ECSE-322

Lecture 2

7 January 2008

Course organization ?

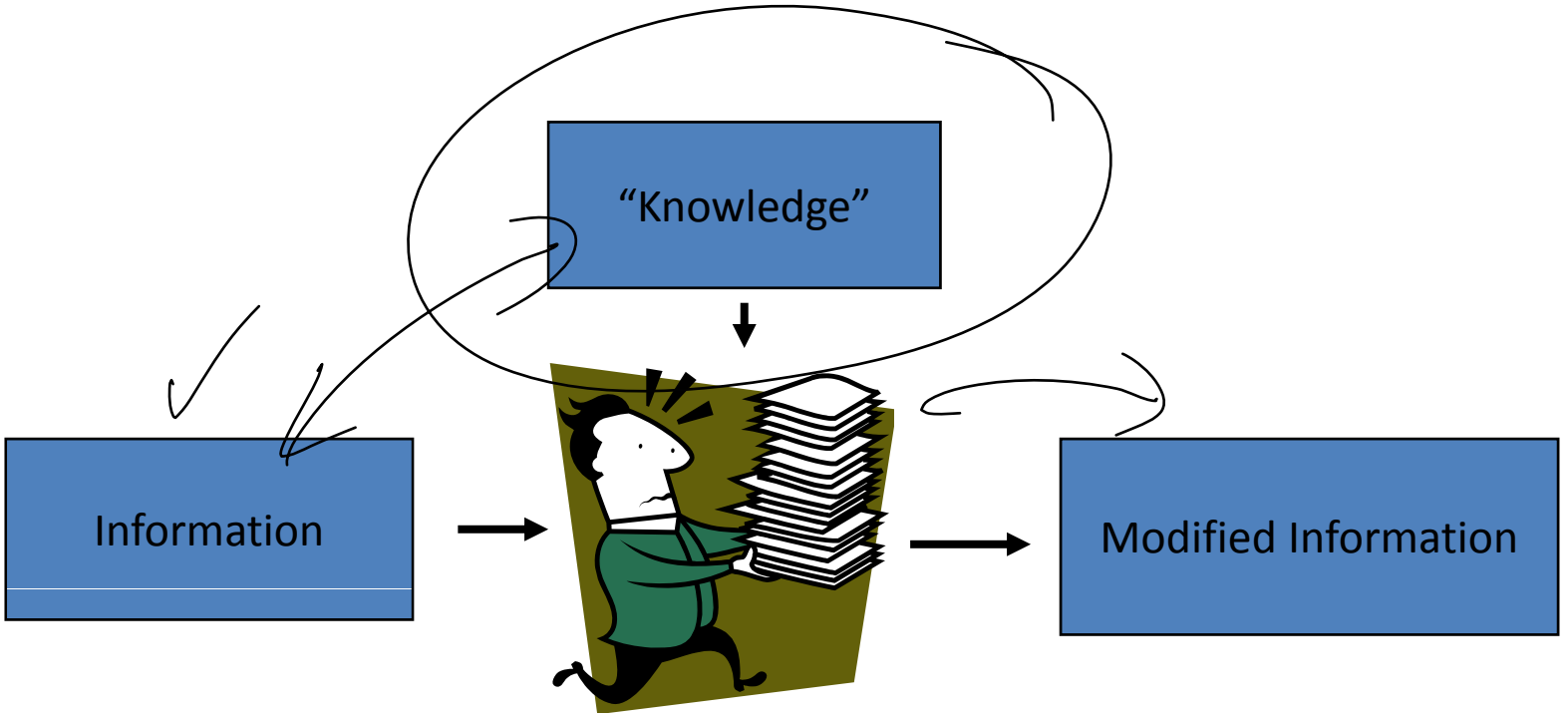
Why computers ?

Information Processing

- Acquire information as data
- Encode data
- Store data
- Transmit data
- Modify data
- Output data – recreate information
  - *People do this really well!*

Information Processing

- So why not just use people?
  - Slow?
  - Error prone? – noise gets introduced into the signals?



Information Processing

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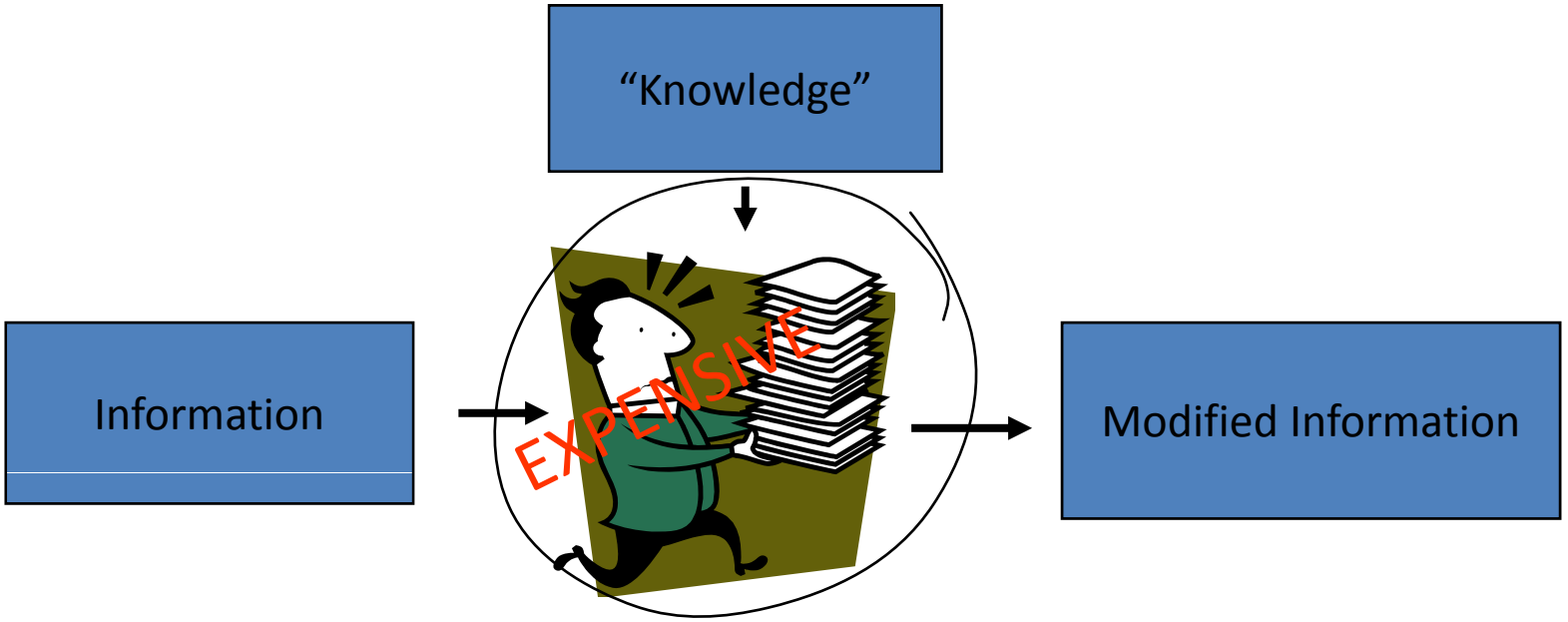
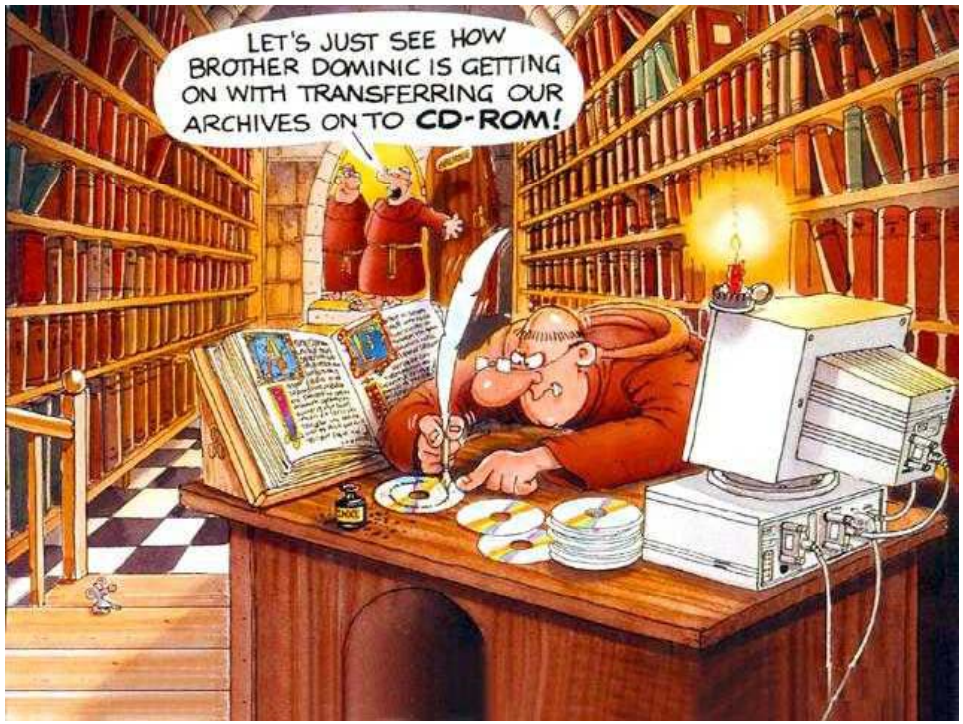


Information Processing

- But…
  - People can store data
  - People can modify data
  - People can transmit data
  - People can modify data…
- However, throughout history humans have developed systems to augment their capabilities..
  - Mechanical systems “amplify” and improve on natural capabilities..

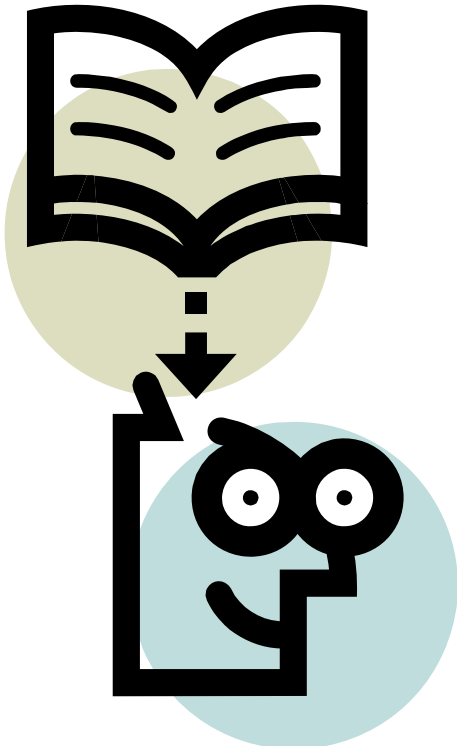
Information Processing

- Information storage and copying
  - The invention of the alphabet
    - The invention of writing – information (knowledge) storage by scribes hand writing and copying text.



Information Processing

- Information retrieval
  - Reading stored information



Information Processing

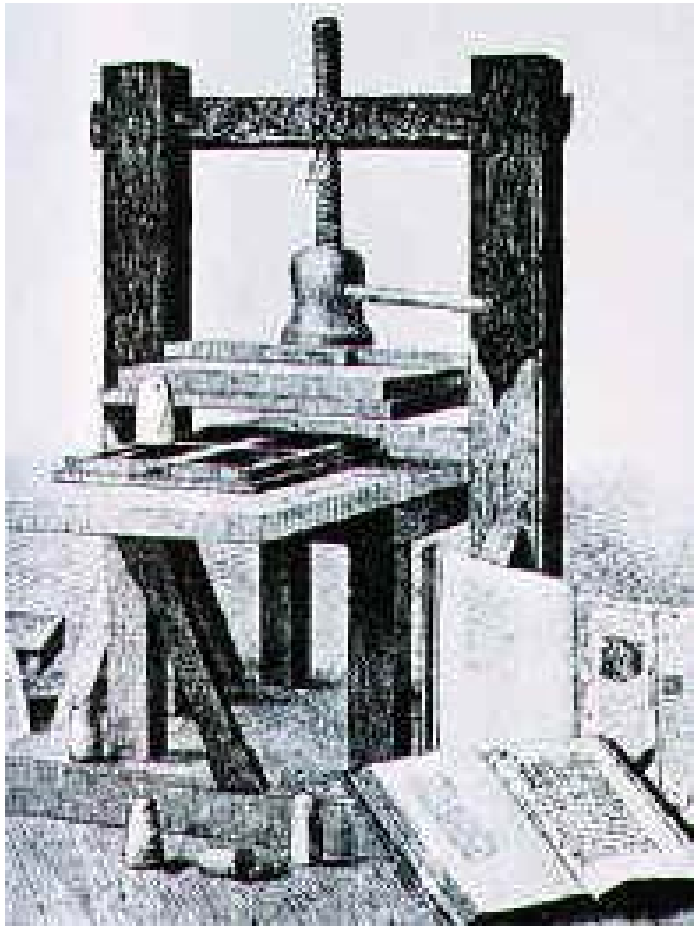
- Information Creation and Modification:
  - Writing a book
  - Editing a document
  - Performing arithmetic
  - …

Information Processing

- Information transfer
  - Written documents
  - Speech
  - Body language
  - …

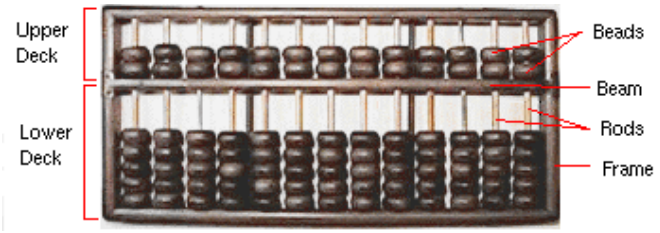
Automating the Processes

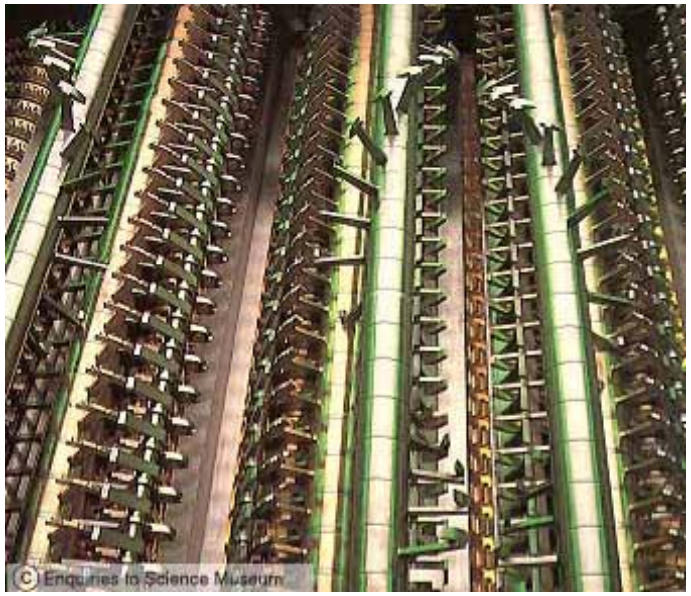
- The printing press – Gutenberg (1452)
  - Most of the components had existed for over 200 years – he added the concept of movable type.
    - *An information revolution in society –as significant as the arrival of computers*.



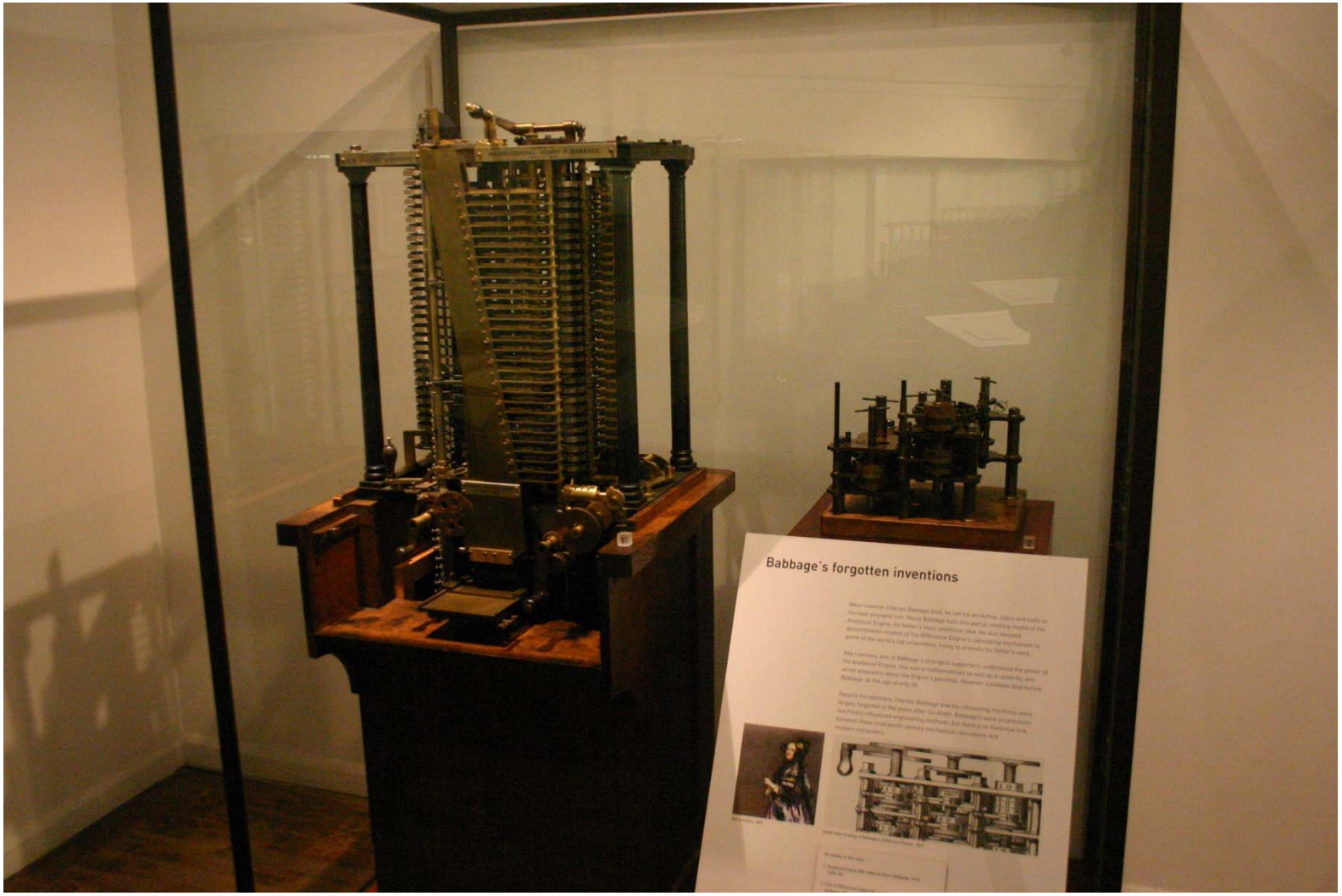
Automating the Processes

- Automatic arithmetic?
  - A memory system – the abacus (500BC)
  - The *analytical engine* – Charles Babbage (1837) – made from brass and steam powered…

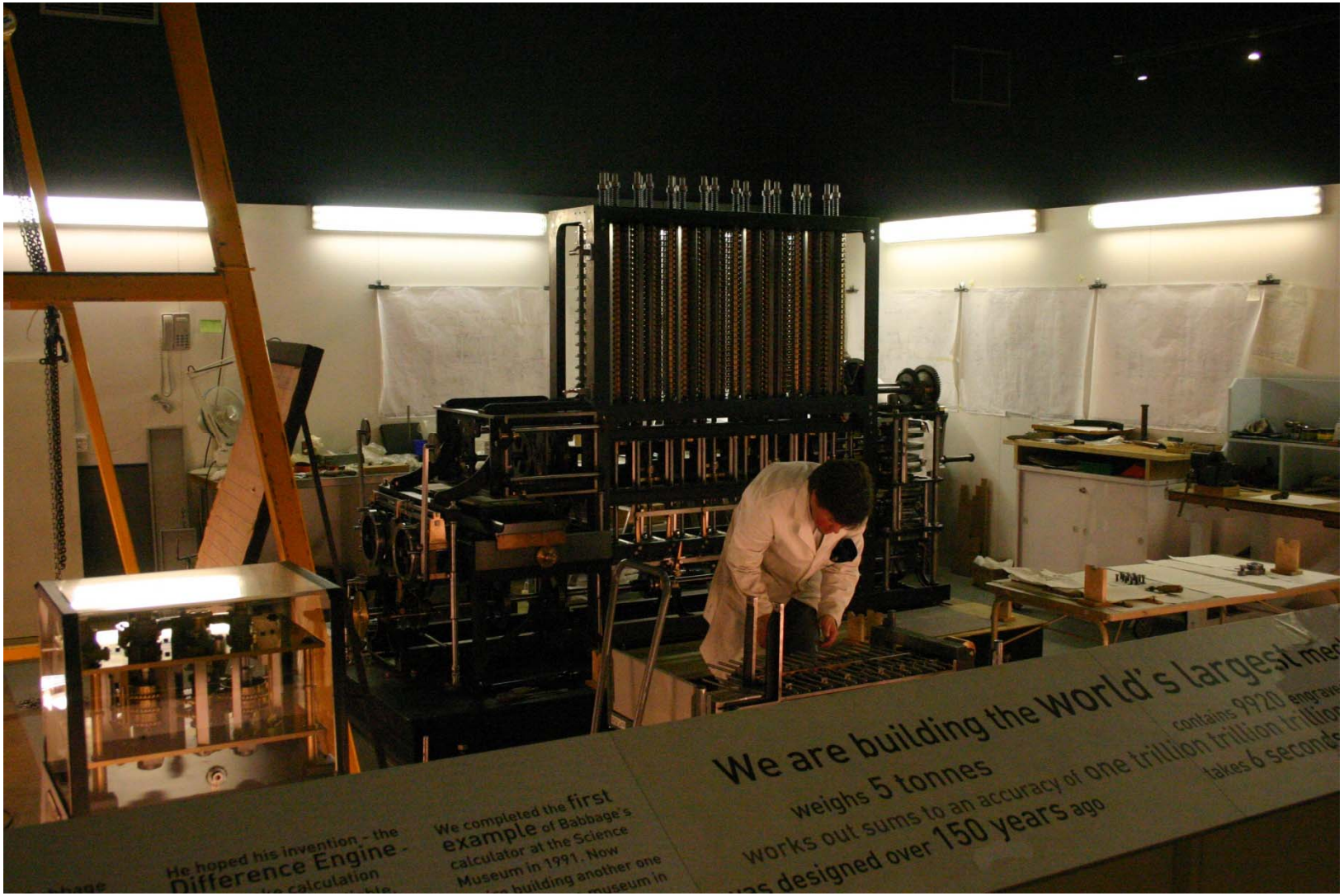




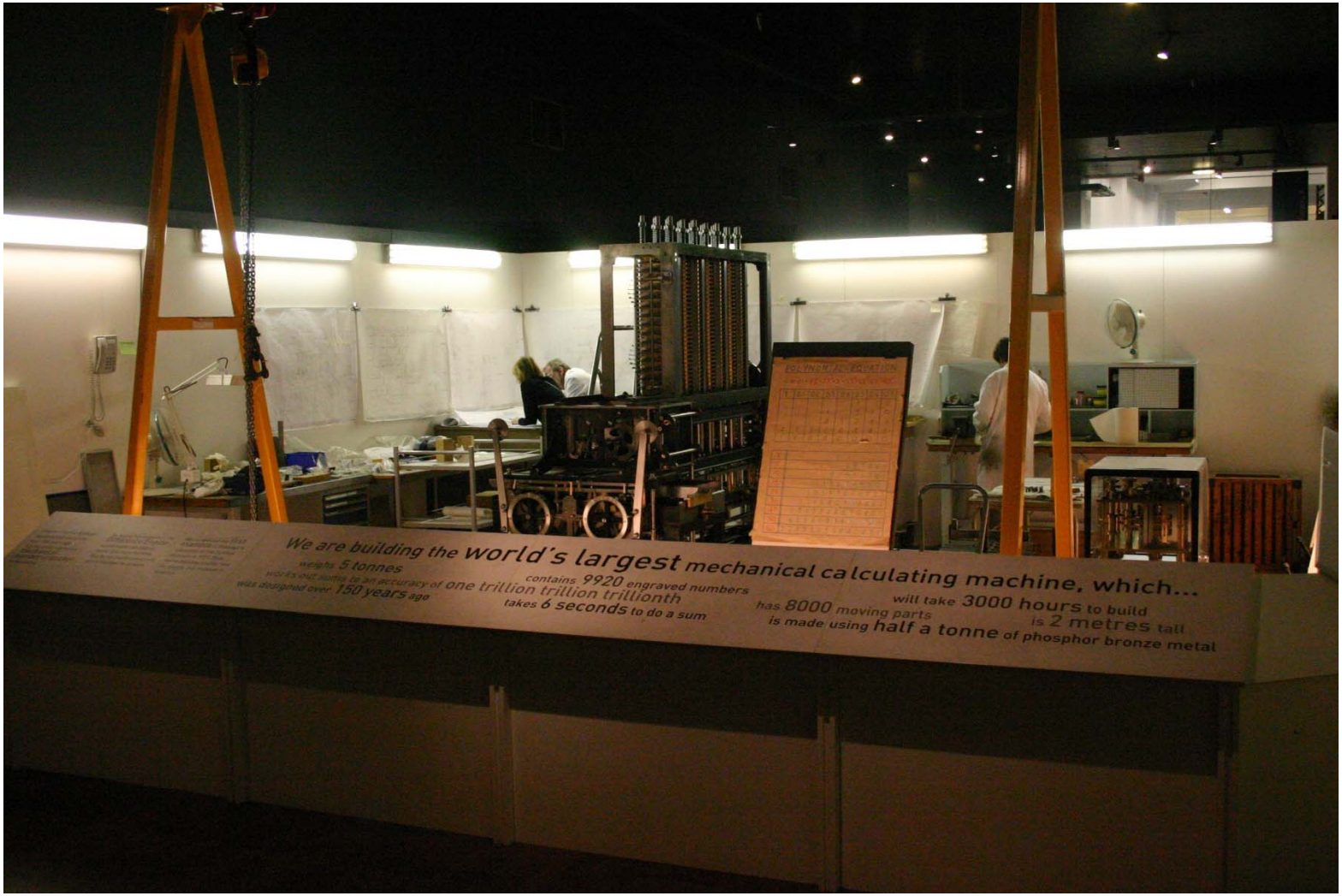
The Difference Engine



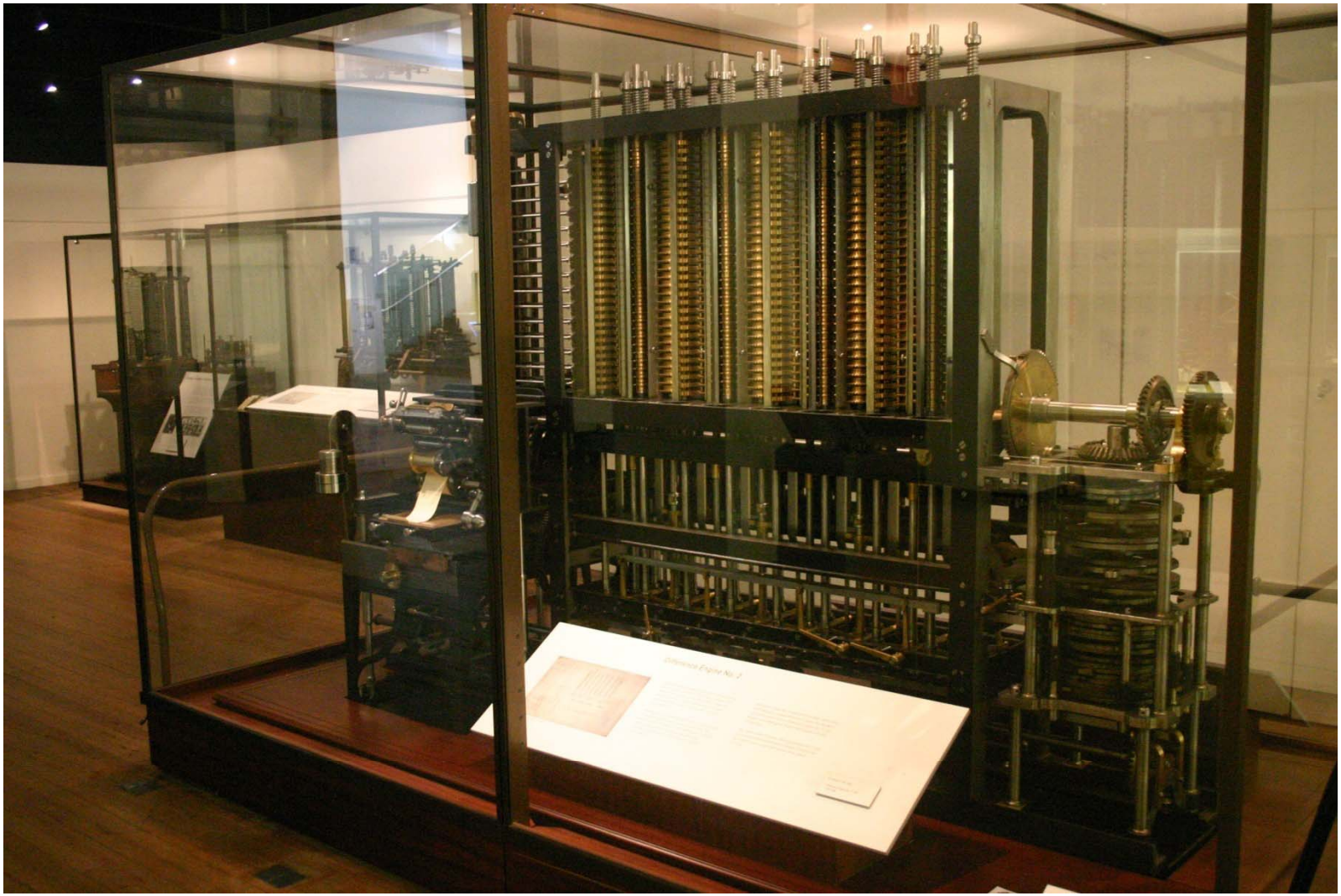
The Analytical Engine



The Analytical Engine



The Analytical Engine

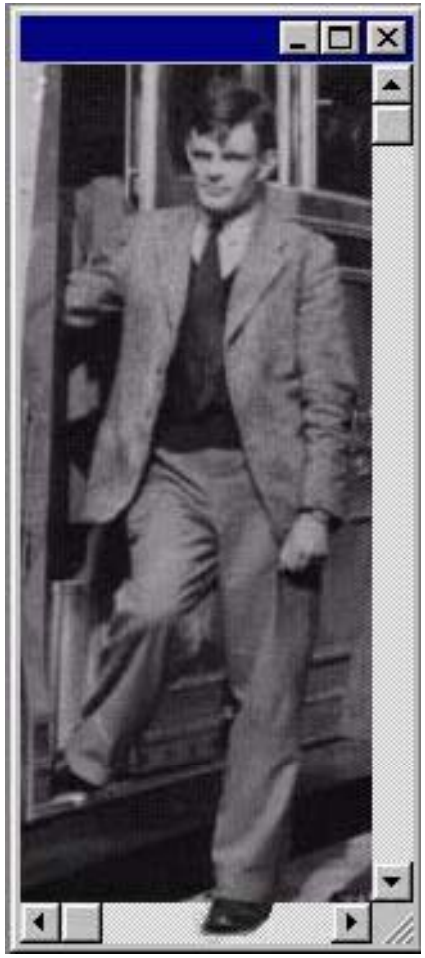


Automating the Processes

- 1940 – electronics had reached a stage where the mechanical structures of the analytical engine could be replaced.
  - A machine could be built which:
    - Encodes data
    - Stores data
    - Transmits data
    - Reads data
    - Manipulates data – *subject to a set of rules..*

Turing

- 1936 – Alan Turing conceives a “universal machine”
  - This machine can be programmed to duplicate the function of any other machine.



ENIAC

- 1947 – US Patent filed for ENIAC:

"…With the advent of everyday use of elaborate calculations, speed has become paramount to such a high degree that there is no machine on the market today capable of satisfying the full demand of modern computational methods. The most advanced machines have greatly reduced the time required for arriving at solutions to problems which might have required months or days by older procedures. This advance, however, is not adequate for many problems encountered in modern scientific work and the present invention is intended to reduce to seconds such lengthy computations..."

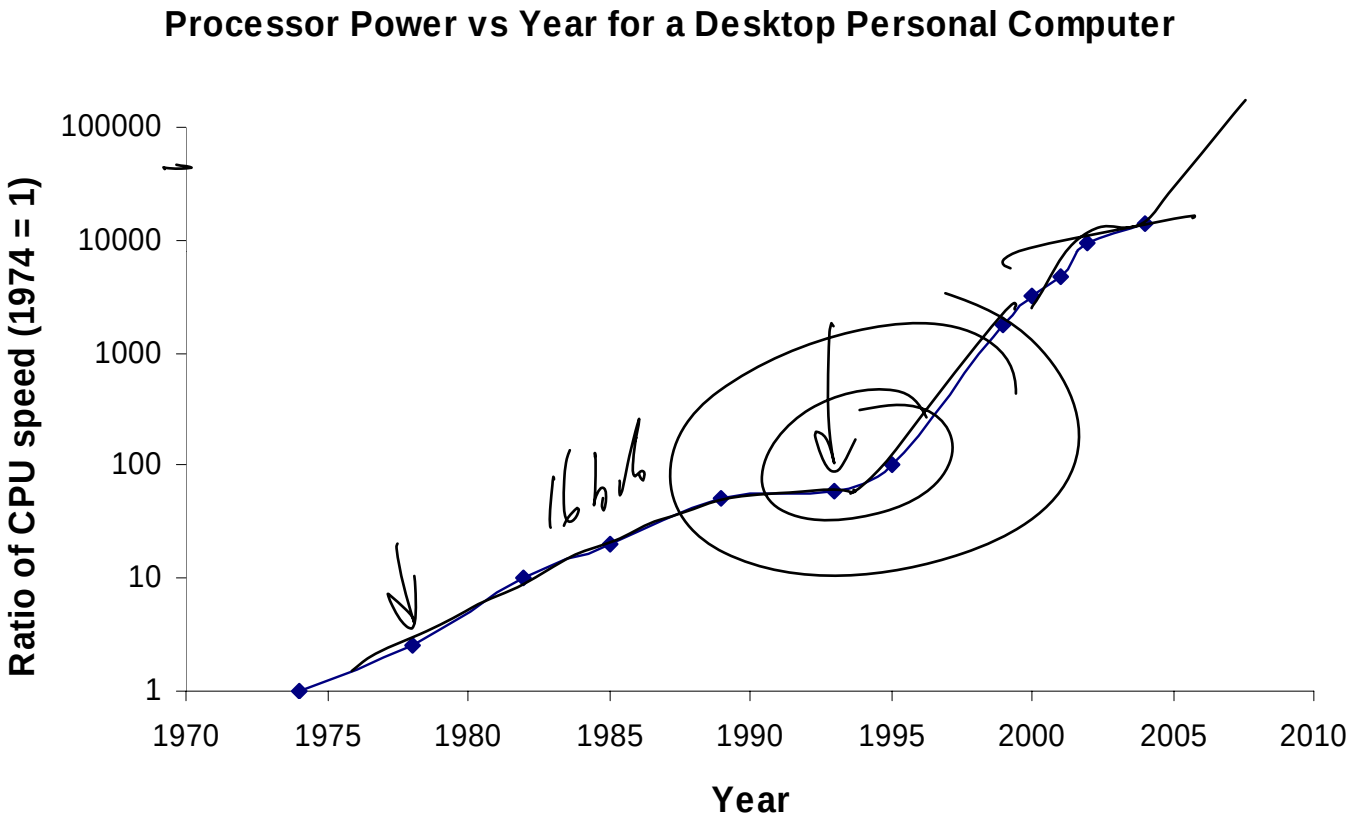
ENIAC

- Created in February 1946
  - 5000 adds, 300 multiplies per second (compare a modern microprocessor at approximately 1 billion adds per second)
  - Programmable
  - 200 bytes (equivalent)
- Turned off in October 1955
  - By this time it is estimated that it had completed more arithmetic computations than had been done by the entire human race up to 1946!

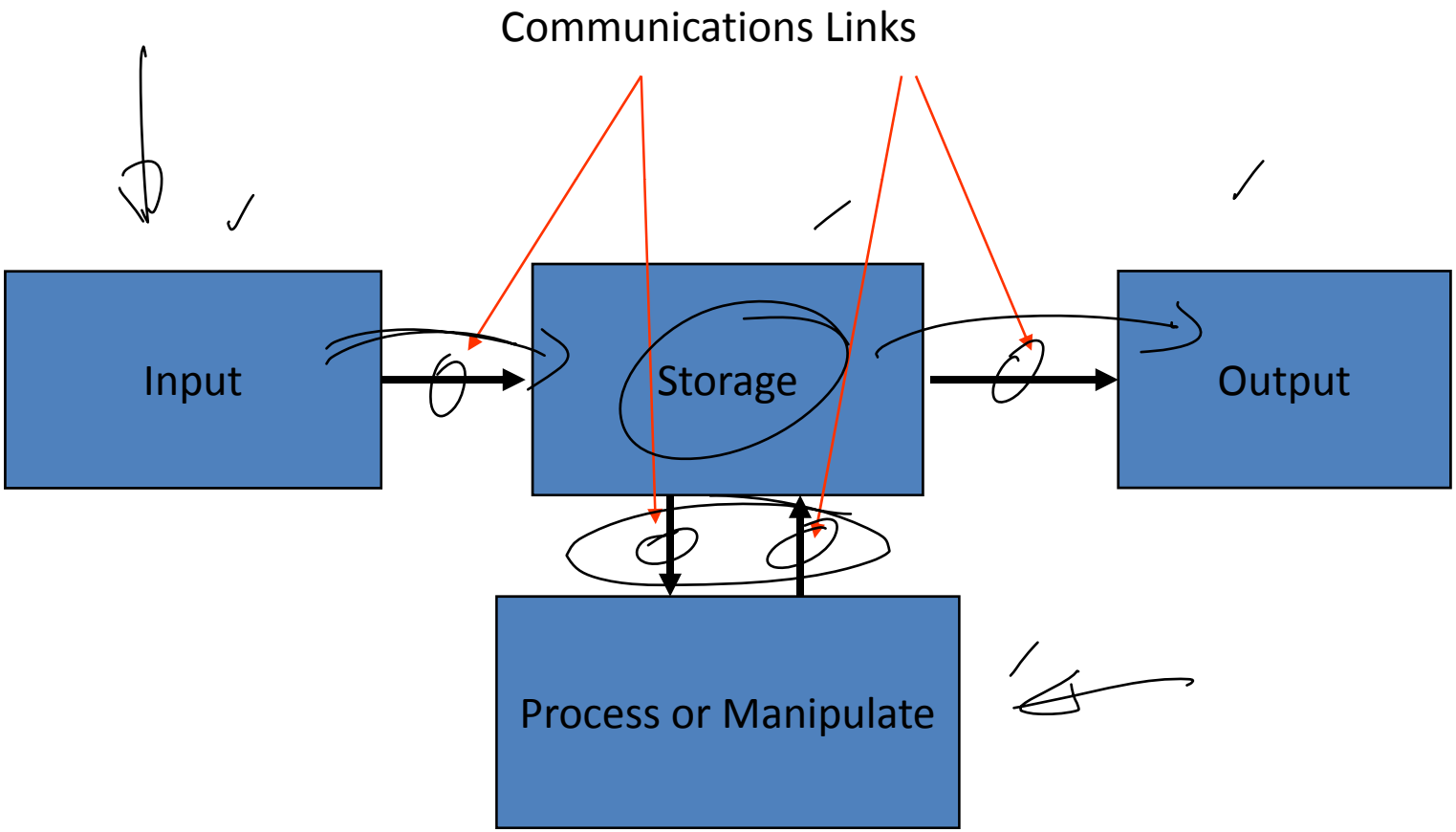
The MicroProcessor

- 1971
  - Intel produces the 4004
    - 4 bit cpu
    - 2 kbits of ROM
    - 320 bit RAM
- 1974
  - the 8080
    - 2 MHz processor
    - ~~16 bit~~ address, 8 bit data
    - Up to 64 kbytes of RAM

Processor Power

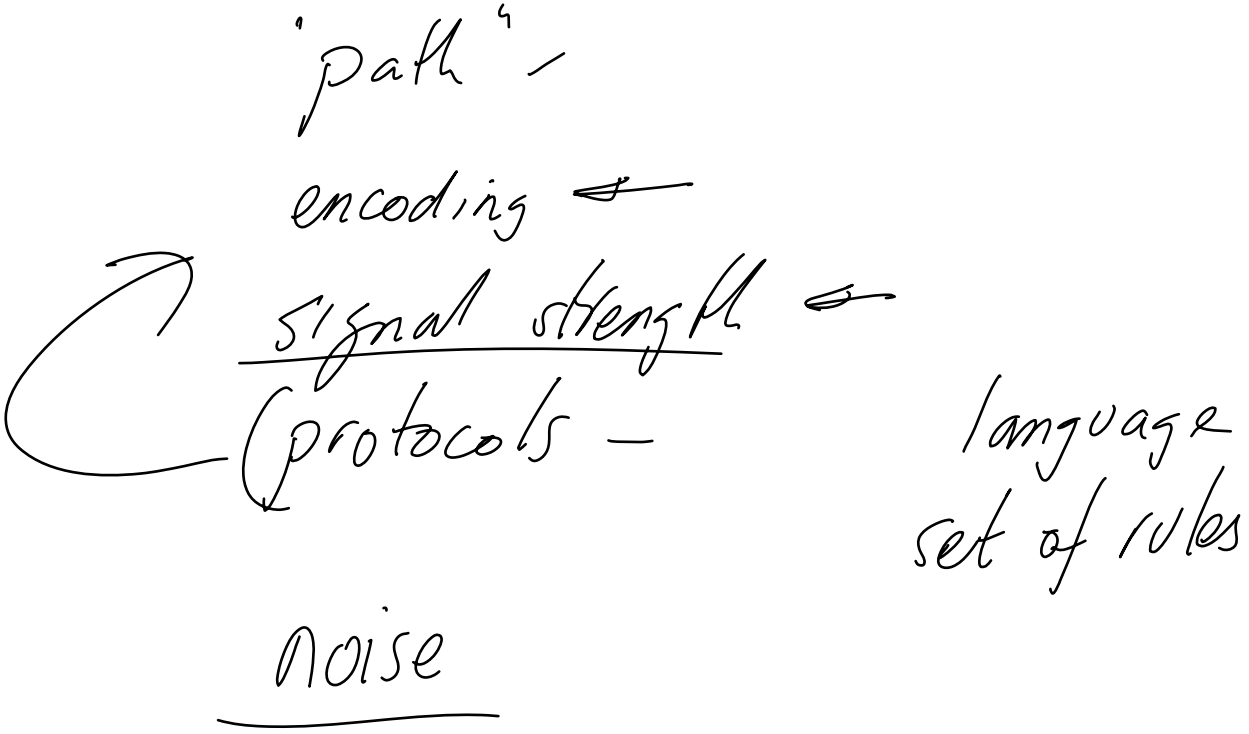


Data Flow


Communications Links
Input
Storage
Output
Process or Manipulate

How Is Information Transferred?

- What are the requirements?

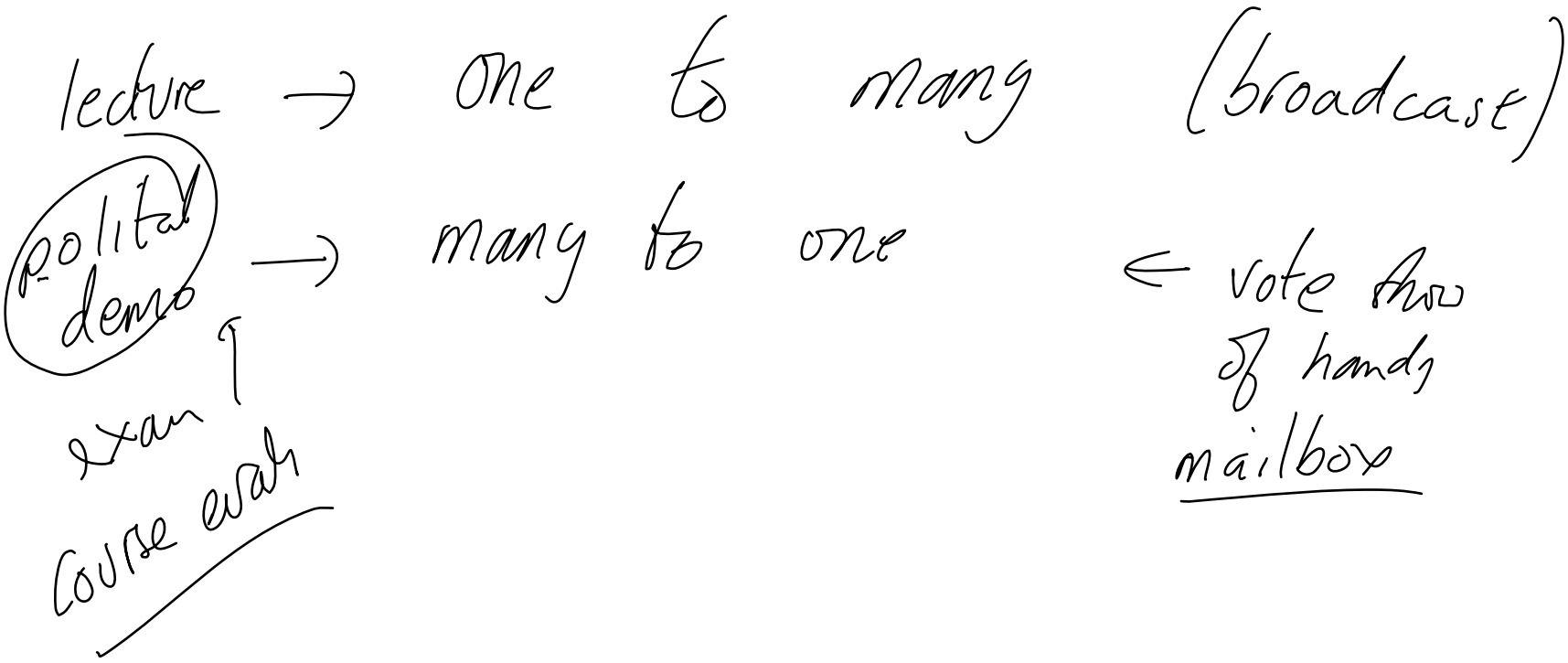


How Is Information Transferred?

- What are the requirements?
  - Minimize errors
  - Identify and correct errors
  - Minimize time
  - Low “cost”

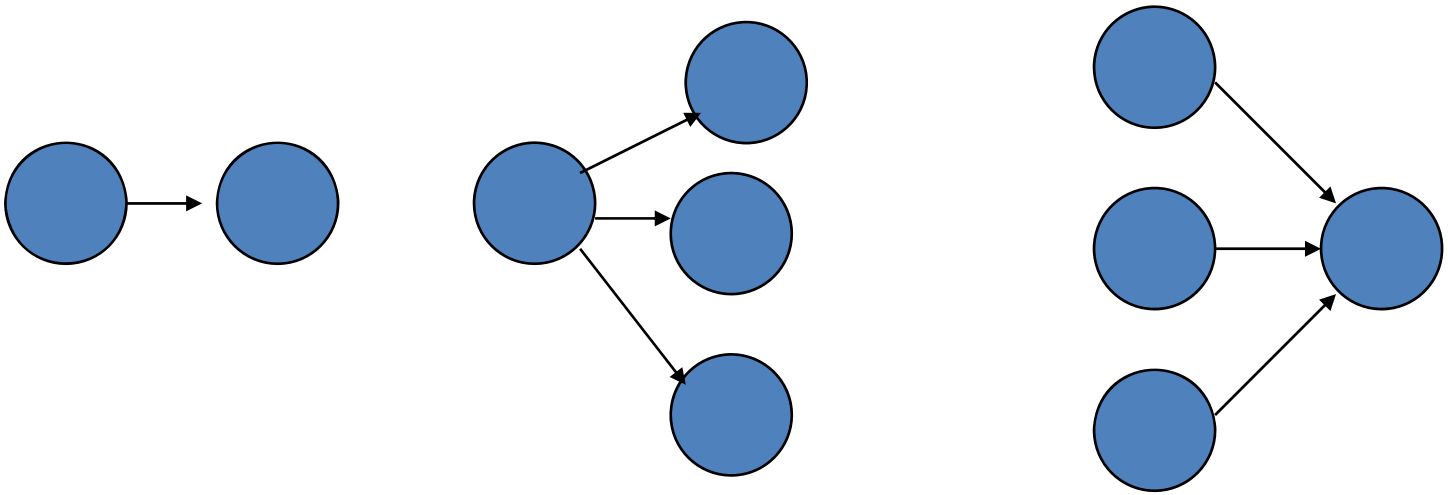
How Is Information Transferred?

- Communications modes?



How Is Information Transferred?

- Communications modes?
  - One to One
  - One to Many
  - Many to One



One-way or two-way?

One-to-one Reliable Communications

- How do we do it?

One-to-one Reliable Communications

- How do we do it?
  - How do we communicate using sound?
  - What other communications methods (non-electronics) do we use?
  - Is there anything common to all the methods?