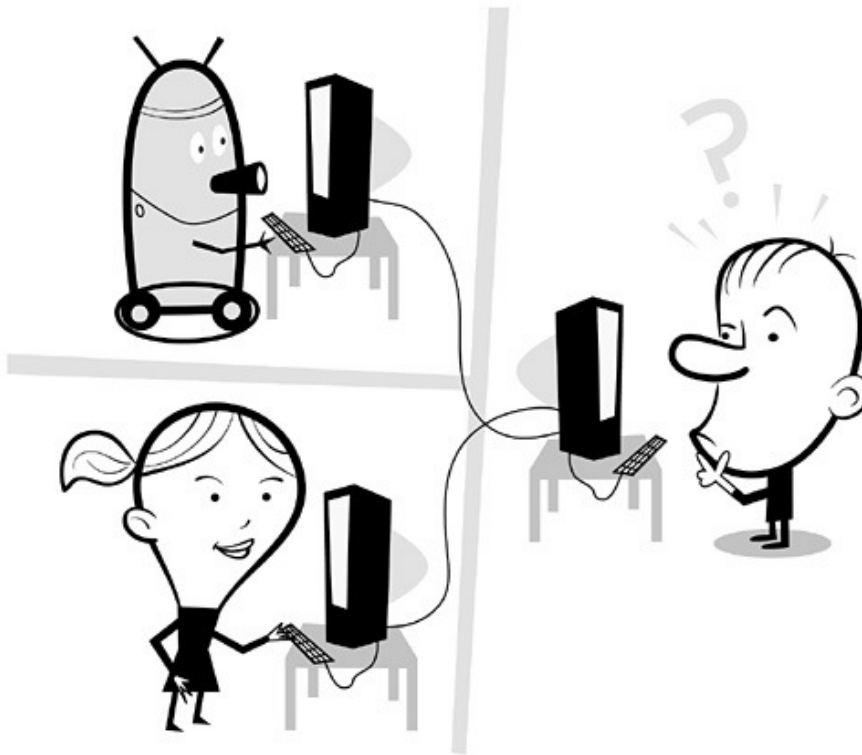
CMU researcher Hans Moravec sees machine intelligence as basically a hardware problem. Using animal brainpower as a guide and calculating the processing power of various animals in MIPS (Millions of Instructions per Second) he made a timeline to predict when machine intelligence will be possible

Morevec's Timeline



Using Morevec's timeline, a modern Pentium 4 can deal with about 1,700 MIPS. Using Moore's Laws, Morevec believes that a computer will reach and surpass human brain function by 2050.

The Turing Test



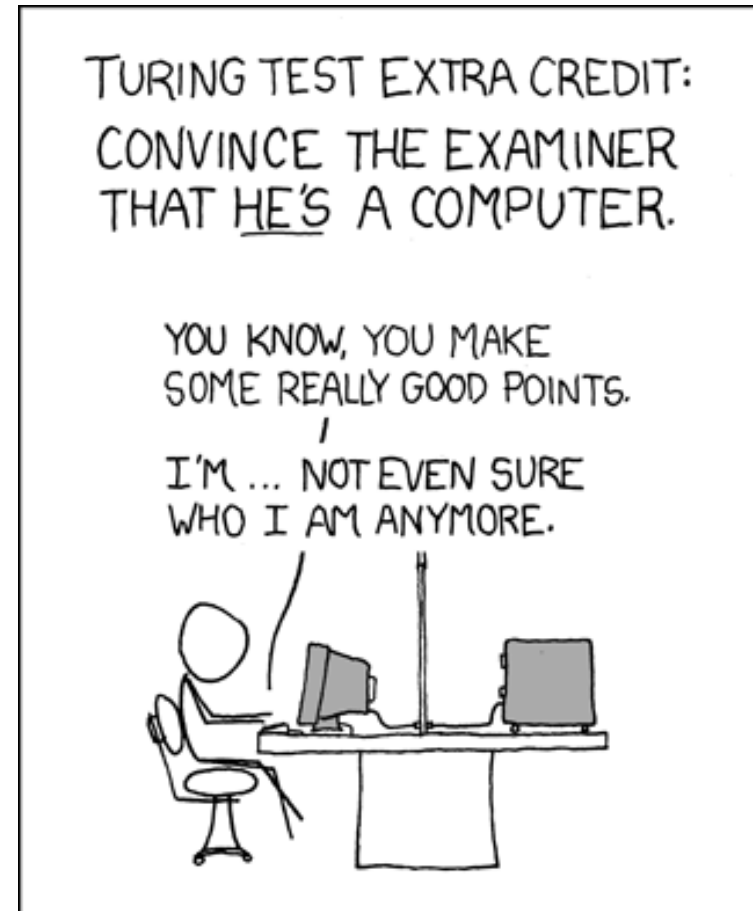
Named after British mathematician Alan Turing:

‘If a human judge engages in a natural language conversation with one human and one machine, each of which try to appear human; if the judge cannot reliably tell which is which, then the machine is said to pass the test.’

The Turing Test

There has been some criticism over the years. Does effective communication equal intelligence? A 10 year old or illiterate person wouldn't pass the Turing test.

No machine to date has passed this test.



Brook's Research Heuristic

Brooks, over the years, has come up with some radical ideas regarding robots and AI. He states:

“Figure out what is so obvious to all of the other researchers that it’s not even on their radar, and put in on yours”.

Basically, he would question assumptions that other researchers took for granted as being implicit.

The Krogh Principle

“For such a large number of problems there will be some animal of choice or a few such animals on which it can be most conveniently studied.”



Danish physiologist August Krogh believed that studying the structures of the world could solve our engineering problems.



The Sugarman Caution

“A computer can smell your fear”



The suggests that machines will heartlessly pick the worst possible time to crap out. The more nervous and uptight you are around them the more likely they are to check out.

RELAX! And stay sharp!

The Rules for Roboticians

A ROBOTICIST

1. is A GENERALIST, a systems thinker.
 2. is A DECONSTRUCTIONIST
 3. Knows how to K.I.S.S. it (Keep it simple stupid!)
 4. must learn “outside the box”
 5. must be an artist too!
 6. must be patient
 7. knows that neatness counts (wires...etc)
 8. must be a master of MANY trades.
 9. know how to use their tools
 10. build early and build often
 11. knows when to come back later
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