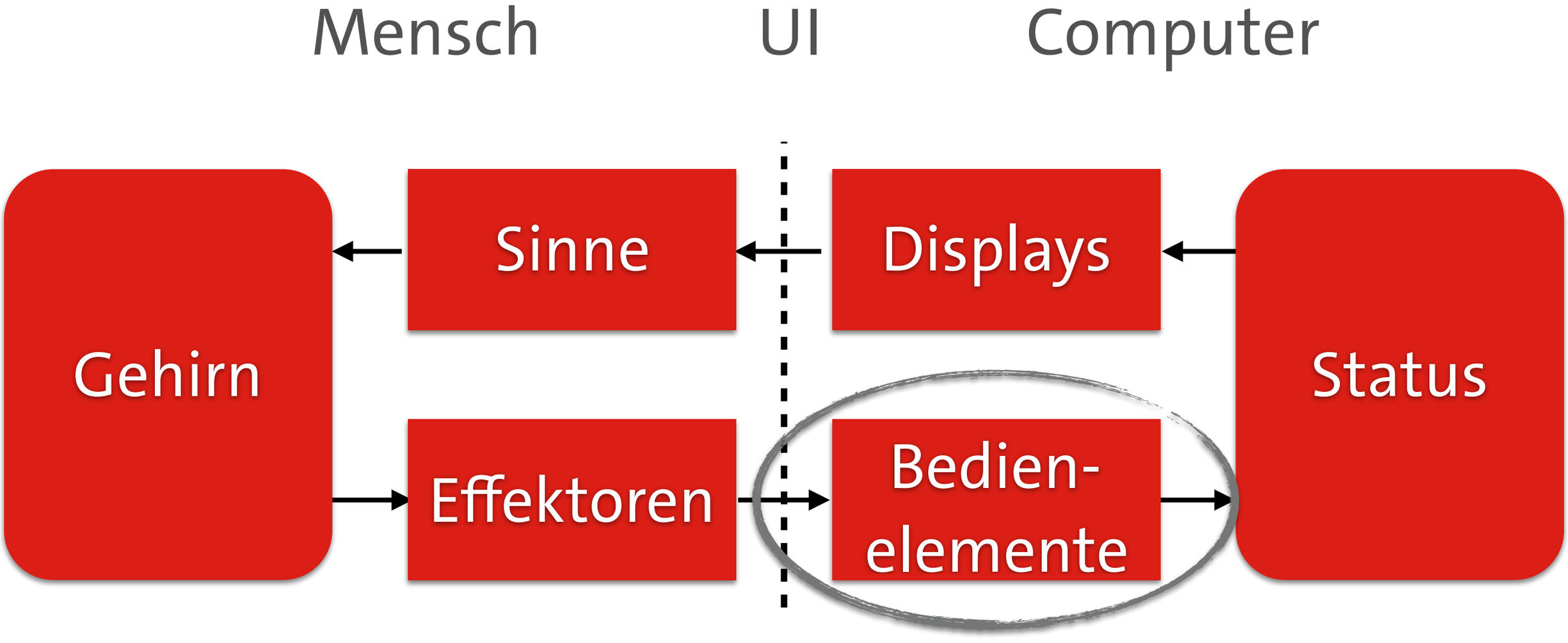
IKON 1

Prof. Dr. Frank Steinicke
Human-Computer Interaction
Fachbereich Informatik
Universität Hamburg

HCI


Mensch
UI
Computer
Gehirn
Sinne
Displays
Status
Effektoren
Bedien-
elemente

Mensch-Computer-Interaktion

Kapitel Historie

Prof. Dr. Frank Steinicke
Human-Computer Interaction, Universität Hamburg

Agenda

1. Generationen der Informatik
   - Hardware
   - Software
   - Mensch-Computer Interaktion
2. Klassische Eingabegeräte
   - Maus
   - Tastatur

Mensch-Computer-Interaktion

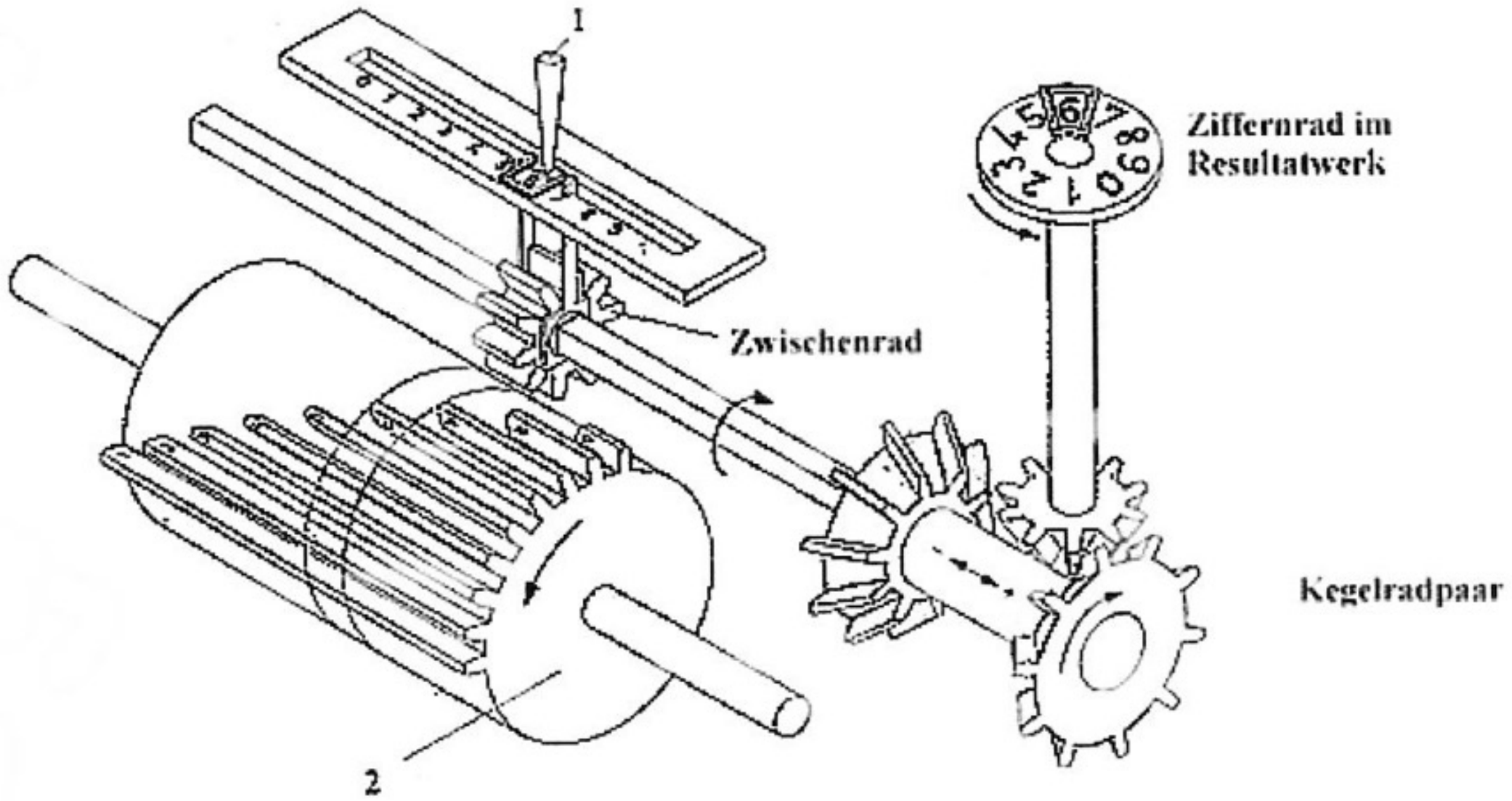
Historie

Generationen der Informatik

die Anfänge ...

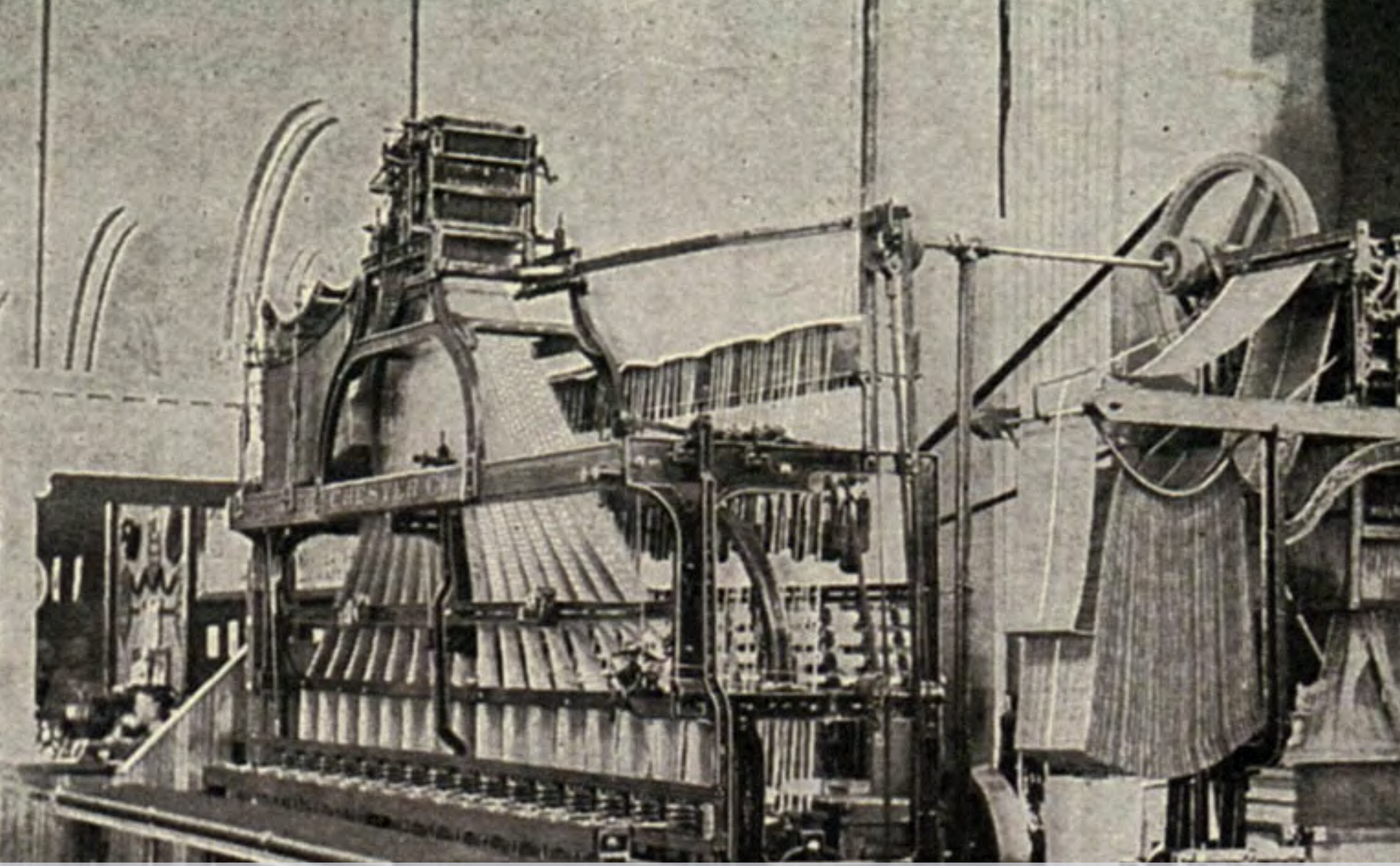
... Rechenautomaten

Das Staffelwalzenprinzip

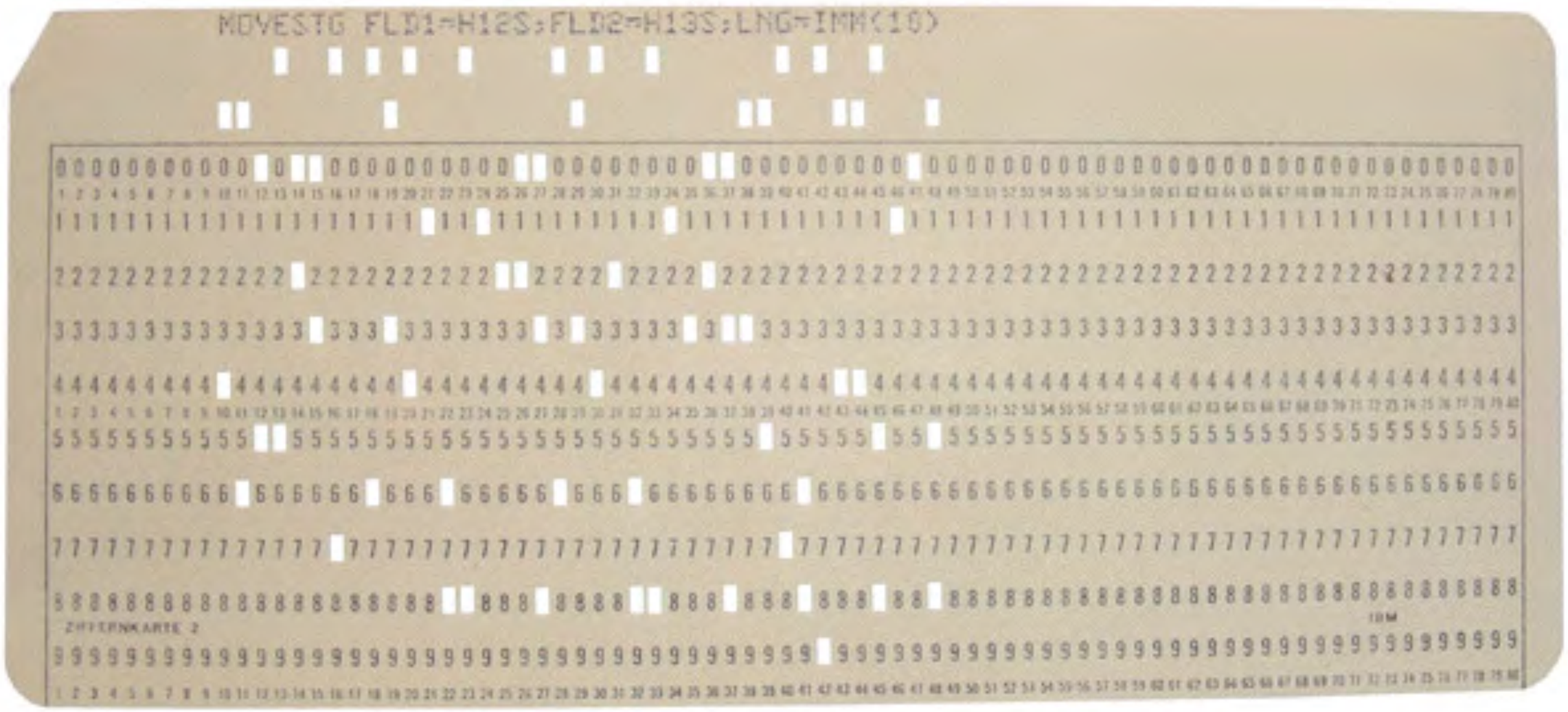


G.W. Leibniz: Mechanische Rechenmaschine, 1673

G.W. Leibniz: Mechanische Rechenmaschine, 1673



J.-M. Jacquard: Webstuhl, 1804



gestanzte IBM Lochkarte

Von Lochkarten lernen!

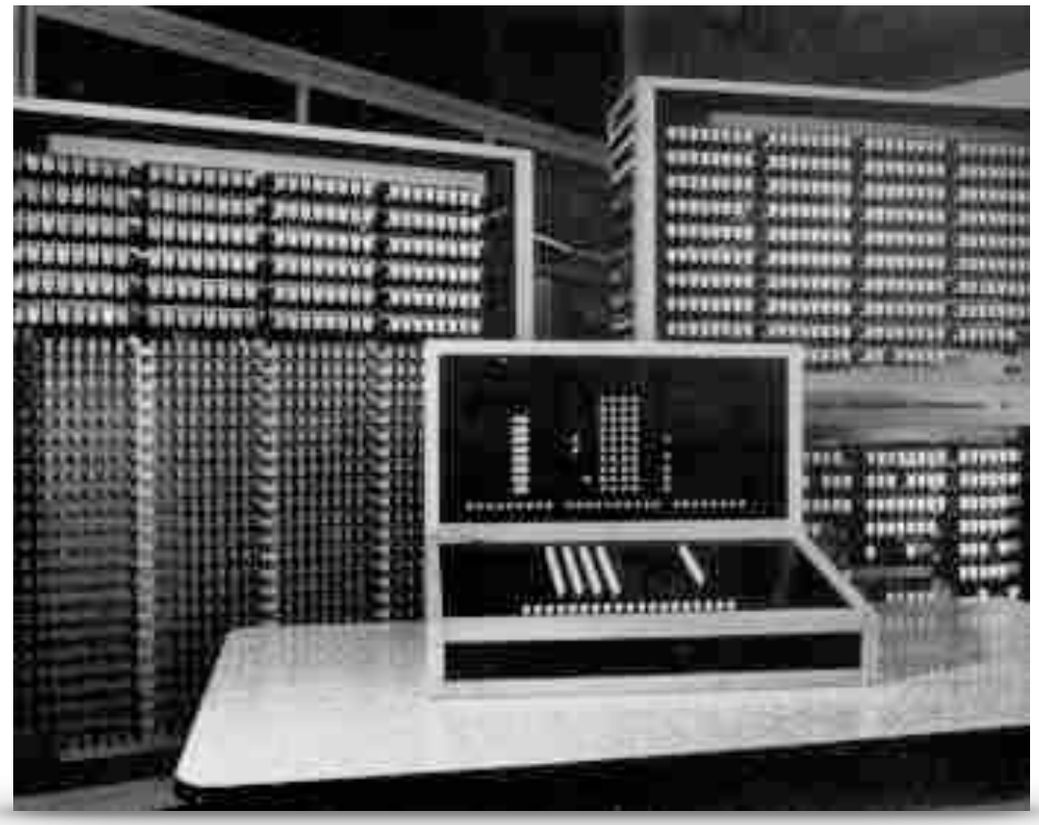
1. Kontrolle des Bewegungsablaufs einer Maschine
2. Bewegungsabläufe können variieren
3. Lochkarten können Punkt 1 und Punkt 2 realisieren
4. Maschinen können durch Befehle (codiert in Lochkarte) kontrolliert werden

Generationen der Informatik

#1 Hardware

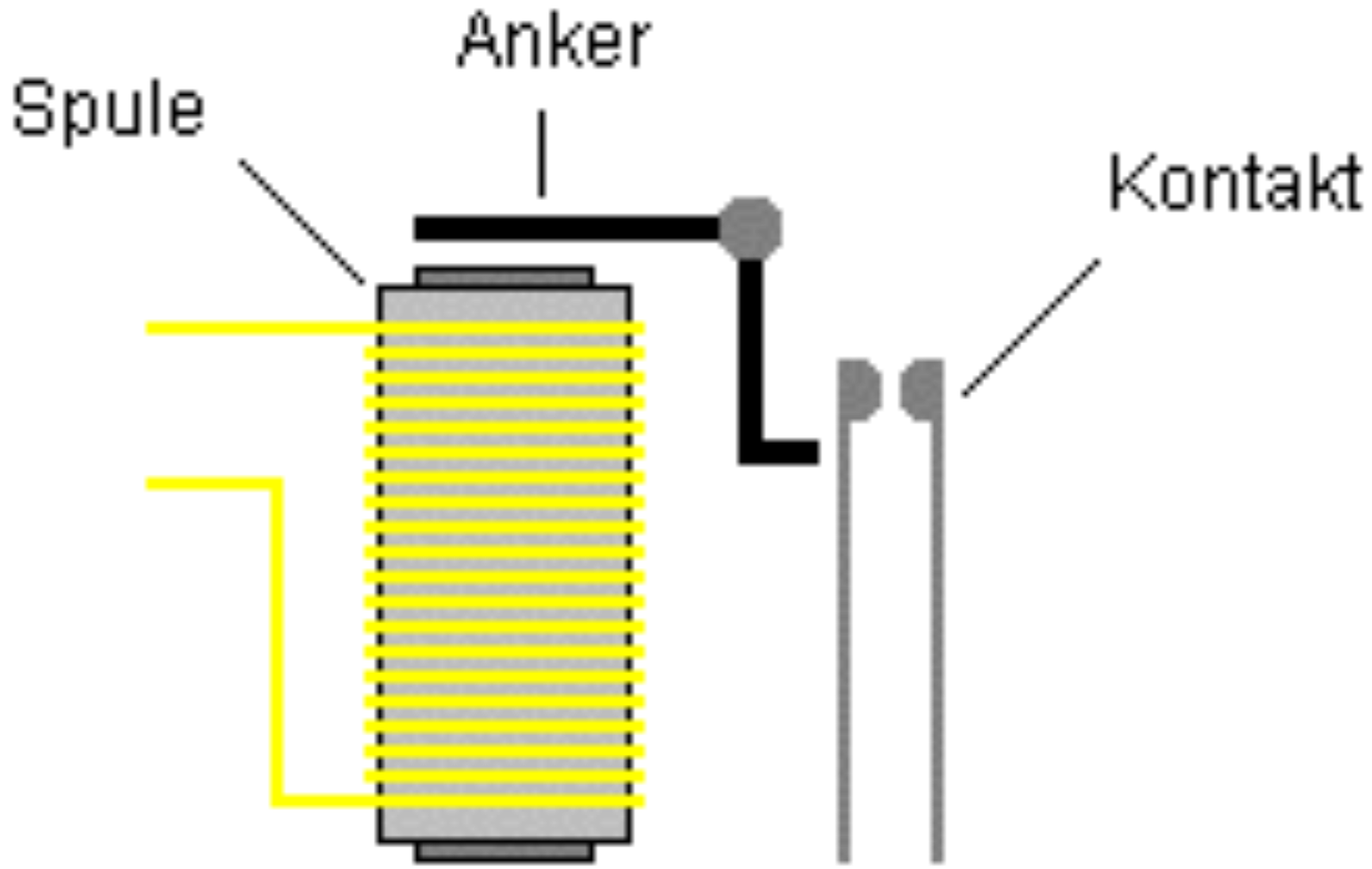
Zuse Z3 (1941)

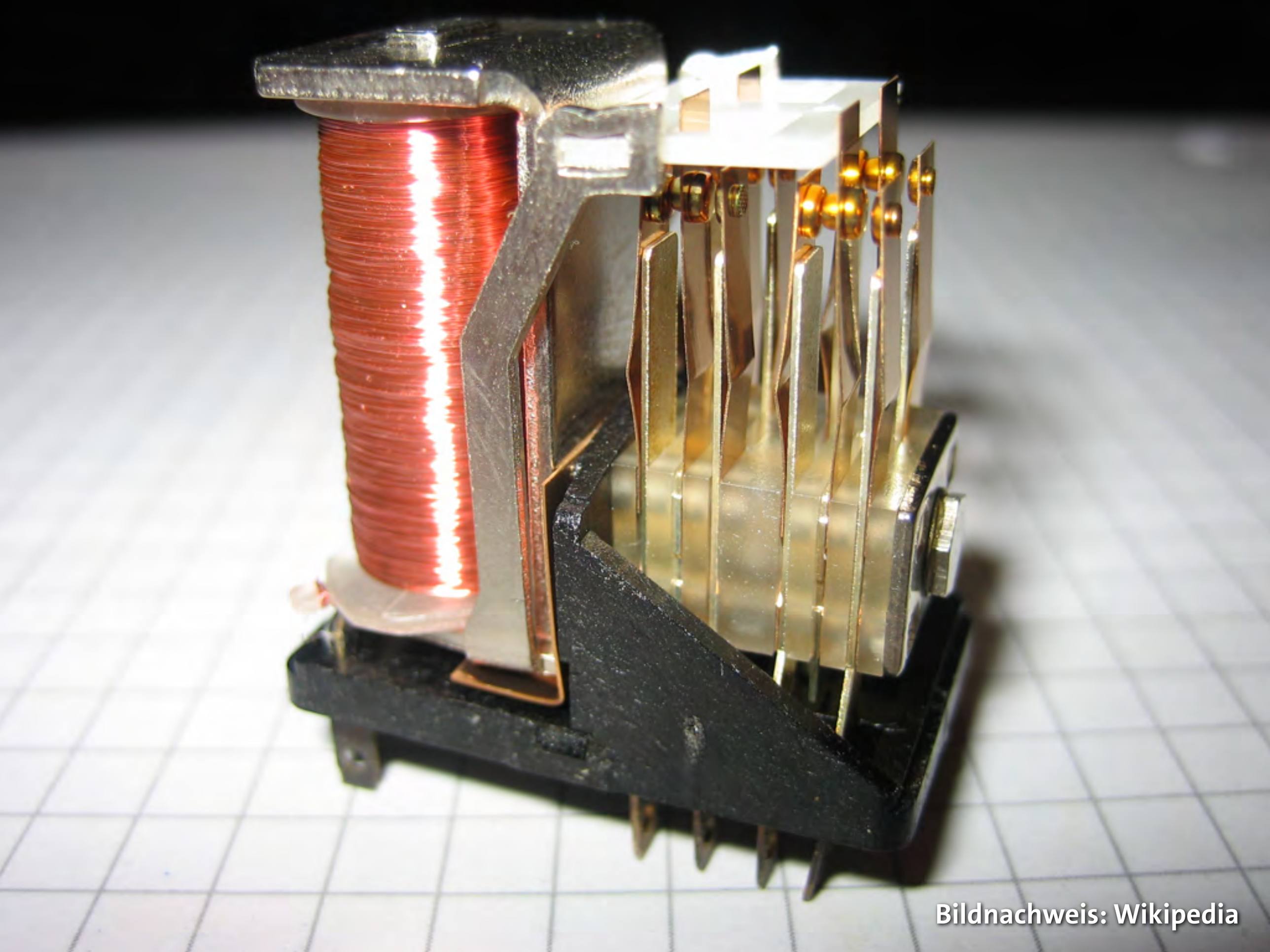
- Konrad Zuse stellt **Z3** in Berlin als ersten **programmgesteuerte Binärrechner** mit **Speicher** und **Zentralrecheneinheit** vor



Computertechnologie

Beispiel: Relais





Bildnachweis: Wikipedia

K. Zuse mit Z3 im Deutschen Museum, Berlin

Bildnachweis: Wikipedia

9/9

0800 Arctan started

1000 " stopped - arctan ✓ { 1.2700 9.037 847 025
9.037 846 ?95 correct

~~1.9826447000~~

13"UC (032) MP - MC ~~2.13047647 15 (-3)~~ 4.615925059(-2)

(033) PRO 2 2.13047 6415

correct 2.13067 6415

Relays 6-2 in 033 failed special speed test

In Relay " 11.00 test.

Relays changed

1100 Started Cosine Tape (Sine check)

1525 Started Mult + Adder Test.

1545 

Relay #70 Panel F
(moth) in relay.

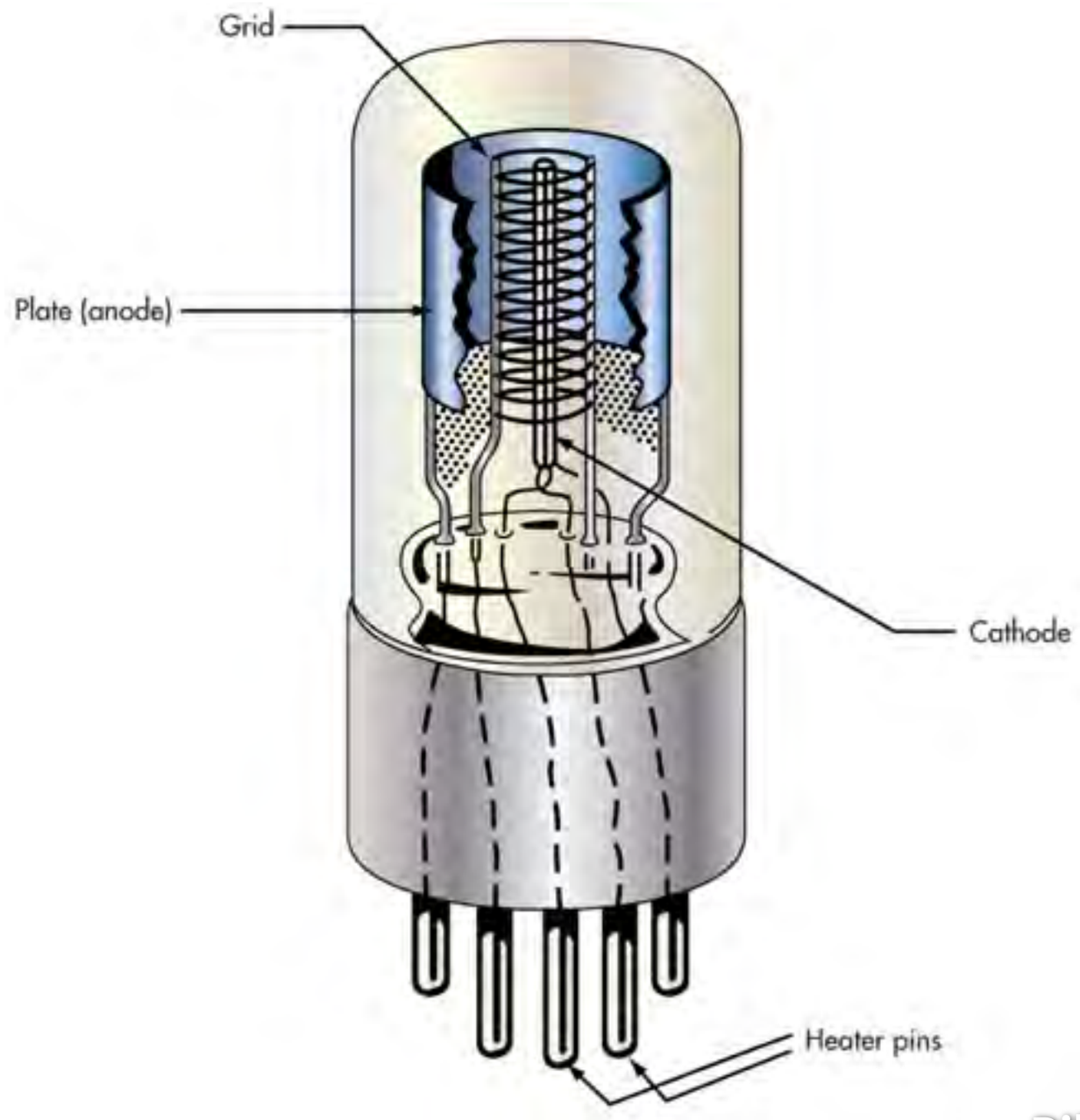
First actual case of bug being found.

1700 closed down.

Grace Hopper: “First actual case of bug being found.”, 1945

Computertechnologie

Beispiel: Vakuumröhren

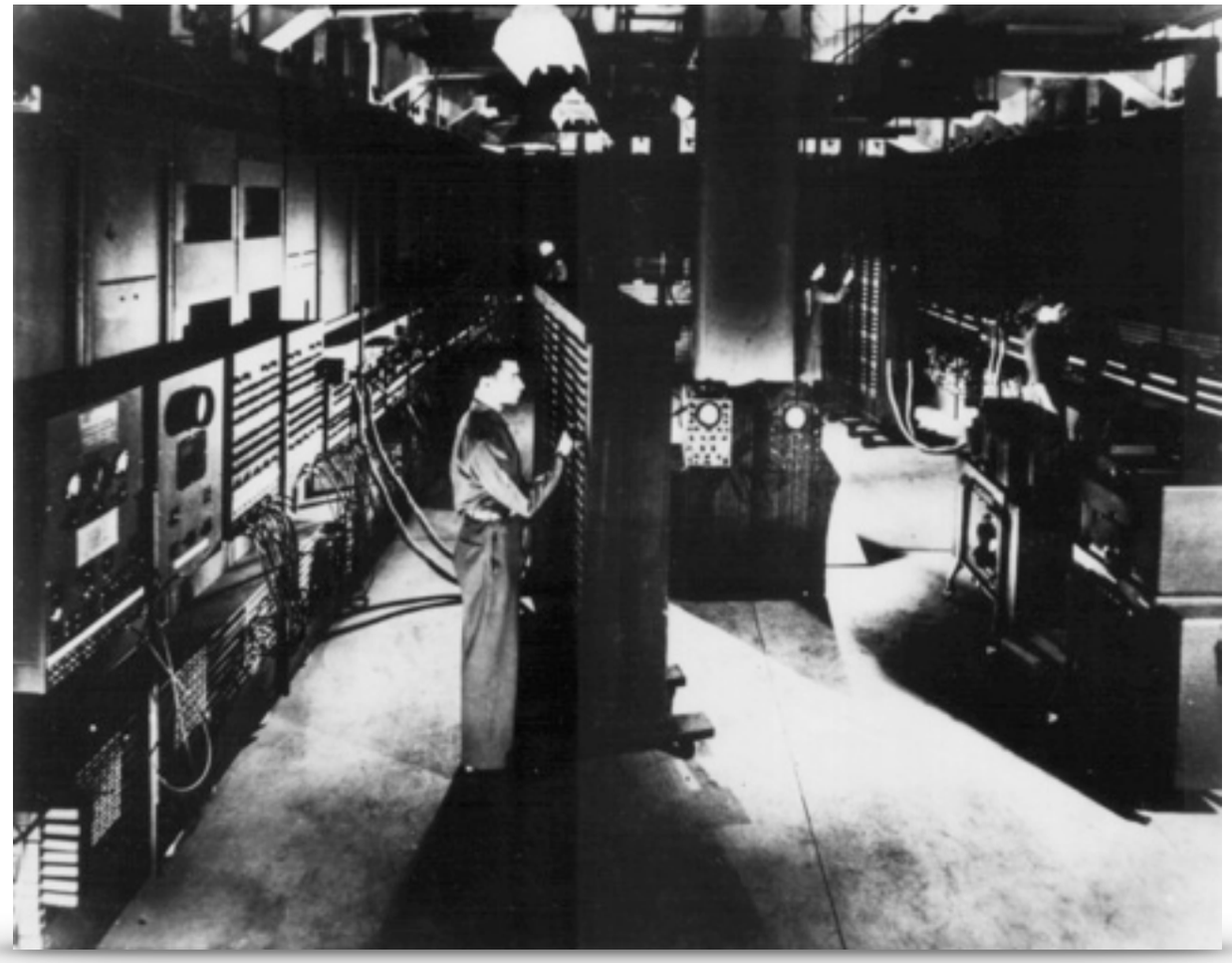


Bildnachweis: Wikipedia

Bildnachweis: Wikipedia

ENIAC (1942)

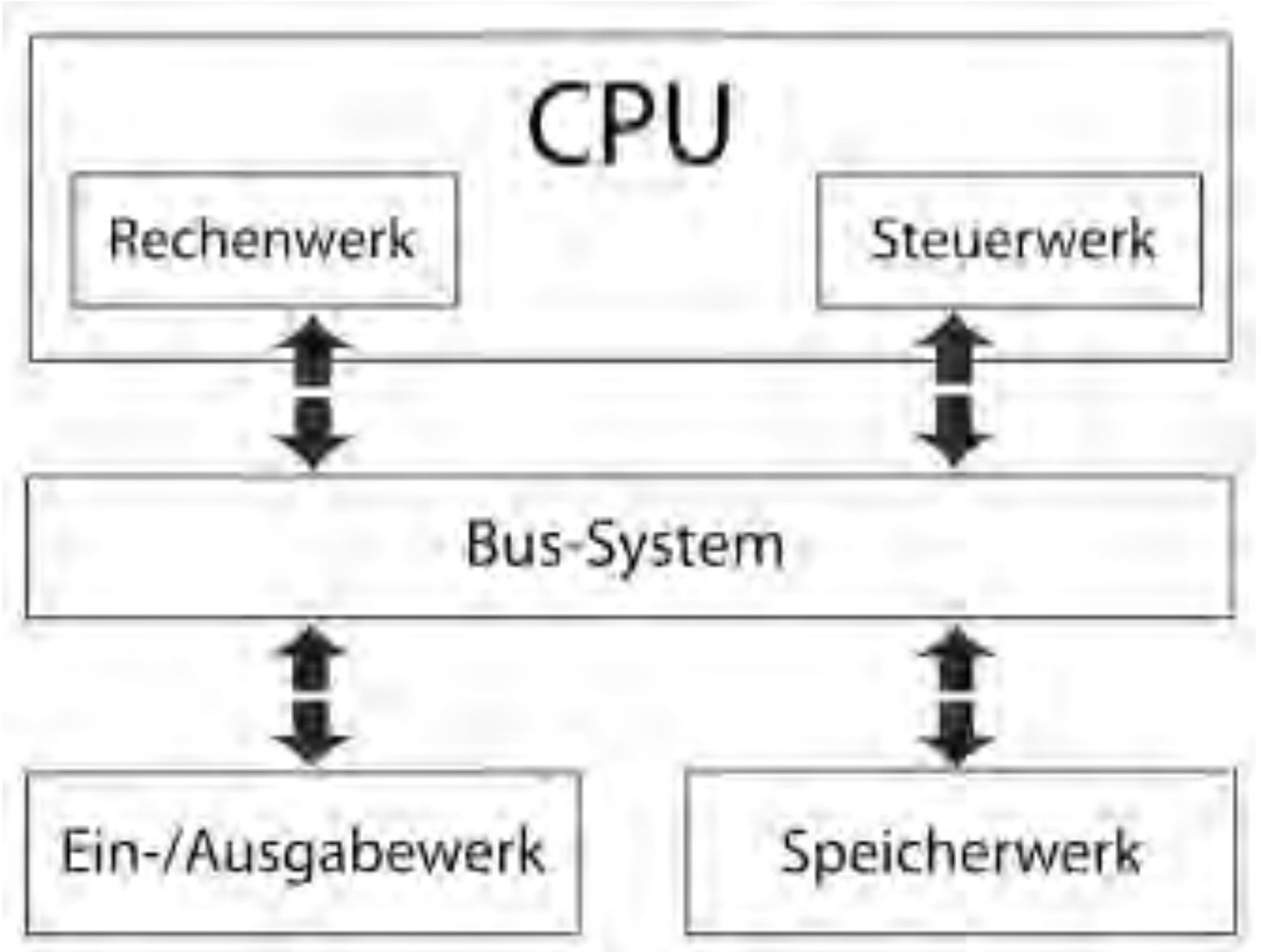
- **ENIAC** war erste rein elektronische Universalrechner auf Basis von Vakuumröhren



Generationen
der Informatik

#2 Software

Von-Neumann-Architektur



J. von Neumann: First Draft of a Report on the EDVAC. 1945

Komponenten

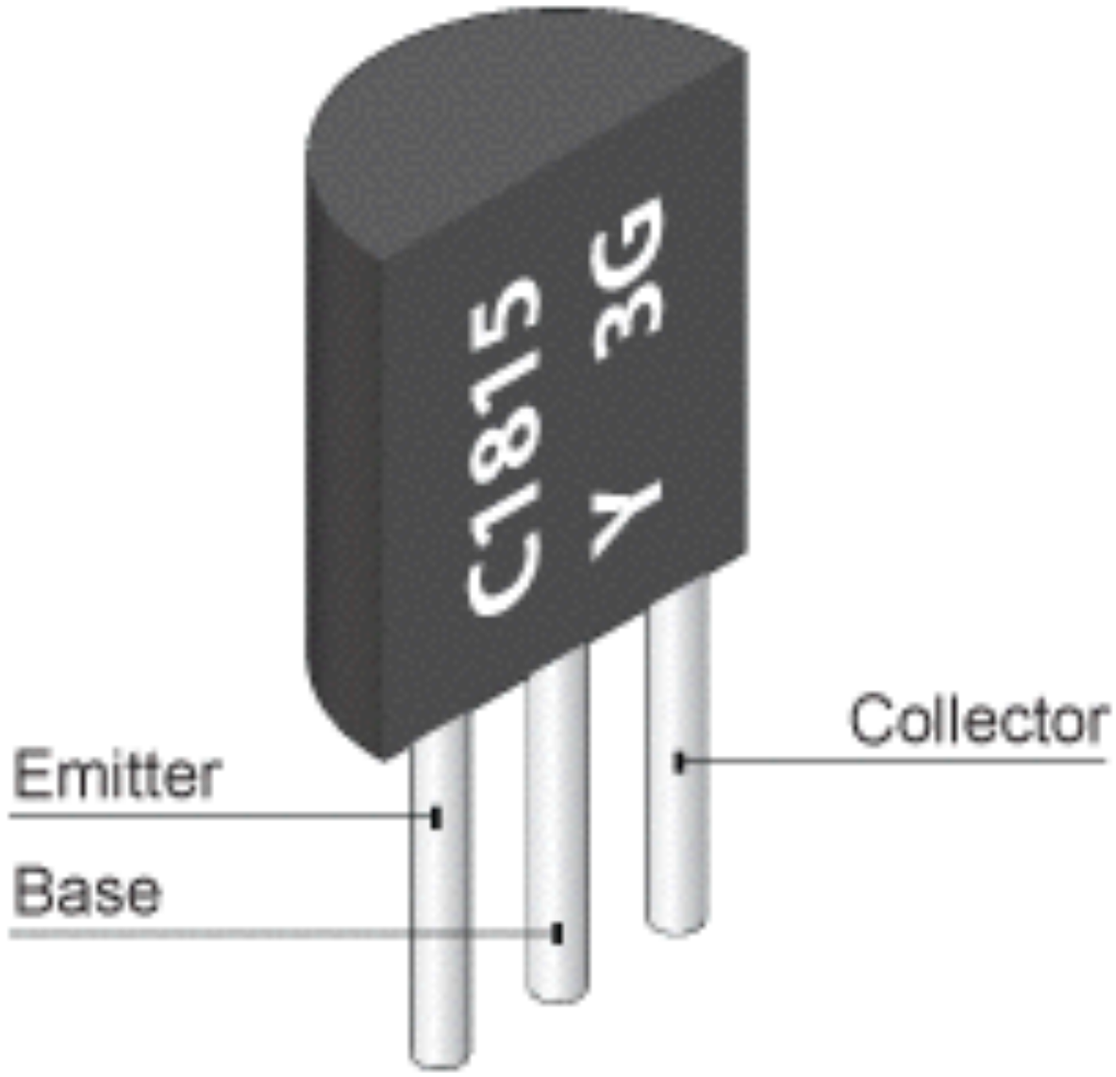
1. **ALU (Arithmetic Logic Unit)** – Rechenwerk
2. **Control Unit** – Steuerwerk oder Leitwerk
3. **Memory** – Speicherwerk
4. **I/O Unit** – Eingabe-/Ausgabewerk

Speicherwerk

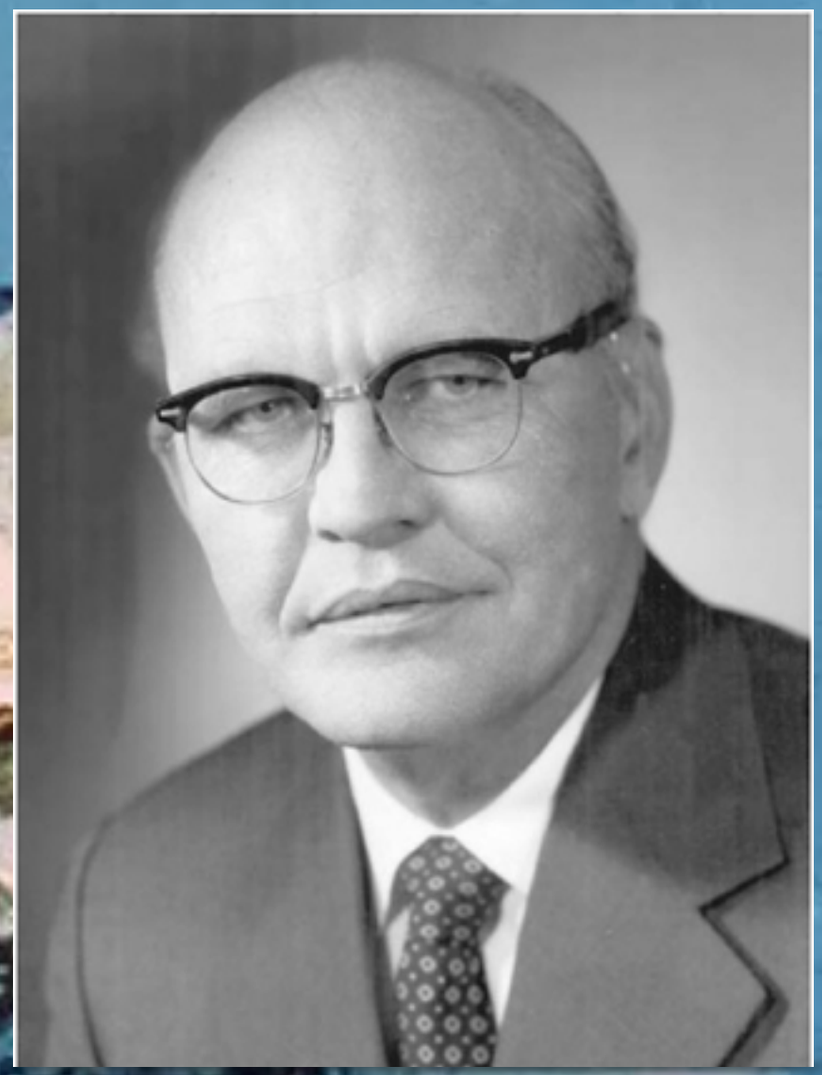
- **Speicherwerk** (engl. ***Memory***) speichert sowohl Programme als auch Daten, welche für das Rechenwerk zugänglich sind
- **Steuerwerk** holt aus Speicherwerk Befehle und Daten
- *Im Gegensatz zur Harvard-Architektur befinden sich bei Von-Neumann-Architektur Daten und Befehle im gleichen Speicher*

Computertechnologie

Beispiel: Transistoren



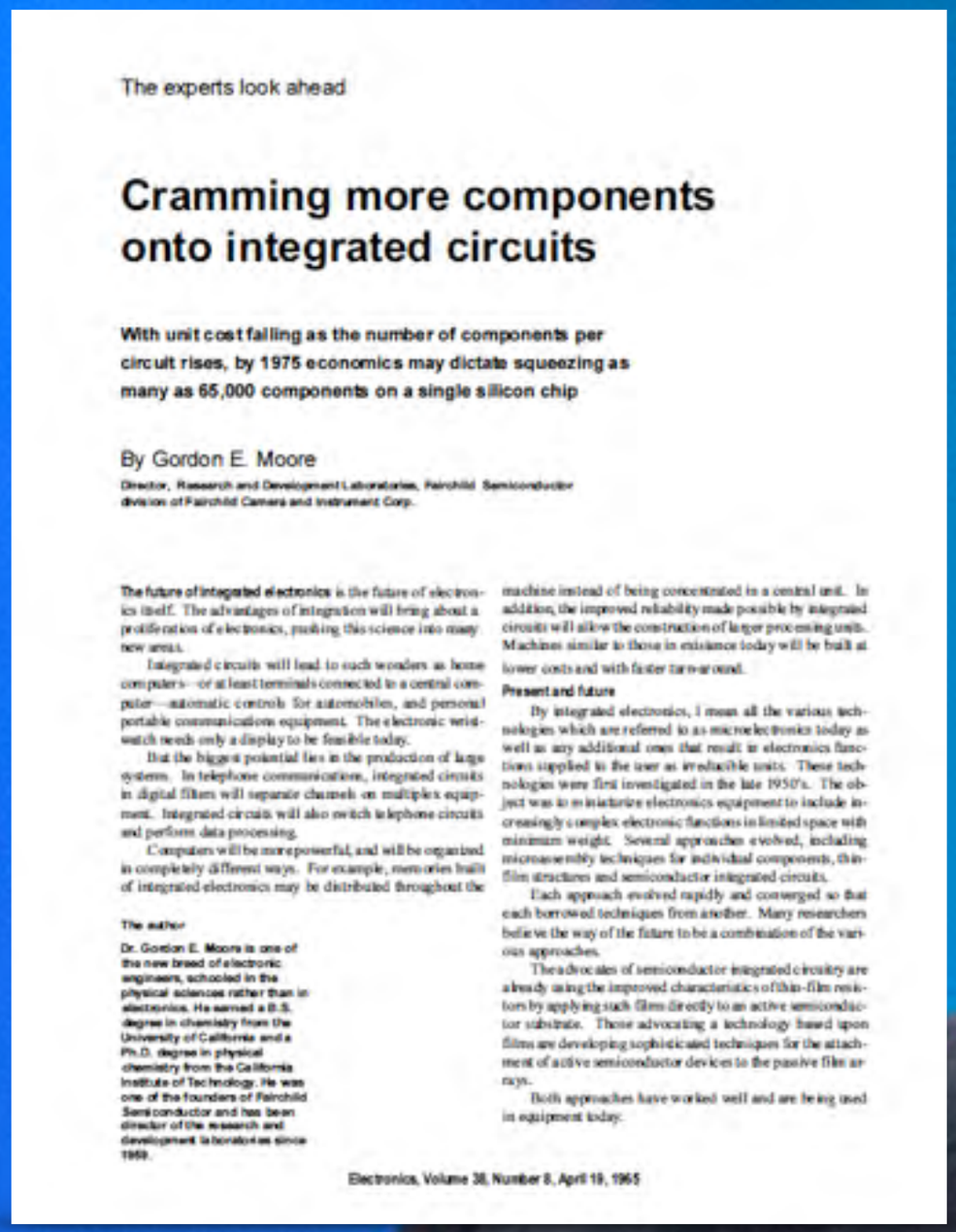
Bildnachweis: Wikipedia



Bildnachweis: Wikipedia

Bildnachweis: Wikipedia

Gordon E. Moore



The experts look ahead

Cramming more components onto integrated circuits

With unit cost falling as the number of components per circuit rises, by 1975 economics may dictate squeezing as many as 65,000 components on a single silicon chip

By Gordon E. Moore

Director, Research and Development Laboratories, Fairchild Semiconductor division of Fairchild Camera and Instrument Corp.

The future of integrated electronics is the future of electronics itself. The advantages of integration will bring about a proliferation of electronics, pushing this science into many new areas.

Integrated circuits will lead to such wonders as home computers—or at least terminals connected to a central computer—automatic controls for automobiles, and personal portable communications equipment. The electronic wristwatch needs only a display to be feasible today.

But the biggest potential lies in the production of large systems. In telephone communications, integrated circuits in digital filters will separate channels on multiplex equipment. Integrated circuits will also switch telephone circuits and perform data processing.

Computers will be more powerful, and will be organized in completely different ways. For example, memories built of integrated electronics may be distributed throughout the machine instead of being concentrated in a central unit. In addition, the improved reliability made possible by integrated circuits will allow the construction of larger processing units. Machines similar to those in existence today will be built at lower costs and with faster turn-around.

Present and future

By integrated electronics, I mean all the various technologies which are referred to as microelectronics today as well as any additional ones that result in electronics functions supplied to the user as irreducible units. These technologies were first investigated in the late 1950's. The object was to miniaturize electronics equipment to include increasingly complex electronic functions in limited space with minimum weight. Several approaches evolved, including microassembly techniques for individual components, thin-film structures and semiconductor integrated circuits.

Each approach evolved rapidly and converged so that each borrowed techniques from another. Many researchers believe the way of the future to be a combination of the various approaches.

The advocates of semiconductor integrated circuitry are already using the improved characteristics of thin-film resistors by applying such films directly to an active semiconductor substrate. Those advocating a technology based upon films are developing sophisticated techniques for the attachment of active semiconductor devices to the passive film arrays.

Both approaches have worked well and are being used in equipment today.

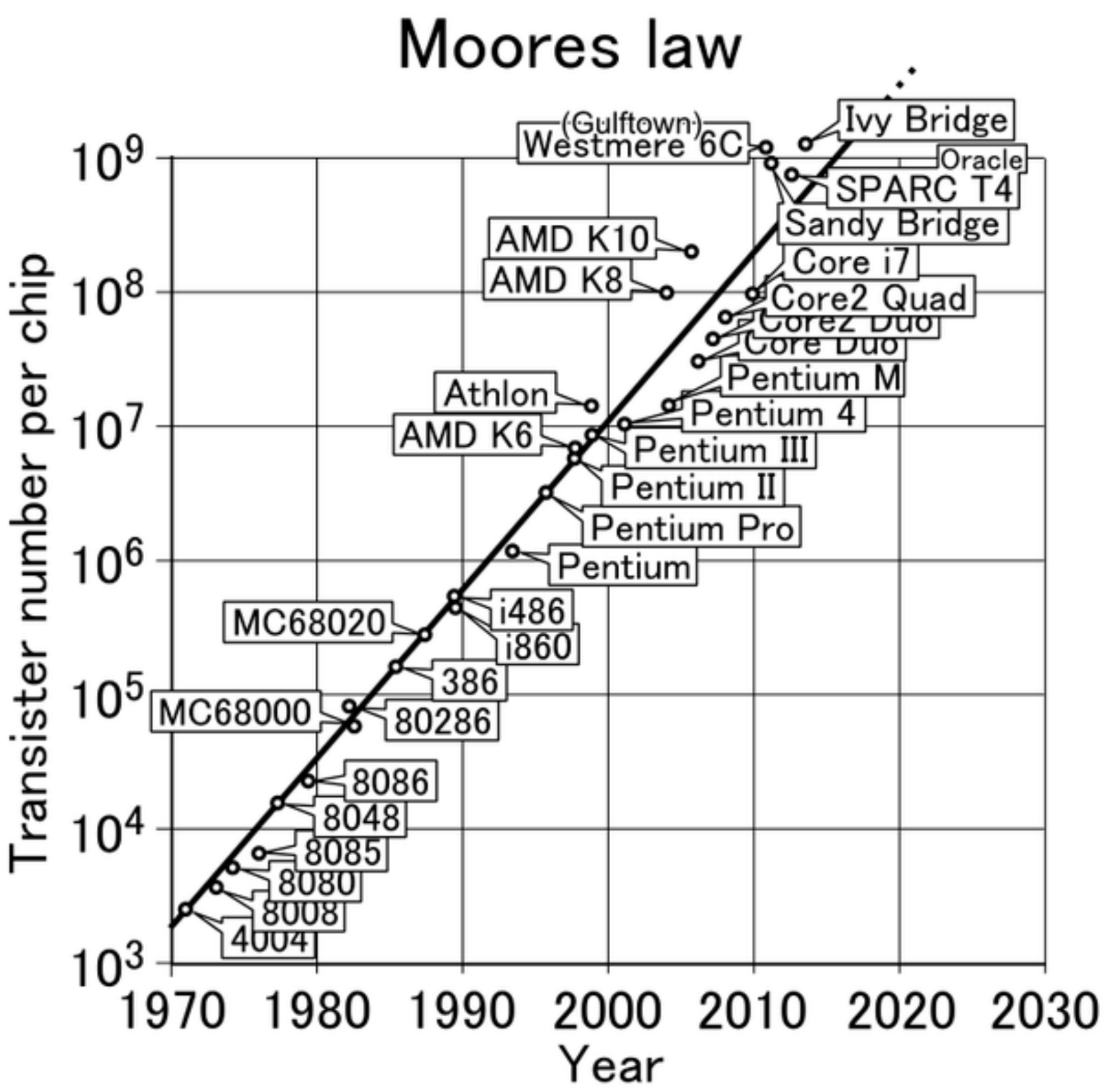
The author

Dr. Gordon E. Moore is one of the new breed of electronic engineers, schooled in the physical sciences rather than in electronics. He earned a B.S. degree in chemistry from the University of California and a Ph.D. degree in physical chemistry from the California Institute of Technology. He was one of the founders of Fairchild Semiconductor and has been director of the research and development laboratories since 1959.

Electronics, Volume 38, Number 8, April 19, 1965

"With unit cost falling as the number of components per circuit rises, by 1975 economics may dictate squeezing as many as 65,000 components on a single silicon chip."

Bildnachweis: www.famous-entrepreneurs.com



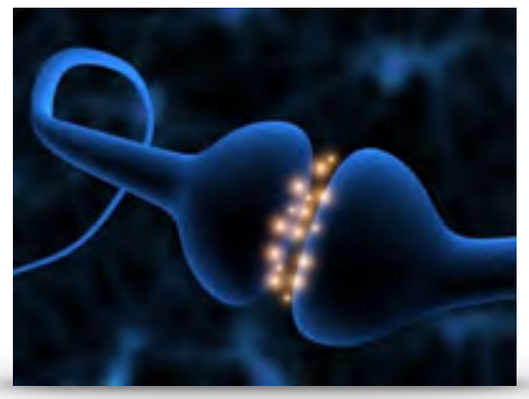
G. Moore: More components onto integrated circuits, 1965

VS

ca. 5 Milliarden

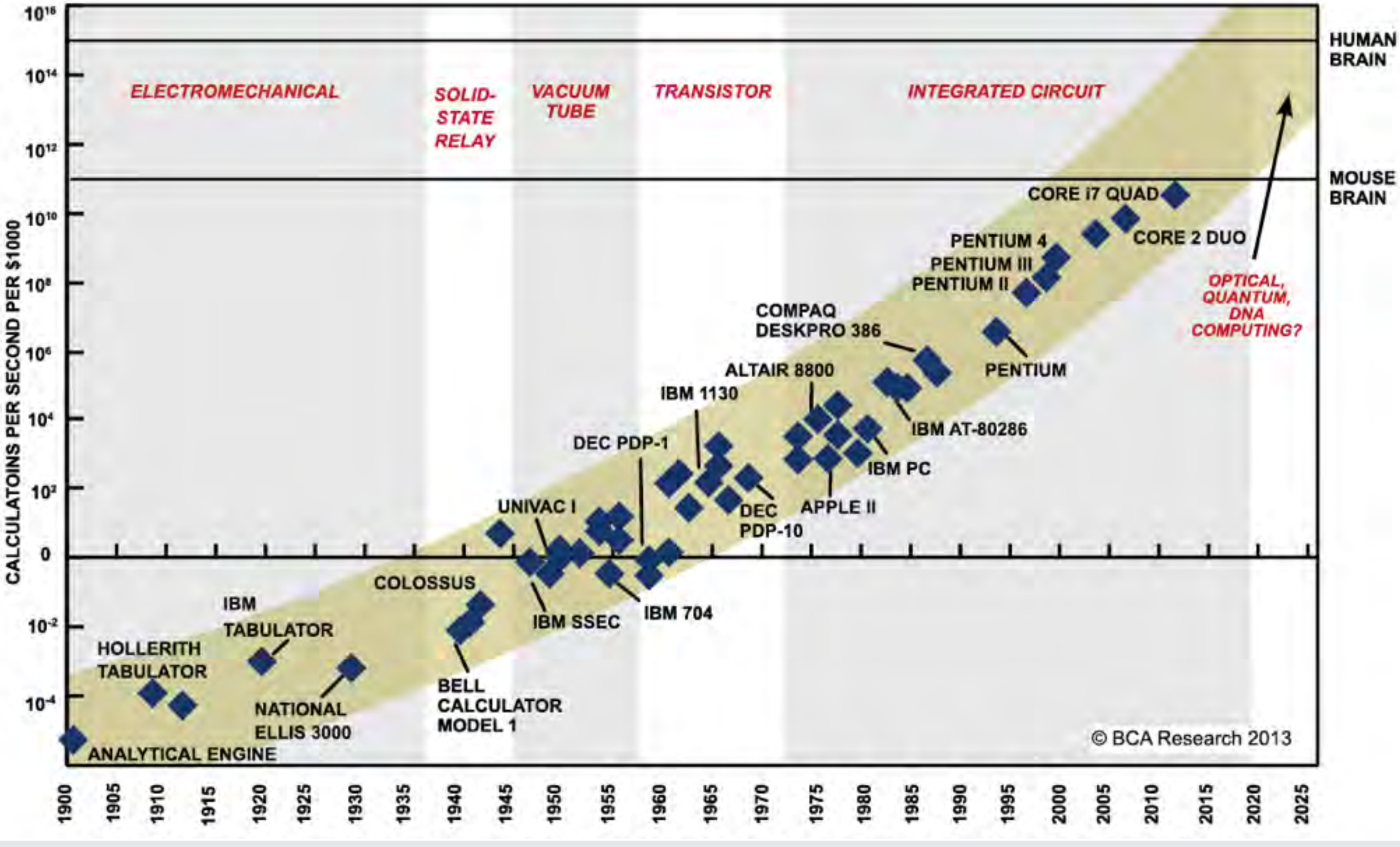
100 Milliarden
Nervenzellen

ca. 5 Billionen



100 Billionen
Synapsen

$$log_2(20) \cdot 1.5 \approx 8$$



R. Kurzweil: Singularity is near, 2006

Benutzungsschnittstellen

- Bisher wurden Programme definiert über Lochkarten oder über verschaltete HW
- Von-Neumann Architektur erlaubt Programmierung durch Programmierer
- Unterscheidung zwischen **Schnittstelle** für **Programmierer** und **Schnittstelle** für **Nutzer**

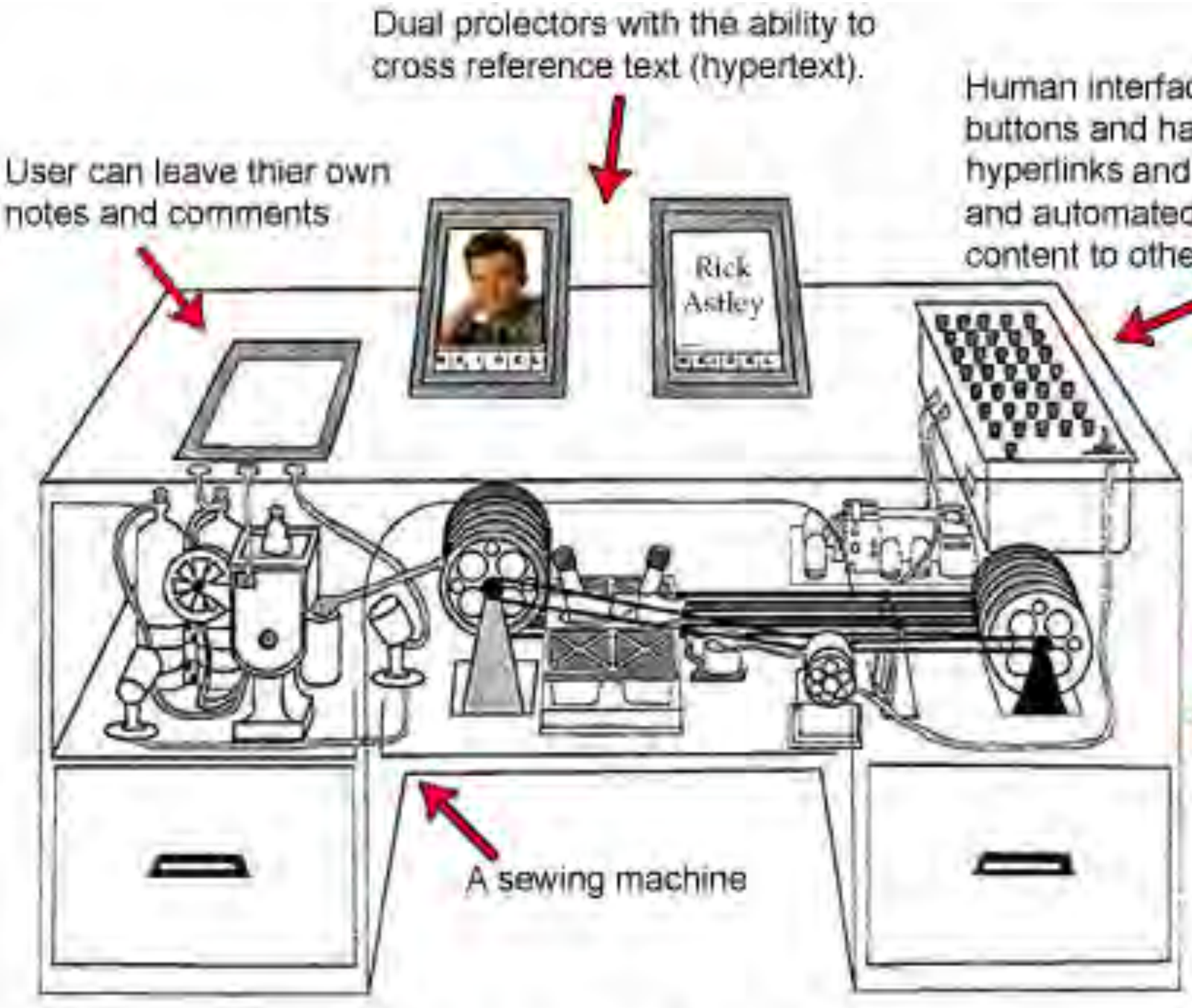
Generationen der Informatik

#3 HCI

V. Bush: Memory Extender, 1945

MEMEX (1945)

- **MEMEX** (***Memory Extension***) ist konzeptionelles Gerät, welches
  - Speicherung sämtlicher Bücher, Bilder und Dokumente erlaubt
  - gezielten und flexiblen Zugriff ermöglicht
  - Anlegen von Verbindungen (***Links***) zwischen Daten ermöglicht


Dual prolectors with the ability to cross reference text (hypertext).
User can leave thier own notes and comments
Human interfaces with machine through buttons and has the ability to make new hyperlinks and associations (like bookmarks) and automated search and export user content to other memex machines
Rick Astley
A sewing machine
Sum of all human knowledge stored on micro-film in the form of text / image compositions

MCI-Paradigma

MEMEX

- Maschinelle Unterstützung “natürlichen” Denkens und Verstehens
- Maschinelle Erweiterung zur Unterstützung von Gedächtnis und spontanen Assoziationen
- Organisation, Manipulation analog zur assoziativen Informationsverarbeitung beim Menschen

J.C.R. Licklider: Man-Computer Symbiosis, 1960

Man-Computer Symbiosis

*"The hope is that [...] **human brains** and **computing machines** will be **coupled** together very **tightly** and that the resulting partnership will think as no human brain has ever thought and **process data** in a way not approached by the information-handling machines we know today."*

J.C.R. Licklider: Man-Computer Symbiosis,
IRE Transactions on Human Factors in Electronics, volume HFE-1, pages 4-11, 1960

MCS

Kurzfristig Ziele

- Time-sharing
- Ein-/Ausgabe symbolischer und illustrativer Informationen
- Interaktive *Real-Time* Systeme
- Speicherung & Abruf großer Datenmengen

MCS
Mittelfristige Ziele

- Kooperation bei Entwicklung großer Softwareprojekte
- Kombination von Sprach-, Schrifterkennen mittels Stift-basierten Eingabegeräten

MCS
Langfristige Ziele

- Verstehen natürlicher (sprecherunabhängiger) Sprache
- heuristische Programming (= Künstliche Intelligenz)

MIT: Whirlwind, 1951

MIT: Whirlwind (1951)

- **Whirlwind** sollte als Flugsimulator entwickelt werden
  - war erster Rechner mit Bildschirm (Kathodenstrahlröhre)
- Lichtgriffel diente als Eingabegerät

IBM: SAGE, 1958

IBM: SAGE (1958)

- **SAGE (Semi-Automatic Ground Environment) Air Defense System**
- Fortführung des Whirlwind durch U.S. Air Force für Luftraumüberwachung
  - 1983: Shutdown des letzten Whirlwind-basierten SAGE Computers

MIT: Sketchpad (1962)

- Sketchpad war erster Schritt in Richtung **grafischer Benutzerschnittstelle** und **CAD**
- Umbau Lincoln-TX-2-Rechners
- objektorientierte Ansätze

➡ Wesentlicher Einfluss auf HCI

SRI: oN-Line System(1968)

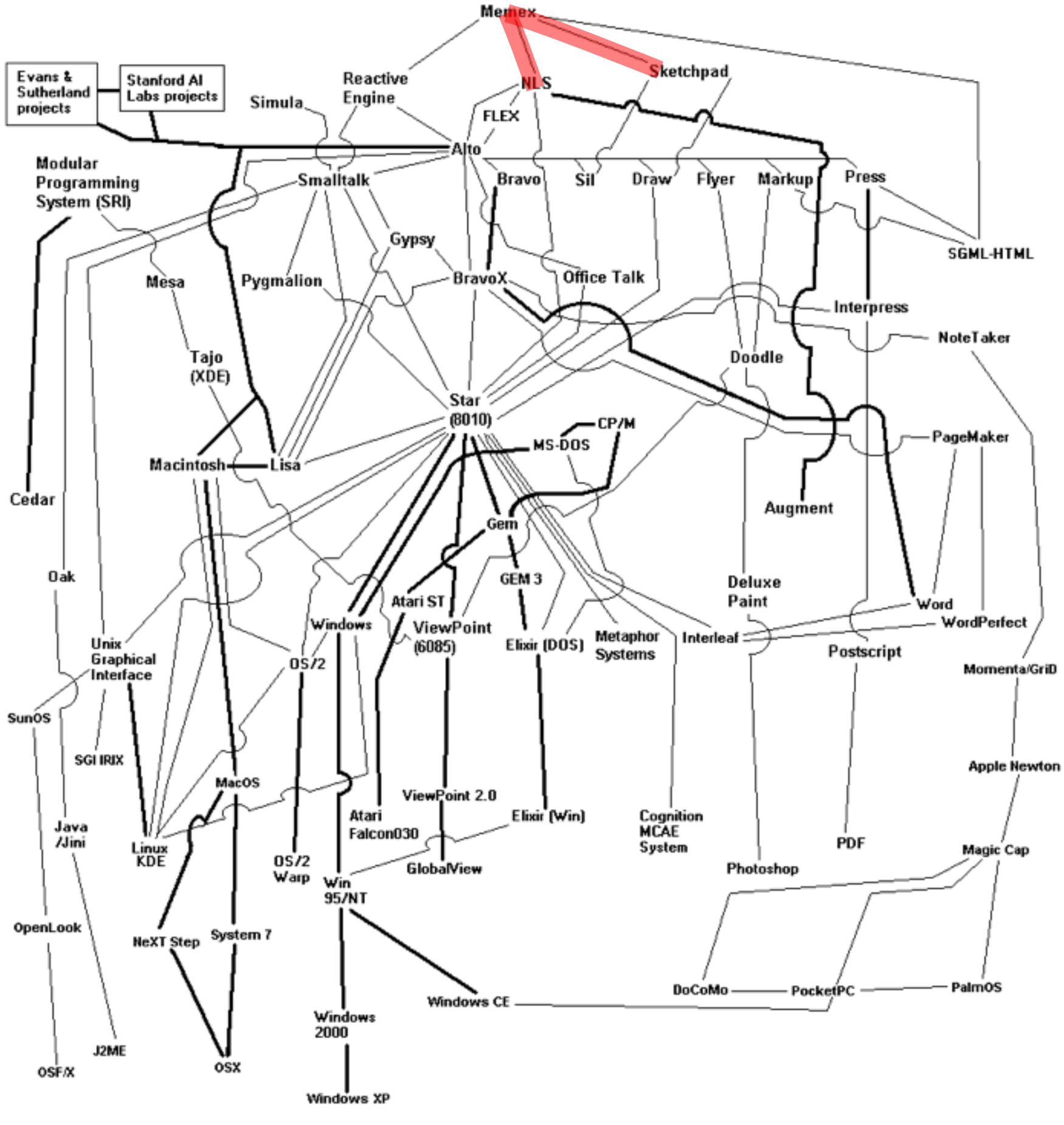
- **oN-Line System (NLS)** war **interaktives kollaboratives System**, welches Bearbeitung eines Text-Dokumentes durch zwei Personen an unterschiedlichen Konsolen ermöglicht hat
- NLS stellte neuartige Konzepte vor: mehrere Fenster, On-Screen Tele-Conferencing, Maus, Tastatur ...

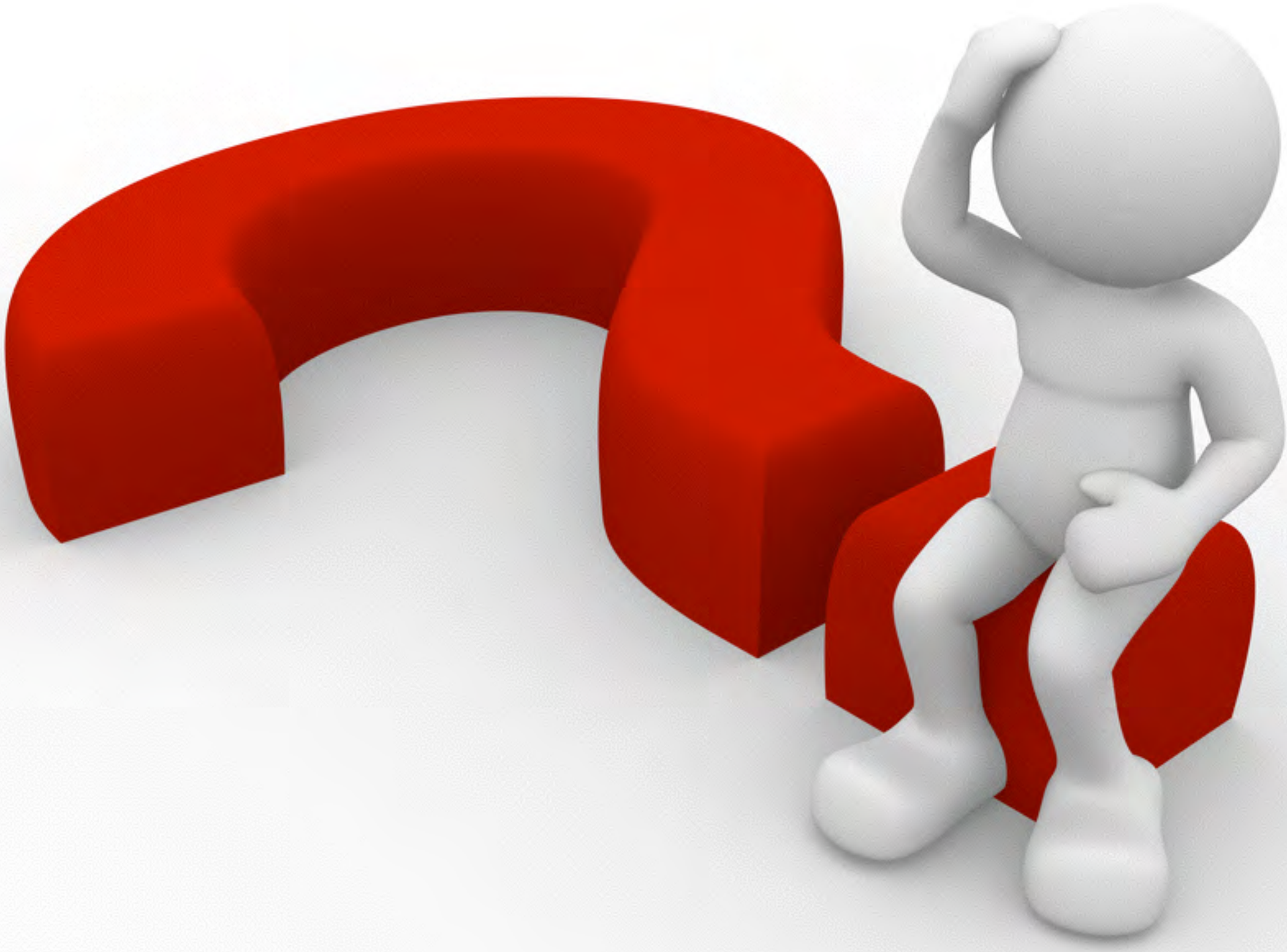
THE CAPTURING ON FILM OF THE AUDIO AND VIDEO WAS A PROCESS SUBSIDIARY TO THE PRESENTATION, AND THE LATTER WAS NOT STOPPED FOR THE TWO TIMES WHEN THE MOVIE-CAMERA OPERATOR HAD TO LOAD FRESH FILM -- CONSEQUENTLY, THERE ARE NOTICEABLE GAPS BETWEEN REELS (OF THE ORDER OF A MINUTE).

SIGNALS FROM AUXILIARY TELEVISION CAMERAS WERE SOMETIMES SWITCHED TO THE PROJECTOR -- THE OPENING SCENE IS FROM SUCH A CAMERA. [illegible]

INTRODUCED.

D. Engelbart: NLS (“Mother of all demos”), 1968

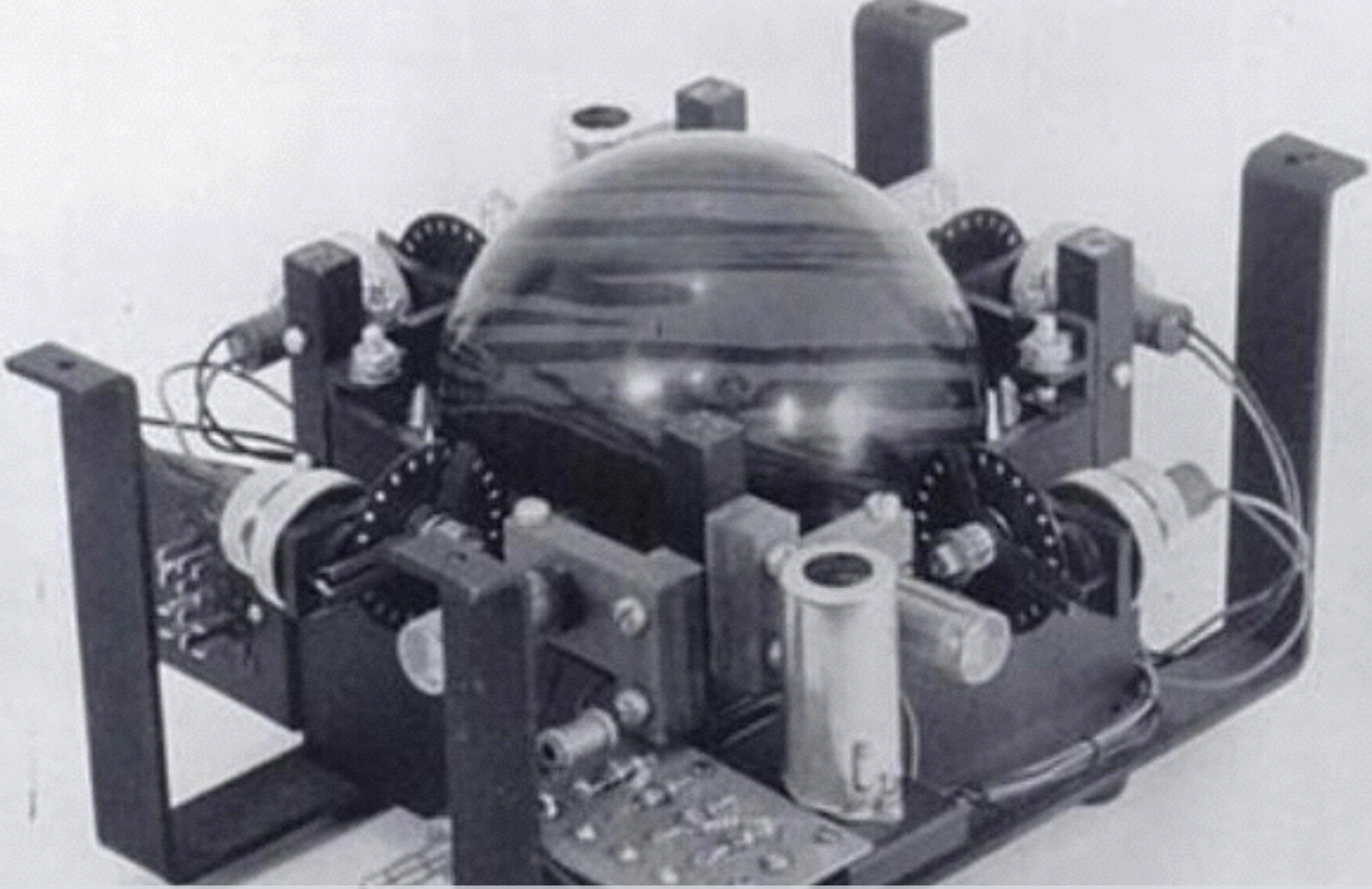

Memex
Sketchpad
NLS
Reactive Engine
Simula
Evans & Sutherland projects
Stanford AI Labs projects
FLEX
Alto
Modular Programming System (SRI)
Smalltalk
Bravo
Sil
Draw
Flyer
Markup
Press
SGML-HTML
Gypsy
Mesa
Pygmalion
BravoX
Office Talk
Interpress
NoteTaker
Tajo (XDE)
Doodle
Star (8010)
CP/M
MS-DOS
PageMaker
Macintosh
Lisa
Cedar
Augment
Gem
Oak
GEM 3
Deluxe Paint
Atari ST
Windows
ViewPoint (6085)
Word
WordPerfect
Unix Graphical Interface
OS/2
Elixir (DOS)
Metaphor Systems
Interleaf
Postscript
Momenta/GriD
SunOS
SGI IRIX
MacOS
ViewPoint 2.0
Apple Newton
Java /Jini
Atari Falcon030
Elixir (Win)
Cognition MCAE System
Linux KDE
OS/2 Warp
GlobalView
PDF
Magic Cap
Win 95/NT
Photoshop
OpenLook
NeXT Step
System 7
DoCoMo
PocketPC
PalmOS
Windows CE
Windows 2000
J2ME
OSF/X
OSX
Windows XP



Mensch-Computer-Interaktion

Historie

Klassische Eingabegeräte

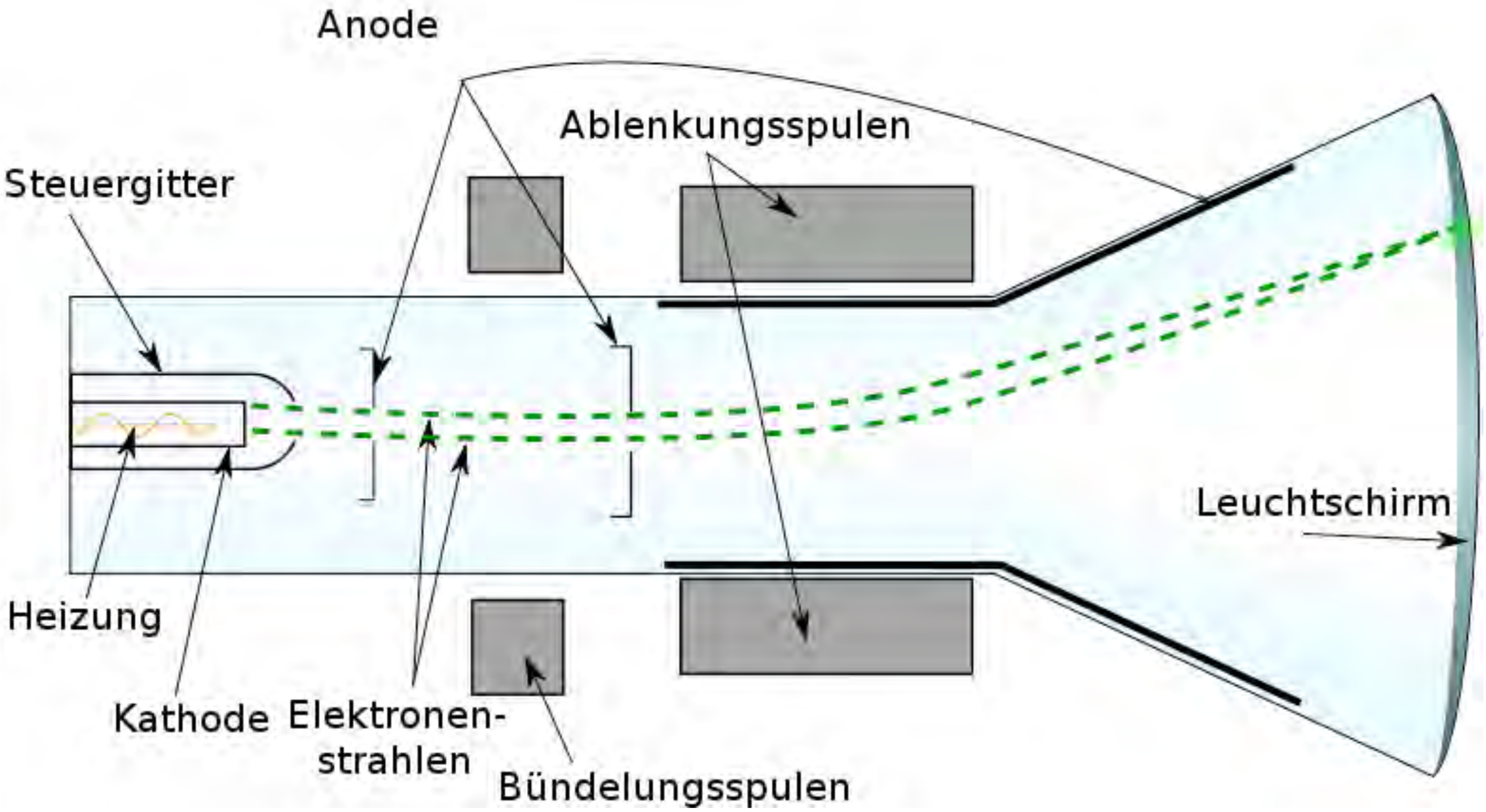


T. Cranston et al.: DATAR, 1952

Data Equipment Company: Grafacon, ~1963

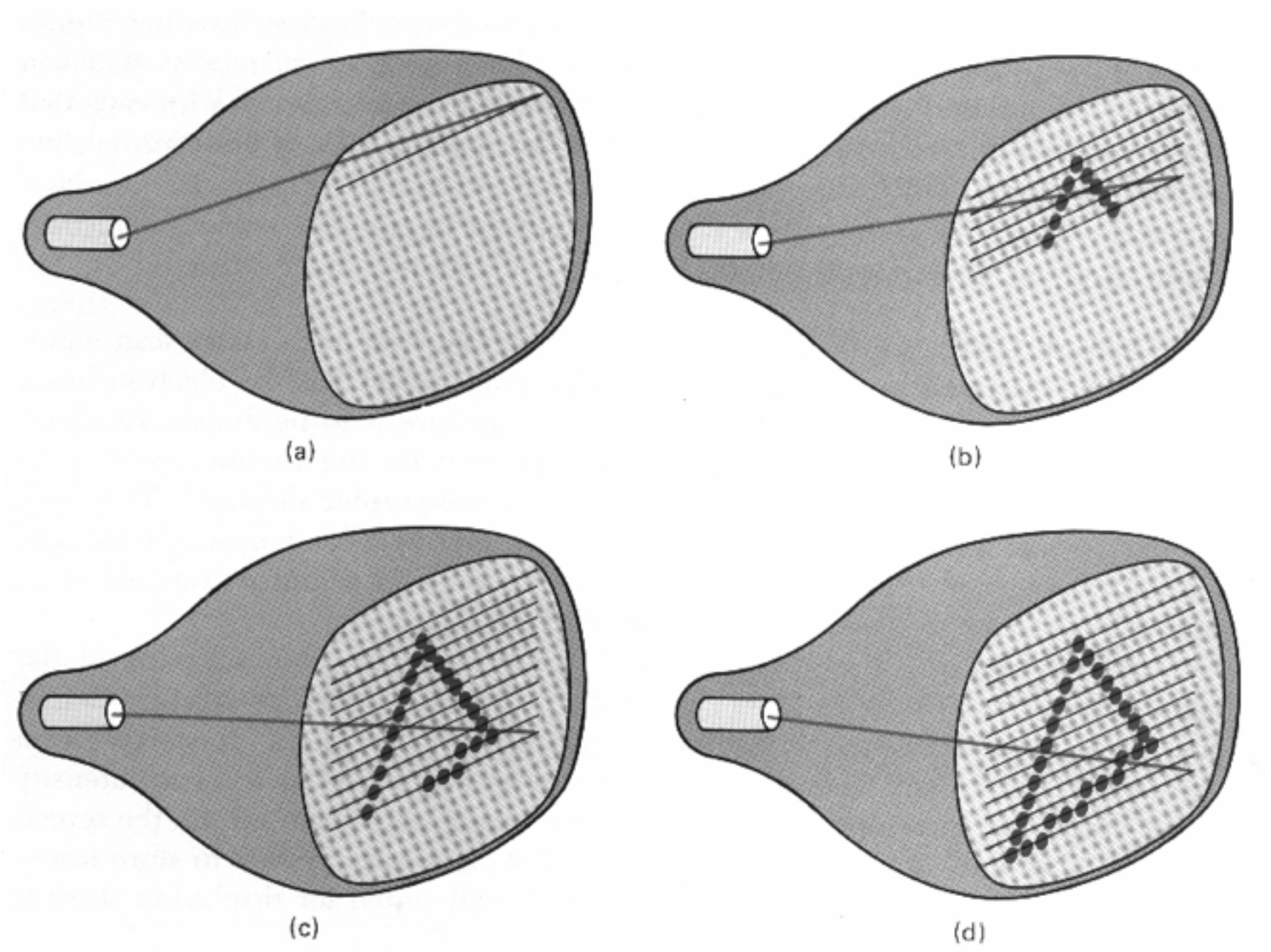
Vektorbildschirm

Kathodenstrahlröhre



Pixel-Traversierung

Beispiel



Lincoln Laboratory: Sketchpad's Light-Pen, 1964

Bildnachweis: Wikipedia

D. Engelbart & B. English (SRI): *The Mouse*, 1963

Bildnachweis: Wikipedia

Nov. 17, 1970 D. C. ENGELBART 3,541,541

X-Y POSITION INDICATOR FOR A DISPLAY SYSTEM

Filed June 21, 1967 3 Sheets-Sheet 1

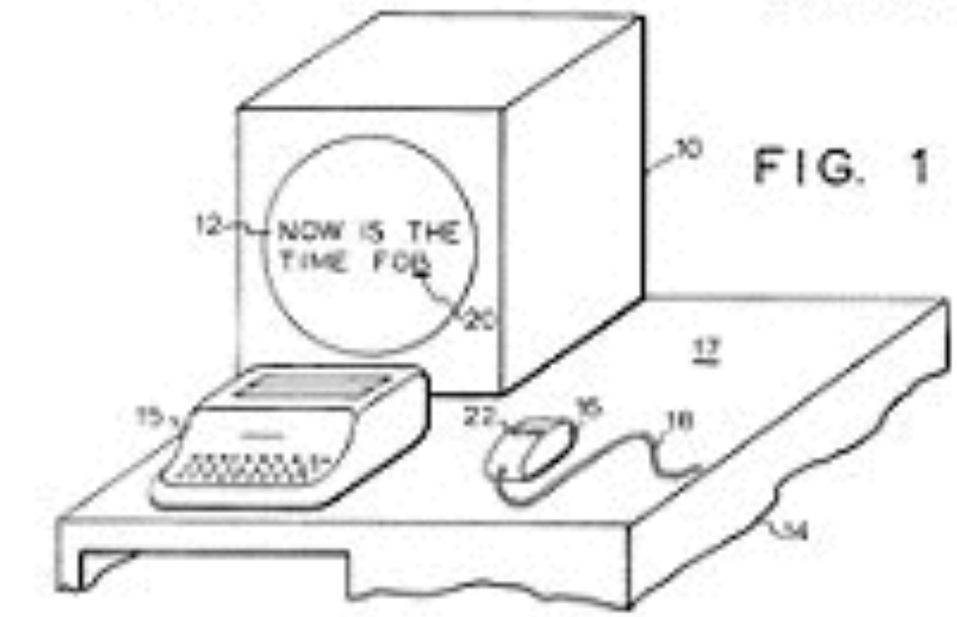


FIG. 1

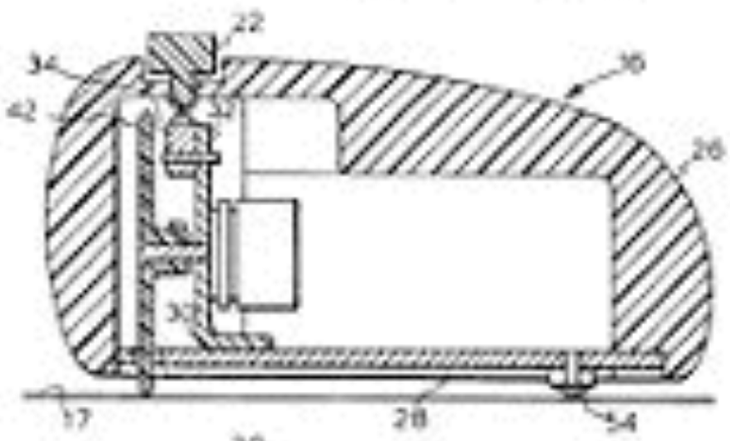


FIG. 2

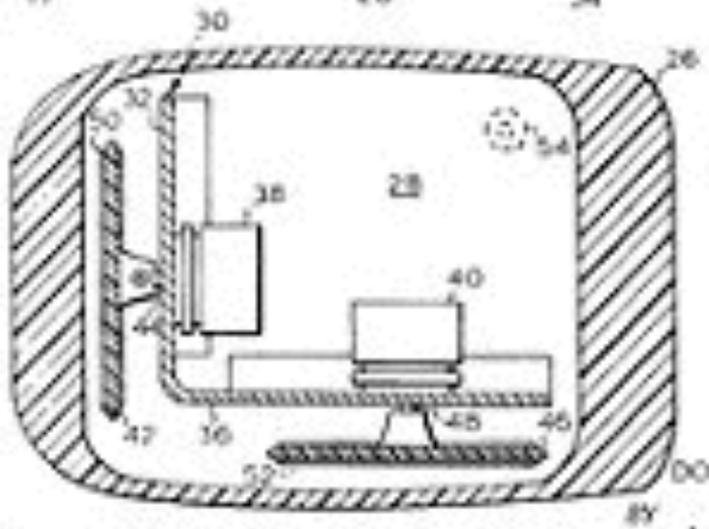
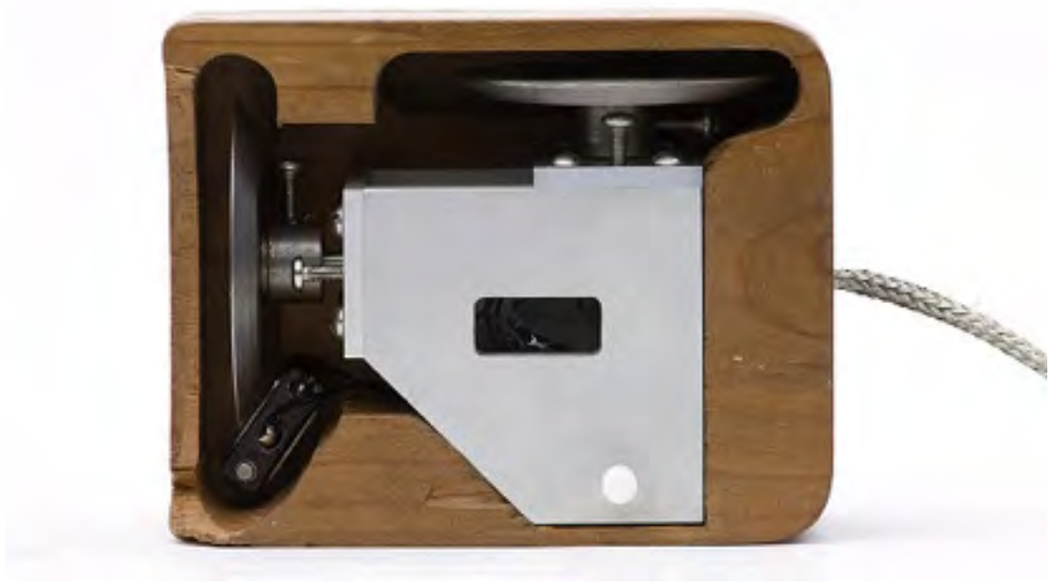
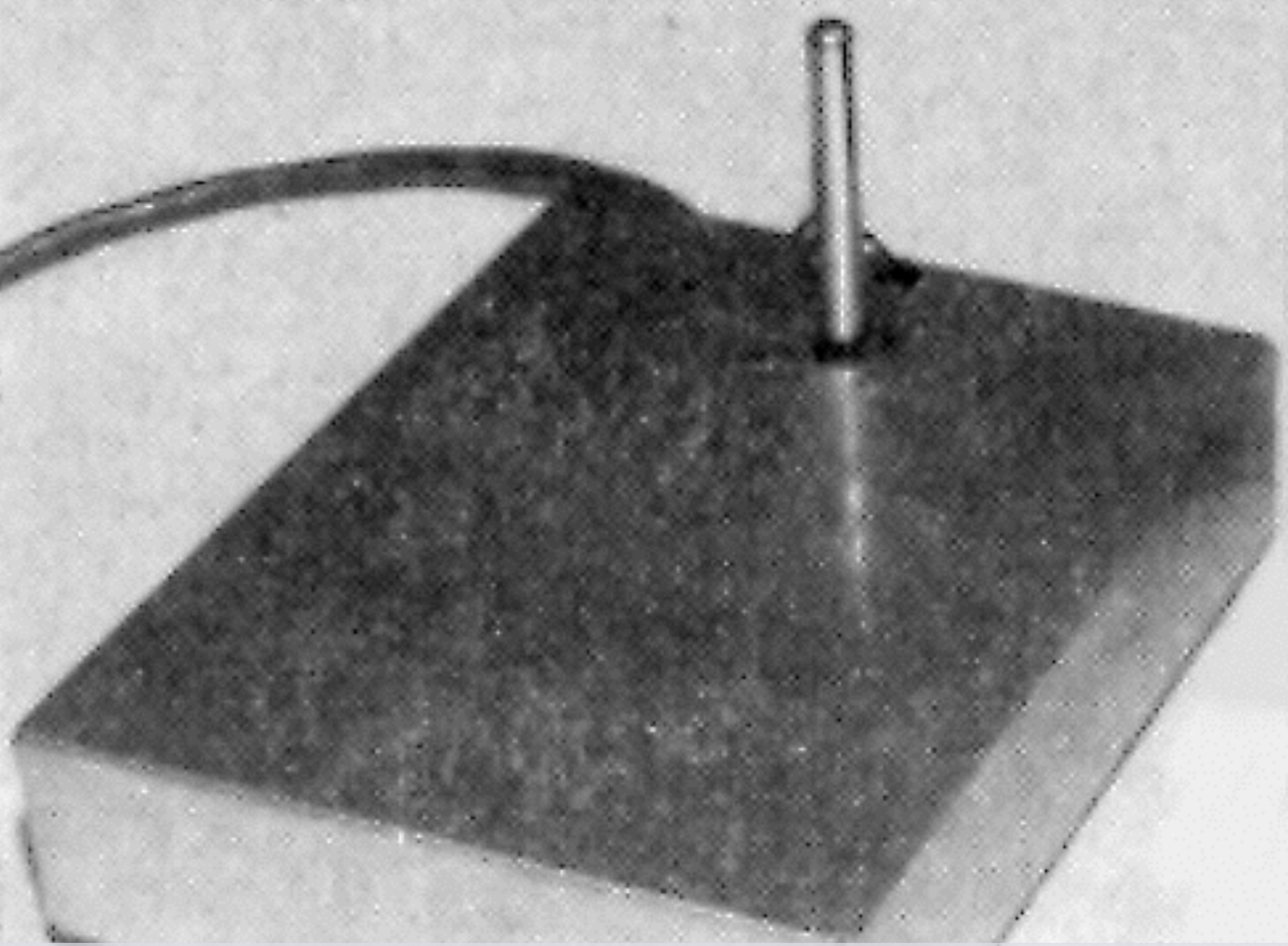


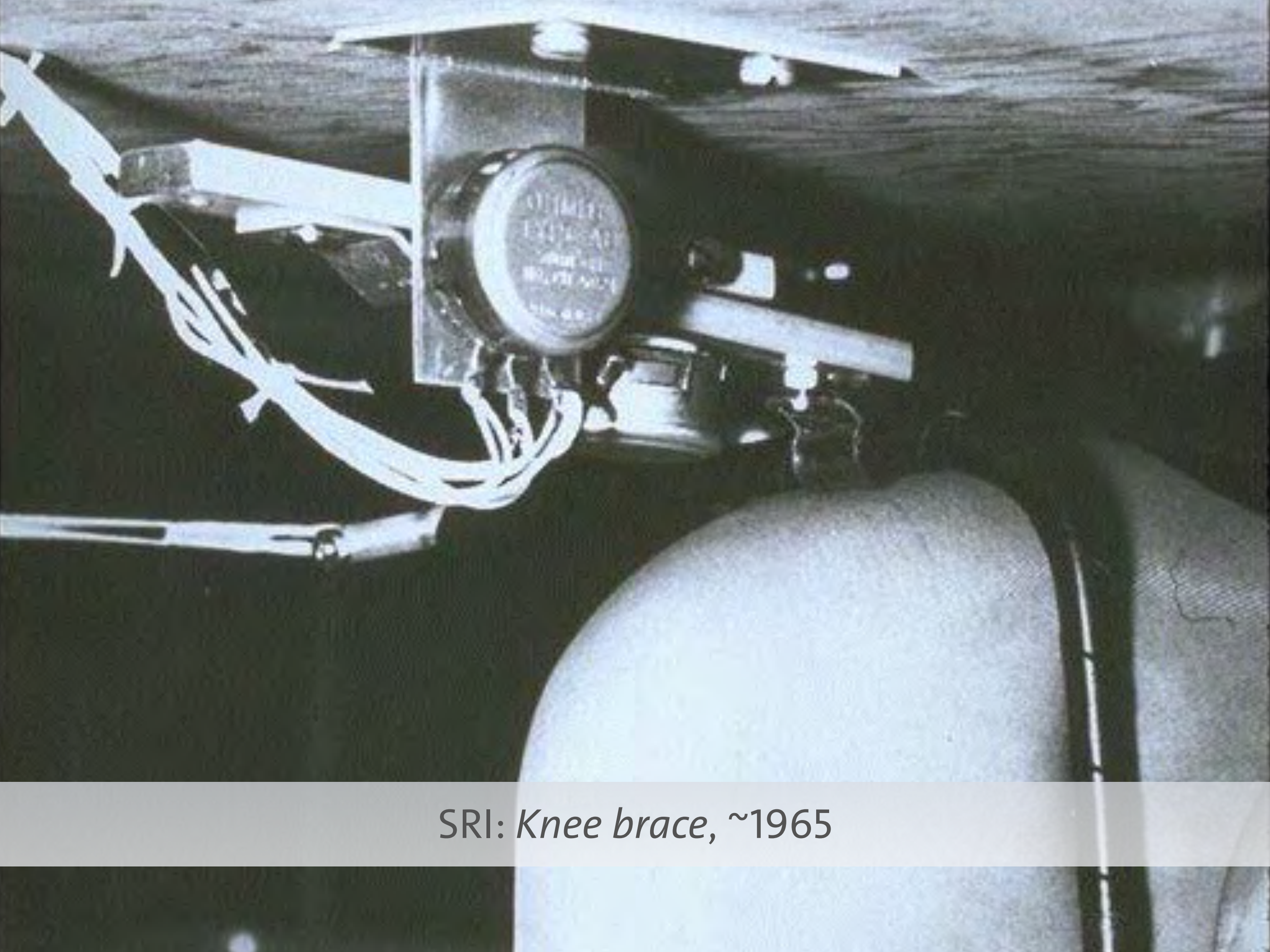
FIG. 3

INVENTOR.
DOUGLAS C. ENGELBART
BY
Ludwig + Trachtel
ATTORNEYS



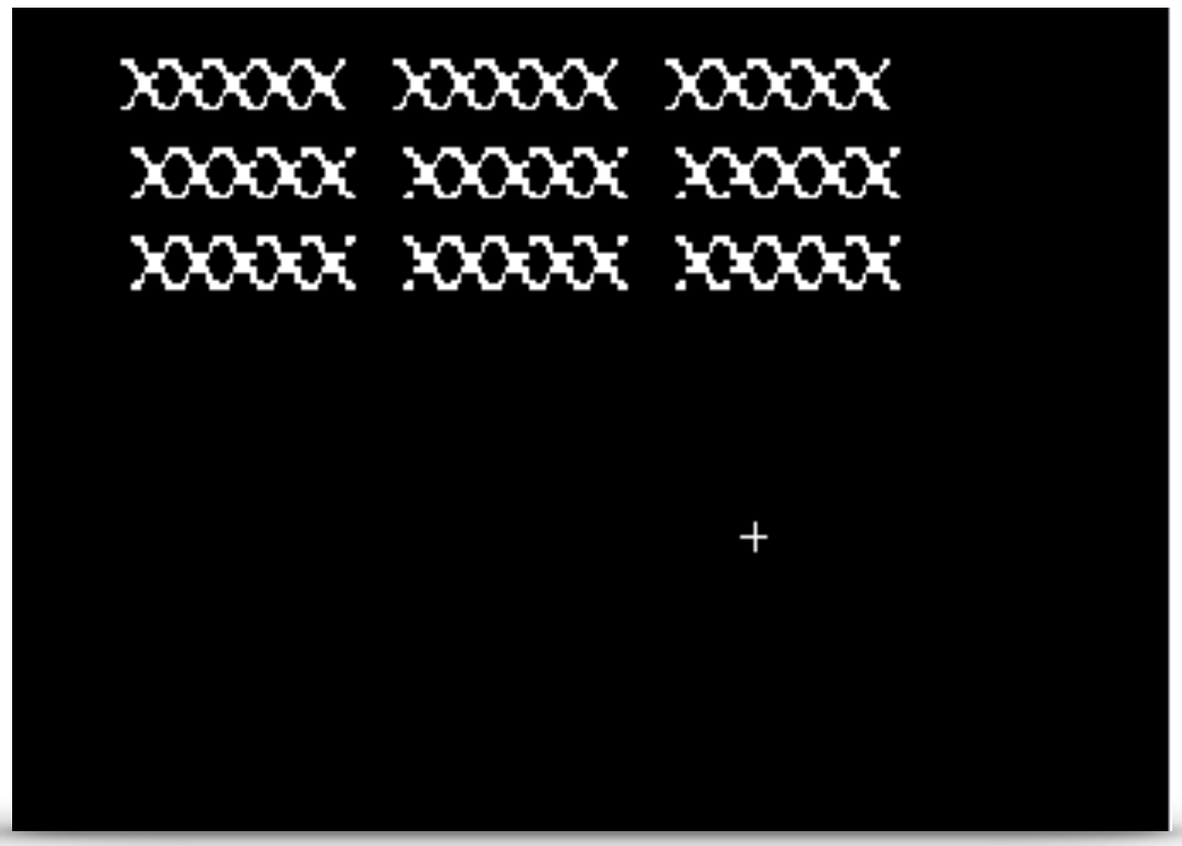


Bowmar Associates: *Joystick* (Model X-2438), 1967



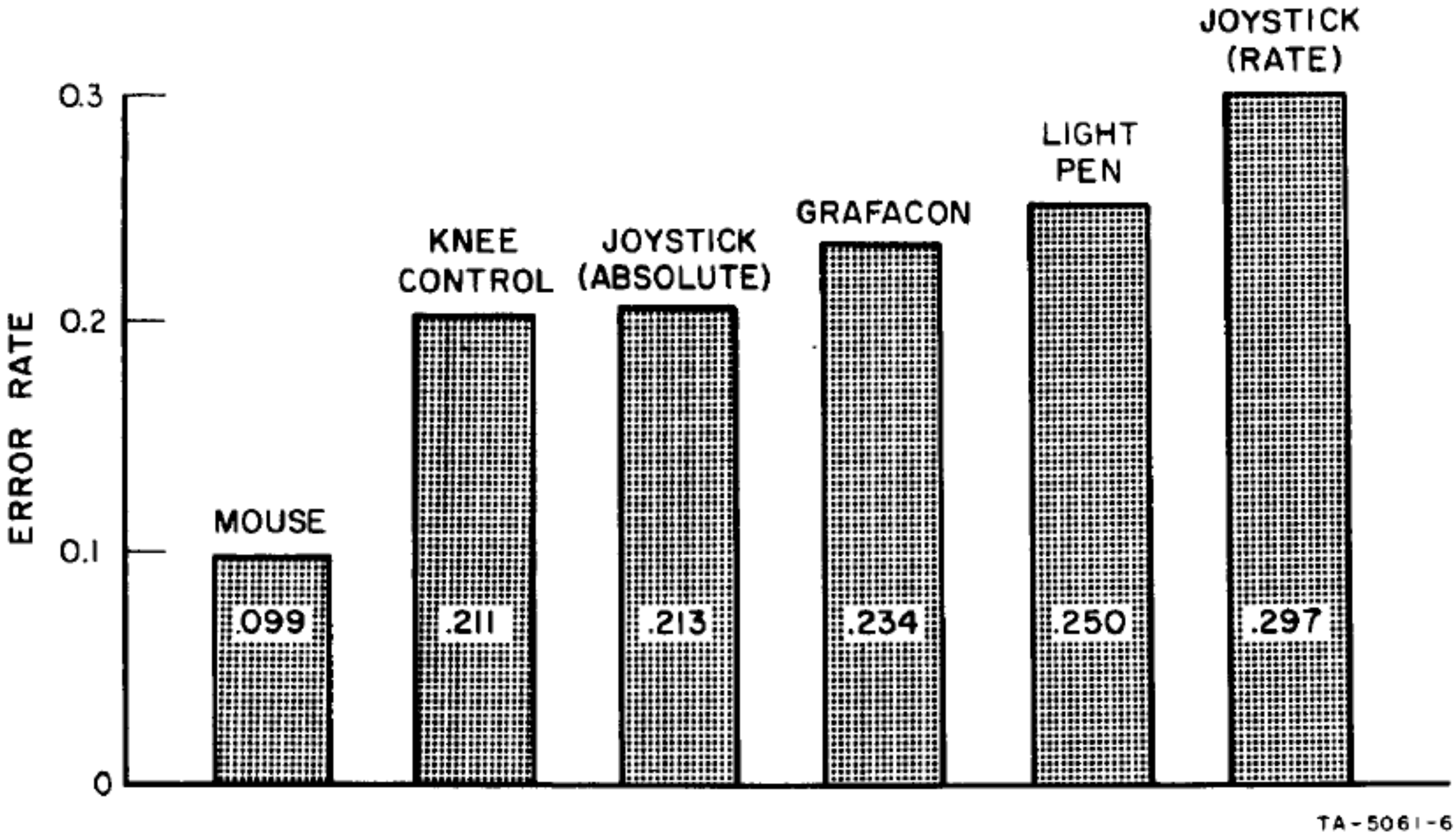
SRI: *Knee brace*, ~1965

Character Selection Task

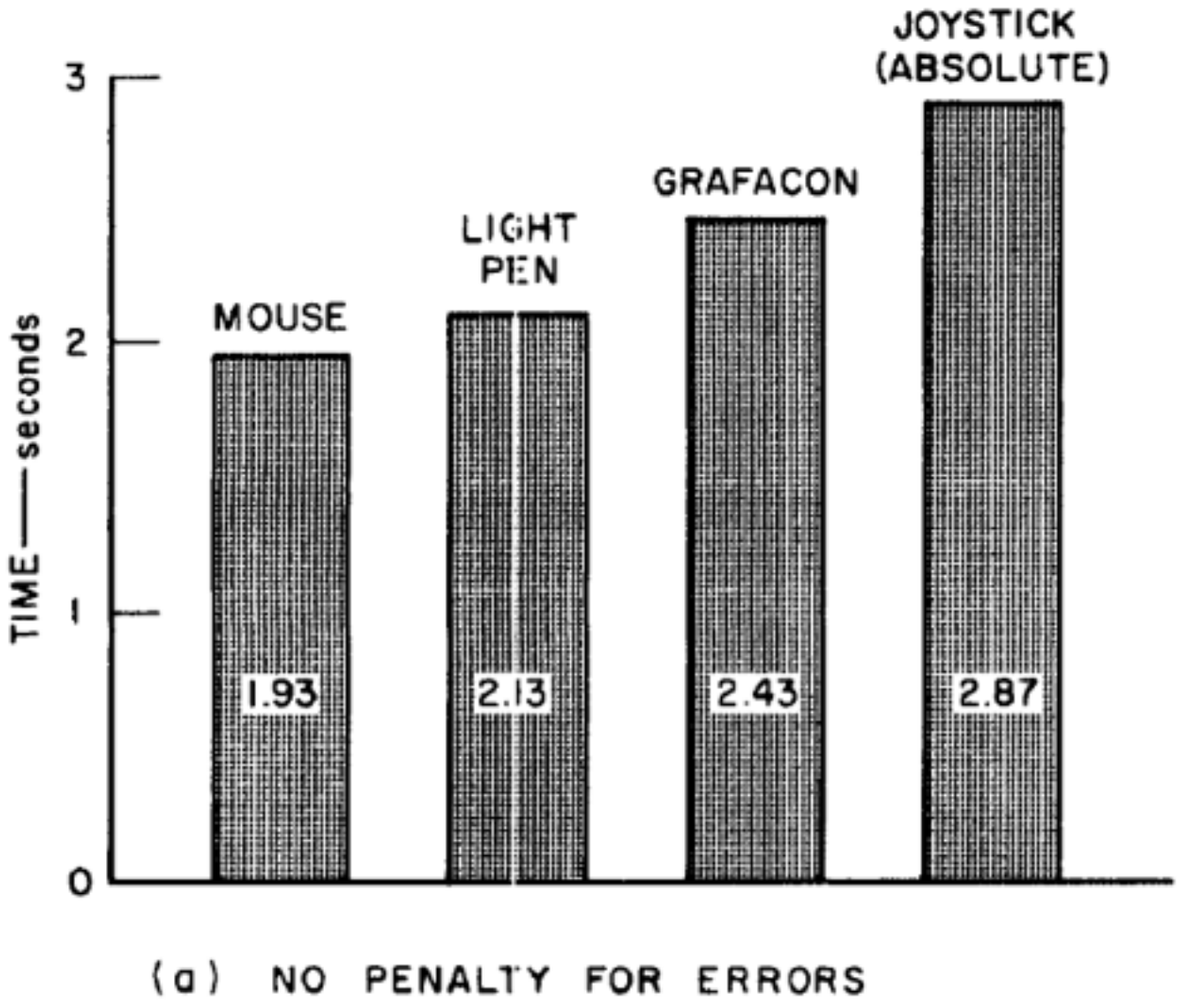


Word Selection Task

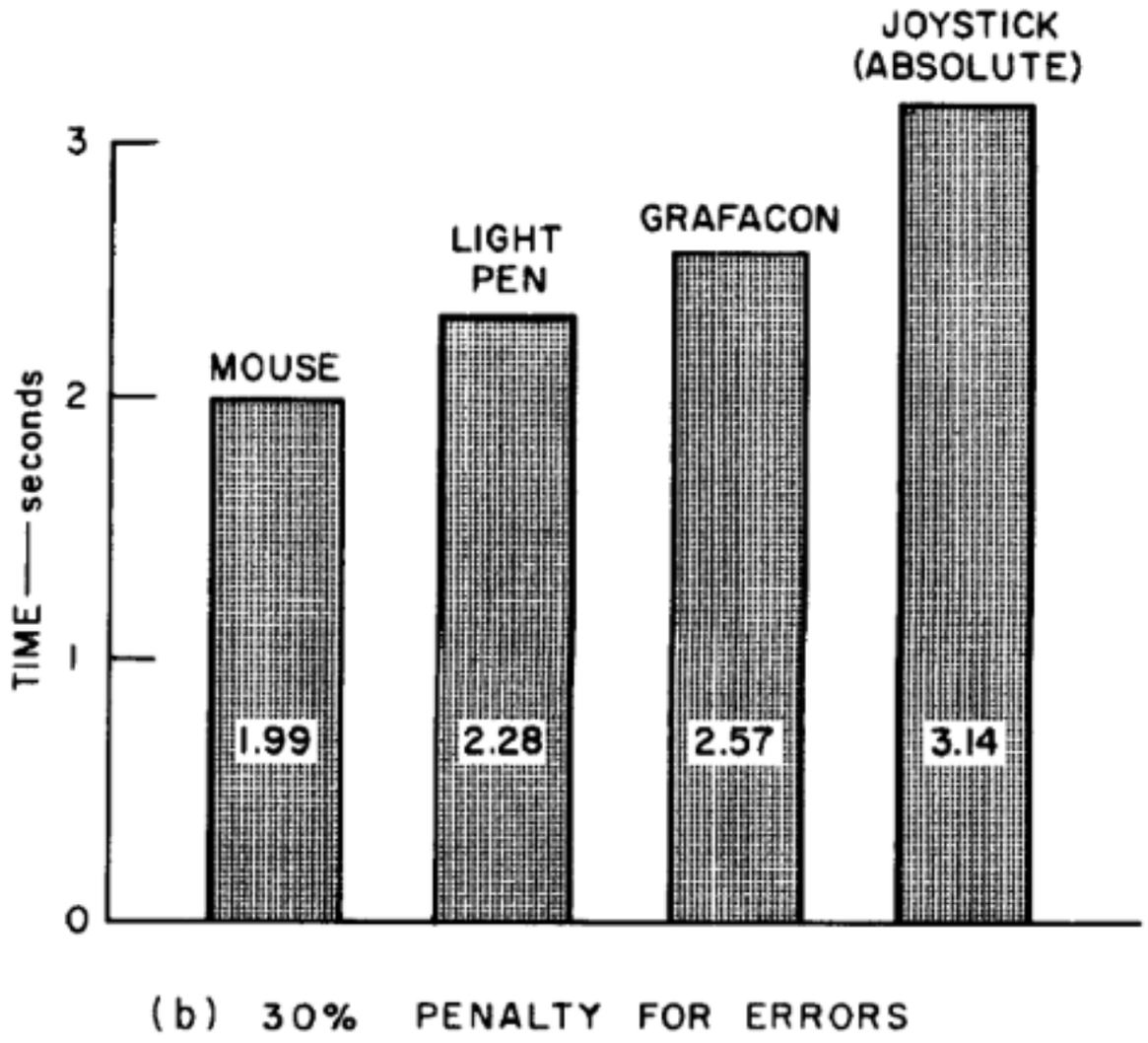
W.K. English, D.C. Engelbart, M.L. Berman: Display-Selection Techniques for Text Manipulation, IEEE Transactions on Human Factors in Electronics (HFE-8)1, pp. 5-15, 1967



W.K. English, D.C. Engelbart, M.L. Berman: Display-Selection Techniques for Text Manipulation, IEEE Transactions on Human Factors in Electronics (HFE-8)1, pp. 5-15, 1967



(a) NO PENALTY FOR ERRORS



(b) 30% PENALTY FOR ERRORS

W.K. English, D.C. Engelbart, M.L. Berman: Display-Selection Techniques for Text Manipulation, IEEE Transactions on Human Factors in Electronics (HFE-8)1, pp. 5-15, 1967

R. Mallebrein (Telefunken): RKS 100-86 ("Rollkugel"), 1968

Illustration der Funktionsweise einer optomechanischen Maus

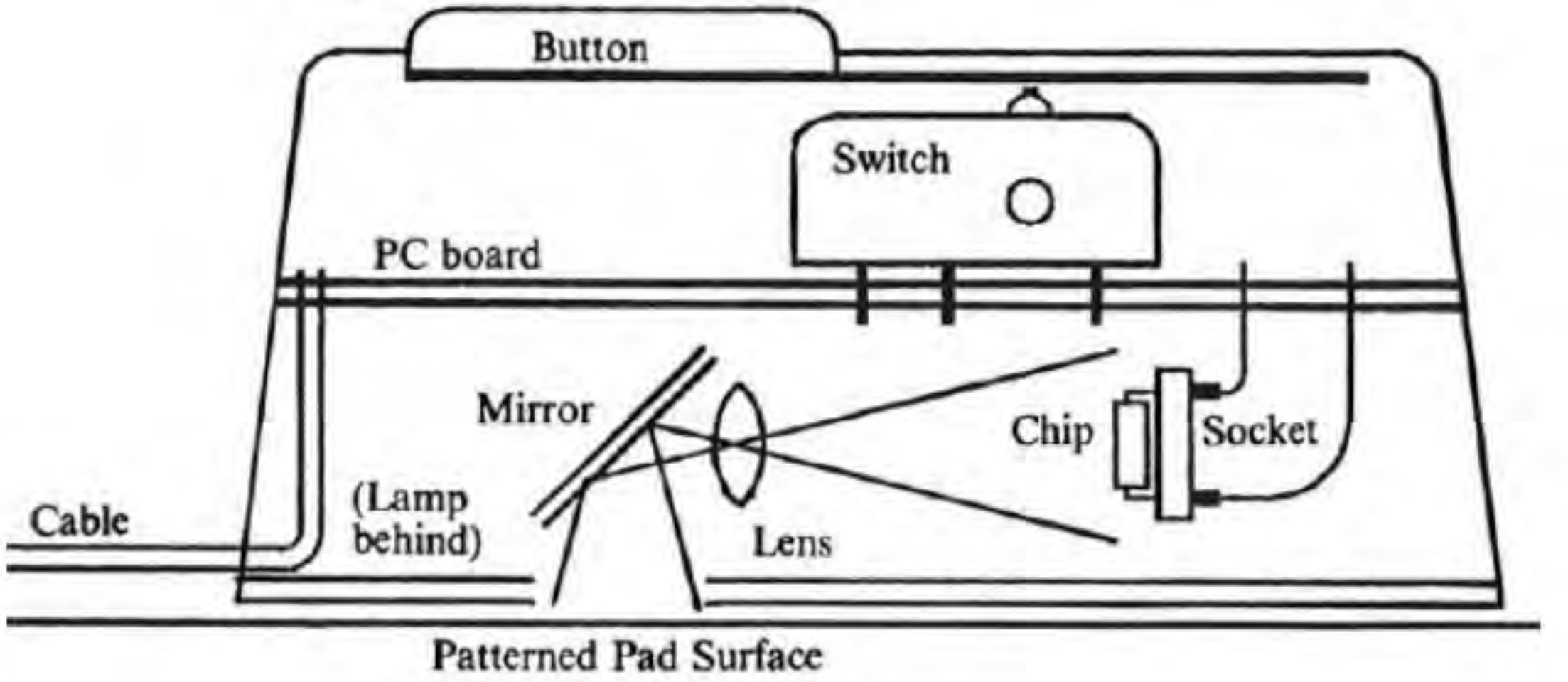


Illustration der Funktionsweise einer optischen Maus

Xerox PARC: Xerox Alto, 1973

Bildnachweis: Wikipedia

Logitech: MouseMan Cordless, 1991

Bildnachweis: Logitech

Microsoft: IntelliMouse, 1996

Bildnachweis: Microsoft

Apple: Magic Mouse, 2009

Bildnachweis: Apple

Schreibmaschinen

- **Remington** Schreibmaschinen waren ersten in Serienfertigung hergestellten Schreibmaschinen (~1874)
- QWERTY-Tastatur
- ***Remington Typewriter Company***
  ⇒ Remington Rand (1927)

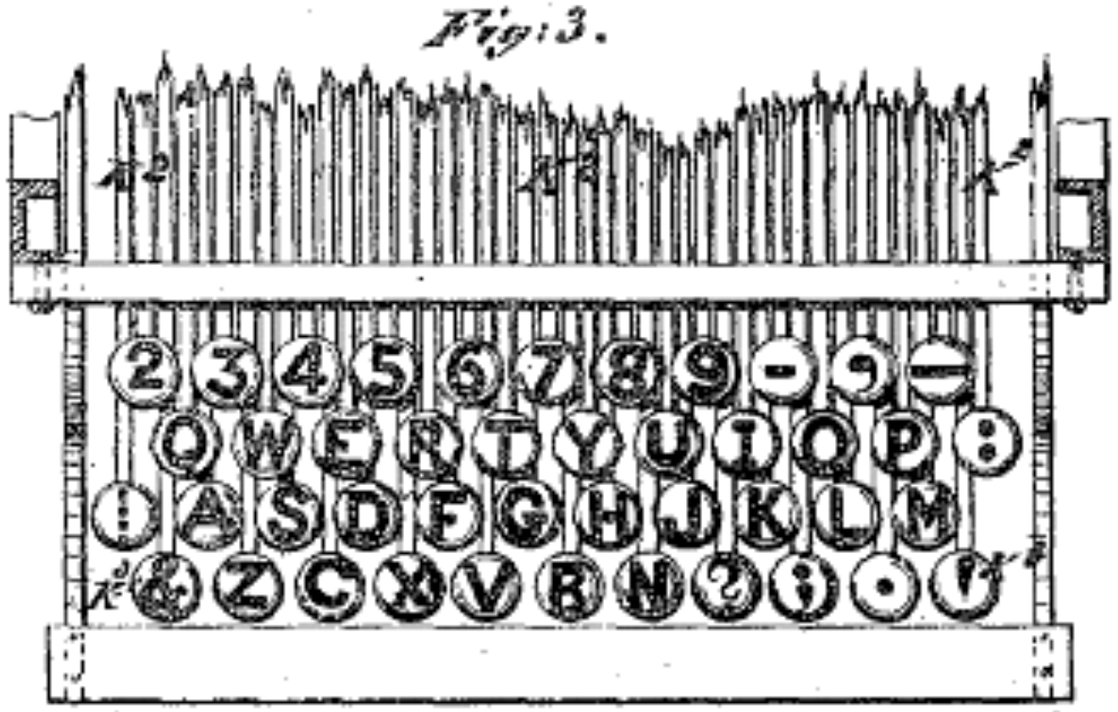
Tastaturbelegung

- **Tastaturbelegung** (aka **Tastaturlayout**) beschreibt Kodierung einzelner Tasten sowie deren Lage (und Häufigkeit) auf Tastatur
- Unterscheidung zwischen **physischen Belegung** (Verteilung der bedruckten Tasten) und variabler, (über Software) anpassbarer Belegung

Tastaturlayout

Beispiel: QWERTY

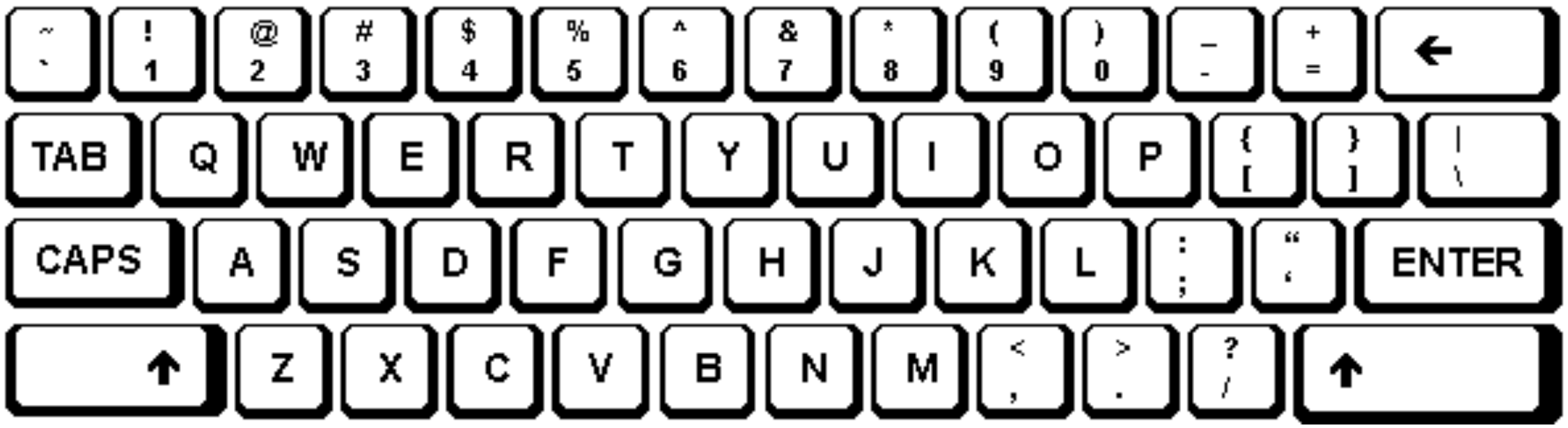
- Bezeichnung für Tastaturbelegung nach **Christopher Sholes**, bei der am häufigsten vorkommenden Buchstabenfolgen räumlich möglichst weit getrennt sind



Tastaturlayout

Beispiel: QWERTY

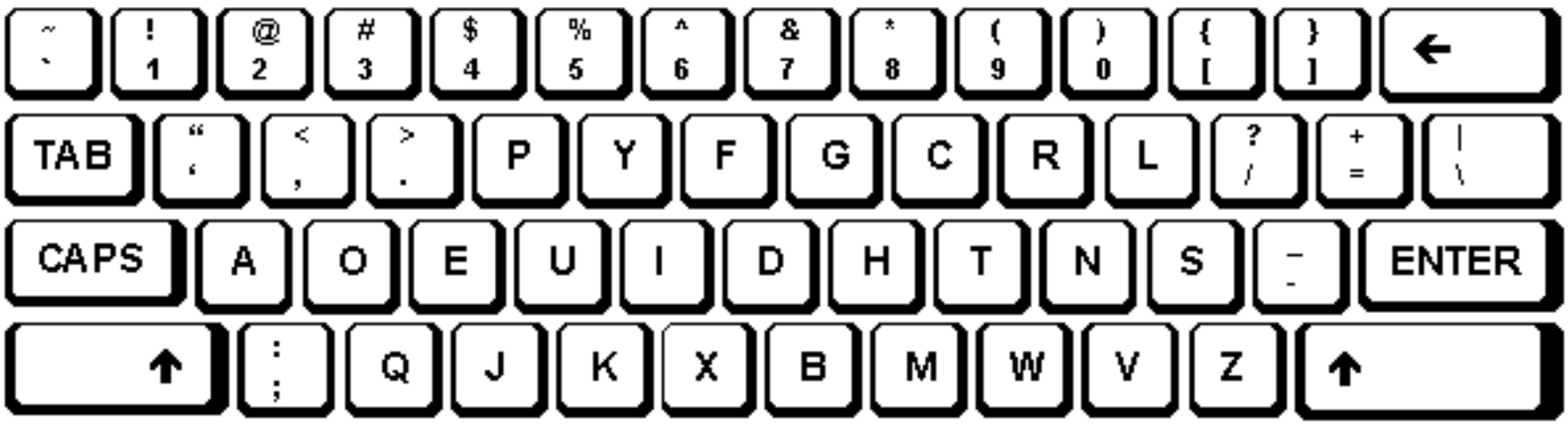
- Bezeichnung für Tastaturbelegungen, auf denen ersten sechs Tasten in oberer Reihe mit lateinischen Buchstaben belegt sind



Tastaturlayout

Beispiel: Dvorak Layout

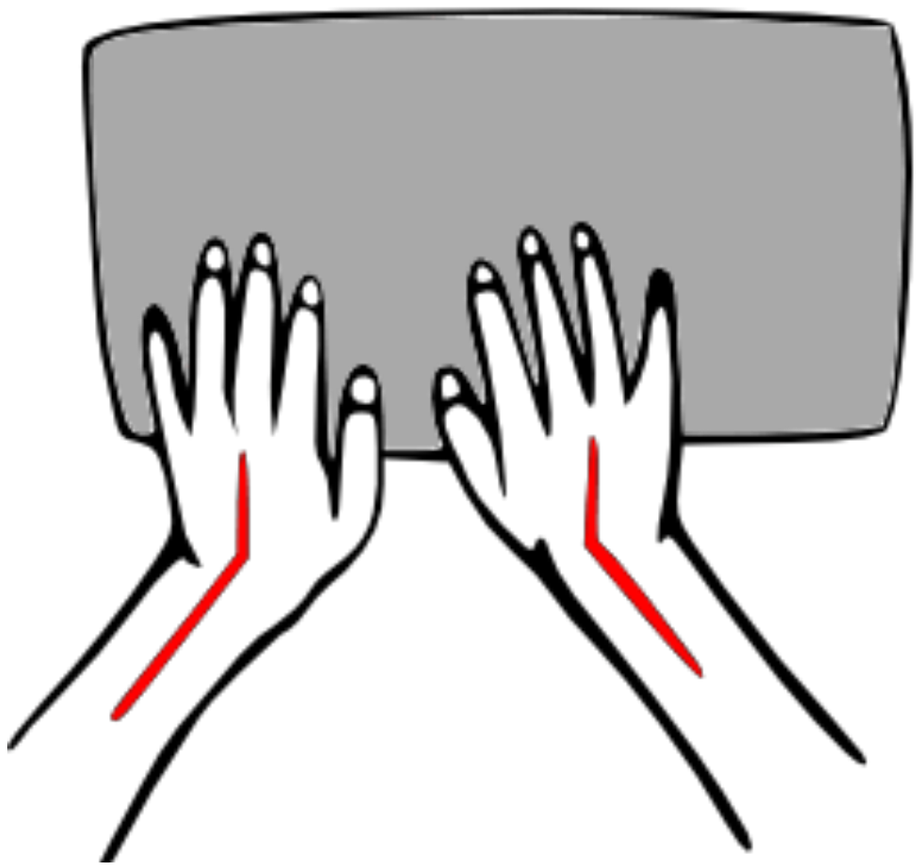
- Bezeichnung ergonomischer Tastatur-belegungen als Alternative zur QWERTY-Tastaturbelegung entwickelt wurde.

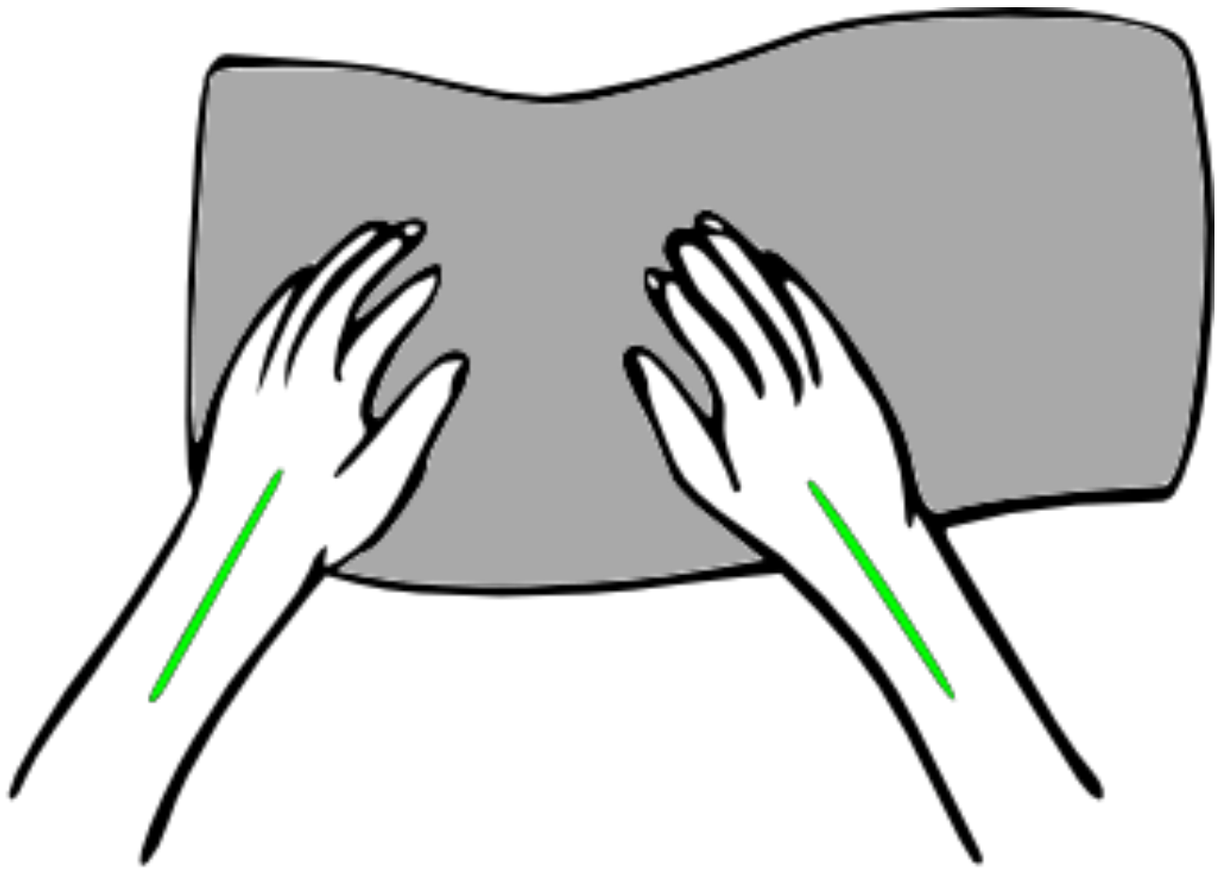


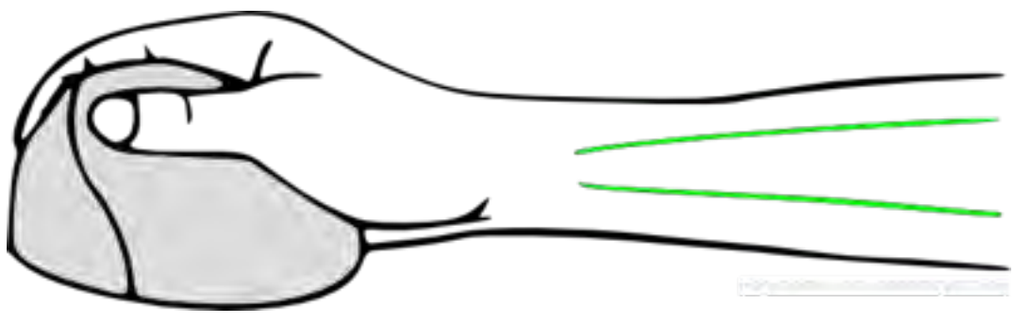
Tastaturlayout

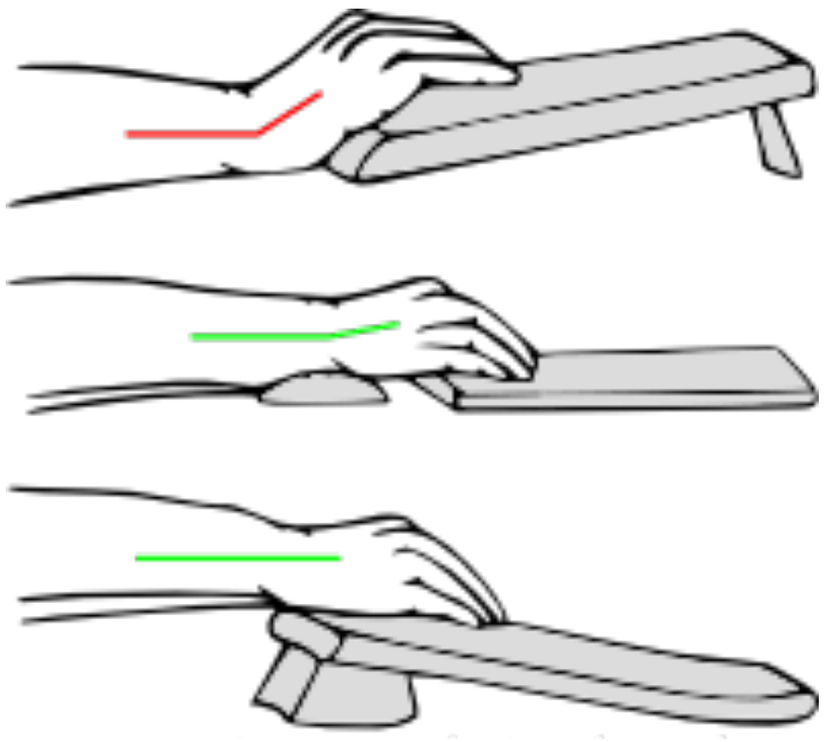
Beispiel: Colemak Layout

- Bezeichnung für Tastaturbelegung, die Vertrautheit des QWERTY-Layout mit Effizienz von Dvorak kombiniert









Bildnachweis: http://ergonomie-am-arbeitsplatz.de/ergonomische-tastatur/

Beispiele: Ergonomische Tastaturen

Beispiele: Ergonomische Tastaturen

Software-basierte anpassbaren Tastaturbelegung

Software-basierte anpassbaren Tastaturbelegung