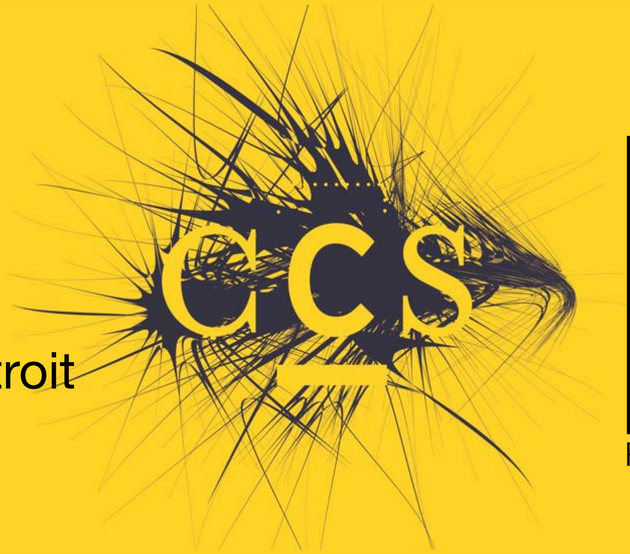
The Future of Cybernetics

Nano Worlds Fair
Pier 48 San Francisco
March 10, 2018

Paul Pangaro, Ph.D.
Chair and Associate Professor
MFA Interaction Design Program
College for Creative Studies, Detroit
paul@pangaro.com

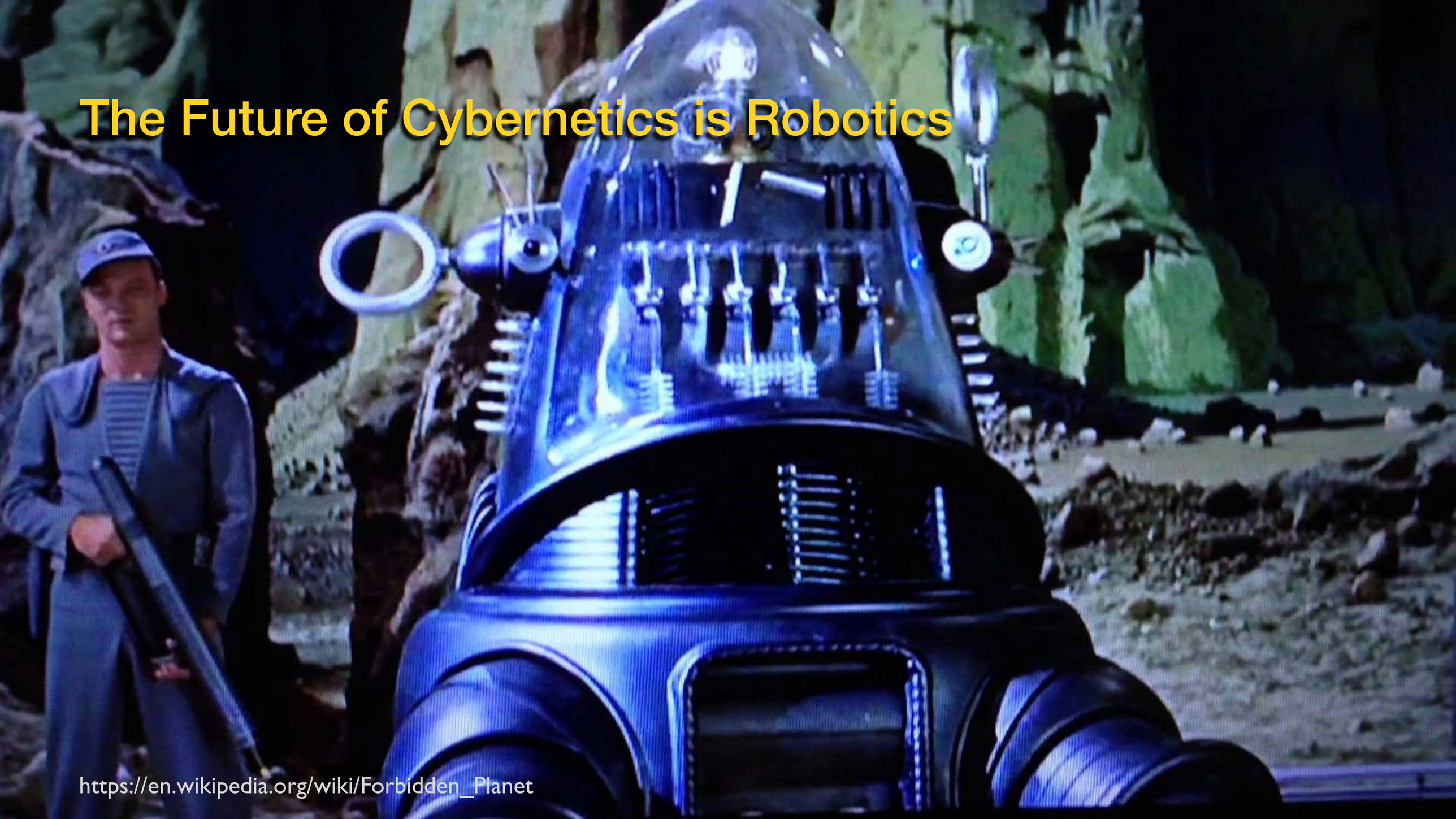


The Future of Cybernetics

MFA Interaction Design
College for Creative Studies, Detroit
paul@pangaro.com

The Future of Cybernetics is…

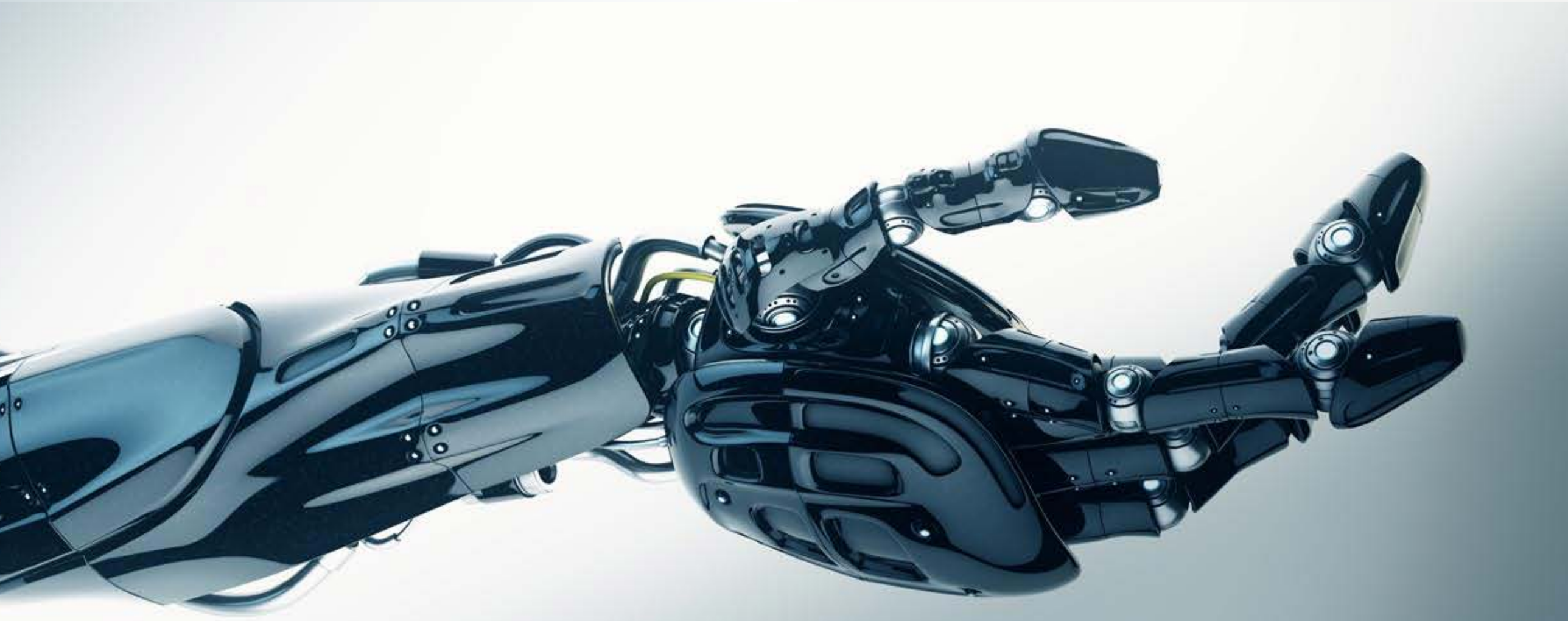
The Future of Cybernetics is Robotics



https://en.wikipedia.org/wiki/Forbidden_Planet

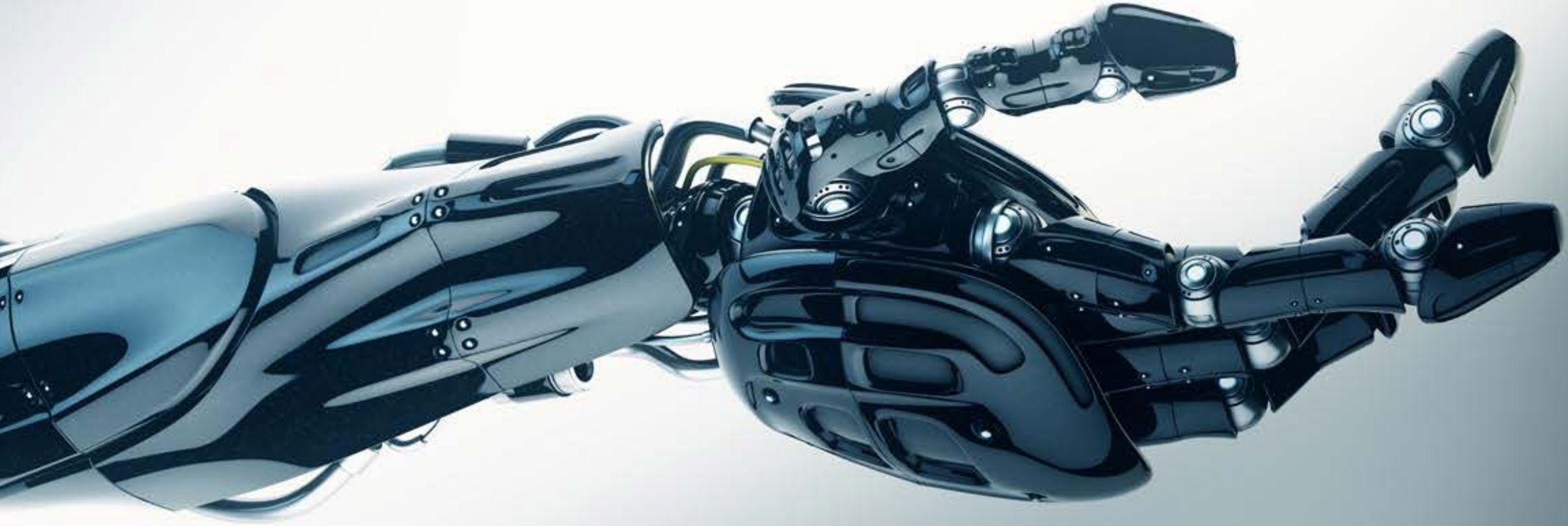

The Future of Cybernetics is Robotics—
… but Cybernetics is not Robotics
https://en.wikipedia.org/wiki/Forbidden_Planet

The Future of Cybernetics is Biomechatronics—



https://carleton.ca/mechatronics/

The Future of Cybernetics is Biomechatronics—
… but Cybernetics is not Biomechatronics



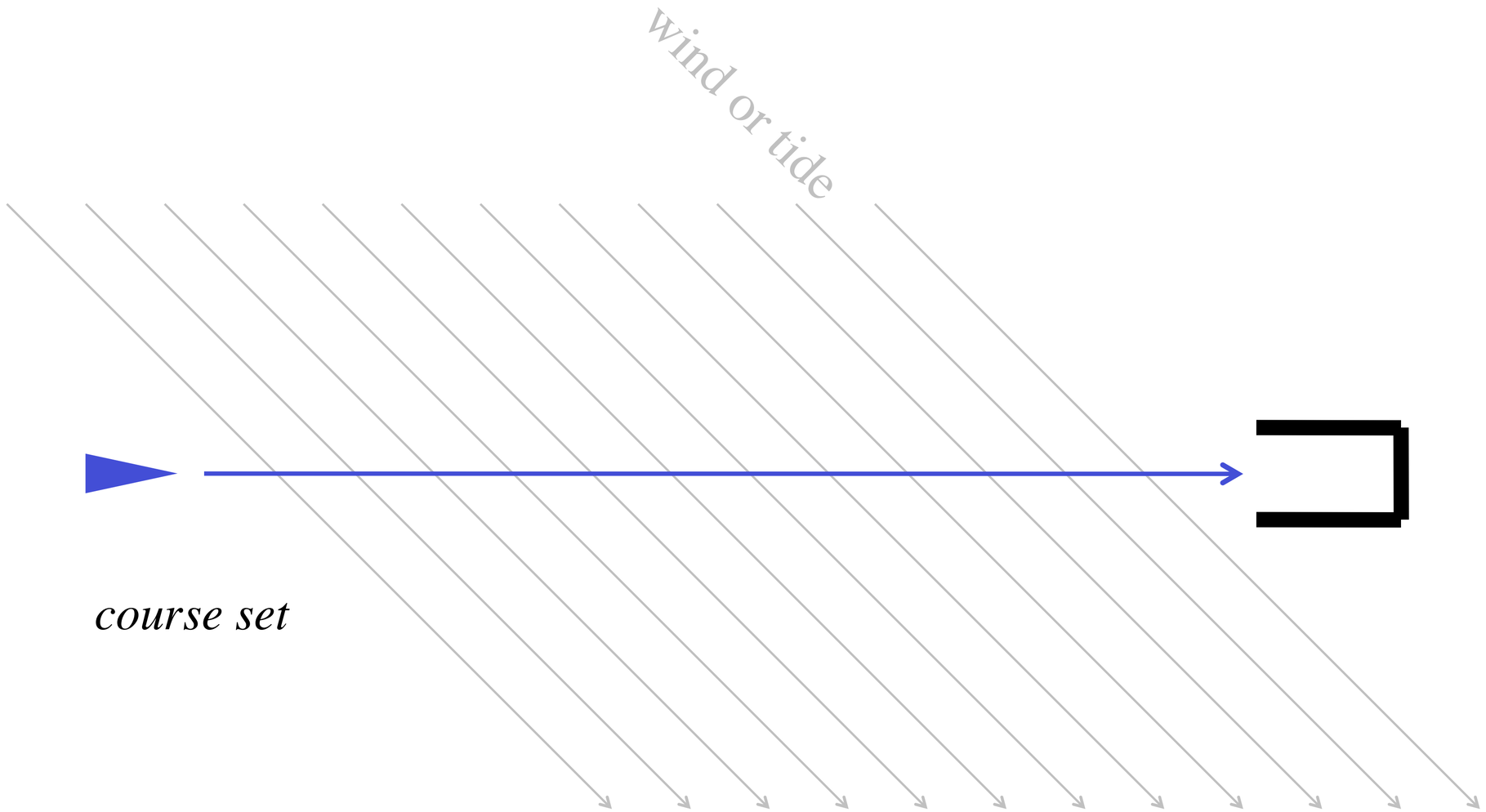
https://carleton.ca/mechatronics/


The Future of Cybernetics is AI—
Annapurna Pictures

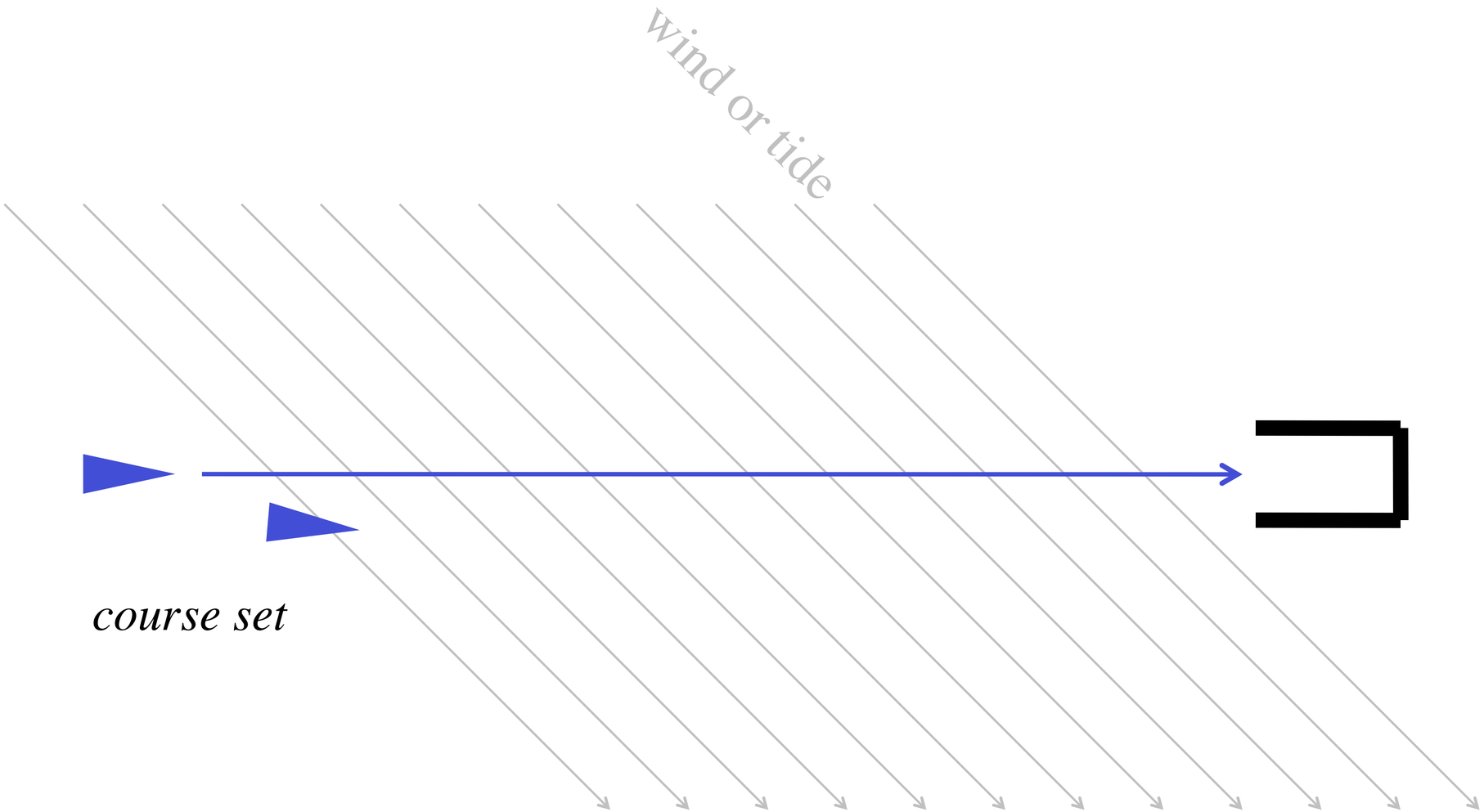

The Future of Cybernetics is AI—
… but Cybernetics is not AI
Annapurna Pictures

The Future of Cybernetics is AI—
… but Cybernetics is not AI
… but Cybernetics is not Biomechatronics
… but Cybernetics is not Robotics
… but Cybernetics is not Chips in Your Brain
… and Cybernetics is not Freezing Dead People!

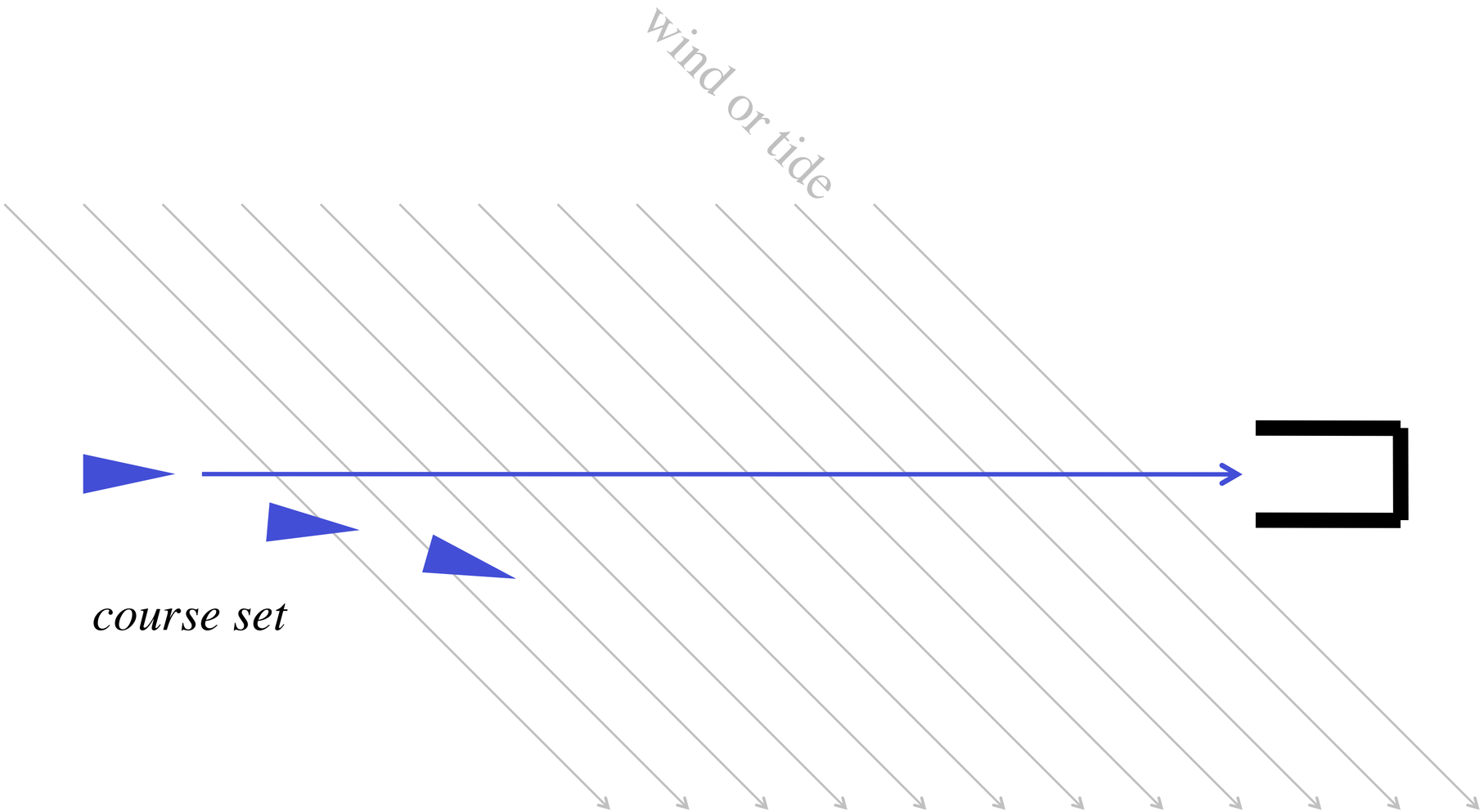
the art of steering



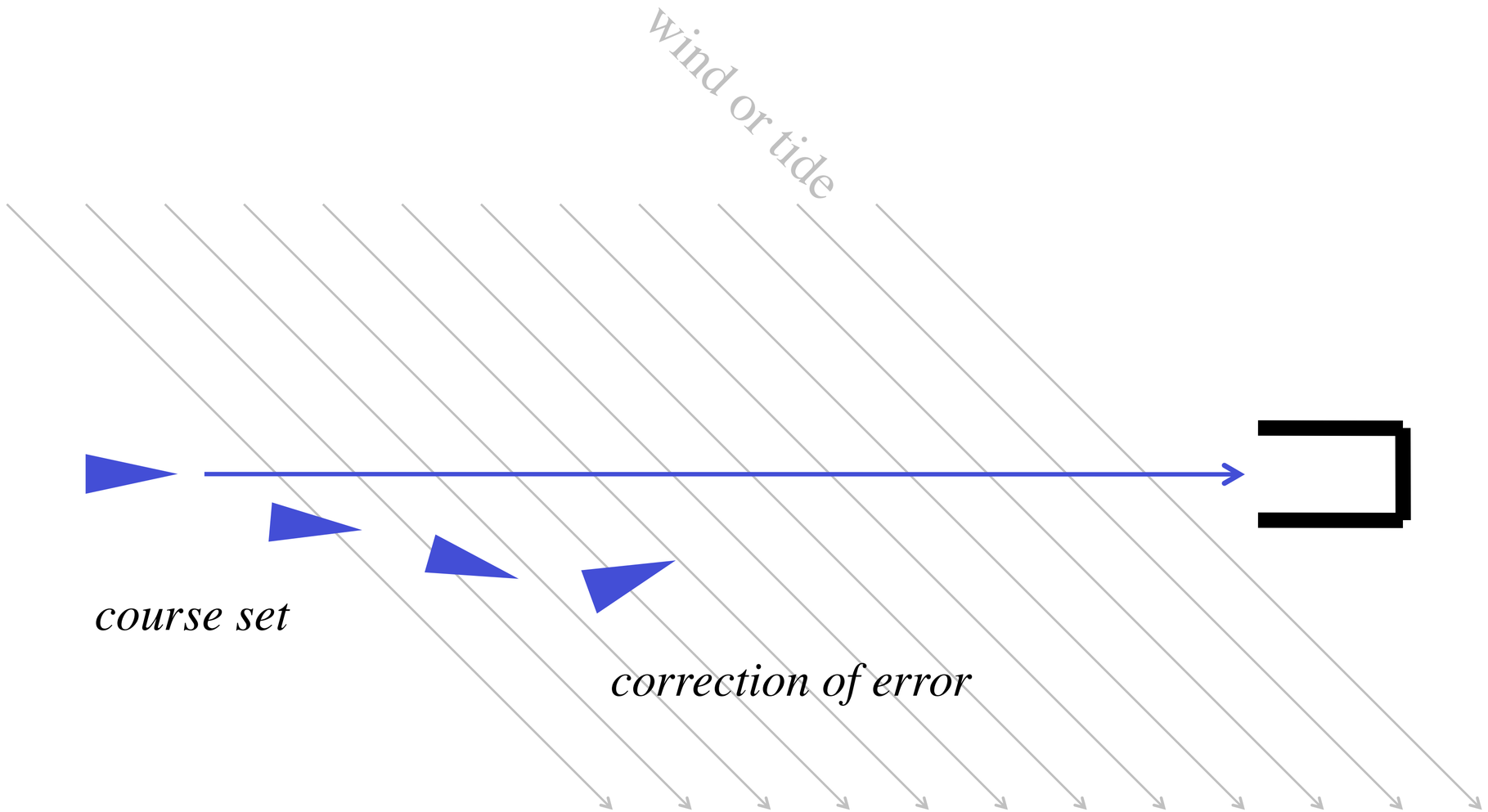
the art of steering



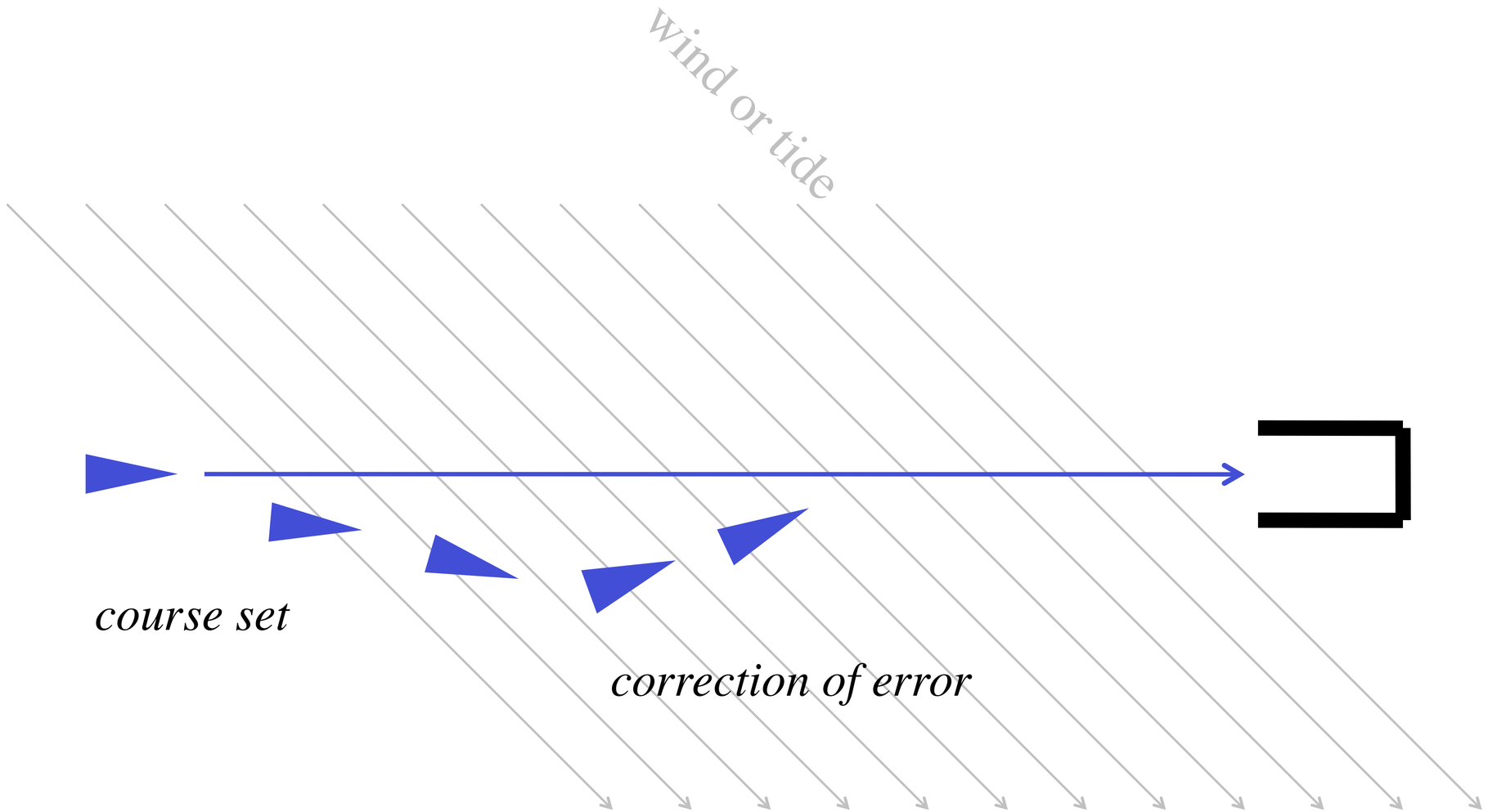
the art of steering



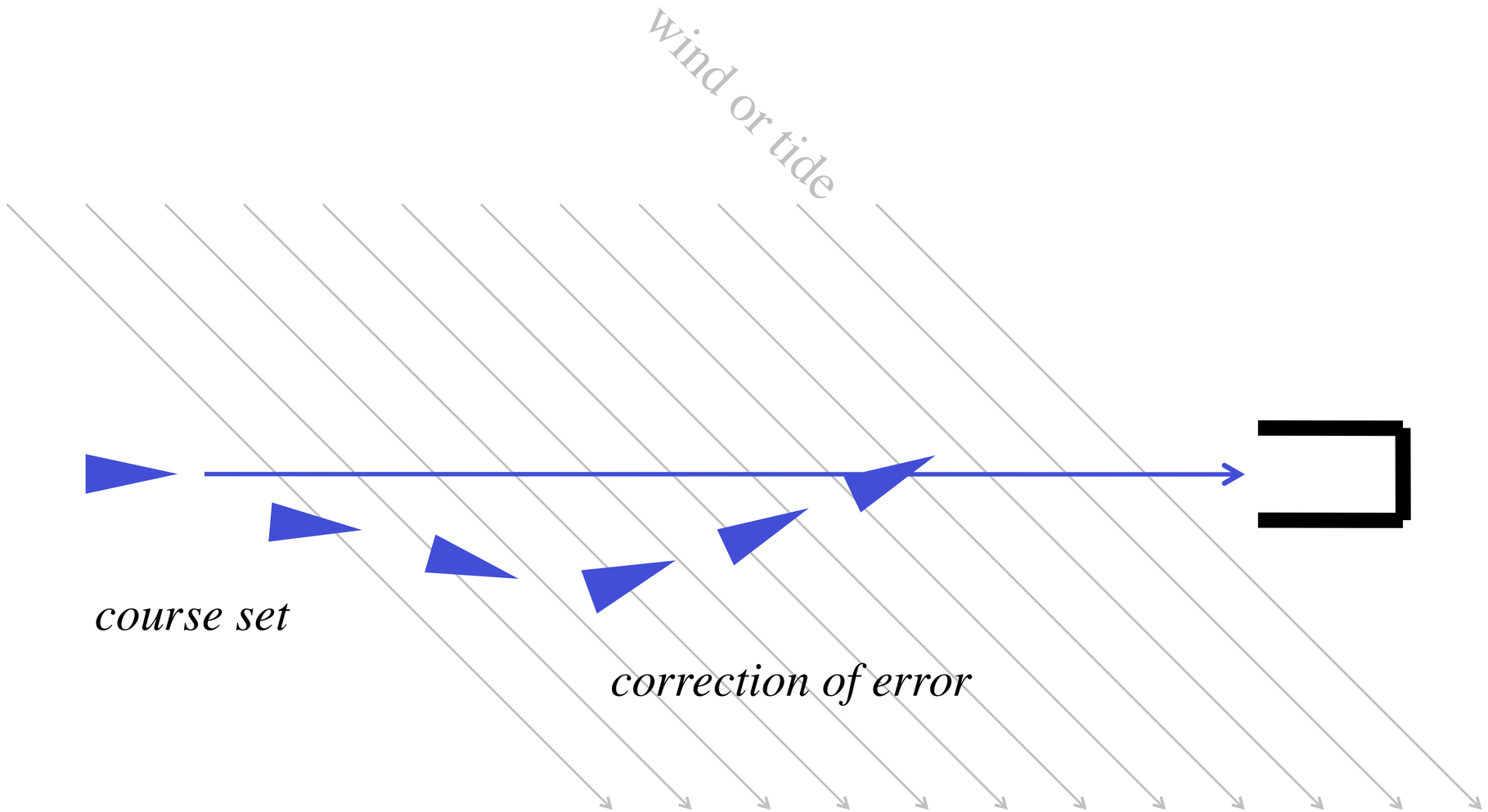
the art of steering



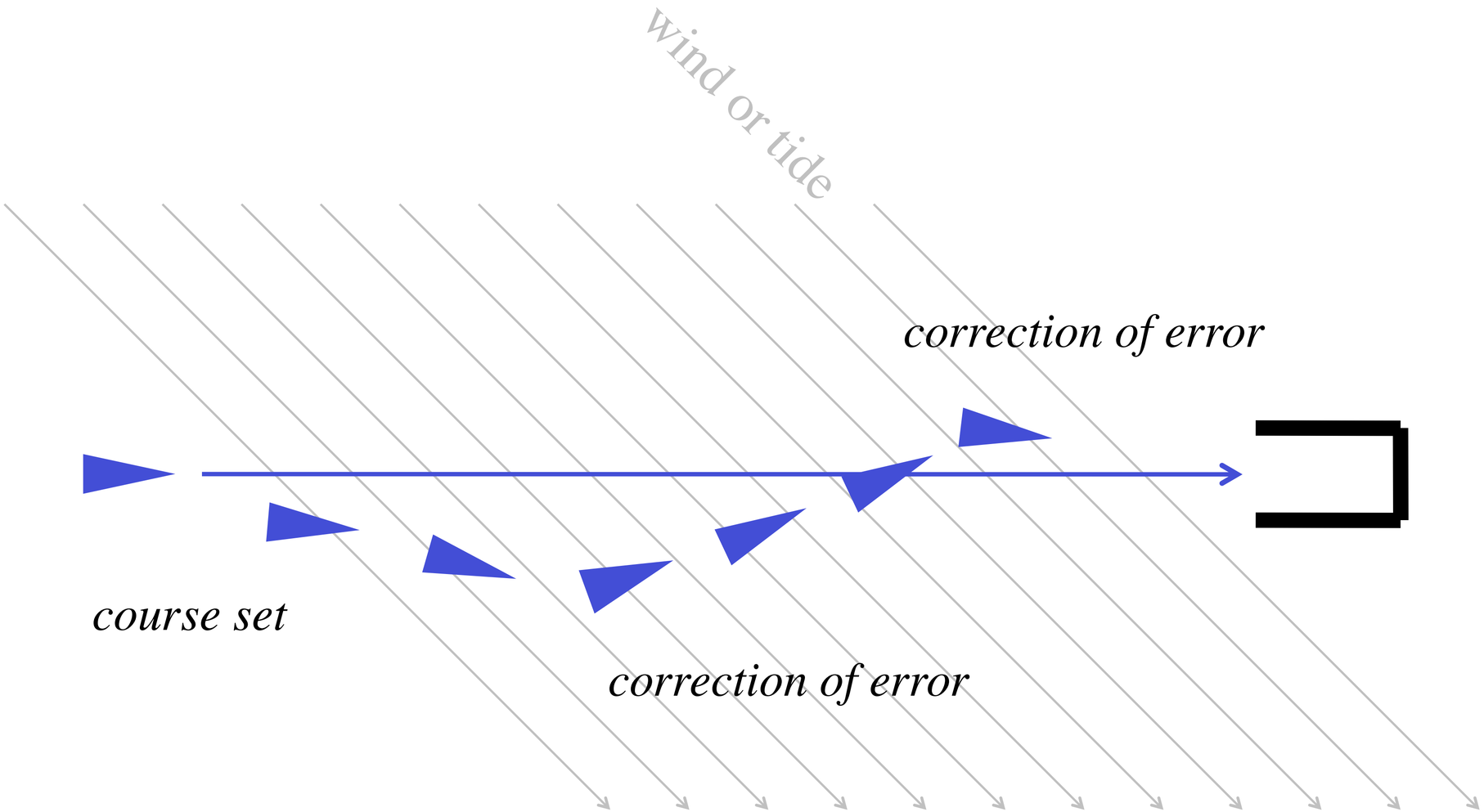
the art of steering



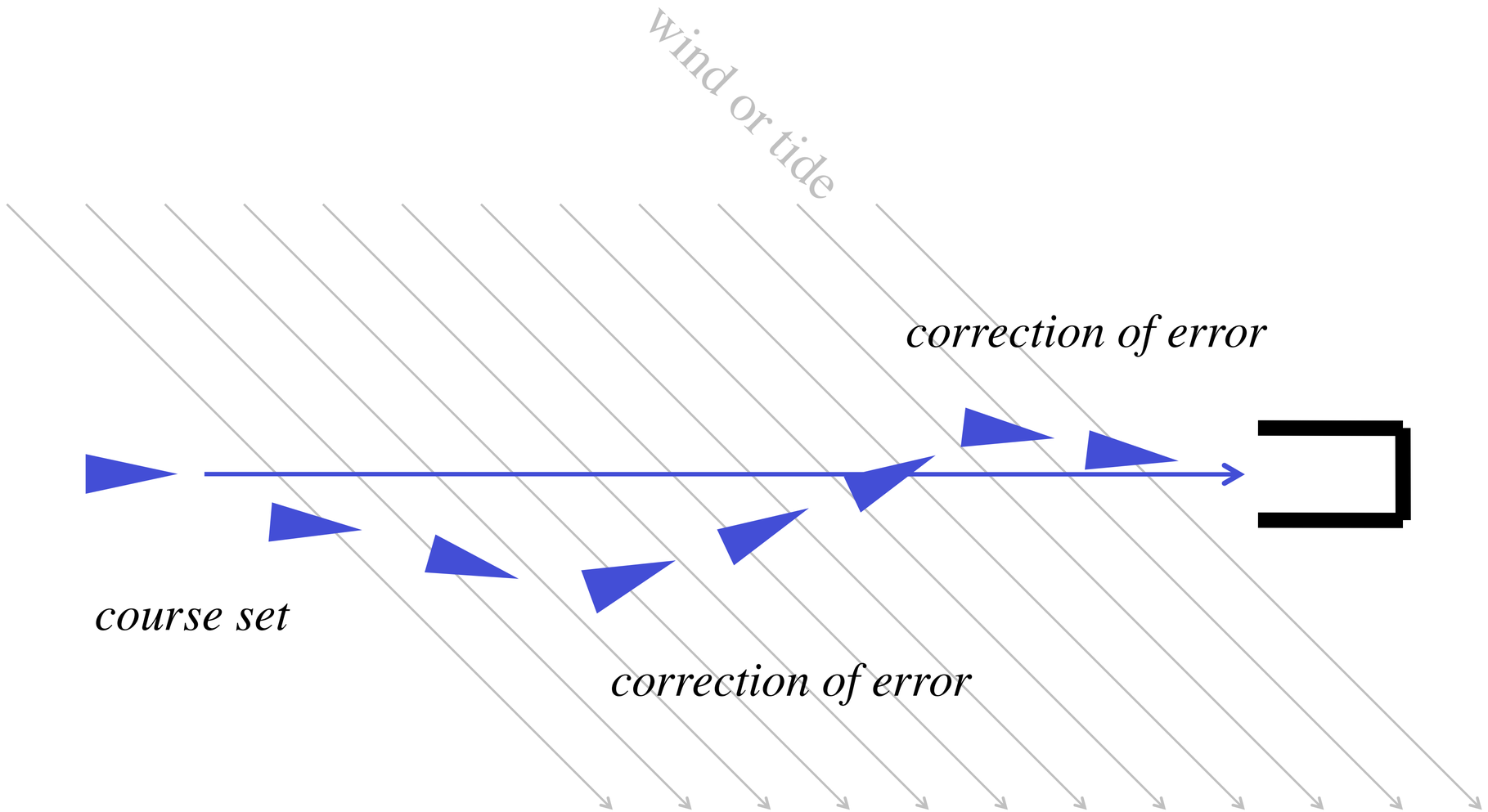
the art of steering



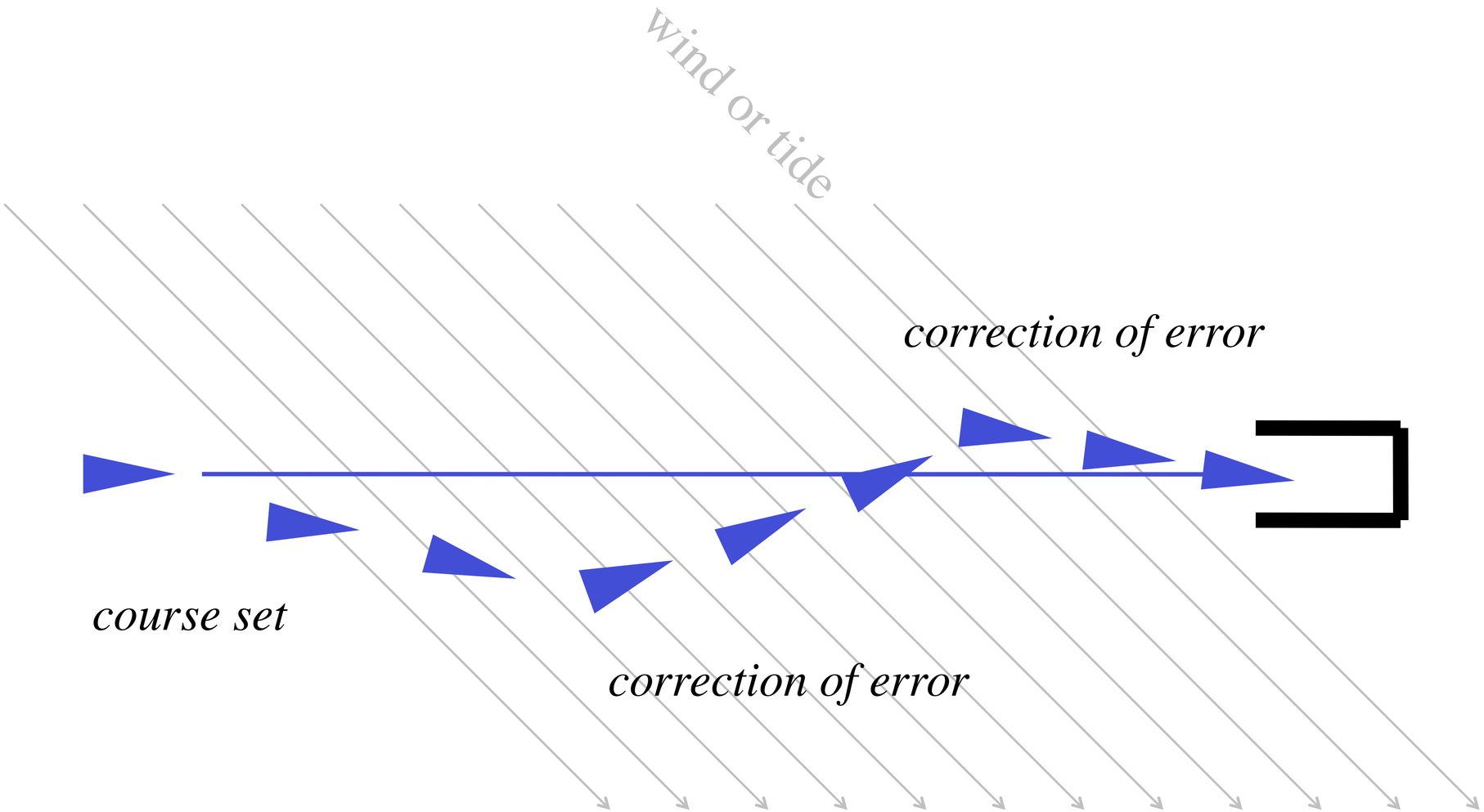
the art of steering



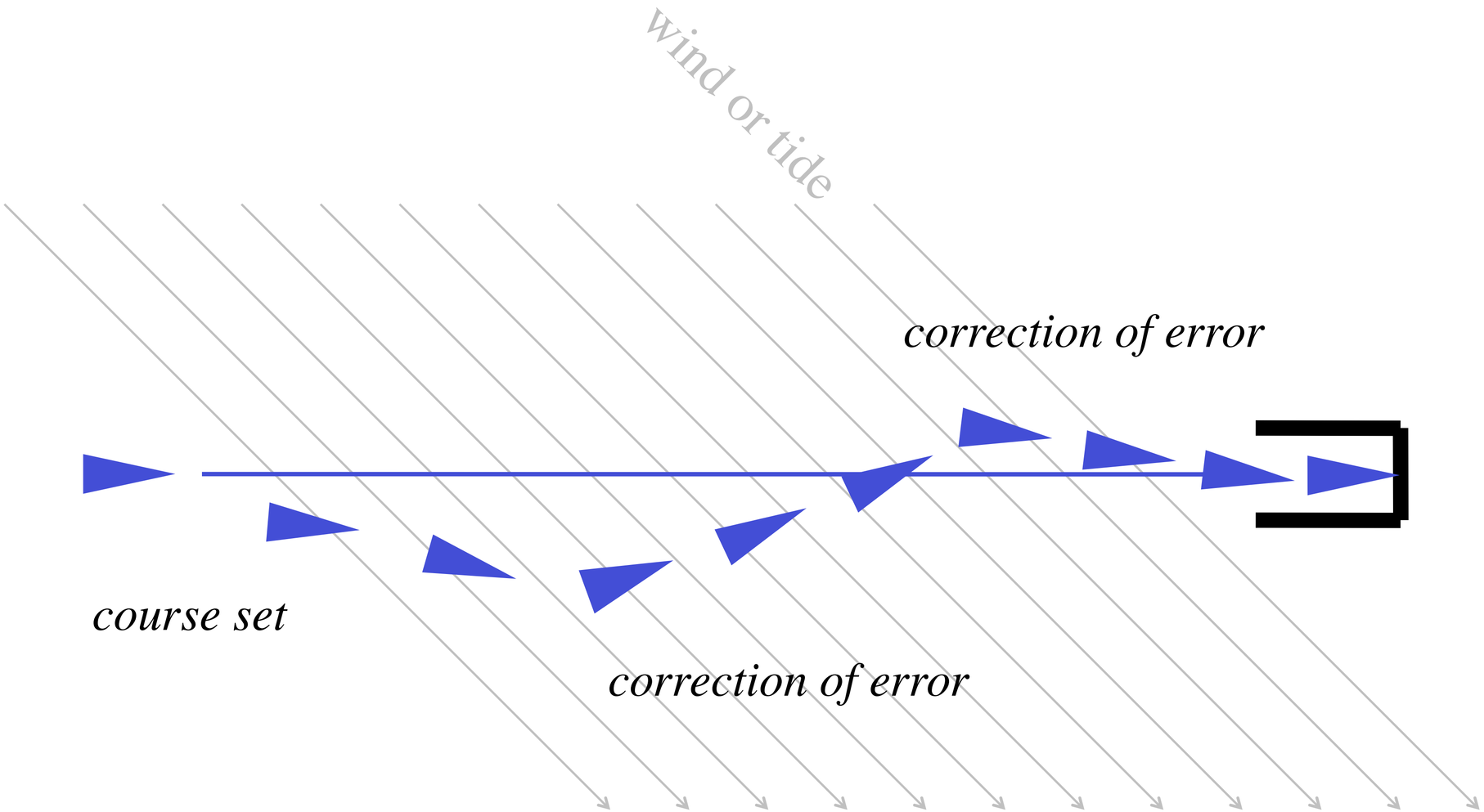
the art of steering



the art of steering

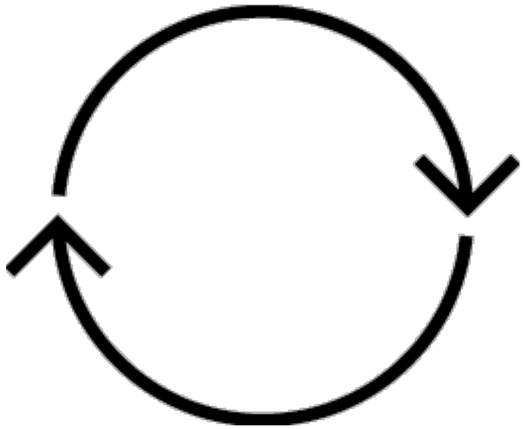


the art of steering



the art of regulation

compares heading with
goal of reaching port



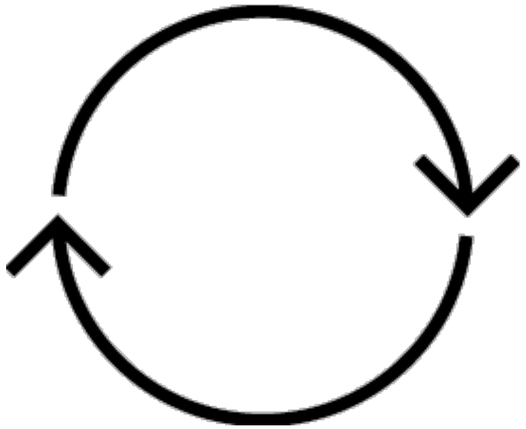
adjusts rudder
to correct heading

ship's heading

the art of regulation

detection of error

compares heading with
goal of reaching port



feedback

adjusts rudder
to correct heading

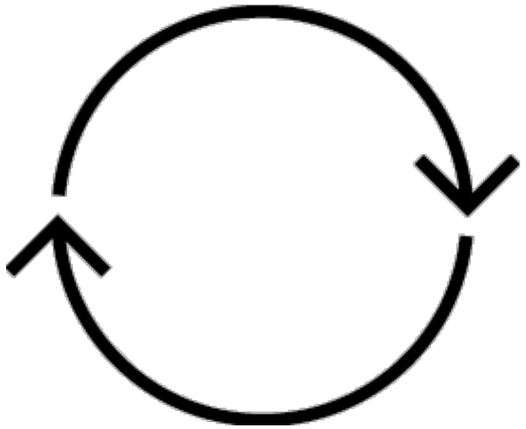
correction of error

ship's heading

the art of regulation

comparing

compares heading with
goal of reaching port



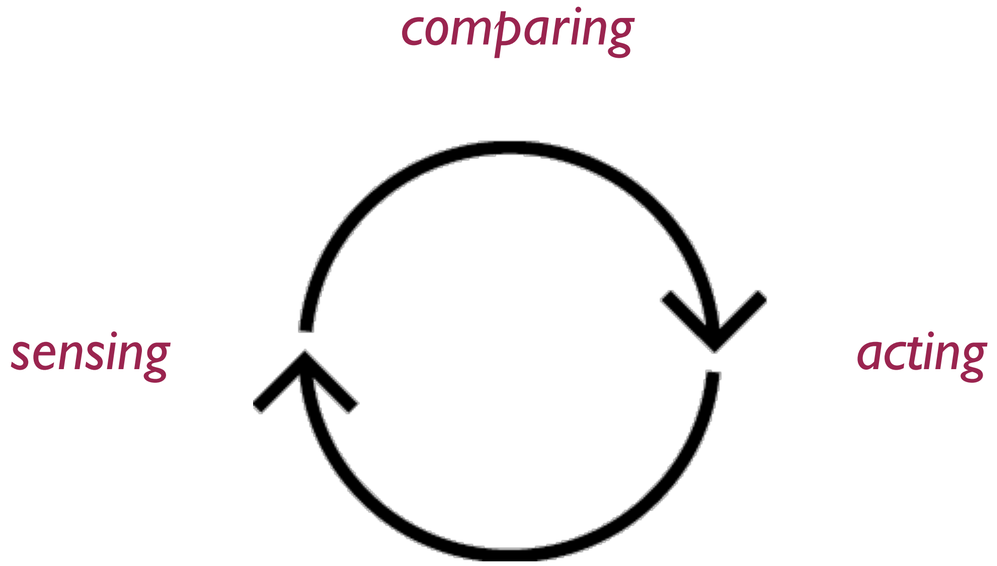
sensing

adjusts rudder
to correct heading

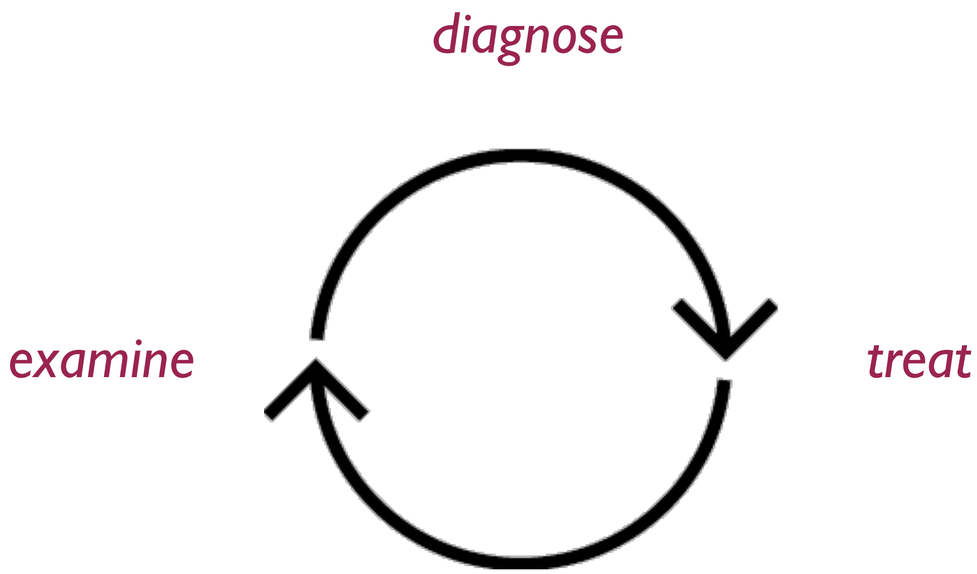
acting

ship's heading

the art of regulation

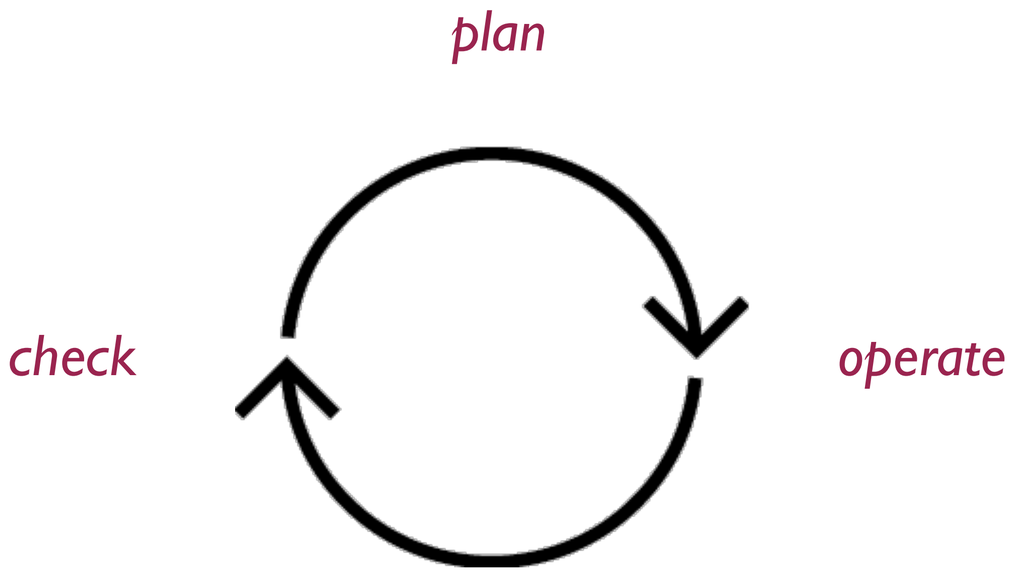


clinical practice (medicine)



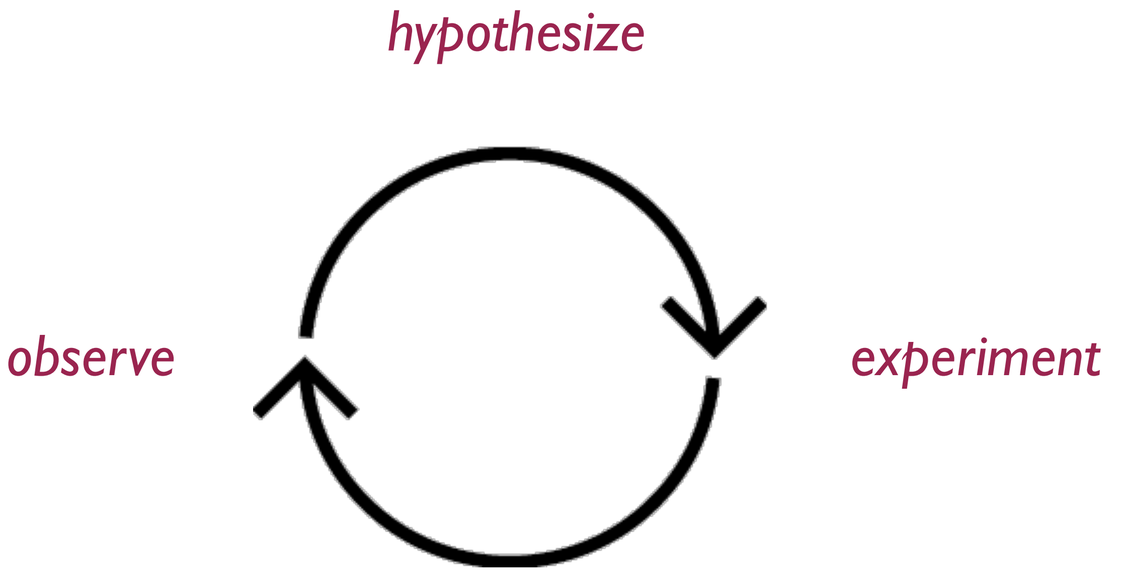
After Dubberly Design Office "Creative Process" concept map

quality cycle (management)



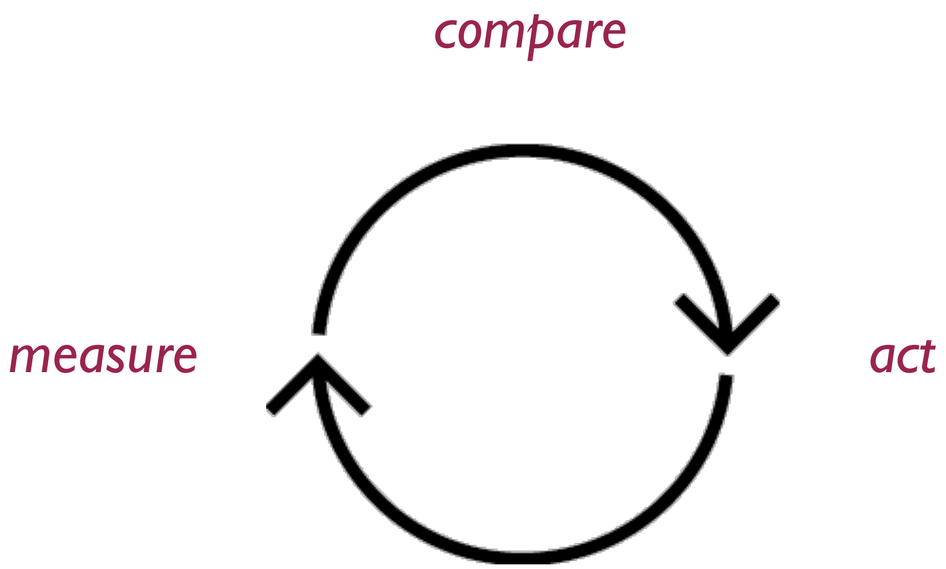
After Dubberly Design Office "Creative Process" concept map

scientific method



After Dubberly Design Office "Creative Process" concept map

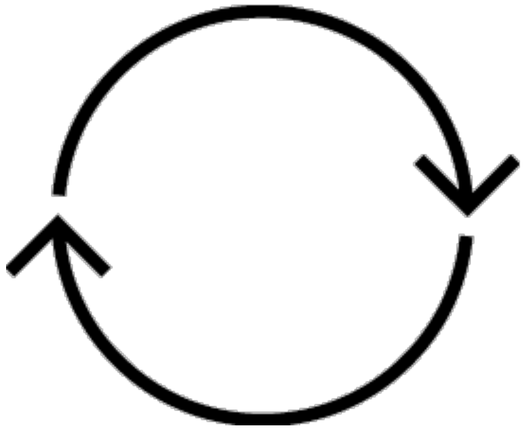
design process



After Dubberly Design Office "Creative Process" concept map

mobile devices

compute

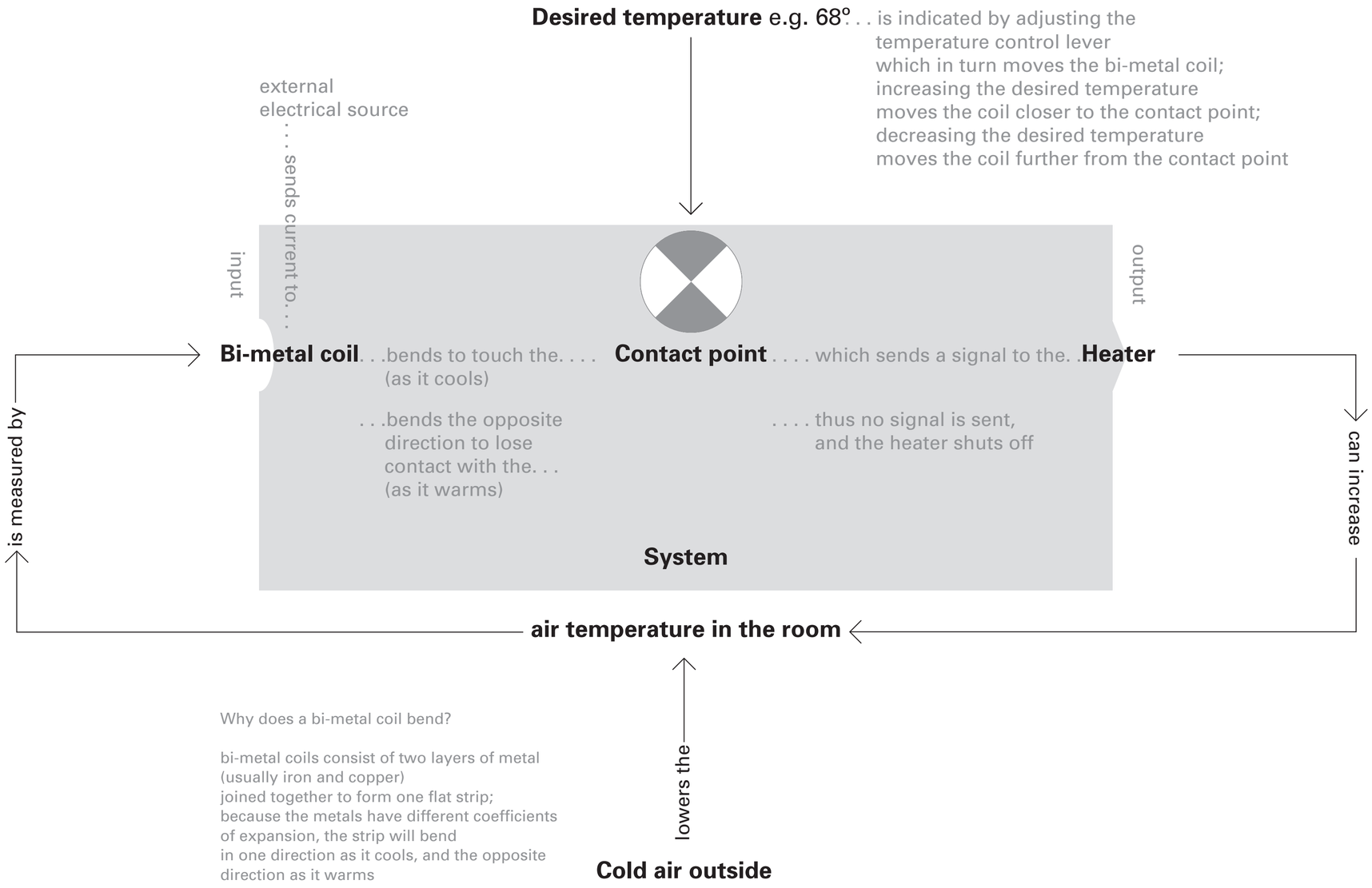


sense from a distance

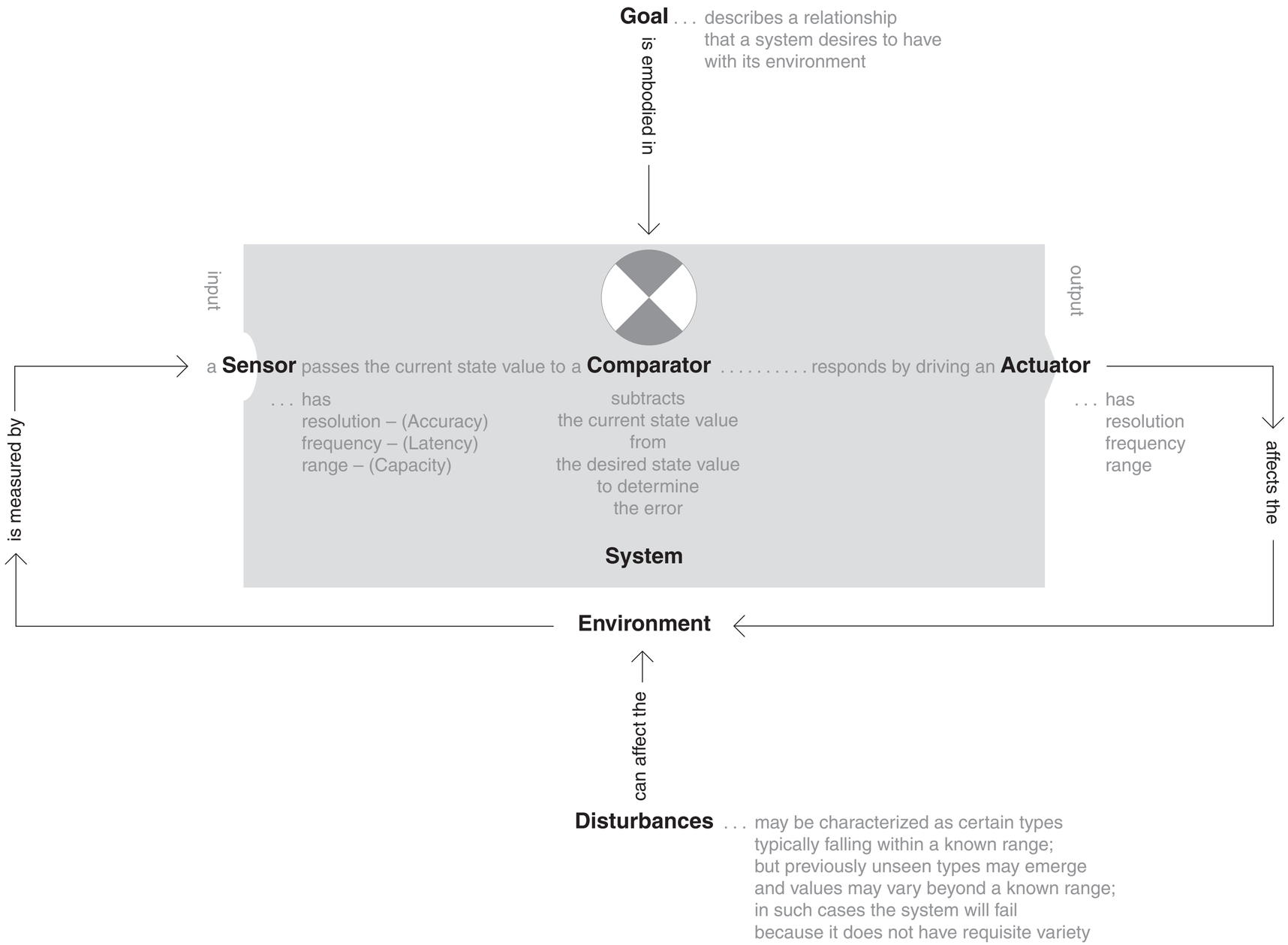
act at a distance

Feedback: Classic Example

Thermostat regulating room temperature
(via a heater)

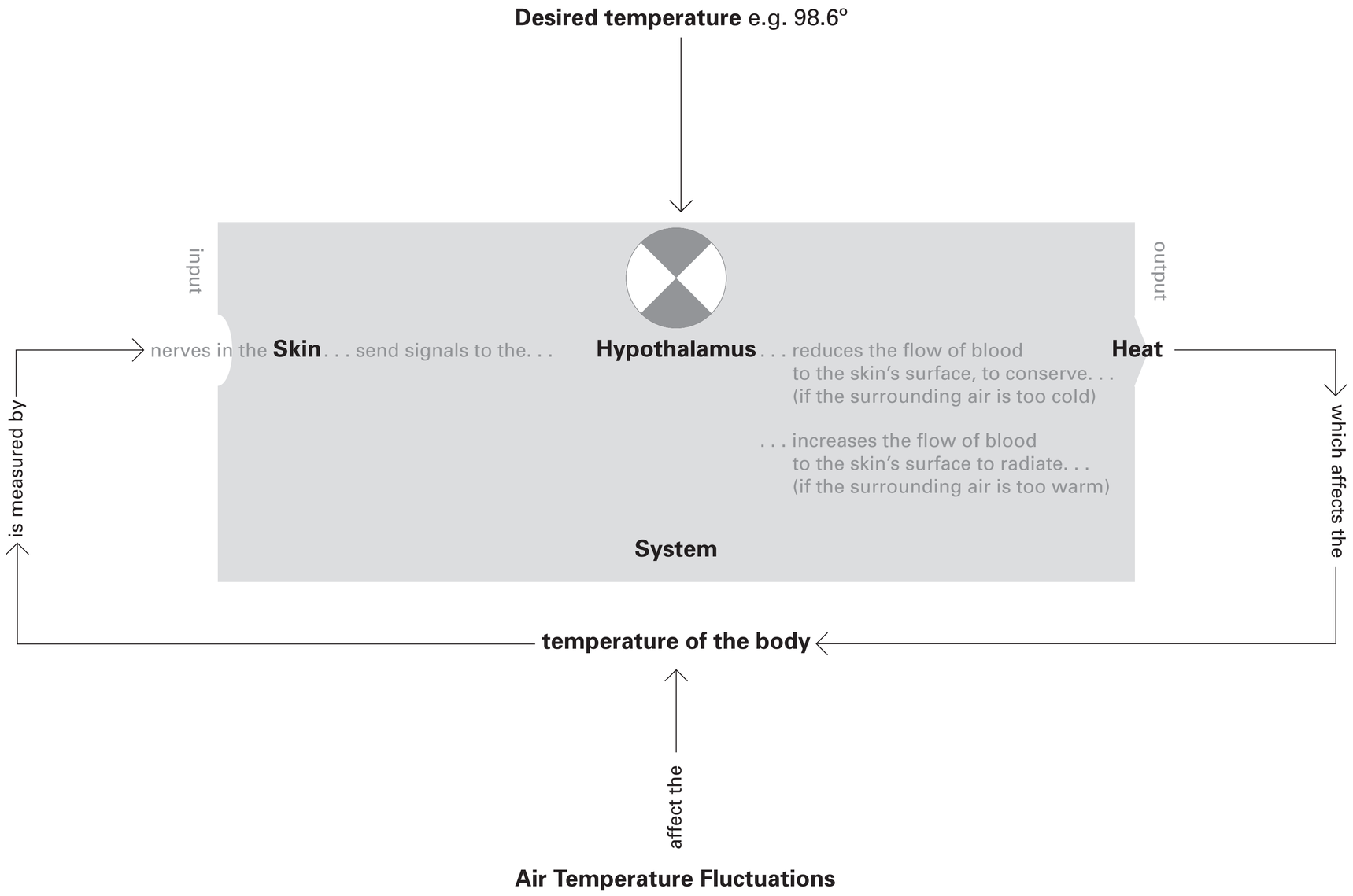


Feedback: Formal Mechanism

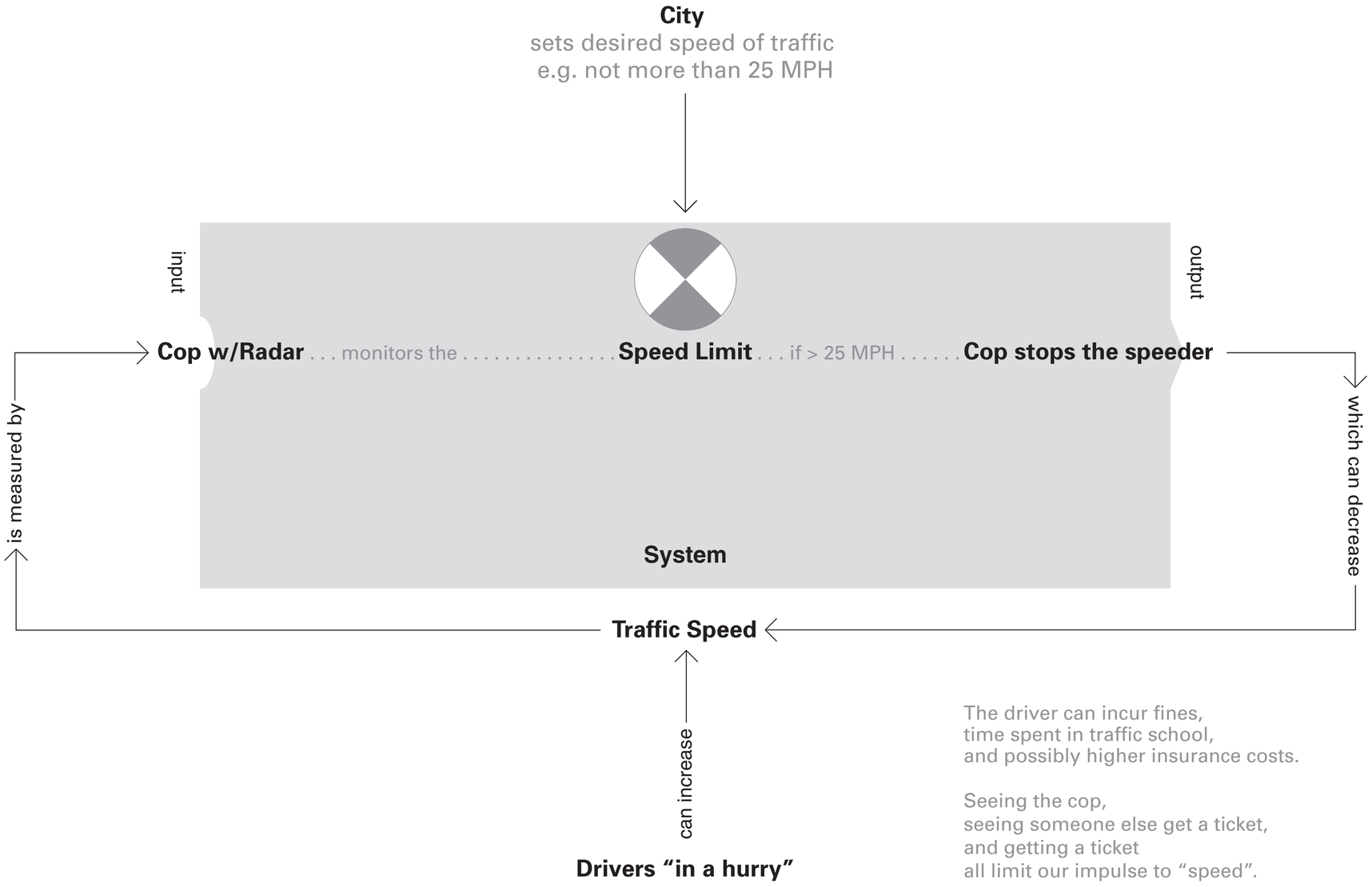


Feedback: Biological Example

Regulating temperature in the human body

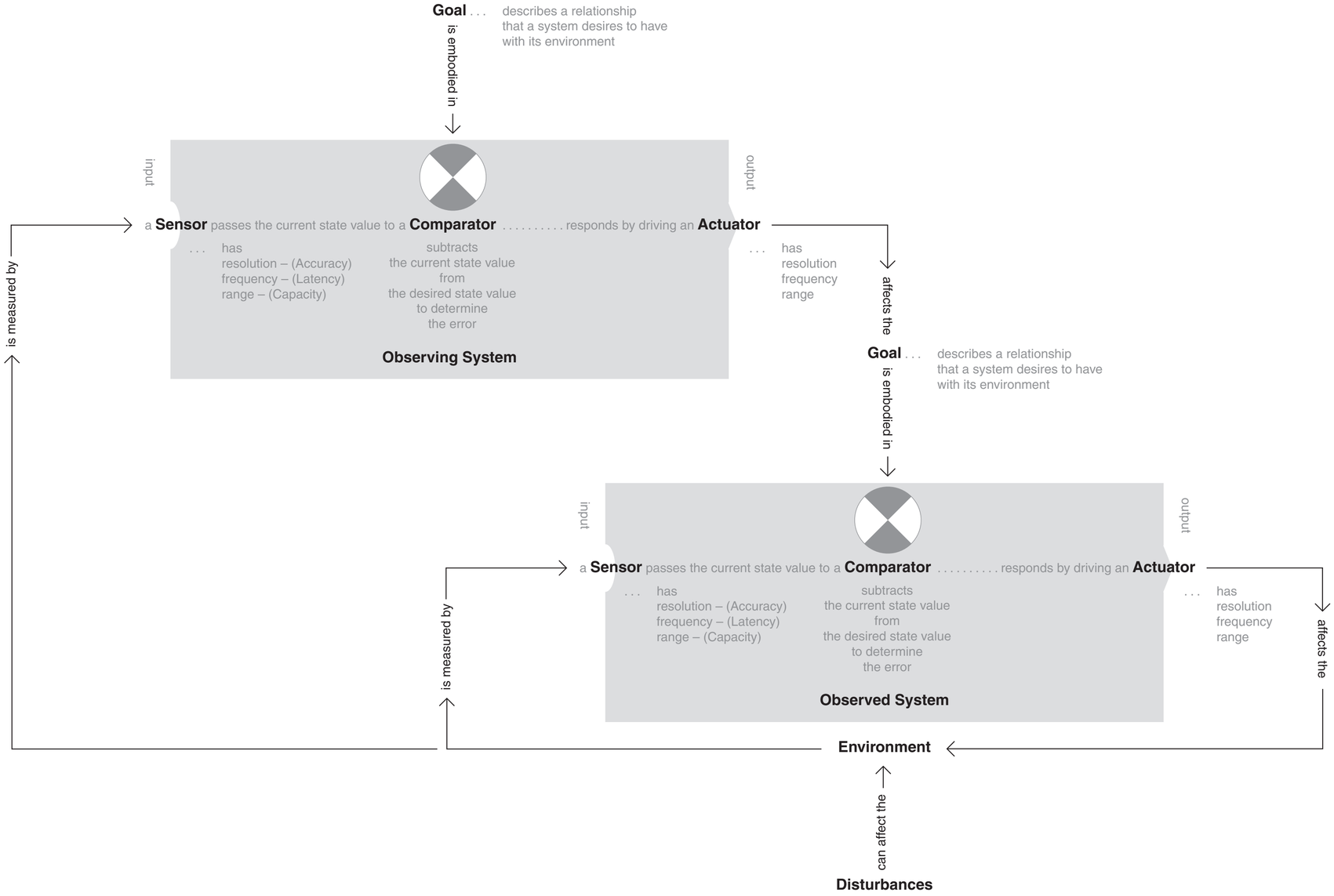


Feedback: Social Example
Regulating traffic speed



Second-order Feedback: Formal Mechanism

An automatic feedback system (first-order) is controlled by another automatic feedback system (second-order). The first system is ‘nested’ inside the second.



parator . . . . . responds by driving an **Actuator**

tracts
t state value
rom
d state value
termine
error

g System

output

. . . has
resolution
frequency
range

affects the

Goal . . . describes a relationship
that a system desires to have
with its environment

is embodied in

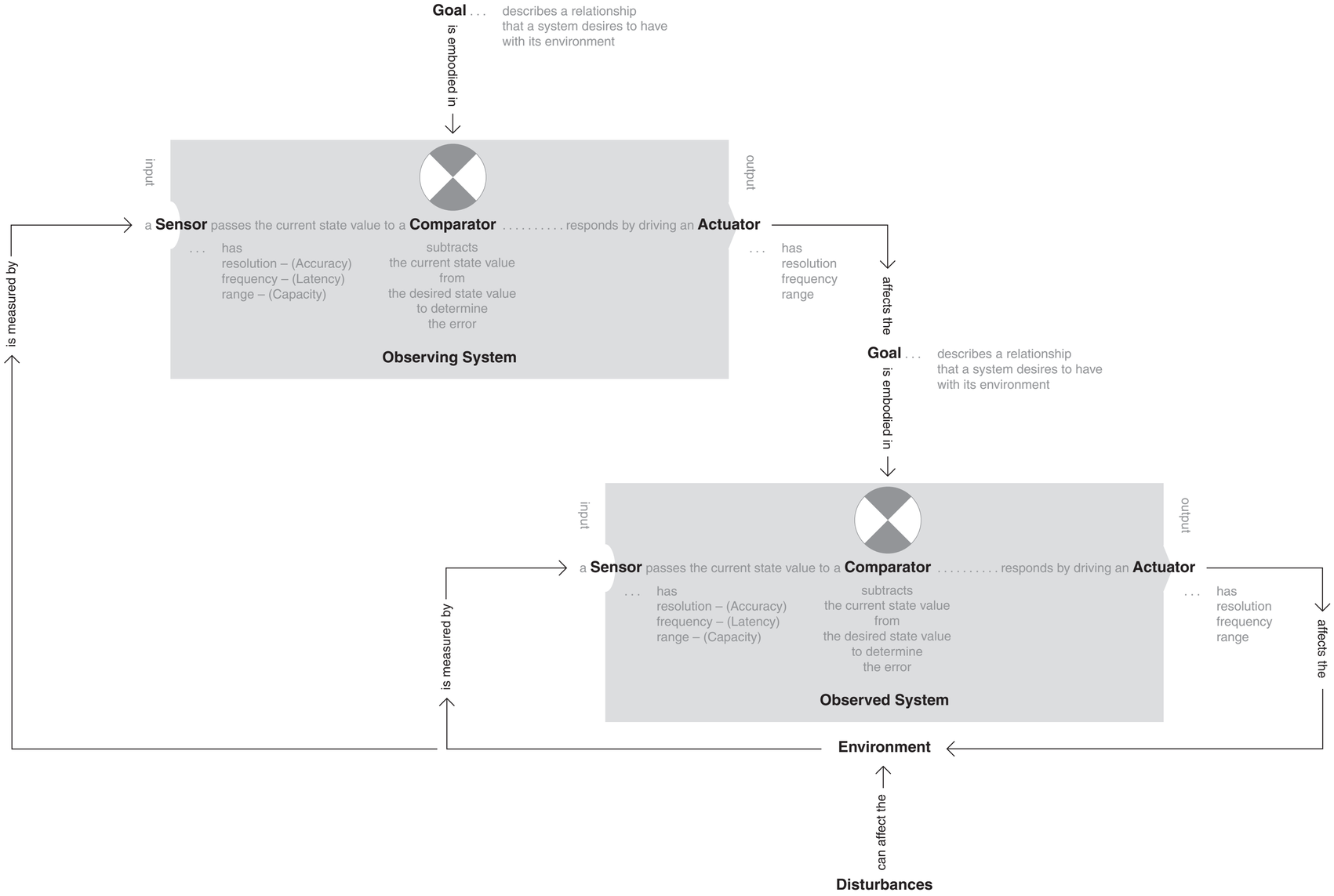
input

a **Sensor** passes the current state value to a **Comparator** . . . . . responds by driving an **Actuator**

output

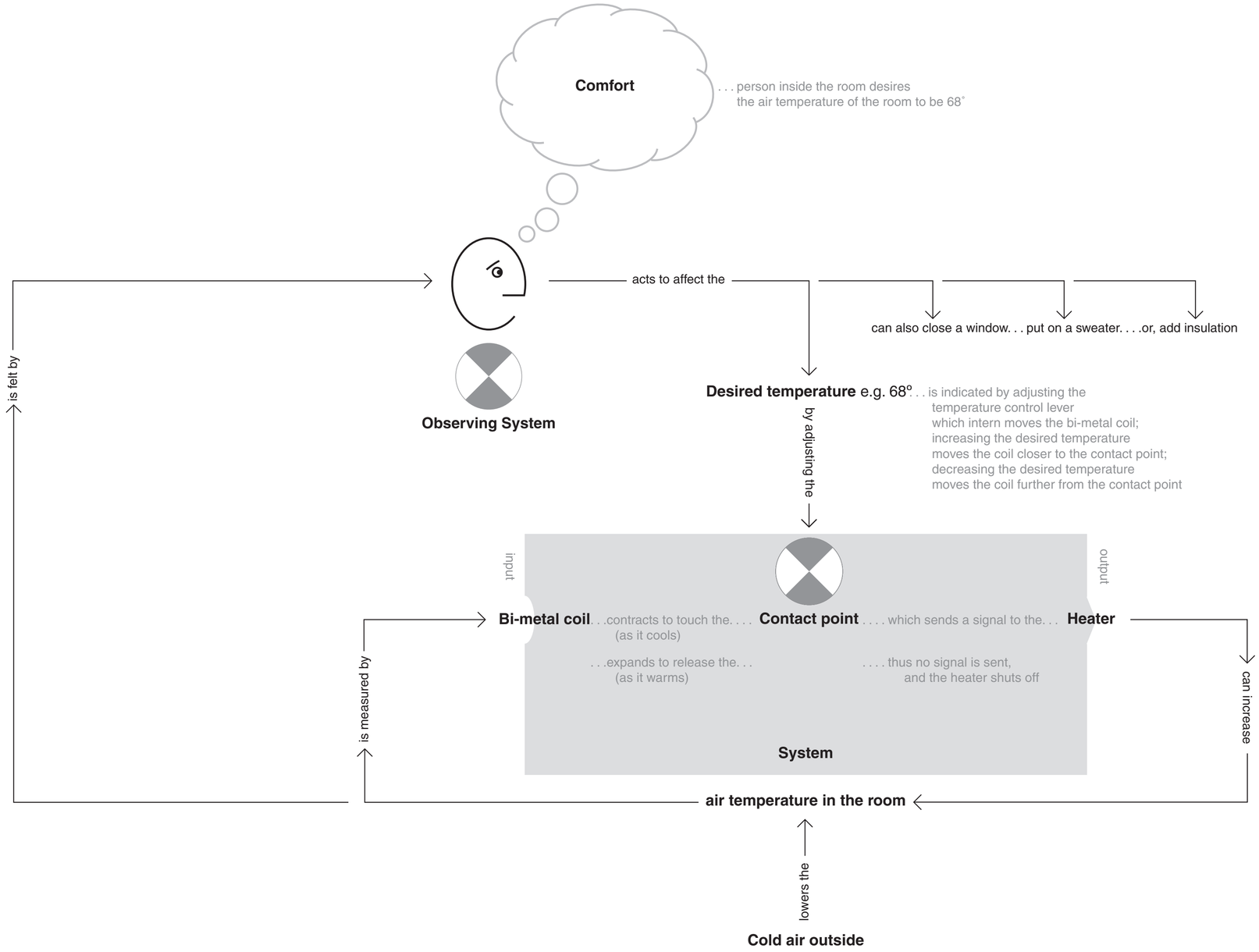
Second-order Feedback: Formal Mechanism

An automatic feedback system (first-order) is controlled by another automatic feedback system (second-order). The first system is ‘nested’ inside the second.



Second-order Feedback: Classic Example

Person controlling a thermostat (regulating a regulator)



1948

CYBERNETICS

OR CONTROL AND COMMUNICATION IN THE ANIMAL AND THE MACHINE

Norbert Wiener

PROFESSOR OF MATHEMATICS
THE MASSACHUSETTS INSTITUTE
OF TECHNOLOGY

THE TECHNOLOGY PRESS

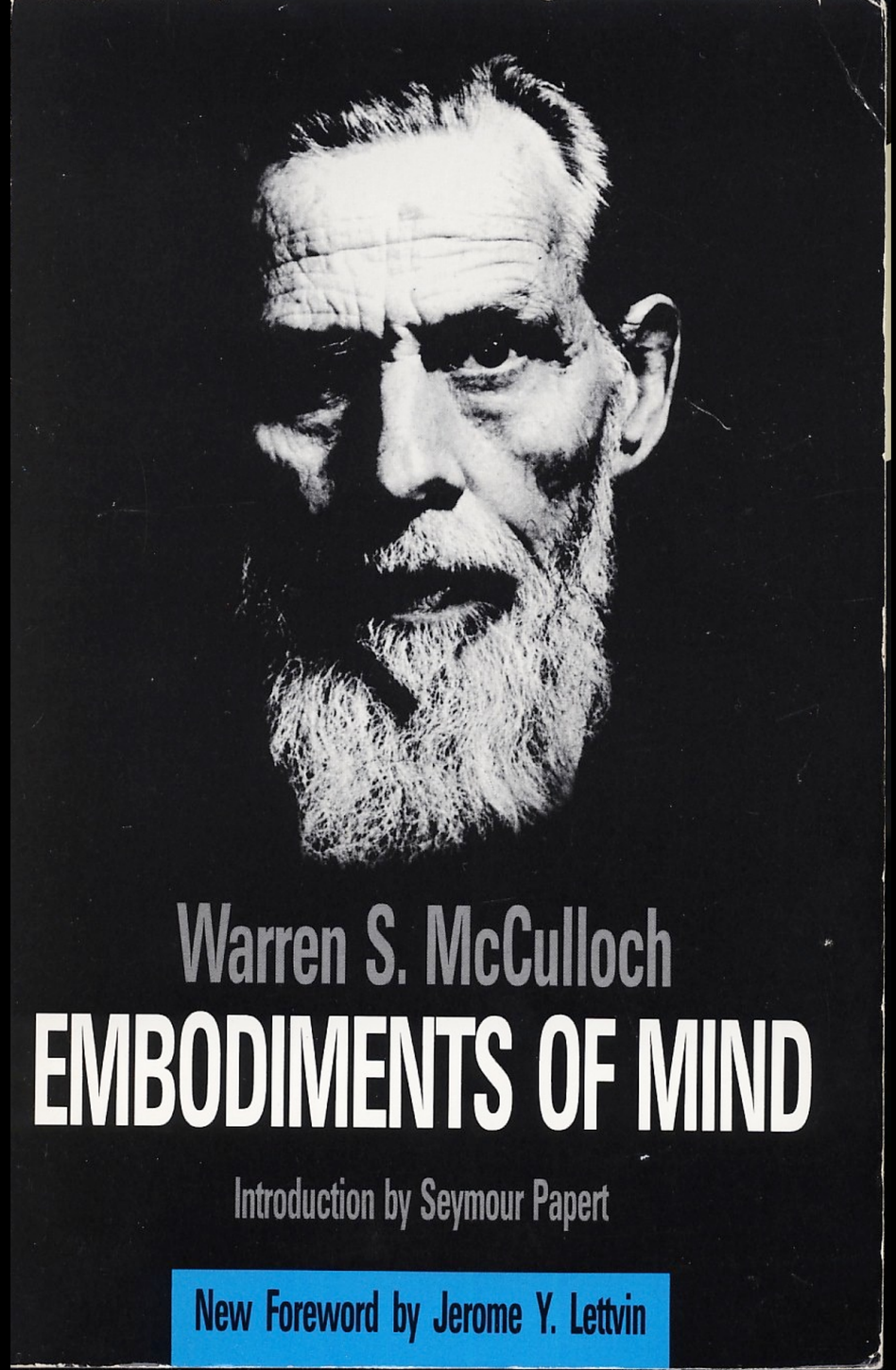
JOHN WILEY & SONS, INC., NEW YORK
HERMANN et CIE, PARIS

Norbert Wiener
Mathematician

Author of *Cybernetics*
1948

Warren McCulloch
Neurophysiologist & Poet

Author of *Embodiments of Mind*
1965



Margaret Mead
Anthropologist

Founder of
American Society
for Cybernetics

Photo via UN Multimedia

Proceedings of
The Macy Meetings

Conferences in Cybernetics
1946–1953

CYBERNETICS

CIRCULAR CAUSAL AND FEEDBACK MECHANISMS IN BIOLOGICAL AND SOCIAL SYSTEMS

Transactions of the Tenth Conference
April 22, 23, and 24, 1953, Princeton, N. J.

Edited by
HEINZ VON FOERSTER
DEPARTMENT OF ELECTRICAL ENGINEERING
UNIVERSITY OF ILLINOIS
CHAMPAIGN, ILL.

Assistant Editors
MARGARET MEAD
AMERICAN MUSEUM OF NATURAL HISTORY
NEW YORK, N. Y.

HANS LUKAS TEUBER
DEPARTMENT OF PSYCHIATRY AND NEUROLOGY
NEW YORK UNIVERSITY COLLEGE OF MEDICINE
NEW YORK, N. Y.

Sponsored by the
JOSIAH MACY, JR. FOUNDATION
NEW YORK, N. Y.

CYBERNETICS

CIRCULAR CAUSAL AND FEEDBACK MECHANISMS IN BIOLOGICAL AND SOCIAL SYSTEMS

Transactions of the Tenth Conference
April 22, 23, and 24, 1953, Princeton, N. J.

Edited by

HEINZ VON FOERSTER

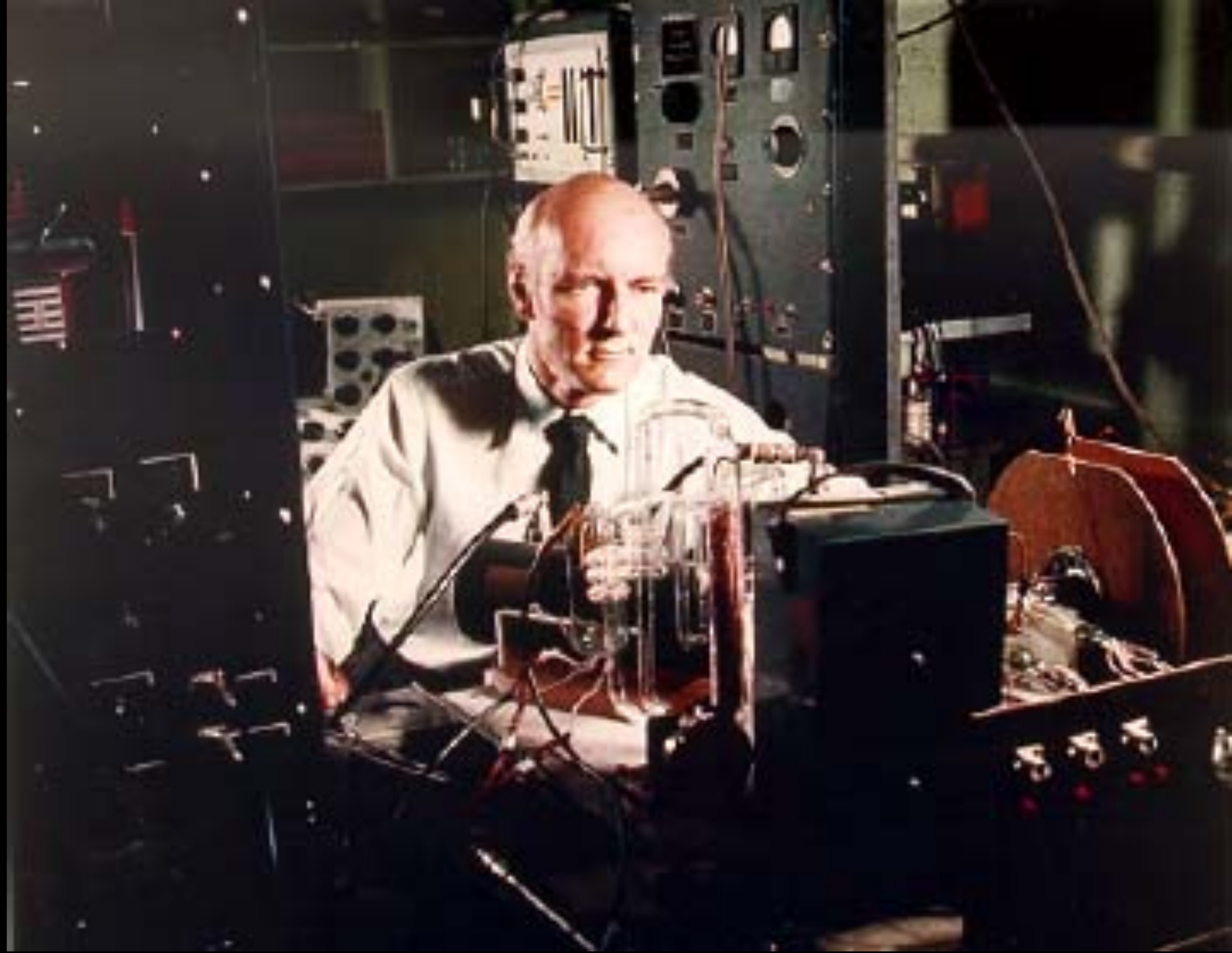
DEPARTMENT OF ELECTRICAL ENGINEERING
UNIVERSITY OF ILLINOIS
CHAMPAIGN, ILL.

Assistant Editors

MARGARET MEAD

AMERICAN MUSEUM OF NATURAL HISTORY
NEW YORK, N. Y.

Heinz von Foerster
Physicist & Cybernetician



1982

Heinz von Foerster

OBSERVING SYSTEMS

THE SYSTEMS INQUIRY SERIES

PUBLISHED BY INTERSYSTEMS PUBLICATIONS

Understanding Understanding

Essays on Cybernetics and Cognition

Heinz von Foerster

2002

CYBERNETICS

CIRCULAR CAUSAL AND FEEDBACK MECHANISMS IN BIOLOGICAL AND SOCIAL SYSTEMS

Transactions of the Tenth Conference
April 22, 23, and 24, 1953, Princeton, N. J.

Edited by

HEINZ VON FOERSTER

DEPARTMENT OF ELECTRICAL ENGINEERING
UNIVERSITY OF ILLINOIS
CHAMPAIGN, ILL.

Assistant Editors

MARGARET MEAD

AMERICAN MUSEUM OF NATURAL HISTORY
NEW YORK, N. Y.

1953

PARTICIPANTS

*Tenth Conference on Cybernetics**

MEMBERS

WARREN S. McCULLOCH, *Chairman* — neurophysiology
Research Laboratory of Electronics, Massachusetts Institute of Technology
Cambridge, Mass.

HEINZ VON FOERSTER, *Secretary* — physics
Department of Electrical Engineering, University of Illinois
Champaign, Ill.

GREGORY BATESON — linguistics etc.
Veterans Administration Hospital
Palo Alto, Cal.

ALEX BAVELAS† — social science
Department of Economics and Social Science, Massachusetts Institute of Technology
Cambridge, Mass.

JULIAN H. BIGELOW
Department of Mathematics, Institute for Advanced Study
Princeton, N. J.

HENRY W. BROSIN — mathematics
Department of Psychiatry, University of Pittsburgh School of Medicine
Pittsburgh, Pa.

LAWRENCE K. FRANK
72 Perry St., New York, N. Y.

RALPH W. GERARD†
Departments of Psychiatry and Physiology, University of Illinois College of Medicine
Chicago, Ill.

GEORGE EVELYN HUTCHINSON
Department of Zoology, Yale University
New Haven, Conn.

HEINRICH KLÜVER — zoology
Division of the Biological Sciences, University of Chicago
Chicago, Ill.

LAWRENCE S. KUBIE — biology
Department of Psychiatry and Mental Hygiene, Yale University School of Medicine
New Haven, Conn.

RAFAEL LORENTE de NÓ†
Rockefeller Institute for Medical Research
New York, N. Y.

DONALD G. MARQUIS
Department of Psychology, University of Michigan
Ann Arbor, Mich.

MARGARET MEAD — anthropology etc.
American Museum of Natural History
New York, N. Y.

F. S. C. NORTHROP — philosophy
Department of Philosophy, Yale University
New Haven, Conn.

* This is the final conference.
† Absent.

mathematics

WALTER PITTS
Research Laboratory of Electronics, Massachusetts Institute of Technology
Cambridge, Mass.

physiology

ARTURO S. ROSENBLUETH†
Department of Physiology, Instituto Nacional de Cardiologia
Mexico City, D. F., Mexico

mathematics

LEONARD J. SAVAGE
Committee on Statistics, University of Chicago
Chicago, Ill.

T. C. SCHNEIRLA
American Museum of Natural History
New York, N. Y.

psychology

HANS LUKAS TEUBER
Department of Psychiatry and Neurology, New York University College of Medicine
New York, N. Y.

GERHARDT VON BONIN
Department of Anatomy, University of Illinois College of Medicine
Chicago, Ill.

GUESTS

biophysics

VAHE E. AMASSIAN
Department of Physiology and Biophysics, University of Washington
School of Medicine
Seattle, Wash.

Y. BAR-HILLEL
Department of Philosophy, Hebrew University
Jerusalem, Israel

chemistry

JOHN R. BOWMAN
Department of Physical Chemistry
Mellon Institute of Industrial Research, University of Pittsburgh
Pittsburgh, Pa.

YUEN REN CHAO
Department of Oriental Languages, University of California
Berkeley, Cal.

JAN DROOGLEEVER-FORTUYN
Department of Neurology, University of Groningen
Groningen, Holland

psychiatry

W. GREY-WALTER
Burden Neurological Institute
Stapleton, Bristol, England

HENRY QUASTLER
Control Systems Laboratory, University of Illinois
Urbana, Ill.

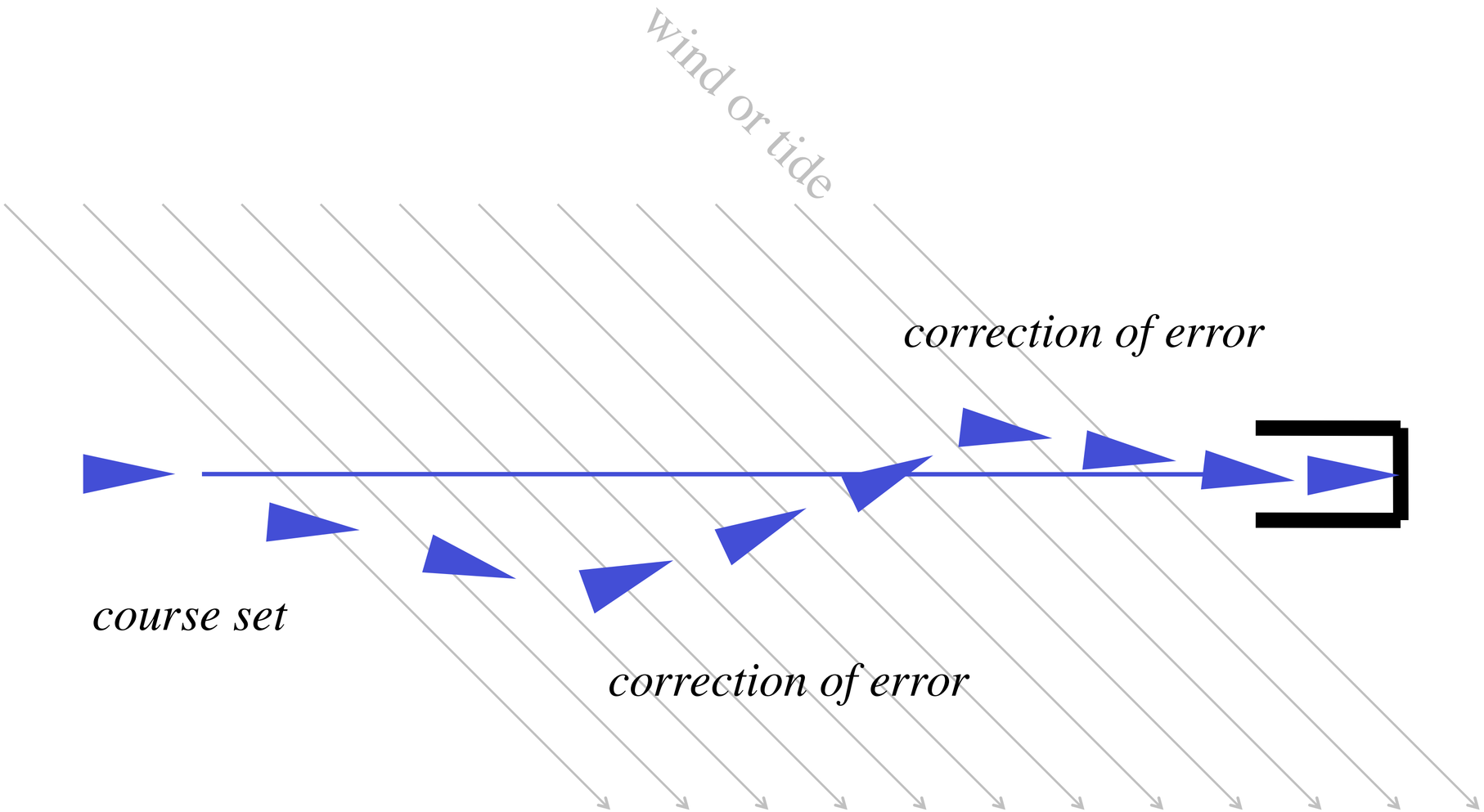
electrical eng.

CLAUDE SHANNON
Bell Telephone Laboratories, Inc., Murray Hill Laboratory
Murray Hill, N. J.

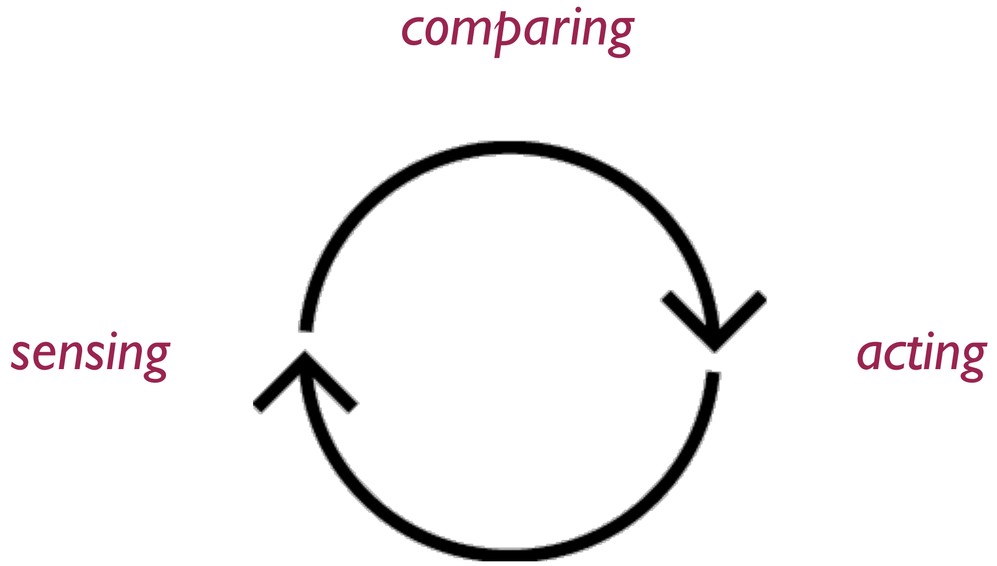
THE JOSIAH MACY, JR. FOUNDATION
FRANK FREMONT-SMITH, *Medical Director*
JANET FREED LYNCH, *Assistant for the Conference Program*

† Absent.

the art of steering



the art of regulation



Gordon Pask
Cybernetician

Paul Pangaro / Nano Worlds Fair – San Francisco / March 2018

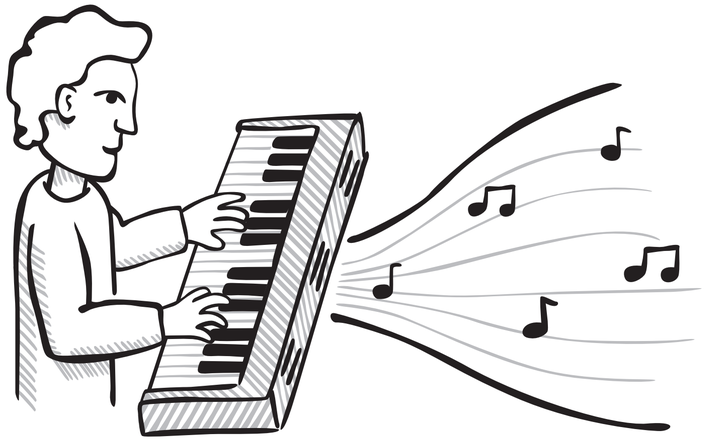
Gordon Pask & Elizabeth Pask

Gordon Pask
London

circa 1988

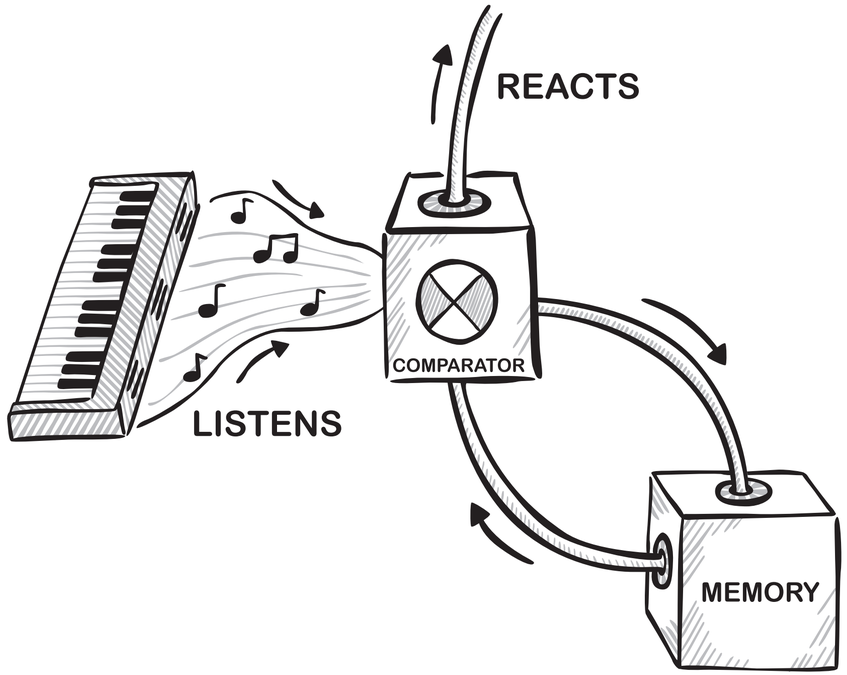
Gordon Pask’s
Musicolour

mid-1950s



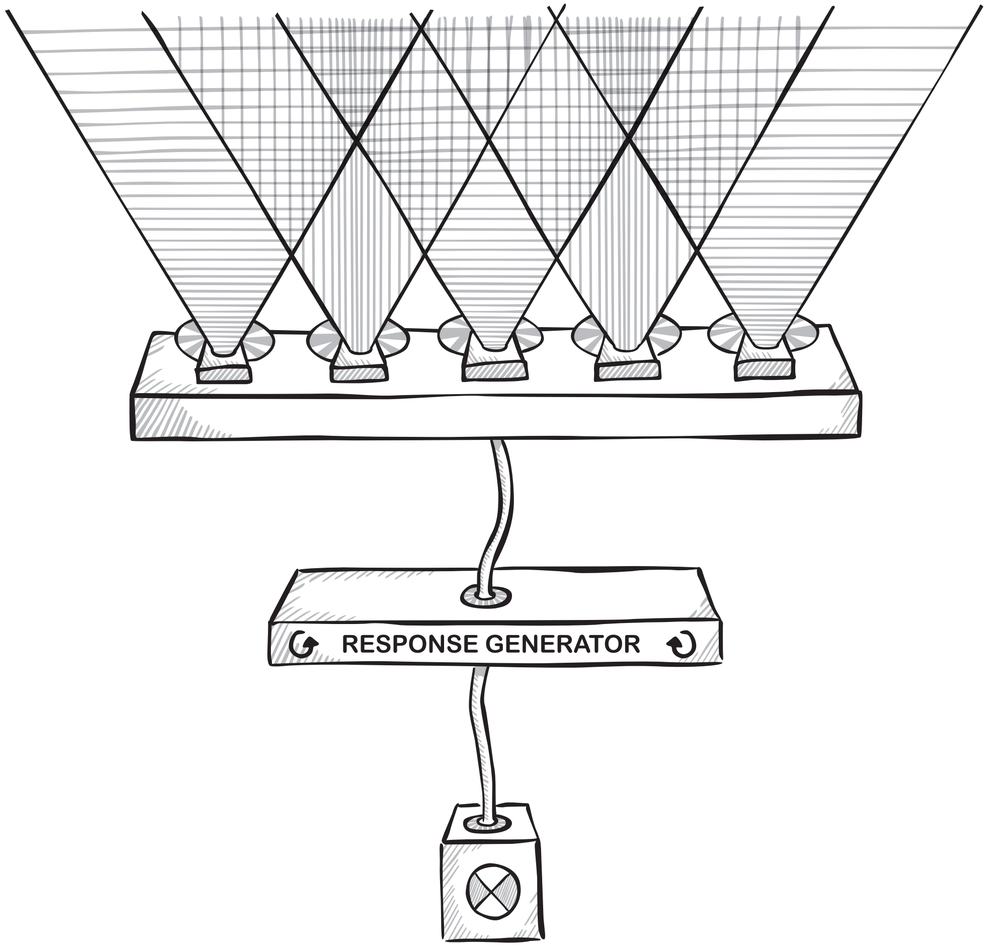
Gordon Pask’s
Musicolour

mid-1950s



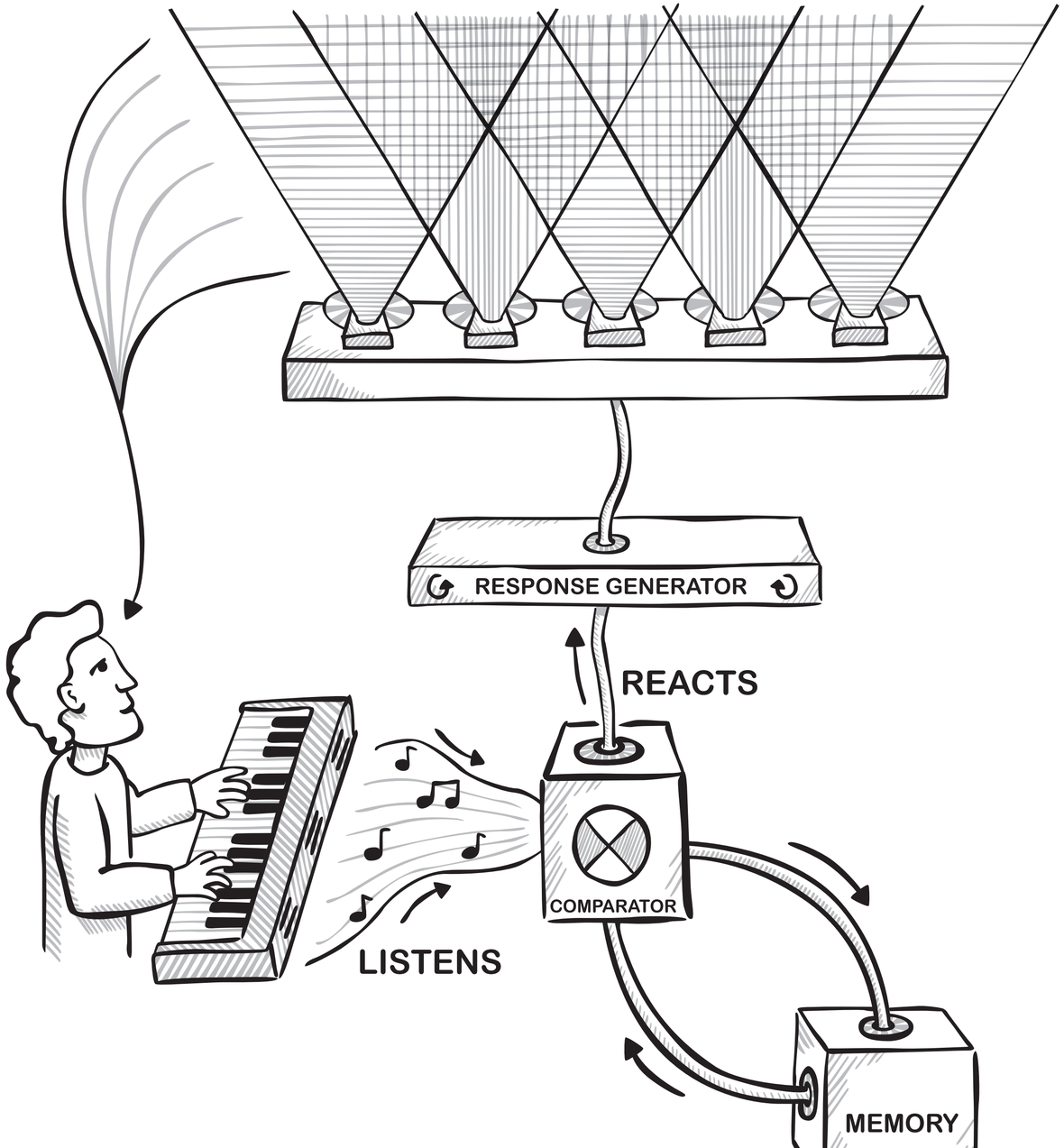
Gordon Pask’s
Musicolour

mid-1950s

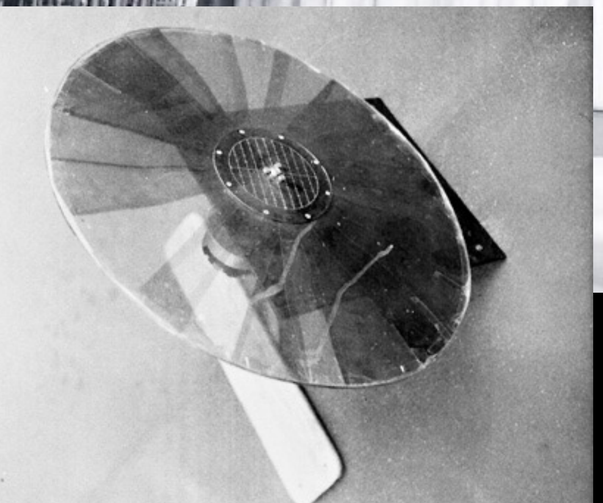


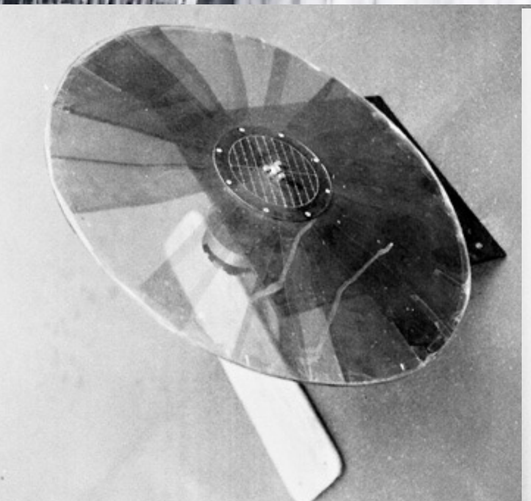
Gordon Pask’s
Musicolour

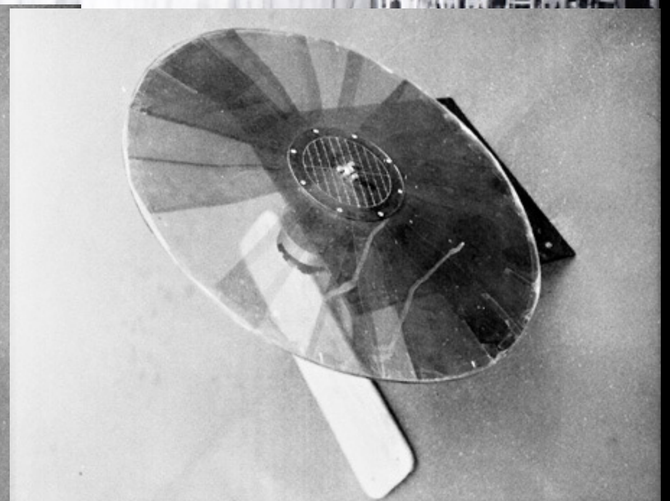
mid-1950s

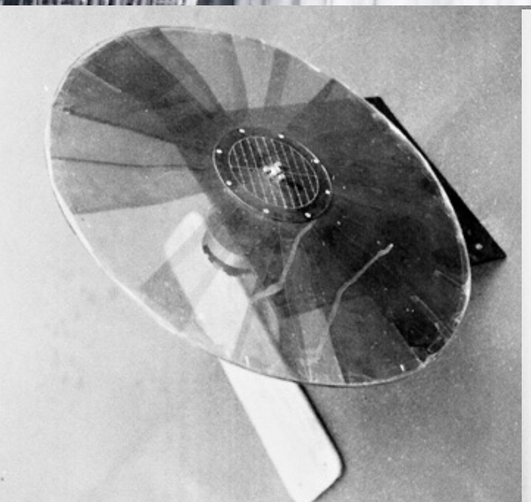


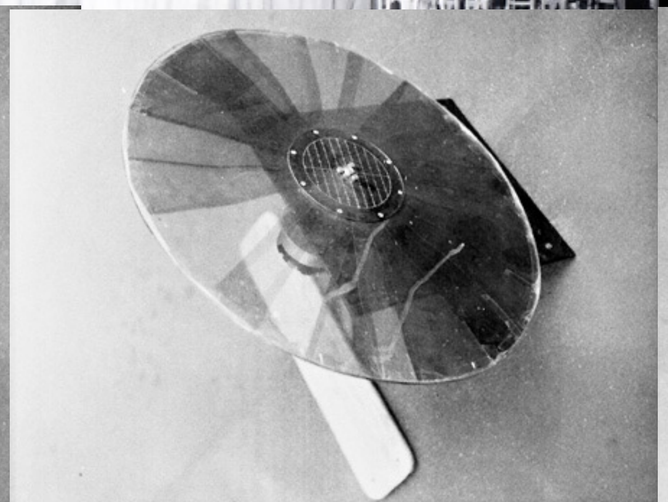
Paul Pangaro / Nano Worlds Fair – San Francisco / March 2018

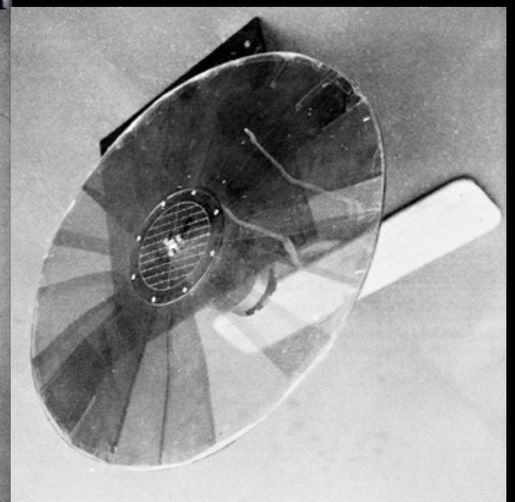


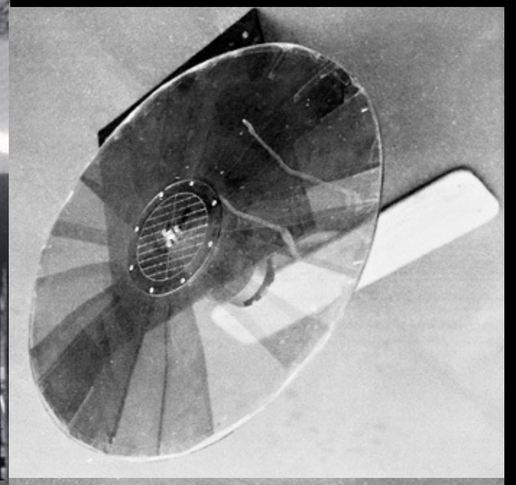


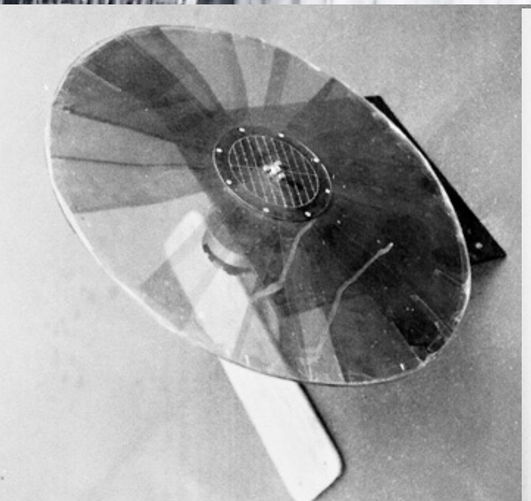


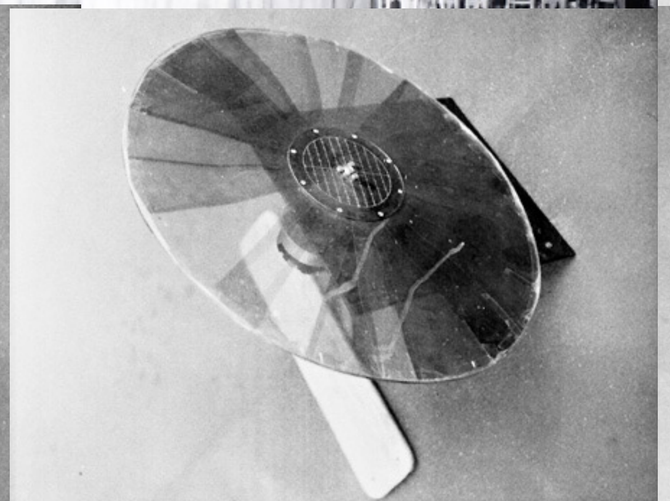


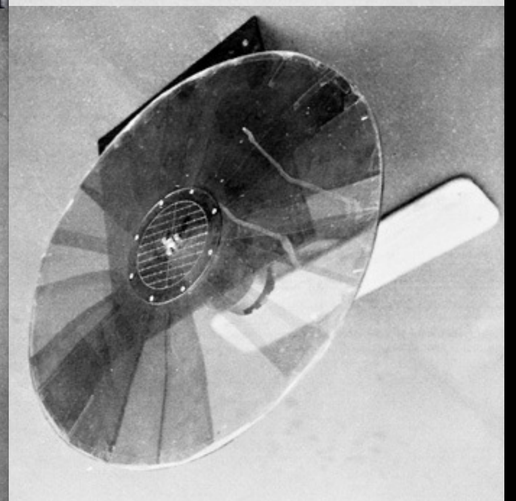


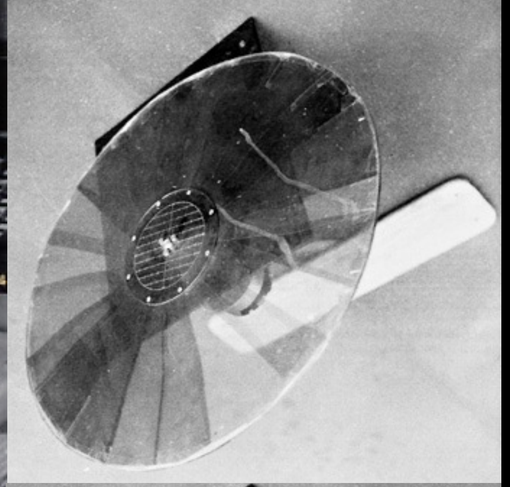


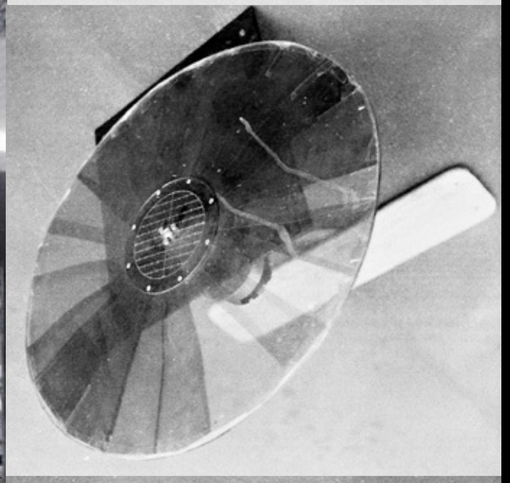


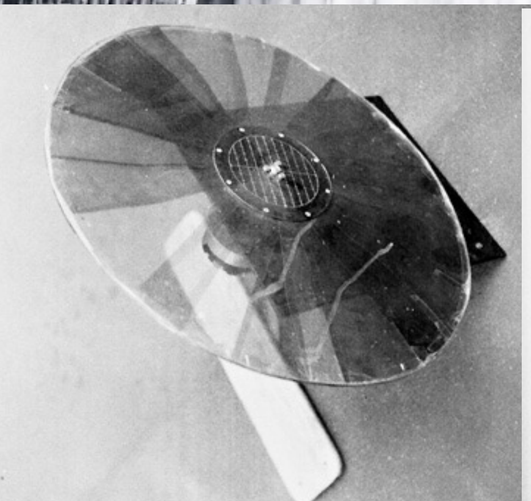


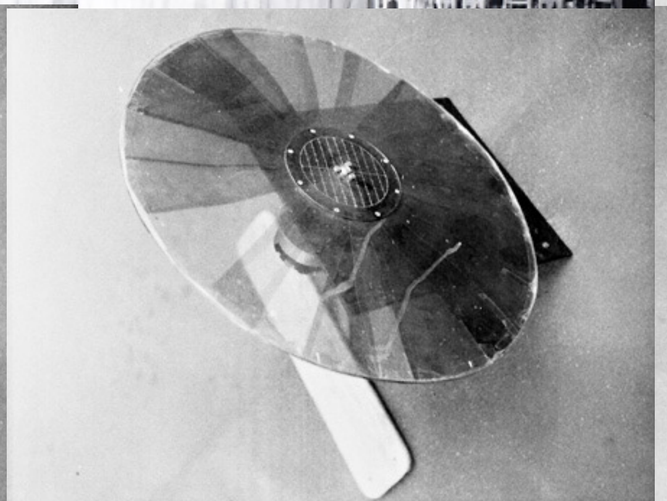


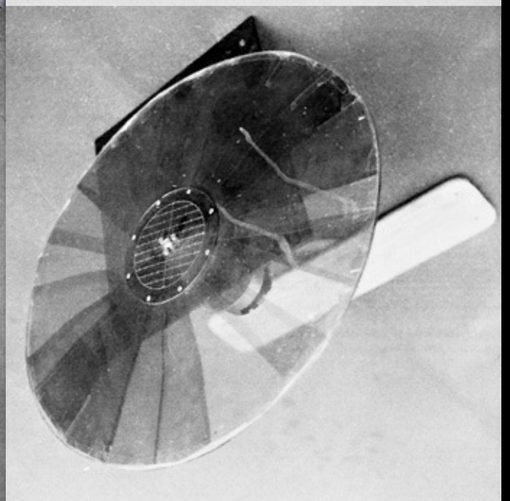


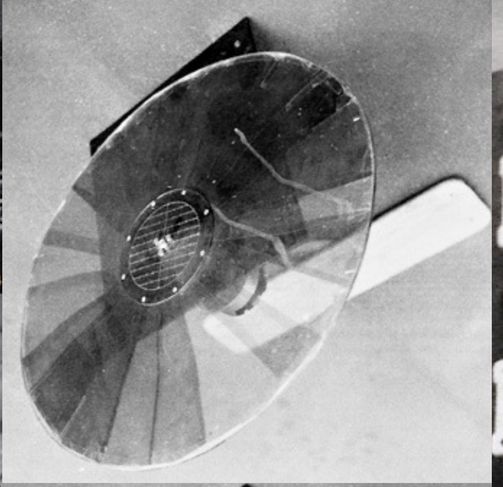


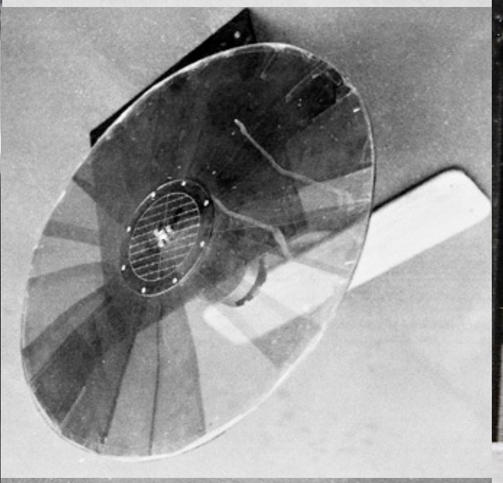


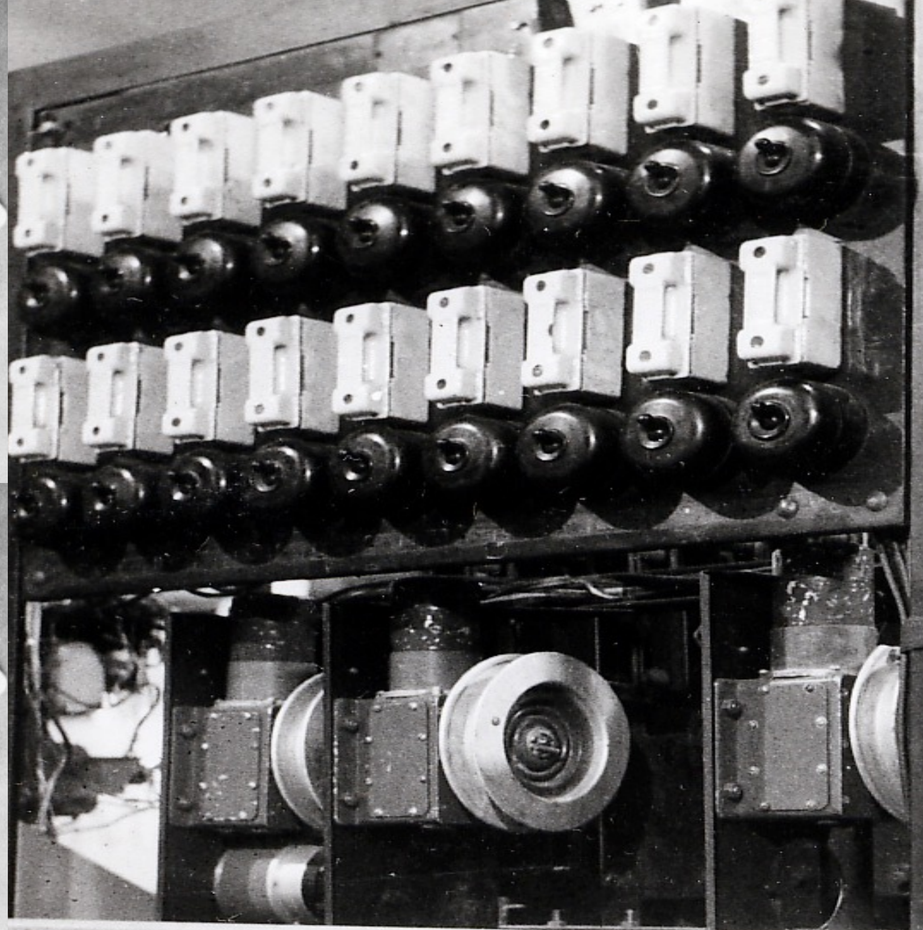


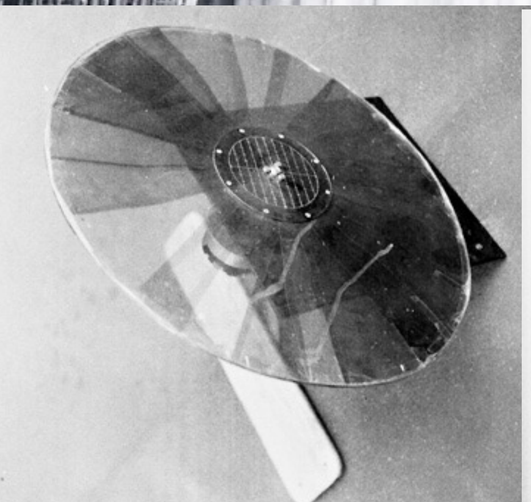


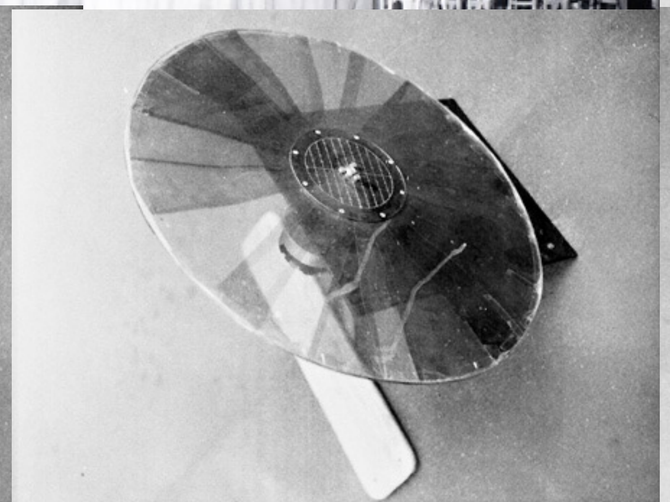


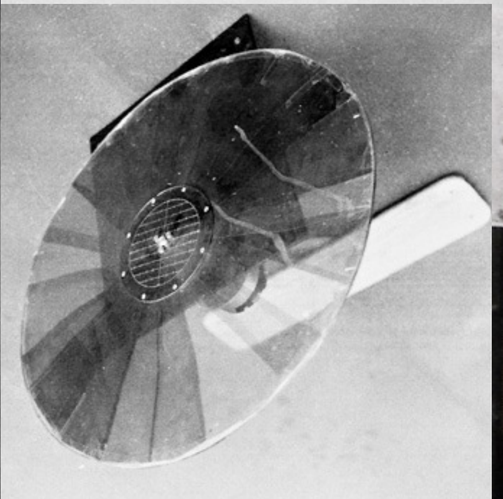


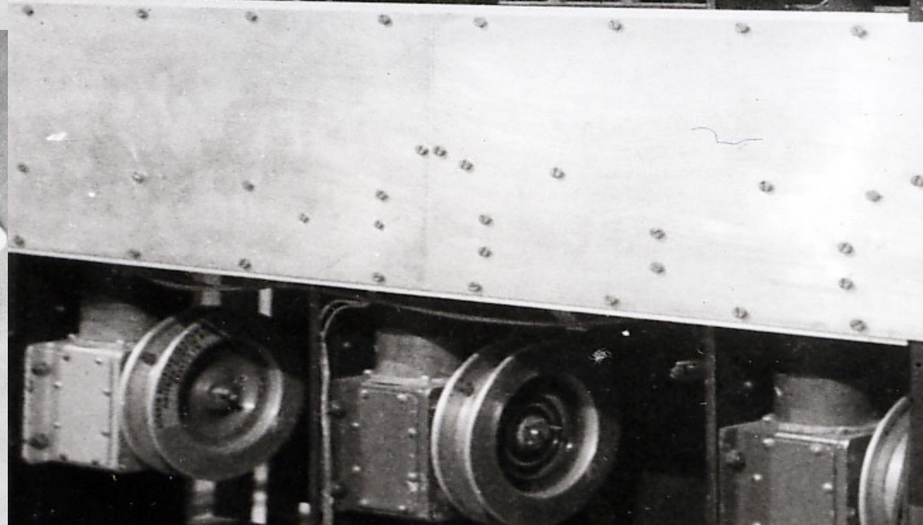






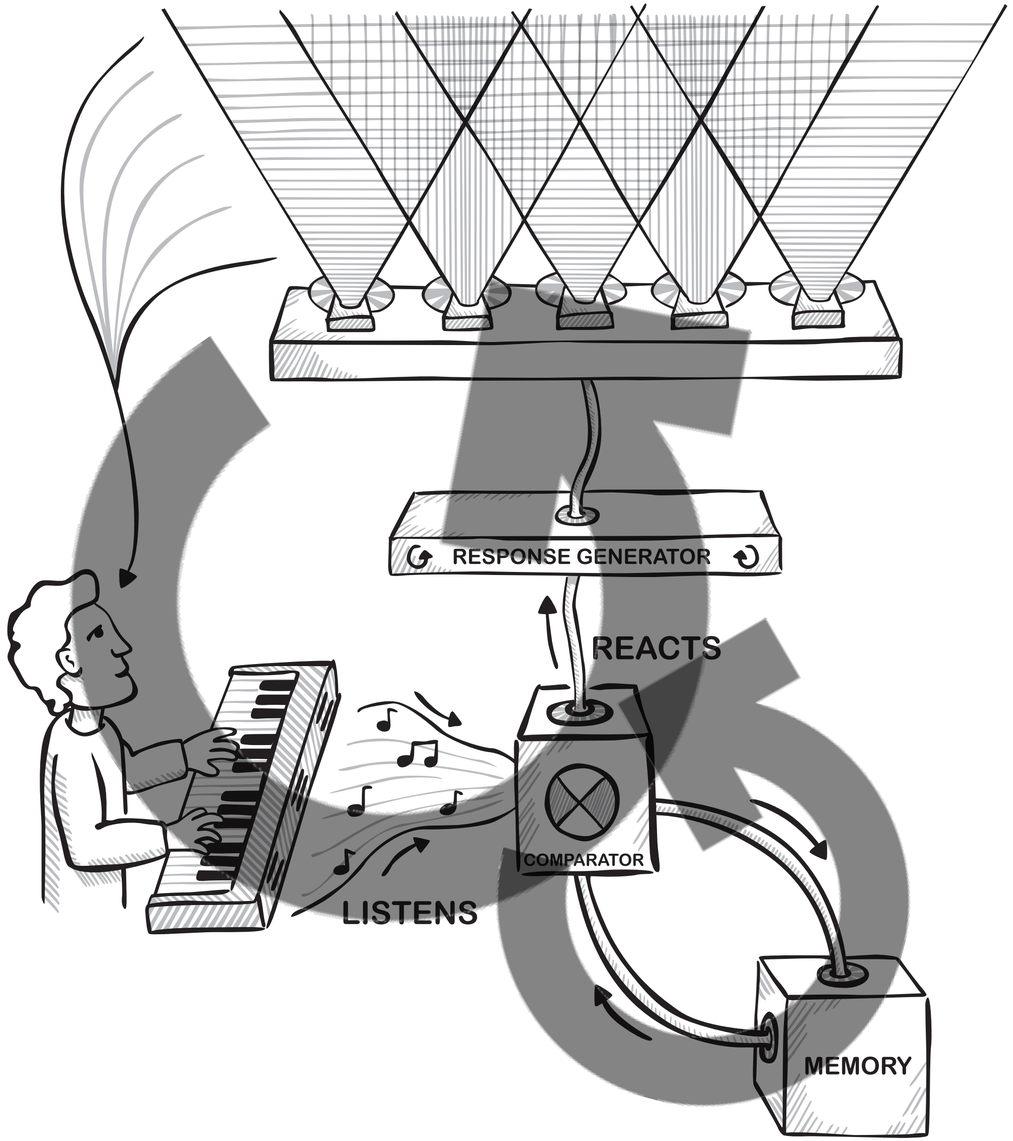






Gordon Pask’s
Musicolour

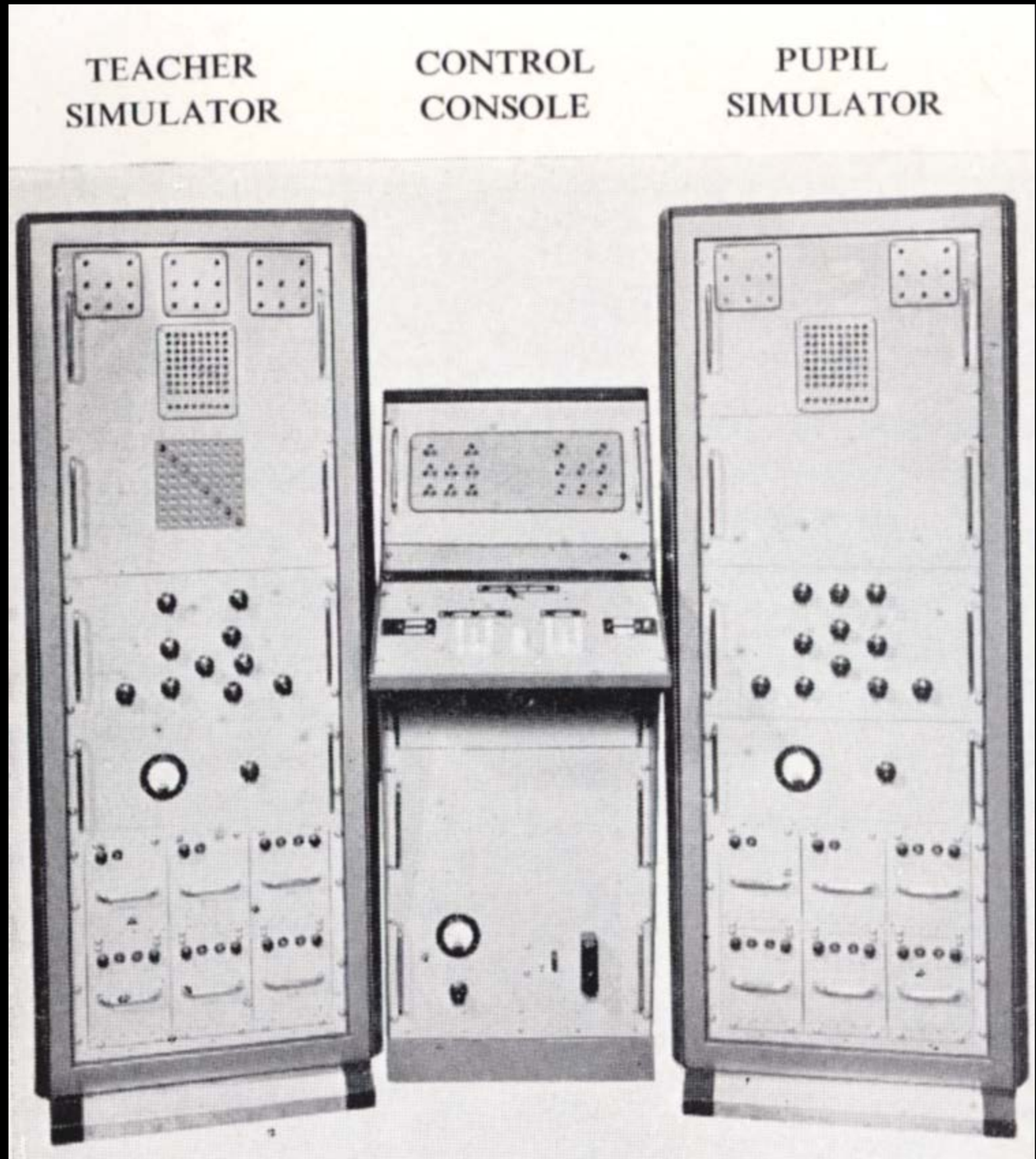
mid-1950s



More on Musicolour

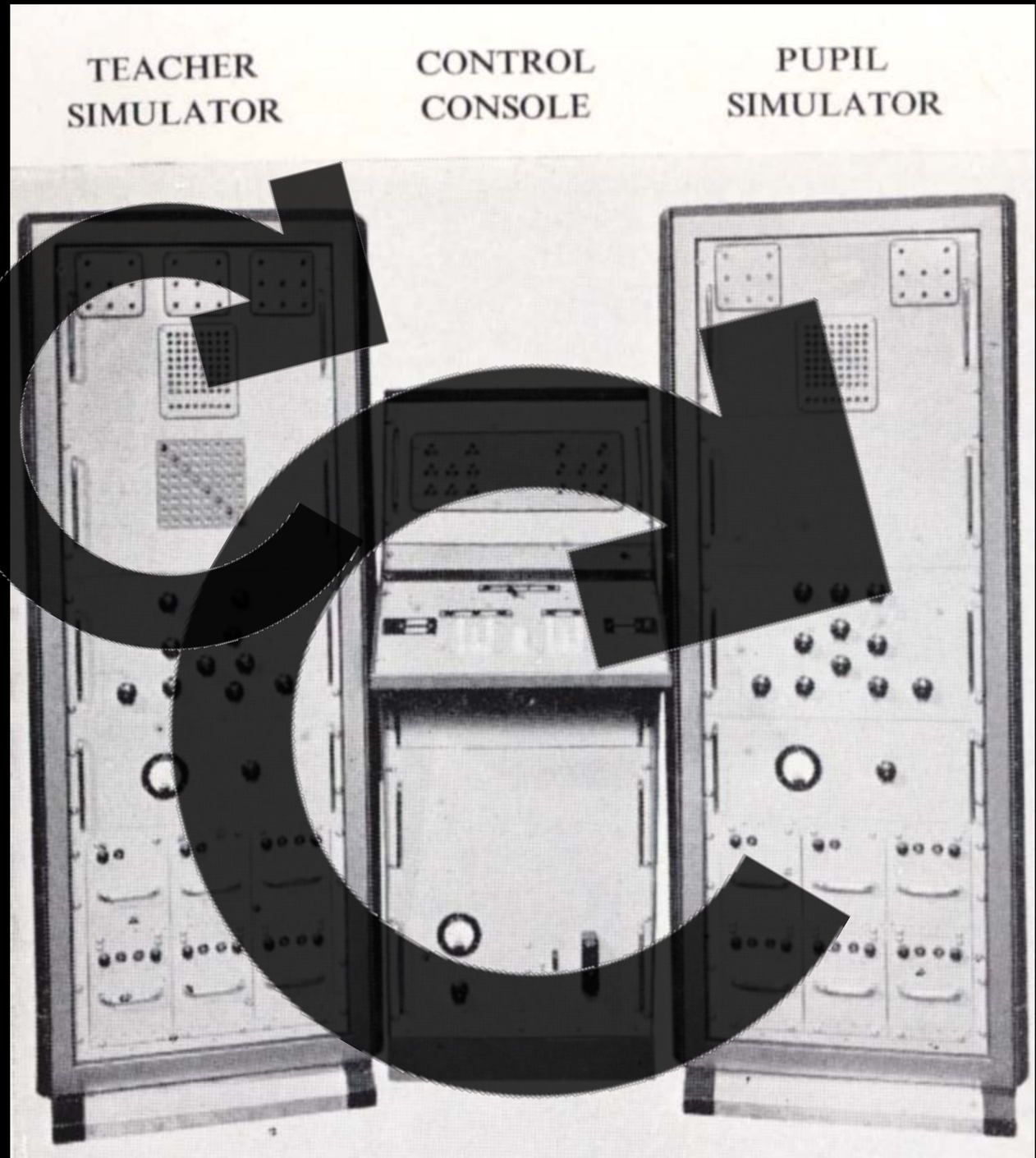
Gordon Pask's
Eucrates

1958



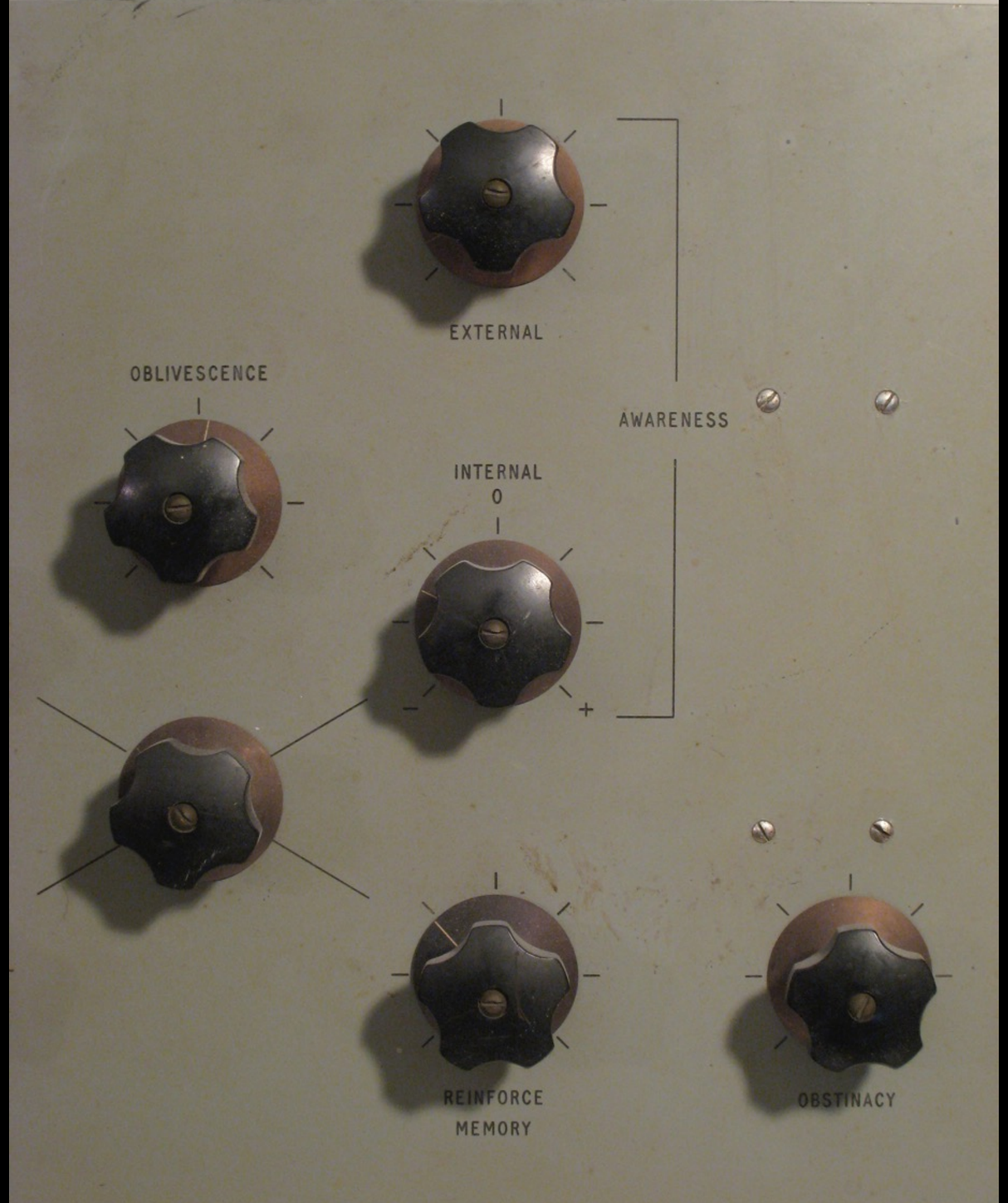
Gordon Pask’s
Eucrates

1958



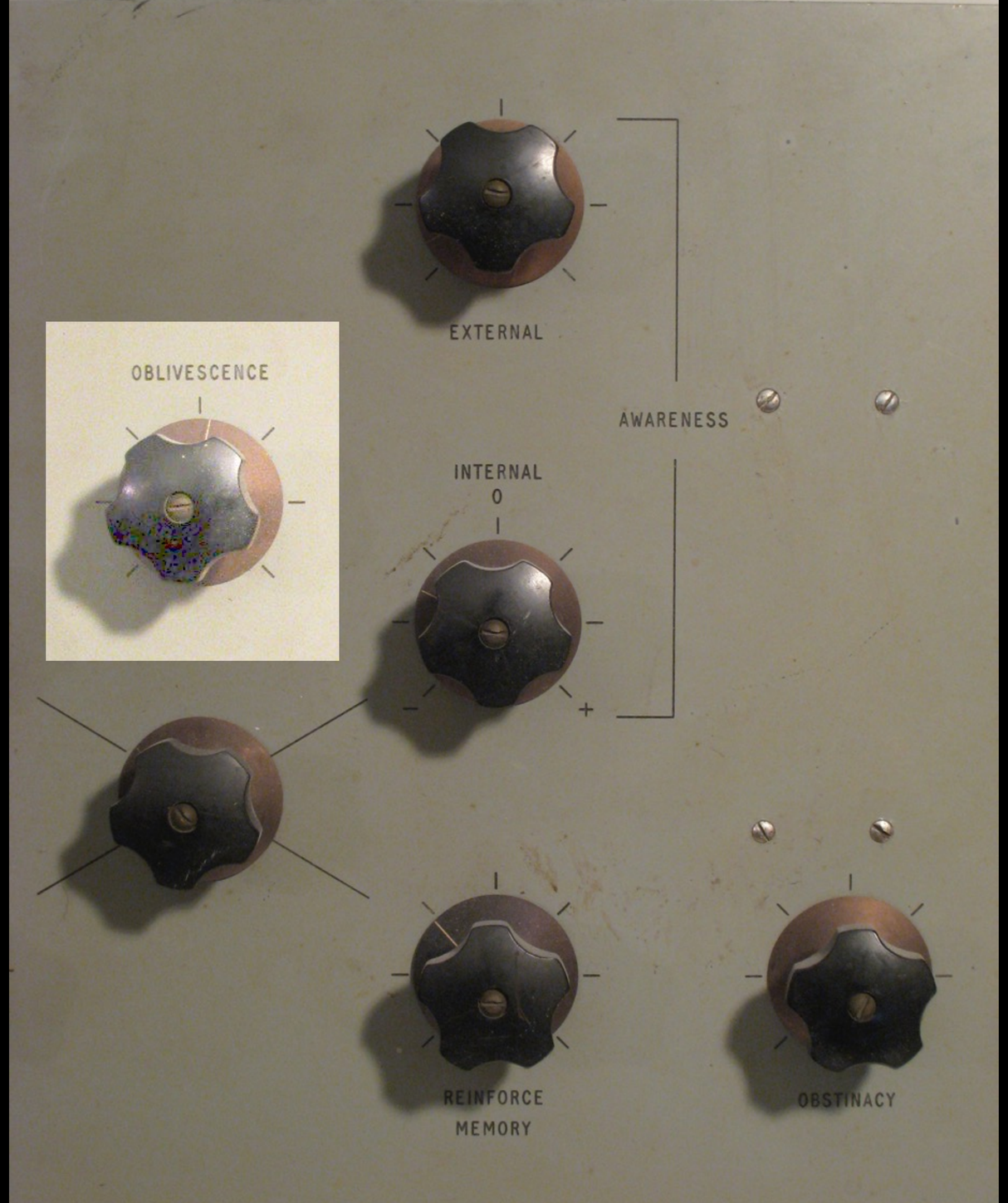
Gordon Pask's
Eucrates

1958



Gordon Pask's
Eucrates

1958



Cybernetic Serendipity

Serendipity

Serendipity

the faculty of making happy chance discoveries by means of control and communication machines both human and electronic

An exhibition

and other serendipitous manifestations

Institute of Contemporary Arts

August 2 - October 26

CYBERNETIC SERENDIPITY LECTURES

Thursday August 8

Tuesday August 13

Thursday August 15

Tuesday August 20

Tuesday August 27

Tuesday September 3

Thursday September 5

Tuesday September 10

Thursday September 12

Thursday September 19

Tuesday September 24

Thursday September 26

Tuesday October 1

Tuesday October 8

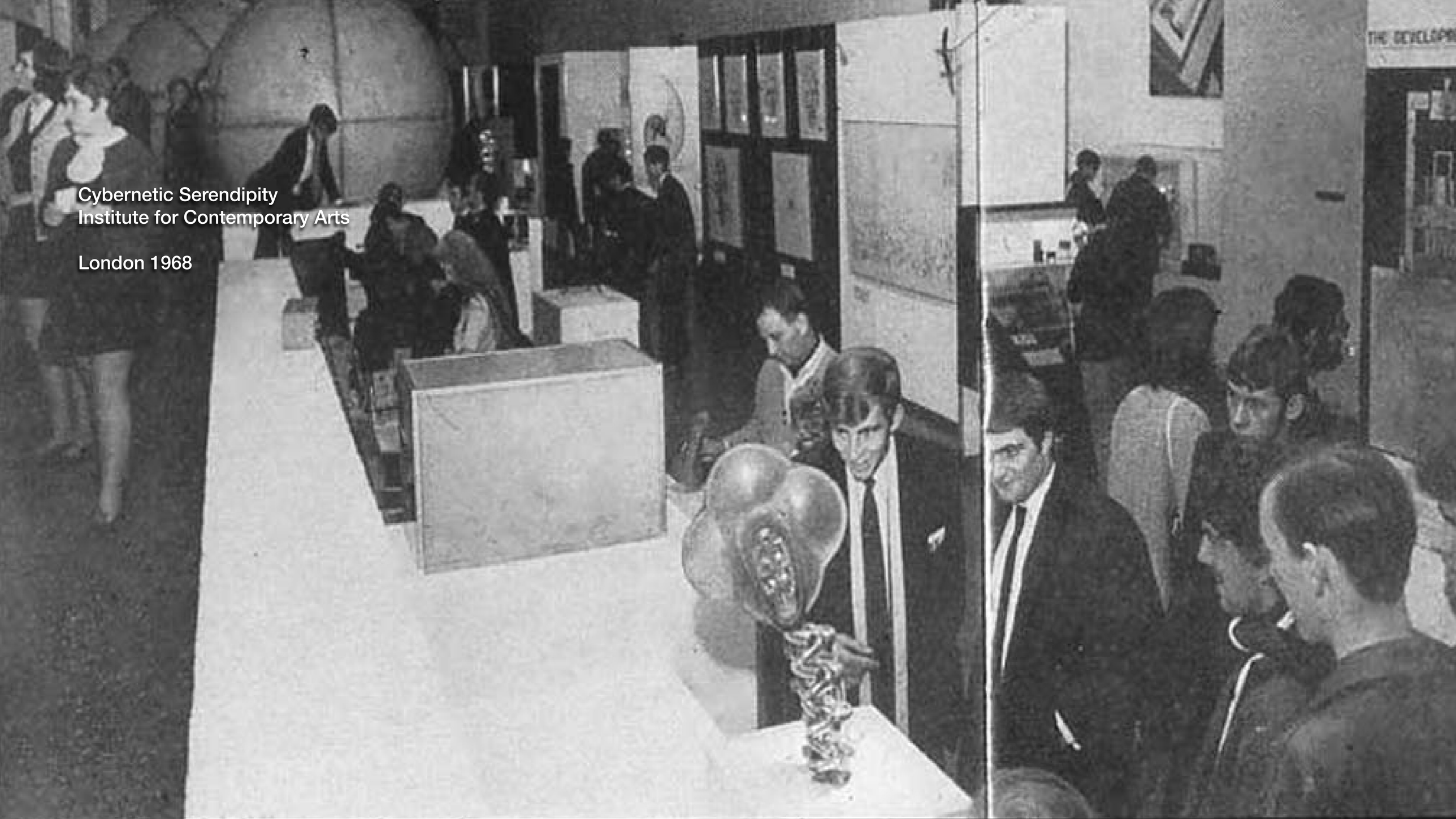
Thursday October 10

Thursday October 17


Cybernetic Serendipity
Institute for Contemporary Arts
London 1968

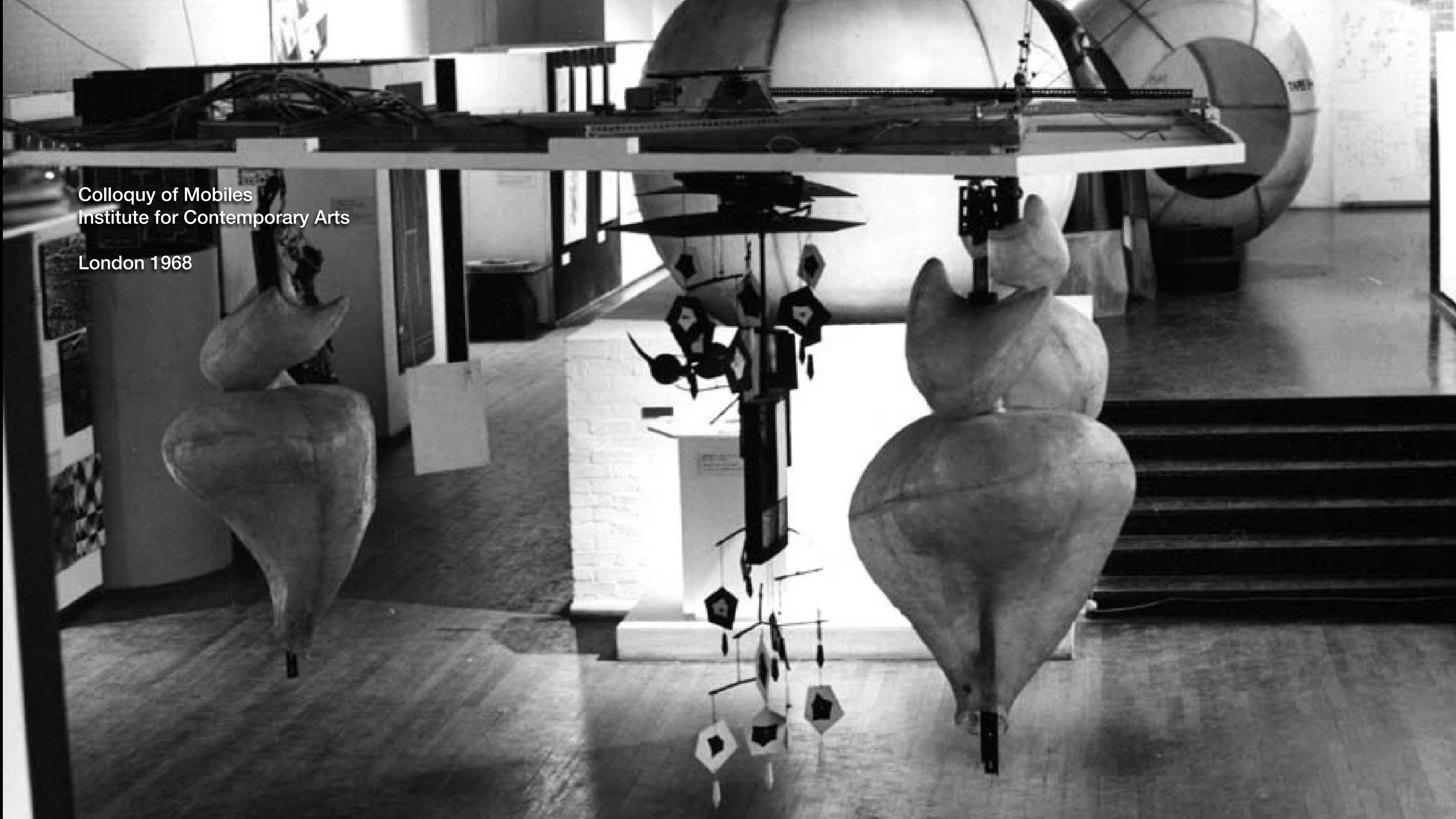
Cybernetic Serendipity
Institute for Contemporary Arts

London 1968



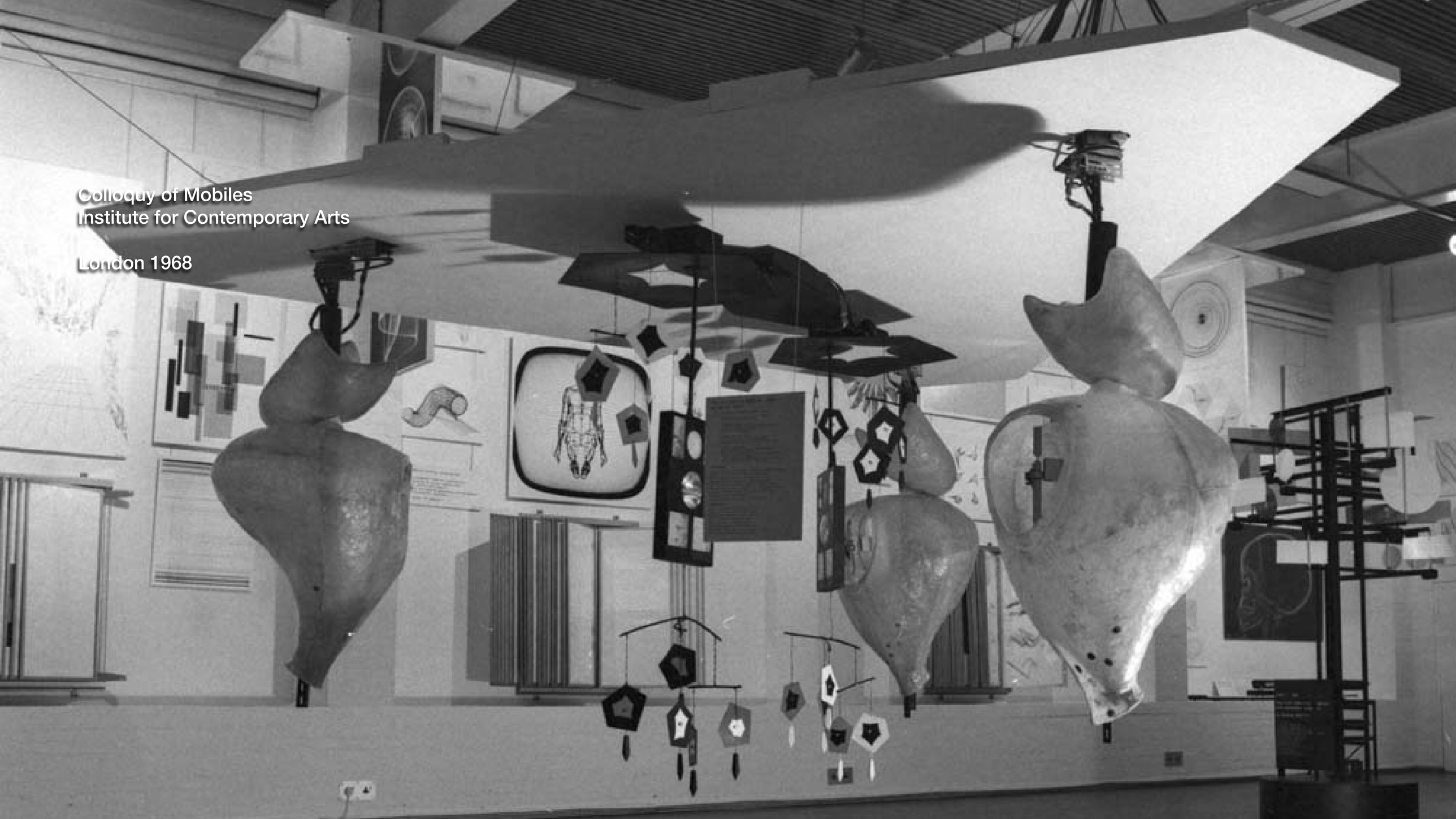
Cybernetic Serendipity
Institute for Contemporary Arts

London 1968



Colloquy of Mobiles
Institute for Contemporary Arts

London 1968

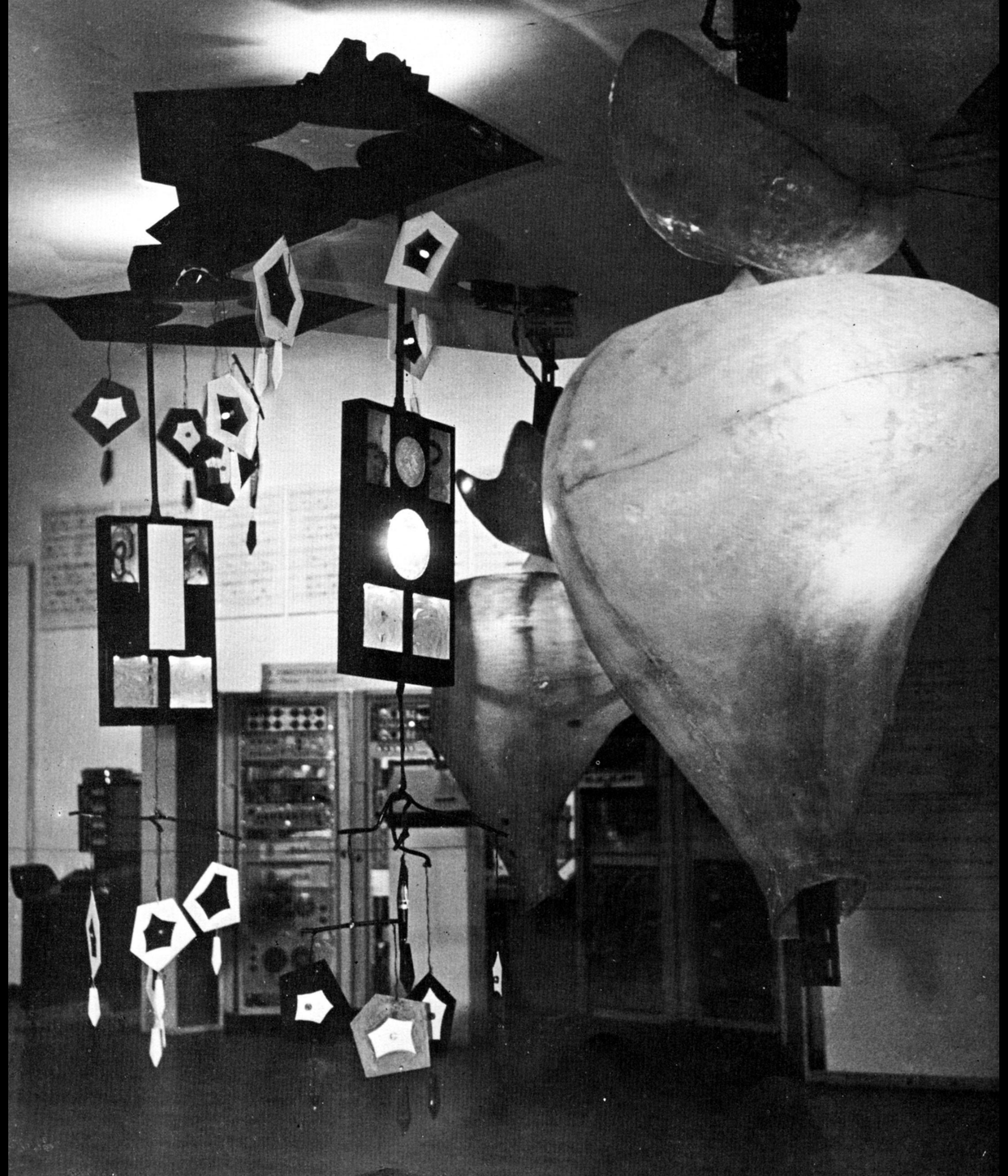


Colloquy of Mobiles
Institute for Contemporary Arts

London 1968

Colloquy of Mobiles
Institute for Contemporary Arts

London 1968



Click for more about
COLLOQUY 2018 Project

Gordon Pask
Concordia University
Montreal, Canada

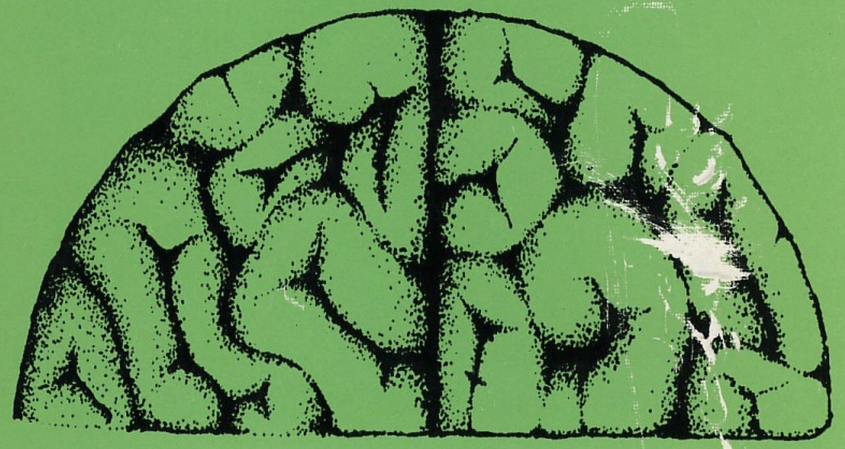
1979

Click to go to video

1975

GORDON PASK

CONVERSATION, COGNITION AND LEARNING



A CYBERNETIC THEORY AND METHODOLOGY

ELSEVIER

GORDON PASK

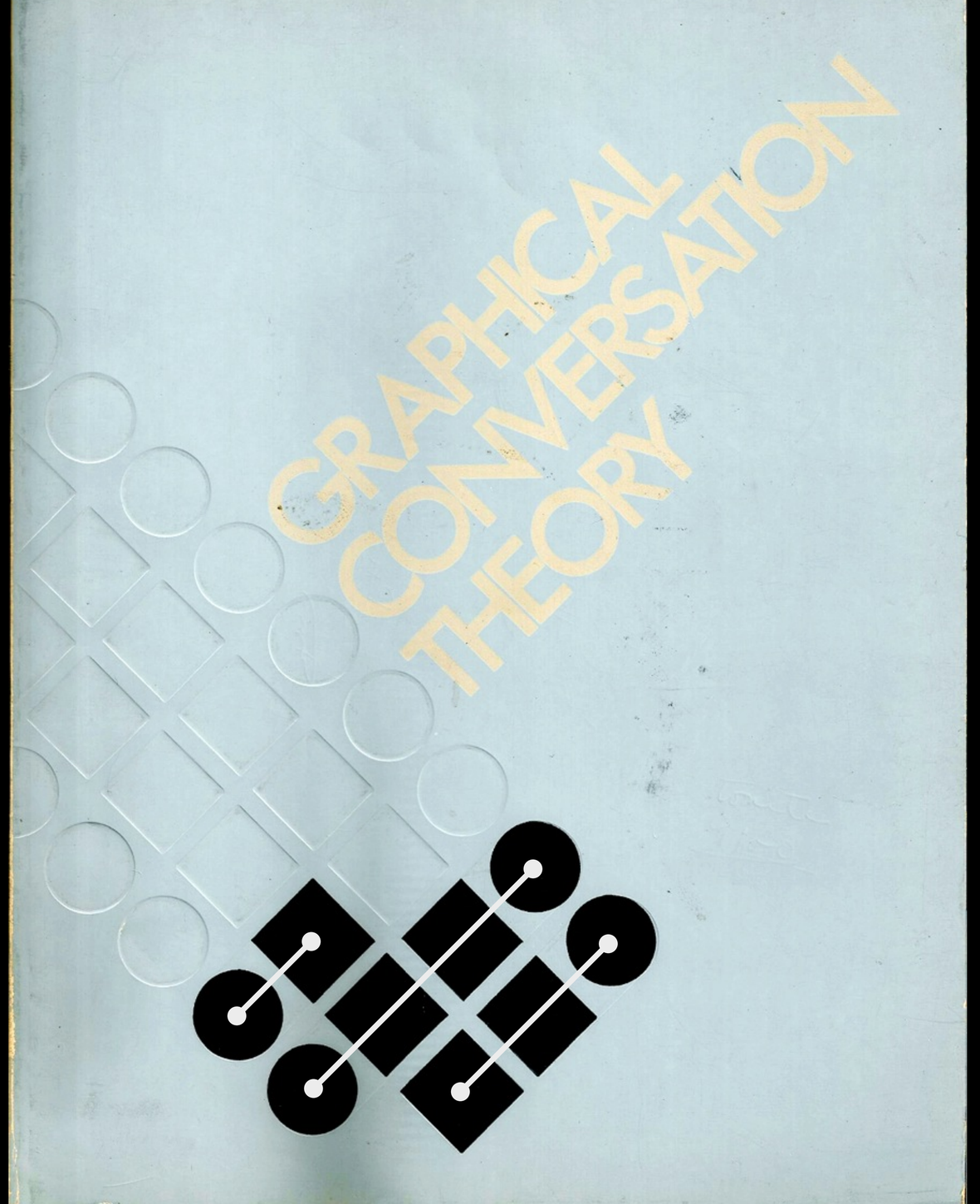
CONVERSATION THEORY

APPLICATIONS IN EDUCATION AND EPISTEMOLOGY

ELSEVIER

1976

MIT Architecture Machine Group
1976

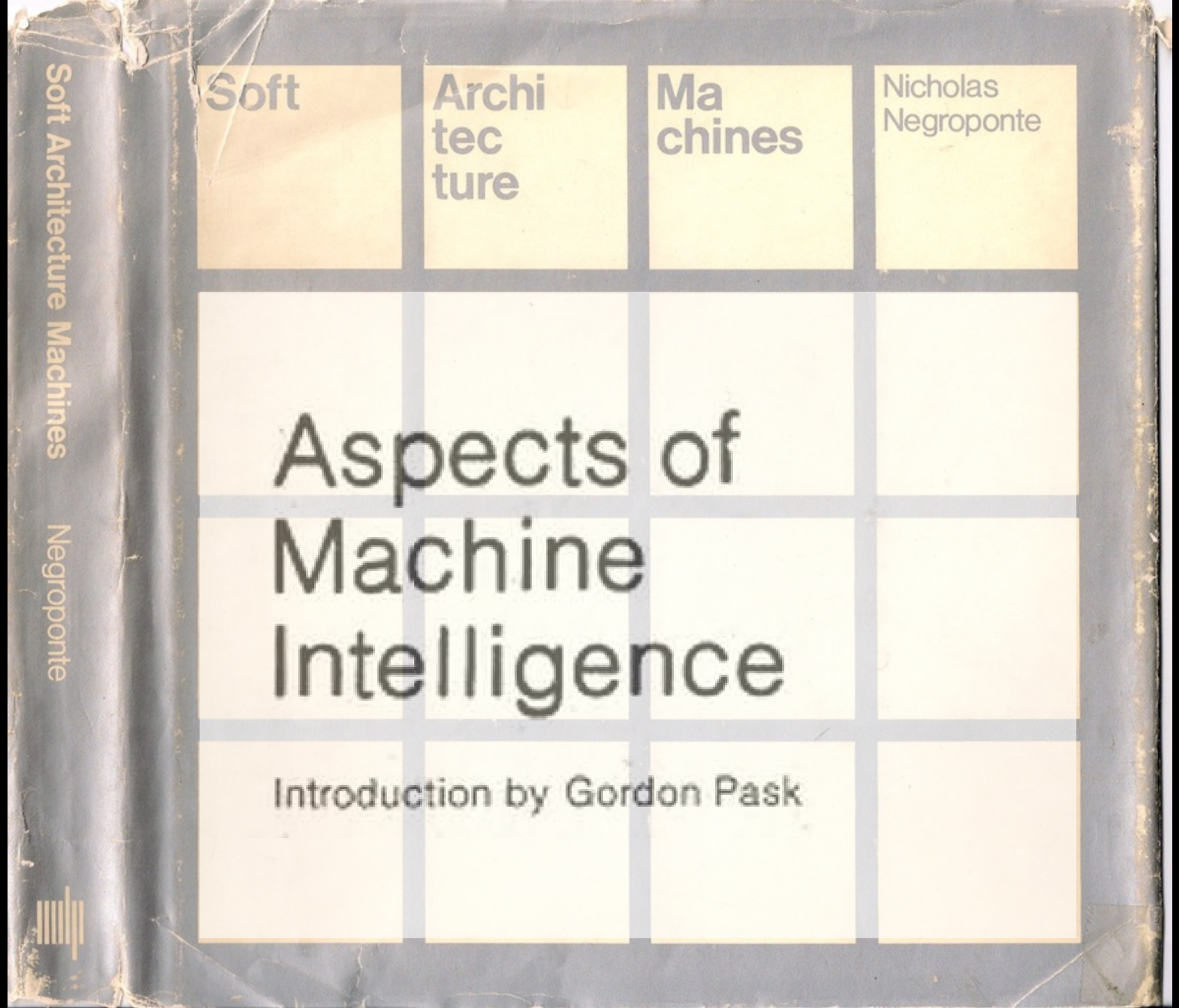


Nicholas Negroponte's *Soft Architecture Machines*

1976

Nicholas Negroponte's *Soft Architecture Machines*

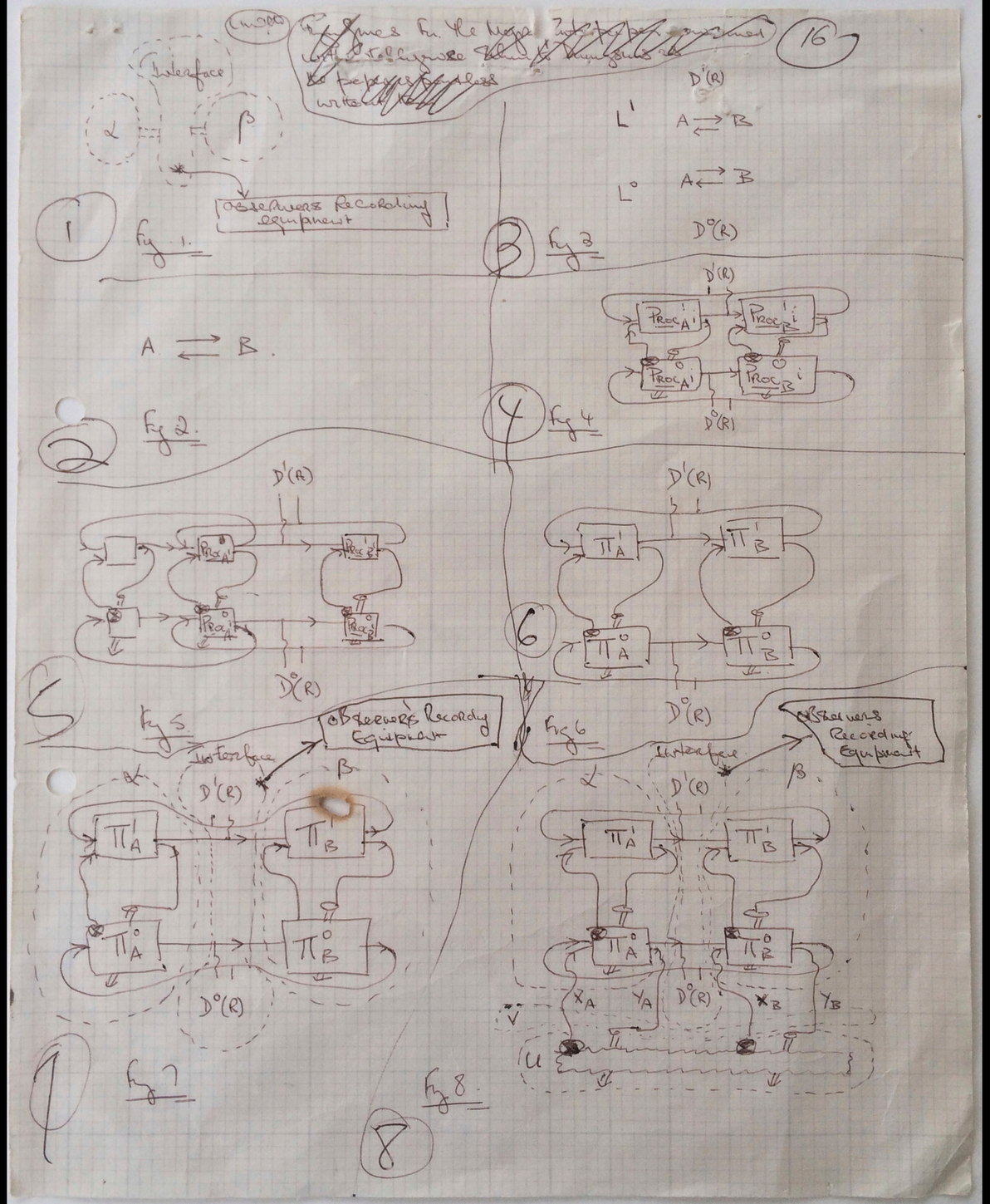
1976



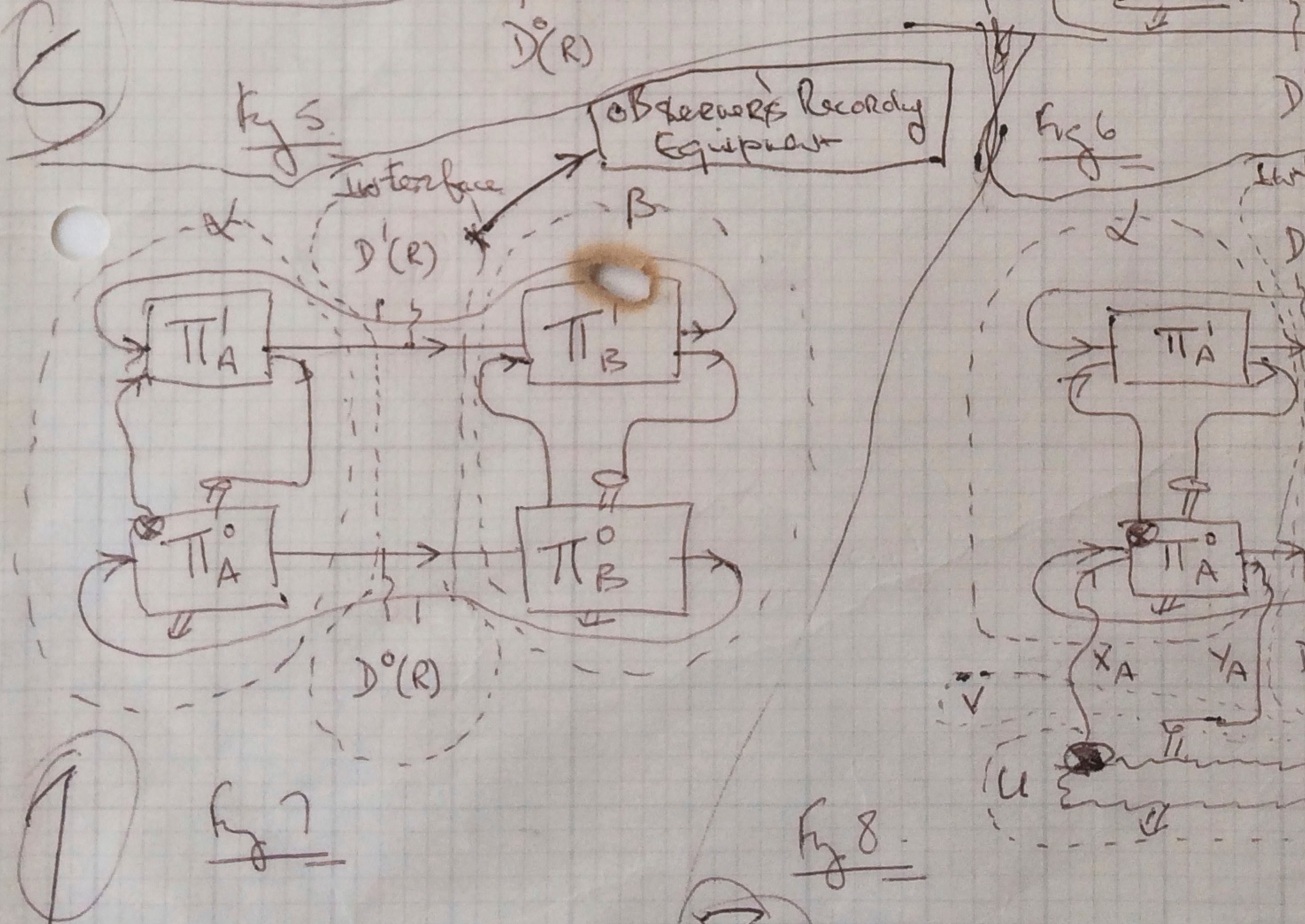
Gordon Pask's
Hand-drawn Figures

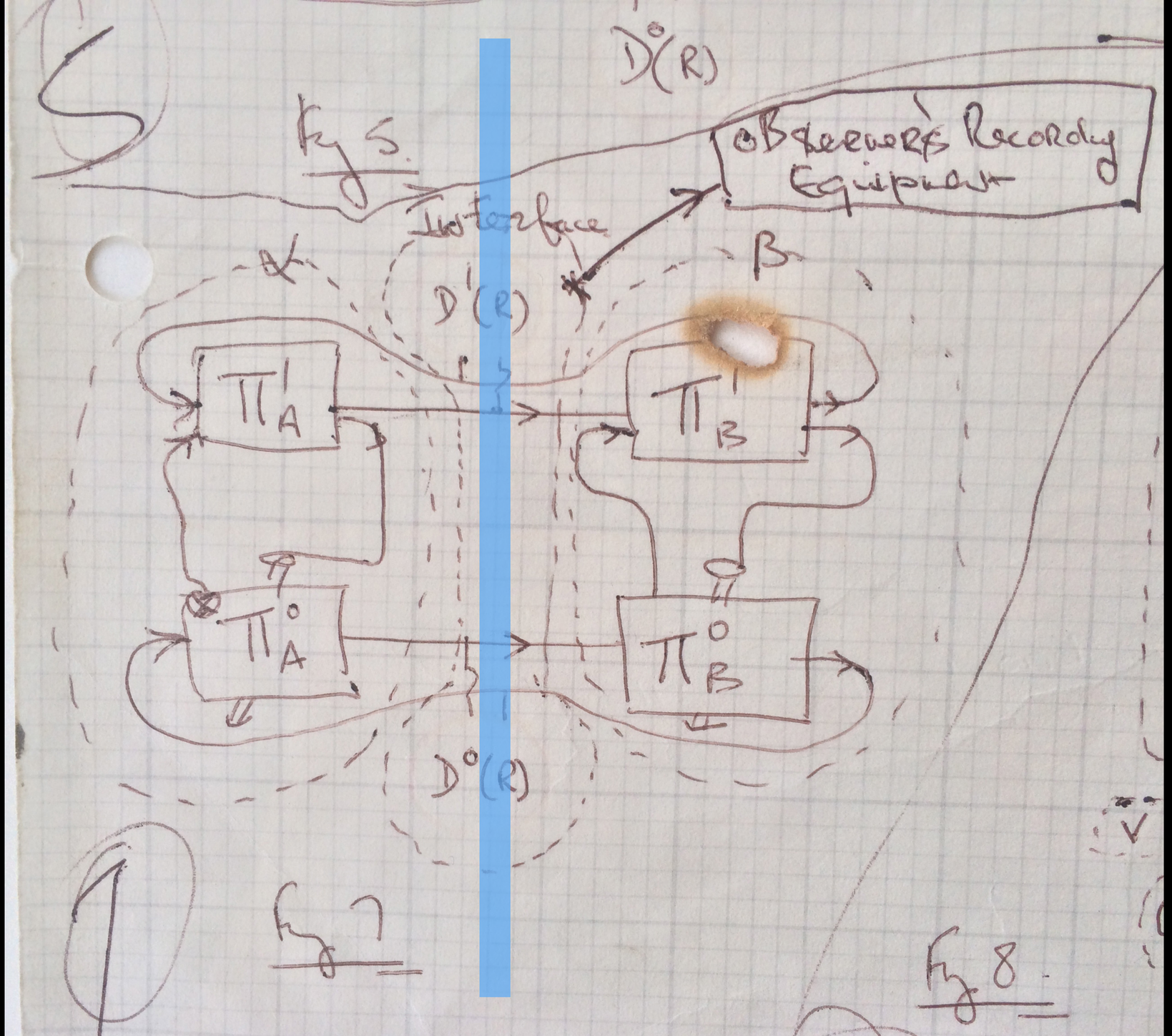
"Aspects of Machine Intelligence"
in *Soft Architecture Machines*
edited by N. Negroponte

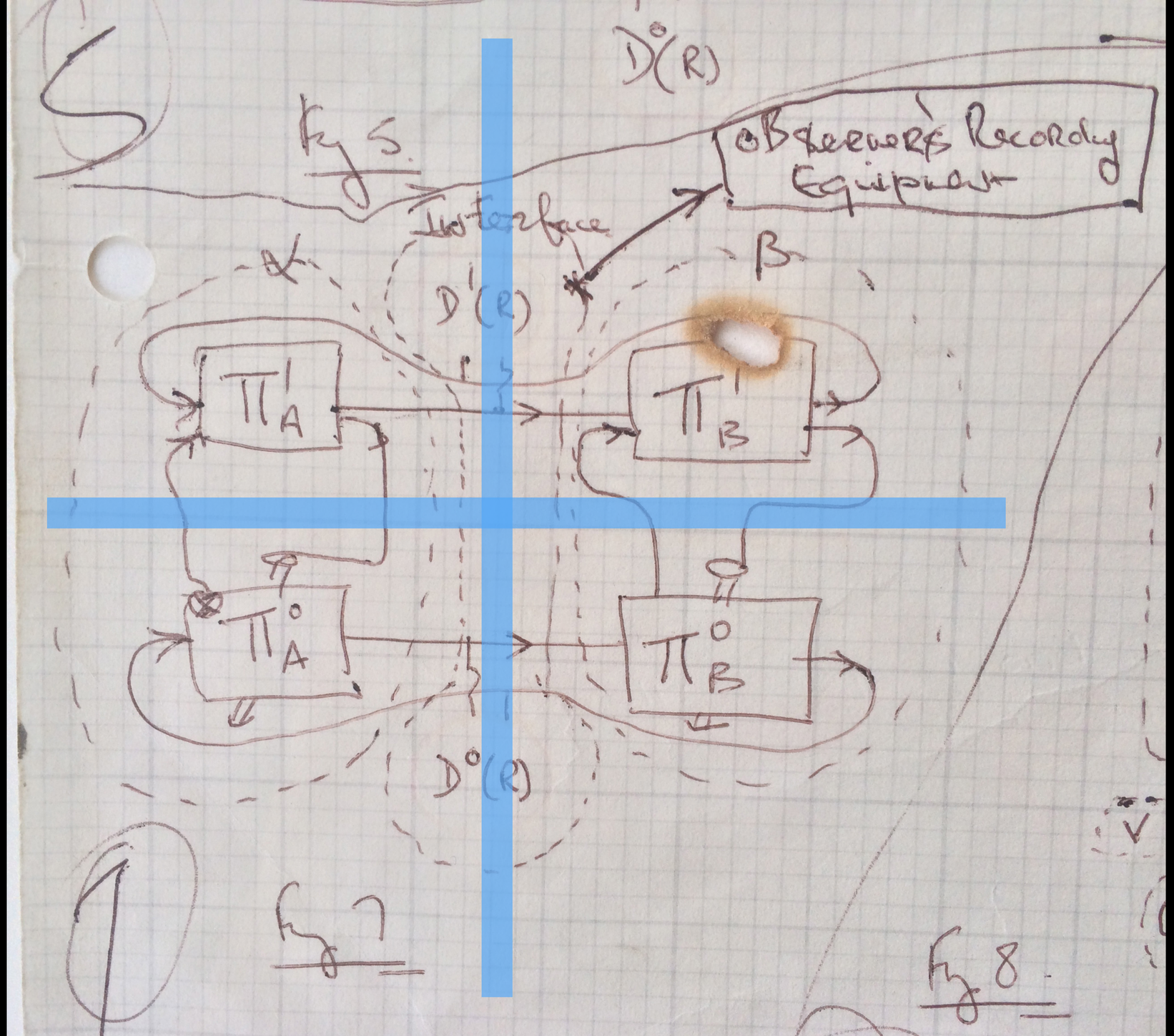
1976

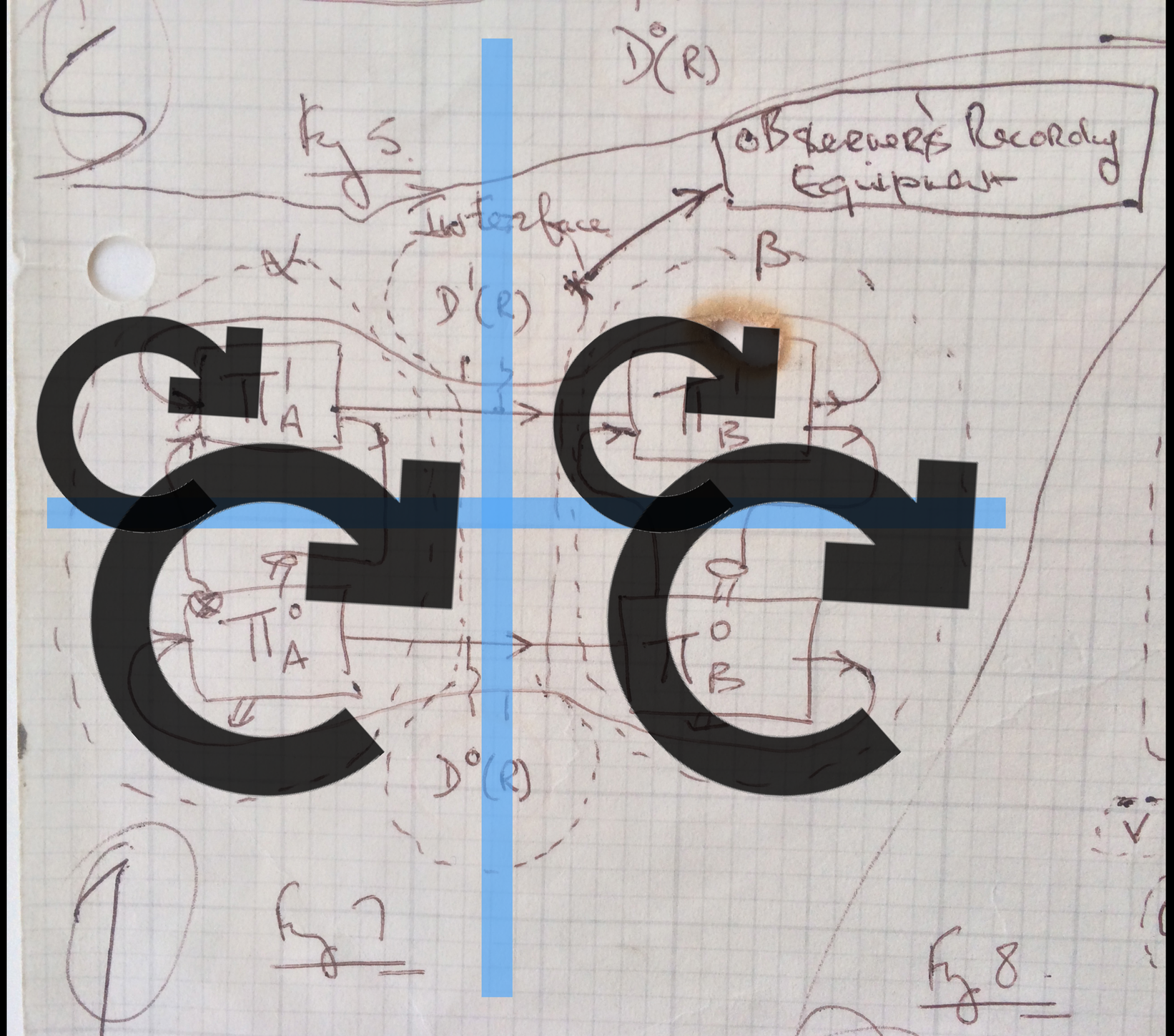


Click for full paper


D°(R)
Fig 5
Observers Recording Equipment
Interface
D'(R)
α
β
Π'_A
Π'_B
Π°_A
Π°_B
D°(R)
Fig 6
γ
Π'_A
Π°_A
X_A
Y_A
V
U
Fig 7
Fig 8


D°(R)
Fig 5.
Observers Recording Equipment
Interface
A
B
D'(R)
Π'A
Π'B
Π°A
Π°B
D°(R)
Fig 7
Fig 8.

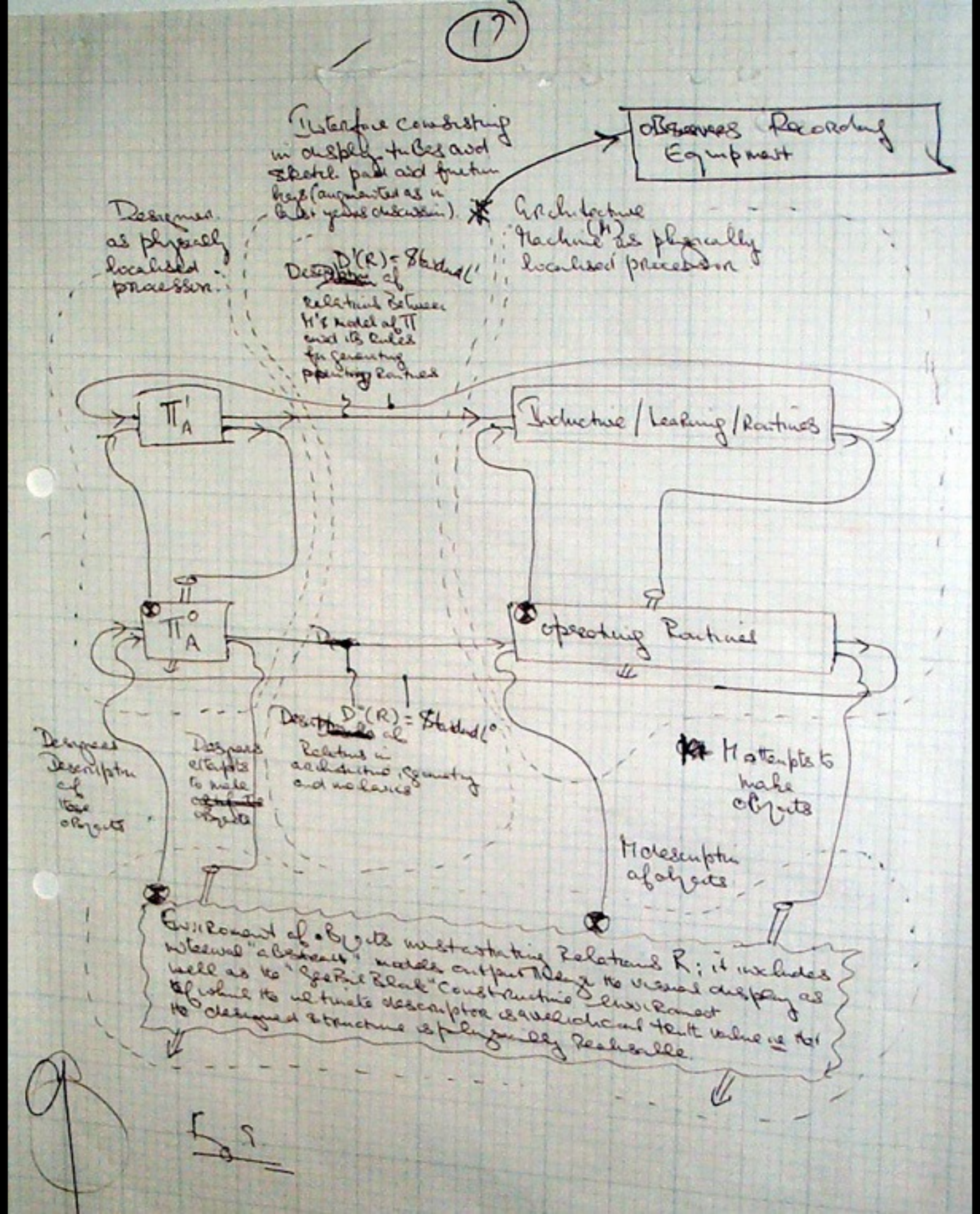

D°(R)
Fig 5.
Observers Recording Equipment
Interface
A
B
D'(R)
Π'A
Π'B
Π°A
Π°B
D°(R)
Fig 7
Fig 8.

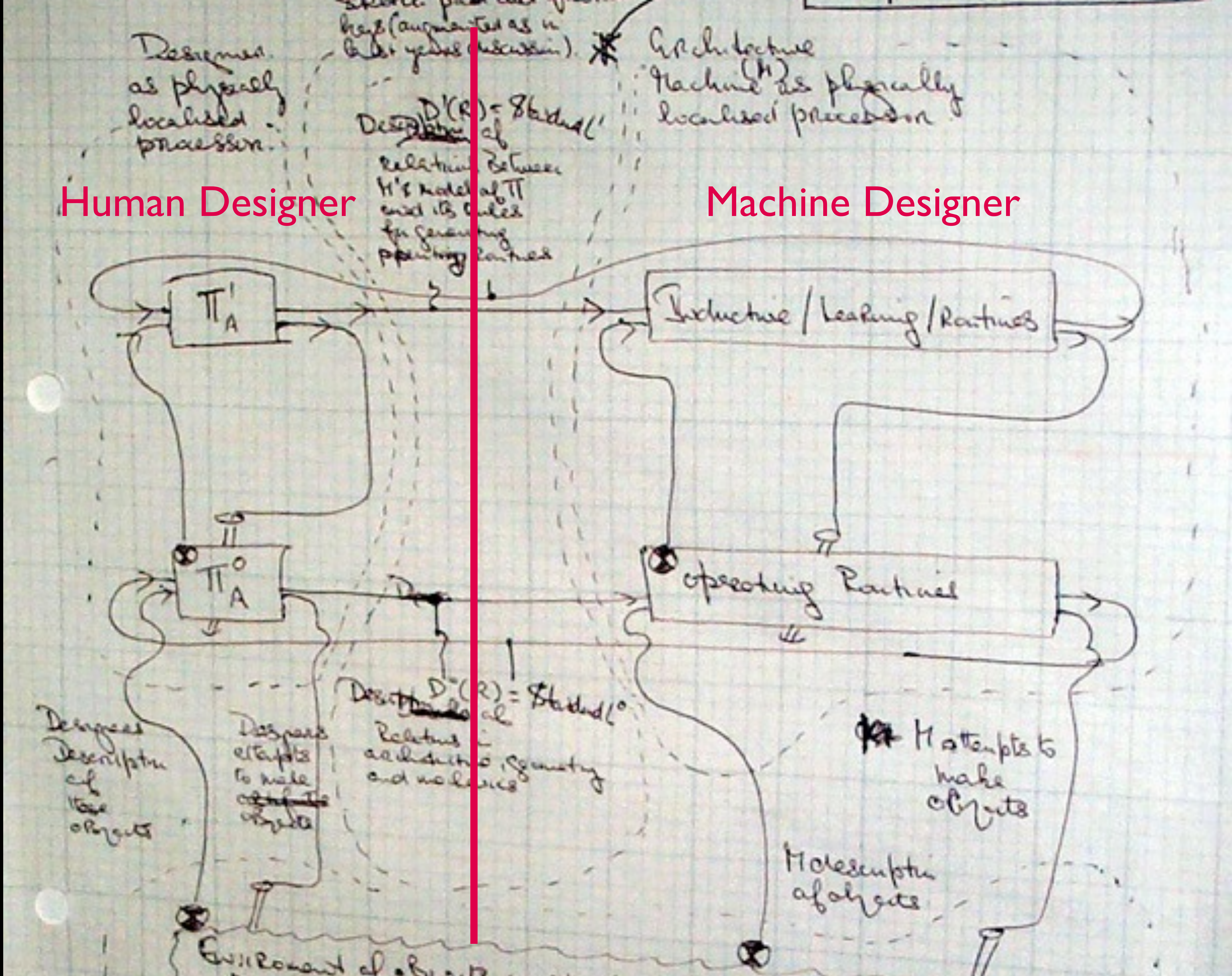

D°(R)
Fig 5.
Observers Recording Equipment
Interface
D'(R)
A
B
Π_A
Π_B
Π^0_A
Π^0_B
D°(R)
Fig 7
Fig 8.

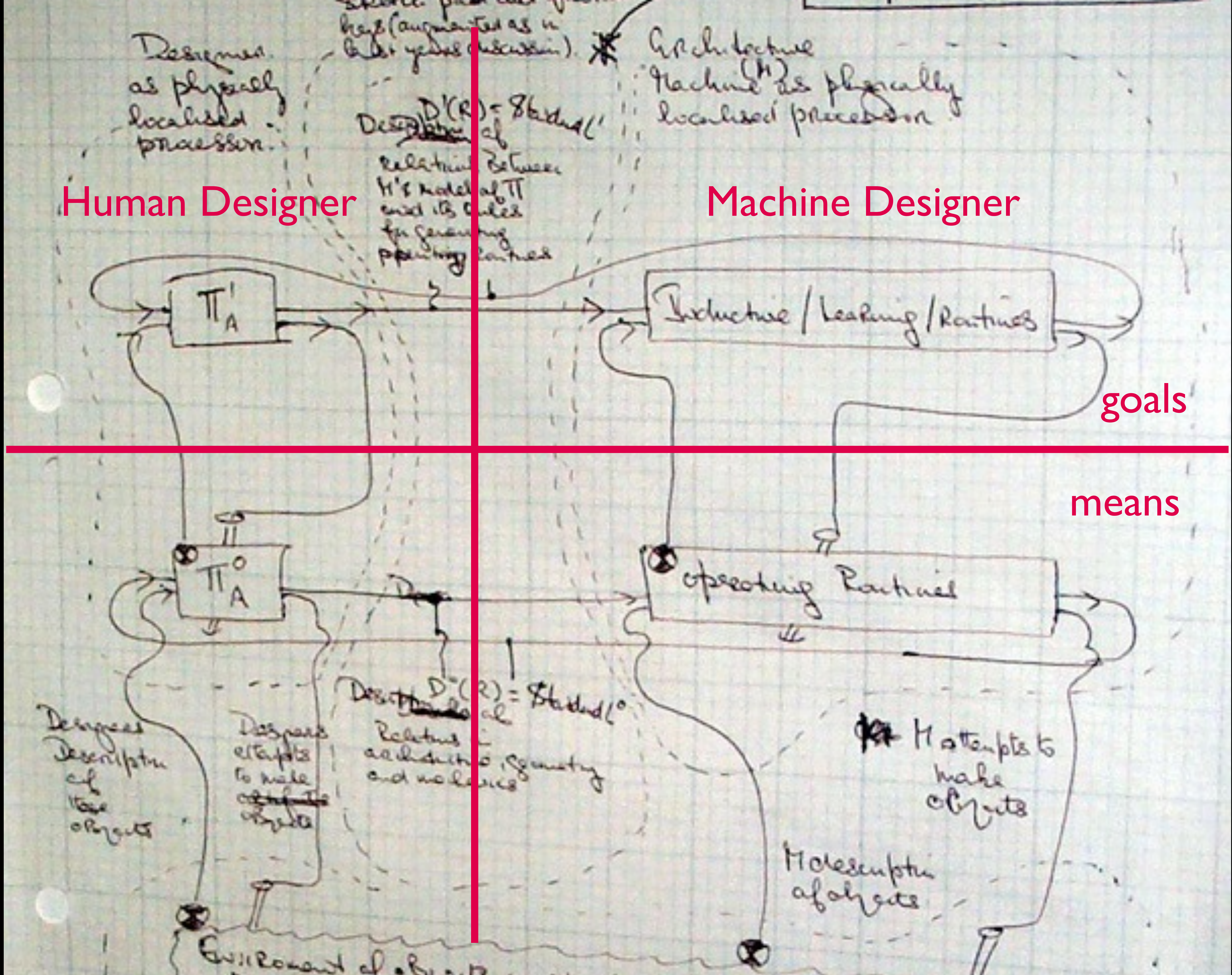
Gordon Pask's
Hand-drawn Figures

"Aspects of Machine Intelligence"
in *Soft Architecture Machines*
edited by N. Negroponte

1976



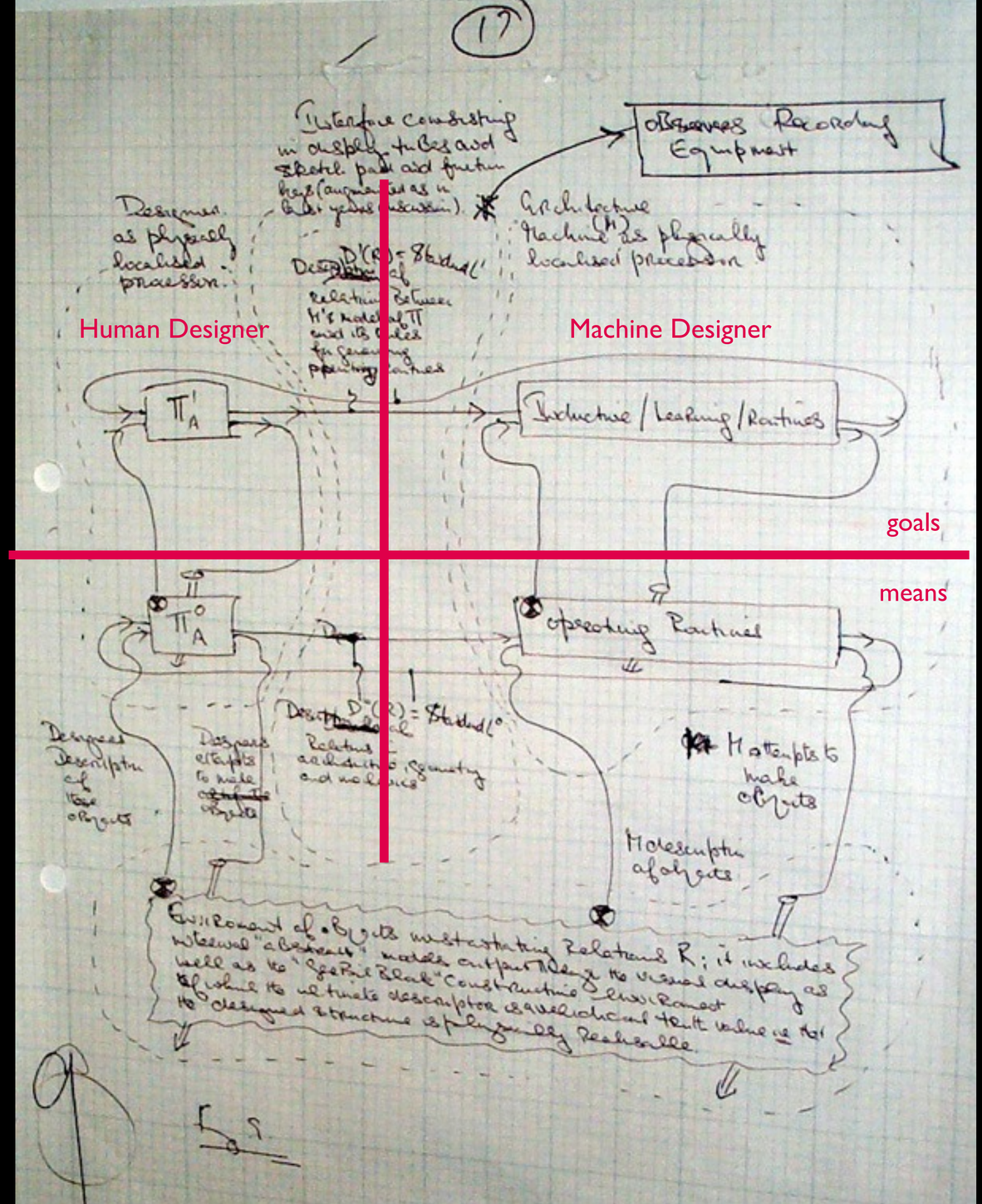

Human Designer
Machine Designer
Designer as physically localised processor
Architecture Machine (M) as physically localised processor
Inductive / Learning / Routines
operating Routines
M attempts to make objects
M description of objects
Designers Description of those objects
Designer attempts to make objects


Human Designer
Machine Designer
goals
means

Gordon Pask's
Hand-drawn Figures

"Aspects of Machine Intelligence"
in *Soft Architecture Machines*
edited by N. Negroponte

1976



Click for full paper

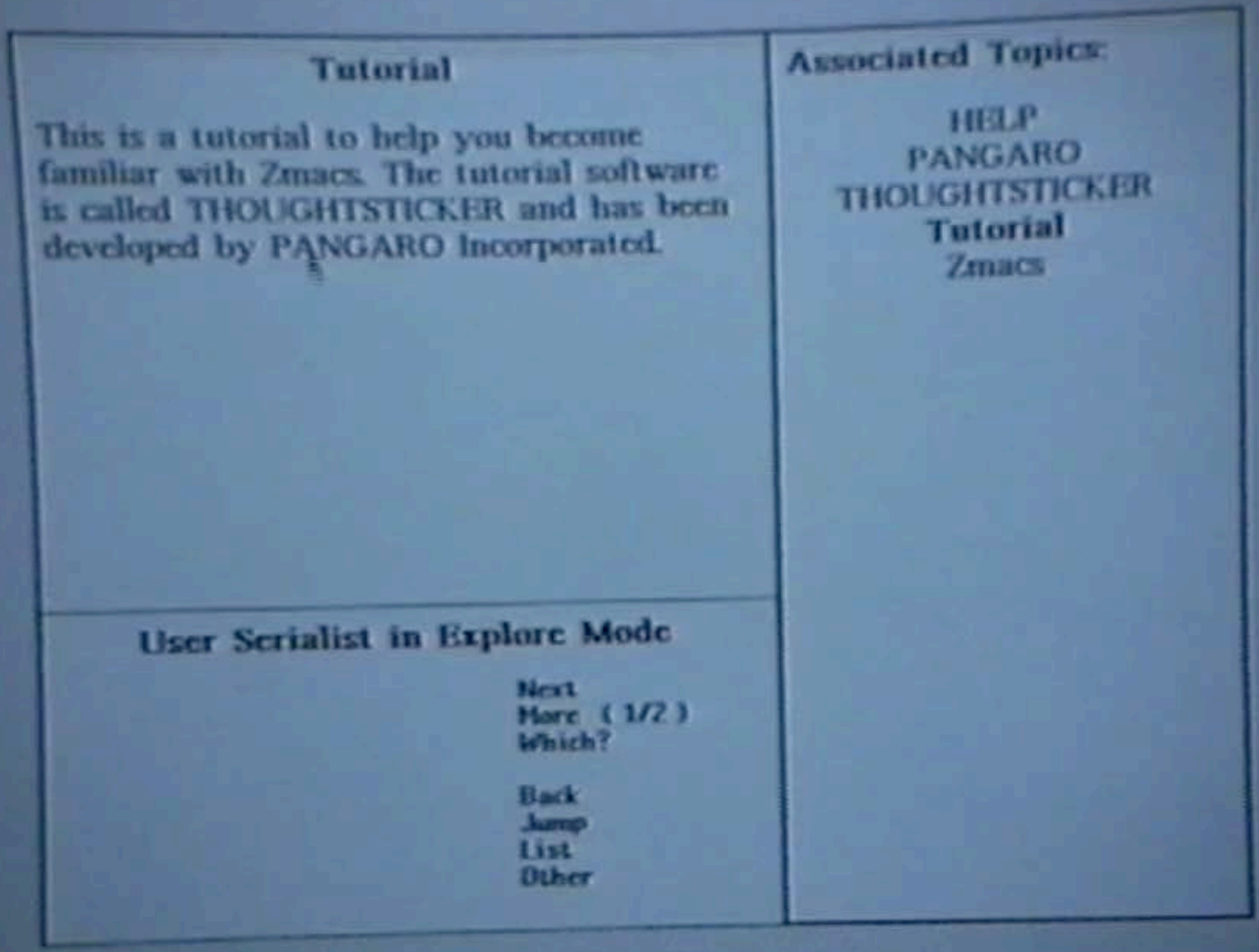
THOUGHTSTICKER
Gordon Pask's Lab
Richmond, England

1979

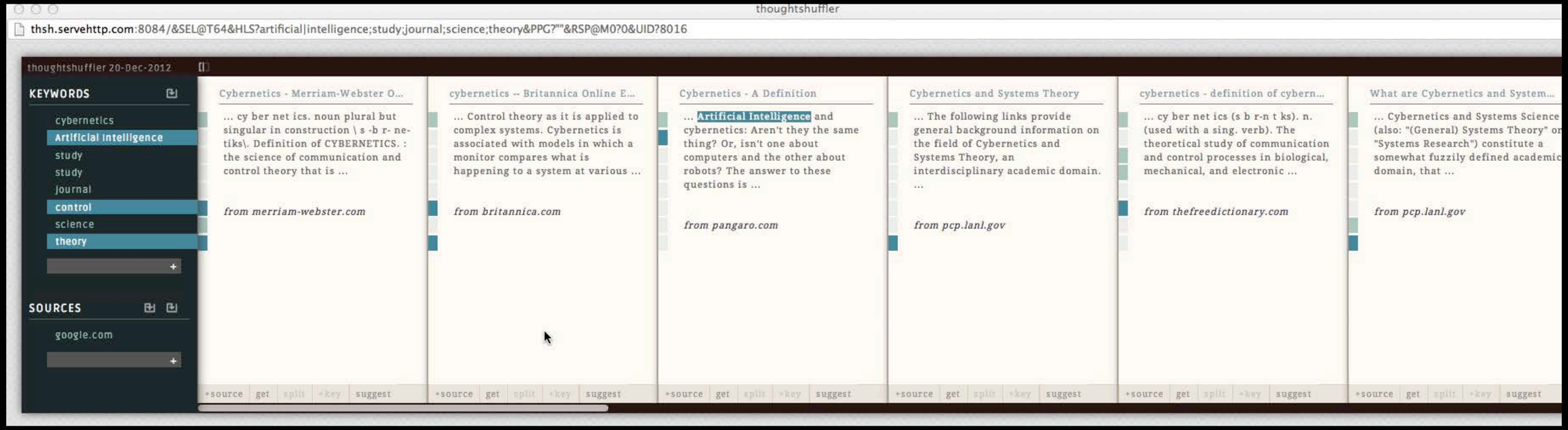
Click for more

THOUGHTSTICKER 1986
Algorithms coded by Jeffrey Nicoll
UI coding & UX by Paul Pangaro

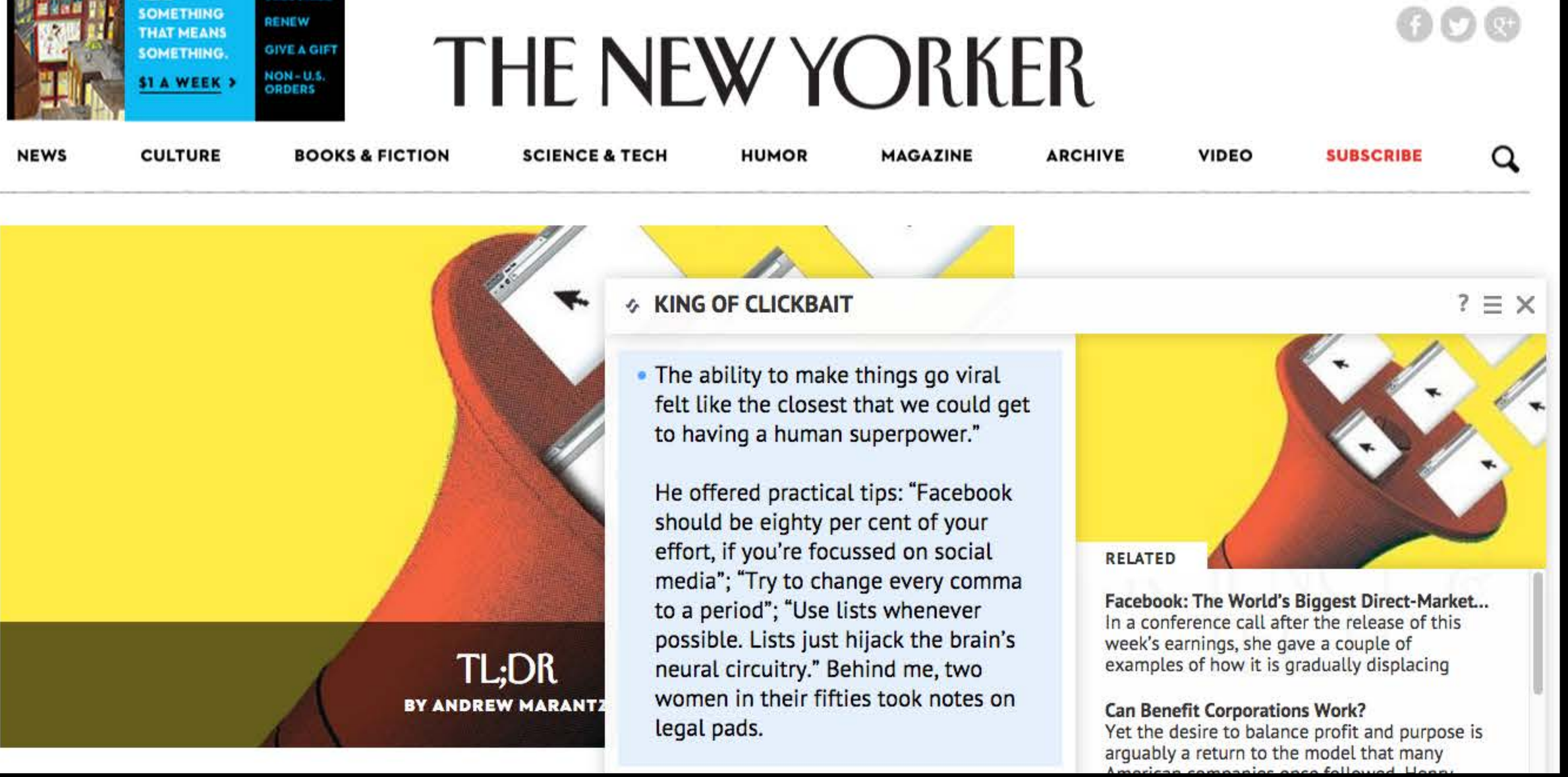
Click for more



THOUGHTSHUFFLER 2013
UI design and coding by Jeremy Scott Diamond
UX & heuristics by Paul Pangaro

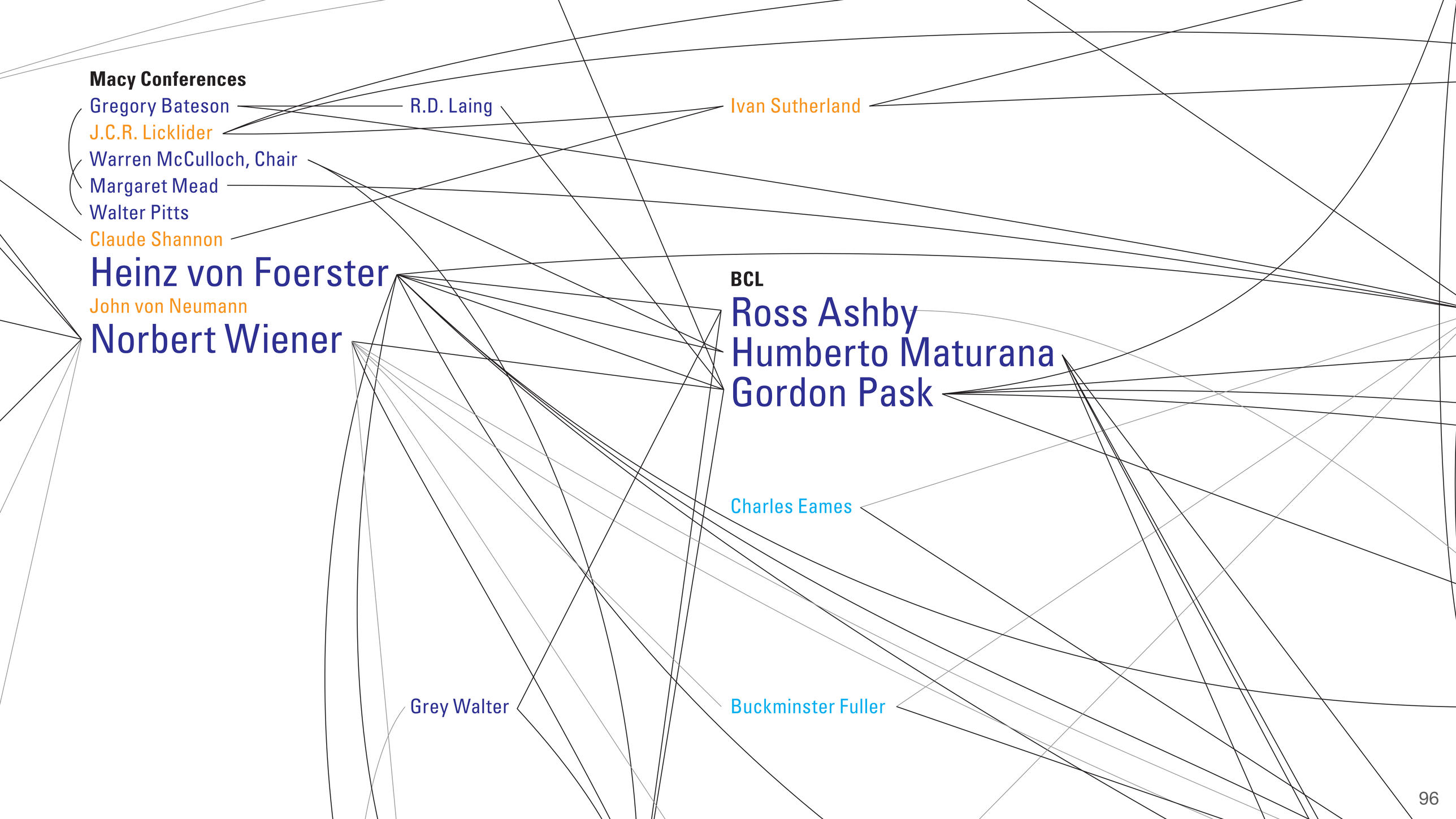


THOUGHTSHUFFLER iOS 2013
UX by Miriam Simun
UI by See-ming Lee
concept & heuristics by Paul Pangaro



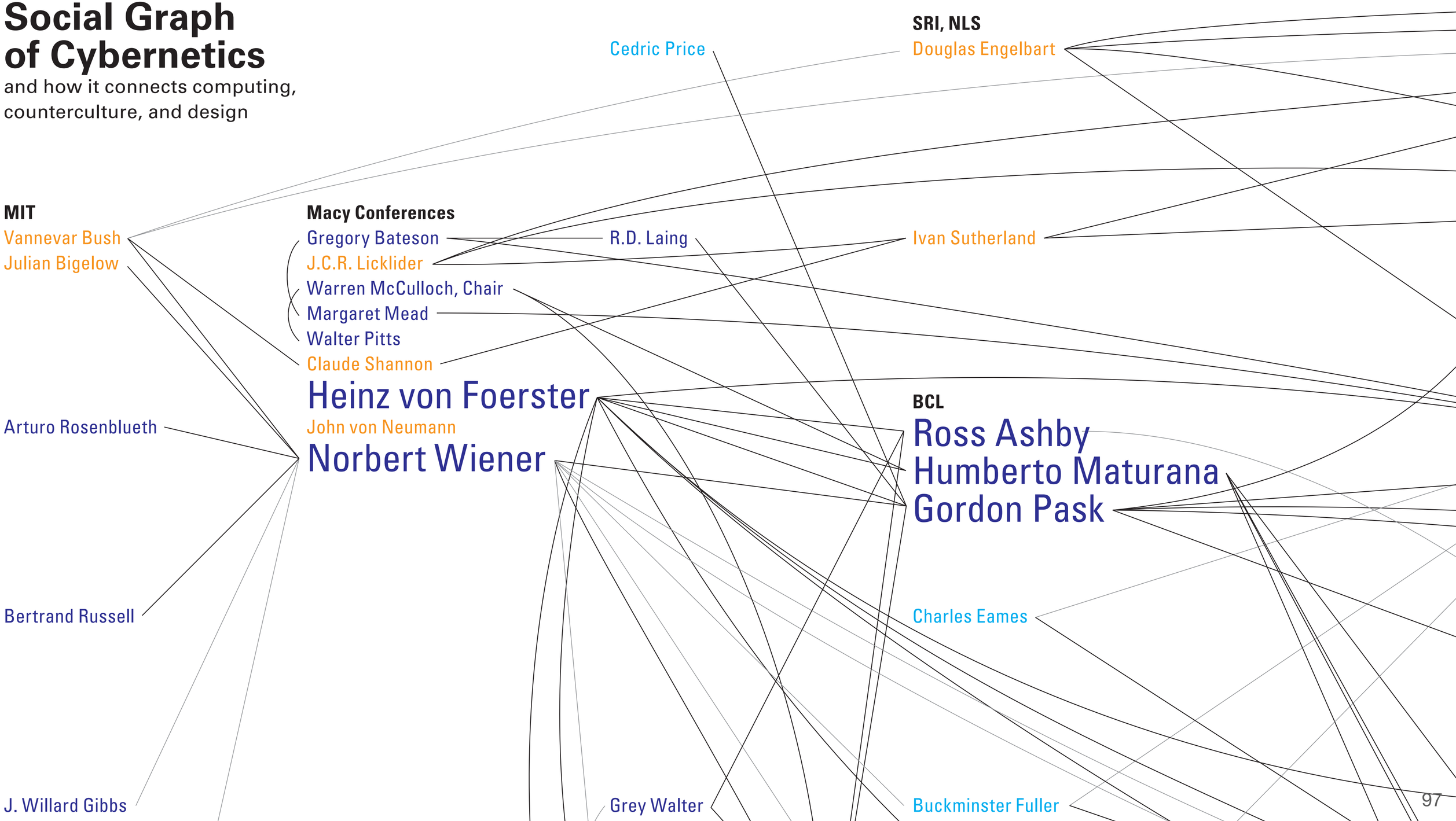
Streamfully
UI by Barbara de Wilde & John Katagawa
UI coding by John Katagawa
UX & heuristics by Paul Pangaro

2015


Macy Conferences
Gregory Bateson
J.C.R. Licklider
Warren McCulloch, Chair
Margaret Mead
Walter Pitts
Claude Shannon
Heinz von Foerster
John von Neumann
Norbert Wiener
R.D. Laing
Ivan Sutherland
BCL
Ross Ashby
Humberto Maturana
Gordon Pask
Charles Eames
Buckminster Fuller
Grey Walter

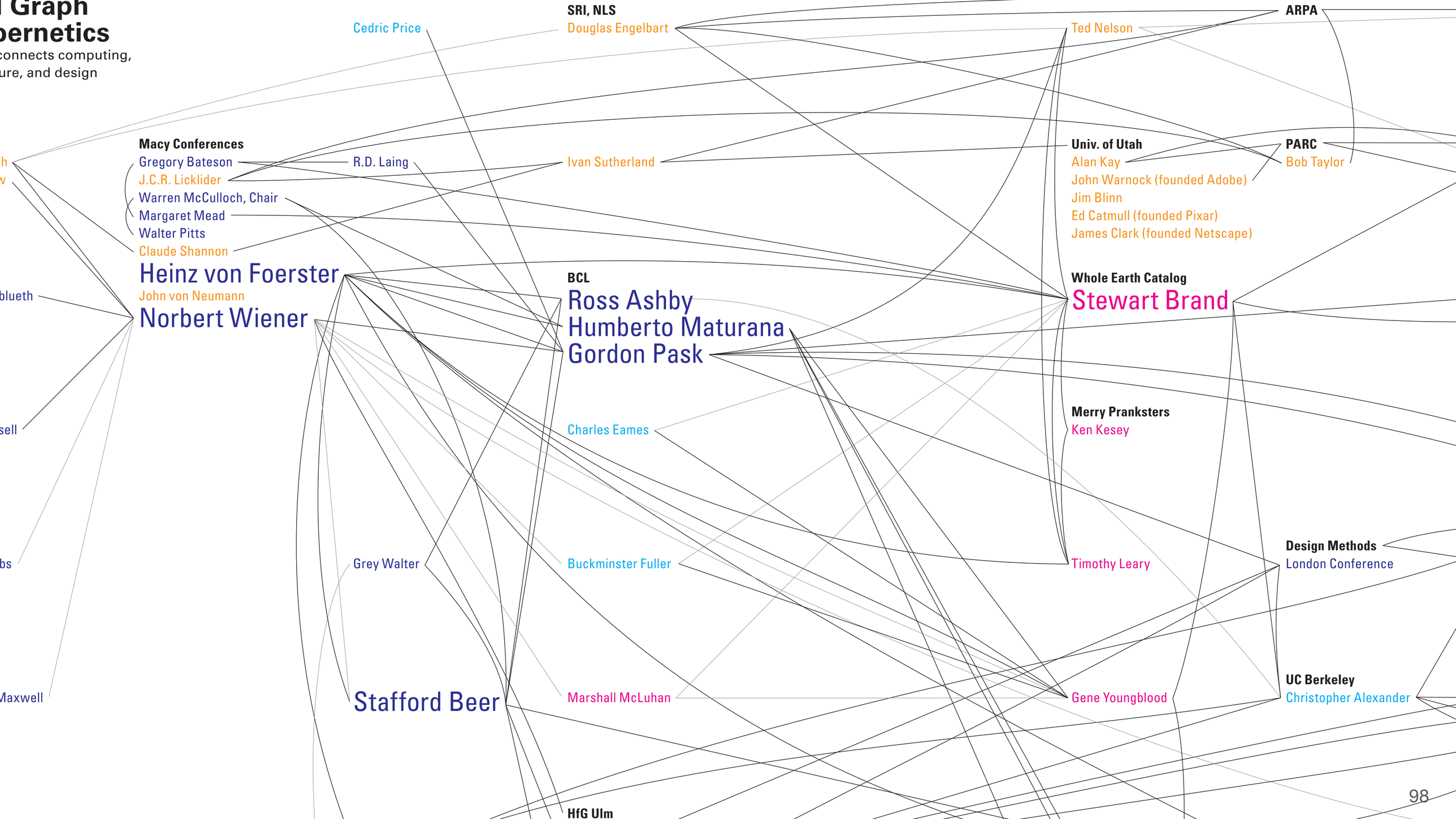
Social Graph of Cybernetics

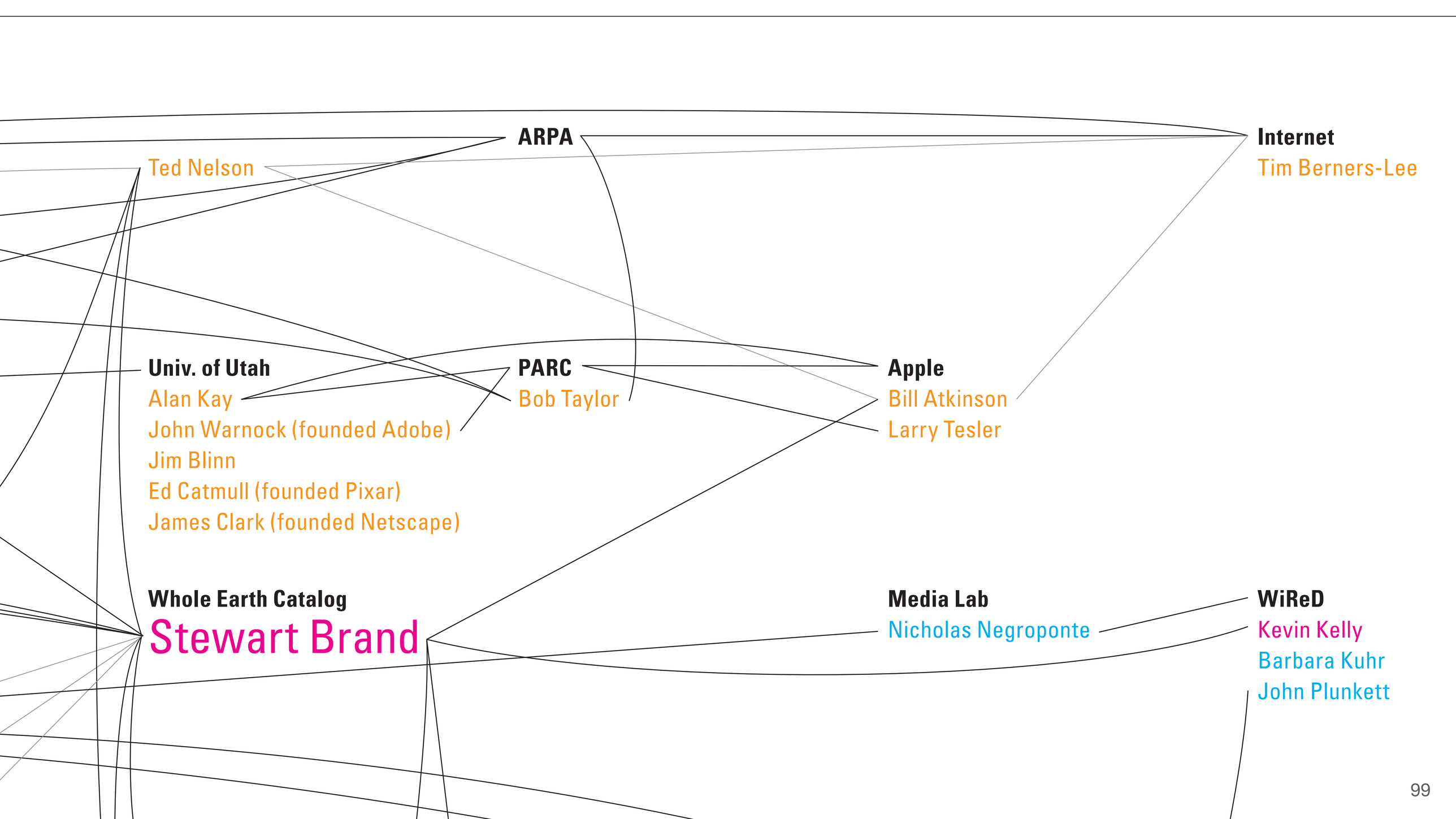
and how it connects computing, counterculture, and design

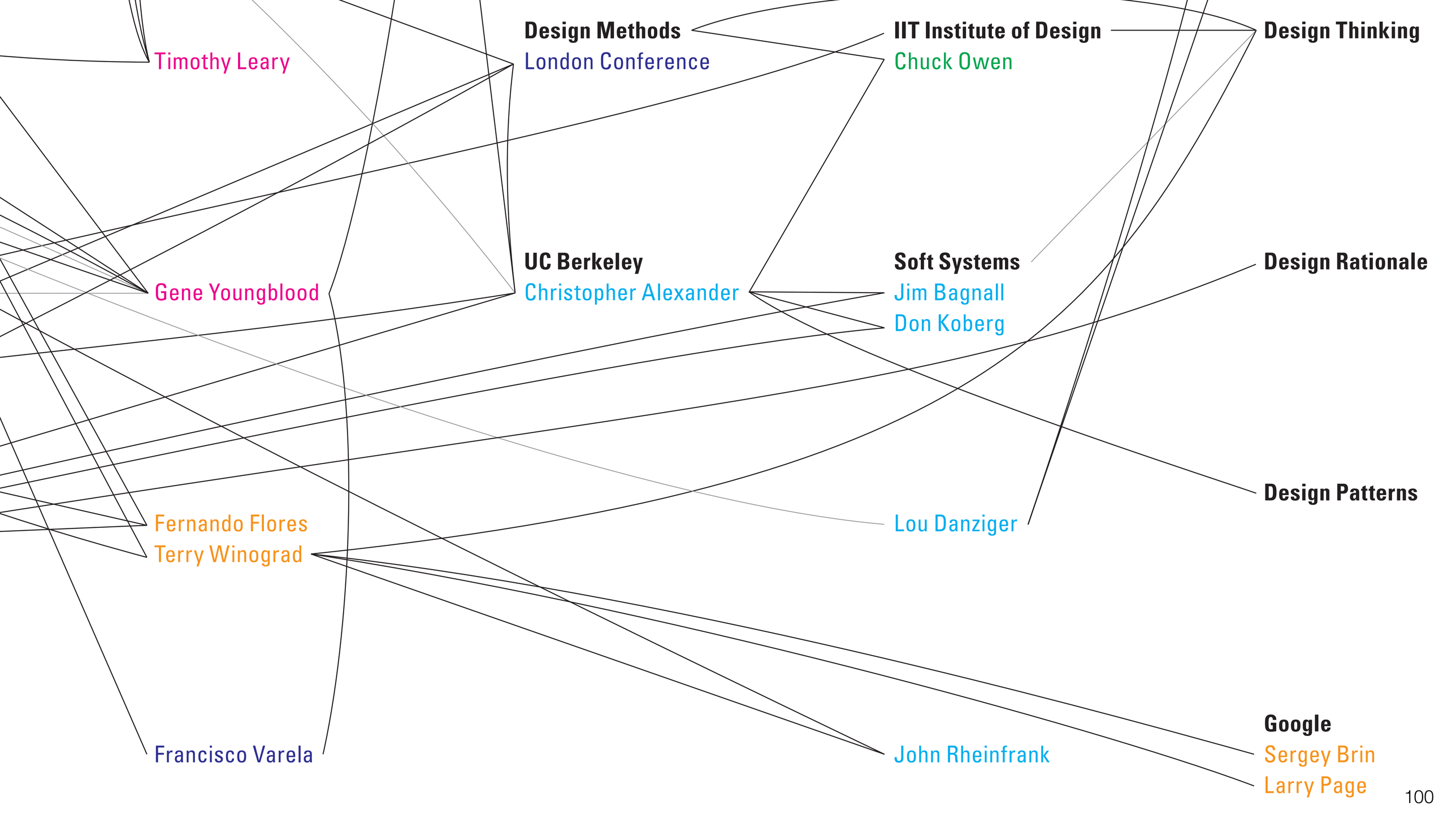


l Graph
bernetics

connects computing,
ure, and design

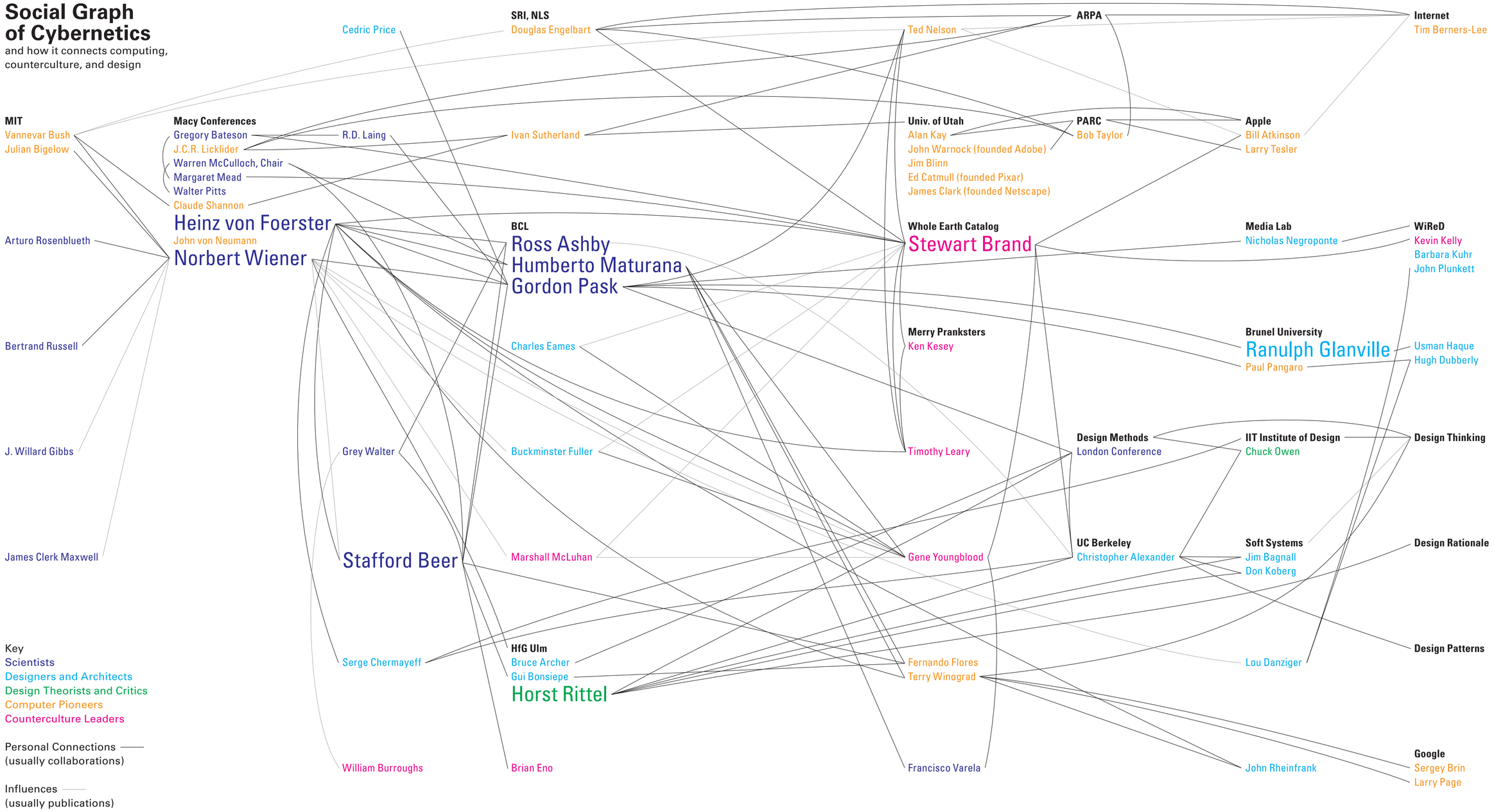



ARPA
Internet
Tim Berners-Lee
Ted Nelson
Univ. of Utah
Alan Kay
John Warnock (founded Adobe)
Jim Blinn
Ed Catmull (founded Pixar)
James Clark (founded Netscape)
PARC
Bob Taylor
Apple
Bill Atkinson
Larry Tesler
Whole Earth Catalog
Stewart Brand
Media Lab
Nicholas Negroponte
WiReD
Kevin Kelly
Barbara Kuhr
John Plunkett


Timothy Leary
Design Methods
London Conference
IIT Institute of Design
Chuck Owen
Design Thinking
Gene Youngblood
UC Berkeley
Christopher Alexander
Soft Systems
Jim Bagnall
Don Koberg
Design Rationale
Design Patterns
Lou Danziger
Fernando Flores
Terry Winograd
Francisco Varela
John Rheinfrank
Google
Sergey Brin
Larry Page

Social Graph of Cybernetics

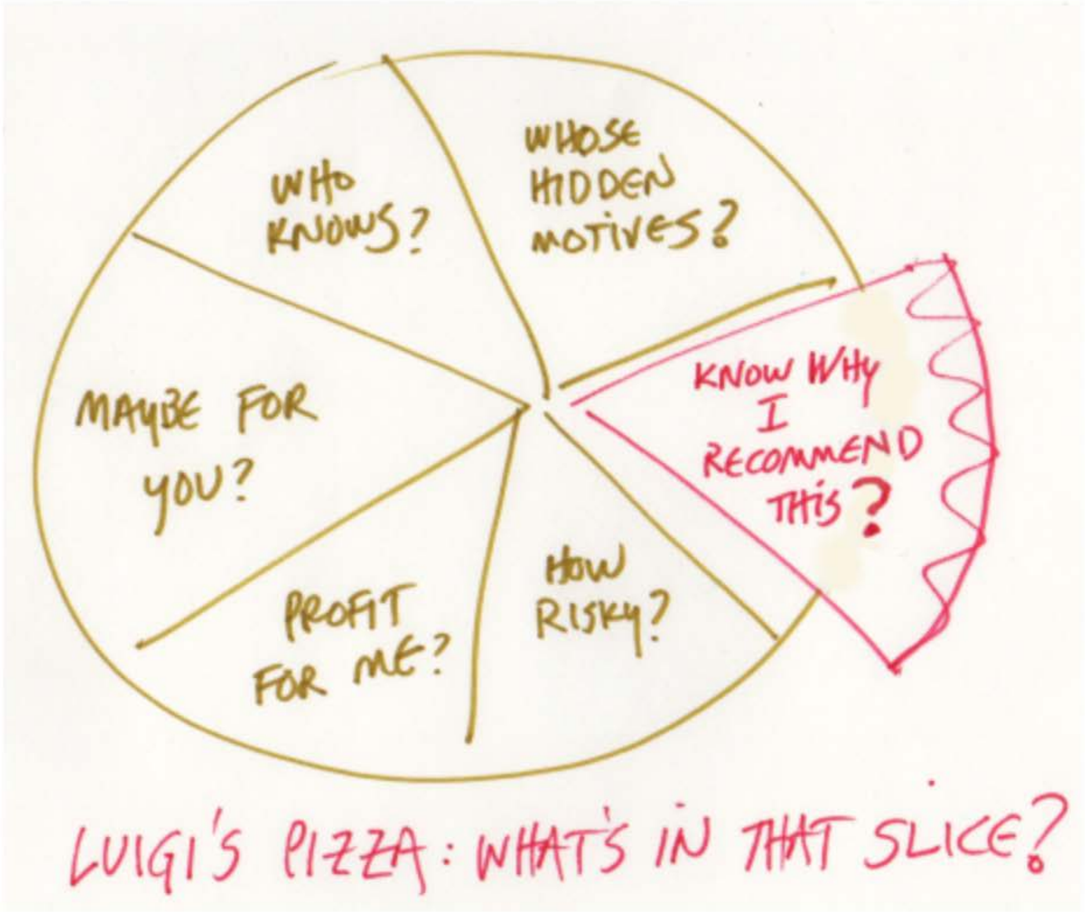
and how it connects computing, counterculture, and design



http://www.dubberly.com/articles/cybernetics-and-counterculture.html

Luigi's Pizza: A Parable

November 8, 2016

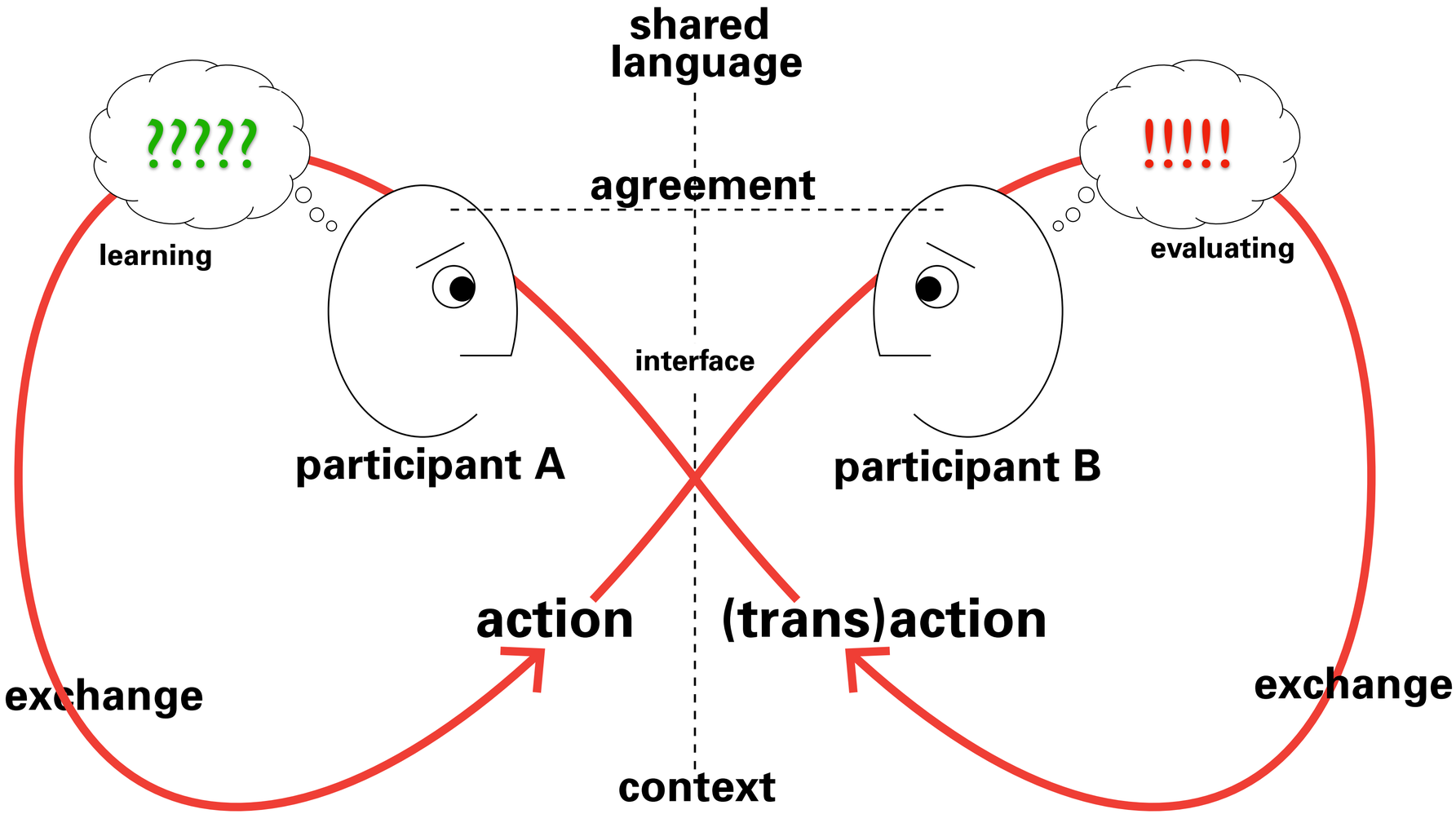


Say you want to eat somewhere and you ask for my recommendation. I say, "Sure, I've got the best place for you: Luigi's Pizza, on the corner of First & Commerce."

Click image see blog post

Axiom #1

Conversation is the minimal ethical interface where conversation means reliable transparency of action & intent—what & why across the interface.


shared
language
?????
!!!!!
agreement
learning
evaluating
interface
participant A
participant B
action
(trans)action
exchange
exchange
context

Why does conversation matter?

- ***to coordinate action, we must reach agreement***
- ***to reach agreement, we must have engagement***
- ***to have engagement, we must have shared language.***

Cooperation and Collaboration require Conversation

What may follow from conversation?

- ***shared history***
- ***relationship***
- ***trust***
- ***unity***

Conversation is the foundation for:

- ***community***
- ***commerce***
- ***culture***
- ***governance***
- ***society***

Axiom #2

Conversation is the minimal humane interface growing the understanding & informing the action of one or more willing & active participants such that trust and collaboration may arise.

What's a "humane conversation"?

- ***responding to fulfill a given task***
- ***offering different means (tasks) to achieve a goal***
- ***helping to achieve an underspecified goal***
- ***collaborating to define the goal.***

Will Conversation Interfaces be designed to do these?

What's a "great conversation"?

- ***stays sensitive to context***
- ***avoids repetition while offering something novel***
- ***maintains continuity***
- ***raises great questions***
- ***helps you be what you want to be… or to become.***

Why can't AI + Conversation Interfaces do these things?

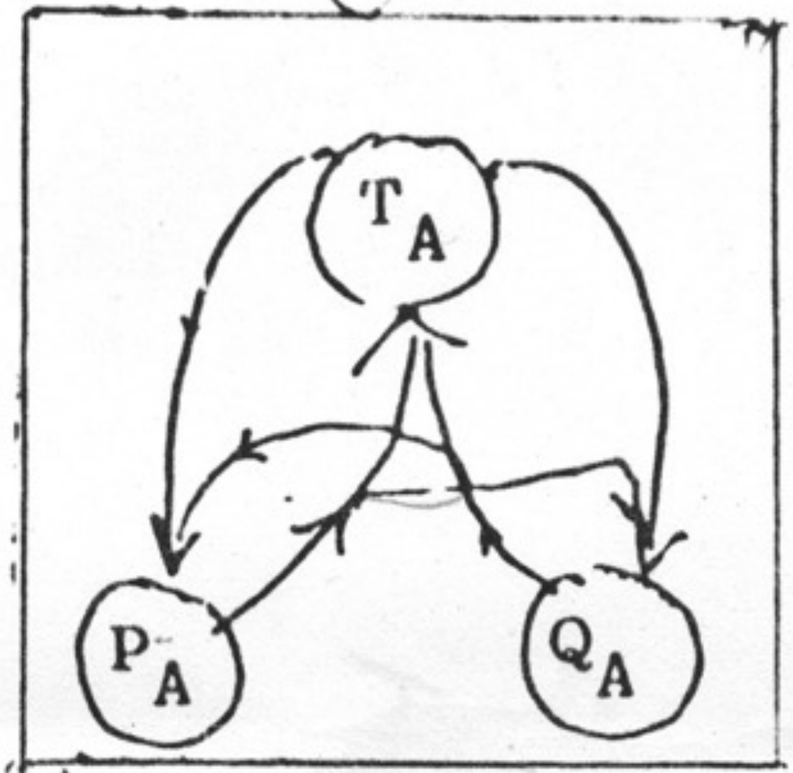


Fig 3.2. Ap.1.

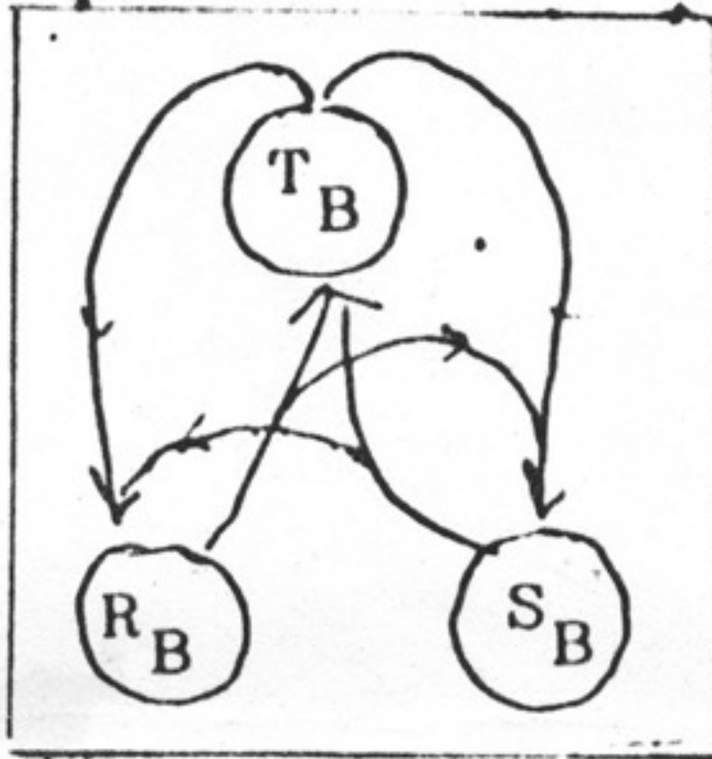


Fig 3.3. Ap.

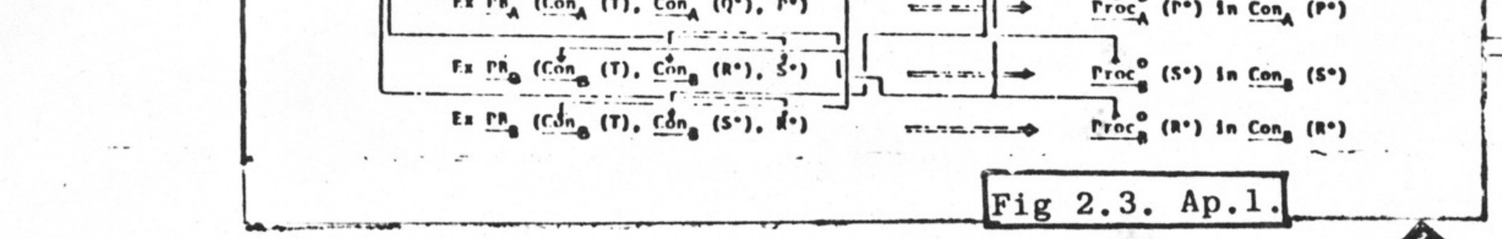


Fig 2.3. Ap.1.

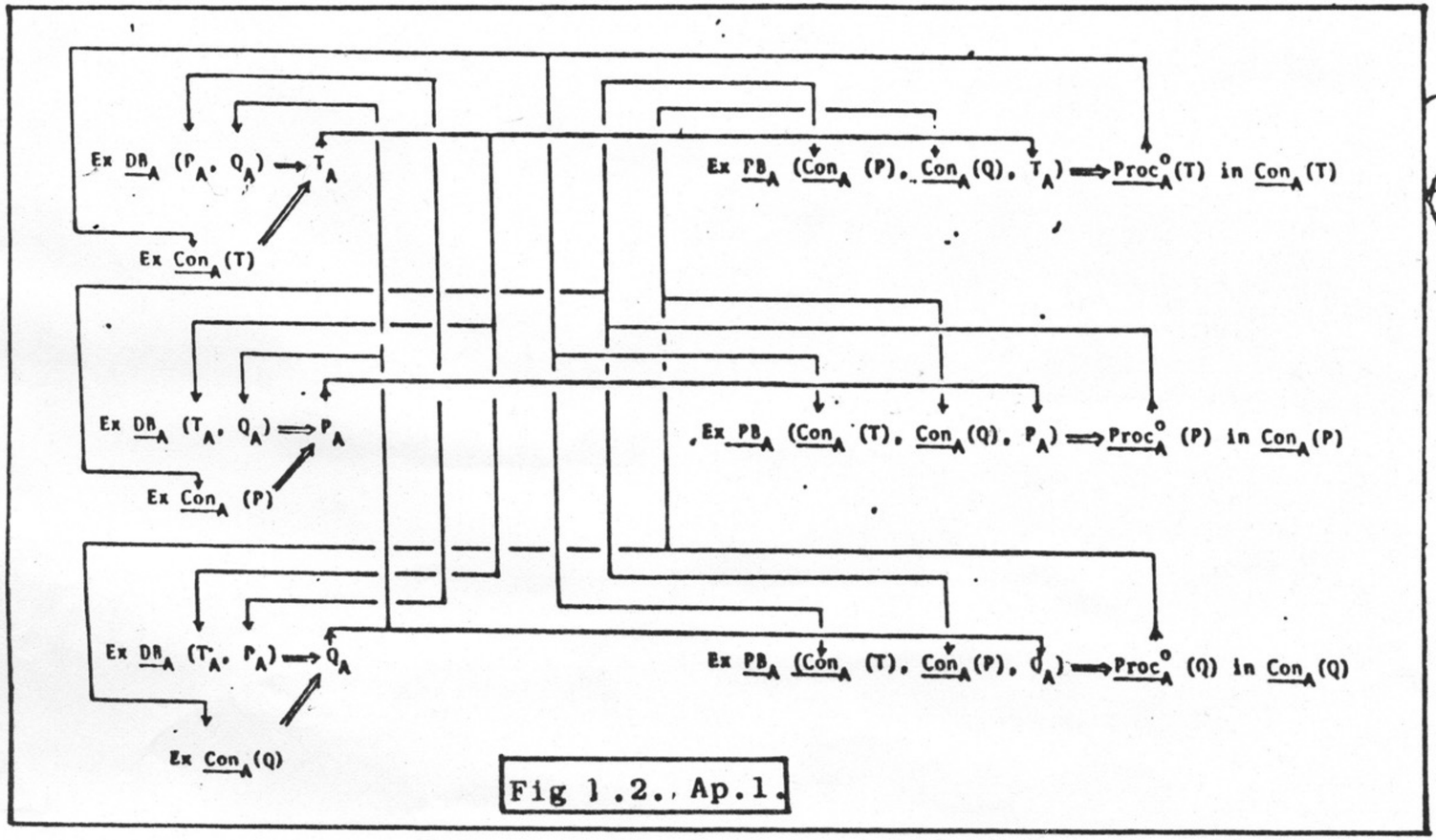


Fig 1.2. Ap.1.

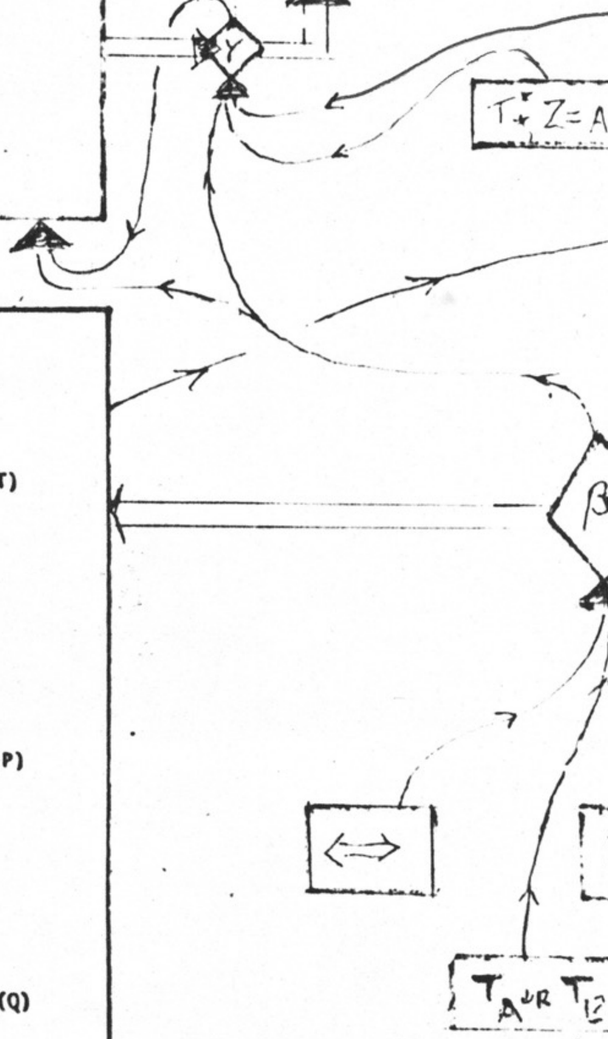


Fig 1. Ap. 1
Con_B, DB_A, DB
informational
standing (Fig
After their c
understanding
is legitimate
in Fig 3.5).
temporal succ
interdepender
that if (as c

4 sheet 2
"2nd order expansion"

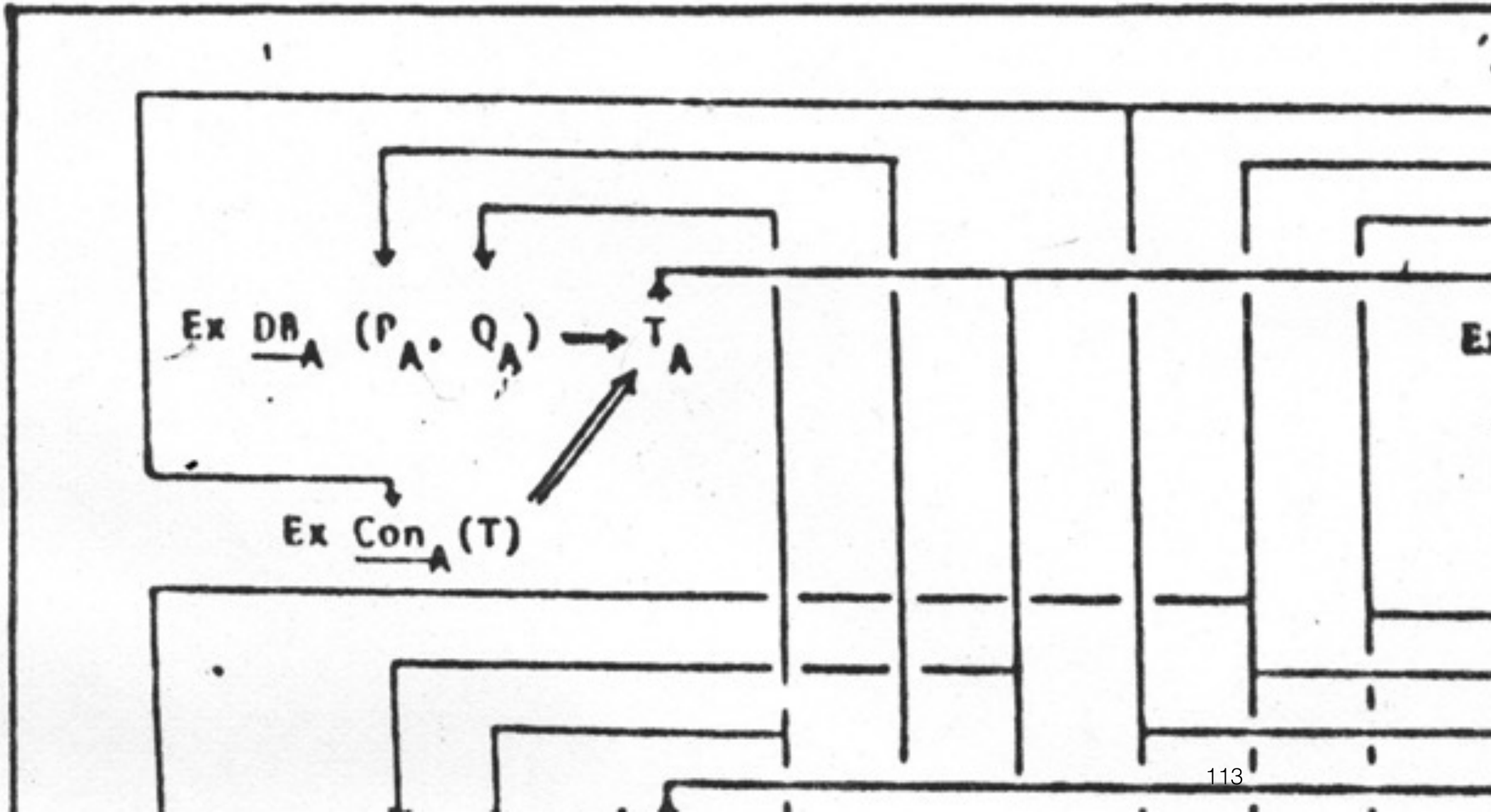
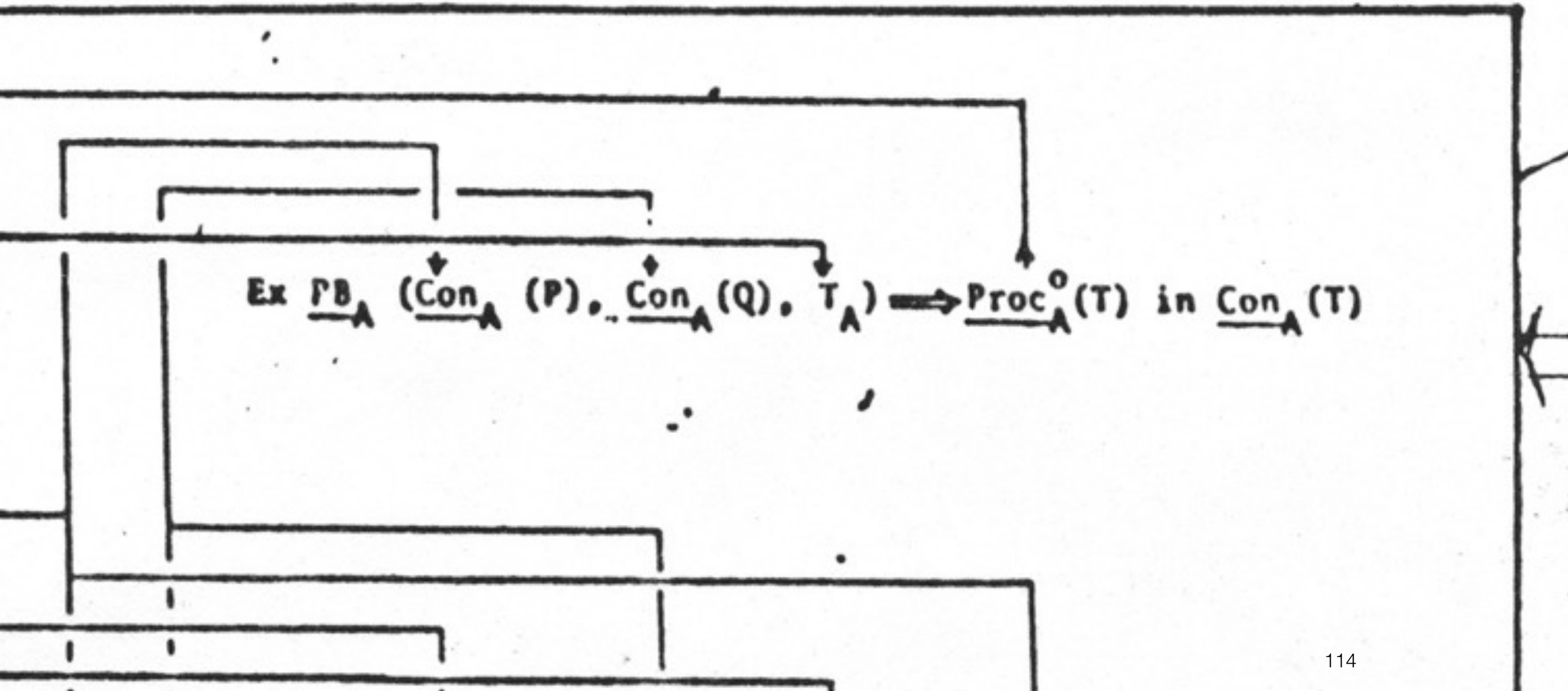

Ex DB_A (P_A, Q_A) → T_A
Ex Con_A (T)

Fig 2.3. Ap.1.



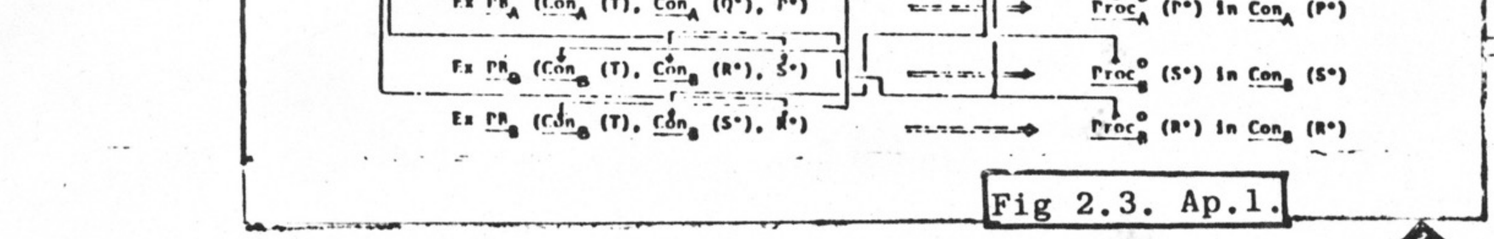


Fig 2.3. Ap.1.

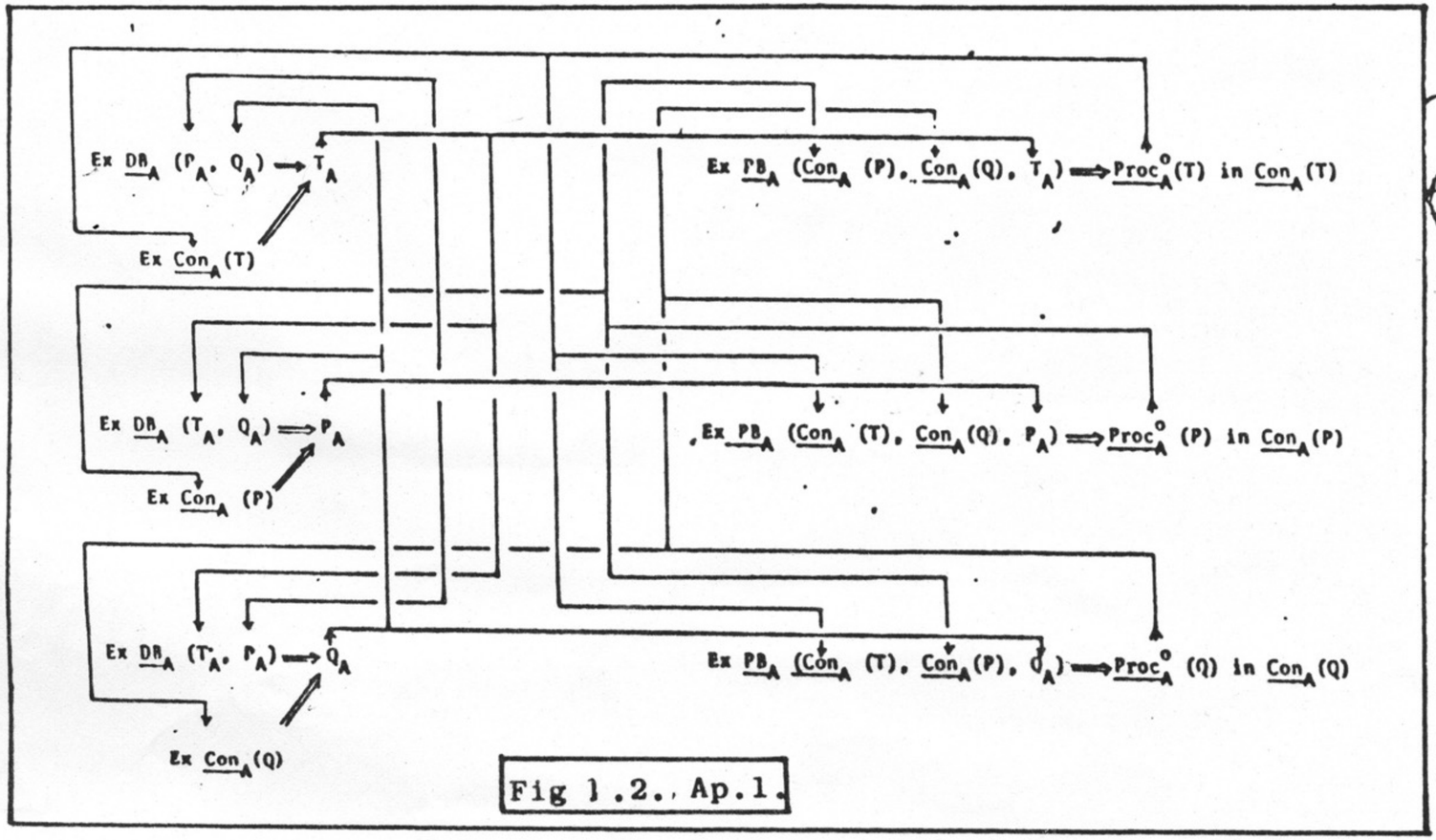


Fig 1.2. Ap.1.

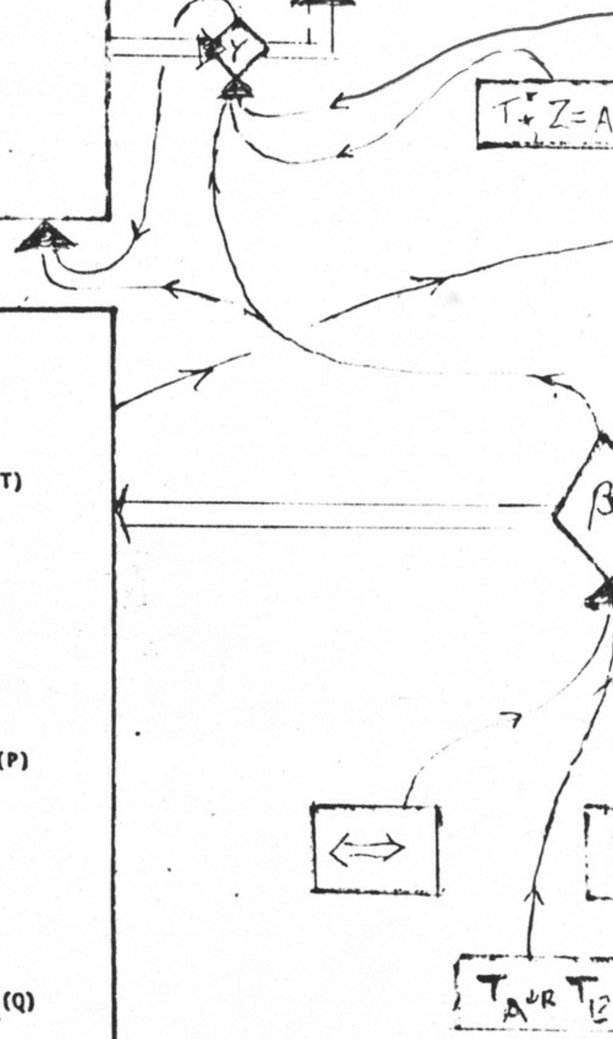


Fig 1. Ap. 1
Con_B, DB_A, DB
informational
standing (Fig
After their
understanding
is legitimate
in Fig 3.5).
temporal succ
interdepender
that if (as

4 sheet 2
"2nd order expansion"

Fig 3.4. Ap. 1.

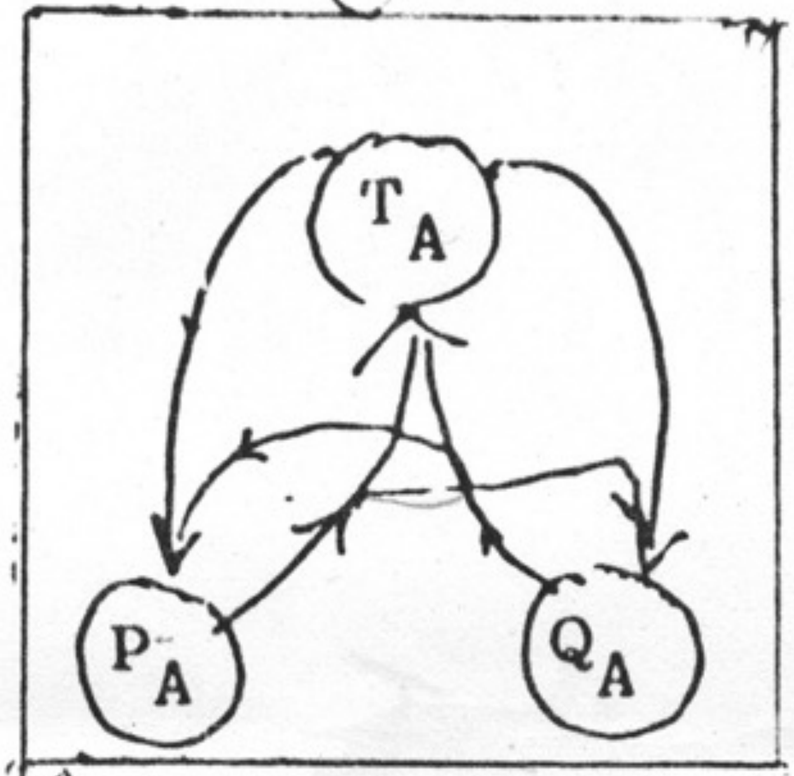


Fig 3.2. Ap.1.

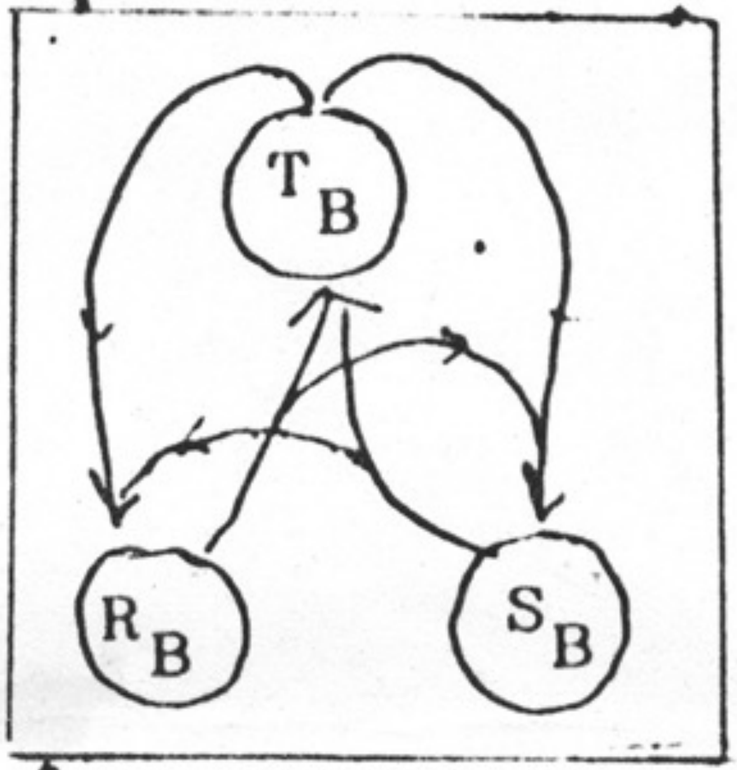
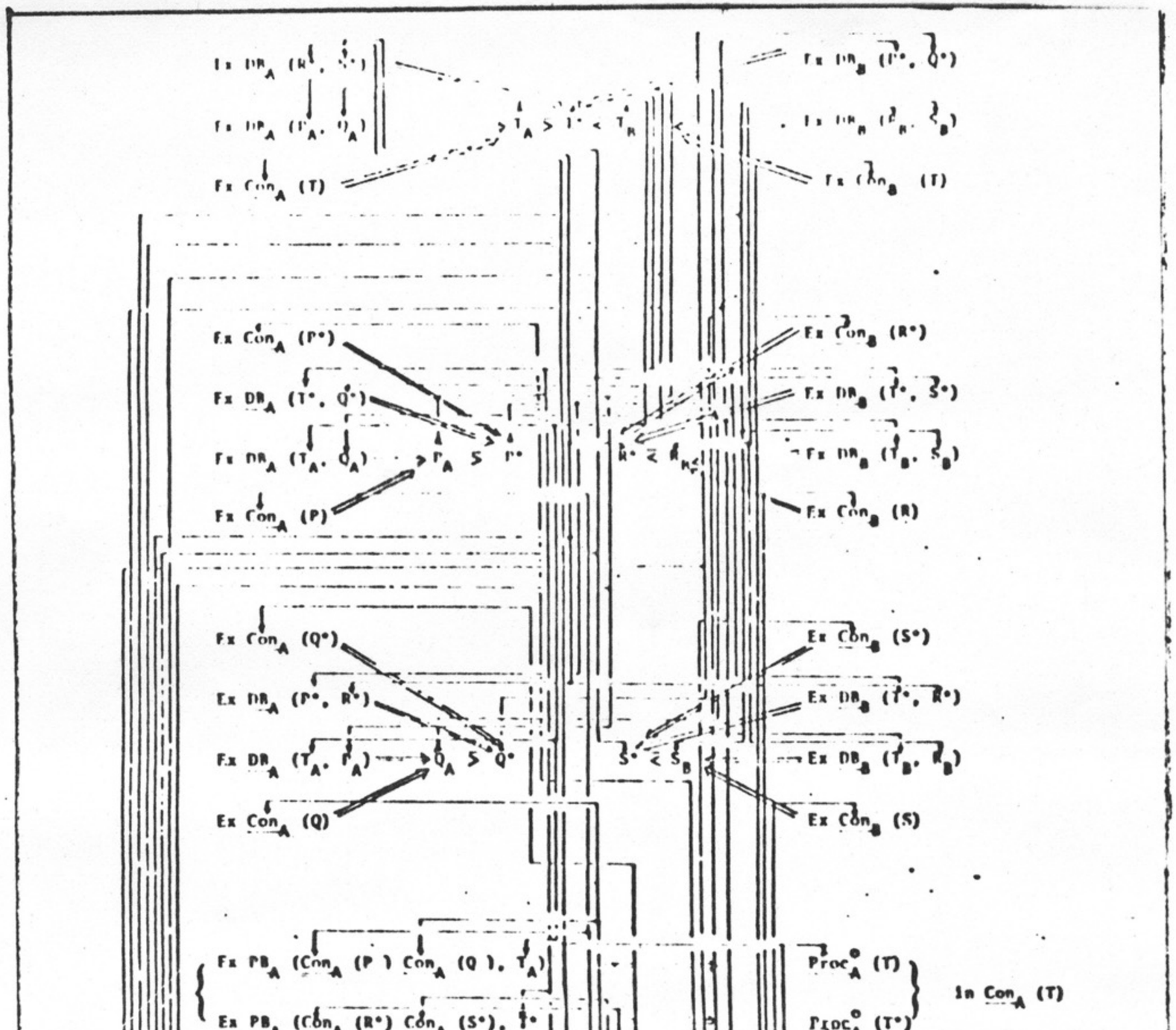
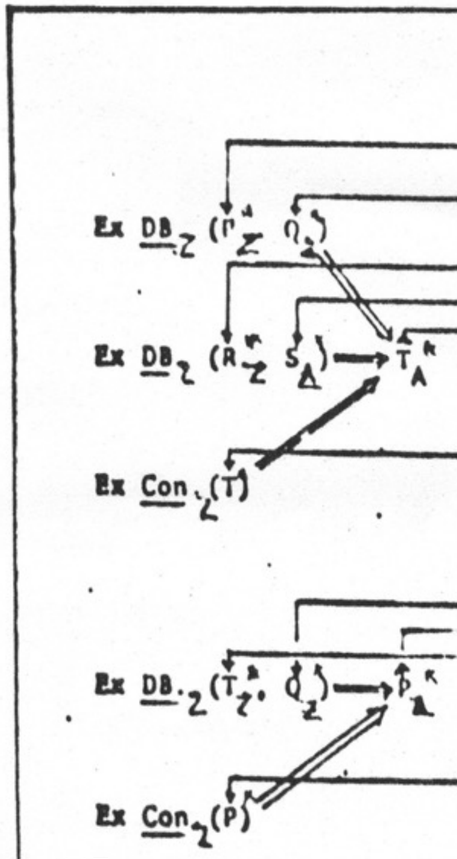


Fig 3.3. Ap.

Pruning


Ex DB_A (R°, S°)
Ex DB_A (T_A, Q_A)
Ex Con_A (T)
T_A ≥ T° < T_B
Ex DB_B (T°, Q°)
Ex DB_B (T_B, S_B)
Ex Con_B (T)
Ex Con_A (P°)
Ex DB_A (T°, Q°)
Ex DB_A (T_A, Q_A)
P_A ≤ P°
Ex Con_A (P)
R° ≥ R_B
Ex Con_B (R°)
Ex DB_B (T°, S°)
Ex DB_B (T_B, S_B)
Ex Con_B (R)
Ex Con_A (Q°)
Ex DB_A (P°, R°)
Ex DB_A (T_A, P_A)
Q_A ≤ Q°
Ex Con_A (Q)
S° ≥ S_B
Ex Con_B (S°)
Ex DB_B (T°, R°)
Ex DB_B (T_B, R_B)
Ex Con_B (S)
Ex PB_A (Con_A (P), Con_A (Q), T_A)
Ex PB_A (Con_A (R°) Con_A (S°), T°
Proc°_A (T)
Proc°_A (T°)
In Con_A (T)


Ex DB_Z (P_Z, Q_Z)
Ex DB_Z (R_Z, S_Z) → T_A
Ex Con_Z (T)
Ex DB_Z (T_Z, Q_Z) → P_A
Ex Con_Z (P)

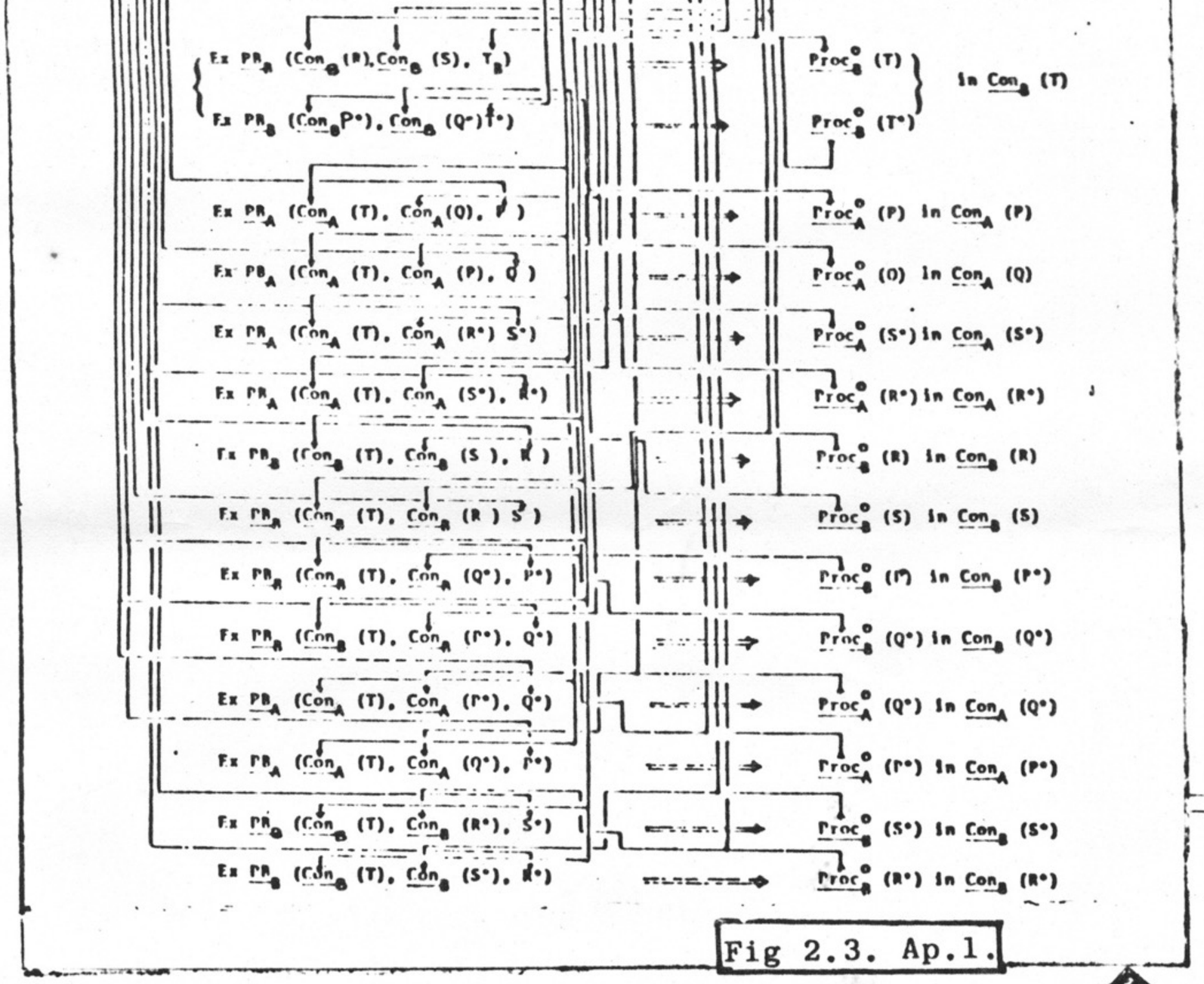

Ex PR_B (Con_B (R), Con_B (S), T_B)
Ex PR_B (Con_B P°), Con_B (Q°) T°)
Proc°_B (T)
Proc°_B (T°)
in Con_B (T)
Ex PR_A (Con_A (T), Con_A (Q), P)
Ex PB_A (Con_A (T), Con_A (P), Q)
Ex PR_A (Con_A (T), Con_A (R°) S°)
Ex PR_A (Con_A (T), Con_A (S°), R°)
Ex PB_B (Con_B (T), Con_B (S), R)
Ex PB_B (Con_B (T), Con_B (R) S)
Ex PB_B (Con_B (T), Con_A (Q°), P°)
Ex PB_B (Con_B (T), Con_A (P°), Q°)
Ex PB_A (Con_A (T), Con_A (P°), Q°)
Ex PB_A (Con_A (T), Con_A (Q°), P°)
Ex PB_B (Con_B (T), Con_B (R°), S°)
Ex PB_B (Con_B (T), Con_B (S°), R°)
Proc°_A (P) in Con_A (P)
Proc°_A (Q) in Con_A (Q)
Proc°_A (S°) in Con_A (S°)
Proc°_A (R°) in Con_A (R°)
Proc°_B (R) in Con_B (R)
Proc°_B (S) in Con_B (S)
Proc°_B (P°) in Con_B (P°)
Proc°_B (Q°) in Con_B (Q°)
Proc°_A (Q°) in Con_A (Q°)
Proc°_A (P°) in Con_A (P°)
Proc°_B (S°) in Con_B (S°)
Proc°_B (R°) in Con_B (R°)
Ex DB_Z
Ex Con_Z (Q)
Ex DB_Z
Ex Con_Z (R)
Ex DB_Z
Ex Con_Z (S).

Fig 2.3. Ap.1.

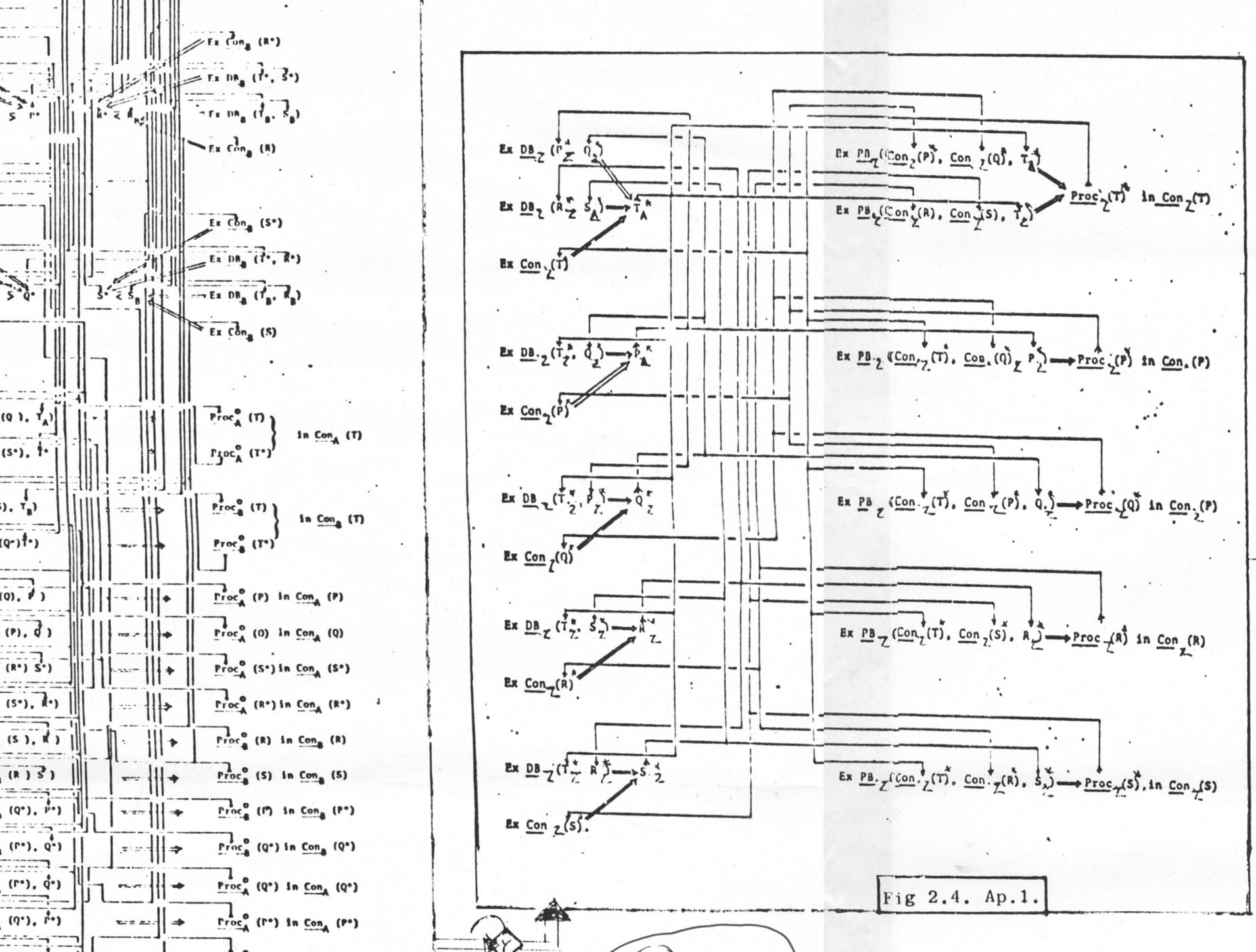


Fig 2.4. Ap.1.

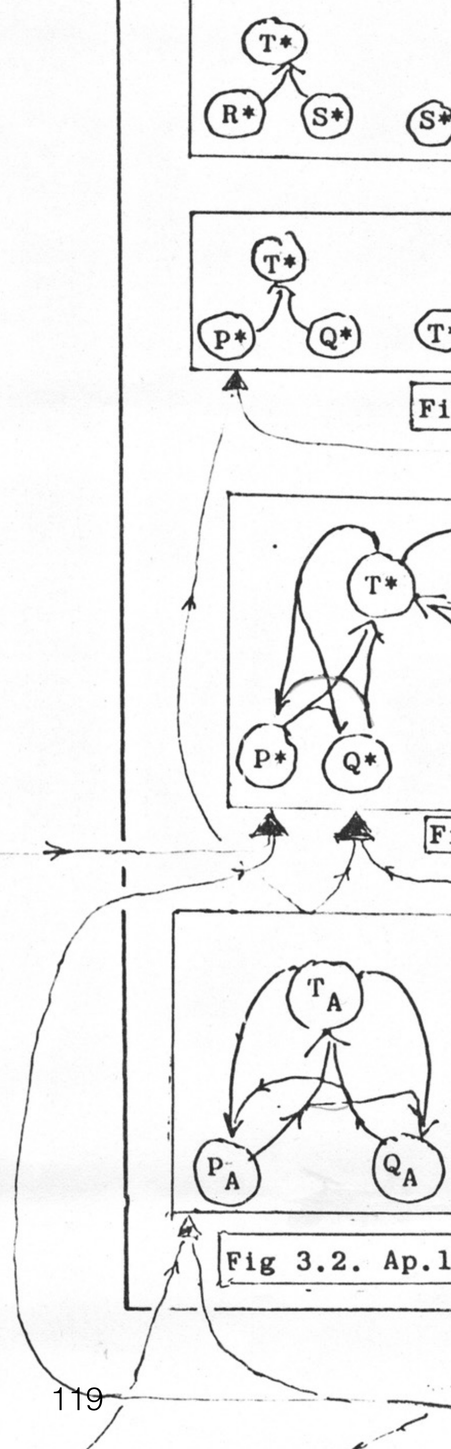


Fig 3.2. Ap.1

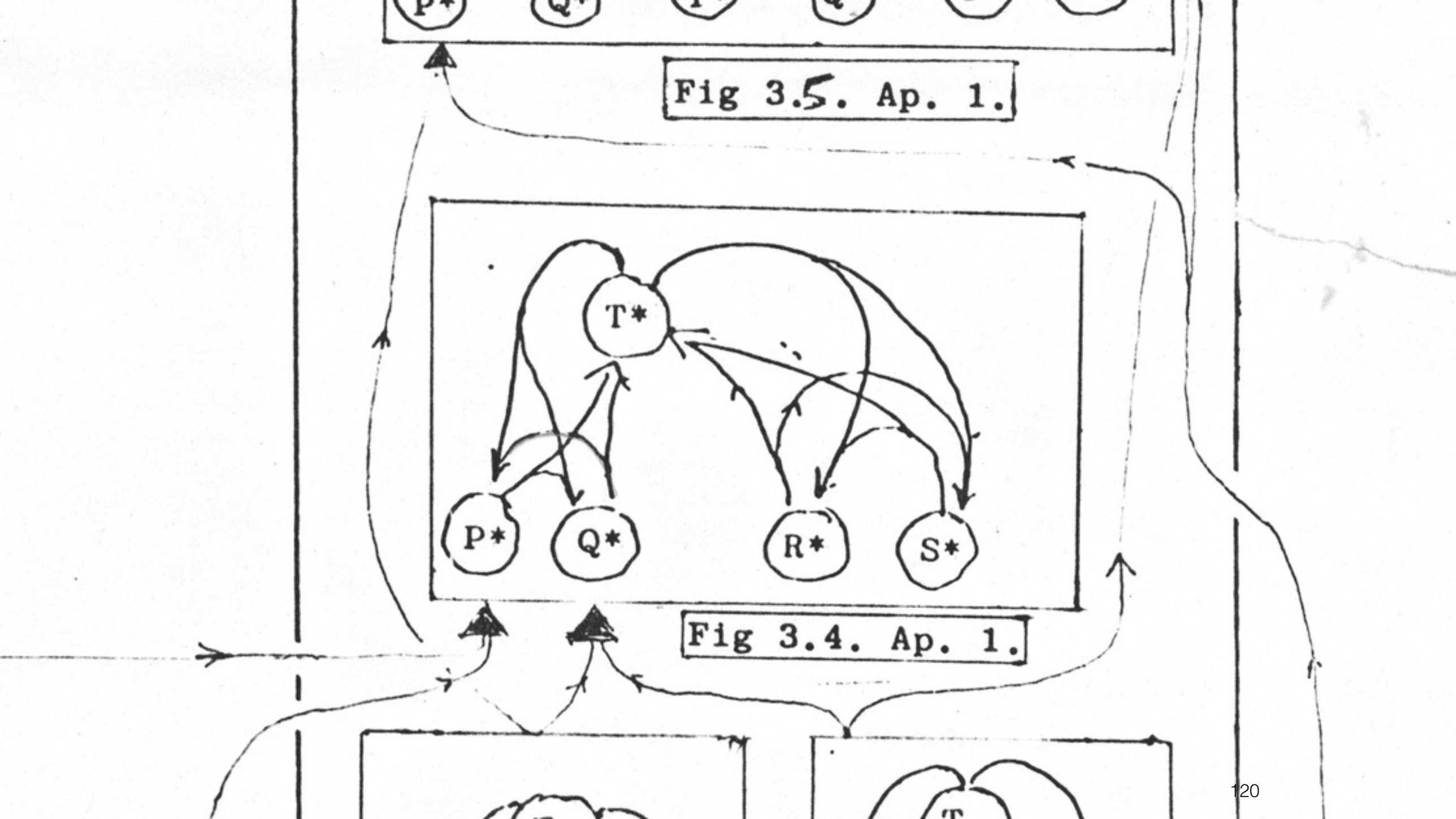


Fig 3.5. Ap. 1.

Fig 3.4. Ap. 1.

Gordon Pask's
Cognitive Process Model of
Conversation & Consciousness

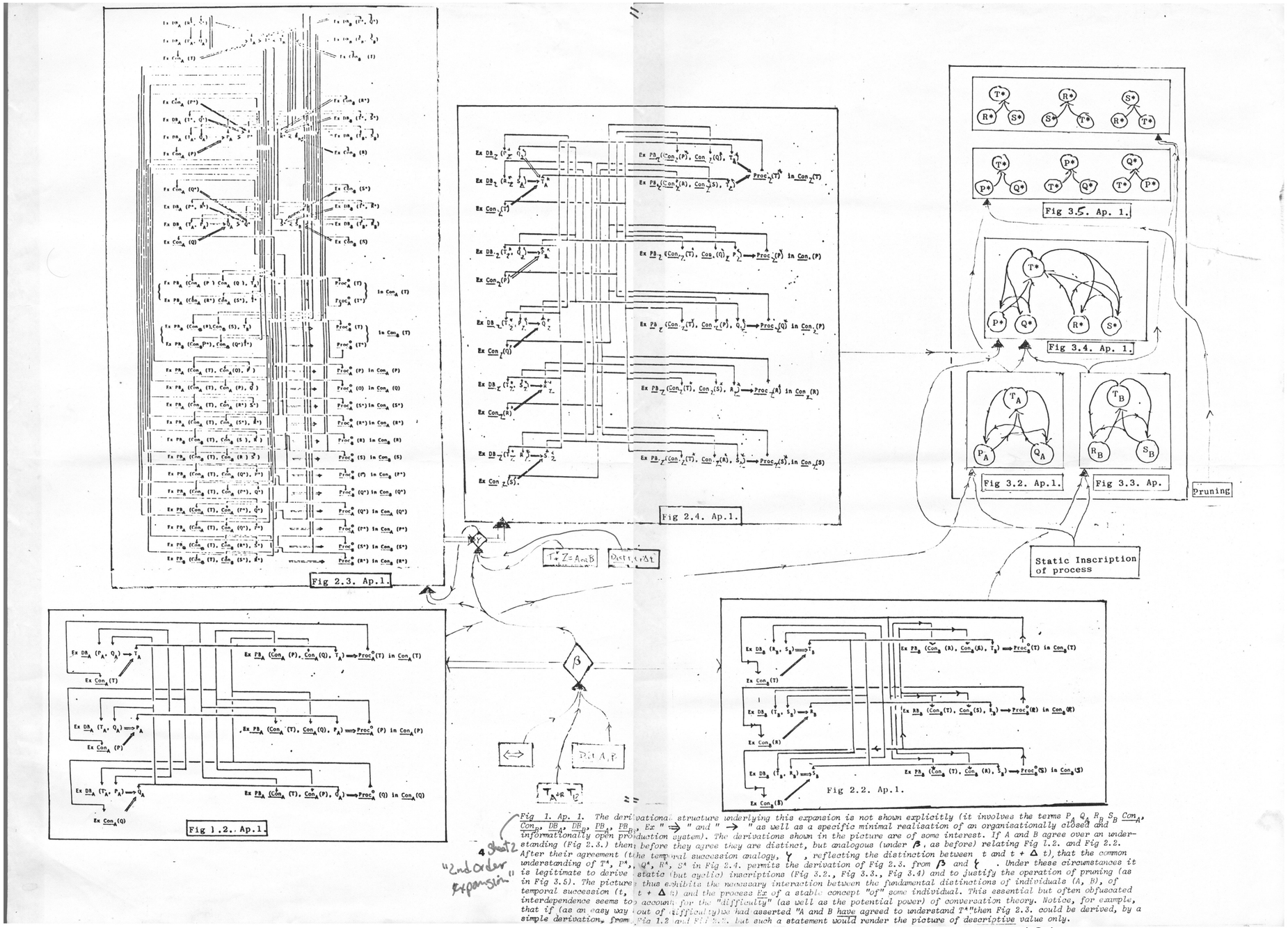
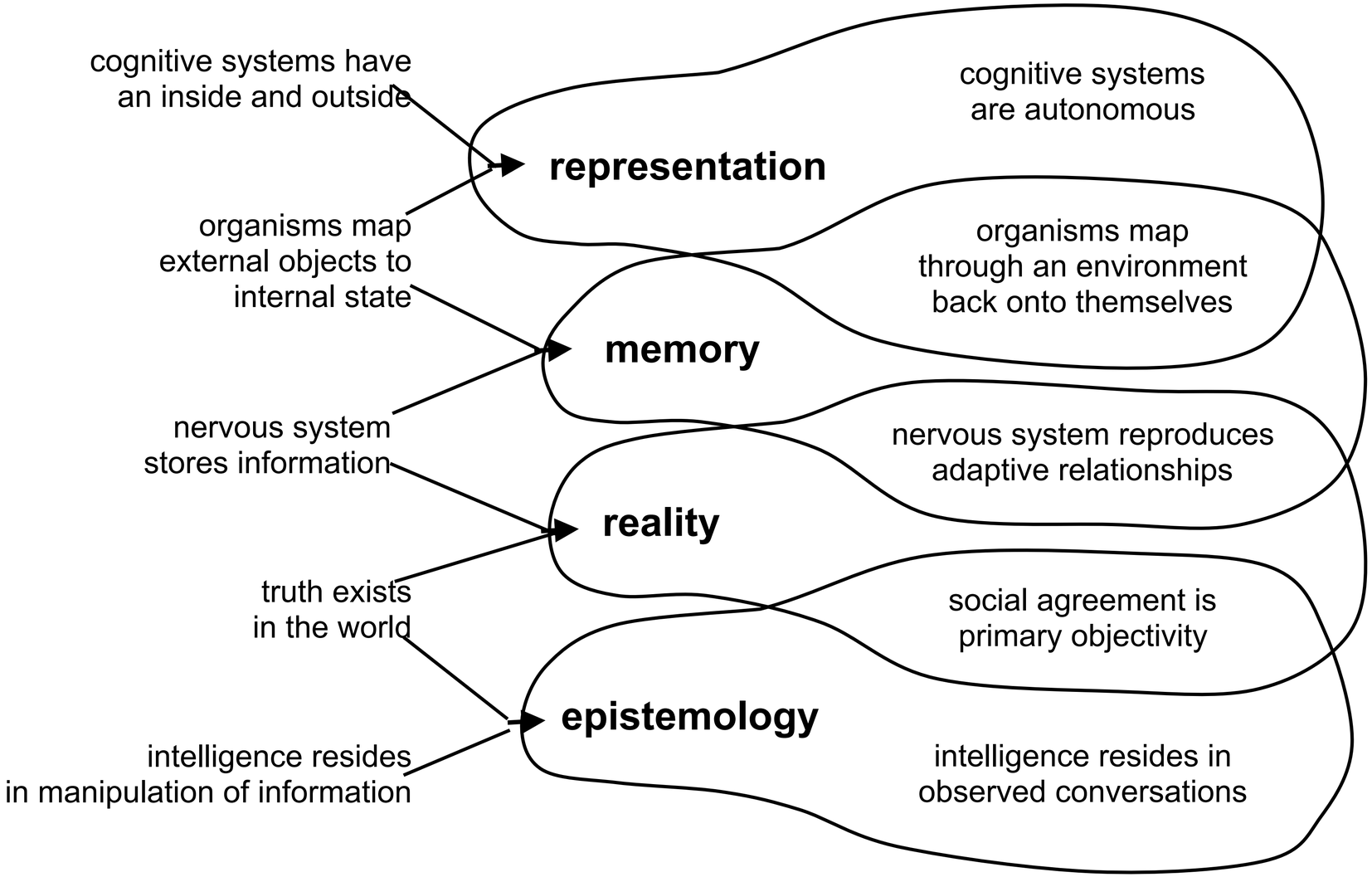
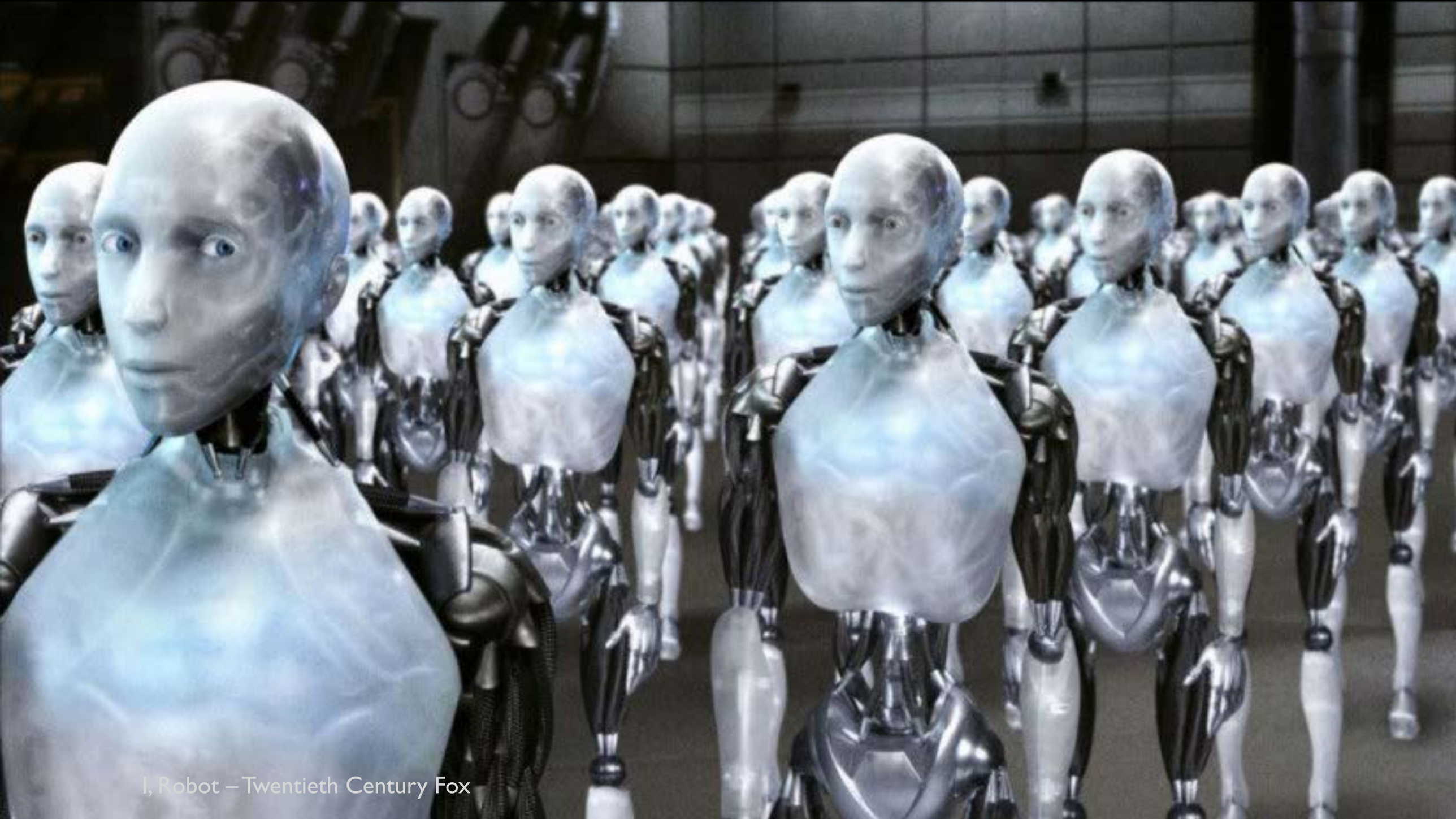


Fig 1. Ap. 1. The derivational structure underlying this expansion is not shown explicitly (it involves the terms P_A Q_A R_B S_B Con_A, Con_B, DB_A, DB_B, PB_A, PB_B, Ex " $\Rightarrow$ " and " $\rightarrow$ " as well as a specific minimal realisation of an organisationally closed and informationally open production system). The derivations shown in the picture are of some interest. If A and B agree over an understanding (Fig 2.3.) then before they agree they are distinct, but analogous (under β, as before) relating Fig 1.2. and Fig 2.2. After their agreement (the temporal succession analogy, γ, reflecting the distinction between t and t + Δ t), that the common understanding of T^A, P^A, Q^A, R^A, S^A in Fig 2.4. permits the derivation of Fig 2.3. from β and ζ. Under these circumstances it is legitimate to derive static (but cyclic) inscriptions (Fig 3.2., Fig 3.3., Fig 3.4) and to justify the operation of pruning (as in Fig 3.5). The picture thus exhibits the necessary interaction between the fundamental distinctions of individuals (A, B), of temporal succession (t, t + Δ t) and the process Ex of a stable concept "of" some individual. This essential but often obfuscated interdependence seems to account for the "difficulty" (as well as the potential power) of conversation theory. Notice, for example, that if (as an easy way out of difficulty) he had asserted "A and B have agreed to understand T^A" then Fig 2.3. could be derived, by a simple derivation, from Fig 1.2 and Fig 2.2. but such a statement would render the picture of descriptive value only.

ARTIFICIAL INTELLIGENCE *contrasted with* **CYBERNETICS**



Click for more on AI versus Cybernetics



I, Robot – Twentieth Century Fox

Cybernetic Design = Design for Conversation

The goal of design for conversations is to facilitate the emergence of conditions in which others can design— to create conditions in which conversations can emerge— and thus to increase the number of choices open to all.

— Dubberly & Pangaro, Cybernetics and Design: Conversations for Action, 2017

Click for more on Cybernetics and Design

“I shall act always so as to increase the total number of choices.”

— Ethical Imperative, Heinz von Foerster

Click for more on Ethics and Cybernetics

X

“If you desire to see, learn how to act.”

— Aesthetic Imperative, Heinz von Foerster

Click for more on Heinz von Foerster

X

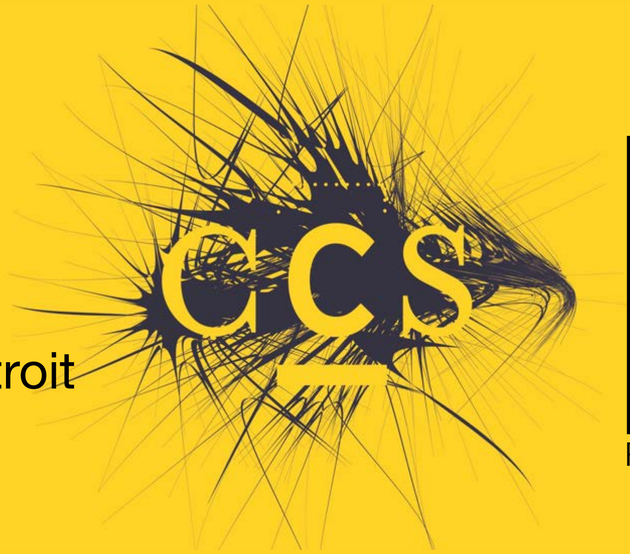
The Future of Cybernetics is Conversation

Download slides from pangaro.com/Pangaro-Nano-2018.pdf

Special Thanks to:

Karen Berntsen
Hugh Dubberly
Pooja Upadhyay

Paul Pangaro, Ph.D.
Chair and Associate Professor
MFA Interaction Design Program
College for Creative Studies, Detroit
paul@pangaro.com

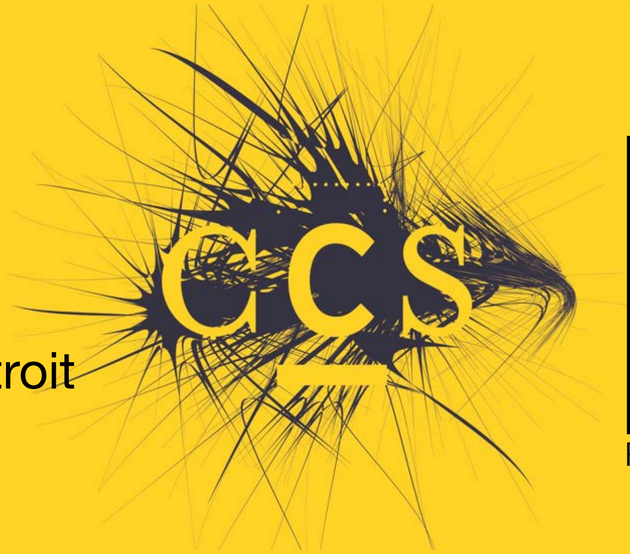


The Future of Cybernetics is Conversation

Download slides from pangaro.com/Pangaro-Nano-2018.pdf

Appendices

Paul Pangaro, Ph.D.
Chair and Associate Professor
MFA Interaction Design Program
College for Creative Studies, Detroit
paul@pangaro.com



Alexa, can you please acquire the skill of conversation

Alexa, what is “conversation”?

Applying C-L-E-A-T

Questions for Designing for Conversation

- What channel is being opened to begin the conversation?
  Is the interruption reasonable in how and when it intrudes?
  What is the bio-cost of the intrusion relative to its benefit?
  Are there better ways to interrupt?

- Is the first message clear?
  Does it offer something to the recipient?

- Does the exchange convey the potential benefits in continuing?
  Is there learning or delight? Is curiosity or interest stimulated?

- Is meaning easily understood—
  do the messages speak in the language of the participants?
  Are messages sensitive to others' context, needs, interests, values?
  How can messages be made more efficient or clear?

From "What is Conversation?"
Dubberly & Pangaro 2009

http://www.dubberly.com/articles/what-is-conversation.html

Why can't AI + Conversation Interfaces do all this?

Applying C-L-E-A-T

Questions for Designing “Conversation Interfaces”

- What does the Conversation Interface (CUI) know about the user’s context—
  what more can it know, automatically or by input from the user?
- How can a user convey intention *to* the software—
  can the CUI be open to the user’s goals, values, preferences?
- Does the CUI evolve during the engagement—
  in addition to understanding the user, can it build new knowledge?
- When should the CUI be confident it understands the user—
  and when should it double-check?
- Can the CUI’s capabilities build a relationship of trust—
  what does that take?

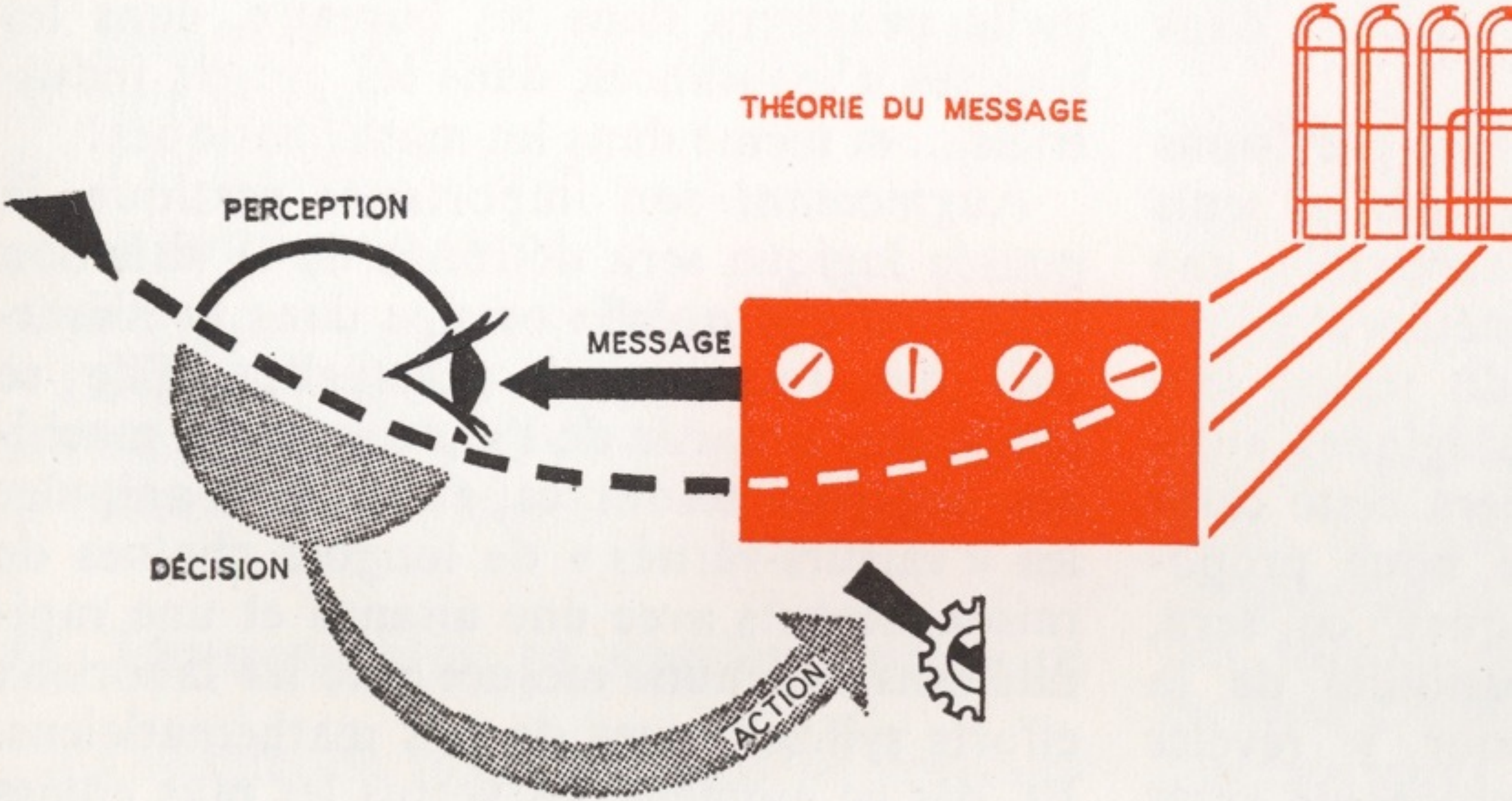
From “What is Conversation?”
Dubberly & Pangaro 2009

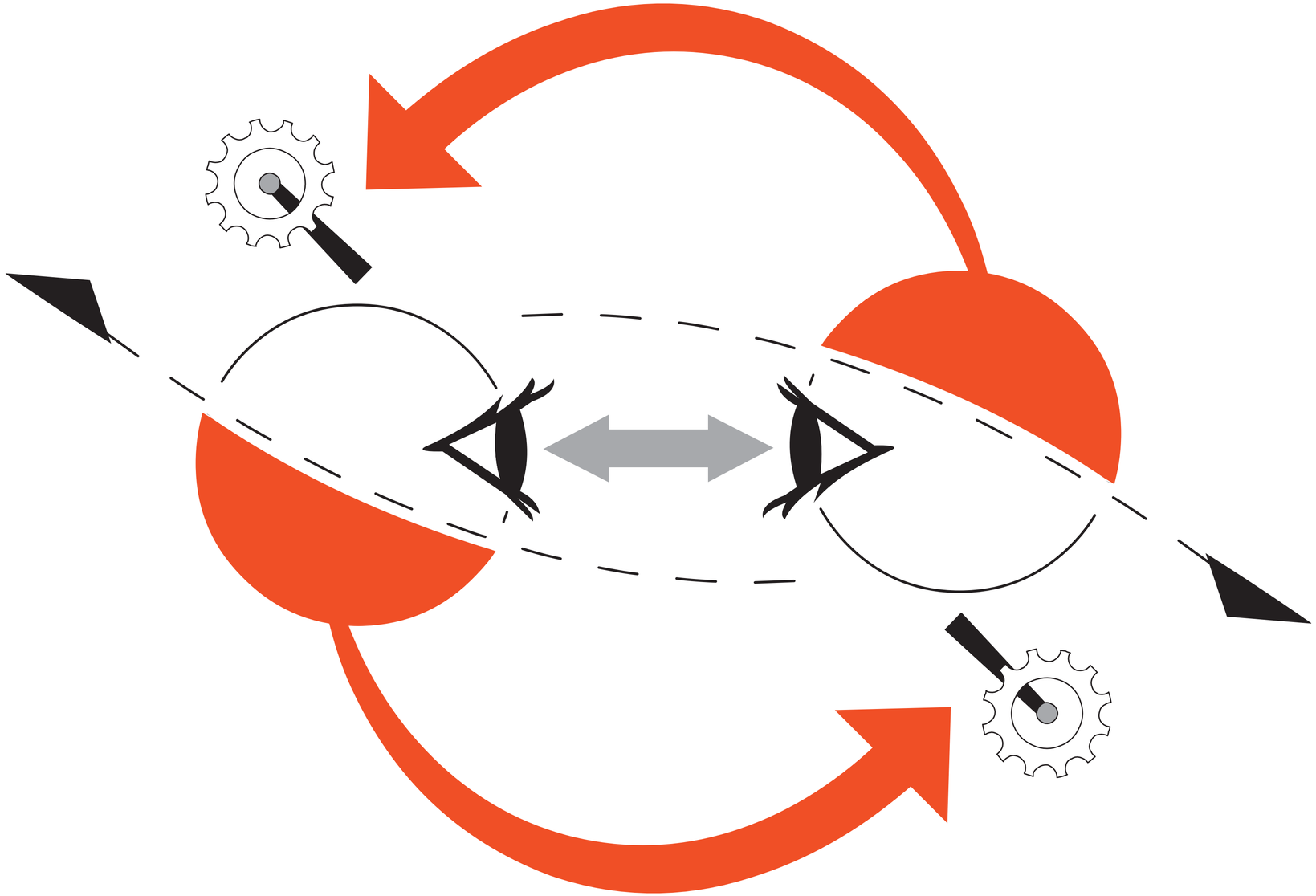
http://www.dubberly.com/articles/what-is-conversation.html

When will Conversation Interfaces do all this?

The Machine Revolution

Role of machines…	**Industrial Revolution** (1750–1850)	**Computer Revolution** (1955–1995)	**Conversation Revolution** (2015–?)
Extend and enhance…	…muscles	…nervous system	…muscles and nervous system
Create value by lowering the cost of…	…performing physical labor	…performing cognitive tasks	…collaborating

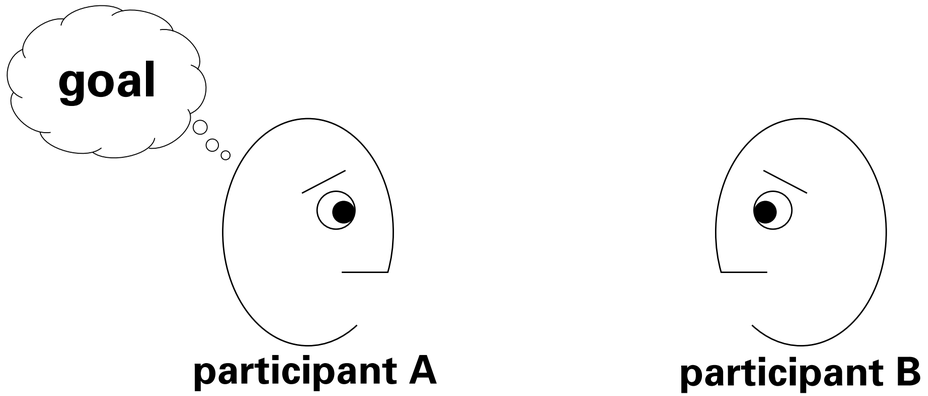

THÉORIE DU MESSAGE
PERCEPTION
MESSAGE
DÉCISION
ACTION



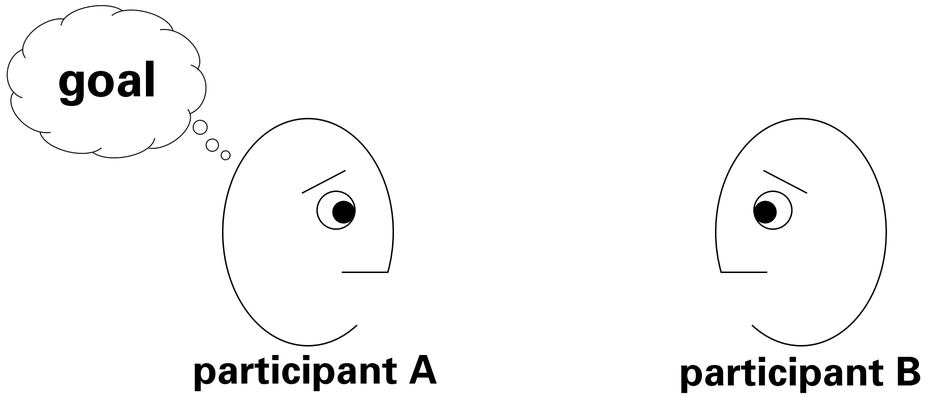
“Everyone designs who devises courses of action aimed at changing existing situations into preferred ones.”

— Herbert Simon

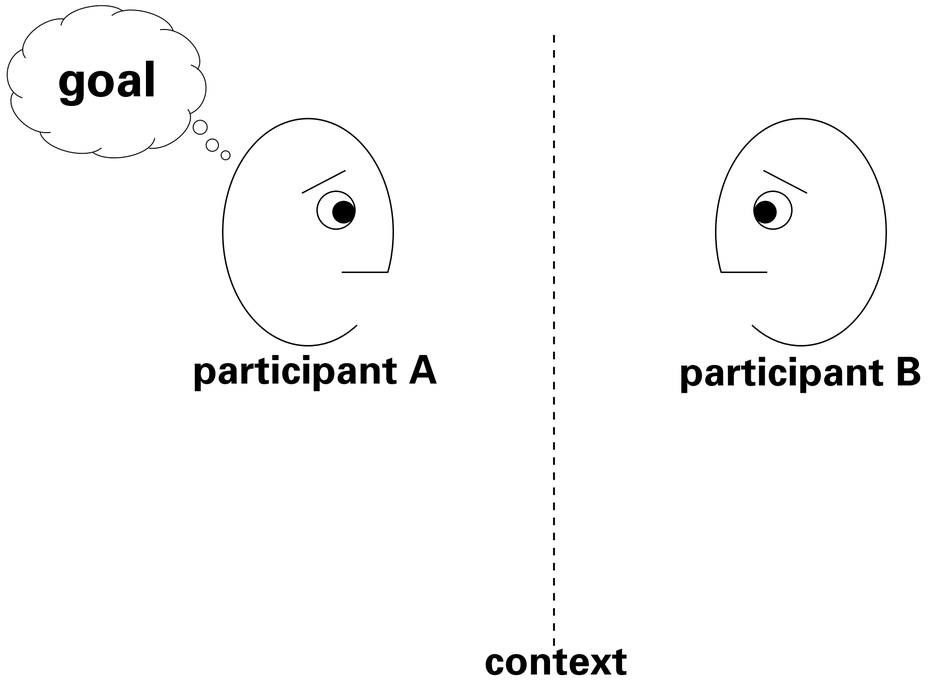
Conversational Frame



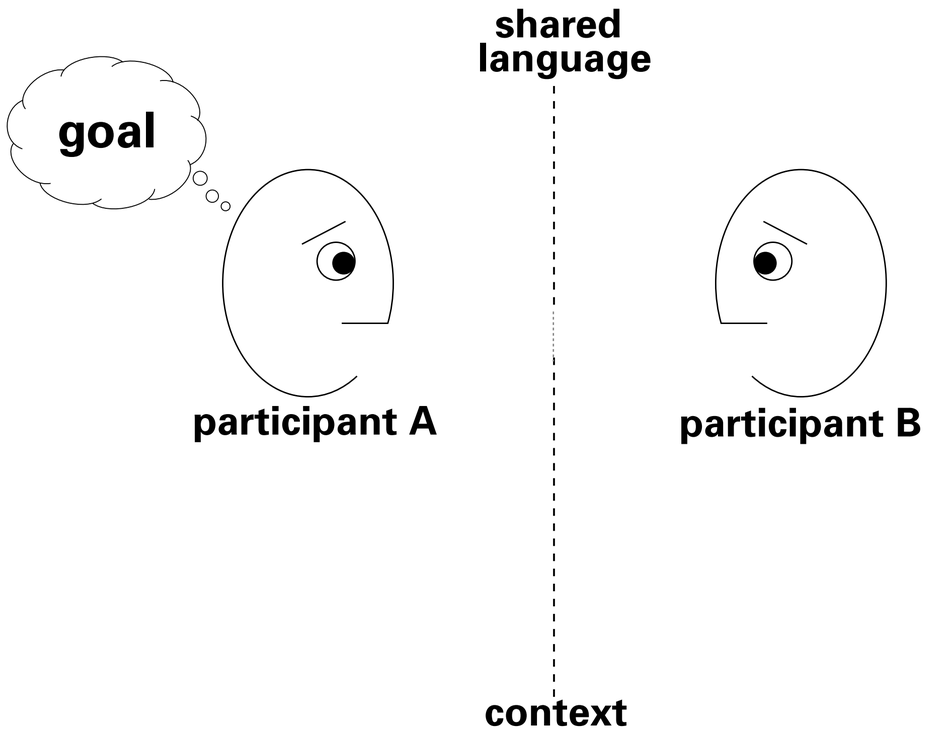
A participant has a goal.



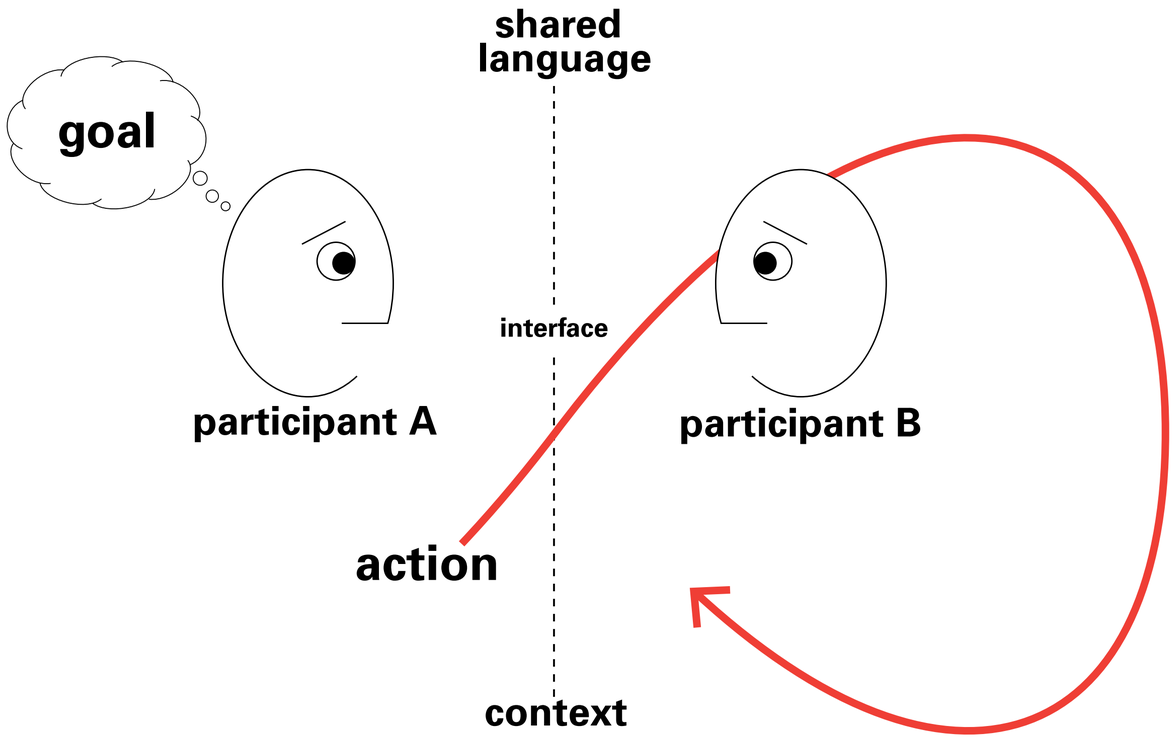
Chooses a context.



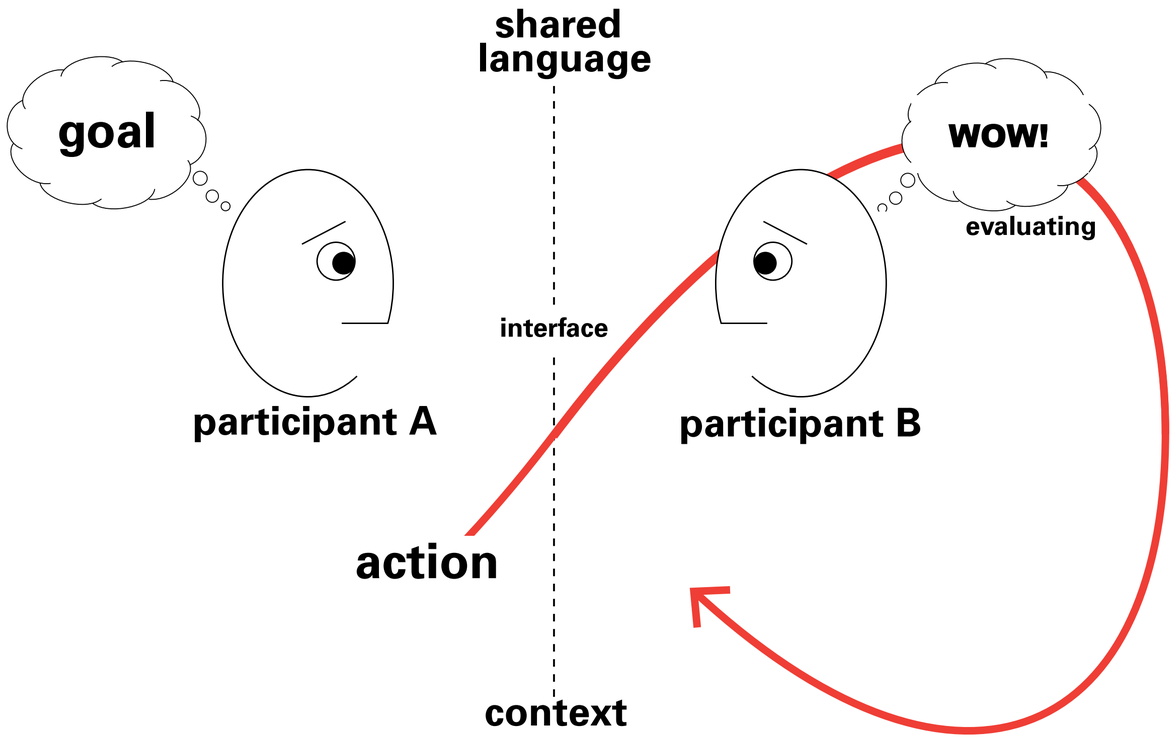
Chooses a language.



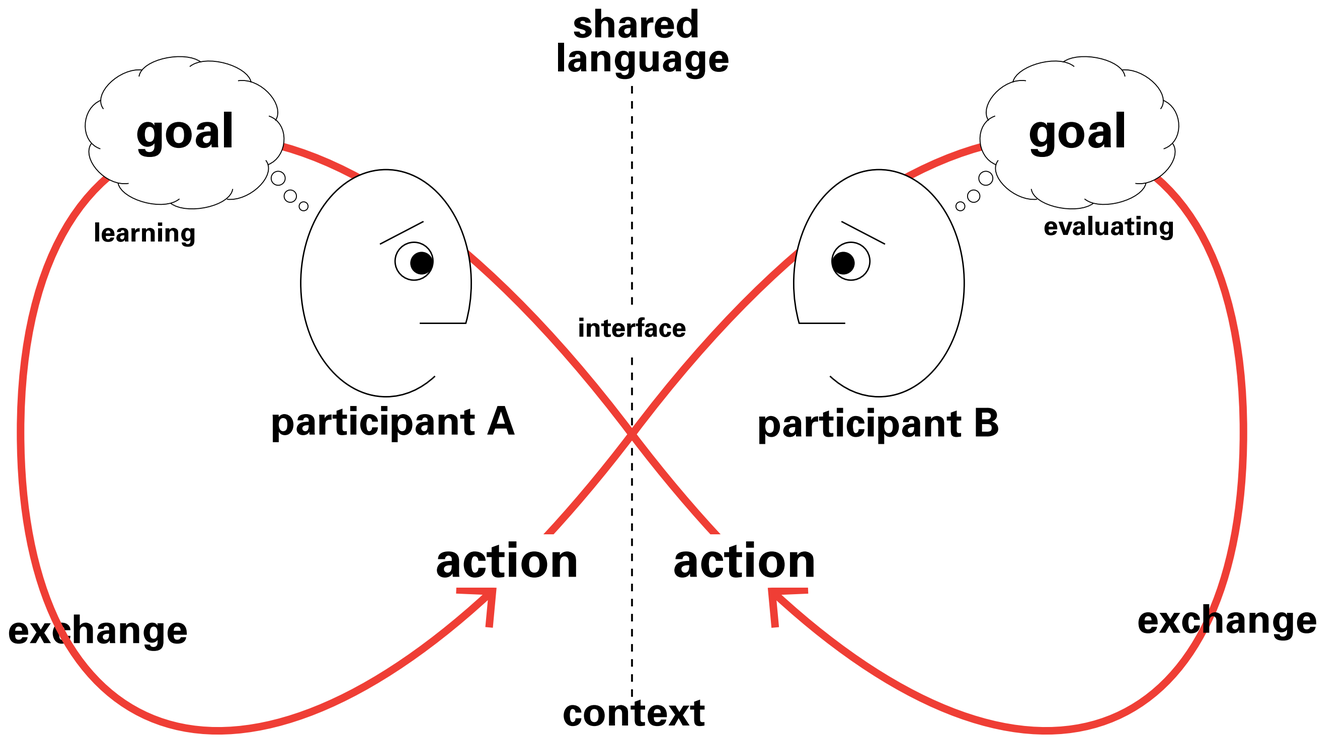
Begins an exchange.



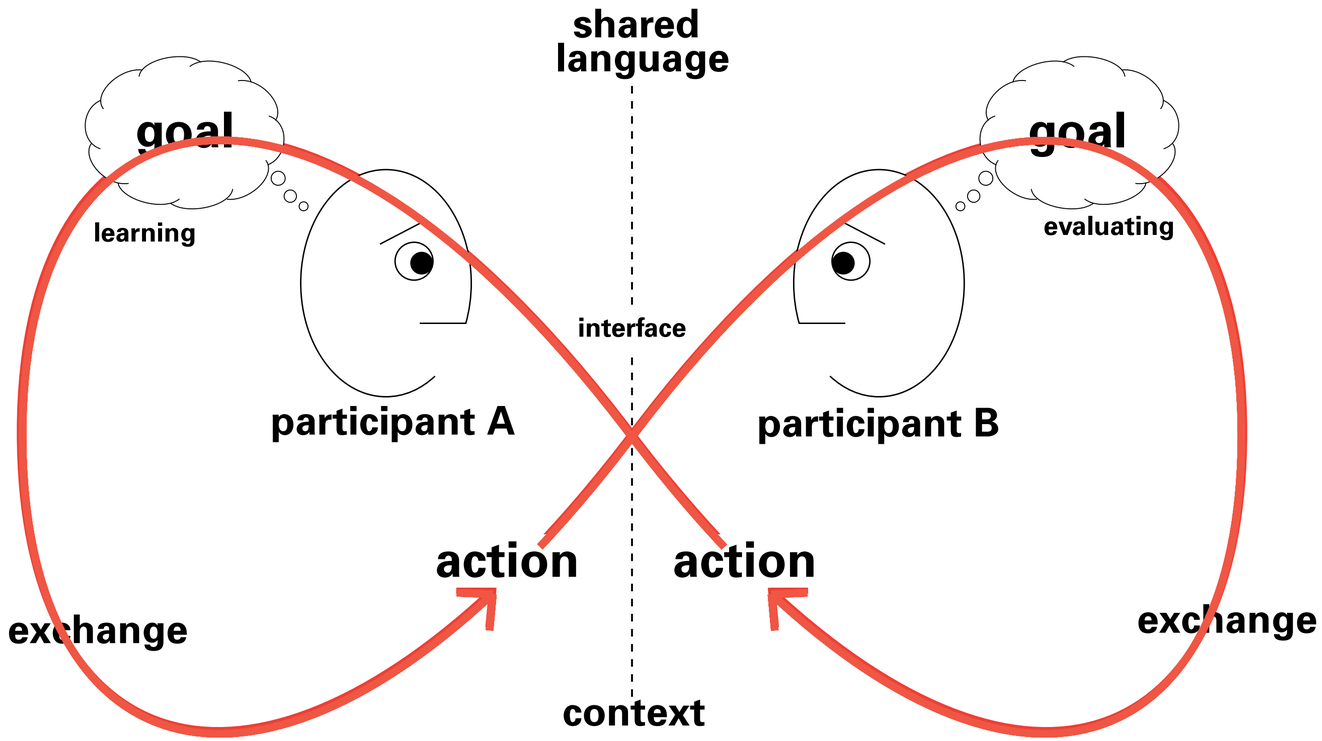
May evoke a response…



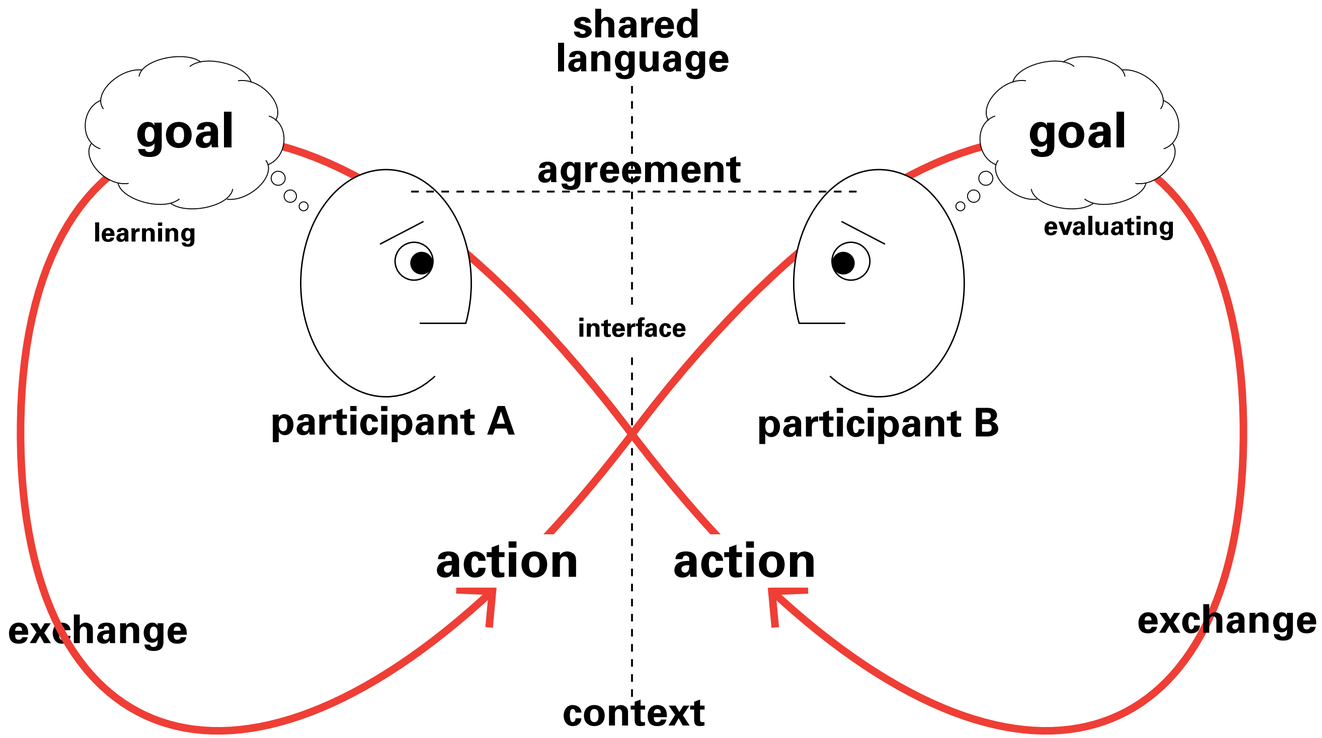
… and a reaction that evokes a reaction…



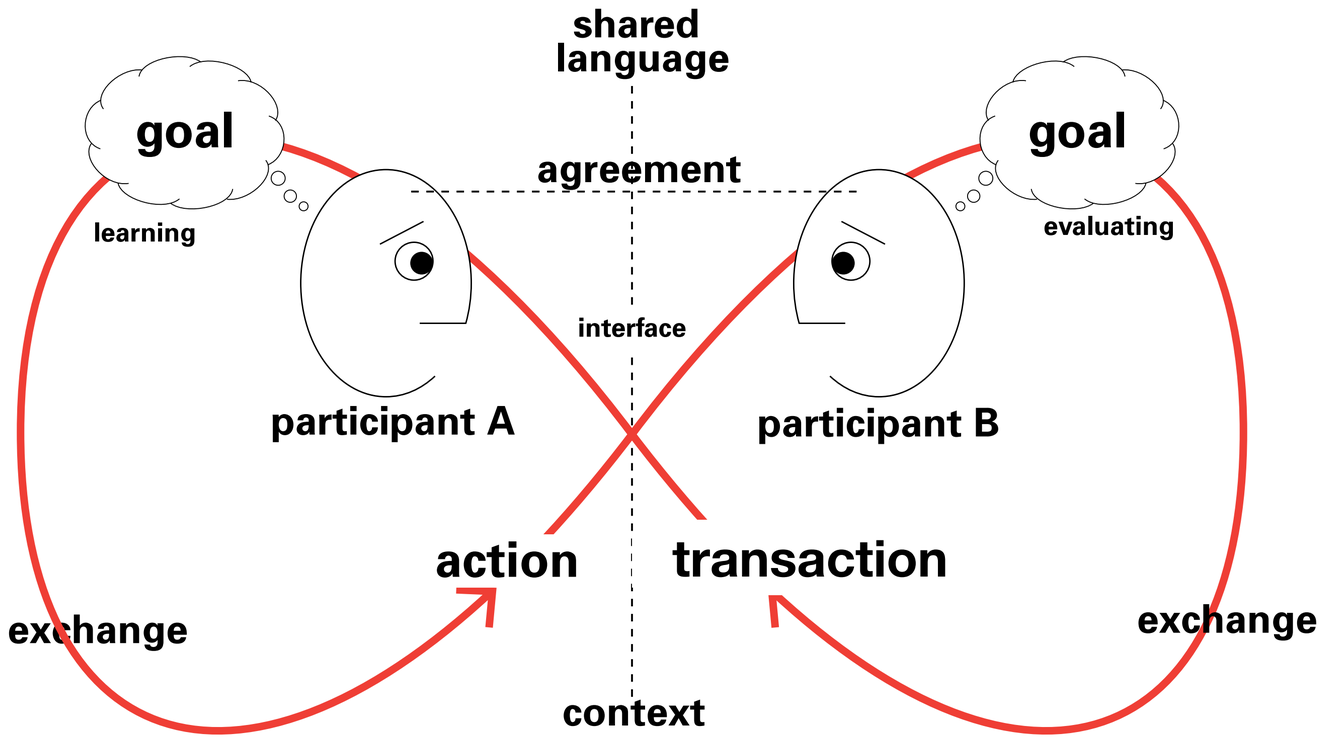
The engagement may continue.



An agreement may be reached.

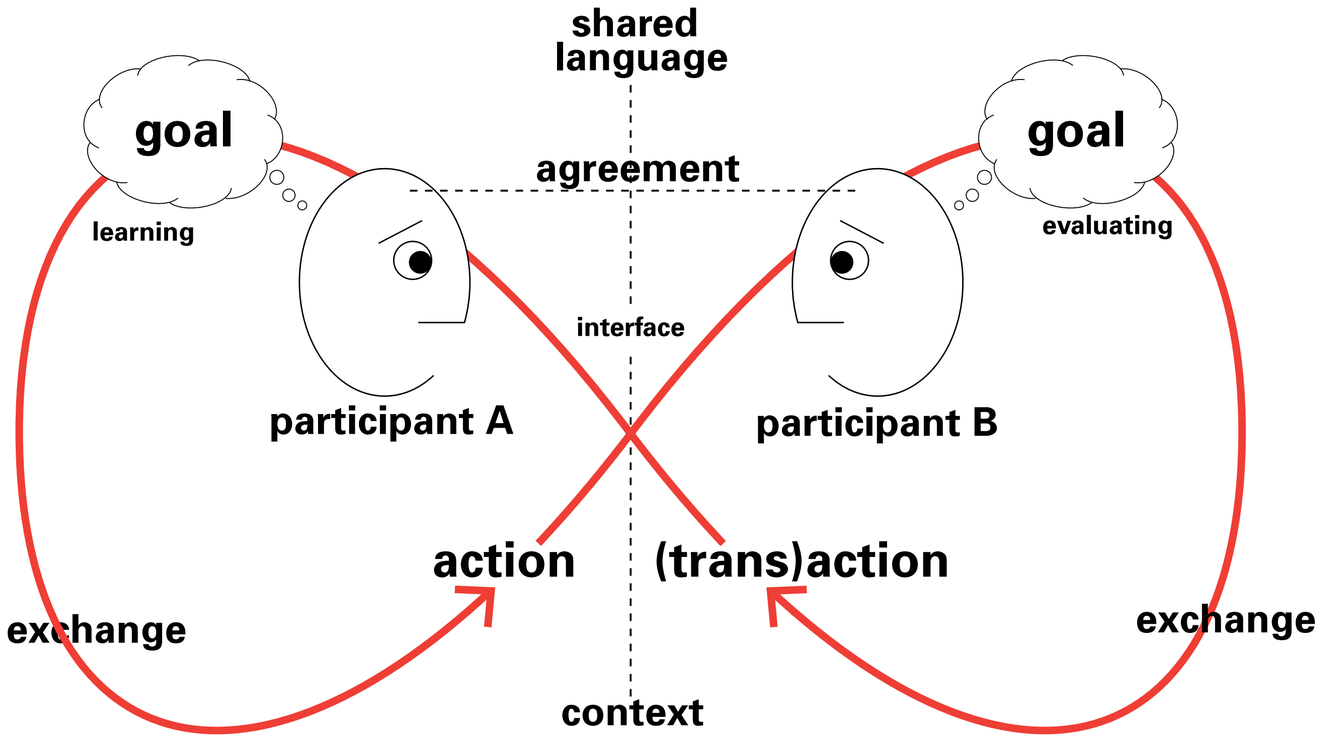


A transaction may occur.



after Dubberly Design Office 2008

Conversation Redux



Conversation Redux — C-L-E-A-T

C – Context
L – Language
E – Engagement
A – Agreement
T – Transaction