Intelligence and Implants

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What is Intelligence?

- Many dictionary definitions – quickness of thought, knowledge, comprehension, gathering information?
- Mental processes sufficient for life.
- Ability to make appropriate and timely choices.
Nature – versus – Nurture

- How much of our intelligence is due to our genes (programming) and how much is due to learning (the environment)?
- Twin studies
- Adopted siblings
- Typical latest – 80/20 in favour of genes/nature.
Intelligence Tests

• An intelligence test measures the degree to which tester and subject think alike – Subjective Intelligence.
• “Everyone is World Champion at some game” (Ross Ashby) – You are the most intelligent person in the world !!!
• Positive links with examination results though – indicate performance in specific areas.
Subjective Intelligence

- What we regard as being an intelligent act, and what not, is very subjective
- Human centred – e.g. jokes
- Animal centred – bat’s ultrasonic sense
- Machine centred – maths, memory
Intelligence Hypersphere

- Intelligence is not something that can be indicated by a single number (IQ)
- Intelligence is multifaceted
Can we improve mental performance?

- What have studies shown thus far? (Orange/Lead)
- Fun with IQ tests!!!
- Two sets of results.
- Q1: If I wish to improve my mental performance in the short term – what can I do?
- Q2: Can the food I regularly eat affect my mental performance?
Experiment 1:

- 200 first year students at Reading University given an IQ test, then an activity + food, then another IQ test.
- How did their results change over that short time period? (IQ points score)
- Trying to answer the question “What is it best to do immediately before an examination, to maximize your performance?”
Results - Food

- Alcohol: 0
- Chocolate: -2
- Coffee: +3
- Orange Juice: -2
- Peanuts: +1
Results - Activity

- Reading/Swatting  -6
- Listening to classical music  -2
- Watching a chat show on TV  +5
- Playing with a construction toy  -4
- Sitting/Chatting  -2
- Watching a documentary on TV  +4
- Walking  +1
- Meditating  +2
- Watching Friends on TV  +1
- Completing a crossword puzzle  0
Experiment 2:

- 50 children (aged 8-11) at Thameside School, Caversham were given regular breakfasts over a one month period.
- They were tested at start/end and during to see how their performance altered.
- IQ equivalent tests in numerical ability/word association/shape recognition.
Results – Breakfast

- Toast + Orange Juice  +3
- Bacon Sandwich        +3
- Control              0
- Cereal               -1
- Eggs (various)       -5
On Machine Intelligence

- What exactly is machine intelligence (AI)?
- Raises questions as to what is life.
- Importantly – can machine intelligence ever surpass human intelligence?
Steven Hawking

• “In contrast with our intellect, computers double their performance every 18 months.”

• “The danger is real that they could develop intelligence and take over the world.”

• “We must develop as quickly as possible technologies that make a direct connection between brain and computer.”
Cyborg studies

- Is it possible to take the best of human and machine intelligence and combine them?
- Implant technology.
- Linking human nervous system/brain to the Computer.
- Seeking to combine human and machine intellects.
CYBORG 1
CYBORG 2
To create a closed loop interface between a biological network and a robot.

**Aims**

**MEA**
Biological neural network
Grown directly on to Multi-electrode array

**STIM**

**AMP**

**PC**
Dimensionality reduction, storage, spike train analysis

**PC**
Culture – Robot mapping, Machine learning etc.

Intranet

Robot running on powered floor
Approach

- Culture brain cells directly on to a recording surface and re-emboby the 'brain' within a robotic body.

- Multi-Electrode Array (MEA) allows recording from 128 electrodes across the entire culture.
CYBORG 3
Super Intelligence

- We can certainly improve our human mental performance to a point – examples given.
- It is possible for a human to design and build a machine which is capable of solving problems that are far beyond the scope of any human.
- An intelligent machine network is quite possible.
- Cyborgs also possible – extra-senses, memory upgrades, thought communication etc.
- Training a Cyborg – just by a software download?
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