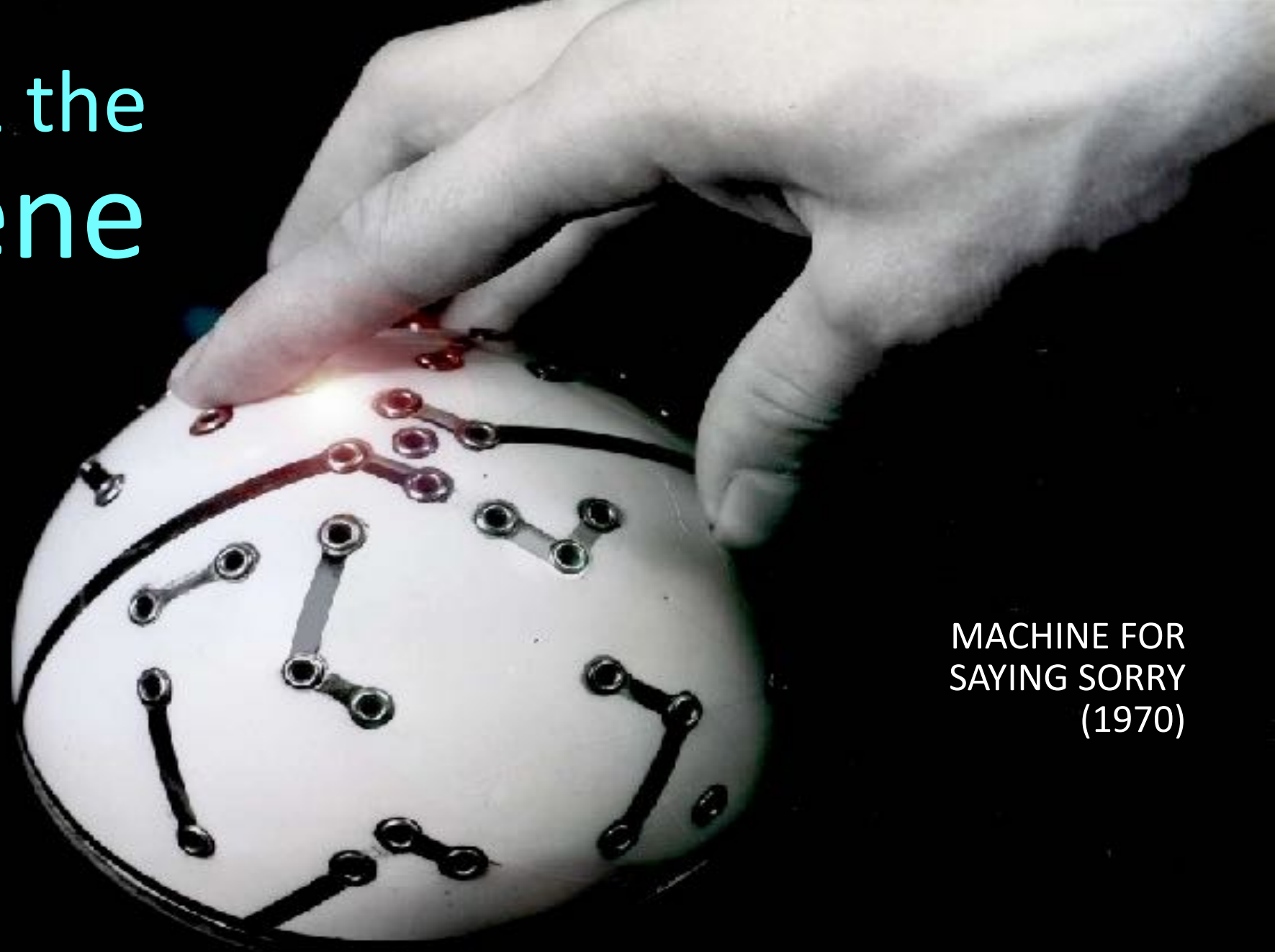


systems theory & the Anthropocene

an introduction



MACHINE FOR
SAYING SORRY
(1970)

Twitter: metadesigners

Email: maxripple@gmail.com

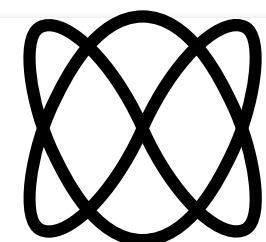
Website: <https://metadesigners.org>

John Wood
Goldsmiths
UNIVERSITY OF LONDON

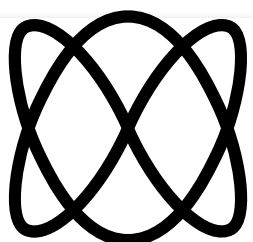


Prifysgol Cymru
Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Swansea
College of Art
Founded 1853

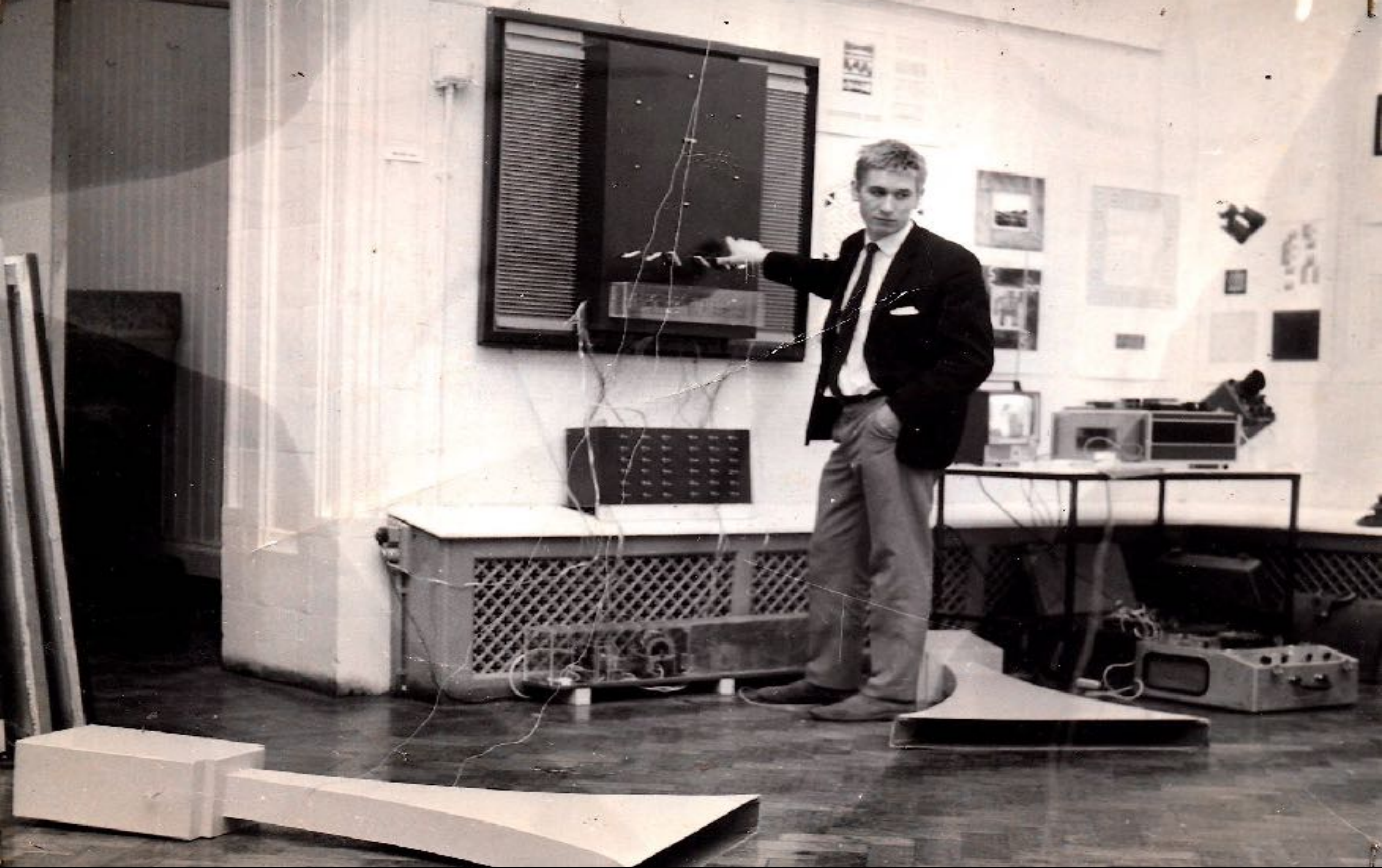


MRC WALES



CYM CYMRU

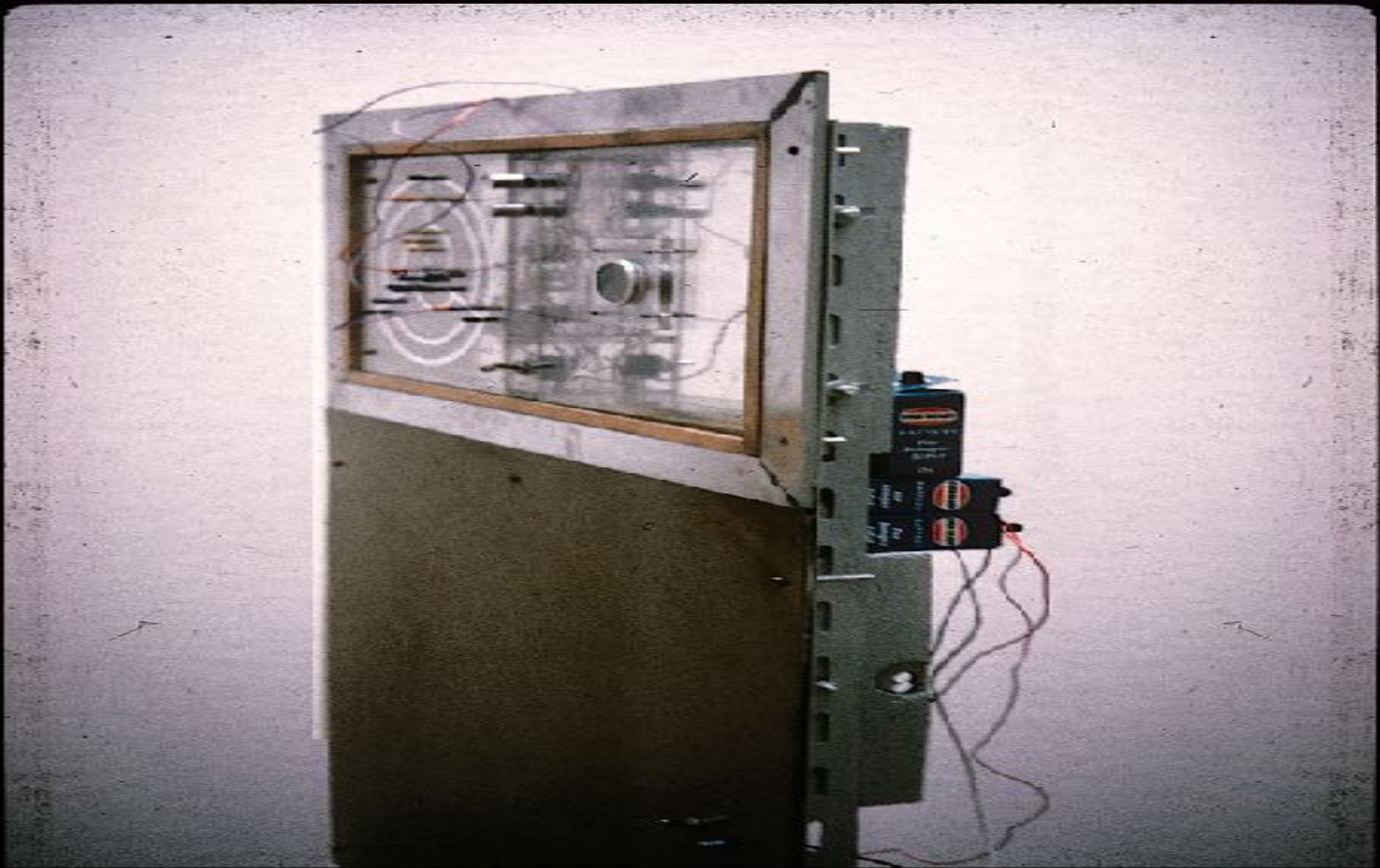
from the
viewpoint of
an artist/designer



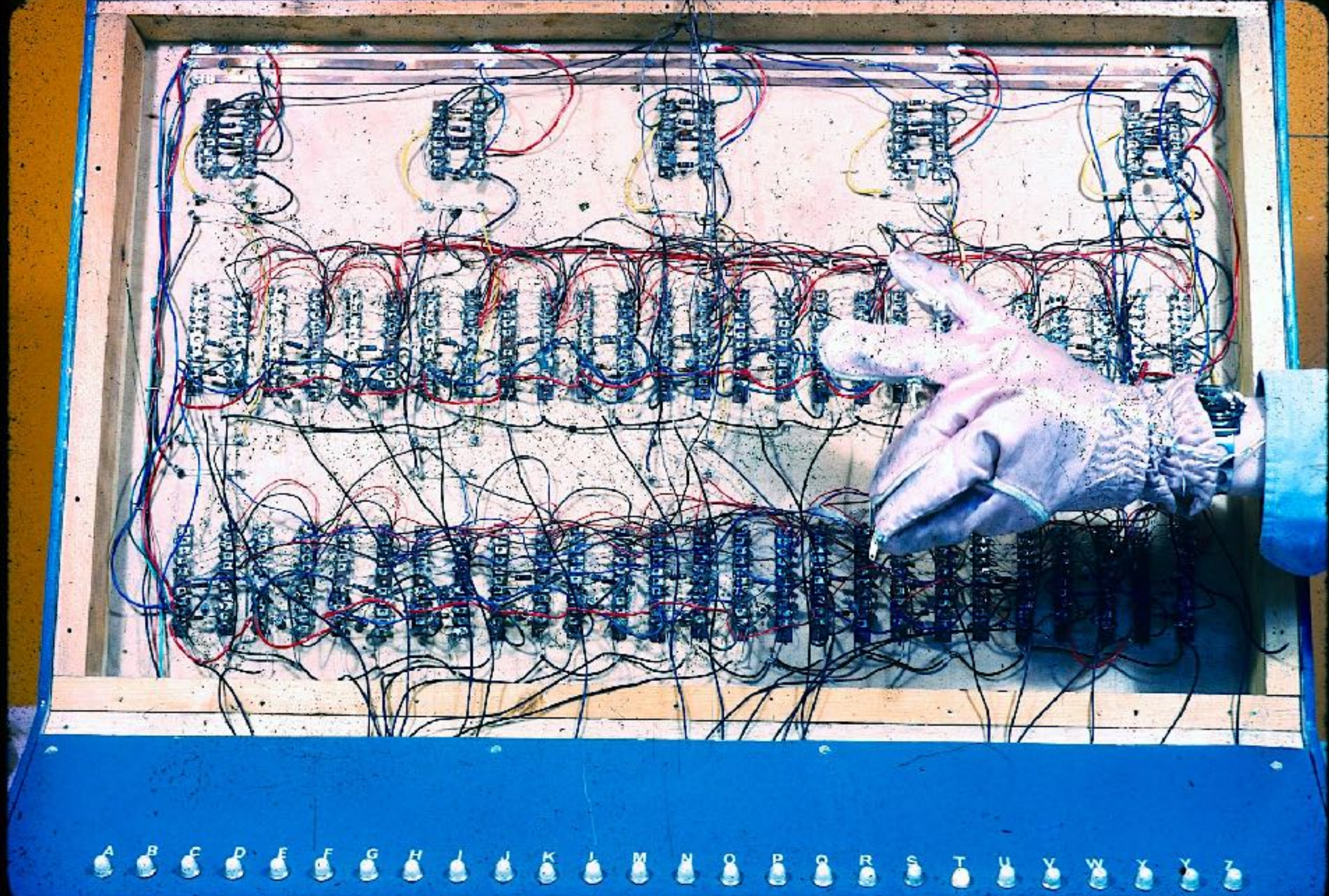
Fine Art degree show 1968



Fine Art degree show 1968



Fine Art degree show 1968



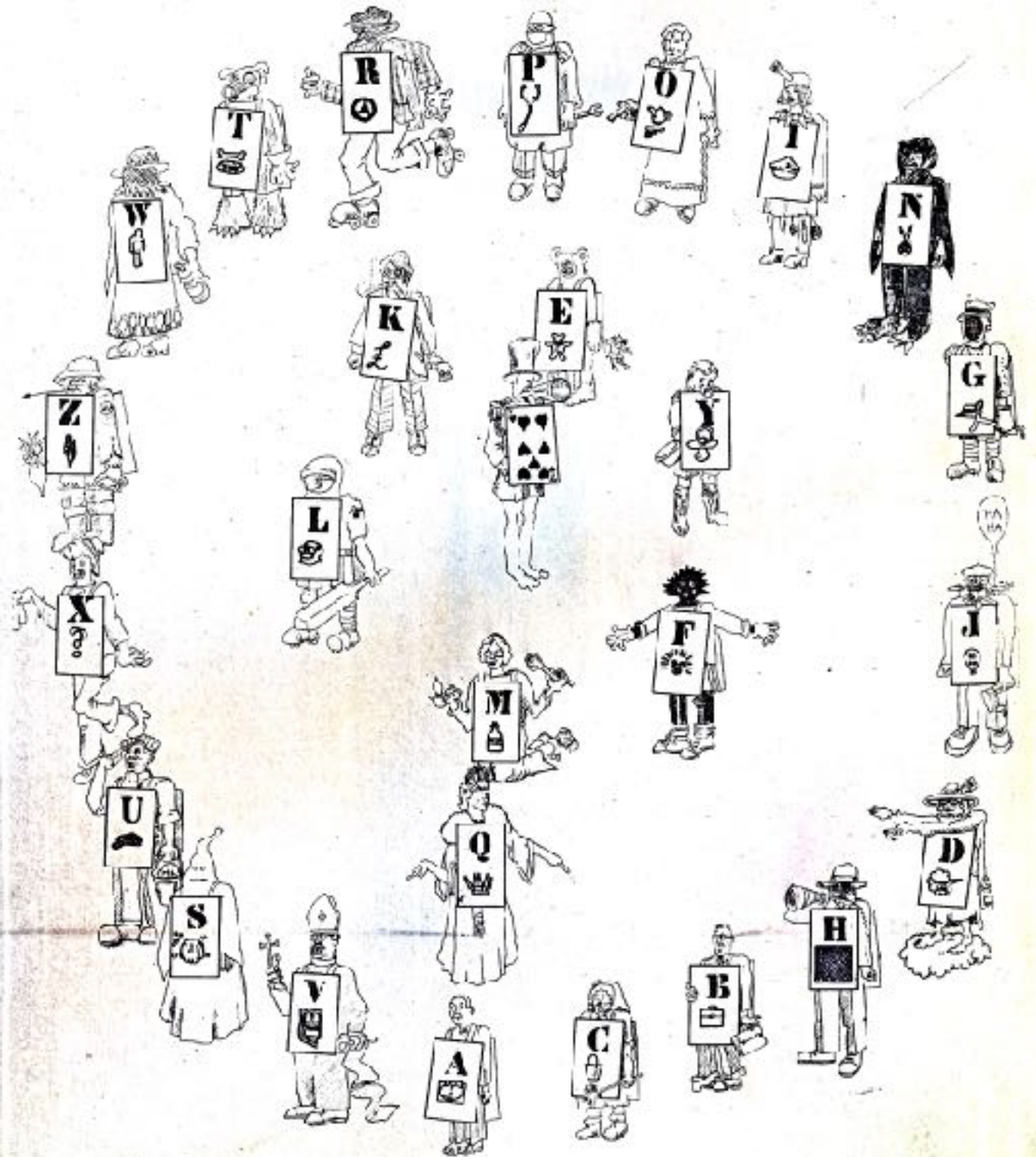
built Joe Wilson's spelling glove 1968

SHOUTING HOUSE

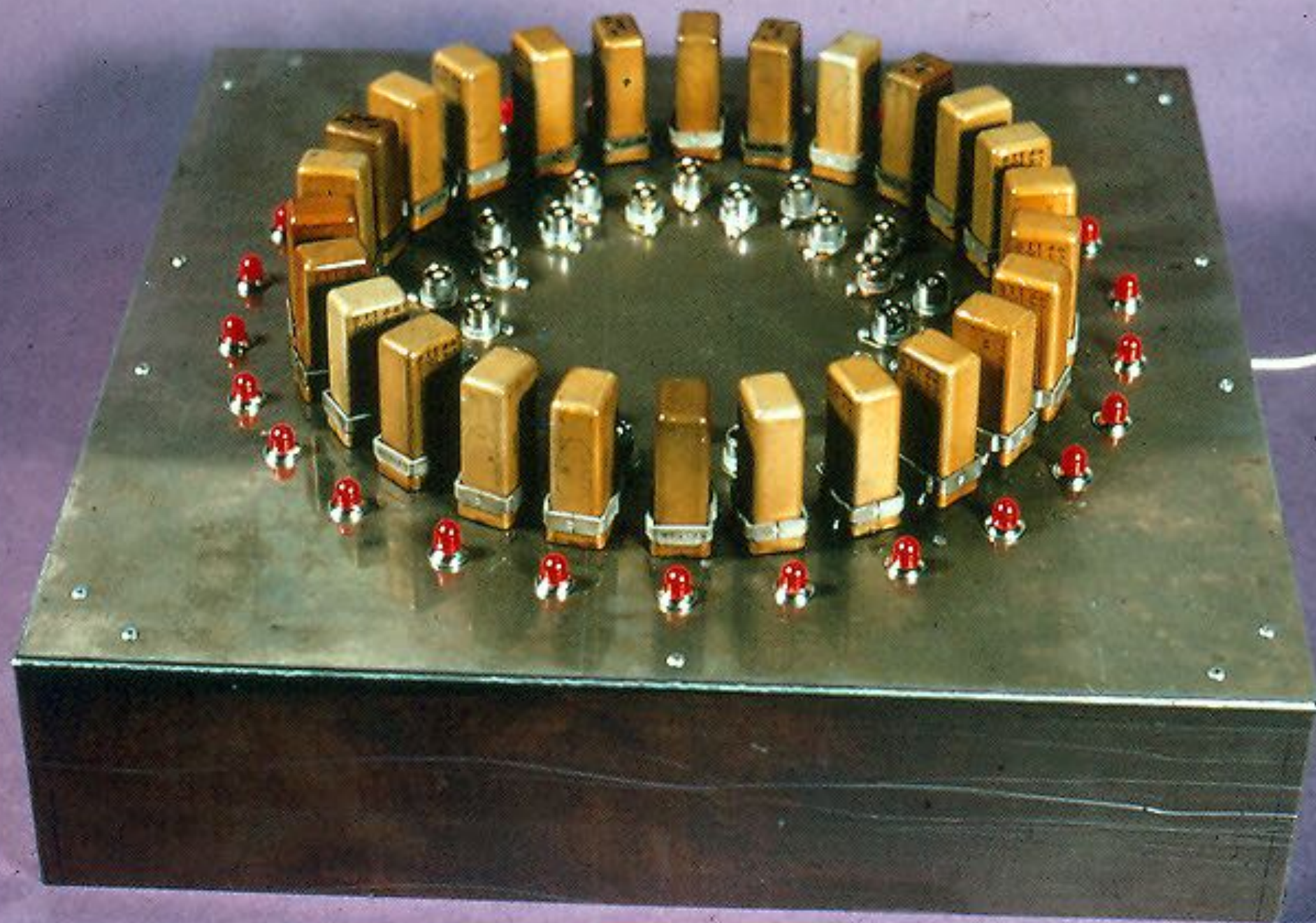
A Story for Children

by

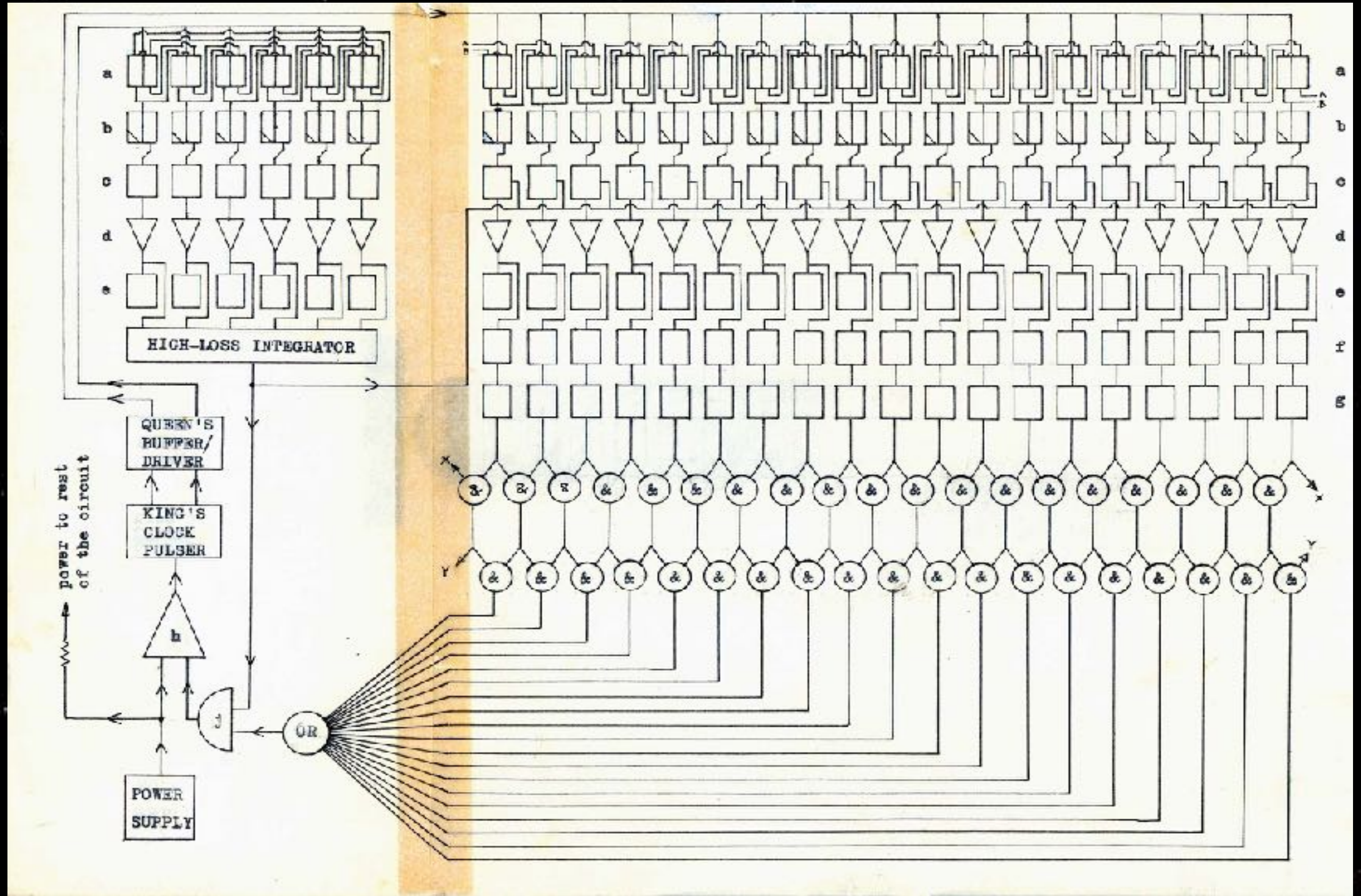
BESSIE WOOD



computer-driven play ICA, London



computer-driven play ICA, London



computer-driven play ICA, London

SCHOOL OF ADVANCED STUDIES,
MANCHESTER COLLEGE OF ART AND DESIGN
ISO-ATLAS CONVERTED PROGRAM

JOB

UMCAD/DIXON = JOHN WOOD DRAMA LOGIC (KING OF SHOUTING HOUSE)
COMPUTING 5000 INSTRUCTIONS
STORE 25/43
OUTPUT

0 LINEPRINTER 900 LINES

USE AB

BEGIN

INTEGER_____ I, J, K, E, L, N, COUNT, D;

REAL_____ X

INTEGER_____ ARRAY_____ AA1, AA2, AA3, AA4(1:19)

INTEGER_____ ARRAY_____ A1, A2, A3, A4 (1 : 19)

INTEGER_____ ARRAY_____ AA, A(1:19), HOLD (1:4)

INTEGER_____ ARRAY_____ B (1:6)

ROUTINE_____ SPEC_____ MAGIC WORD

CYCLE_____ J = 1, 1, 19; READ (A)J); REPEAT_____

CYCLE_____ J = 1, 1, 6; READ (B)J); REPEAT_____

CYCLE_____ J = 1, 1, 19; A1(J) = A(J);

A2(J) = A(J); A3(J) = A(J);

A4(J) = A(J); AA1(J) = 0; AA2(J) = 0; AA3(J) = 0; AA4(J) = 0;

REPEAT_____

D = 0; E = 0

SELECT OUTPUT (0); NEWLINE; SPACES (50)

CAPTION_____ FIRST PASS; NEWLINE;

CYCLE_____ J = 1, 1, 19; AA(J) = 0; REPEAT_____

11: J = 0; N = 0; I = 0; COUNT = 0

11 -> 22 IF K = HOLD(1) OR K = HOLD(E+1); MAGIC WORD

22: E = E + 1; IF B > 4 THEN E = 1; HOLD(E) = K

COUNT = COUNT + 1; N = 0

IF COUNT > 11 THEN K = 19

IF COUNT > 11 THEN COUNT = 0;

IF K = 19 THEN COUNT = 0

IF K = 0 THEN K = 1; -> 2 IF K >= 1 AND K > J

I = 0; J = 0

21 J = J + 1; I = I + 1; IF I = 7 THEN I = 1

-> 3 IF J > K; -> 2

31 CAPTION_____ K =

IF A(J) = B(I) THEN J = J + 1

K = J; PRINT (K, 2, 0); SPACES (3)

CAPTION_____ I = 1; PRINT (1, 1, 0); SPACES (3)

CAPTION_____ B = 1; PRINT (B(1), 1, 0);

-> 5 IF J > 7

-> 6 UNLESS B(I) < A(J) OR B(I) > A(J);

A(J) = B(I); N = 1

IF E = 1 THEN A1(J) = B(I)

IF E = 2 THEN A2(J) = B(I)

IF E = 3 THEN A3(J) = B(I)

IF E = 4 THEN A4(J) = B(I)

41 -> 6 IF A(J) > 0; -> 6 UNLESS AA(J) = -1;

IF A(J-1) = 0 OR A(J-1) = 0 THEN -> 7;

51 -> 77 IF J = 19

61 NEWLINE; SPACES (3); CAPTION_____ A ARRAY =

CYCLE_____ L = 1, 1, 19; PRINT (A(L), 2, 0); SPACES (2);

REPEAT_____ 1, NEWLINE

SPACES (6); CAPTION_____ AA ARRAY = 1;

CYCLE_____ L = 1, 1, 19; PRINT (AA(L), 2, 0)

SPACES (2); REPEAT_____ 1, NEWLINE; -> 8 IF K = -1;

IF N = 1 THEN AA1(J) = -1; -> 1 IF N = 0

IF E = 1 THEN AA1(J) = -1

IF E = 2 THEN AA2(J) = -1

A V
C 2 S
D F L X
J Y K W
M E T
I O P R

THE RITUAL CIRCLES

KING

Q Queen

inner circle (FAMILY OF SHOUTING HOUSE)

M	Matron	1
L	Lance the Eldest Child	0
K	King's Brother	0
E	Eva's Teddy Bear	1
Y	Youngest Child (Mark)	1
F	Fat Black Doll	0

outer circle (COURTIERS OF SHOUTING HOUSE)

A	Allen the Staff Butler	1
C	Charwoman	0
B	Denson (King's Special Adviser)	1
H	Hornblower to Nicodemus	0
D	Miss Dad of Dreamland	2
J	Jester	0
G	Governess	0
N	Nicodemus the Goat	0
I	Iris the Kitchen Maid	0
O	Old Lady in Black	0
P	Physician to the King	1
R	Rupert the Chauffeur	0
T	Tory the Fat Spaniel	1
W	Witch	0
Z	Zebedee the Gardener	1
X	Mr. X	0
U	Uncle Stan	1
S	Spirit of Wobbly Face	0
V	Vicar of Shouting House	2

computer-driven play ICA, London



THE GUARDIAN

Saturday January 31 1970



Members of the Manchester College of Art and Drama design department acting out a computerised game at the Institute of Contemporary Arts in London yesterday. The players, wearing a personal identifying motif on a sandwich board, take part in "ring o' roses" dance to a sound track determined by the computer. (Picture by Eric Wadsworth)

computer-driven play ICA, London



The Machine for Saying Sorry 1970

what is
the Anthropocene?

A photograph showing a deforested landscape. A river or stream flows through the center, carrying a large number of cut logs. The surrounding land is cleared, with only stumps and debris visible. The sky is overcast with grey clouds.

how did we
get here?

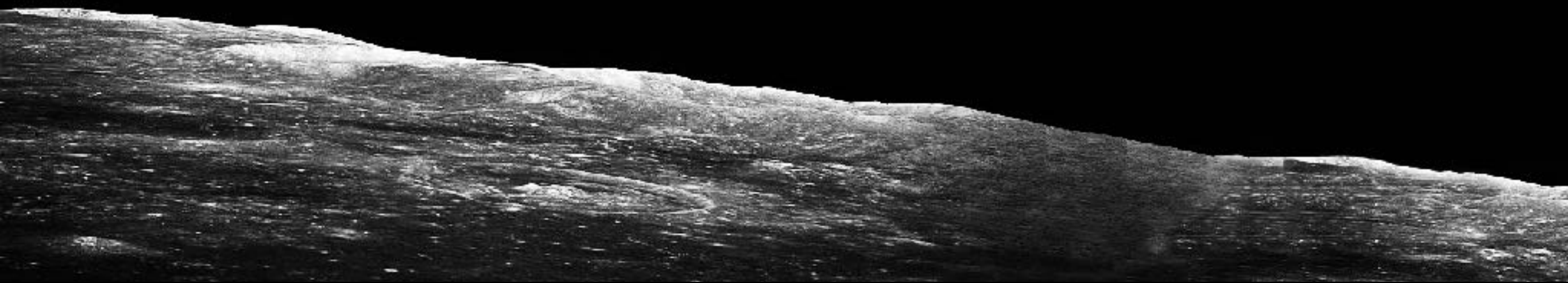
how on Earth did we get here?

3.9 billion yrs ago

GAIA HYPOTHESIS

living organisms interact with their inorganic surroundings on Earth to form a complex, synergistic & self-regulating system that helps to maintain and perpetuate the conditions for life on the planet.

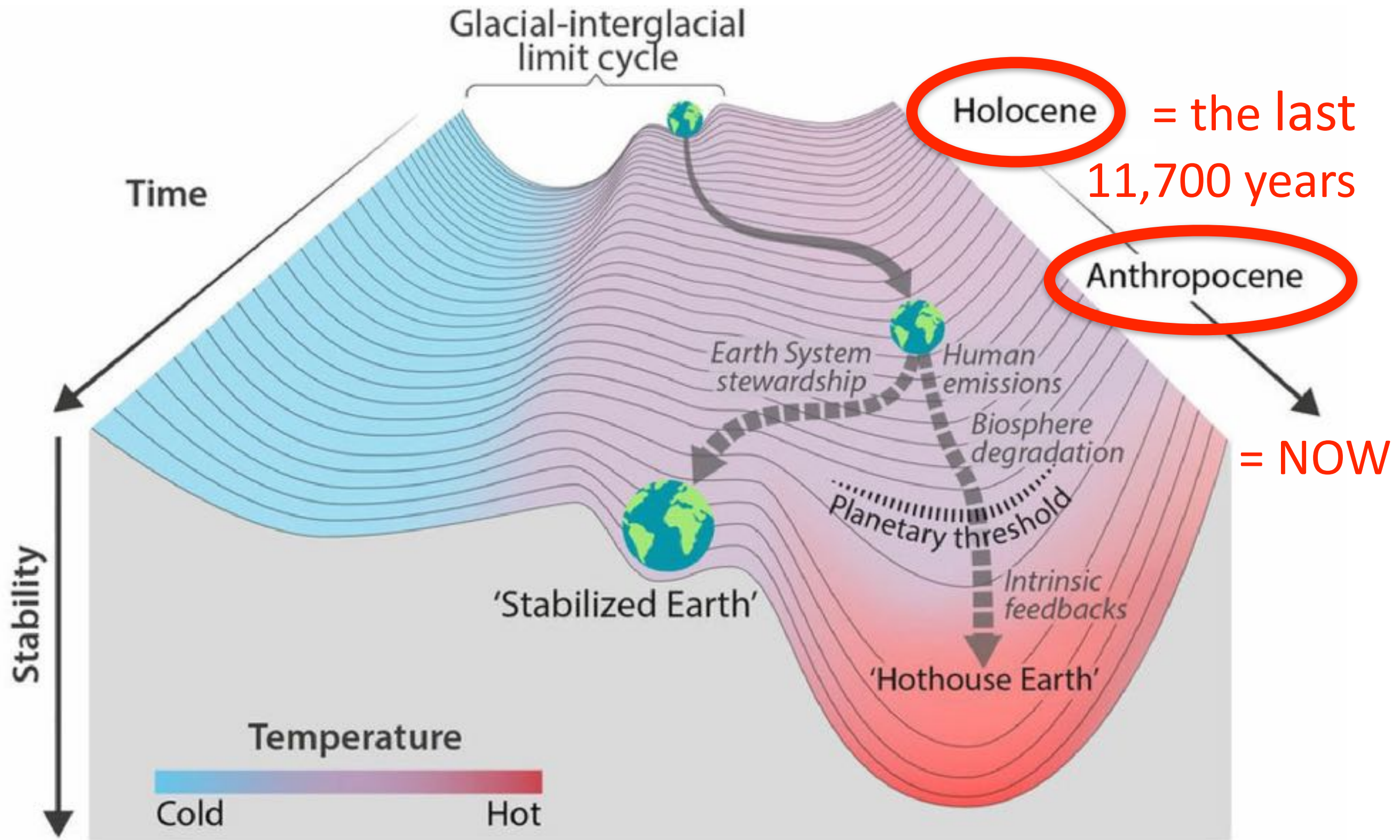
(Lovelock & Margulis, 1979)



Life emerged from chemical chaos



are 21st c. chickens 'designed'?



Systems Theory & the Anthropocene

what is
a *system*?

21st century

A

GROUP OF
INTERACTING
OR INTERRELATED
ENTITIES THAT FORM
A UNIFIED WHOLE

what is a system?

what is a

‘whole’?

A detailed view of the Earth from space, showing the continents of North and South America, the surrounding oceans, and swirling white clouds. The Earth is positioned in the center-right of the frame, with a vast field of stars in the deep blue and black background of space.

too complex to understand?

15th century

Wholes + Parts

Nicholas of Cusa (1401-1464)

- can we ever see the big picture?
- only by looking for distinctions, then pigeon-holing them in categories

UNIVERSE: an infinite, omniscient whole

15th century

Wholes + Parts

Nicholas of Cusa (1401-1464)

- each viewpoint carries some truth:
- but it is only true when seen in relation to other parts in the whole

discursive thinking = an aspect of reality



19th century

William Morton Wheeler, (1865–1937)

one big superorganism?



20th century

James Lovelock (1919-) claimed that
the Earth maintains all life by acting as a
huge self-regulating system

Gaia is our big system

the idea of
cybernetics

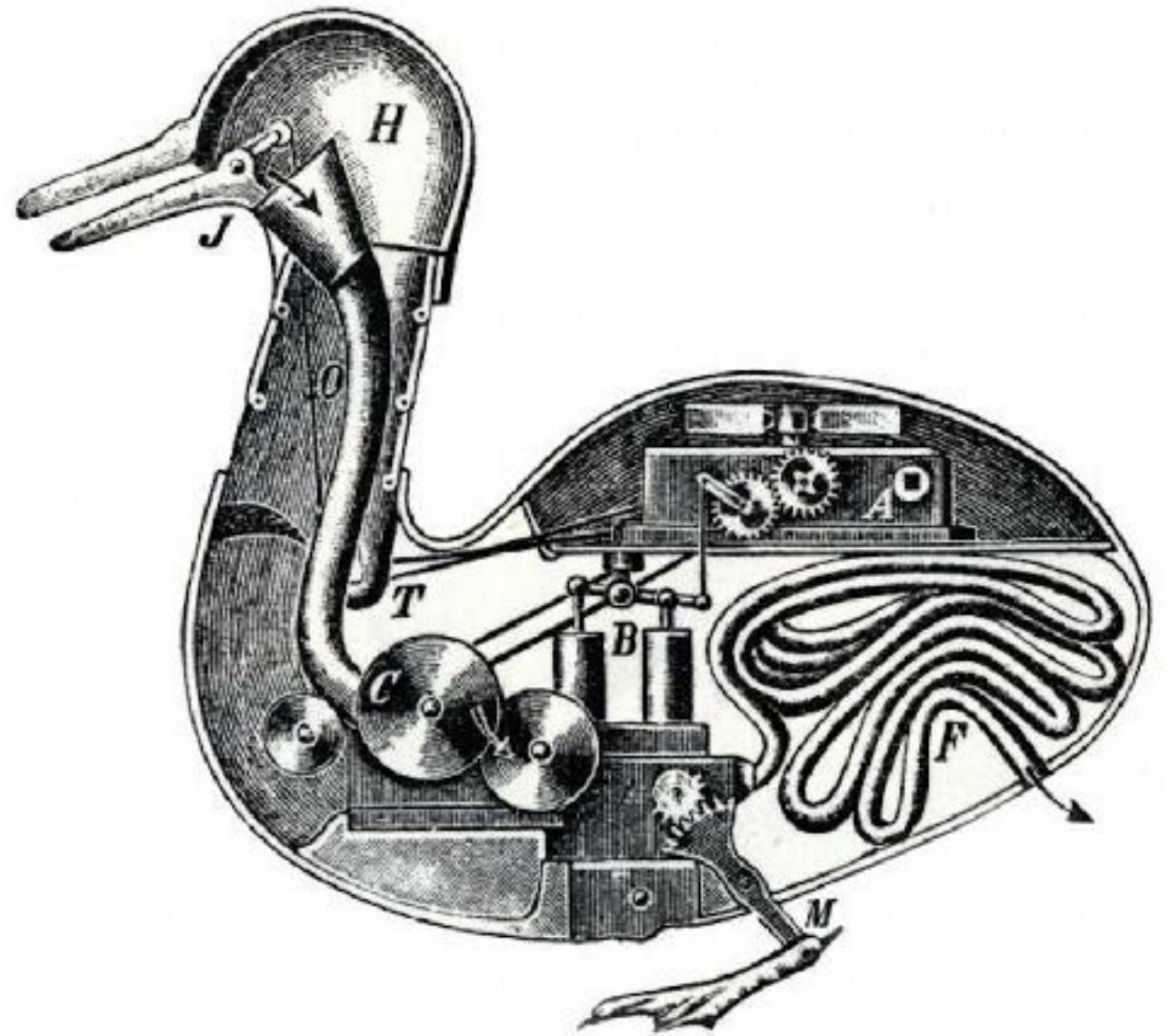
Plato (427-347 BC)



(originally) “the study of self-governance”

17th-18th century

Descartes (1596 - 1650)
although animals are
living organic creatures,
in essence they are
mechanical automata



Canard Digerateur - Jacques de Vaucanson, (1739)

“the scientific study of control & communication in the
animal and the machine.”

Norbert Wiener (1948)

First Order Cybernetics

1. 'Black Box' thinking

2. feedforward

3. feedback

- positive feedback
- negative feedback

4. self-regulation

5. homeostasis

the idea of the
BLACK BOX

this 'thing'

SOME
DESIRED
OUTCOMES

black box as an unknown system



the Box's 'inputs' and 'outputs'

the idea of
feedforward



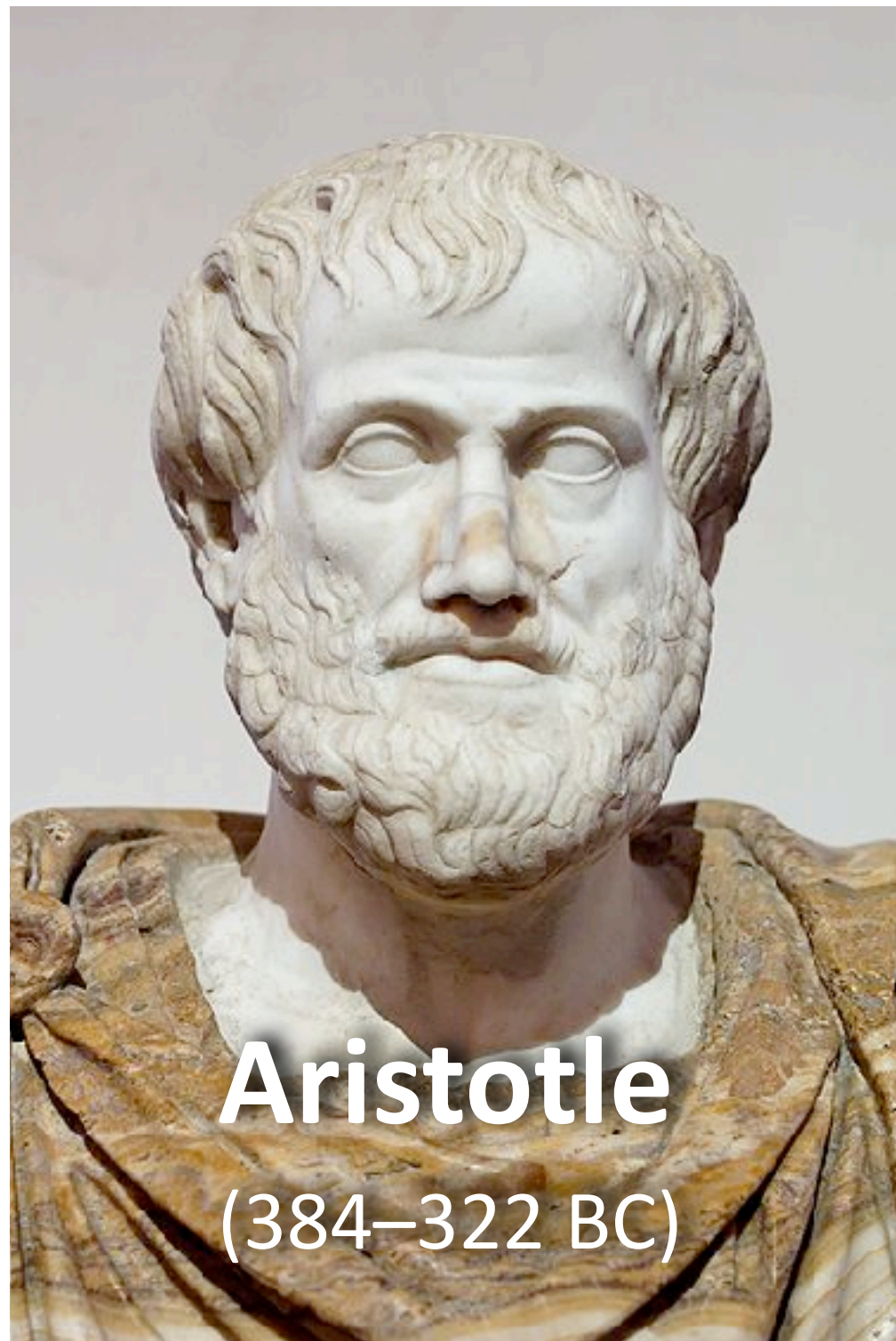
stockpiling

feedforward is anticipatory

A close-up photograph of a person's hands and torso while sitting in a car. The person is wearing a grey sweater over a white collared shirt. They are buckling their seatbelt, with one hand holding the buckle and the other holding the strap. The car's interior, including the black leather seat, door panel, and gear shift, is visible. A semi-transparent dark rectangle is overlaid on the center of the image, containing the text "wearing seatbelts" in a light blue, sans-serif font.

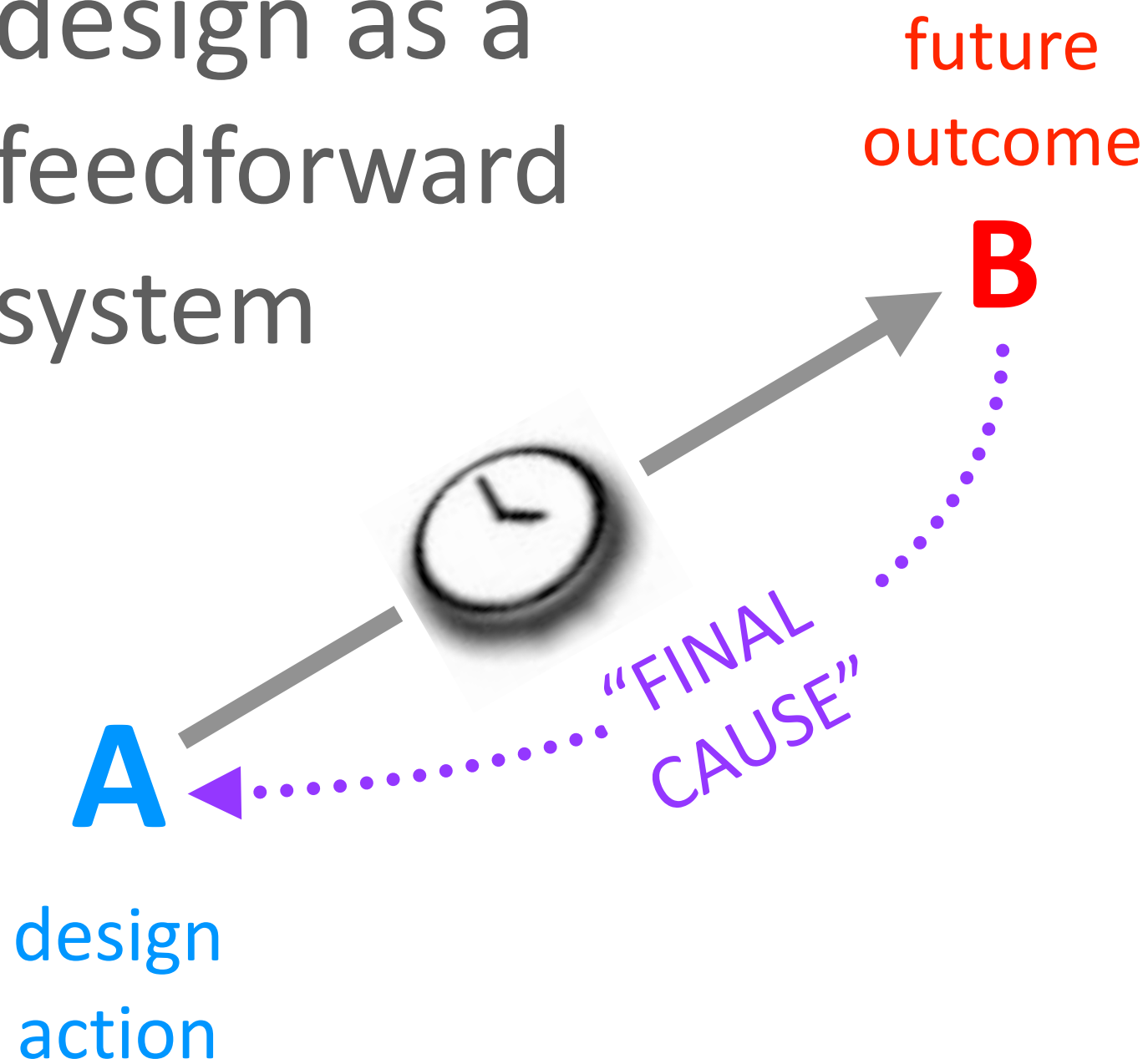
wearing
seatbelts

feedforward is anticipatory



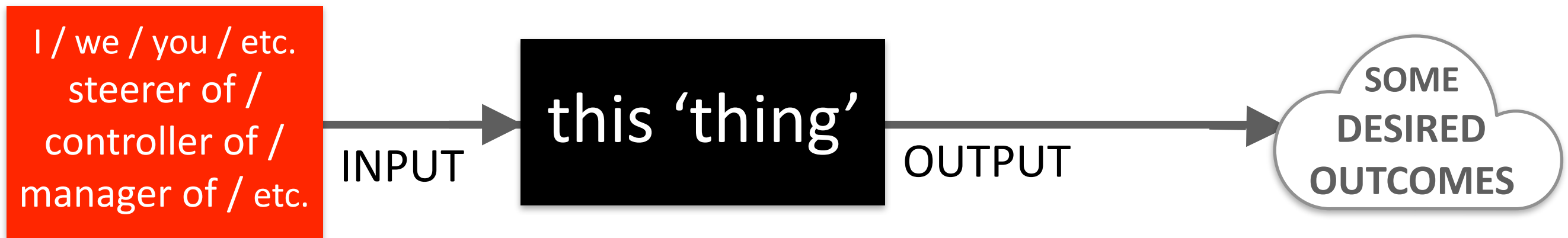
Aristotle
(384–322 BC)

design as a
feedforward
system

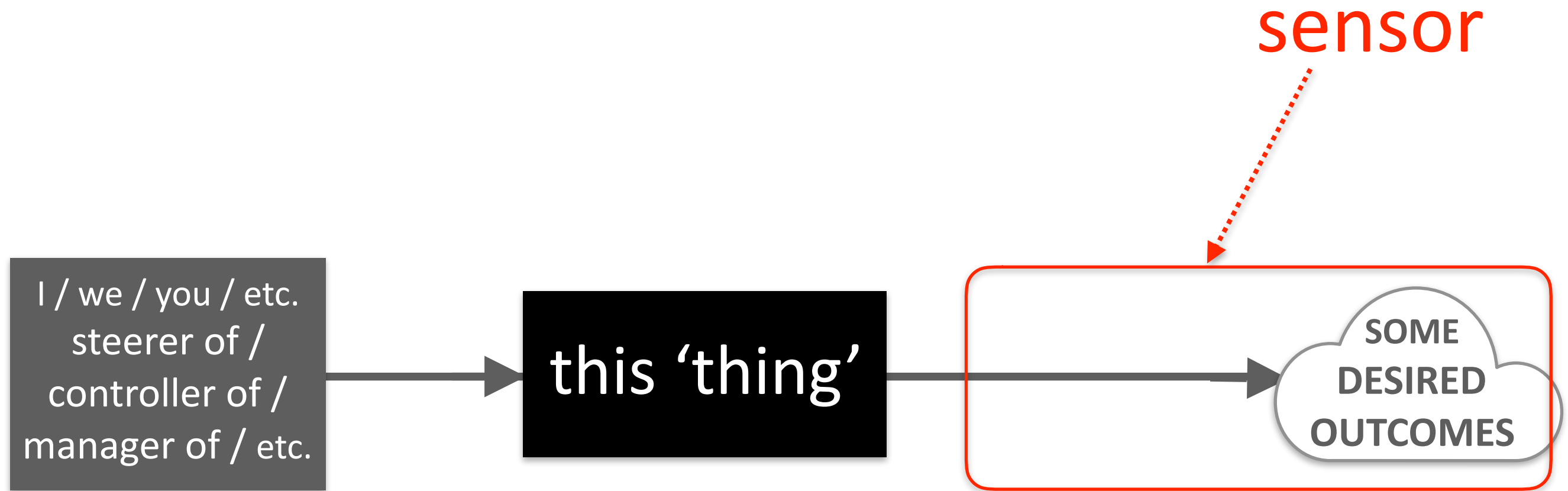


he saw **B** as the 'cause' of **A**

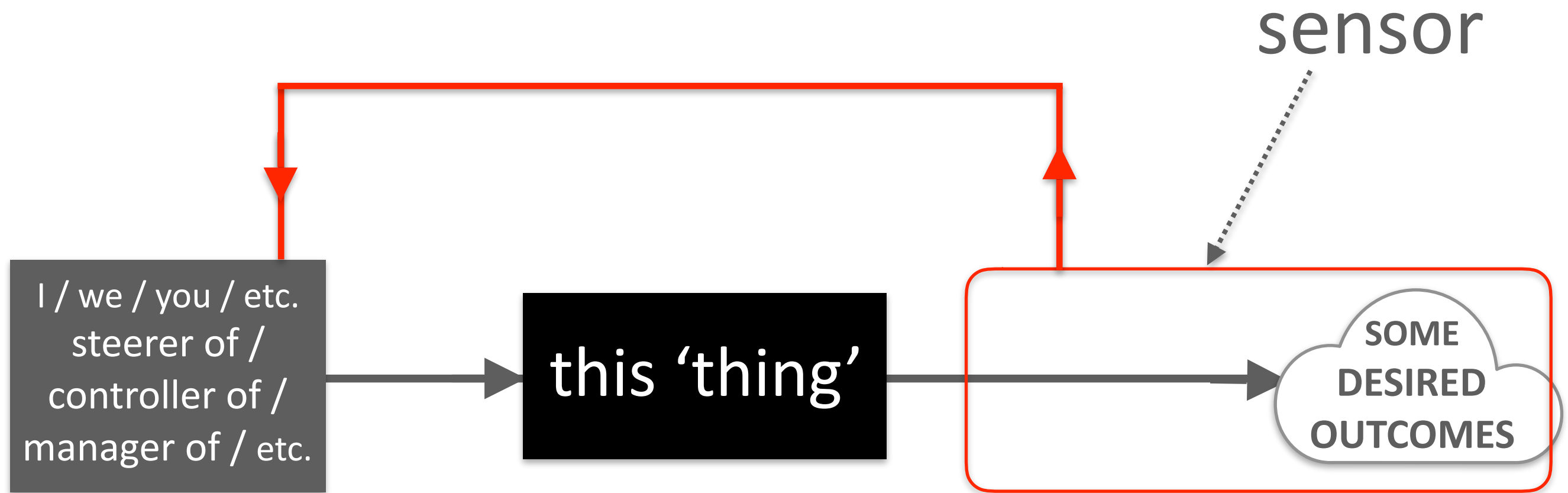
feedforward is anticipatory



the 'regulator' or 'ruler'

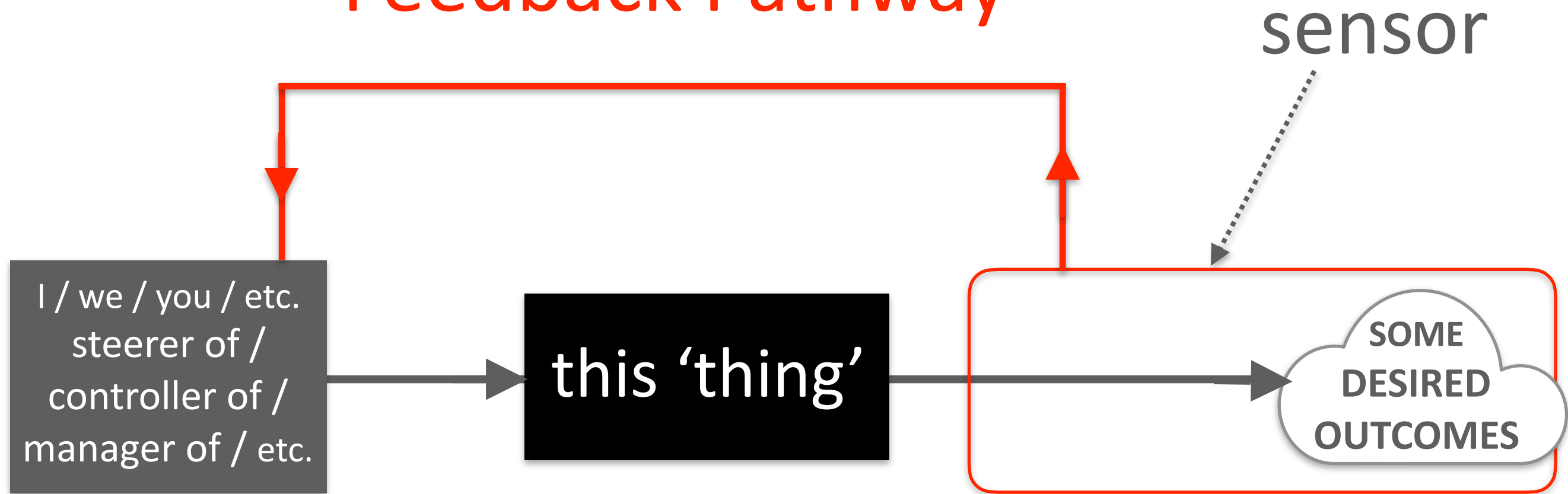


the sensory system



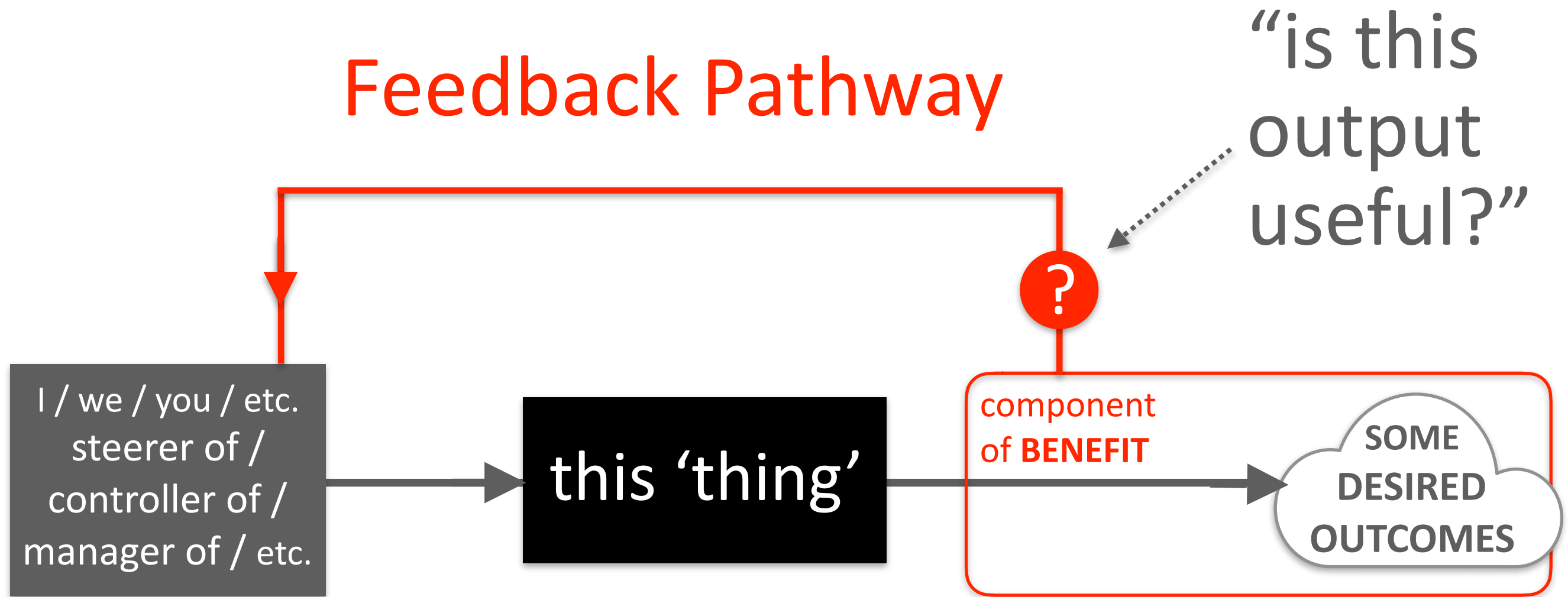
observation/monitoring

Feedback Pathway



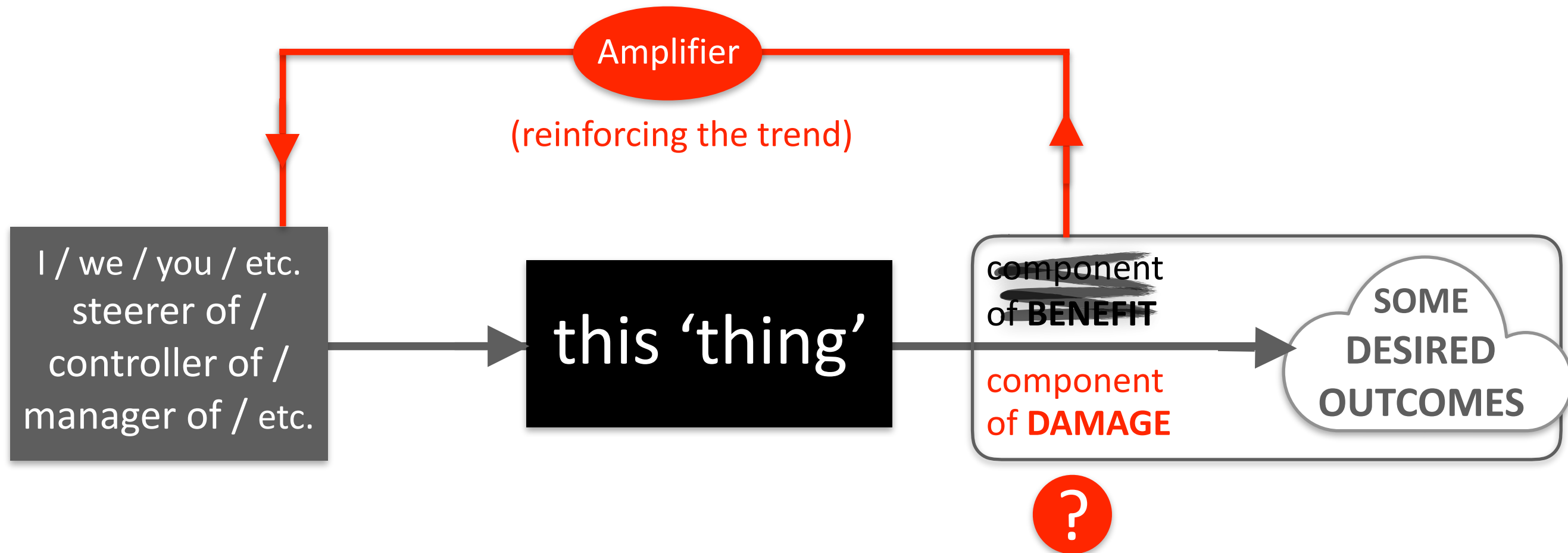
information feedback pathway

Feedback Pathway



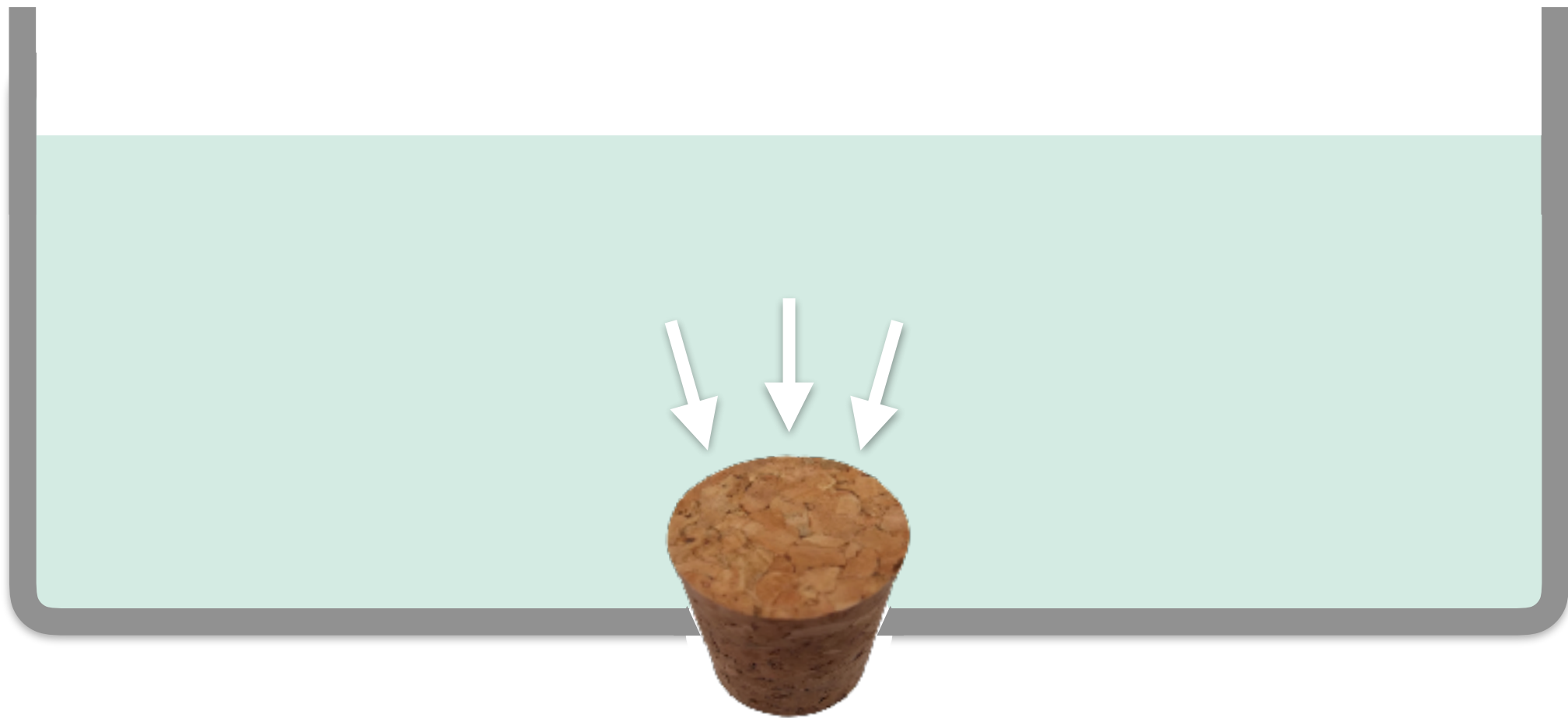
information feedback pathway

Positive Feedback

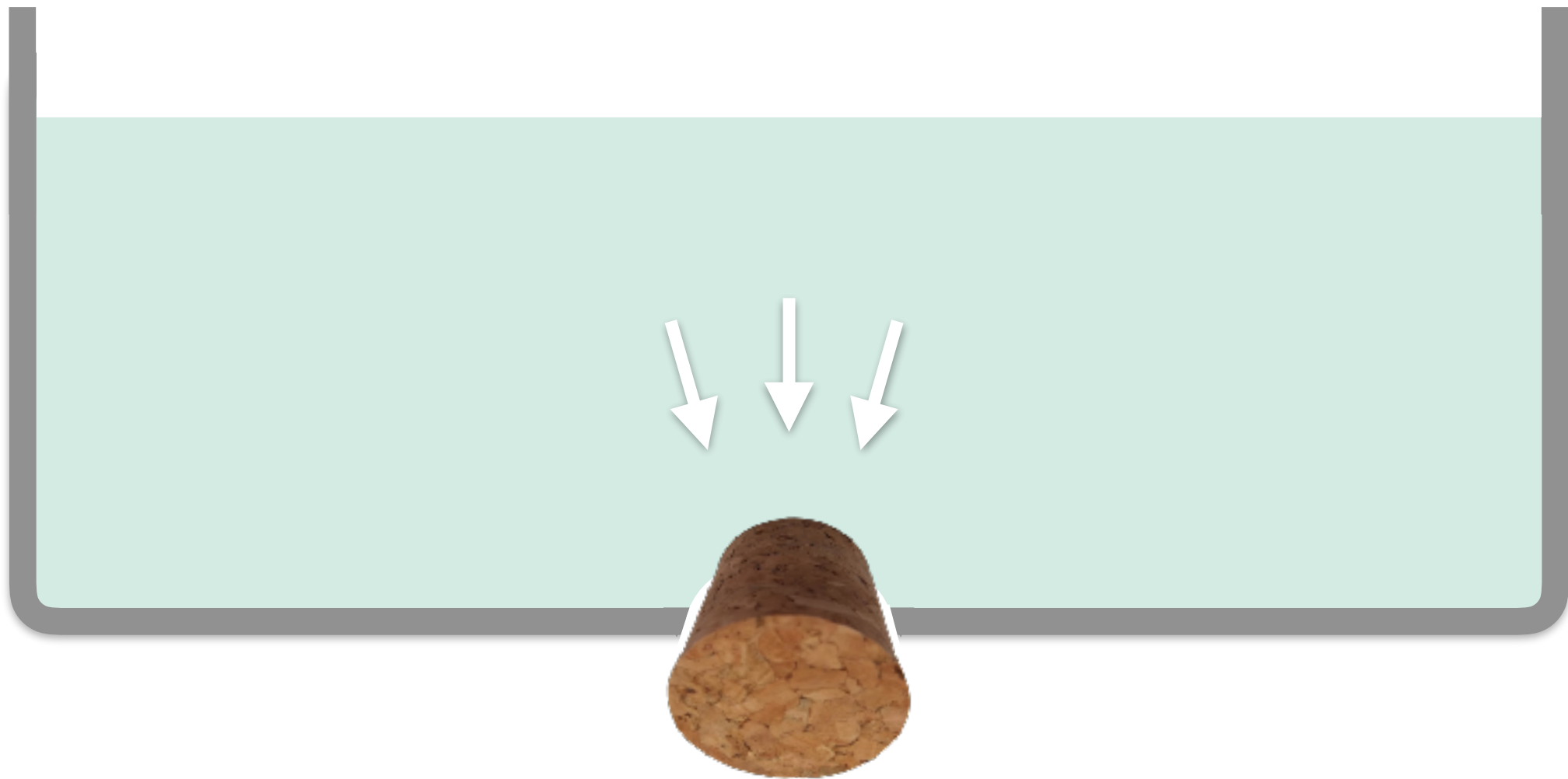


Here, '**positive**' does NOT mean helpful or beneficial. It simply means that the information gets reinforced. EITHER 'errors' compounded OR useful things strengthened.

POSITIVE feedback pathway



positive feedback in a stable system

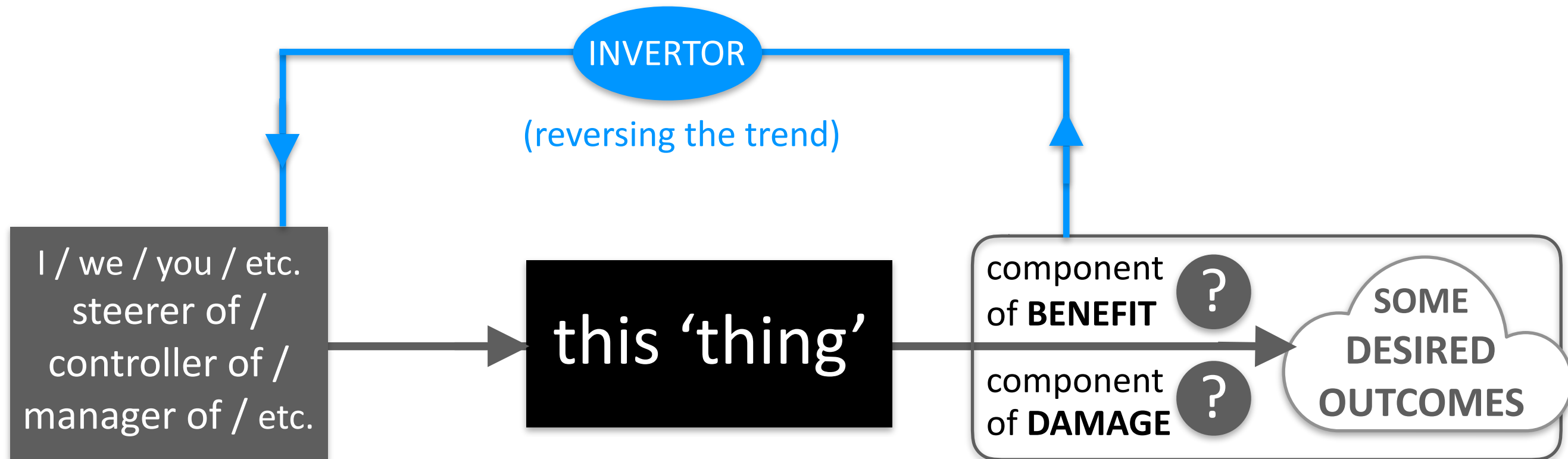


positive feedback in a runaway system



irreversible positive feedback system

Negative Feedback



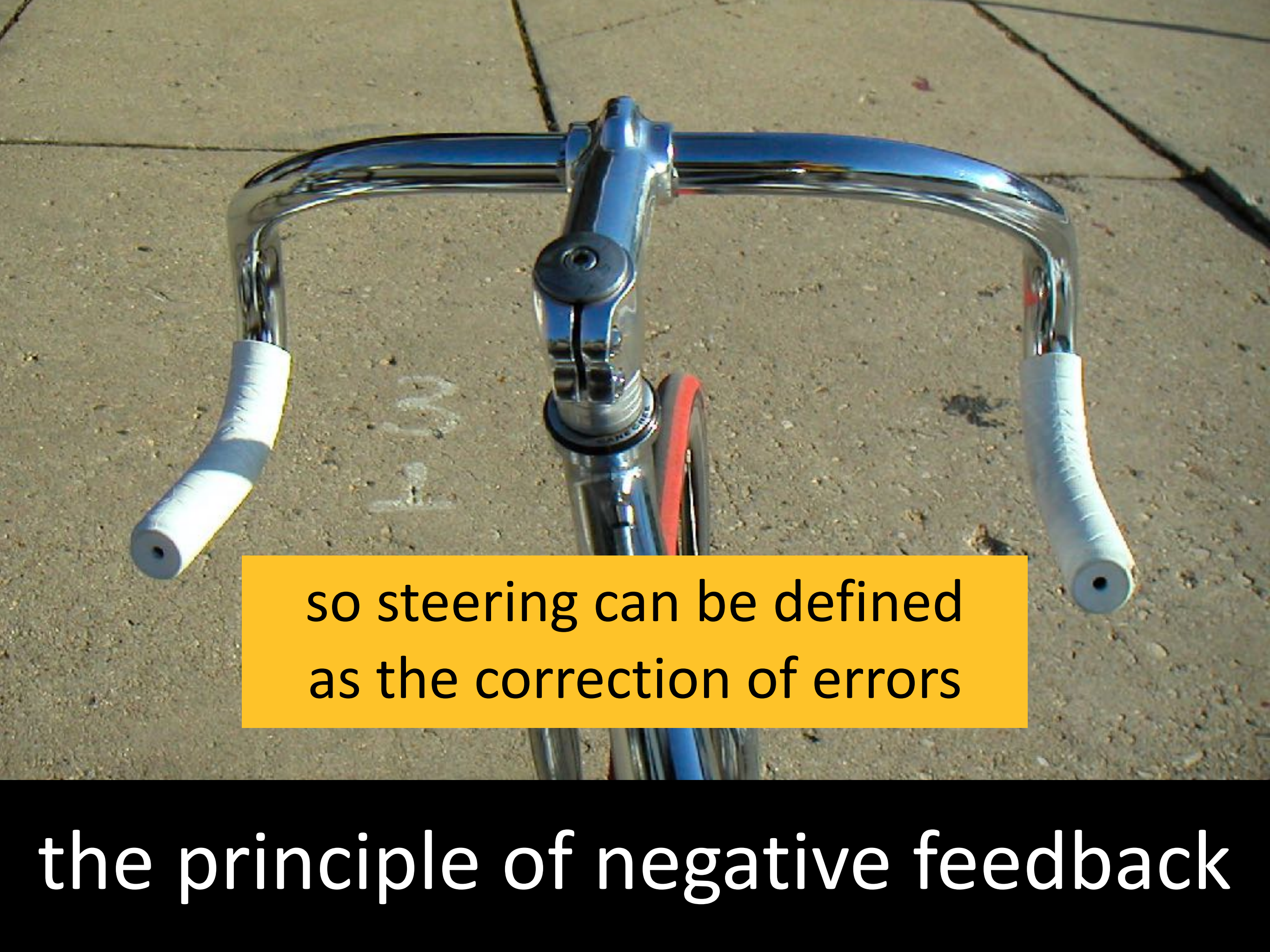
Here, '**negative**' does NOT mean damaging or wrong.
It simply means a reversal of the trend in information
EITHER 'errors' corrected OR useful things made *less* useful

NEGATIVE feedback pathway



in 'negative feedback', corrective information goes to the steerer

cybernetics: the idea of steering



so steering can be defined
as the correction of errors

the principle of negative feedback

It is not the not the mechanism, but
the **principle of steering** that living
creatures & machines have in common

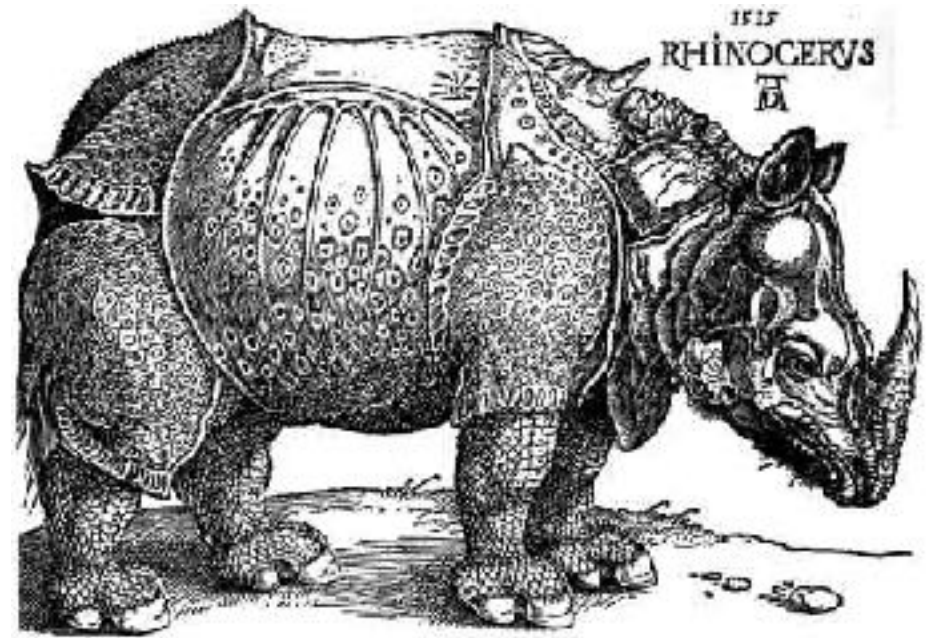


reconciling living/dead processes

the idea of
self-regulation

Erasmus

(1469-1536)
the idea of
'self-regulation'



Rene Descartes (1637)

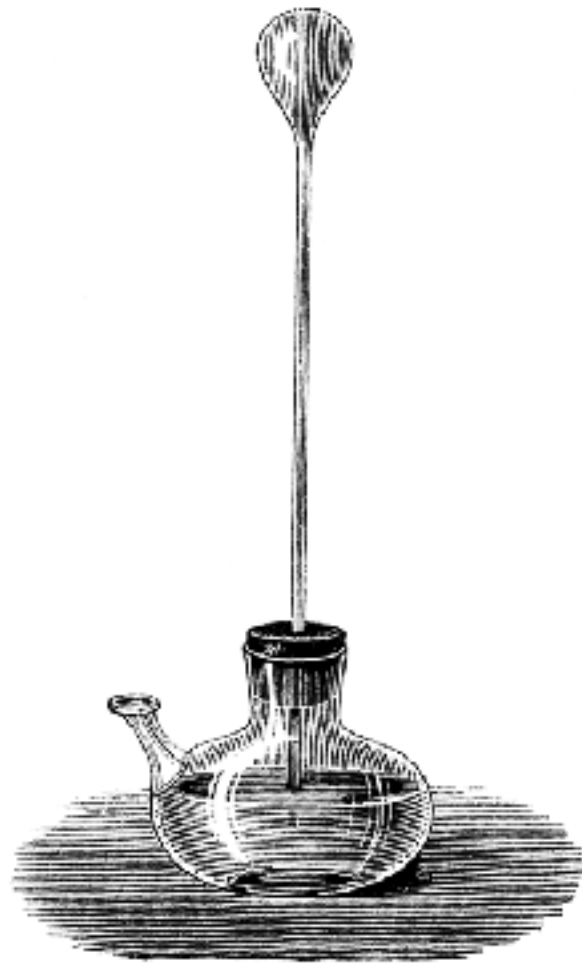
“animals are self-moving machines”



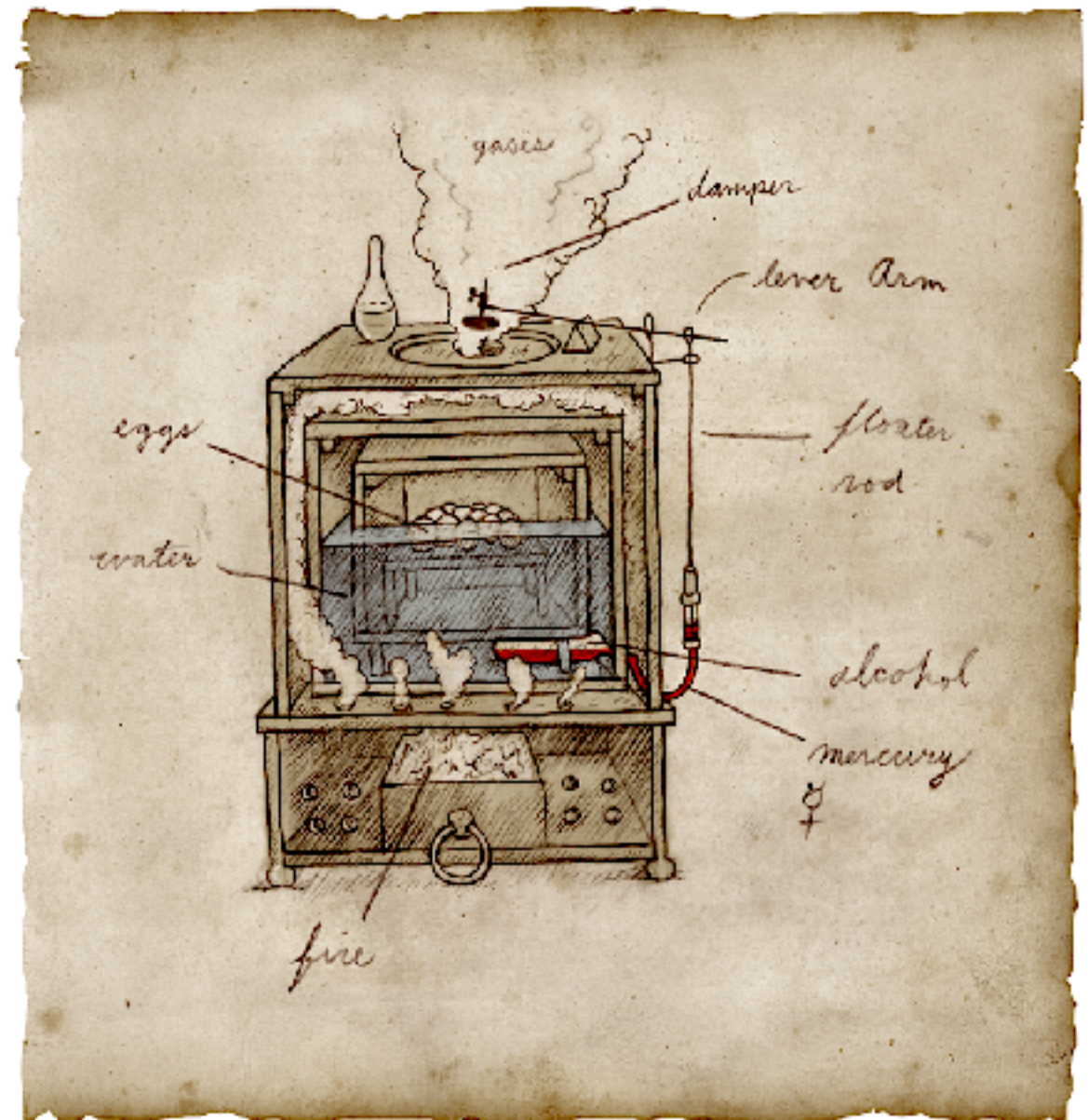
Adam Smith - “The Wealth of Nations” (1776)
the idea of an ‘invisible hand’ guiding the flow
of money within the economic system

Erasmus was a humanist

16th to 17th century



Galileo Galilei (1564-1642)
the thermoscope (1593)



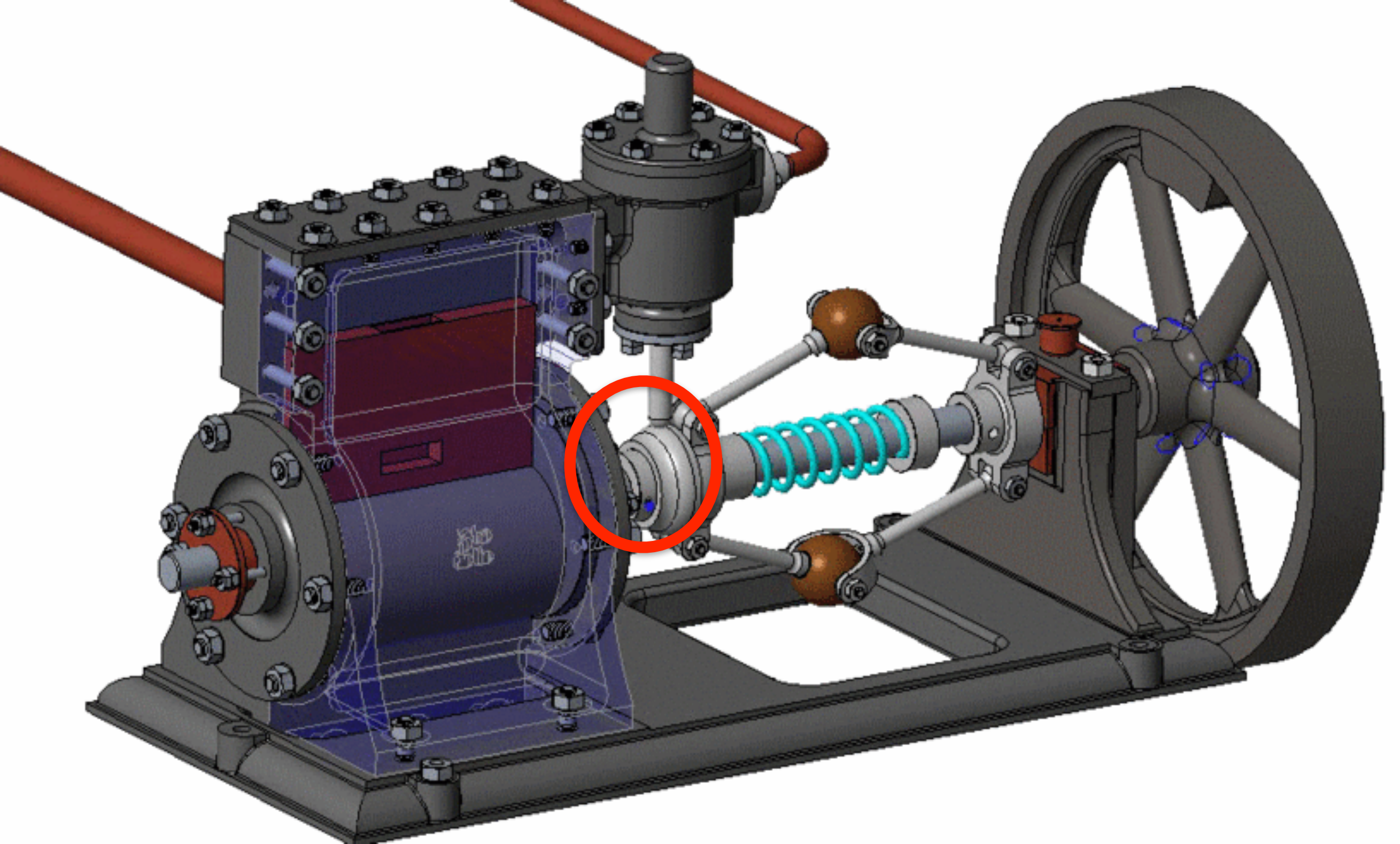
Cornelius Drebbel (1572-1633)
thermostatic oven regulator

negative feedback in machines

21st century



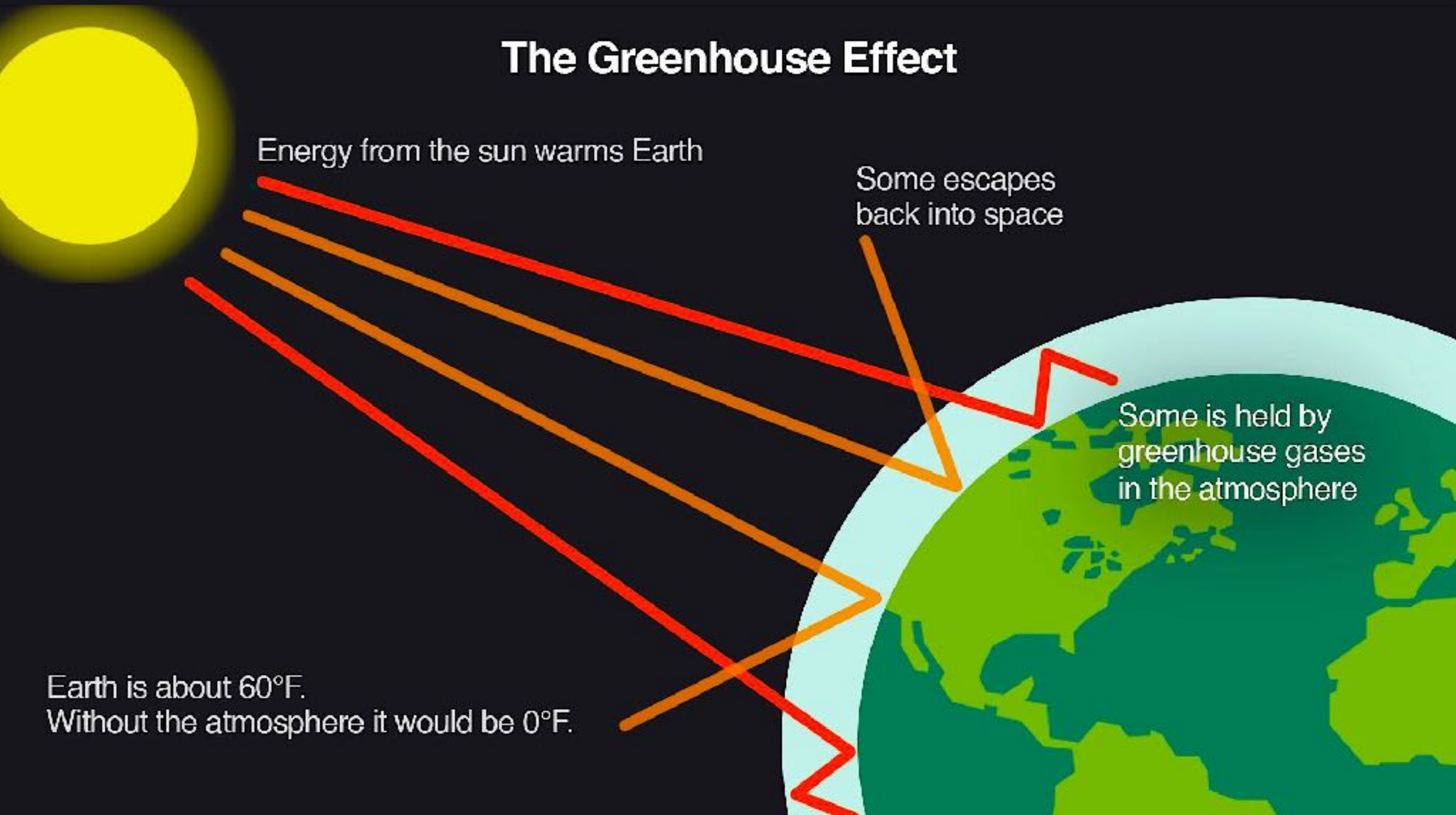
but thermostats don't experience



negative feedback in machines

the role of
feedback in
Global Warming

The Greenhouse Effect



what is Global Warming?

the idea of
paradigms

paradigm 1



παραδείγματι

‘deigma’ (from ‘deiknumi’ = “I show”)



a display / exhibition / display sample



best factory sample was known as a ‘paradeigma’



Plato’s use of the term

- **Ferdinand de Saussure (1857-1913)** : a class of elements with 'similar meanings' (in language and grammar)
- **Thomas Kuhn (1962)** extended the term to other disciplines and described paradigm change in academic disciplines.
- **Donella Meadows (1995)** adopts a practical, systemic approach to changing the paradigm ('levers for change')

later meanings of 'paradigm'



21st century building paradigm

Ford model T (1919)

national / international
marketing strategies

driving accessories

medical procedures
for road accidents

weight-loss
therapies

commuter belts

tarmac roads

credit cards

music genres
for driving

out of town
supermarkets

accident insurance

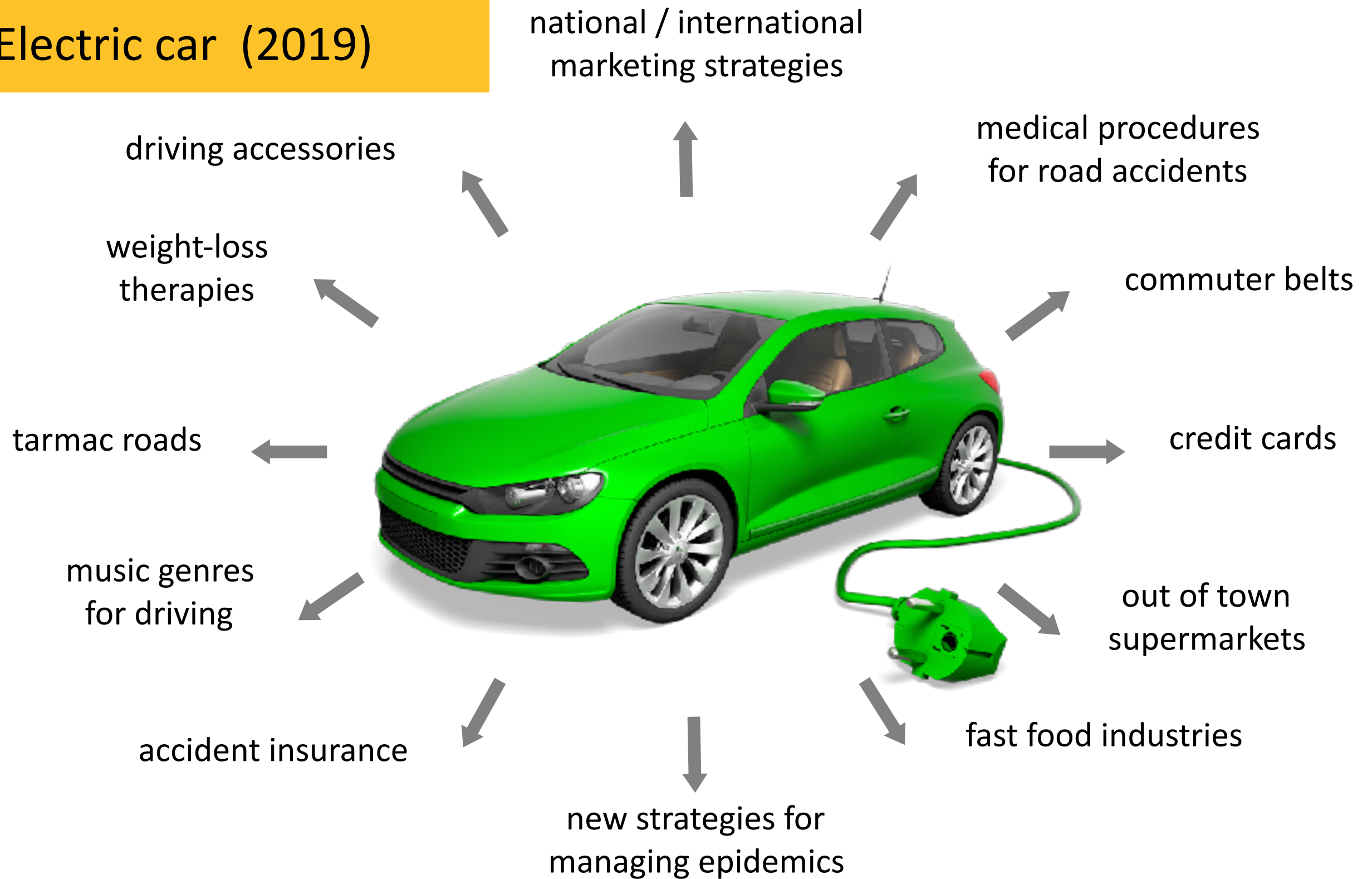
fast food industries

new strategies for
managing epidemics

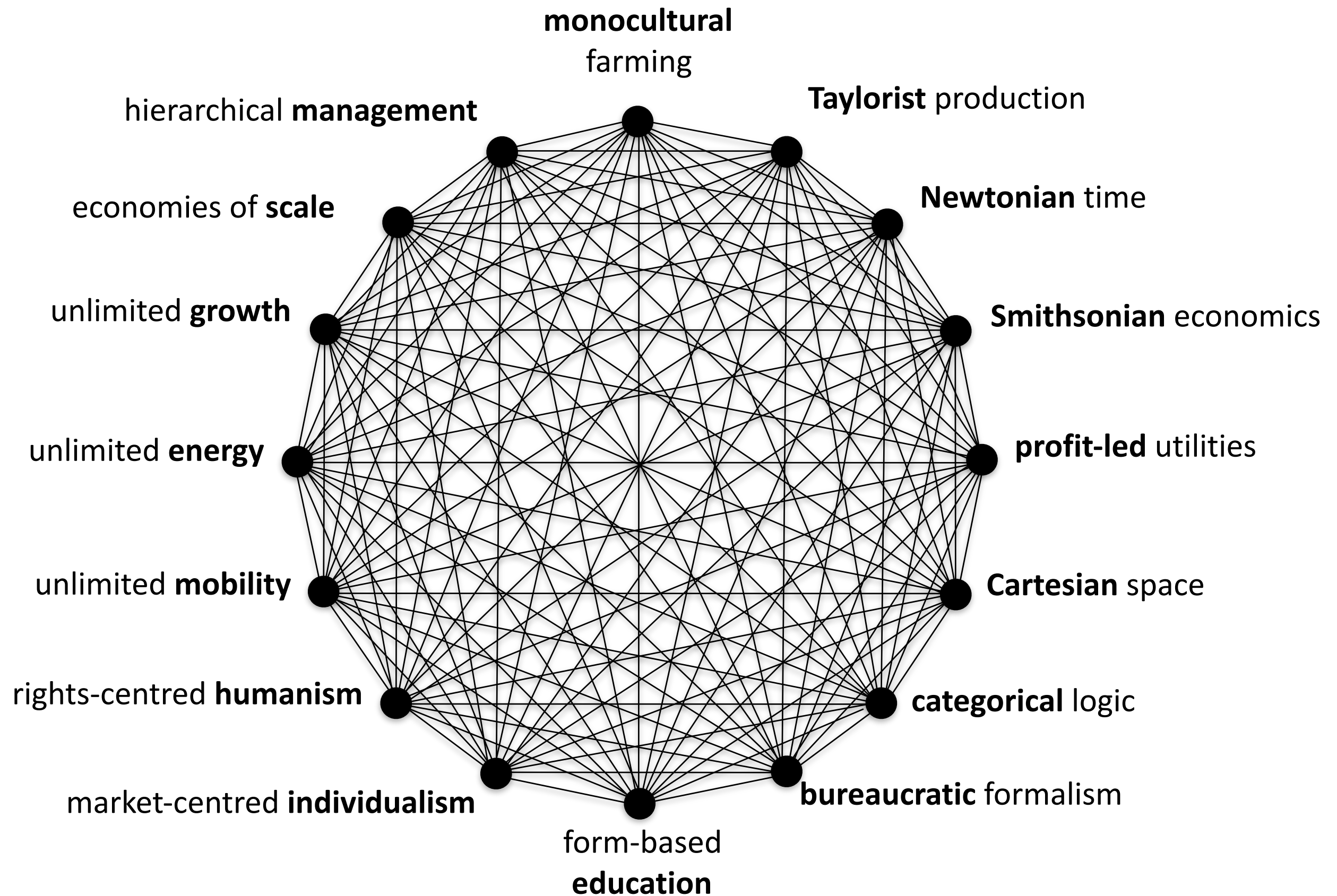


industrial paradigms are allopoietic

Electric car (2019)



can we re-design paradigms?



we are trapped in a paradigm-of-paradigms

c. 10,000 yrs ago



we swapped uncertainty for tedium



ONLY VARIETY CAN CONTROL VARIETY
in order to maintain itself
only the system's own variety
can successfully modify its variety

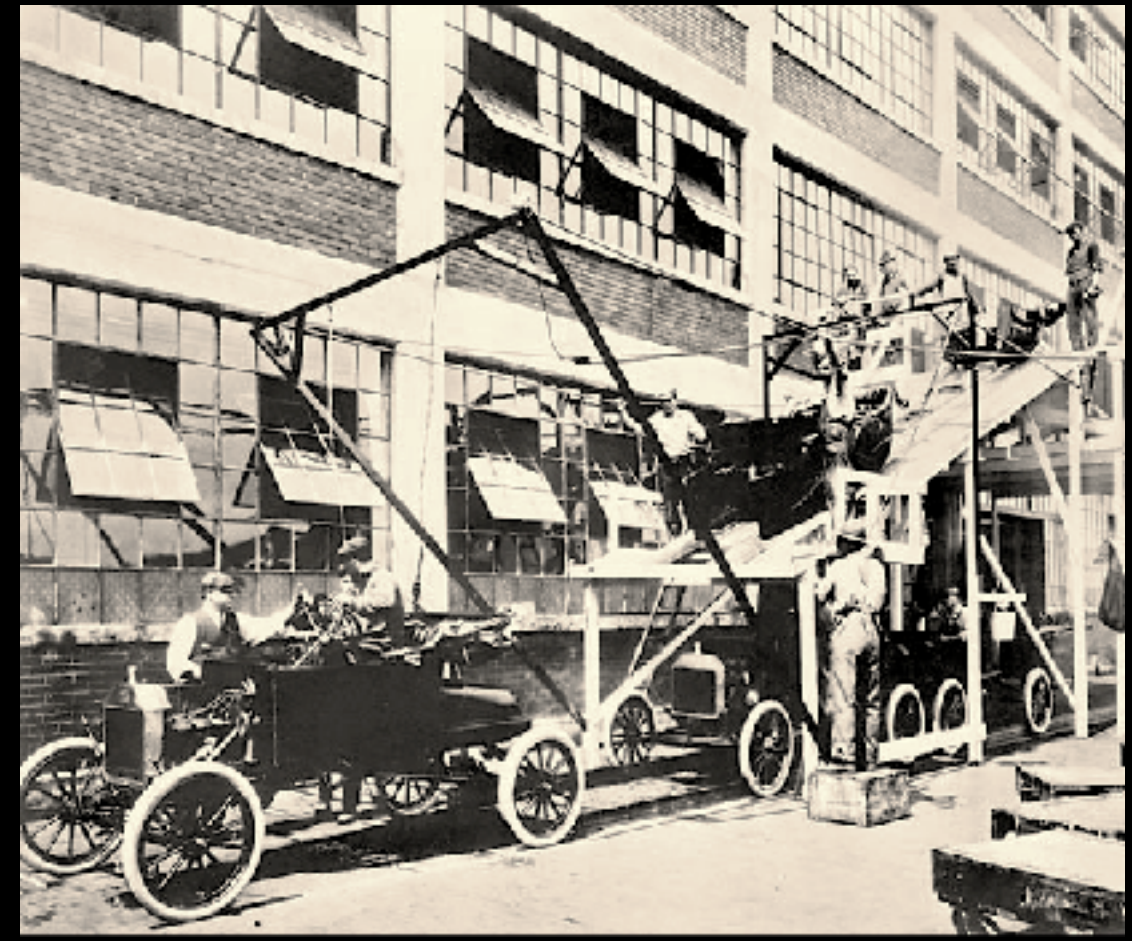
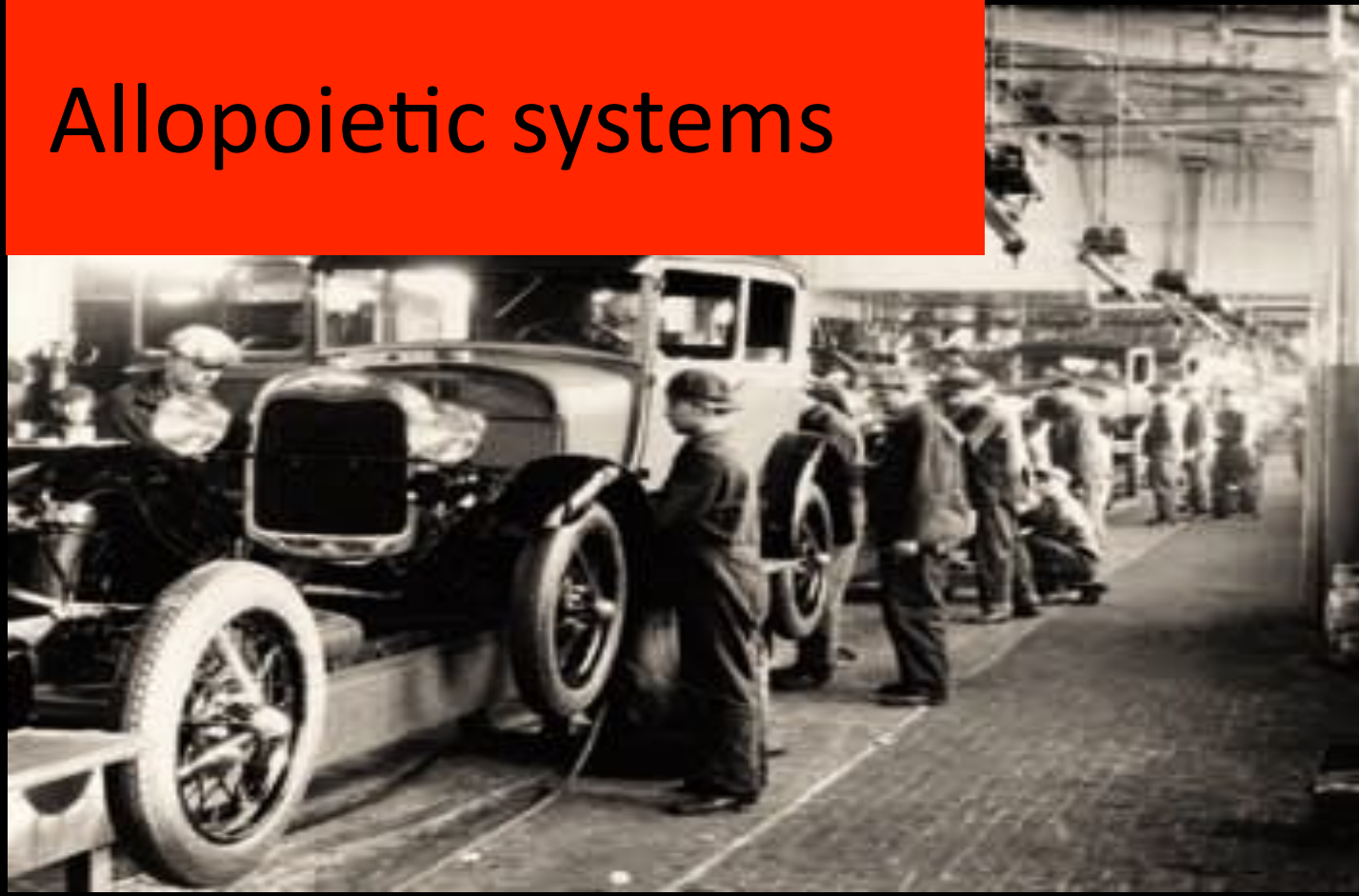
Ashby's 'Law of Requisite Variety' (1956)

ALLOPOIESIS

the process by which
a system produces
something other
than itself

(from Greek: 'allo' = 'other' / 'different'.
'poiesis' = 'bringing forth' / 'creation')

Allopoietic systems



a production line is often used as an example



G20 GERMANY 2017
HAMBURG



fiscal governance is standard

12. Constants, parameters, numbers e.g. subsidies, taxes, standards
11. Size of buffers & other stabilizing stocks, relative to their flows
10. Structure of material stocks and flows
e.g. transport network, population age structures
9. Length of delays, relative to the rate of system changes
8. Strength of negative feedback loops
(relative to the effect they are trying to correct against)
7. Gain around driving positive feedback loops
6. Structure of information flow - who has access to information?
5. Rules of the system e.g. incentives, punishment, constraints
4. Power to add, change, evolve, or self-organize system structure
3. Goal of the system
2. Mindset or paradigm that the system arises from:
i.e. its goals, structure, rules, delays, parameters —
1. Power to transcend paradigms

‘Levers for Change’ (Donella Meadows, 1995)

bottom-up systems



self-organization - a system's ability to 'steer' itself by adding or taking away feedback loops or by establishing new rules that make sense to it.

a good community is a living system

AUTOPOIESIS

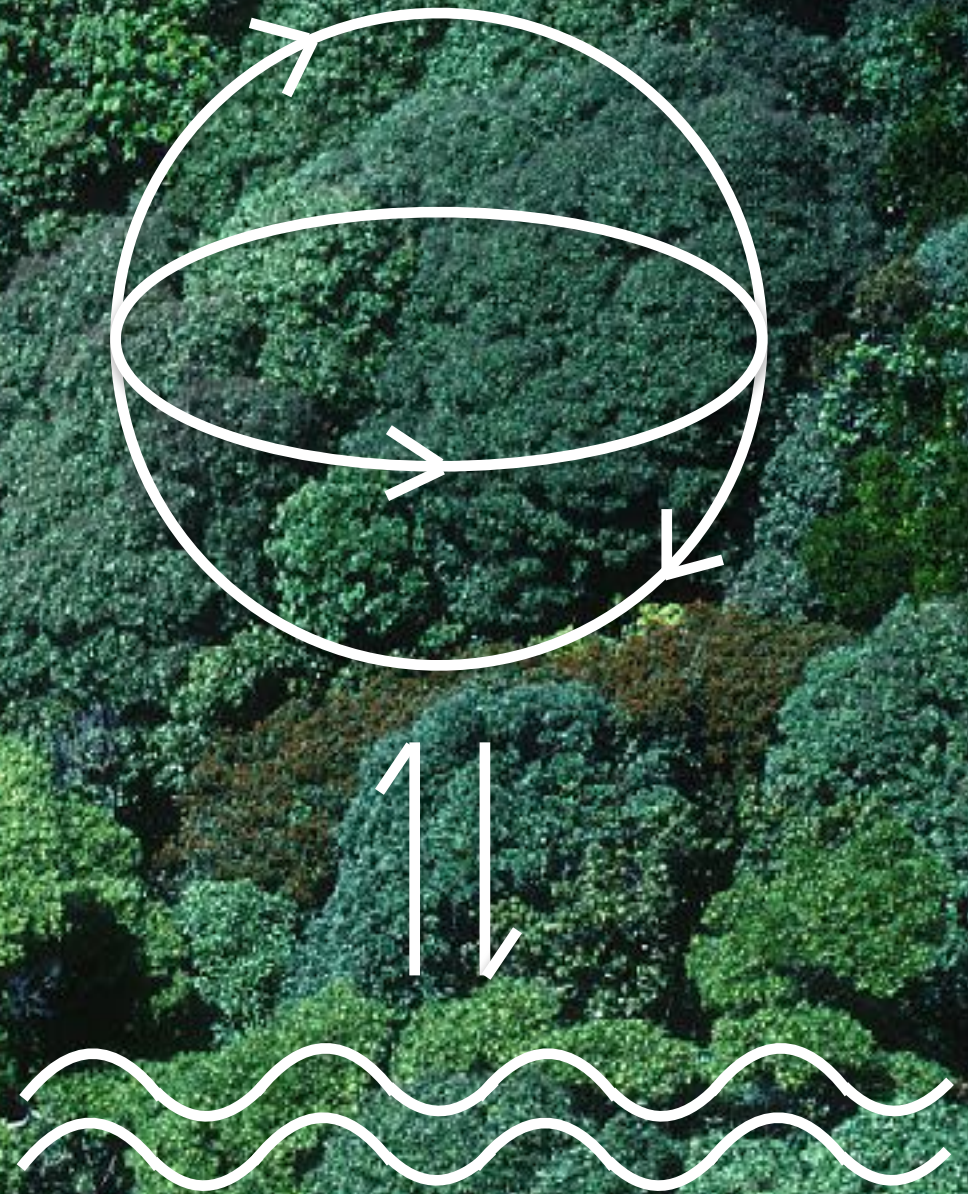
refers to systems that
produce themselves

(from the Greek: 'auto' = 'self' and
'poiesis' = 'bringing forth / 'creation')

Autopoietic systems

living systems
'create themselves'
via '*circular causality*'

they survive by managing
energy & materials flow
within their own system
in the context of their
own environment



a theory to explain living systems

Autopoietic systems



human culture has no purpose

Autopoietic systems

“the space defined by an autopoietic system is self-contained and cannot be described by using dimensions that define another space”

(Maturana & Varela, 1973)

human culture has no purpose

HOMEOSTASIS

what can we learn
from autopoietic systems?

The biological idea of 'metabolism' can also be seen in a systemic way as the self-regulation of an 'internal' environment.

(Claude Bernard, 1865)

The word *homeostasis* (*homoios*, "similar" and *στάσις stasis*) literally means "standing still" - i.e. "staying the same".

(Walter Bradford Cannon, 1926)

THANK YOU

Twitter: metadesigners

Email: maxripple@gmail.com

Website: <https://metadesigners.org/Second-Order-Systems>

