Reading Discussion

Badr and Jiayi

"The topic this week is whether simple approaches to robotics might yield better (depending on how you define 'better') or more interesting results"

— Professor Michael

Chapter 5: Toys, Totems, and Tools

The Living Brain

Totems

1. Why do you think is it meaningful for humans to worship Totems – the mimicry of life in a form of appearance?
2. What makes the difference when we move from imitating external appearances to imitating performance and behaviours? A extension of totems or not?

# Automatic Device – A Working Model

3. The reading raised ways for automatic devices to imitate behaviours.
   a. To simulate the system of the nerve fibre
   b. To find out the "principles and character of the whole apparatus in operation"

Considering multiple factors like cost, complexity, flexibility, observable performance, potential of development, etc., which one do you prefer? Which one is better?

Machina Speculatrix, "Tortoise"

4. Given the principles of M. Speculatrix,

i. Parsimony

ii. Speculation

iii. Positive tropism

iv. Negative tropism

v. Discernment

vi. Opitma

vii. Self-recognition

viii. Mutual recognition

ix. Internal stability
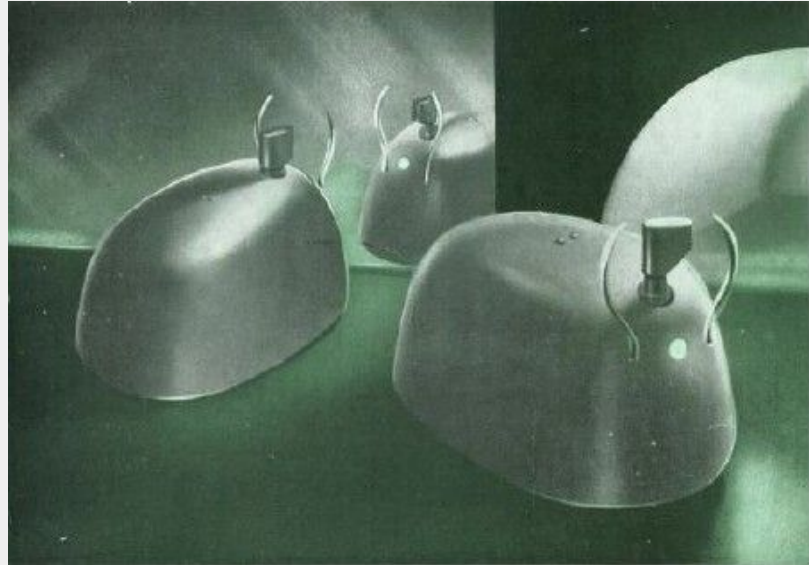
Which principle do you think the most significant? What principles might be missing? Would the robot be more interesting/functional if missing some of the principles?

"The way in which the social behaviour of the models breaks down under the influence of a competitive struggle for a common goal, imitates almost embarrassing some of the less attractive features of animal and human society. That is the fault of the maker, who could, however, easily endow his creatures, as man is endowed, with a **discriminatory recognition circuit** that would function in an emergency, a **'women- and children first'** reflex".

A quick question: How do you interpret this "discriminatory recognition circuit"?

Chapter 2: The Quest for an Artificial Creature

Flesh and Machines: How Robots will change us

Grey Walter's tortoises

- An attempt to reproduce **exploratory** and **speculative** behaviors using a few sensors, actuators, and motors.
- Very similar to **Braitenberg vehicles.**
- Coupled with micro effects (eg. voltage), these behaviors become very hard to predict.
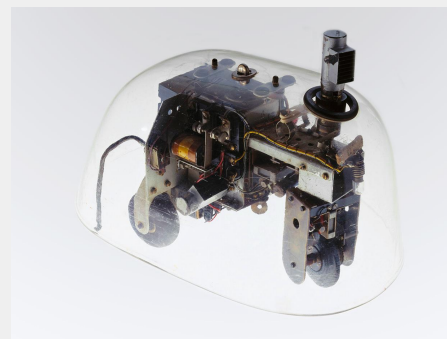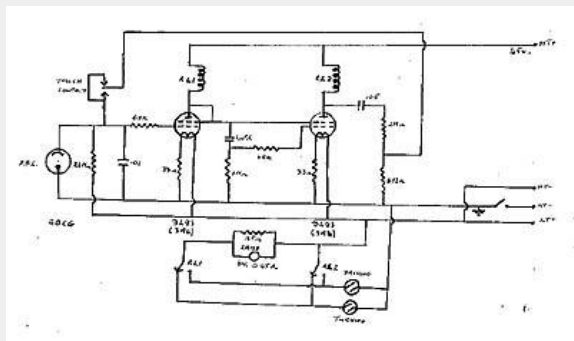
Lessons to be learned

1. Even a seemingly very **simple** creature can have extremely **complex** behaviors in the physical world because of the way that small **variations** in what is sent, and how the actuators interact with the world, can change the actual behavior of the creature.

From an observing point of view, can these complex behaviors produce a sense of intelligence?

Lessons to be learned

2. Simple creatures, with just few nonlinear elements, can end up producing a wide variety of **emergent behaviors**, where multiple elementary behaviors couple with the environment to produce behaviors that are more than simple strings or suppositions of the elementary behaviors.

Where do these emergent behaviors stand between the butterfly effect, chaos theory, determinism, self-awareness, and free will?

Lessons to be learned

3. It is certainly **difficult** to implement a theoretical, psychological or neurological construct on a **physically** embodied system.

In fact, the details are often not important at the level of distinction being made in the theories, but they are **essential** to get instances of the theory coupled into all the constraints that result from the body and the environment.

Is there a physical root for all human/animal behaviors,
or do they transcend physical boundaries?

SAIL's Cart robot (rover)

- It took **three** generations to build it.
- Started as a system that follows a white line without having a previous perception of the world and responds to the environment in **real time**.
- Added a **3D model** of the world to help it know its way in an environment.
- Implemented **computer vision** to analyze the environment, find obstacles then decide on the optimal path.

Comparing Cart to the tortoises

A robot relying on millions of dollars of equipment did not appear to operate nearly as well as grey Walter's little tortoises that cost less than ten dollars each.

Internally, Cart was much more complex than the tortoises and was using advanced computer vision algorithms. However, for an external observer, the tortoises are one step ahead.

Were the internal models truly useless, or were they a down payment on better performance in future generations of robots?