Cybernetics and the Pioneers of Computer Art

URL: http://dreher.netzliteratur.net/4_Medienkunst_Kybernetike.html

Base Two

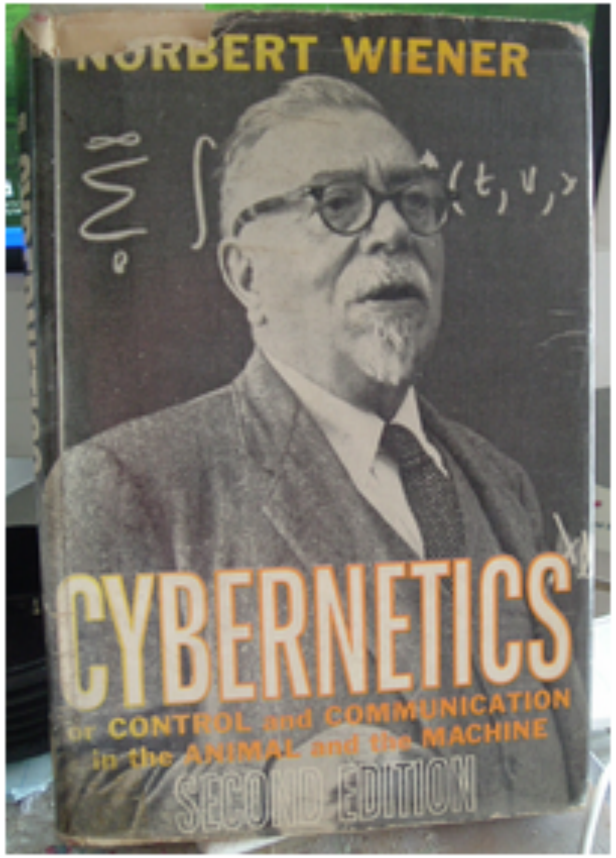
Lecture, part of the series of events “Base Two” commemorating the 300th anniversary of Gottfried Wilhelm Leibniz´s death

Sprengel Museum Hannover, 10/19/2016

Thomas Dreher

URL: http://dreher.netzliteratur.net

The Founders of Cybernetics

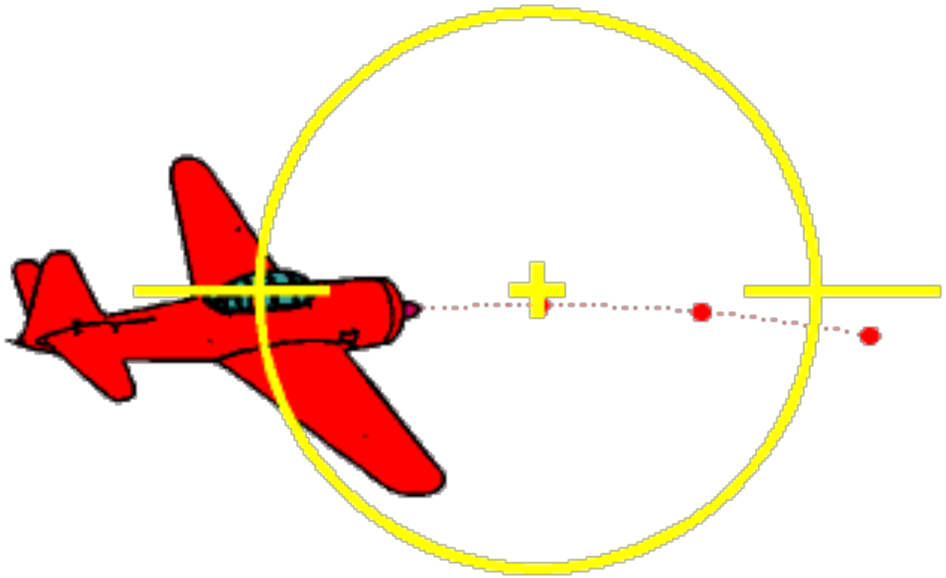


Norbert Wiener (Cover of "Cybernetics", second edition, 1962).

Claude Elwood Shannon with "Theseus" (1952) and the mouse navigating itself through the labyrinth (Credit: MIT Museum, Boston / Nixdorf MuseumsForum, Paderborn).

Image source: https://www.flickr.com/photos/arselectronica/5056388921/

Ballistics WWII



If the target moves across the course of the fighter, a certain amount of lead has to be taken into account: One has to fire at the point in space where the target will be when the projectiles arrive. The fighter therefore has to fly a curve while firing, i.e. it is turning at some rate. Evidently, there would be no problem if the projectiles arrived instantaneously. Of course they do not, but it is advantageous to reduce the time of flight as much as possible, by using guns with a high muzzle velocity.

(Source: Gustin, Emmanuel: The WWII Fighter Gun Debate (1998-99). Chapter Ballistics. In: URL: http://users.telenet.be/Emmanuel.Gustin/fgun/fgun-th.html)

Fire Control Systems

Fig. 9.1. M-9 gun director, tracking head with operators. One follows the target in elevation, the other in azimuth. The unit and the operators rotate while tracking. Courtesy of AT&T Archives.

Source: Mindell: Human 2004, S.128.

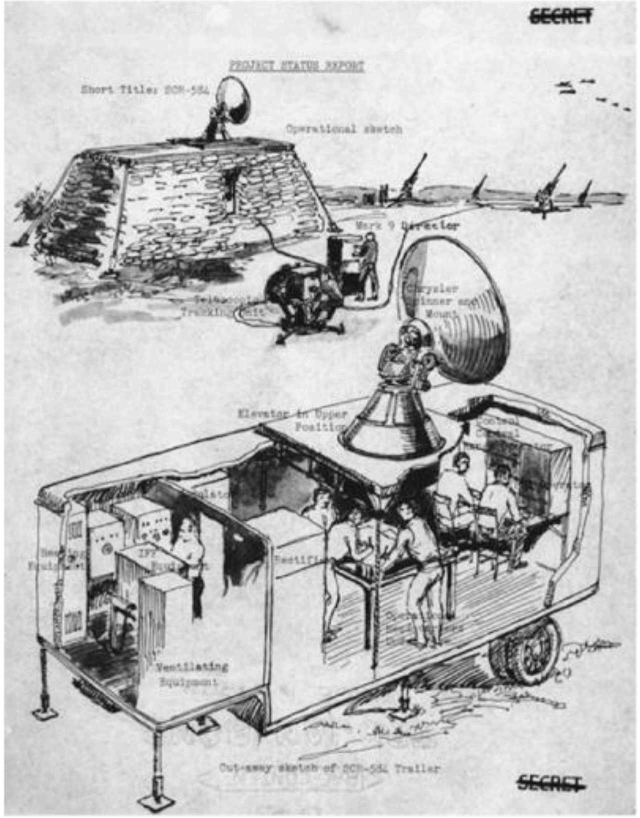


Fig. 9.6. A glimpse of automated war. The SCR-584 radar, driving the M-9 gun director, and 90 mm guns with Sperry servo drives. The 584 itself is in the foreground, as well as buried into a revetment as part of the system in the background. This system proved successful against the V-1 buzz bombs in 1944. Courtesy of MIT Museum.

Source: Mindell: Human 2004, S.352.

Left: Pursuit of a goal (one operator) and localisation (two operators) without radar. Right: Pursuit of a goal with radar and the localisation, the calculation of the goal´s flight line for predicitions and their transfers to cannons.

Feedback

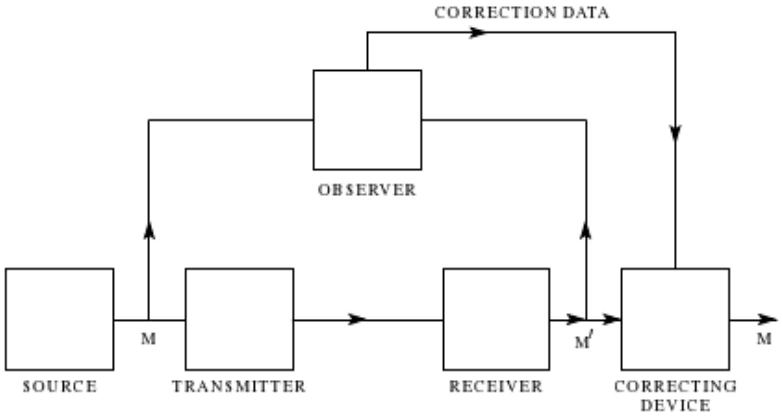


Fig. 8 — Schematic diagram of a correction system.

Shannon, Claude Elwood: A Mathematical Theory of Communication. In: Bell System Technical Journal, Vol. 27/Nr.3, 1948, p. 409.

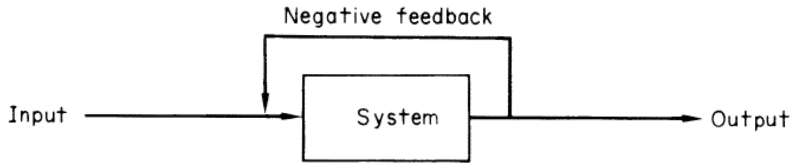
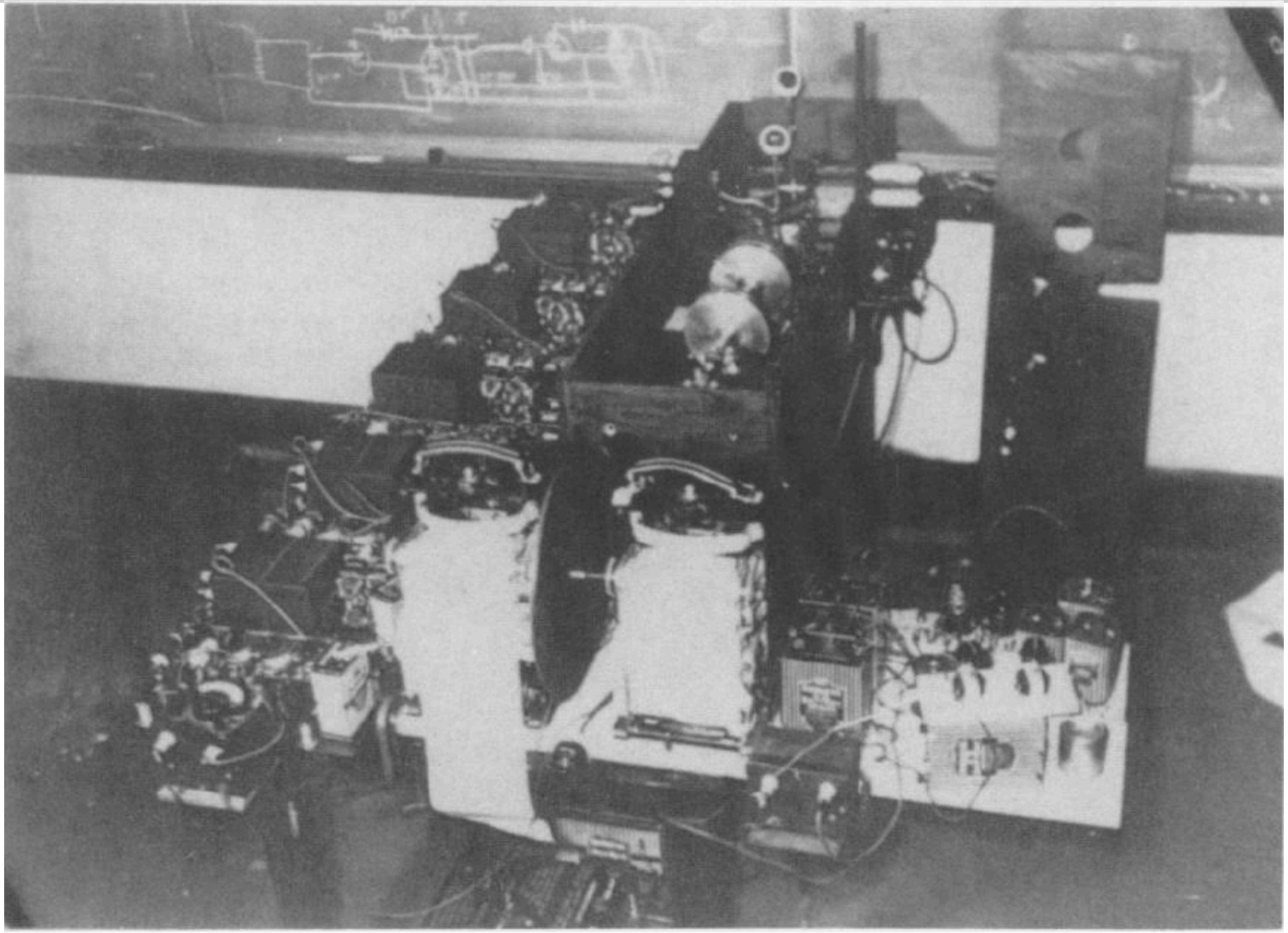


Fig. 2. Negative feedback.

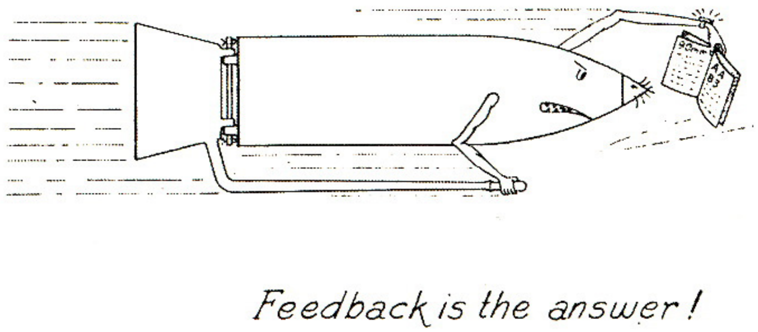
Apter: Cybernetics 1969, p.257-265.

Antiaircraft Predictor

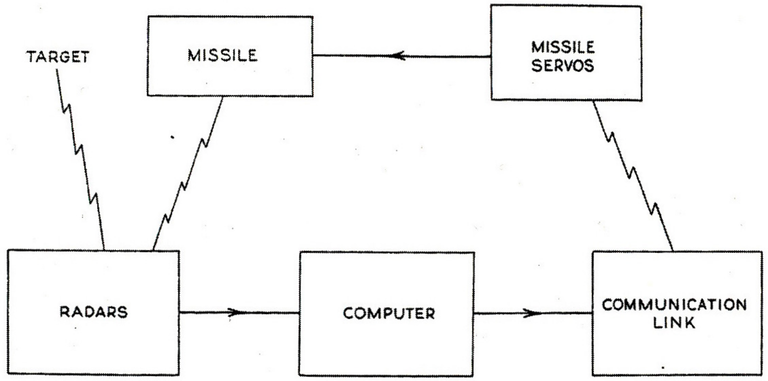


Wiener, Norbert/Bigelow, Julian/Mooney, Paul: Antiaircraft Predictor. From Norbert Wiener to D. I. C. 5980 A. A. Directors, “Summary Report for Demonstration,” 10 June 1942, Record Group 227, Office of Science and Research Development, National Defense Research Committee Contractors' Technical Reports, Division 7, MIT, NDCrc-83, National Archives, Library of Congress, Washington, D. C. (Galison: Ontology 1994, p.239).

Nike Ajax



Automated feedback in Nike Ajax (Roch: Shannon 2009, p.158).



Communication diagram Nike, 1945 (Roch: Shannon 2009, p.159).

Cybernetic Model: Homeostat

William Ross Ashby beside the "Homeostat", realised in 1946-47.

Image source: URL: http://www.rossashby.info/gallery/images/WRA%20+%20Homeostat.jpg

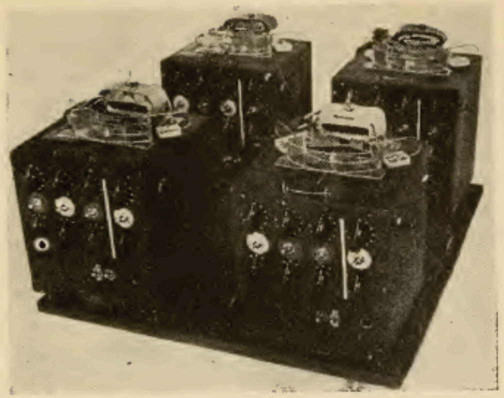


FIGURE 8/2/1 : The Homeostat. Each unit carries on top a magnet and coil such as that shown in Figure 8/2/2. Of the controls on the front panel, those of the upper row control the potentiometers, those of the middle row the commutators, and those of the lower row the switches *S* of Figure 8/2/3.

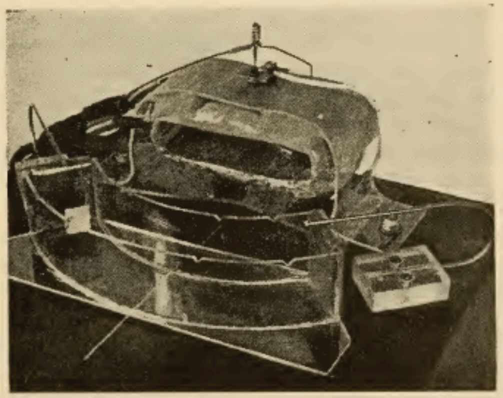
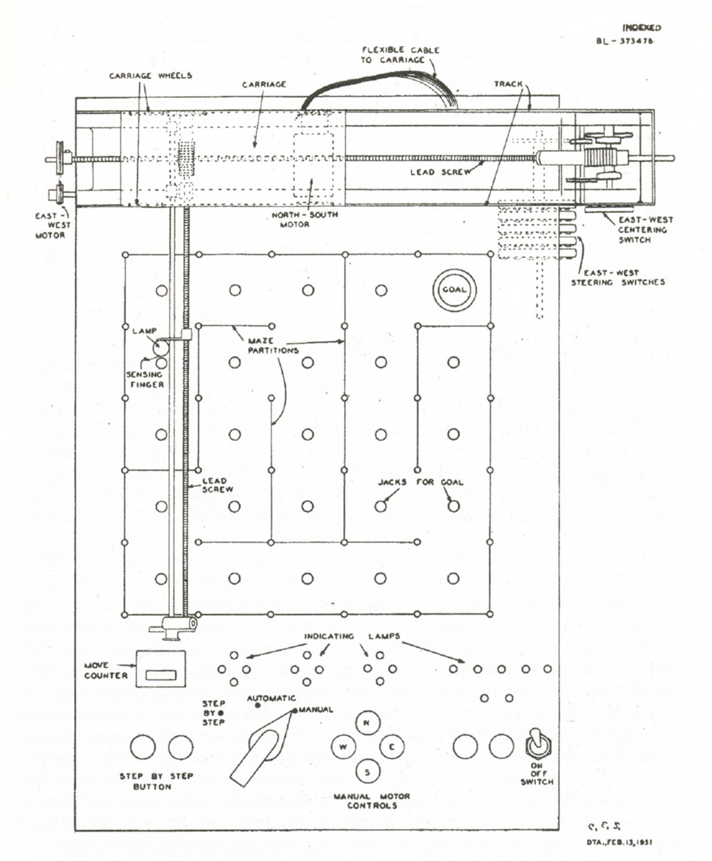


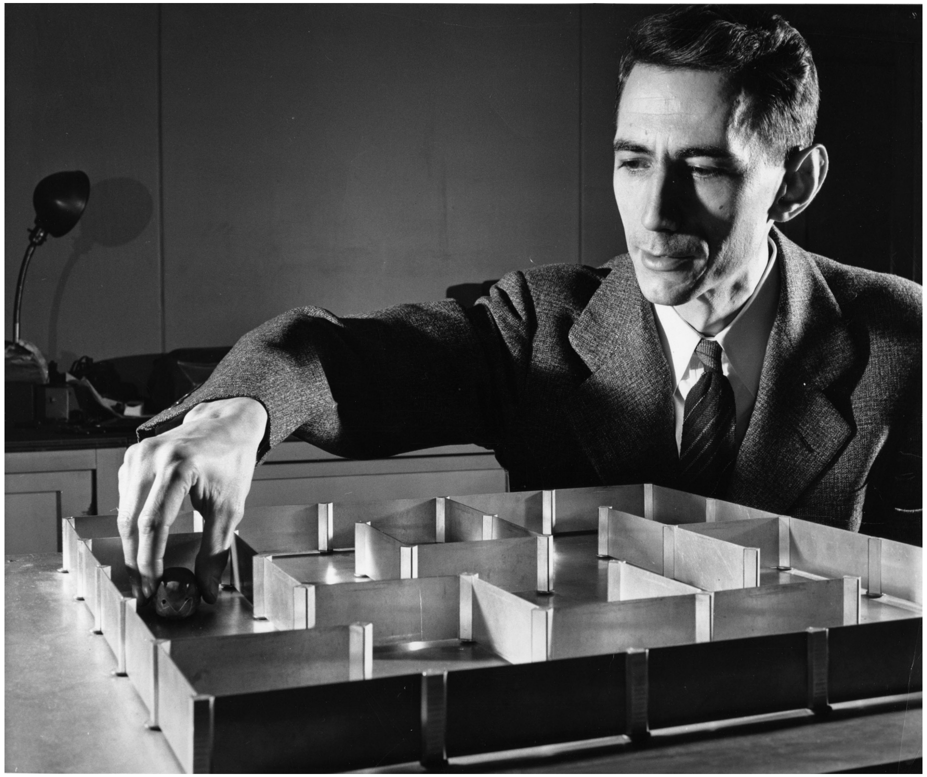
FIGURE 8/2/2 : Typical magnet (just visible), coil, pivot, vane, and water potentiometer with electrodes at each end. The coil is quadruple, consisting of *A*, *B*, *C* and *D* of Figure 8/2/3.

Ashby, William Ross: Homeostat, 1946-47 (Ashby: Design 1960, p.101).

Cybernetic Models: Maze-Solving Machine



Left: Shannon, Claude Elwood: Maze-Solving Machine, plan (Shannon: Presentation 1951, p.174, figure 8).

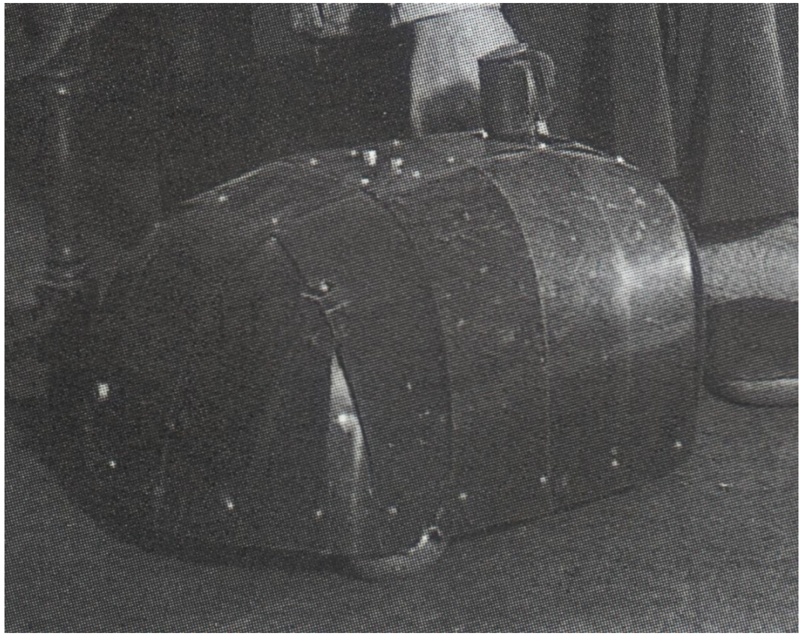


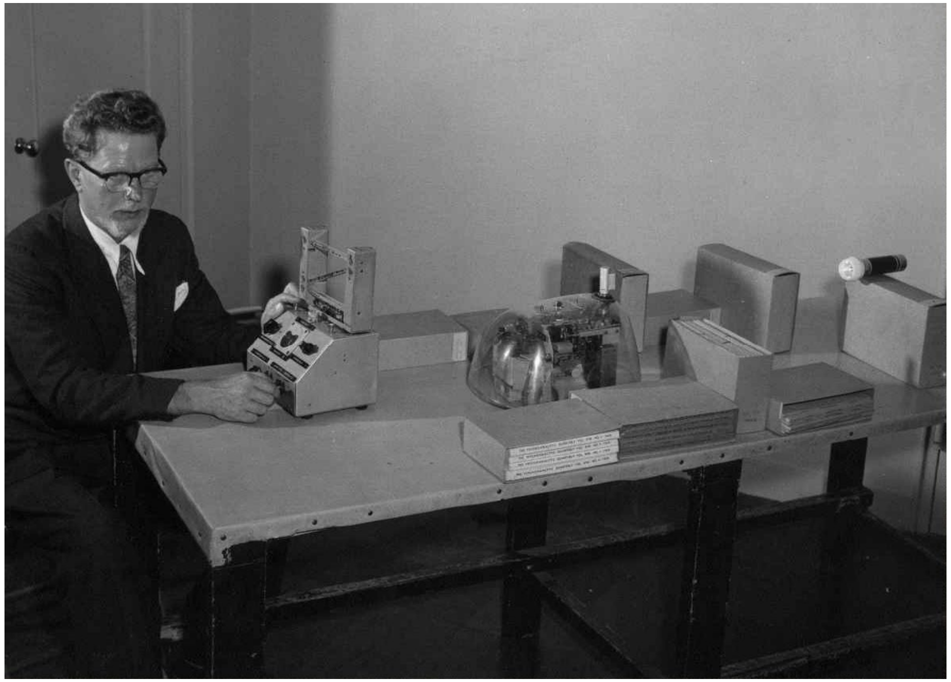
Right: Claude Elwood Shannon with "Theseus" (1952) and the mouse navigating itself through the labyrinth (Credit: MIT Museum, Boston / Nixdorf MuseumsForum, Paderborn).

Image source: https://www.flickr.com/photos/arselectronica/5056388921/

Cybernetic Models: Robots

Right: Walter, William Grey: Elmer, 1948.
Image source: URL: http://cyberneticzoo.com/wp-content/uploads/2009/09/ElmerHiRes_p3-1024x813.jpg.

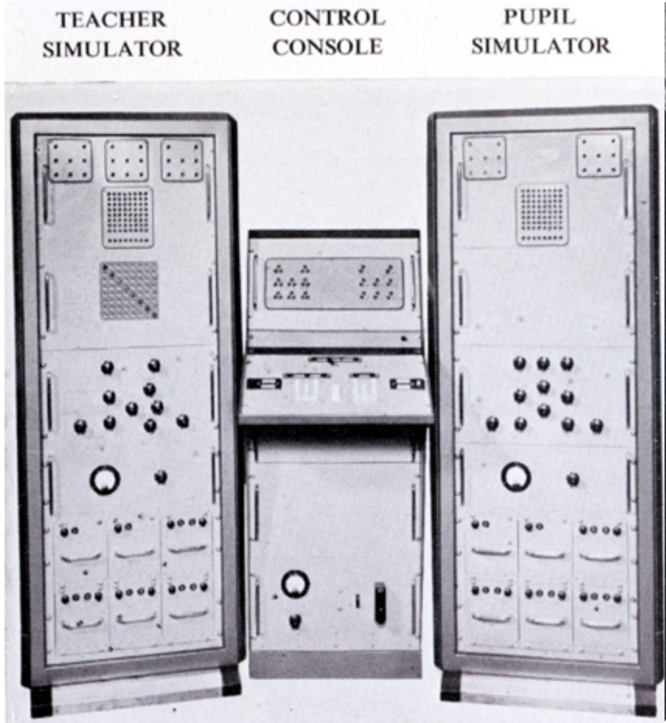


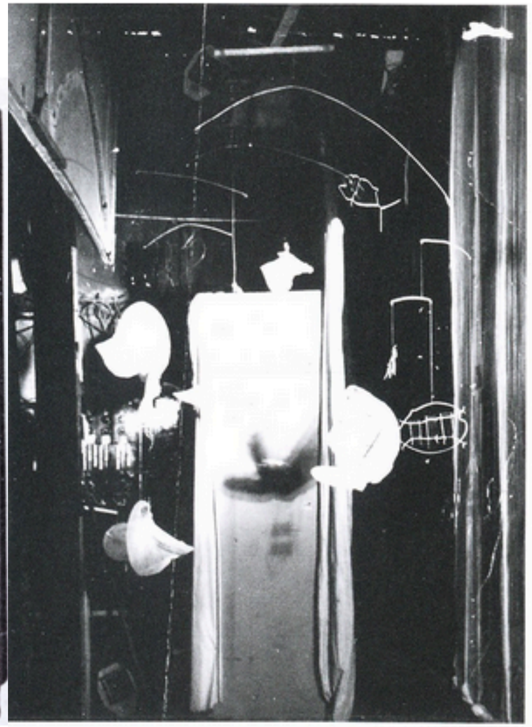


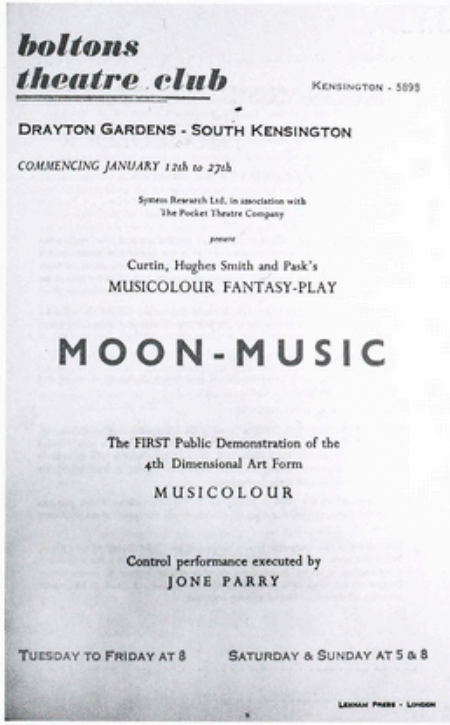
Left: Walter, William Grey: Cora, model for demonstrations on a table, 1951 (constructed by Bunny Warren for the Festival of Britain in London, Exhibition of Science, Science Museum, South Kensington, 1951).

Image source: URL: http://cyberneticzoo.com/wp-content/uploads/WGW-NewYork-p1.JPG

Gordon Pask: Early Works







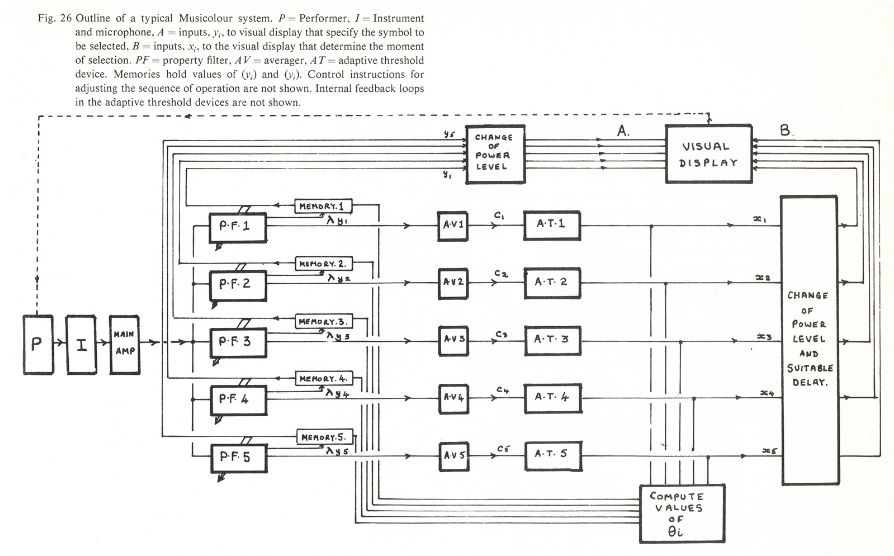
Solartron EUCRATES II, ca. 1956 (Pask: Approach 1961, pl.I 8(i)).

Musicolour, Boltons Theatre Club, South Kensington 1954.

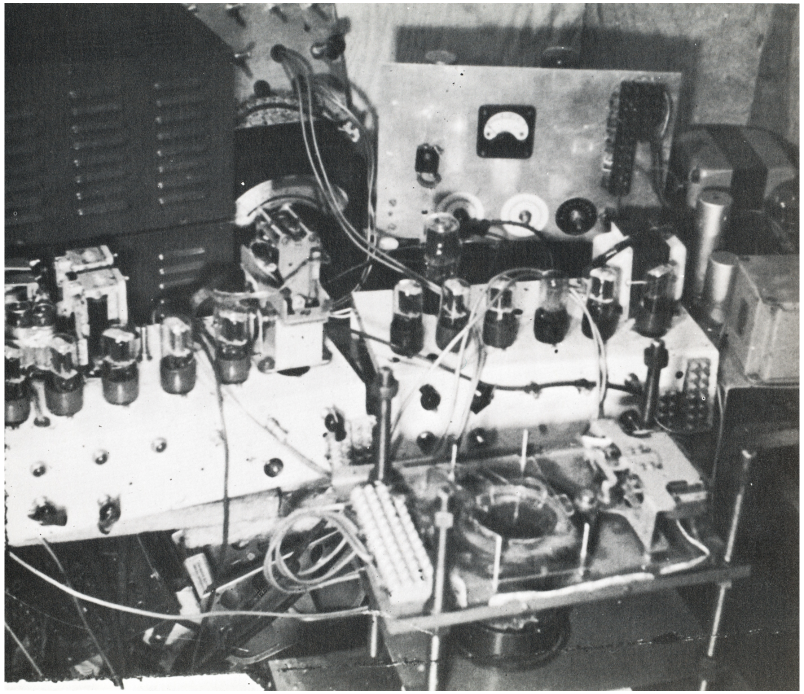
Left: Stage with a projection screen for Musicolour.

Right: Moon-Music, playbill (Rosen: Control 2008, p.139).

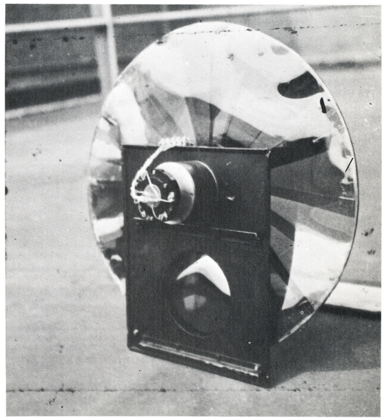
Gordon Pask: Musicolour 1953-57



Circuit diagram (Pask: Comment 1971, p.79, fig. 26).



Electrochemical system (Pask: Comment 1971, p.85, fig.31).



Projection wheel controlled by a servomechanism (Pask: Comment 1971, p.81, fig.27).

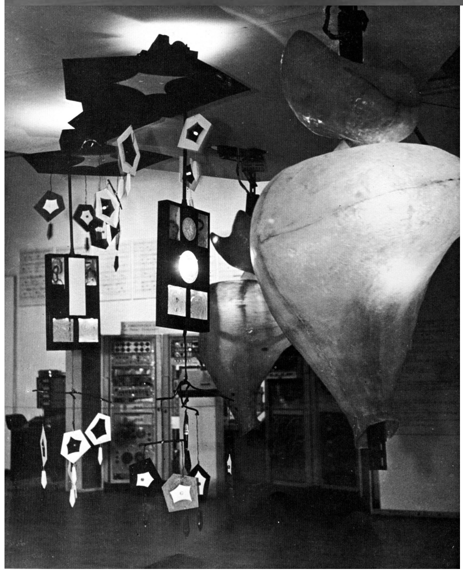
Nicolas Schöffer: CYSP 1, 1956

Left: exhibition, Institute of Contemporary Arts, London 1960. The navigation desk at the right side was normally substituted by autonavigation.

Image source: URL: http://www.olats.org/schoffer/img/cyspica2.jpg

Image Source: http://www.thecentreofattention.org/exhibitions/feCYSP1sm.jpg

Reactive Installations with Computing Processes



Pask, Gordon: Colloquy of Mobiles, 1968 (installed at "Cybernetic Serendipity", Institute of Contemporary Art, London 1968. Pask: Comment 1971, p.90,97, fig. 34,40).

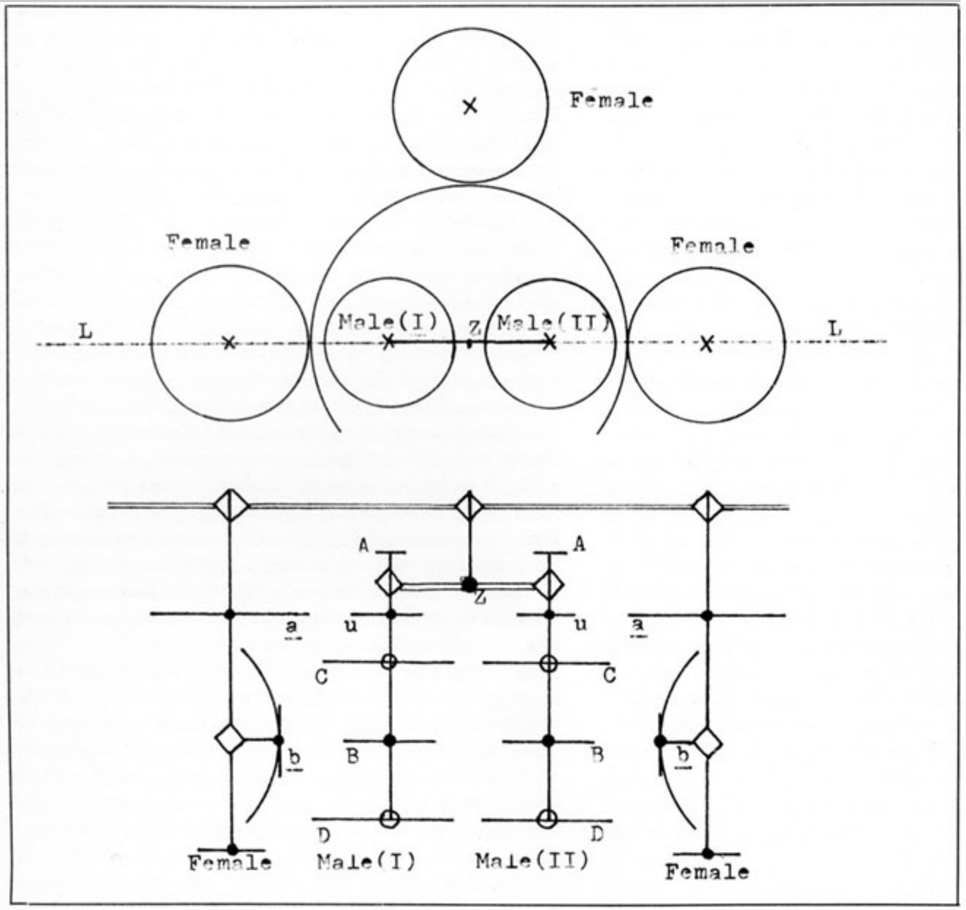
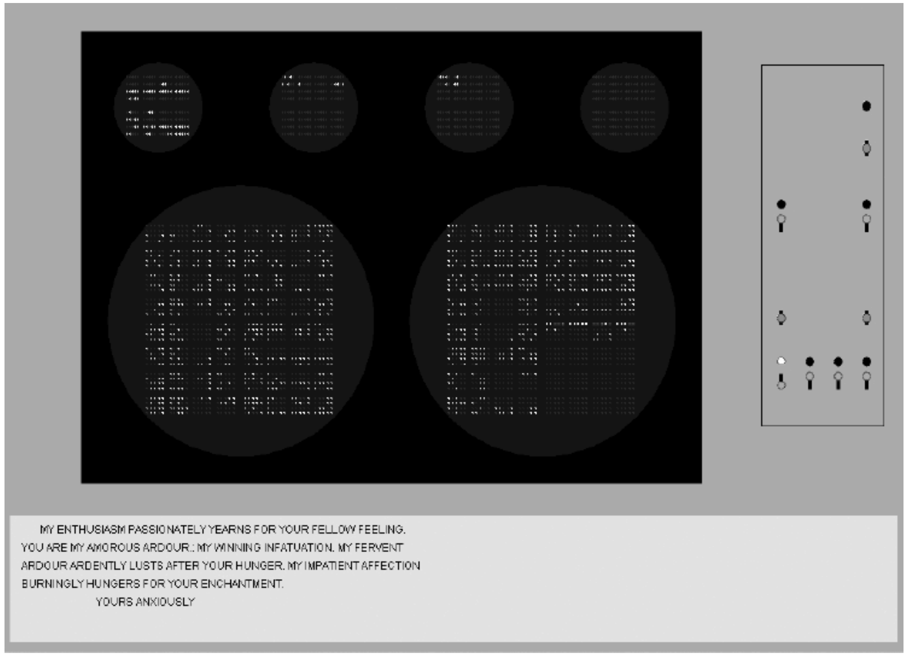


Fig. 34 A rough sketch of powered mobiles.
a Horizontal plan
b Vertical section taken through line *L* in horizontal plan.
A = drive state display for male
B = main body of male, bearing 'energetic' light projectors *O* and *P*
C = upper 'energetic' receptors
D = lower 'energetic' receptors
U = non-'energetic', intermittent signal lamp
a = female receptor for intermittent positional signal
b = vertically movable reflector of female
Z = bar linkage bearing male I and male II

◇ = Drive motor
= Free coupling
= Fixed coupling
= Bar linkage

Word Processing



The stored word library contained a selection from Roget´s Thesaurus. The words supplied with syntax indices – "adjectives", "substantives", "adverbs" and "verbs" – are combined following two syntactical structures: "My—[Adjective]—Substantive—[Adverb (adv)]—Verb (verb) —Your—[Adjective]—Substantive" or "You are my—Adjective (adj)—Substantive (noun)". In the case of repetitions the second structure was reduced to "My—Adjective—Substantive". After a salutation combined by using a database called "Letter Start" to select words followed five sentences generated by combinations of stored words using the syntactical schemes described above. The end of the letter was constructed with the scheme "Yours—Adverb—MUC" (MUC = Manchester University Computer).

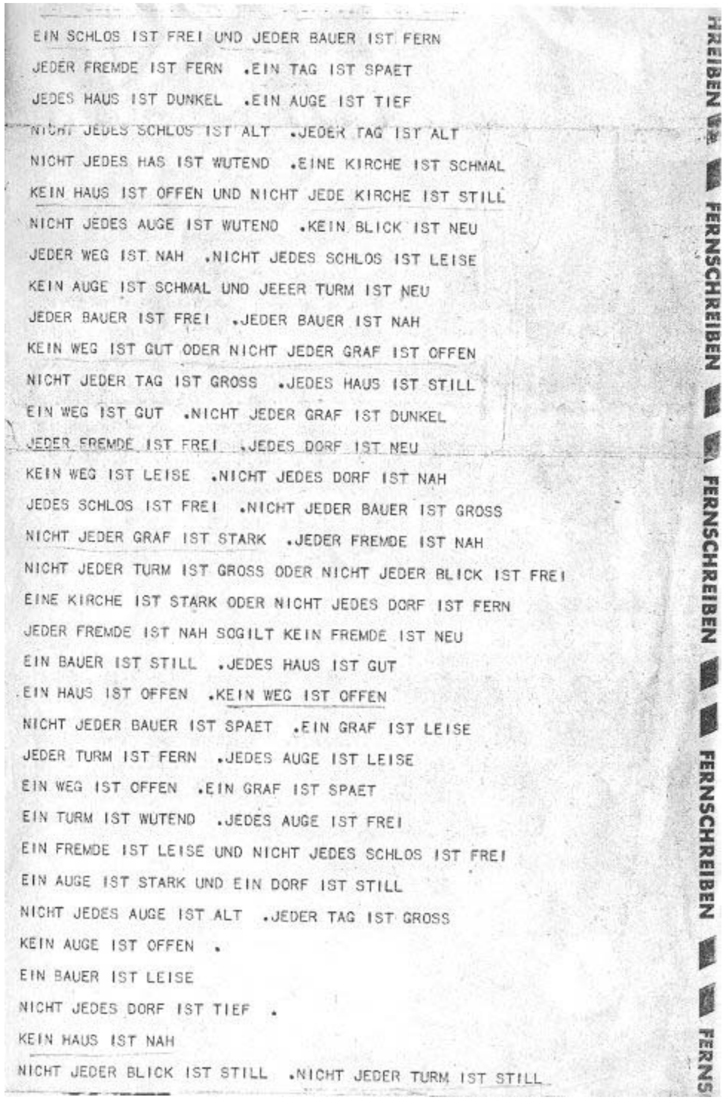
Left: Link, David: Ferranti Mark I Emulator with Christopher Strachey´s "Love-letters", 1952 (Link: Angel 2006, p.16, fig.1).

Right: Syntax indices of Christopher Strachey´s "Love-letters", 1952 (Link: Angel 2006, p.19).

Word Processing

The database contained a selection of 16 subjects and 16 predicates as they were found in Kafka´s "The Castle". Four "logical constants" (“und”, “oder”, “so gilt”, “.” ["and", "or", "if...then", ". "]) for the syntax of the combinations, four "logical operators" for the subject´s existence (“ein”, “jeder”, “kein”, “nicht jeder” ["one", "each", "no one" and "not each”] in feminine, masculine and factual German forms) as well as the stored subjects and predicates should appear with equal frequency in a computer-generated text. Only the "relative frequency" of the point (the sign for the negation) was determined higher than the frequency of the other logical constants.

Left: Lutz, Theo: Stochastic Text, 1959. Syntax indices of the program.



EIN SCHLOS IST FREI UND JEDER BAUER IST FERN
JEDER FREMDE IST FERN .EIN TAG IST SPAET
JEDES HAUS IST DUNKEL .EIN AUGE IST TIEF
NICHT JEDES SCHLOS IST ALT .JEDER TAG IST ALT
NICHT JEDES HAS IST WUTEND .EINE KIRCHE IST SCHMAL
KEIN HAUS IST OFFEN UND NICHT JEDE KIRCHE IST STILL
NICHT JEDES AUGE IST WUTEND .KEIN BLICK IST NEU
JEDER WEG IST NAH .NICHT JEDES SCHLOS IST LEISE
KEIN AUGE IST SCHMAL UND JEEER TURM IST NEU
JEDER BAUER IST FREI .JEDER BAUER IST NAH
KEIN WEG IST GUT ODER NICHT JEDER GRAF IST OFFEN
NICHT JEDER TAG IST GROSS .JEDES HAUS IST STILL
EIN WEG IST GUT .NICHT JEDER GRAF IST DUNKEL
JEDER FREMDE IST FREI .JEDES DORF IST NEU
KEIN WEG IST LEISE .NICHT JEDES DORF IST NAH
JEDES SCHLOS IST FREI .NICHT JEDER BAUER IST GROSS
NICHT JEDER GRAF IST STARK .JEDER FREMDE IST NAH
NICHT JEDER TURM IST GROSS ODER NICHT JEDER BLICK IST FREI
EINE KIRCHE IST STARK ODER NICHT JEDES DORF IST FERN
JEDER FREMDE IST NAH SOGILT KEIN FREMDE IST NEU
EIN BAUER IST STILL .JEDES HAUS IST GUT
EIN HAUS IST OFFEN .KEIN WEG IST OFFEN
NICHT JEDER BAUER IST SPAET .EIN GRAF IST LEISE
JEDER TURM IST FERN .JEDES AUGE IST LEISE
EIN WEG IST OFFEN .EIN GRAF IST SPAET
EIN TURM IST WUTEND .JEDES AUGE IST FREI
EIN FREMDE IST LEISE UND NICHT JEDES SCHLOS IST FREI
EIN AUGE IST STARK UND EIN DORF IST STILL
NICHT JEDES AUGE IST ALT .JEDER TAG IST GROSS
KEIN AUGE IST OFFEN .
EIN BAUER IST LEISE
NICHT JEDES DORF IST TIEF .
KEIN HAUS IST NAH
NICHT JEDER BLICK IST STILL .NICHT JEDER TURM IST STILL

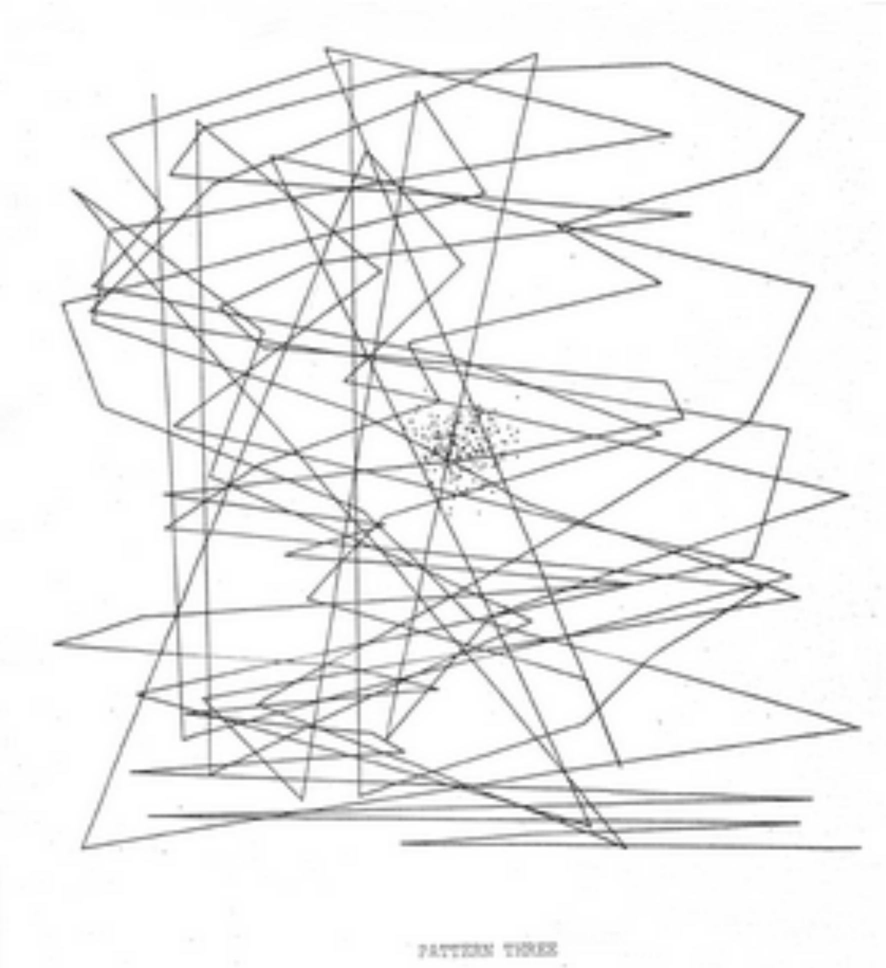
Right: Lutz, Theo: Stochastic Text, 1959. Zuse Z22, teleprinter output. Source: URL: http://auer.netzliteratur.net/0_lutz/lutz.jpg

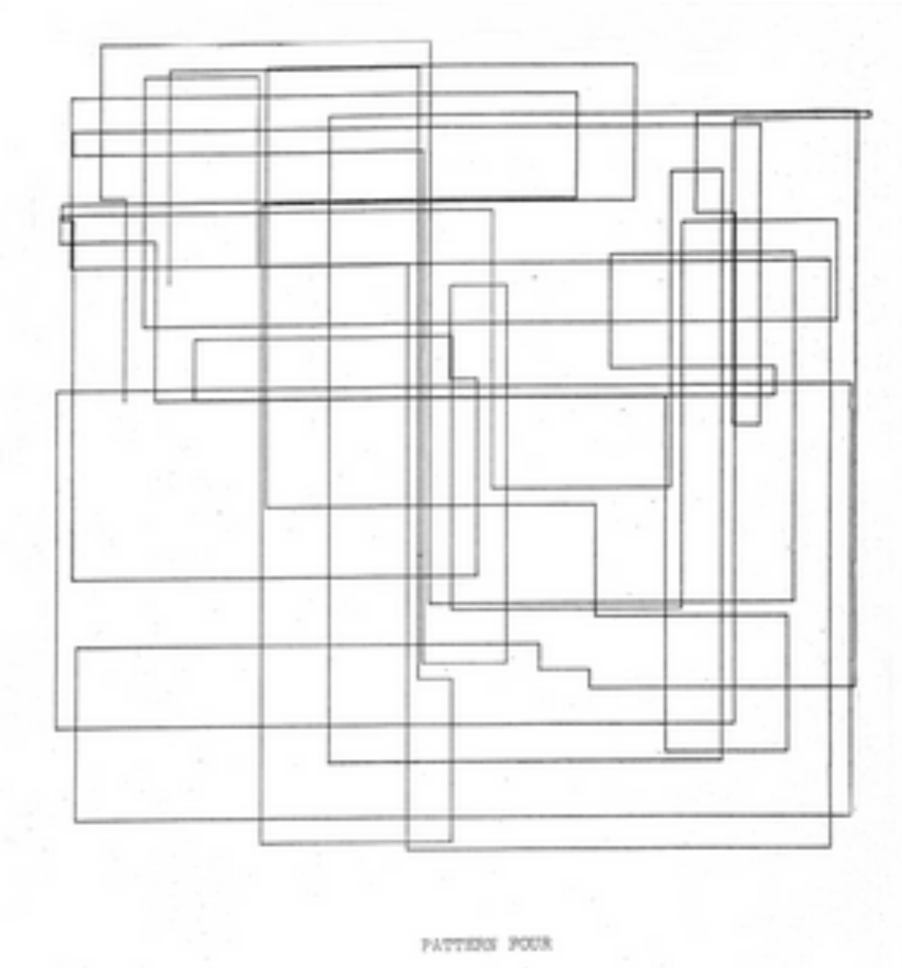
Computer Graphics

Noll, Nees and Nake revived the following procedures of computer literature being developed by Christopher Strachey, Theo Lutz and a few others:

- The selection of basic elements,
- a random generator,
- determinations of the frequency the program chooses elements, and
- a syntax combining the elements.

Michael A. Noll: Patterns

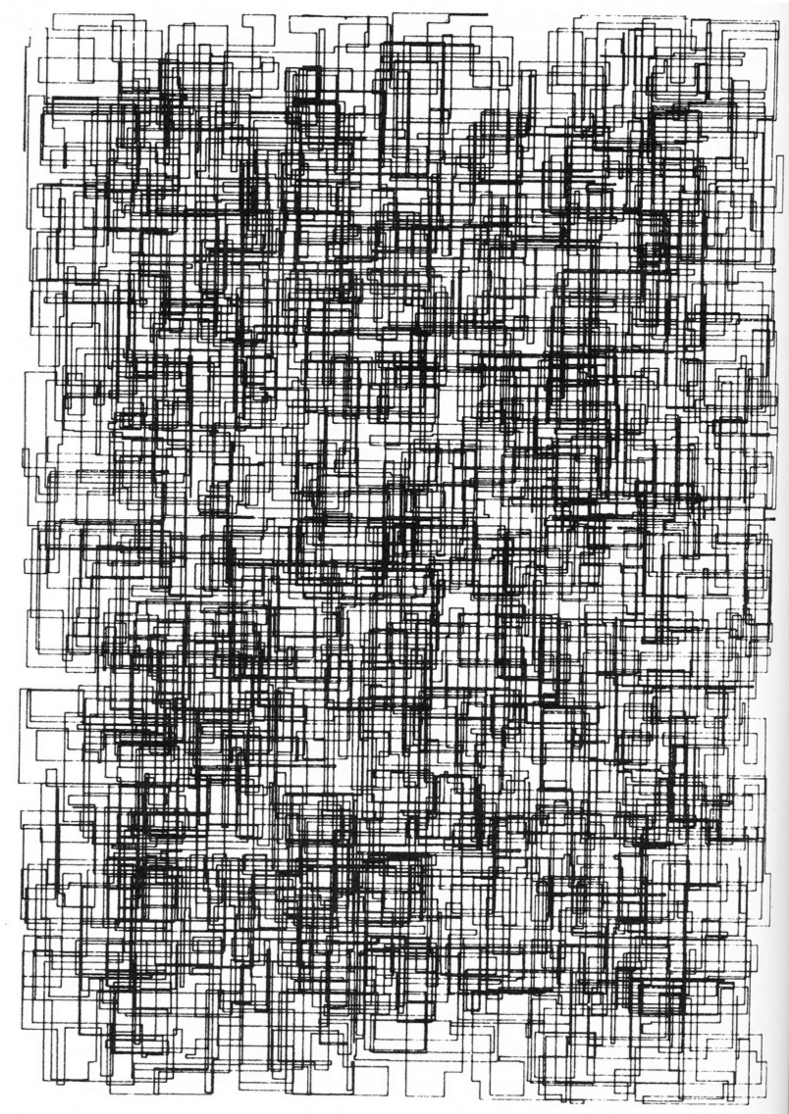




Left: Pattern Three, 1962, photo print. Right: Pattern Four, 1962, photo print (Noll: Patterns 1962, unpaginated).

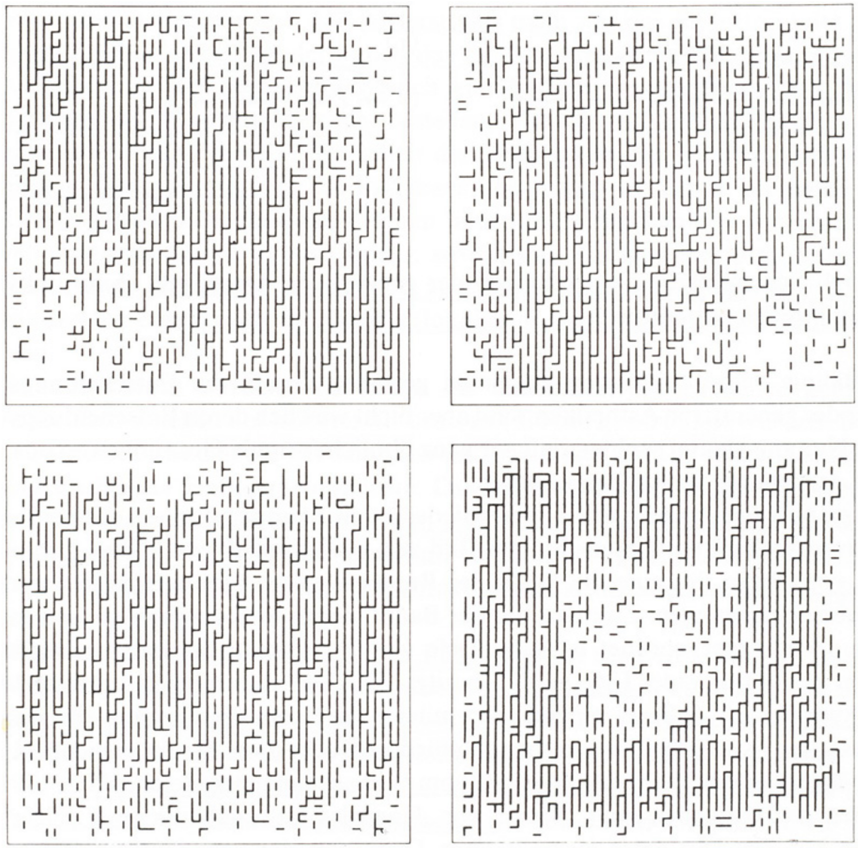
Georg Nees: Computer Graphics

23-Ecke (23 corners) , 1964, plotter drawing (Nees: Grundlagenstudien 1964, p.124, ill. 2).



Untitled (Micro Innovation), 1967, plotter drawing (Nees: Computergraphik 2006, p.222, ill. 31).

Frieder Nake: Walk-Through-Raster, 1966



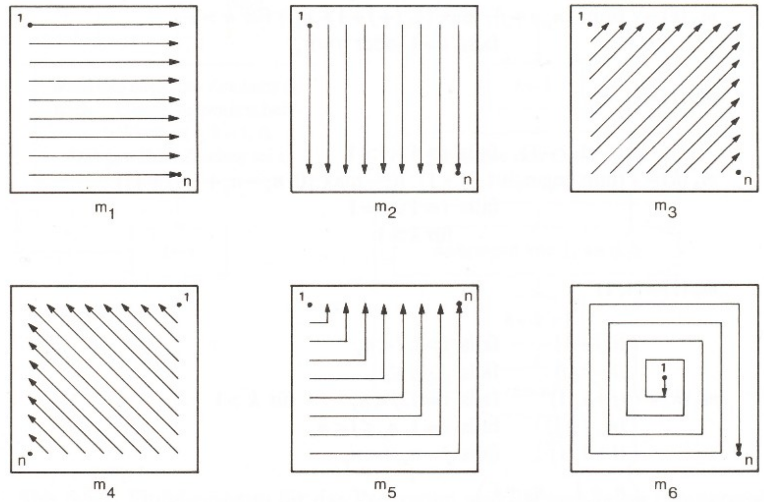
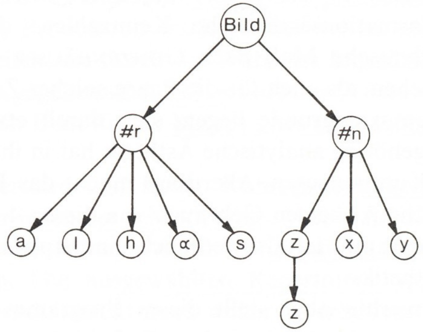
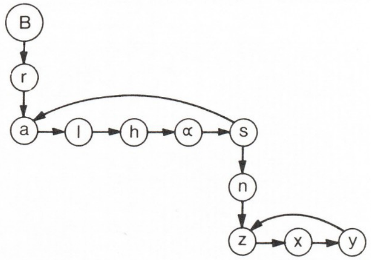


Abb. 5.5-1. Sechs Modi für das Auftragen einer linearen Kette in der Ebene



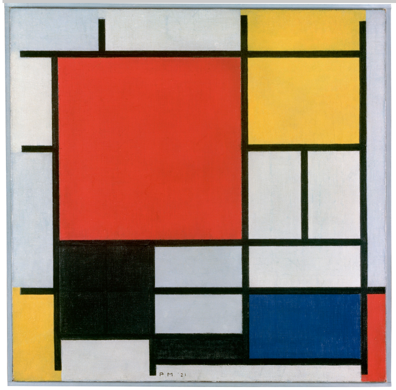
Right, top: Walk-Through-Rasters, 1966, six modes of a computing process to step across the plane (Nake: Ästhetik 1974, p.229, ill. 5.5-1).

Left: Walk-Through-Raster, series 2.1, four realisations, 1966, plotter drawings (Nake: Ästhetik 1974, p.236, ill. 5.5-5).

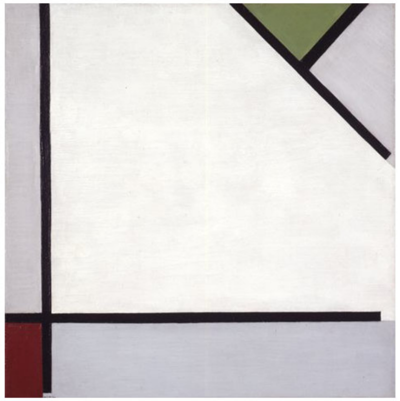


Center right and bottom right: Walk-Through-Raster, 1966, diagram of the tree structure (Nake: Ästhetik 1974, p.235, ill. 5.5-4).

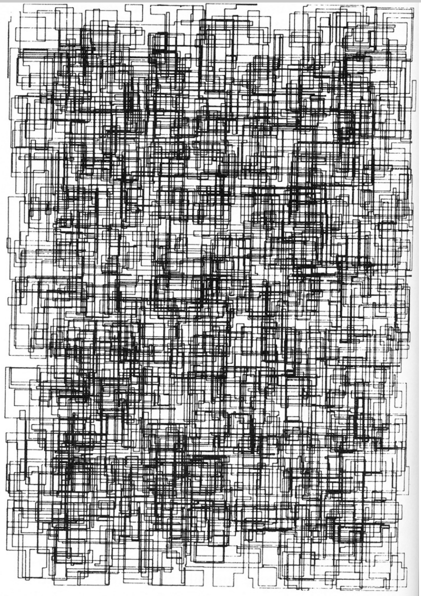
De Stijl/Computer Graphics/Serial Art



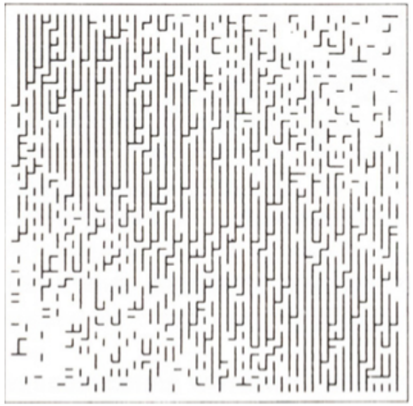
Piet Mondriaan: Composition with Large Red Plane, Yellow, Black, Grey and Blue, 1921. Oil on canvas. Gemeentemuseum Den Haag. Source: URL: http://www.gemeentemuseum.nl/de/collection/item/6496



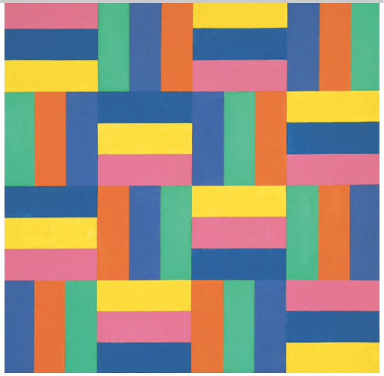
Theo van Doesburg: Simultaneous Counter-Composition, 1929. Oil on canvas. San Francisco Museum of Modern Art. Source: URL: http://arttattler.com/archivetheovandoesburg.html



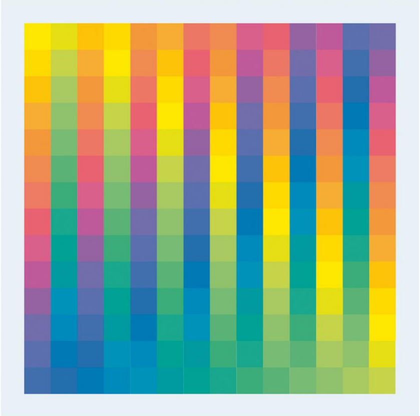
Georg Nees: Untitled (Micro Innovation), 1967, plotter drawing (Nees: Computergraphik 2006, p.222, ill. 31).



Frieder Nake: Walk-Through-Raster, series 2.1, four realisations, 1966, plotter drawings (Nake: Ästhetik 1974, p.236, ill. 5.5-5).



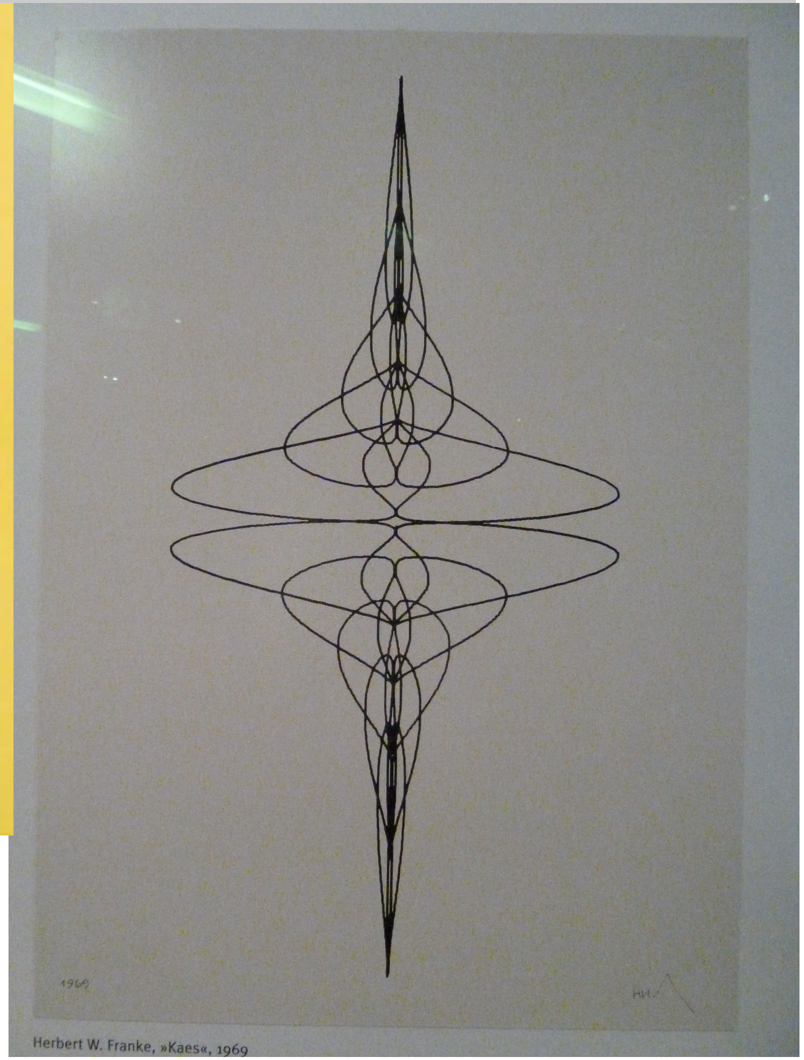
Richard Paul Lohse: Squares formed by Colour Groups 1944/2. Oil on canvas. Richard Paul Lohse Foundation, Zürich.
Source: URL: http://lohse.ch/popup_farbgruppen_e.html



Karl Gerstner: Polychrome of Pure Colors, 1956-58. Printer’s ink on cubes of Plexiglas, fixed in a chrome-plated metal frame. Courtesy of the artist.
Source: URL: http://www.ourdailyread.com/2015/12/why-the-history-of-maths-is-also-the-history-of-art/

Herbert W. Franke

Left: Phänomen Kunst. Die kybernetischen Grundlagen der Ästhetik. Stuttgart 1967 (Phenomen Art. The Cybernetic Foundations of Aesthetics. Stuttgart 1967. Cover with Marcel Wyss' "Spiral").



Right: KAES, 1969. Plotter print. Nixdorf MuseumsForum, Paderborn.

Bibliography with informations about the abbreviations used in the captions:

Dreher, Thomas: Cybernetics and the Pioneers of Computer Art. Chapter Bibliography. In: URL: http://dreher.netzliteratur.net/4_Medienkunst_Kybernetike.html