Historical Introduction

September 3, 2020

Early History

- Runners
  - Egypt, 2000 BC
  - Marathon-Athens, 490 BC
- Calling posts
  - Persia, 400 BC
  - Germany, 1796
- Mirrors
  - Greece, 400 BC
  - Arizona, US Army, 1886

Long Distance Communication Methods

Method	First Recorded Use	Last Recorded Use
Pigeons	Egypt 2900 BC	California 1981 AD
Runners/Carriers	Egypt 1928 BC	Pony Express 1860 AD
Beacons/Torches	Troy 1184 BC	England 1588 AD
Calling Posts	Persia 400 BC	Germany 1796 AD
Heliographs	Greece 400 BC	Arizona 1886 AD
Flags	Greece 400 BC	Maritime Use Today

Aeschylus' Line of Beacons

Location	Modern Name	Altitude (m)	Distance (km)
Troy	Troy	100	0
Mt Ida	Kaz Dagi	1774	55
Lemnos	Skopia at Lemnos	420	154
Mt Athos	Athos	2033	70
Macistus	Kastillion (Euboea)	1209	177
Messapius	Ktipas	1020	30
Cithaeron	Elatias	1410	25
Mt Aegiplanetus	Mt Jeraneia	1370	30
Aragnean Hgt	Arna	1199	50
Mycenae	Mycenae	150	20

More Early Examples

- Horses
  - Romans, 100 AD, 80 km/day
  - Mongols, 1100 AD, 160 km/day
  - Pony Express, 1860, 320 km/day
- Pigeons
  - Eygpt, 3000 BC
  - England, WWI, 380 pigeoneers, 20,000 pigeons
  - California, 1981, sending microfilm 40 km between plant and test site

Still More Examples and Methods

- Fire Beacons
  - Greece, the fall of Troy (1180 BC)
  - North American indians, 19th century
- Flags/Semaphores
  - Greece, 400 BC
  - Naval and general maritime use today
- Light Flashing
  - Babbage, 1851
  - Naval and general maritime use today

Other Methods: Pigeons

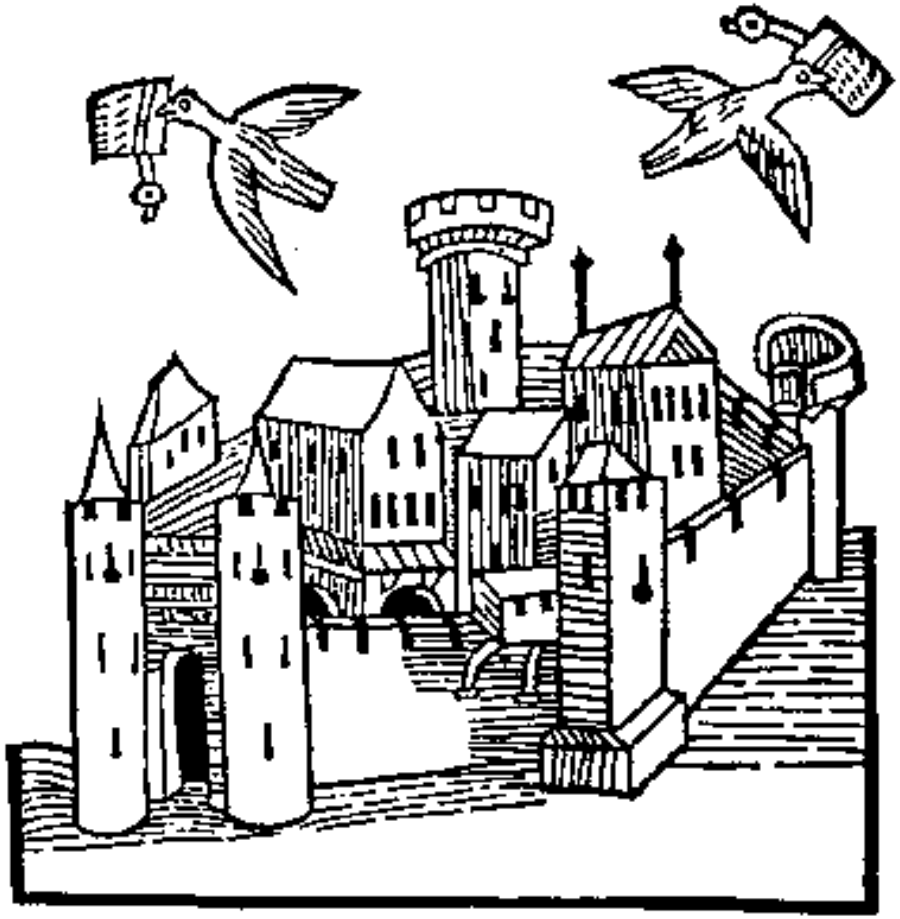


Figure 1.1 Pigeon Post, Woodcut from A.D. 1481.
(Coll. Bibl. de Genève, [Febre 1963], p. 44)

Other Methods: Fire Beacons

Other Methods: Sound

- Sound (e.g., church bells)

Other Methods: Light

- Heliographs

Other Methods: Smoke

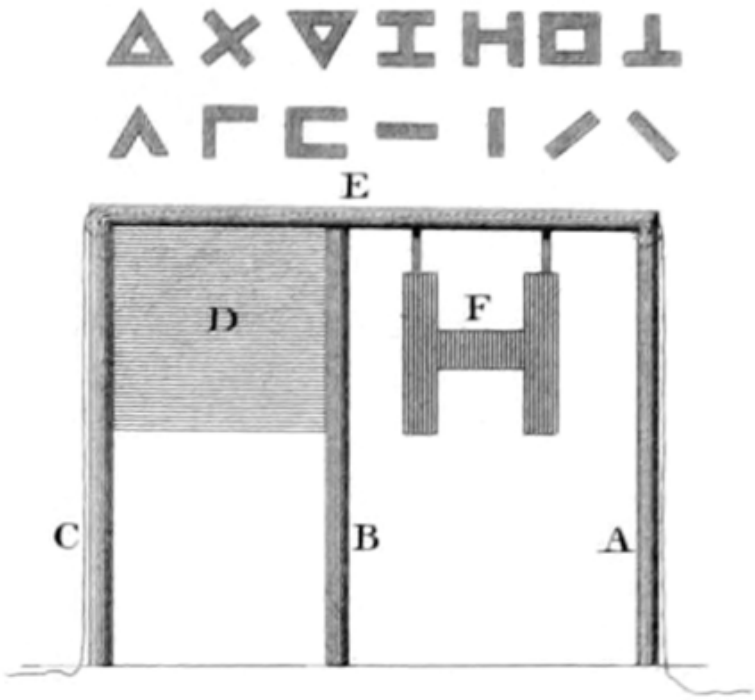
- Used by American Natives and elsewhere

Other Methods: Magic

- There was a kind of mystique about message transmission.
  - Magic needles (people believed that if two needles were touched by same lodestone would always move parallel to each other!)
  - The ruthless French prime minister Richelieu was believed to have a set of needles because he was always so well-informed!

Hooke's Semaphore

- Various symbols that might be used are indicated at the top;

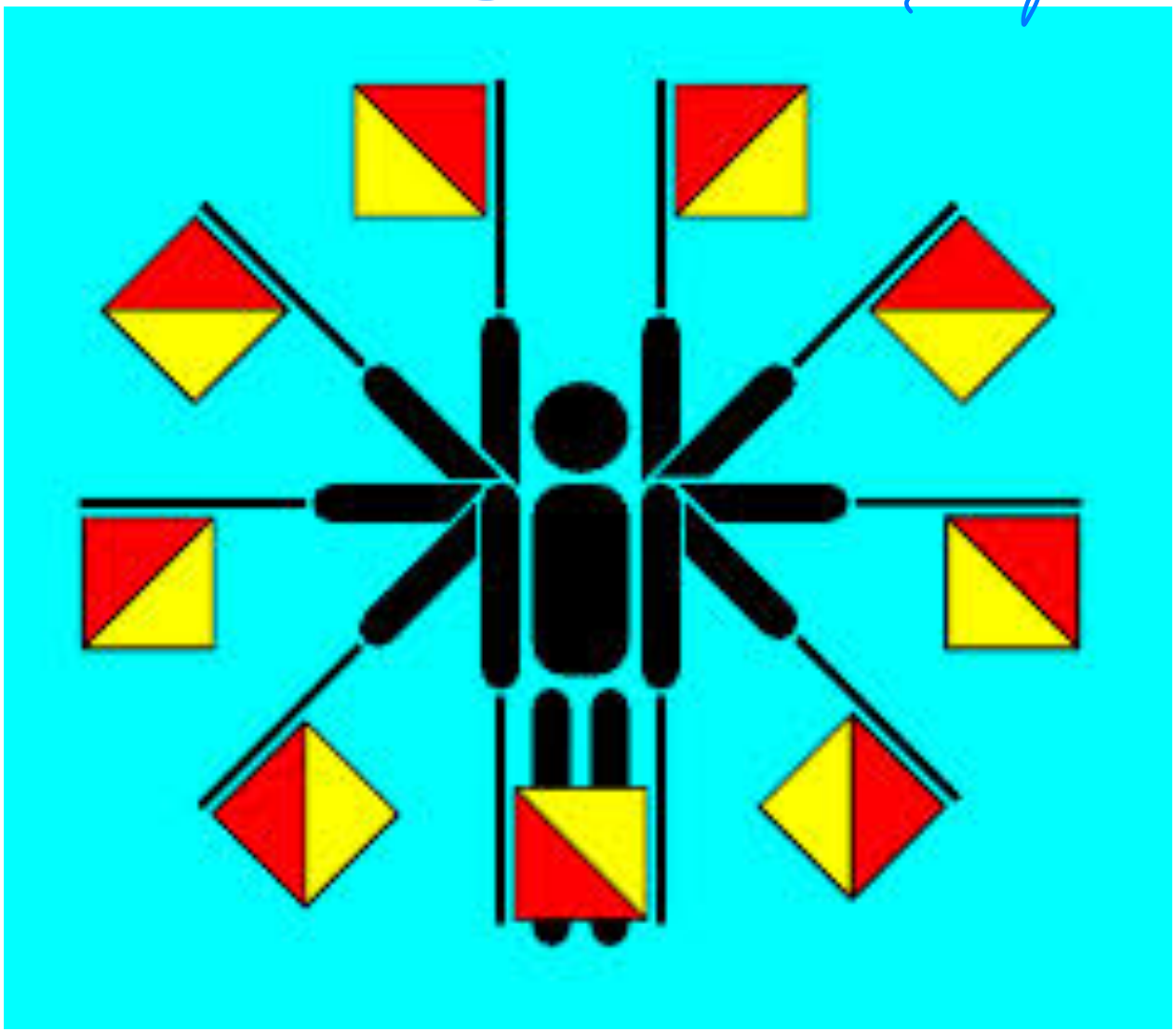


- ABCE indicates the frame.
- D indicates the screen behind which each of the symbols are hidden when not in use.

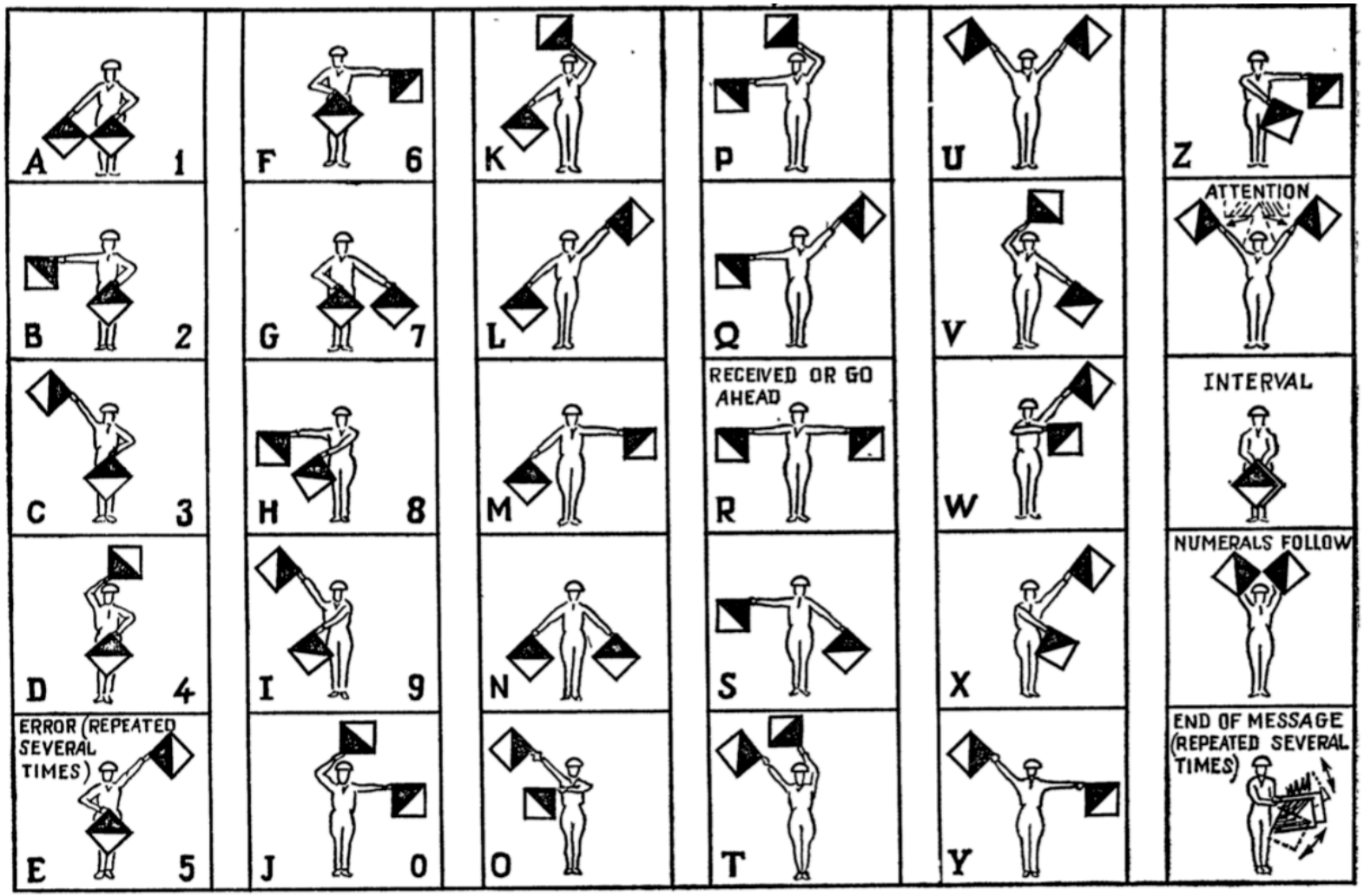
Greek

Semaphores

flag carriers

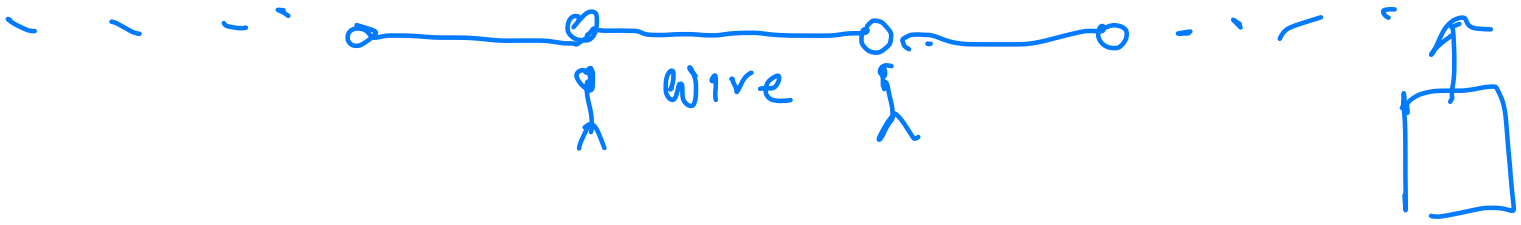


Semaphores: Alphabet



Electrical Networks

- They wanted to know if electricity can be used for transmission.
  - In April 1746 about 200 monks of the Carthusian Convent in Paris were arranged in a snake-like line
  - Each monk held one end of a 25 feet long iron wire.
  - The abbe (and noted scientist) Jean-Antoine Noilet connected a primitive electrical battery at one end and gave them all a powerful electrical schock!
- The experiment showed that electricity could be transported.



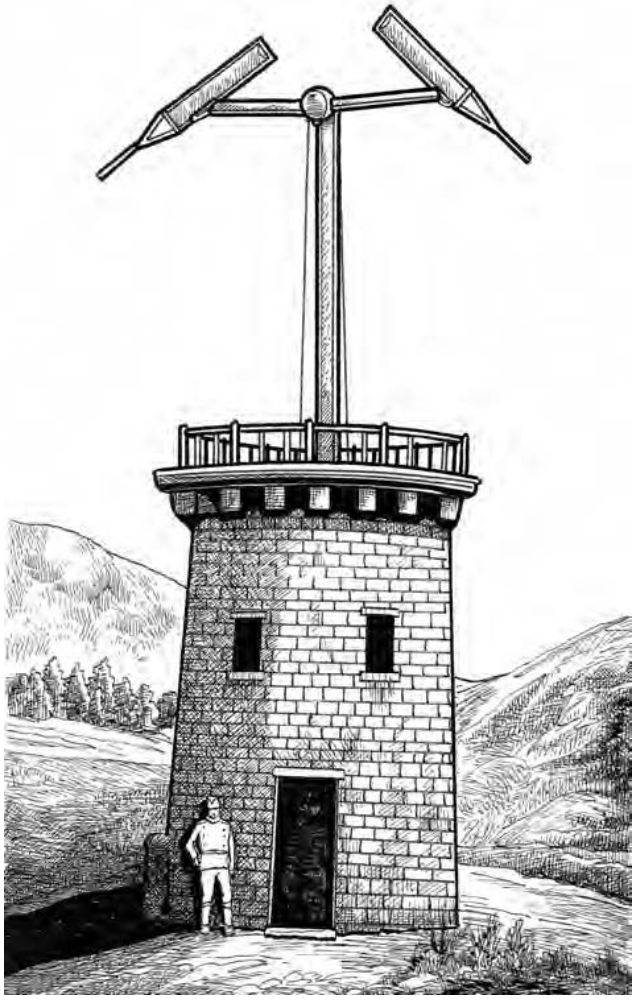
Electrical Networks

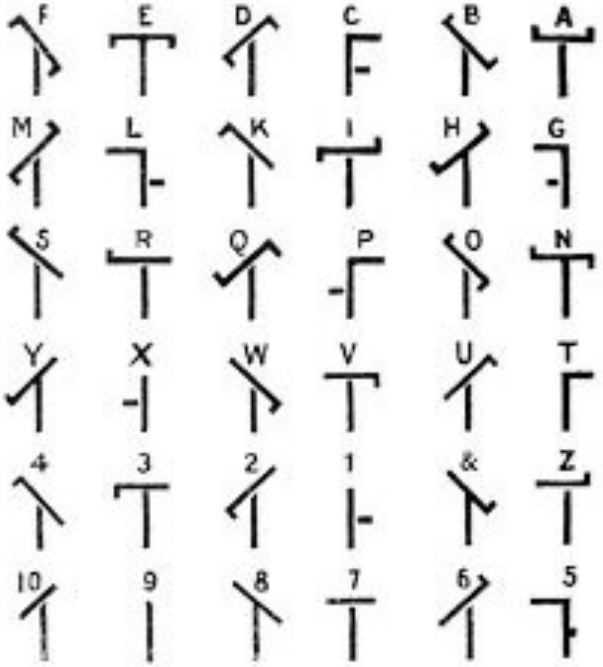
Electrical Networks

Important Pre-Telegraph Examples: France

- France - Claude Chappe, 1791
  - Semaphore system
  - Largest reach: Paris to Milan (720 Km)
  - 2 symbols/min; 92 symbols; about .5 bits/sec

Chappe Network





Important Pre-Telegraph Examples: Sweden

- Sweden - Abraham Edelcrantz, 1794
  - 10 shutters, open or closed, 1024 symbols
  - In 1801, connected to Danish network to form first internet
  - 1805, 50 stations, 720 people

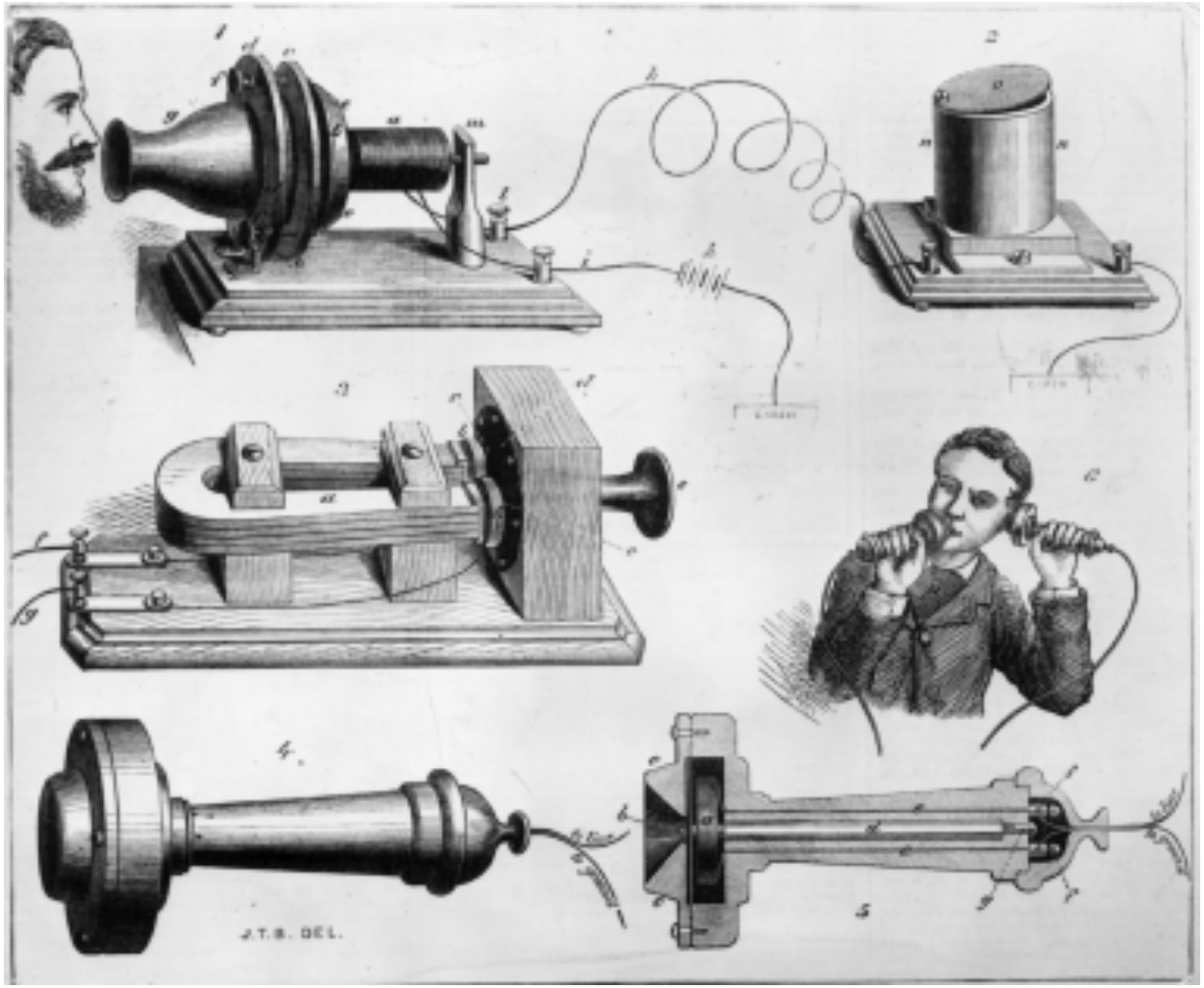
Edelcrantz Network

Telegraph and Telephone

- Telegraph ("Far Writer") developed in early 1800's
- Most successful version due to Samuel Morse
- Led to developments in codes, eventually information theory
- Reached speeds of 1-2 characters/sec or about 10 bits/sec
- Telephone developed in 1876 by Alexander Graham Bell

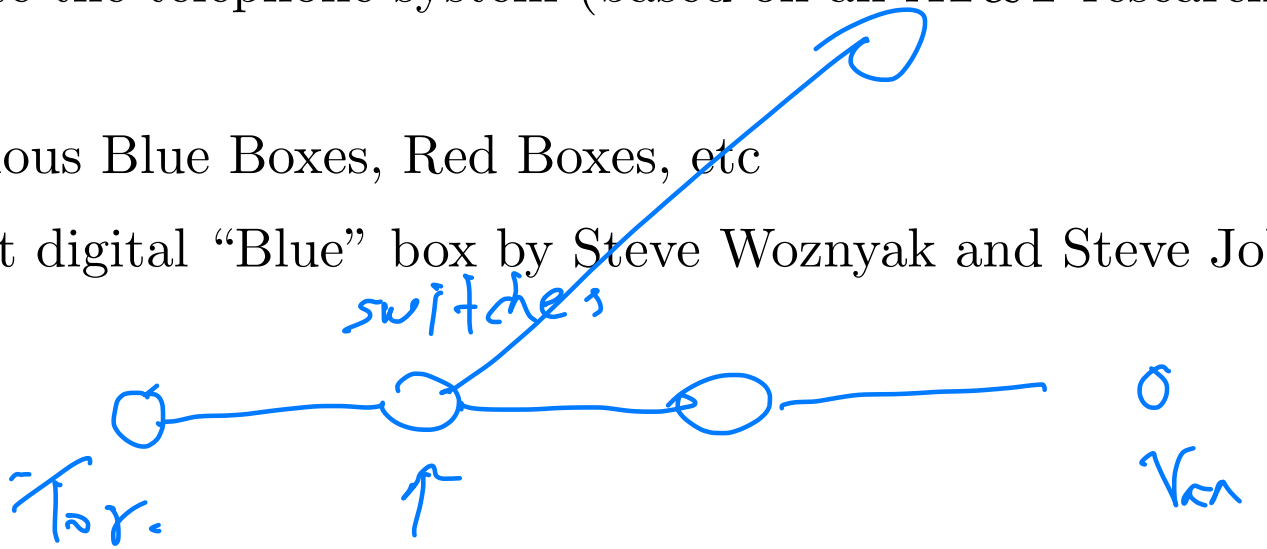
Morse Telegraph

Alexander Graham Bell Telephone



Telephone Phreaks and Hackers

- Phone phreaks in the 60s scanning for interesting toll-free numbers.
  - Calling the White House (Direct line to President Nixon)
  - Calling CIA and NORAD security lines
  - Doing free teleconferences and phone calls
- Development of boxes taking advantage of 2,600 Hz lines to inflitrate the telephone system (based on an AT&T research article)
  - Various Blue Boxes, Red Boxes, etc
  - First digital "Blue" box by Steve Woznyak and Steve Jobs.



Article on Technical Specs


THE BELL SYSTEM

Technical Journal

- A. Weaver, N. A. Newell, In-Band Single-Frequency Signaling, Nov. 1954, Bell System Technical Journal.

Blue Boxes on Sale

Invention	Year
Runners	-2000
Calling Posts	-400
Mirrors	-400
Horses	100
Pigeons	-3000
Fire Beacons	-1200
Semaphores	-400
Electrical Networks	1746
Semaphore Networks	1791
Morse Code	1832
Telephone	1876

Internet

- ARPANET (US Army, Advanced Research Project Agency)
- ETHERNET (Xerox PARC, Palo Alto. Developed by Metcalfe)
- NSFNET (Network for the US National Science Foundation)

ARPANET	1969
ETHERNET	1982
NSFNET	1987
MOSAIC	1991

Exercises[a]

1. Would the internet revolution have happened without the need to satisfy military applications?
2. What are the key factors that influenced the development of the internet?
3. Give a heuristic discussion to estimate the speed of transmission through
   (a) fire beacons.
   (b) heliographs
4. Where are semaphores being used today?

[a] Do not submit!

Bibliography

- J. Abbate, "Inventing the Internet", MIT Press, 1999.
- G. J. Holzmann and B. Pehrson, "The Early History of Data Networks", IEEE Computer Society, 1995.
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