Computing Conversation / When, Why, How, Who?

pangaro.com/cmucode2019/

Paul Pangaro
Professor of Practice
Human-Computer Interaction Institute
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Computational Design Lecture Series
Computational Design Lab | Department of Architecture
Carnegie Mellon University
April 2019

HYLOZOIC GROUND
Philip Beesley / Living Architecture Systems
Canadian Pavilion, Venice Biennale
Venice 2010
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EPIPHYTE MEMBRANE
Beesley Studio / Living Architecture Systems
Opernwerkstätten
Berlin 2014
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SENTIENT VEIL
Beesley Studio / Living Architecture Systems
Isabella Stewart Gardner Museum
Boston 2017
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AMATRIA
Beesley Studio / Living Architecture Systems
Luddy Hall, Indiana University
Bloomington, Indiana 2018
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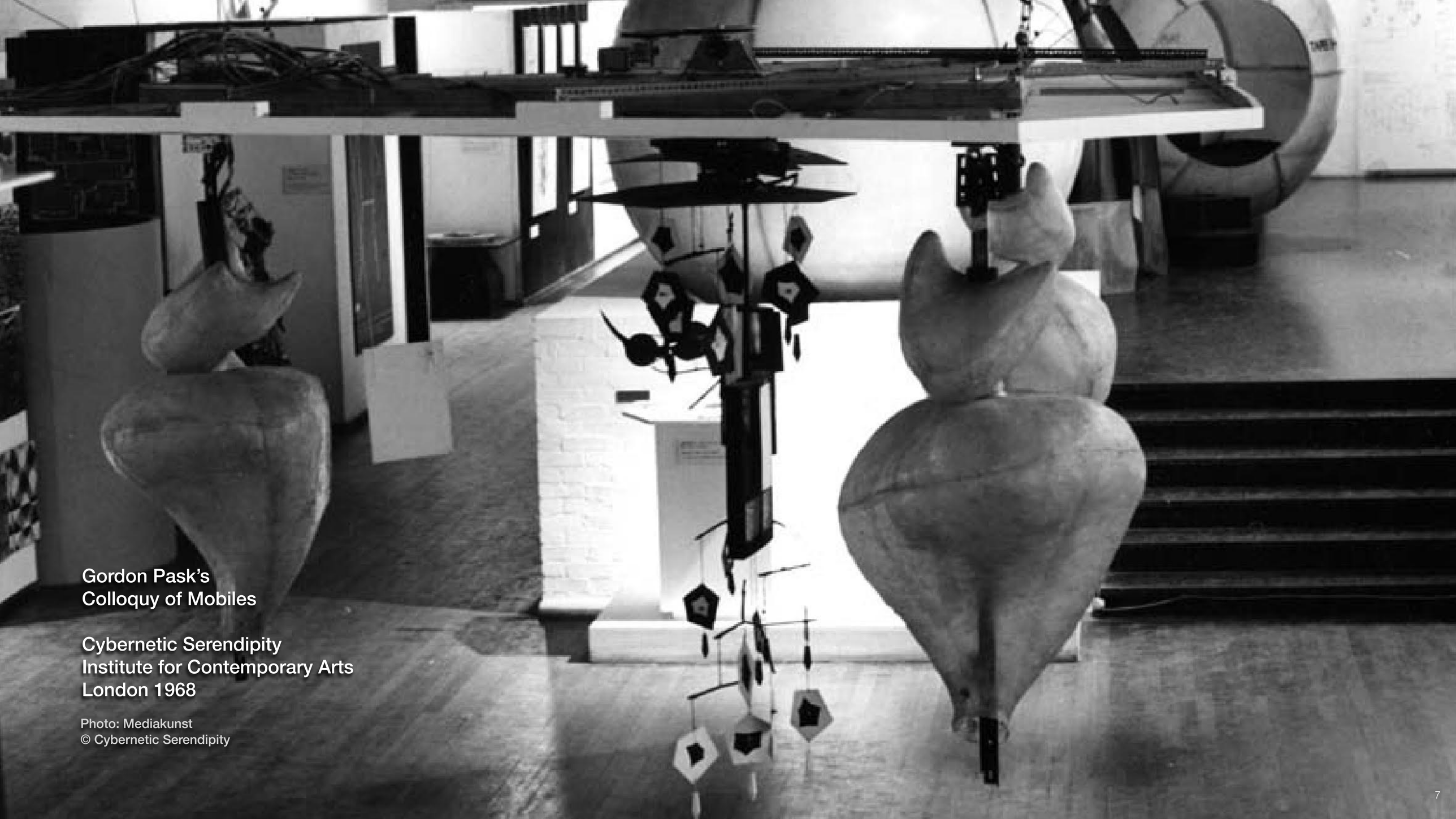
Gordon Pask's
Colloquy of Mobiles

Cybernetic Serendipity
Institute for Contemporary Arts
London 1968

Photo: Mediakunst



Gordon Pask’s
Colloquy of Mobiles

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Institute for Contemporary Arts
London 1968

Photo: Mediakunst

Gordon Pask’s
Colloquy of Mobiles

Cybernetic Serendipity
Institute for Contemporary Arts
London 1968

Photo: Gordon Pask Archive

Gordon Pask in front of a male mobile of his own design

Cybernetic Serendipity
Institute for Contemporary Arts
London 1968

Photo: Gordon Pask Archive
University of Vienna

Yolanda Sonnabend, prominent theatre and ballet designer for the Royal Ballet, designer of Colloquy’s female mobiles

Photo: © Johnny Dewe-Mathews

Cybernetic Serendipity

Serendipity

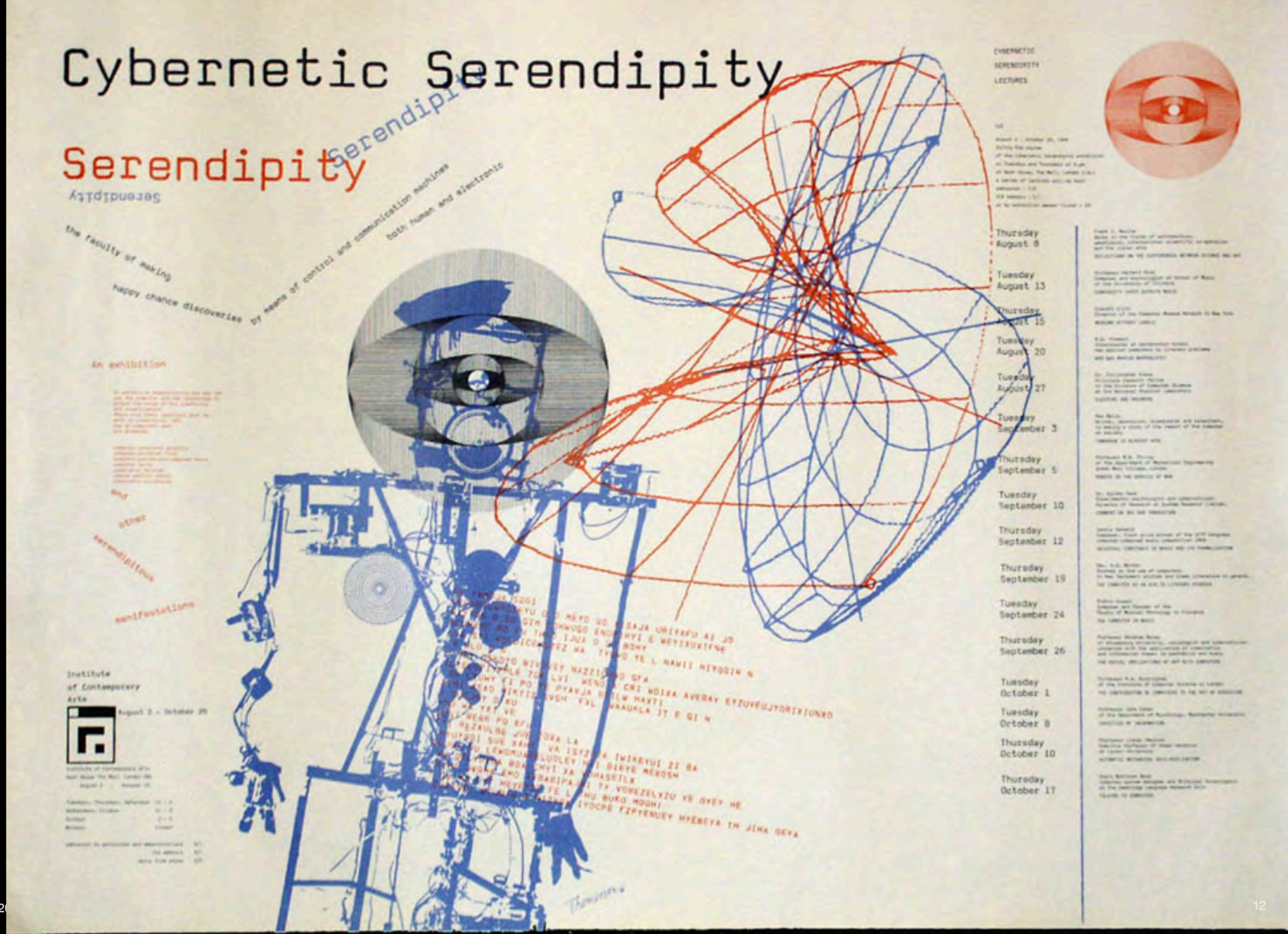
Serendipity

the faculty of making

happy chance discoveries by means of control and communication machines

both human and electronic

An exhibition



Exhibition poster by
Franciszka Themerson

Photo: Mediakunst
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Cybernetic Serendipity
Institute for Contemporary Arts
London 1968

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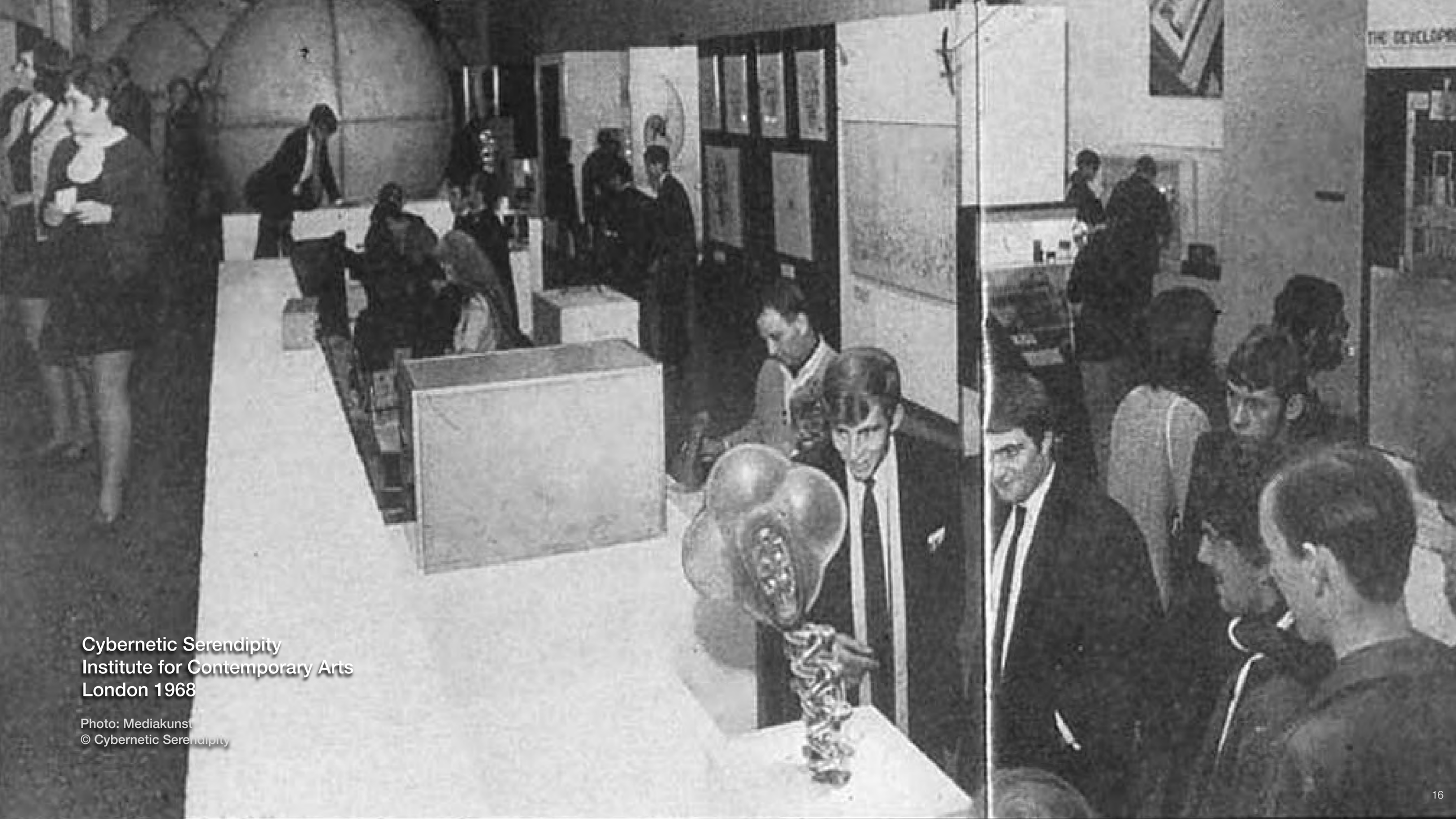
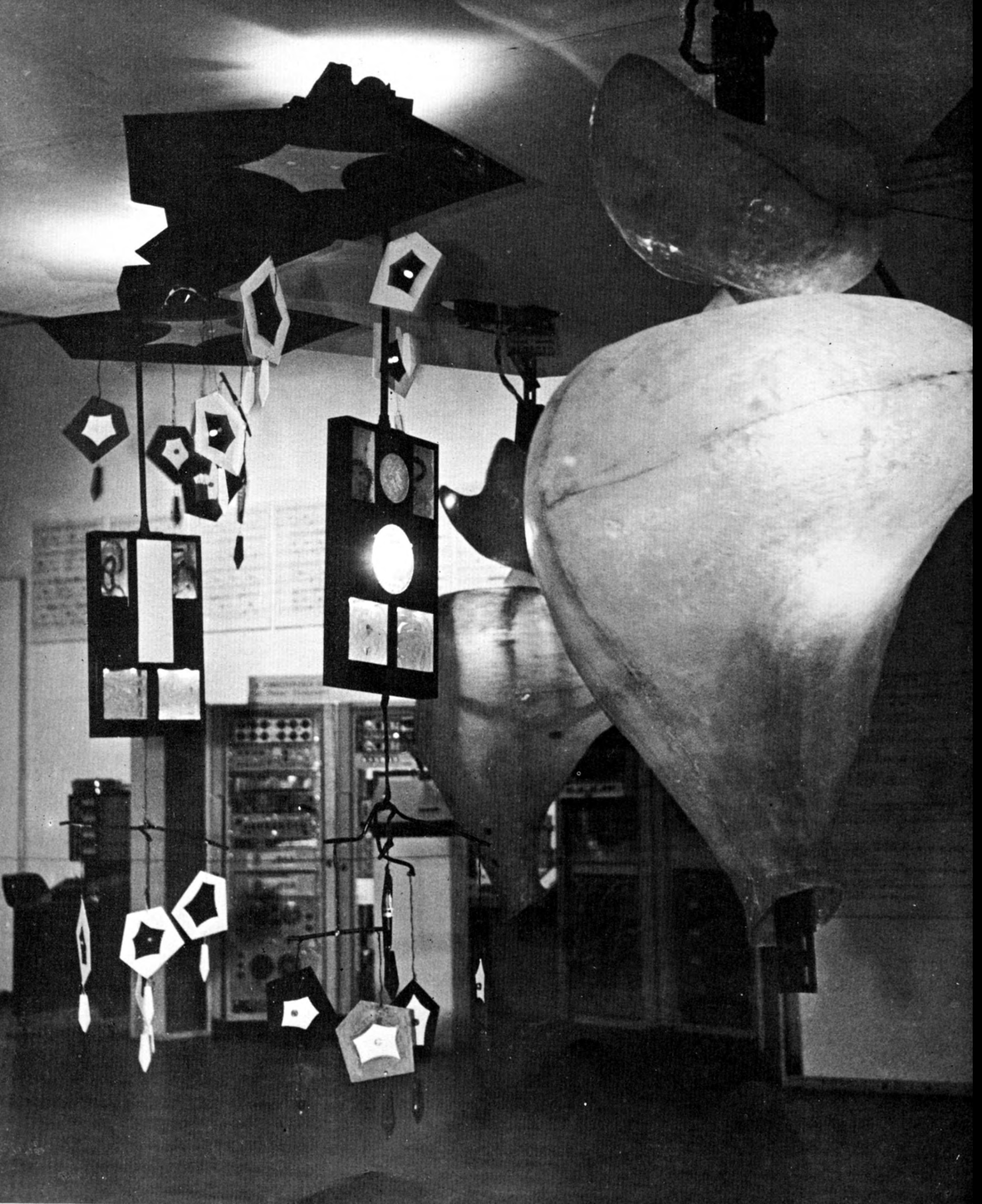
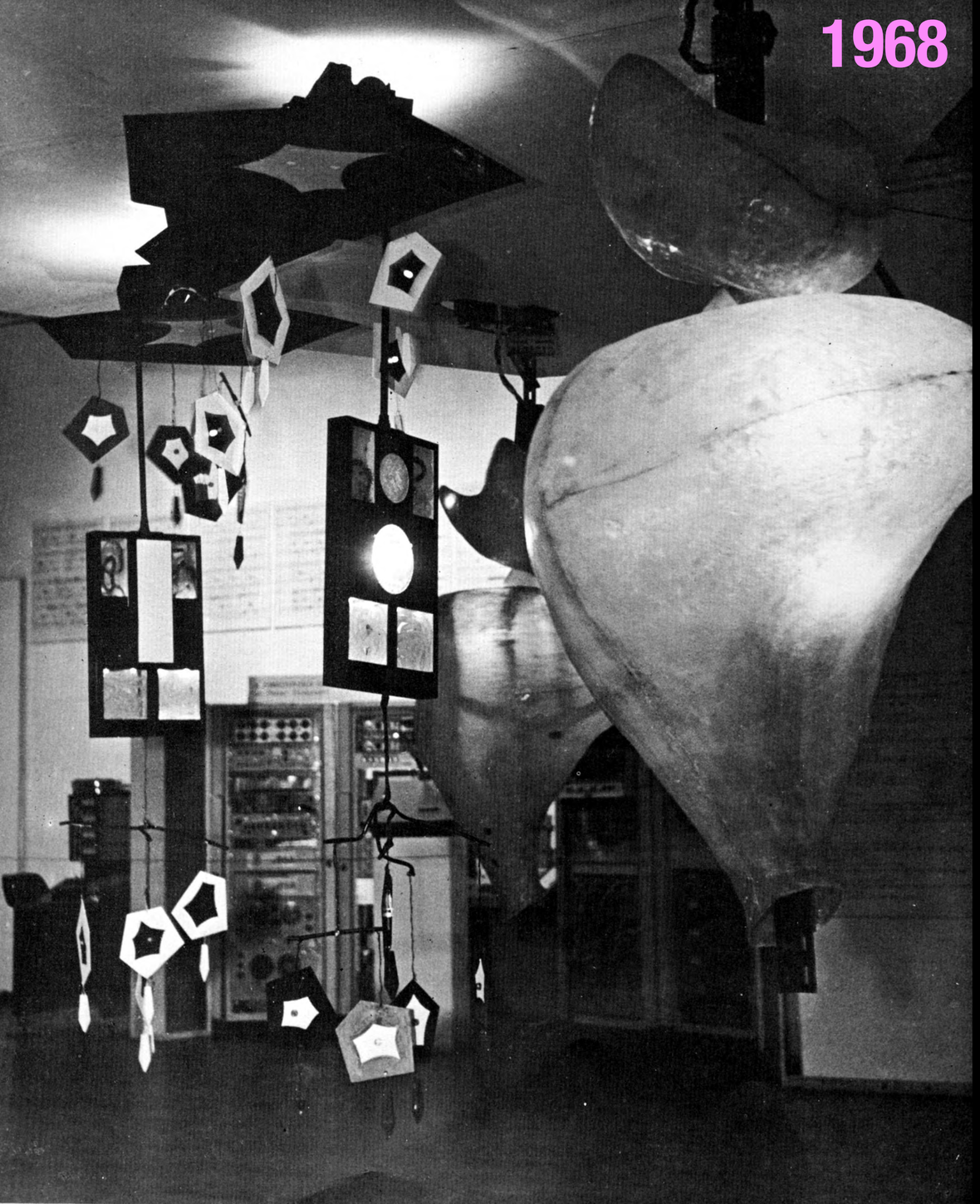


Cybernetic Serendipity
Institute for Contemporary Arts
London 1968

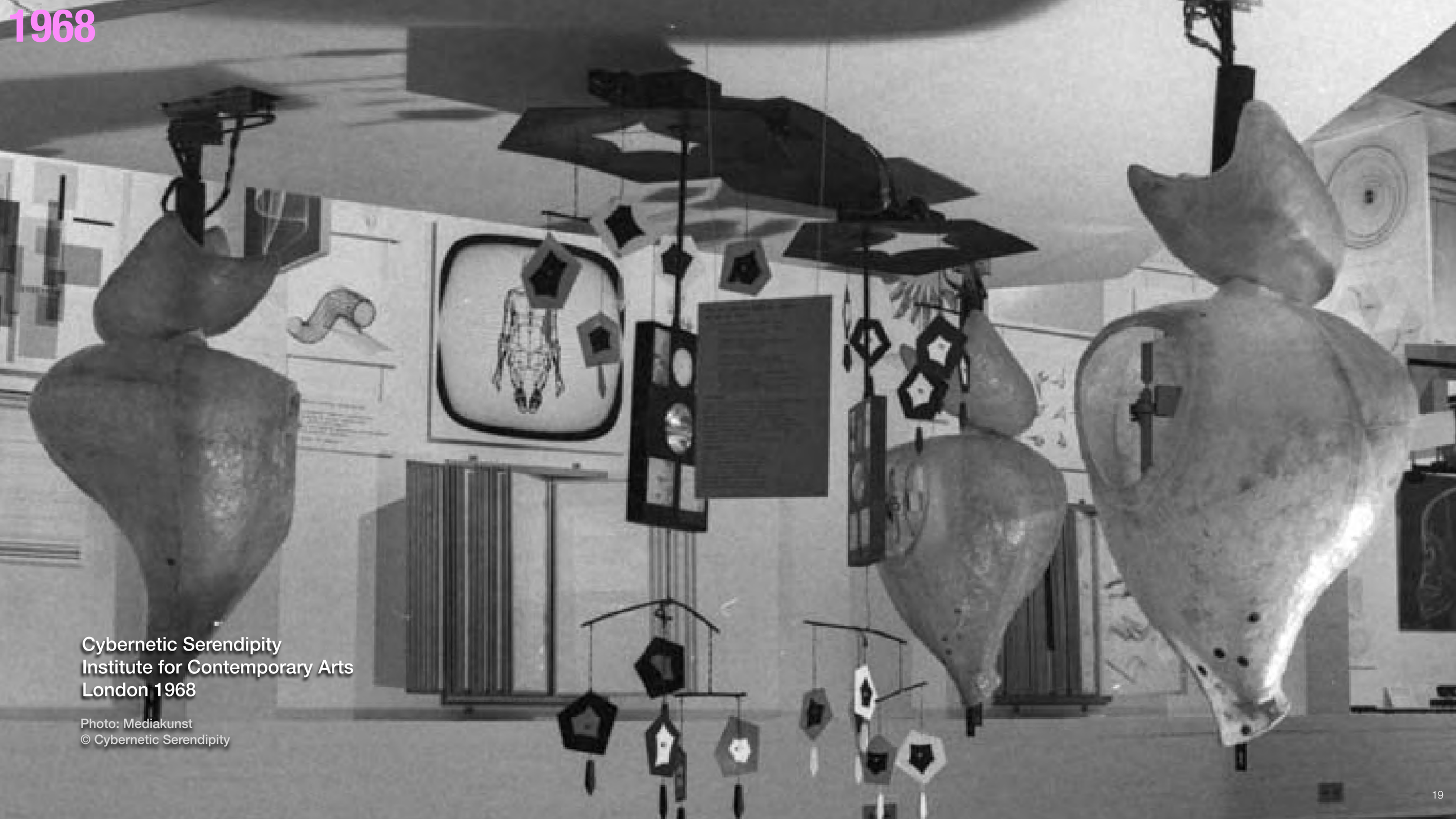
Photo: Mediakunst




1968


2018

1968



Cybernetic Serendipity
Institute for Contemporary Arts
London 1968

Photo: Mediakunst
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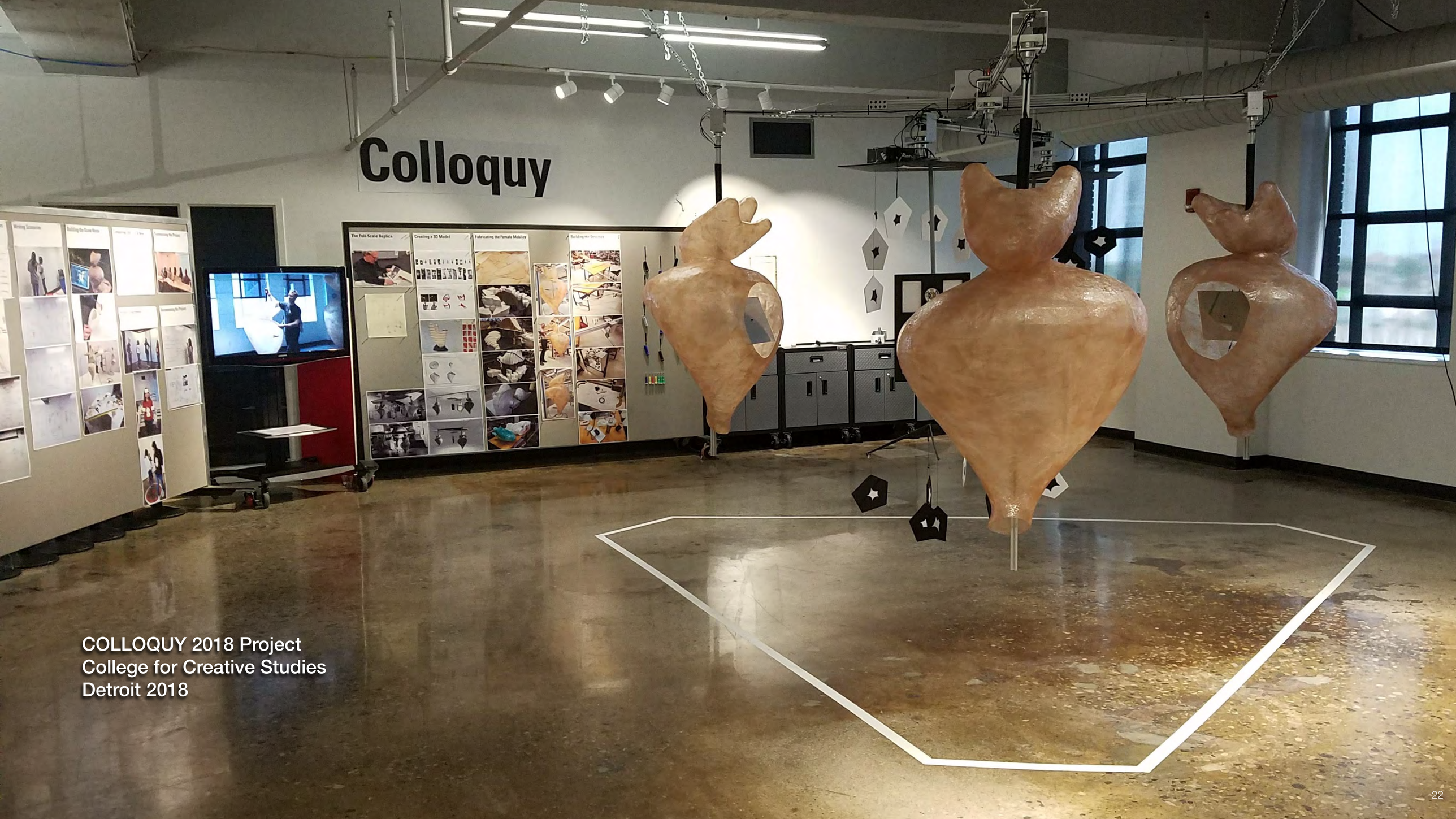
2018

COLLOQUY 2018 Project
College for Creative Studies
Detroit 2018

COLLOQUY 2018 Project
College for Creative Studies
Detroit 2018



COLLOQUY 2018 Project
College for Creative Studies
Detroit 2018

COLLOQUY 2018 Project
College for Creative Studies
Detroit 2018

Computing Conversation / When, Why, How, Who?

Gordon Pask
Female Mobile Behavior Flowchart

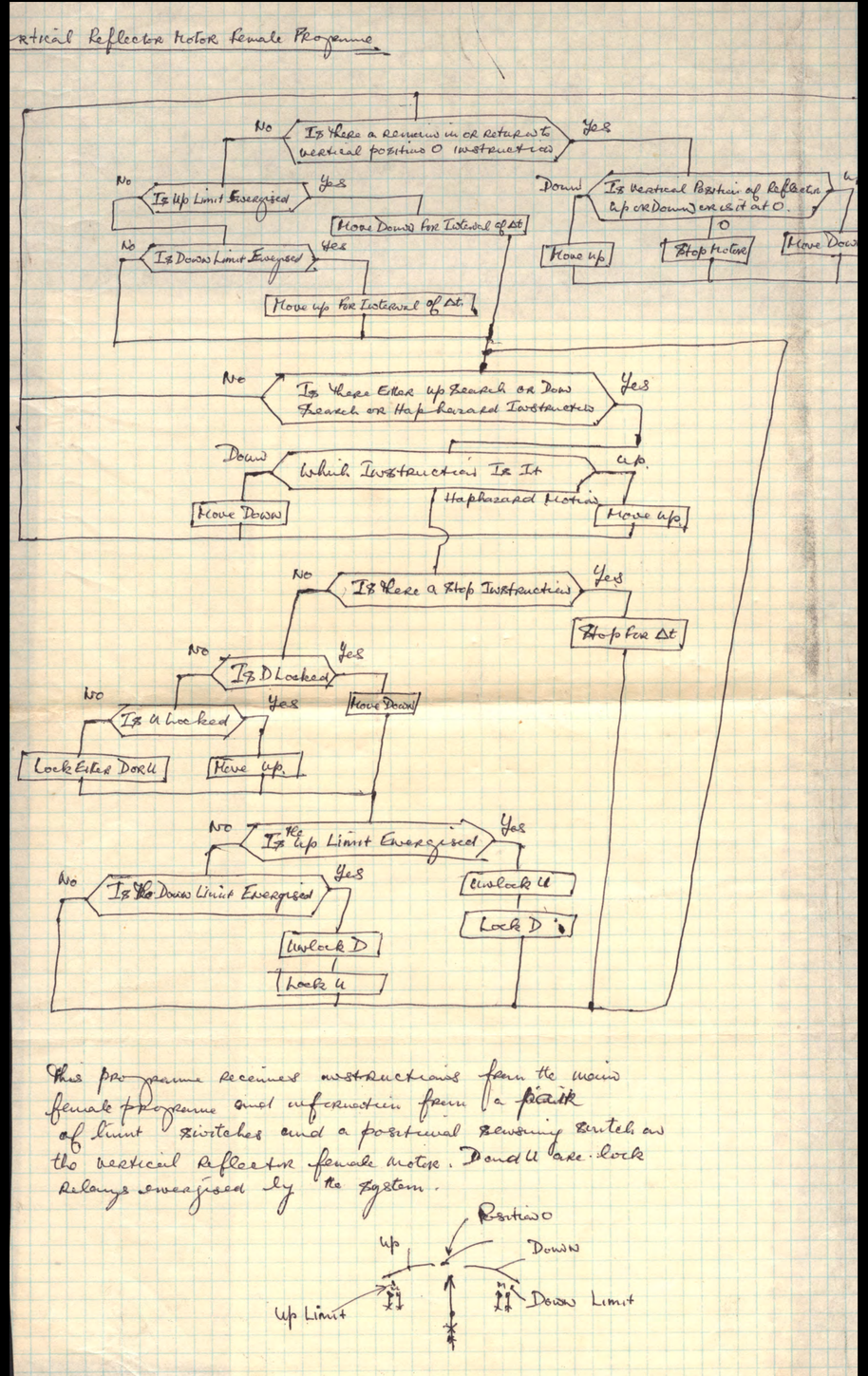
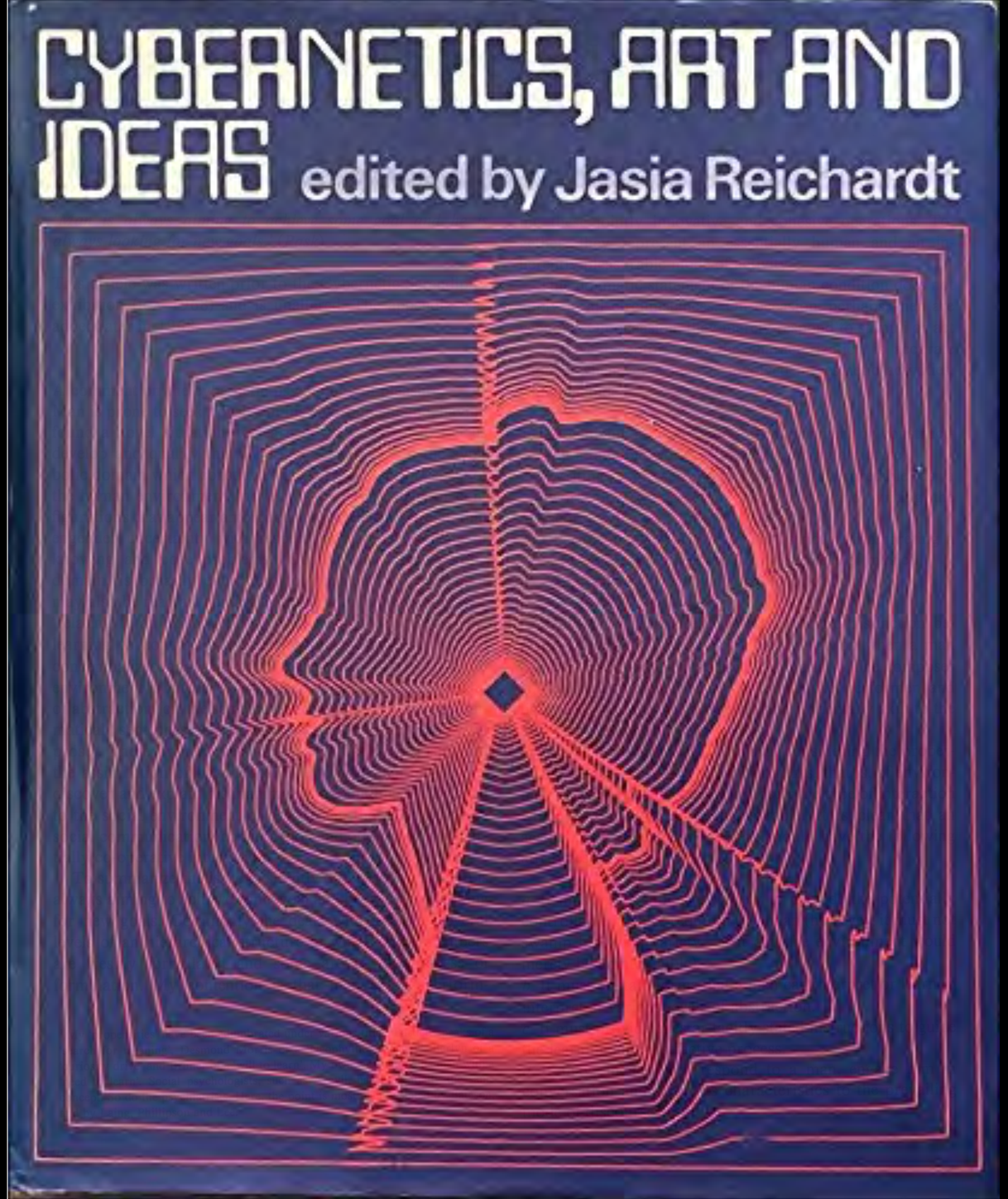


Diagram: Gordon Pask Archive
University of Vienna



Cybernetics, Art and Ideas
Jasia Reichardt, ed.,
Greenwich, CT: New York Graphic Society Ltd., 1968

"A comment, a case history, and a plan", written by Gordon Pask before Colloquy was created

Cybernetics, Art and Ideas
Jasia Reichardt, ed.,
Greenwich, CT: New York Graphic Society Ltd., 1968

A comment, a case history and a plan

Gordon Pask

'Man is always aiming to achieve some goal and he is always looking for new goals.' (Pask)

This article was written prior to the Cybernetic Serendipity exhibition (ICA 1968) and is unaltered. The appendix was added later in 1968.

A comment on the cybernetic psychology of pleasure

Man is prone to seek novelty in his environment and, having found a novel situation, to learn how to control it. Let us develop and qualify this cybernetic statement. In the symbolic domain which constitutes the most important aspect of the human environment, 'novelty' inheres in events or configurations that appear ambiguous to a given individual, that engender uncertainty with respect to his present state of knowing and pose problems. 'Control', in this symbolic domain, is broadly equivalent to 'problem solving' but it may also be read as 'coming to terms with' or 'explaining' or 'relating to an existing body of experience'. Further, when learning to control or to solve problems man necessarily conceptualizes and abstracts. Because of this, the human environment is interpreted at various levels in an hierarchy of abstraction (on the same page we see letters, words, grammatical sentences, meaningful statements and beautiful prose). These propensities[1] are at the root of curiosity and the assimilation of knowledge. They impel man to explore, discover and explain his inanimate surroundings. Addressed to the social environment of other men, they lead him into social communication, conversation and other modes of partially co-operative interaction.

To summarize the issue in slightly different words, man is always aiming to achieve some goal and he is always looking for new goals. Commonly, he deals with goals at several levels of an hierarchical structure in which some members are freshly formulated and some are in the process of formulation. My contention is that man enjoys performing these jointly innovative and cohesive operations. Together, they represent an essentially human and an inherently pleasurable mode of activity.

This dogmatic statement of the human condition does not apply in all circumstances. On occasion, perhaps, men are vacuous. On occasion, they merely respond to stimuli or act as passive receptors. But the characterization is accurate enough whenever a man is involved in aesthetic activities, which include:

1 Organizing a bit of symbolic environment by constructing a tangible work of art (e.g. painting a picture).
2 Writing a prescription which is interpretable as a work of art (e.g. composing music and writing the score).
3 'Performing a work of art' or, strictly, 'interpreting a work of art prescription, such as a piece of music'.
4 Appreciating or enjoying some work of art.

It does not seem useful to make a rigid distinction between the types of mental process that go on when a man occupies these different roles: 1, 2, 3 and 4. The composer is, in some sense, mentally akin to the performer and listener; the man who views a picture is mentally akin to the artist who painted it.

With all this in view, it is worth considering the properties of aesthetically potent environments, that is, of environments designed to encourage or foster the type of interaction which is (by hypothesis) pleasurable. It is clear that an aesthetically potent environment should have the following attributes:

a It must offer sufficient variety to provide the potentially controllable novelty required by a man (however, it must not swamp him with variety—if it did, the environment would merely be unintelligible).
b It must contain forms that a man can interpret or learn to interpret at various levels of abstraction.
c It must provide cues or tacitly stated instructions to guide the learning and abstractive process.
d It may, in addition, respond to a man, engage him in conversation and adapt its characteristics to the prevailing mode of discourse.

[1] My 'propensities' have been adumbrated under various titles. Bartlett speaks of a 'search for meaning', Desmond Morris of a 'Neophyllic tendency', Berlyn of a 'curiosity drive' and Bruner of a 'will to learn'. My own writing credits man with a 'need to learn'. Social psychologists, such as Argyll, have essentially the same concept. So do the psychiatrists. Here, the point is most plainly stated by Bateson, and by Laing, Phillipson and Lee.

Plan and Section views
of Colloquy of Mobiles

“A comment, a case history, and a plan”, written by Gordon Pask before Colloquy was created

In *Cybernetics, Art and Ideas,*
Jasia Reichardt, ed.,
Greenwich, CT: New York Graphic Society Ltd., 1968, p 90

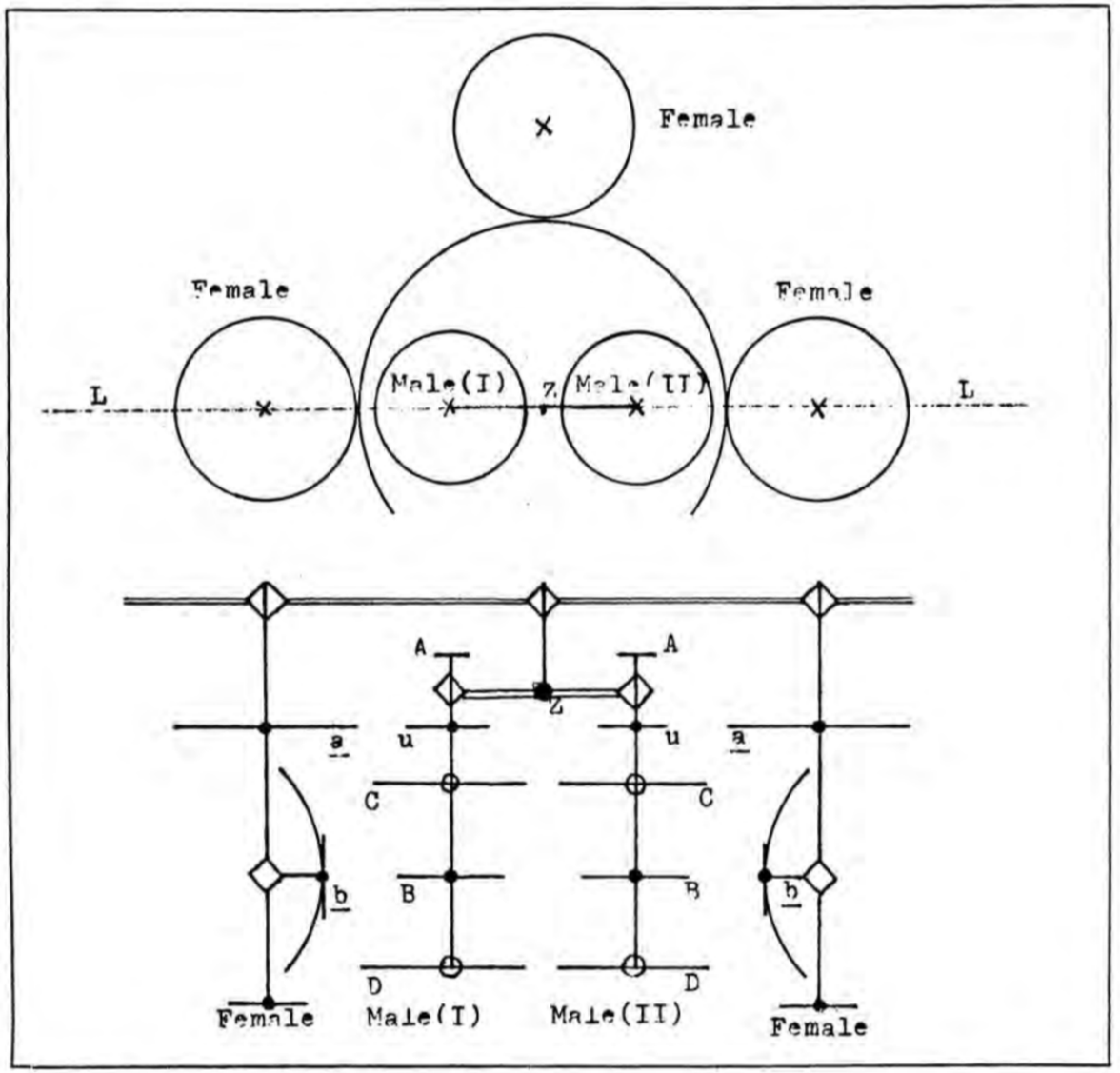


Fig. 34 A rough sketch of powered mobiles.
a Horizontal plan
b Vertical section taken through line *L* in horizontal plan.
A = drive state display for male
B = main body of male, bearing 'energetic' light projectors *O* and *P*
C = upper 'energetic' receptors
D = lower 'energetic' receptors
U = non-'energetic', 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

Plan View

Section View

Movies of Colloquy
Institute of Contemporary Arts
London
1968

Movies of Colloquy
Institute of Contemporary Arts
London
1968

Gordon Pask in 1975

"…was to use in the classroom or certain places like that.

That is a machinery, hardly discernible perhaps, for um… running a Colloquy of Mobiles, as it was called.

Ah… is the wrong way up, yes.

These were large suspended mobiles and I was taxed with the ability of making an exhibition piece for entertainment, in fact, where the people would engage in 'conversations through'…

So I made a family of mobiles… um…

Click for video

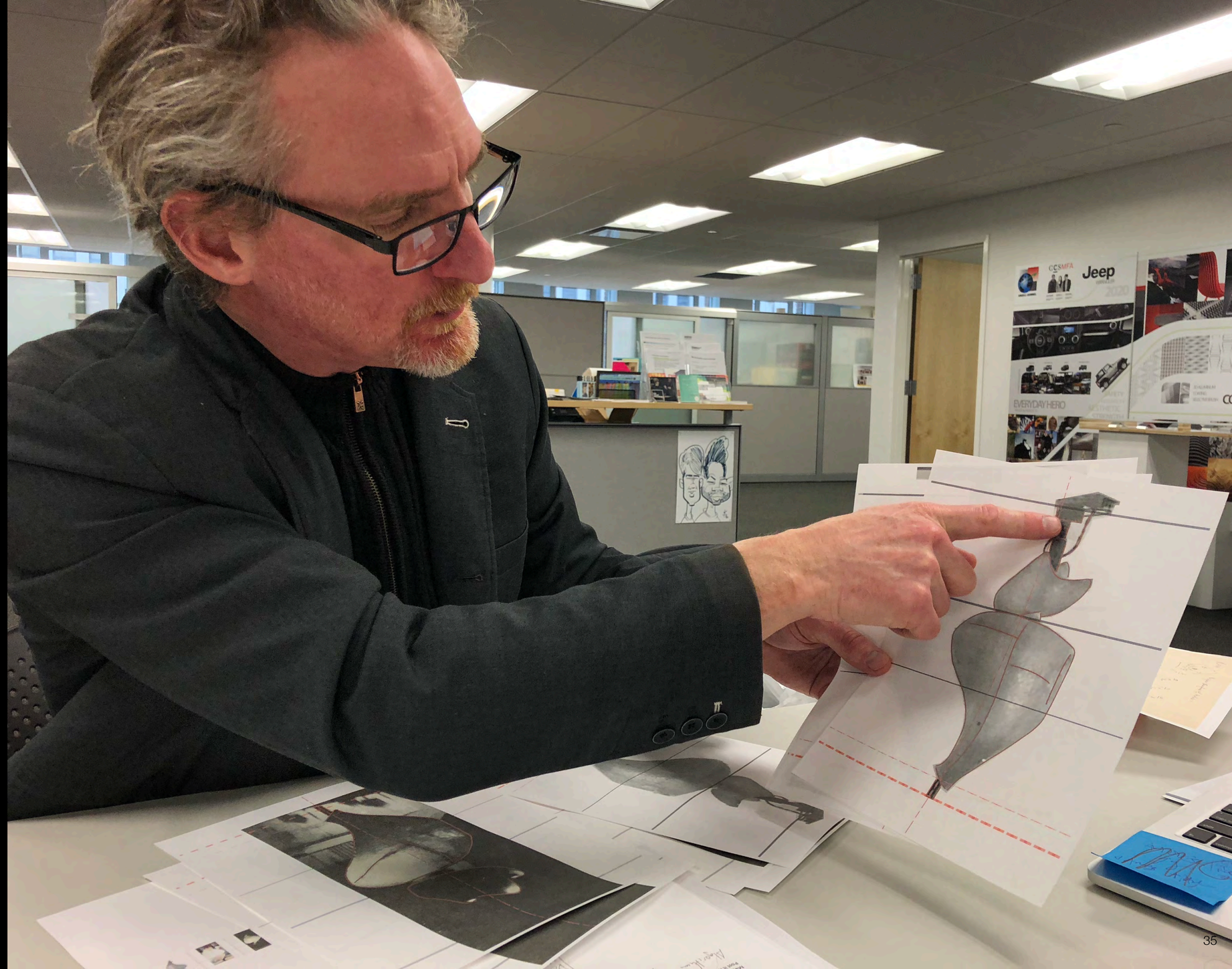
… which were these things on mechanically rotating beams, an environment out of PDP8 computers and whatnot, and what in those days would be the equivalent to a microprocessor with a load of junk in each one.

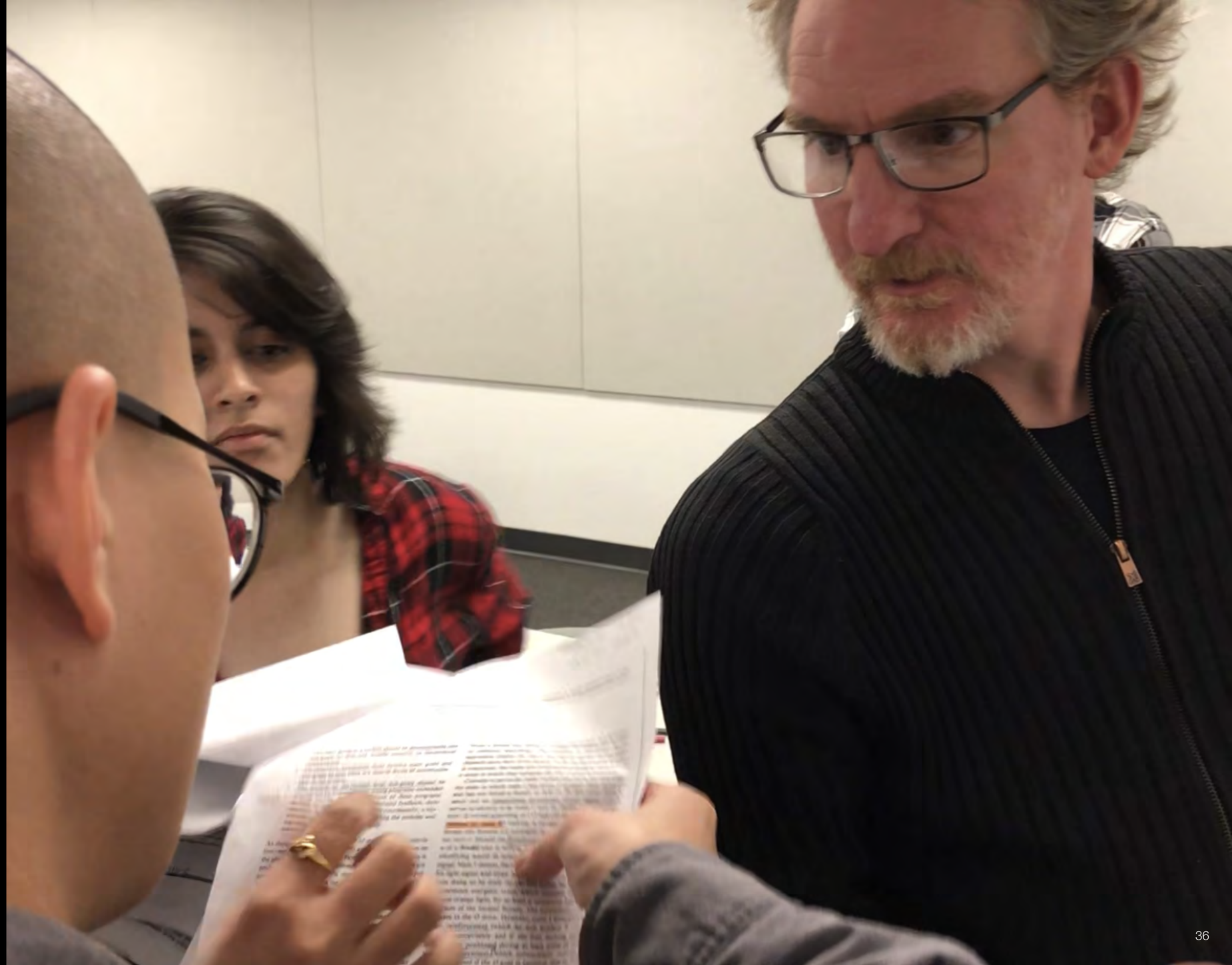
The point being that the mobiles had a life of their own and they chatted to each other by beams of light which they waggled up and down… and by hooting sounds and so forth and anybody could go into that discourse if they wanted to and hoot at them or put their hand up in front of the light.

And they did."

Computing Conversation / When, Why, How, Who?

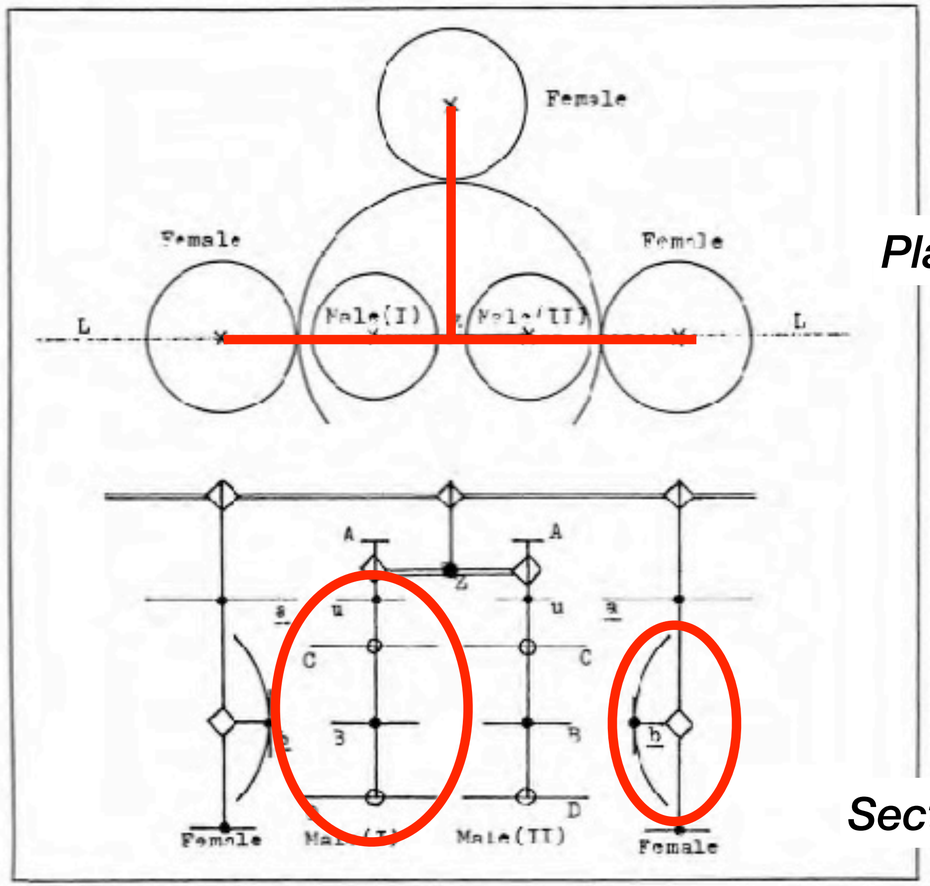
TJ McLeish, Master Fabricator
COLLOQUY 2018 Project
MFA Interaction Design
College for Creative Studies
2018





TJ McLeish, Master Fabricator
COLLOQUY 2018 Project
MFA Interaction Design
College for Creative Studies
2018

Pask's schematic drawing (before building Colloquy)
1968



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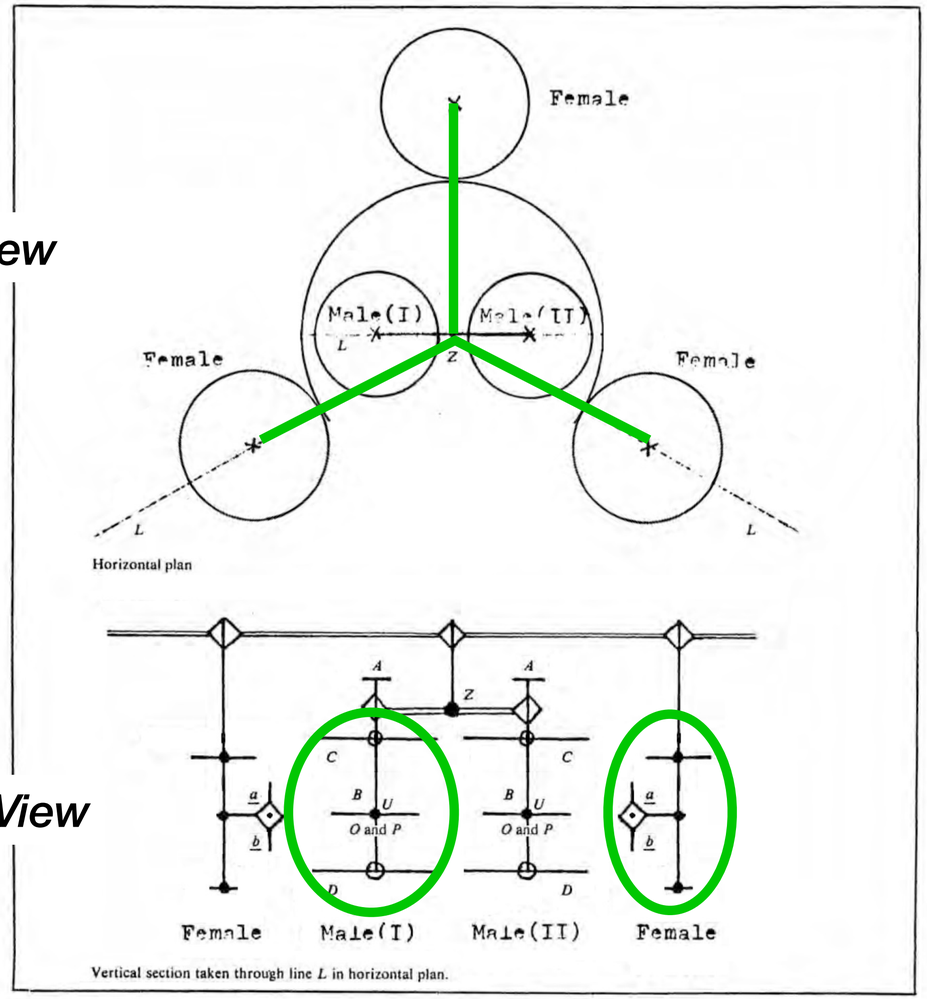
a = female receptor for intermittent positional signal
b = vertically movable reflector of female
Z = bar linkage bearing male I and male II

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

Plan View

Section View

Corrections based on photographic record
2018



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= Drive motor
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Description of behaviors

“A comment, a case history, and a plan”, written by Gordon Pask before Colloquy was created

In *Cybernetics, Art and Ideas,* Jasia Reichardt, ed., Greenwich, CT: New York Graphic Society Ltd., 1968, p 91

It is evident that the achievement of the *O* satisfaction goal involves an hierarchy of sub-goals and that communication in pursuit of these sub-goals takes place at various levels. Further, the selection of a main goal (such as *O* satisfaction) involves a still higher level process. Referring back to the list of desiderata, we can check that the male members of the mobile community satisfy all of them.

Consider a female: she also has an *O* drive and a *P* drive. Unless both drives are satisfied (when she becomes inert) the female rotates and searches for a male. According to her drive state, she is receptive to males offering *O* or *P* co-operation or to both. Suppose that she is looking for *O* co-operation and suppose she encountered male I in the state already described, on receipt of his intermittent directional signal, she puts his name ‘male I’ and his intention ‘*O* satisfaction’ into a short-term memory. Next, she emits the correlated sound which he can recognize and expects to receive the ‘energetic’ beam of orange light. If this *does* fall on her vertical reflector, *b*, she stops her rotational motion and starts a search, using this reflector, to position the beam on some part of male I that will give rise to a reinforcement signal; her goal is to obtain the conjunction of orange light on her reflector and the reinforcement signal from male I; goal achievement reduces her *O* drive. Her likelihood of achieving this goal in the rather short time allowed for an unreinforced encounter, depends upon the vertical reflector search strategy and this in turn depends upon her previous

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search. A simila
not all males are
on *D* and *P* ligh
In any case, t
short time (and
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the female drive
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are run asynch
figures 35, 36
flow-charts of fi
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A COMMENT, A CASE HISTORY AND A PLAN

It is evident that the achievement of the *O* satisfaction goal involves an hierarchy of sub-goals and that communication in pursuit of these sub-goals takes place at various levels. Further, the selection of a main goal (such as *O* satisfaction) involves a still higher level process. Referring back to the list of desiderata, we can check that the male members of the mobile community satisfy all of them.

Consider a female: she also has an *O* drive and a *P* drive. Unless both drives are satisfied (when she becomes inert) the female rotates and searches for a male. According to her drive state, she is receptive to males offering *O* or *P* cooperation or to both. Suppose that she is looking for *O* cooperation and suppose she encountered male 1 in the state already described, on receipt of his intermittent directional signal, she puts his name 'male 1' and his intention '*O* satisfaction' into a short-term memory. Next, she emits the correlated sound which he can recognize and expects to receive the 'energetic' beam of orange light. If this does fall on her vertical reflector, *b*, she stops her rotational motion and starts a search, using this reflector, to position the beam on some part of male 1 that will give rise to a reinforcement signal; her goal is to obtain the conjunction of orange light on her reflector and the reinforcement signal from male 1; goal achievement reduces her *O* drive. Her likelihood of achieving this goal in the rather short time allowed for an unreinforced encounter, depends upon the vertical reflector search strategy and this in turn depends upon her previous experience (upon what she has learned and placed in a long-term 'memory'). In ignorance of males, her vertical strategy is a haphazard search reflecting the beam up and down. However, if she has previously learned that reinforcement for *O* light comes from reflecting it upwards (in fact on to *C* of male 1), then her strategy becomes a limited upwards search. A similar comment applies to *P* experience. Further, not all males are necessarily the same; some may like *O* light on *D* and *P* light on *C*; she can learn that trick also.

In any case, the vertical search strategy terminates after a short time (and the rotational search is resumed) if a reinforcement signal is not received from the male.[1] If a signal is received, the vertical search is prolonged possibly until the female drive state has been modified. The whole process is summarized in the accompanying flow-charts. There are five independent systems, three female and two male which are run asynchronously in parallel. The flow-charts of figures 35, 36 and 37 represent a female system and the flow-charts of figures 38 and 39 represent a male system.

This completes[2] our description of the social environment of mobiles.

The really interesting issue is what happens if some human beings are provided with the wherewithal to produce signs in the mobile language and are introduced into the environment. It is quite likely that they will communicate with the mobiles, for the mobiles are interacting already and ostensively define the gambits involved in the process. Further, their community has quite an intriguing organization. At this level alone, the environment has the properties required of an aesthetically potent environment.

But the mobiles produce a complex auditory and visual effect by dint of their interaction. They cannot, of course, interpret these light and sound patterns. But human beings can and it seems reasonable to suppose that they will also aim to achieve patterns that they deem pleasing by interacting with the system at a higher level of discourse.

I do not know. But I believe it may work out that way.

[1] The vertical search is the female form of an autonomous process.

[2] We have cited special cases. The account is, however, readily generalized to cover all actual syndromes of the mobiles.

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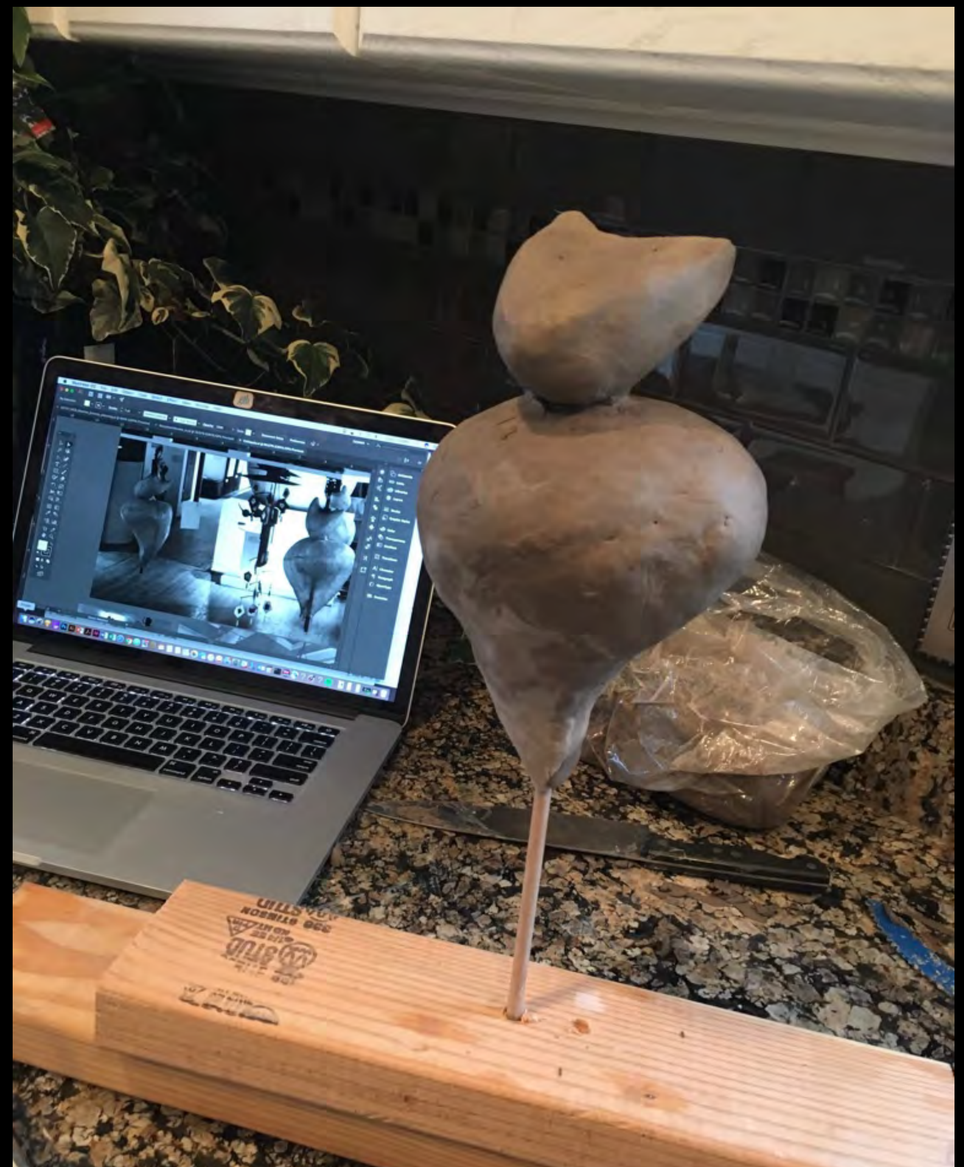
Extracting scenarios

MFA Studio
COLLOQUY 2018 Project
MFA Interaction Design
College for Creative Studies
2018


Scenario I
Male
G
00:00
00:05
limit
"O"
Drive
00:06
J
180
270°
00:06
Speed
G = 10 sec/270°; 2 Sec/180°
F1 = 8 Sec/360°
45°
Mirror
00:10
Speed of Mirror
0.5sec/up ; 0.5 sec/down
00:12
Mirror up and down
00:13 ~ 00:14
Mirror fixed upwards
00:14 ~ 00:17
Short-term M for Upwards search.
00:18
1 sec Fixed delay
1 sec Fixed delay

Acting out mobile behaviors
Students of Studio IV
MFA Interaction Design
College for Creative Studies
2018

Building the scale model
Students of Studio II: Prototyping & Internet of Things
MFA Interaction Design
College for Creative Studies
2018



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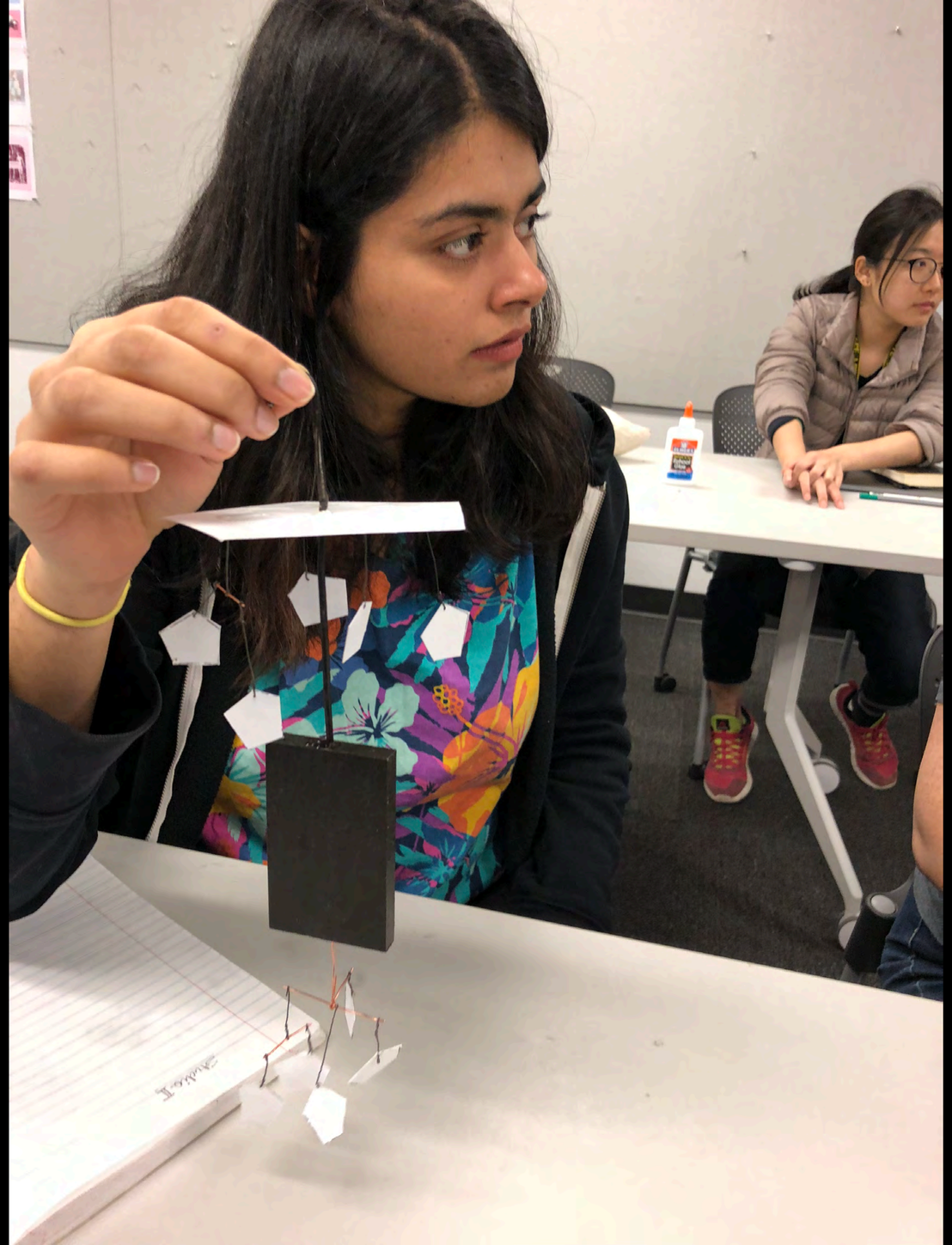
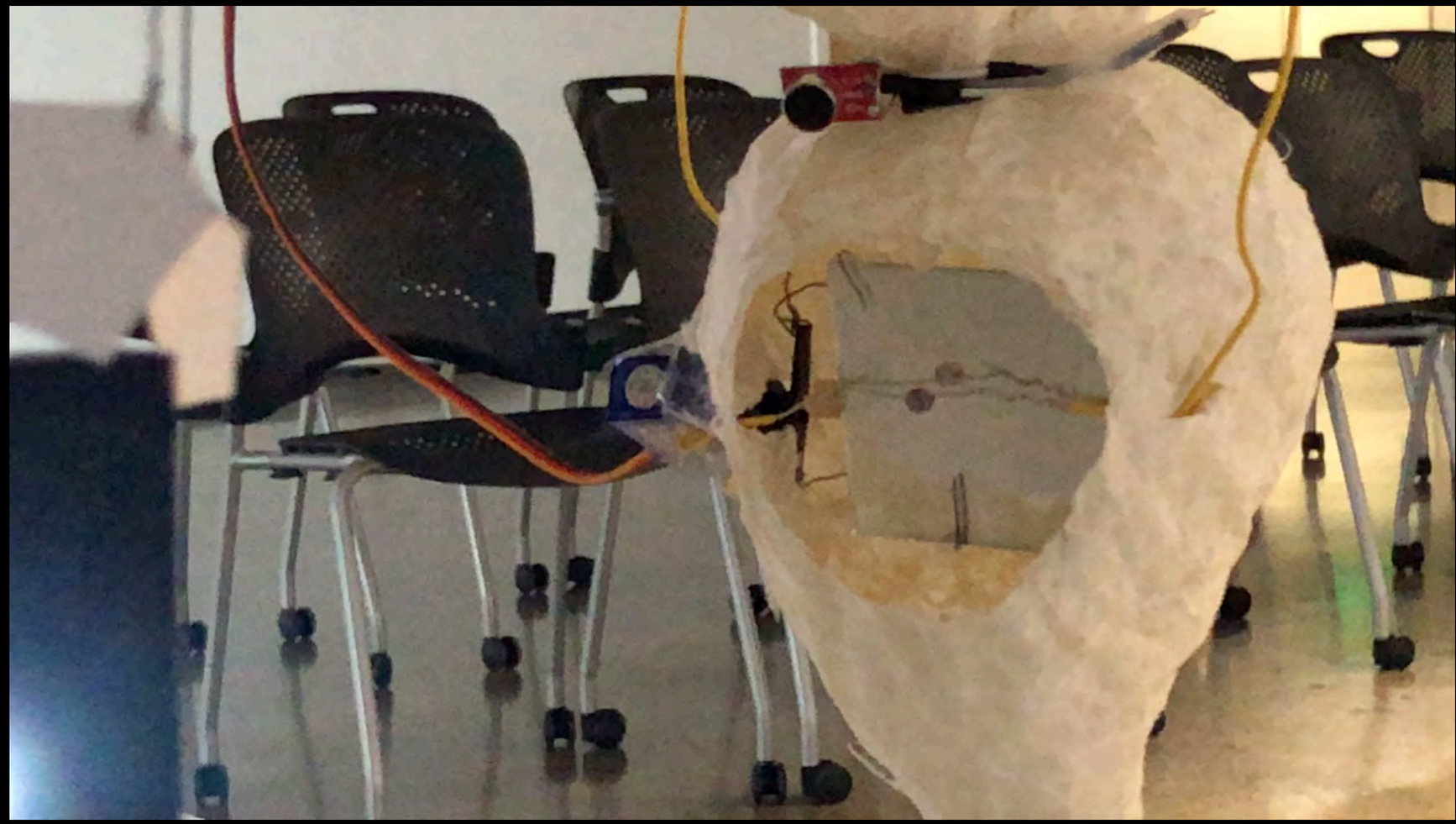
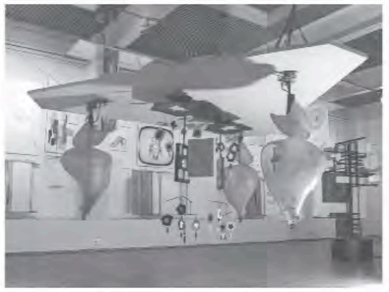
Building the scale model
Khyati Shah, Student
Studio II: Prototyping & Internet of Things
MFA Interaction Design
College for Creative Studies
2018

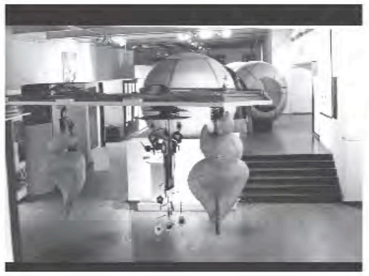


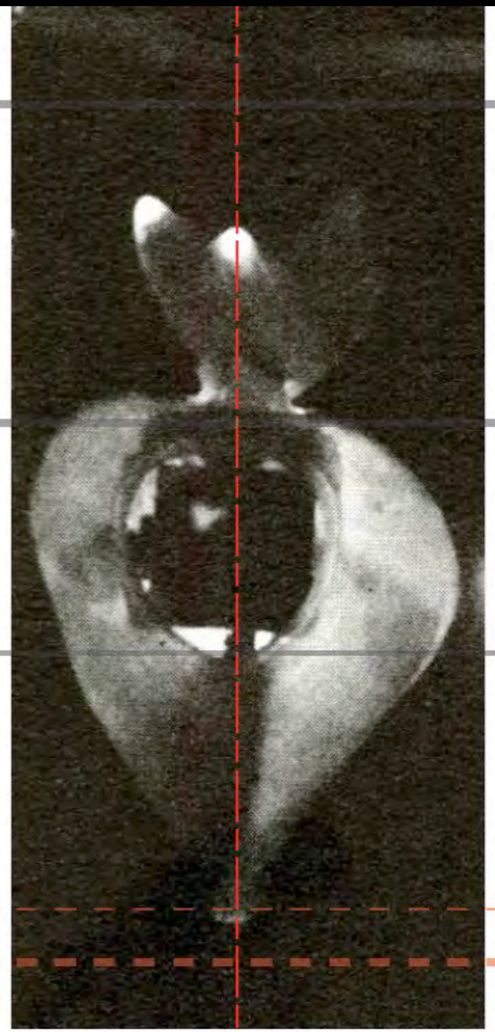
Building the scale model
Sofia Lewandowski, Student
Studio II: Prototyping & Internet of Things
MFA Interaction Design
College for Creative Studies
2018

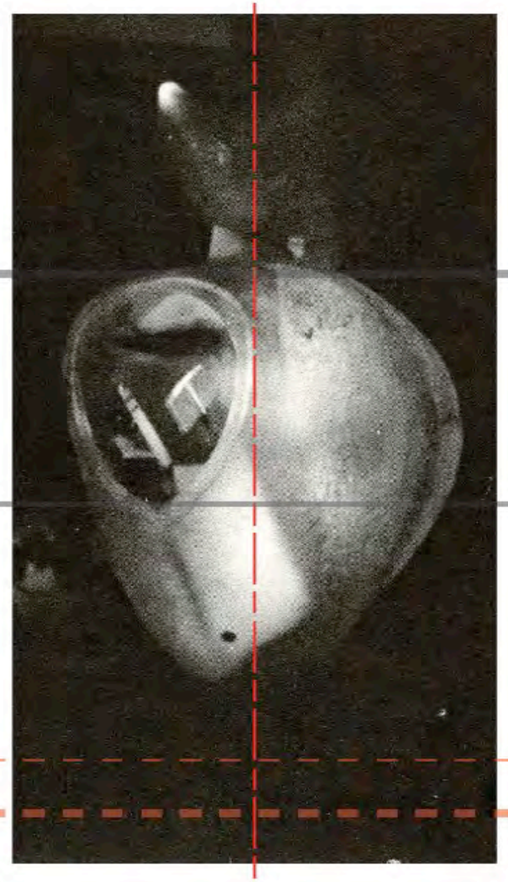
Colloquy 1/6 Scale Model
Studio II: Prototyping & Internet of Things
MFA Interaction Design
College for Creative Studies
2018

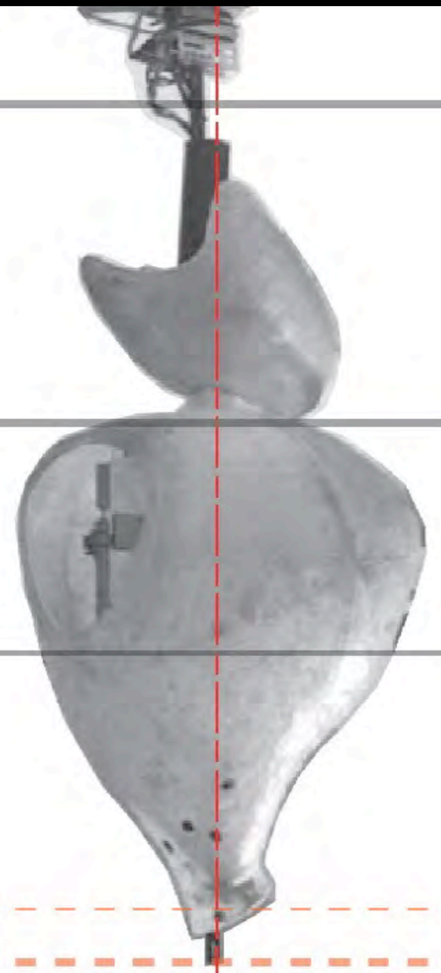


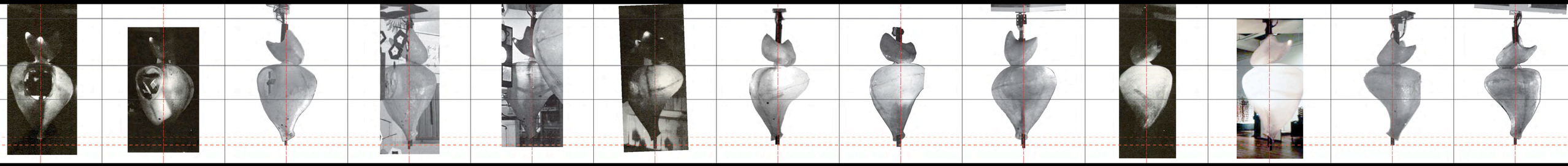


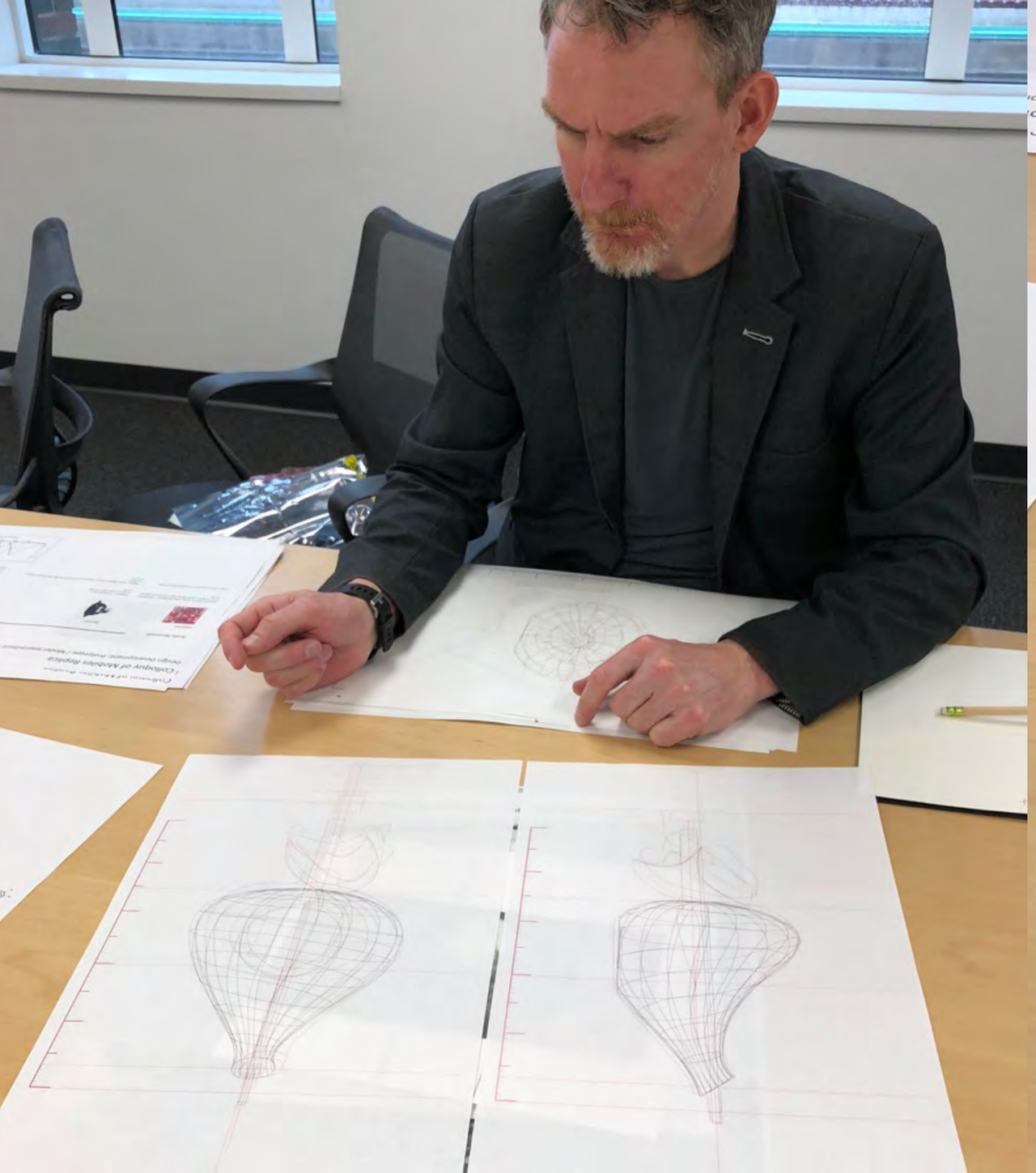


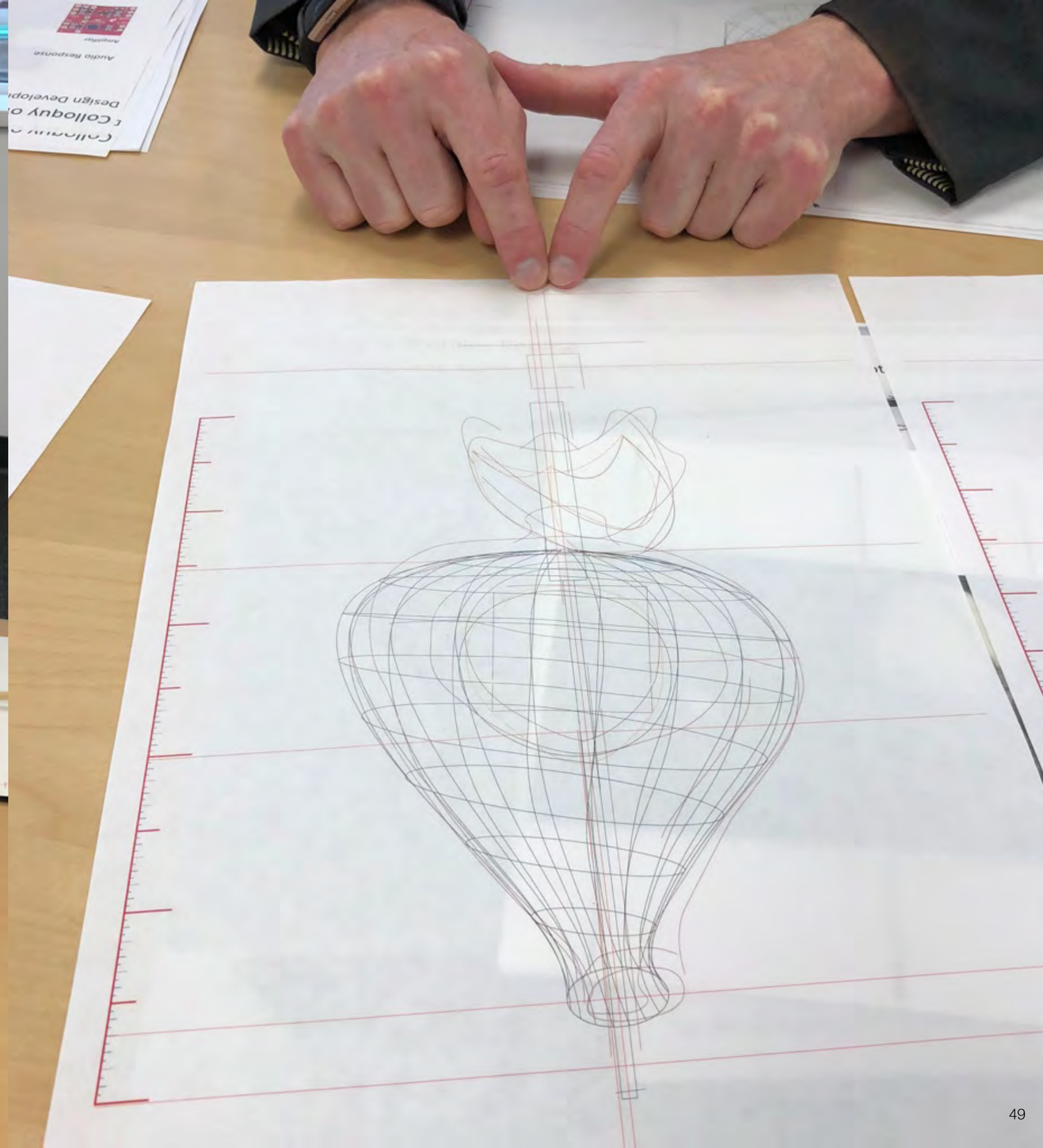


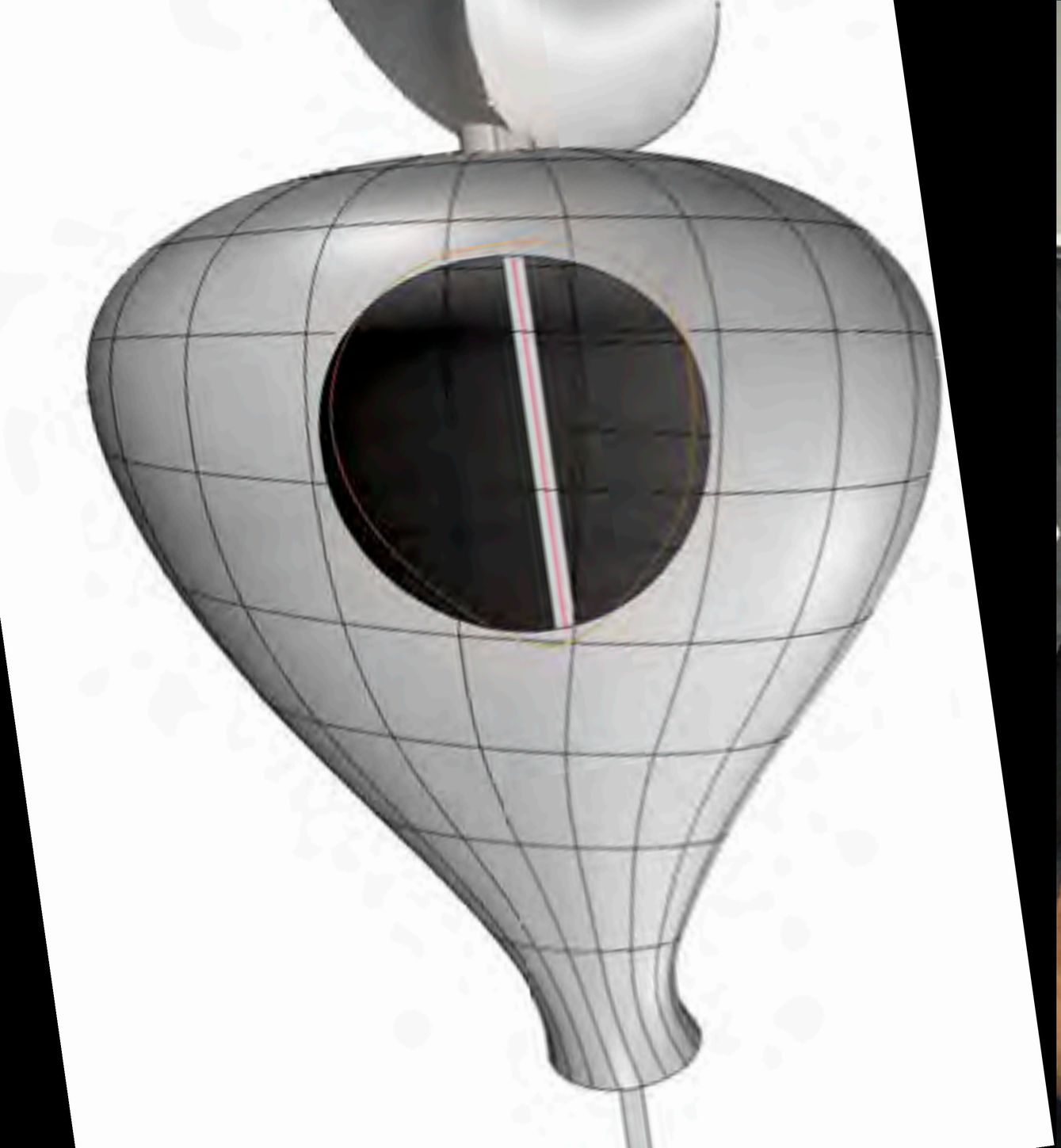


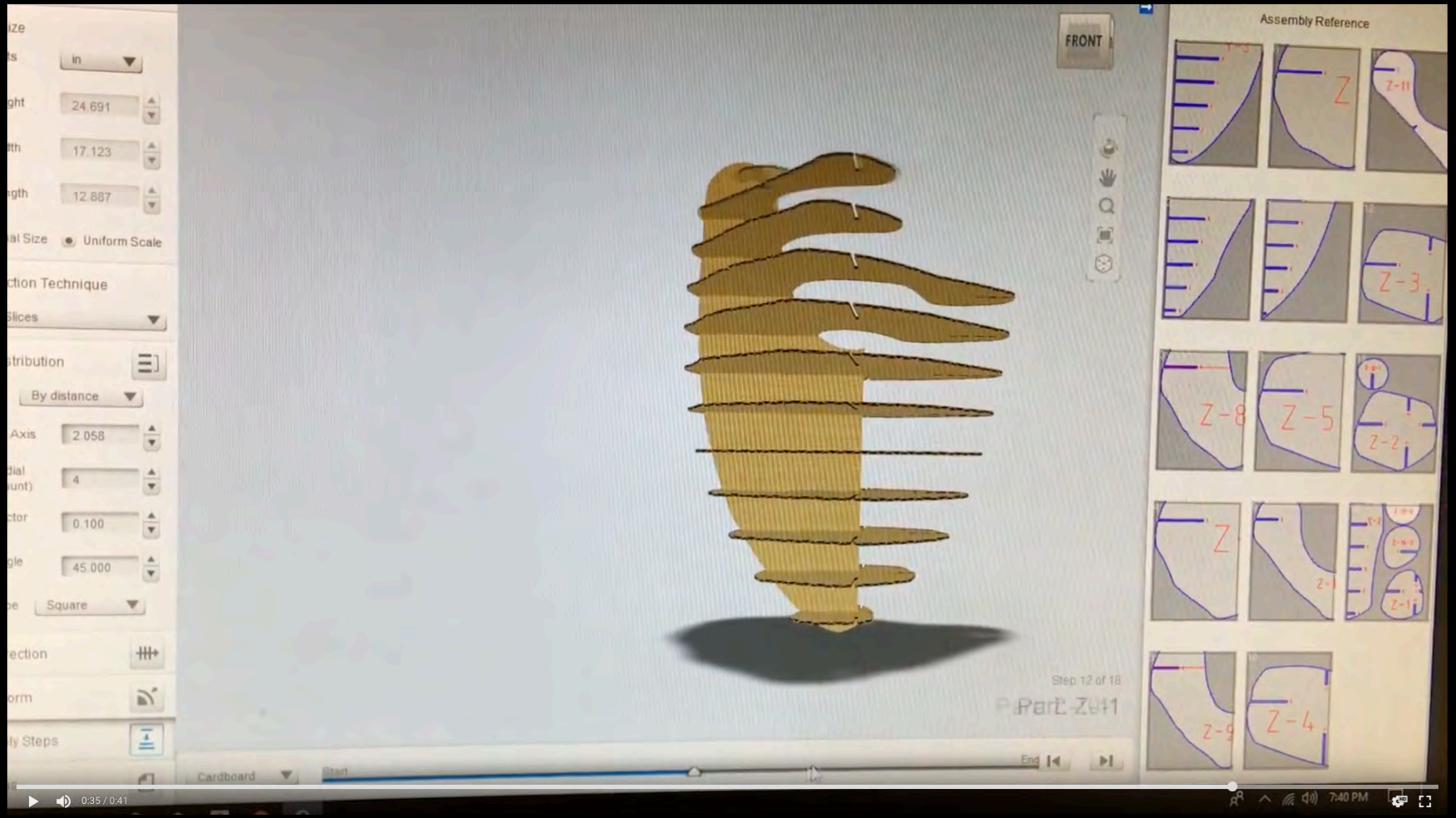


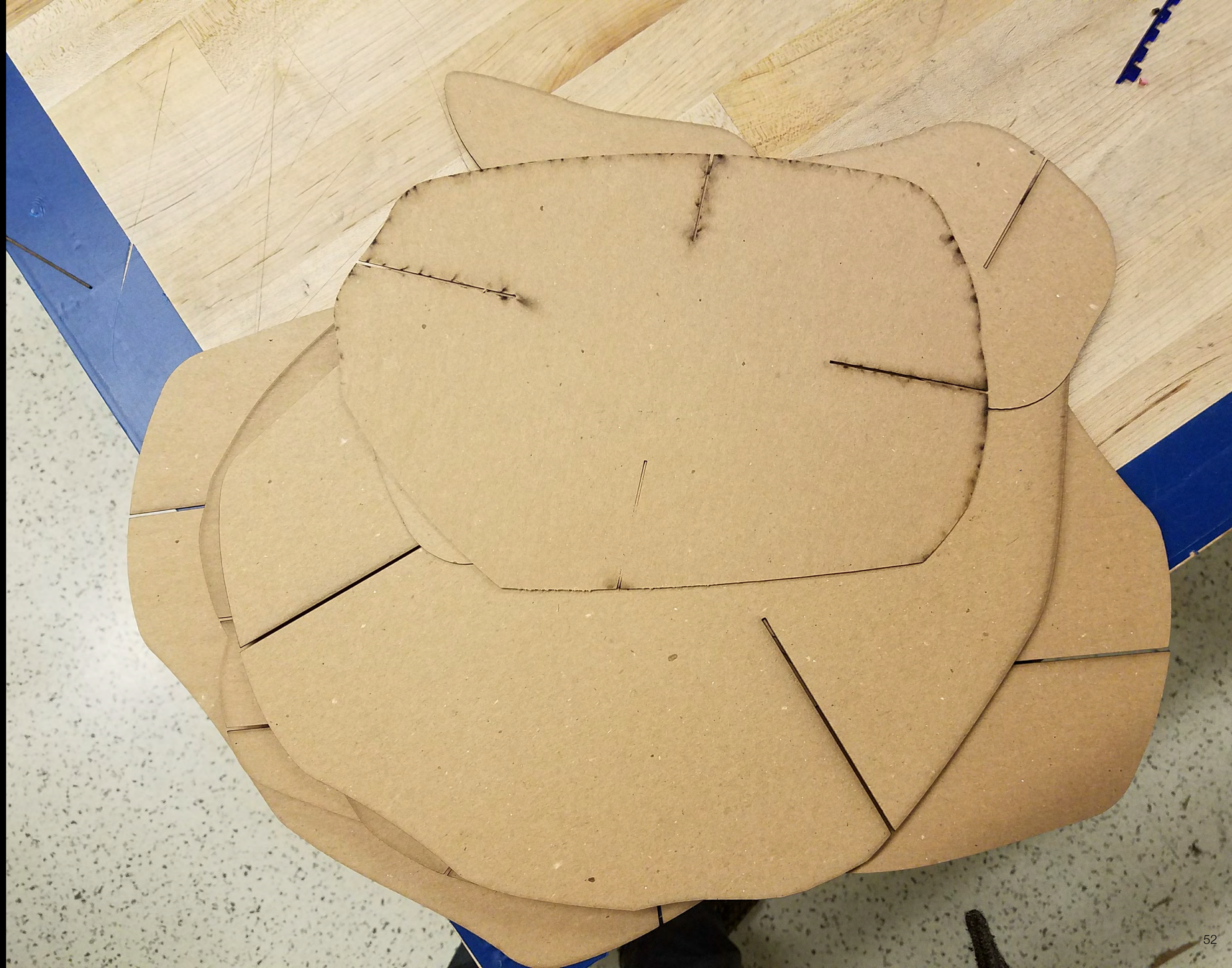






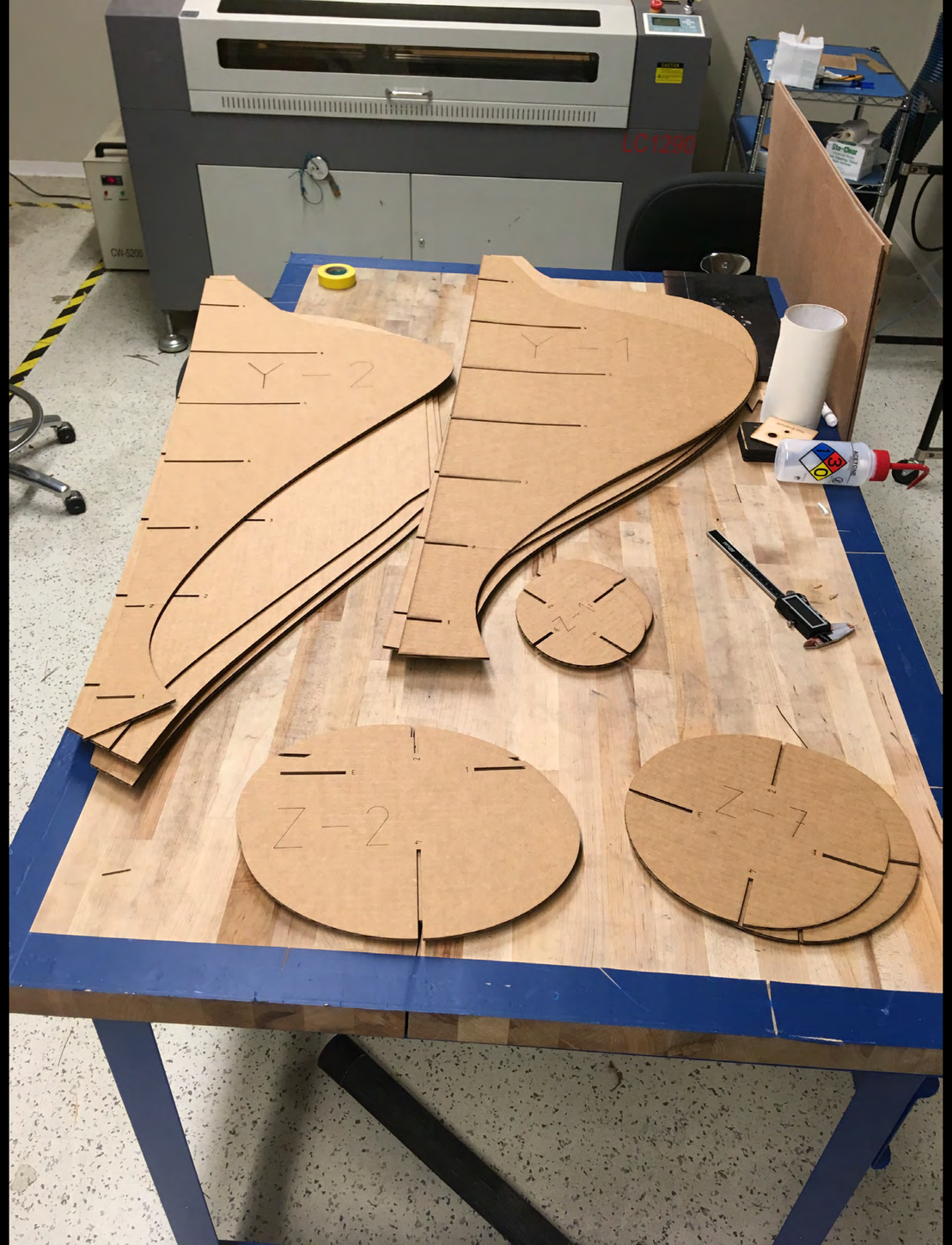



in
24.691
17.123
12.887
Uniform Scale
Slices
By distance
2.058
4
0.100
45.000
Square
FRONT
Assembly Reference
Z
Z-11
Z-3
Z-8
Z-5
Z-2
Z-4
Step 12 of 18
Part Z#1
Cardboard
Start
End
0:35 / 0:41
7:40 PM

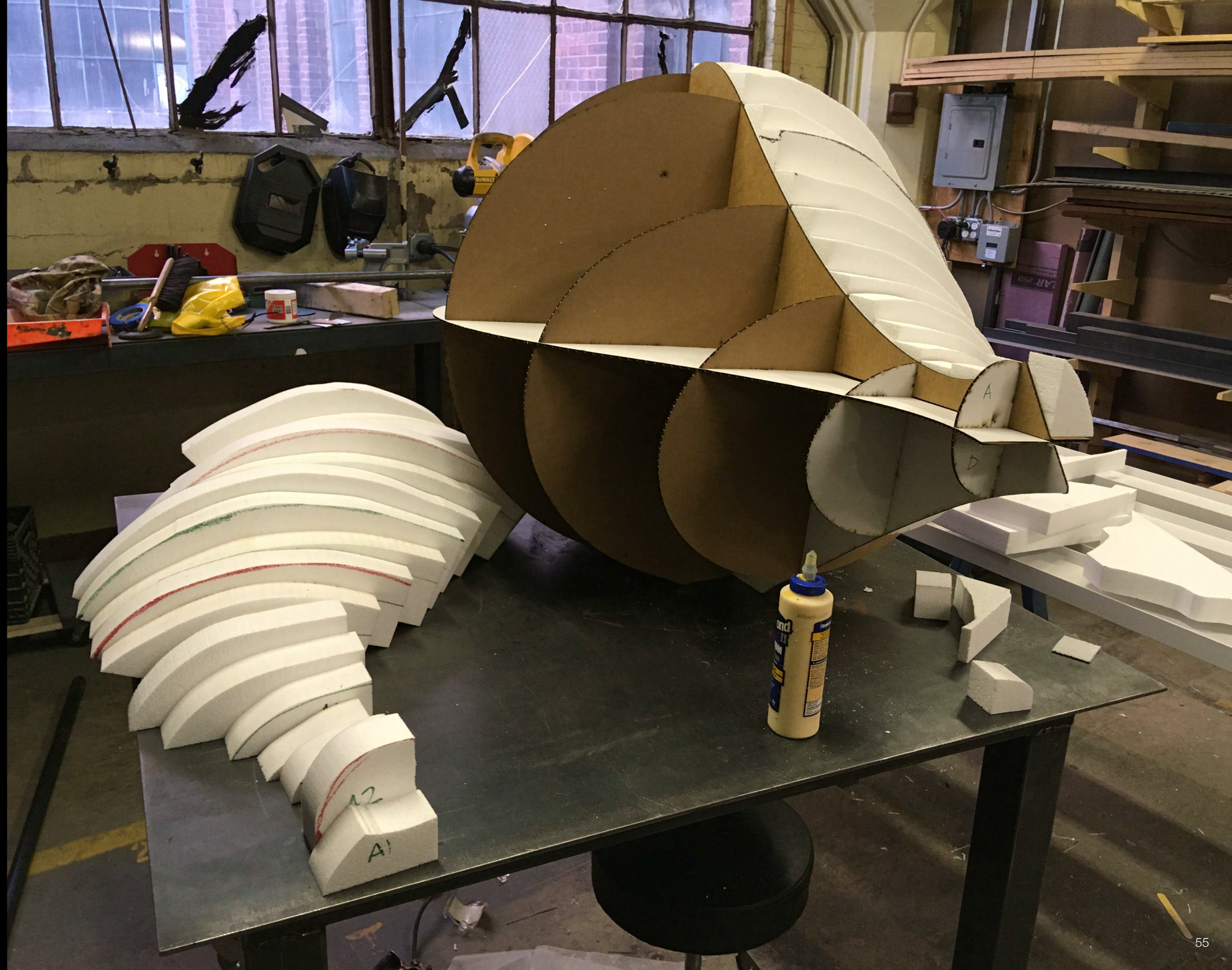


Laser-cut sections
Female mobiles
Building Brown Workshop
Chicago

Laser-cut sections
Female mobiles
Building Brown Workshop
Chicago



Assembling the forms
Female mobiles
Building Brown Workshop
Chicago



Cutting foam to fit the forms
Female mobiles
Building Brown Workshop
Chicago

Assembling and glueing
Female mobiles
Building Brown Workshop
Chicago

Smoothing the foam models
Female mobiles
Building Brown Workshop
Chicago

Wrapping before coating with resin
Female mobiles
Building Brown Workshop
Chicago

Completed Female mobile
TJ McLeish, Master Fabricator
mHub, Chicago


EXIT

Fabricating the support structure
Primary material “8020”

Design and fabrication
by TJ McLeish

Rotating bar for male mobiles

Design and fabrication
by TJ McLeish

Beginning assembly
MFA IxD Class of 2018 & Class of 2019
CCS MFA Interaction Design

Raising the structure
MFA IxD Class of 2018 & Class of 2019
CCS MFA Interaction Design

Assembling the female mobiles
TJ McLeish
Alecia Secord, MFA IxD Class of 2019
Sofia Lewandowski, MFA IxD Class of 2018
CCS MFA Interaction Design

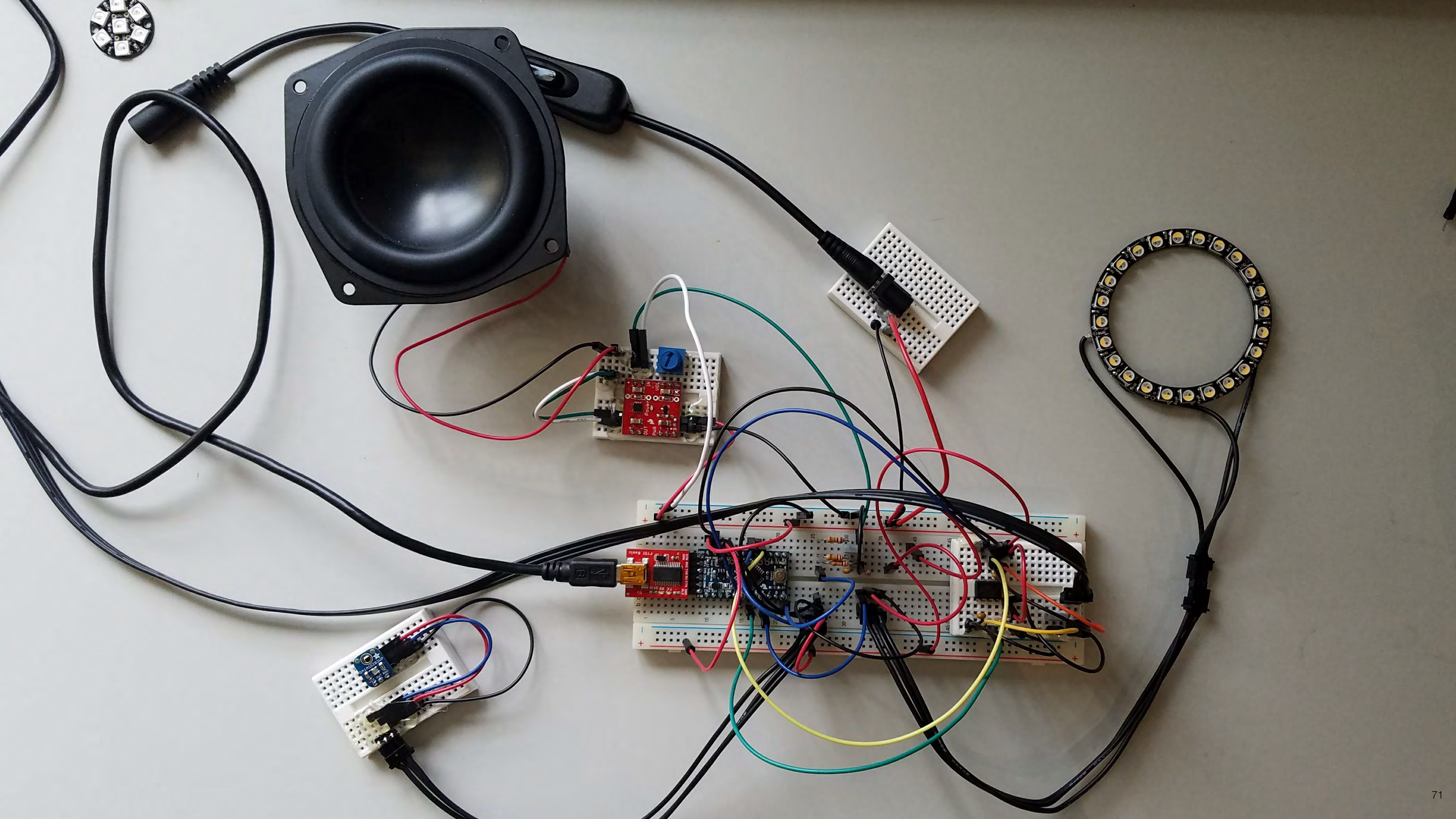
Hanging the female mobiles
TJ McLeish
Alecia Secord, MFA IxD Class of 2019
Sofia Lewandowski, MFA IxD Class of 2018
CCS MFA Interaction Design

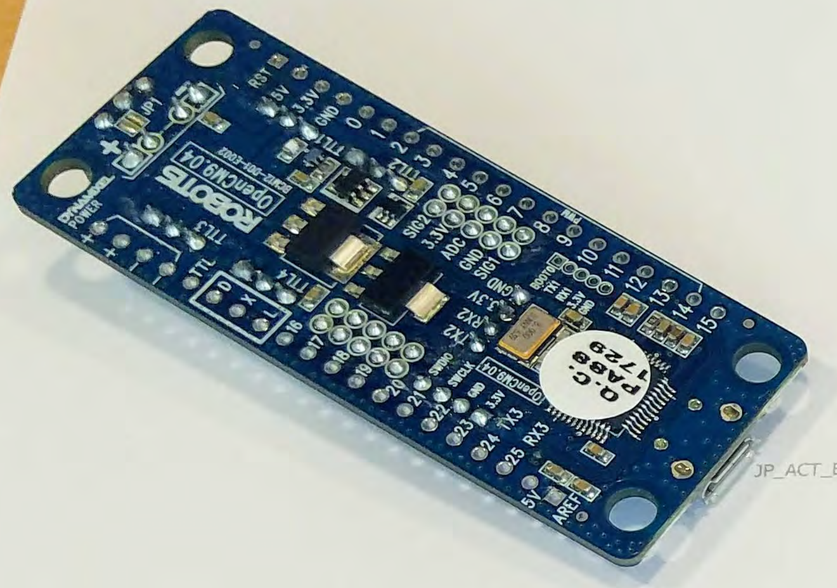
Cutting templates for male mobile parts
Paul Pangaro, MFA IxD Chair
MFA Interaction Design
College for Creative Studies
2018

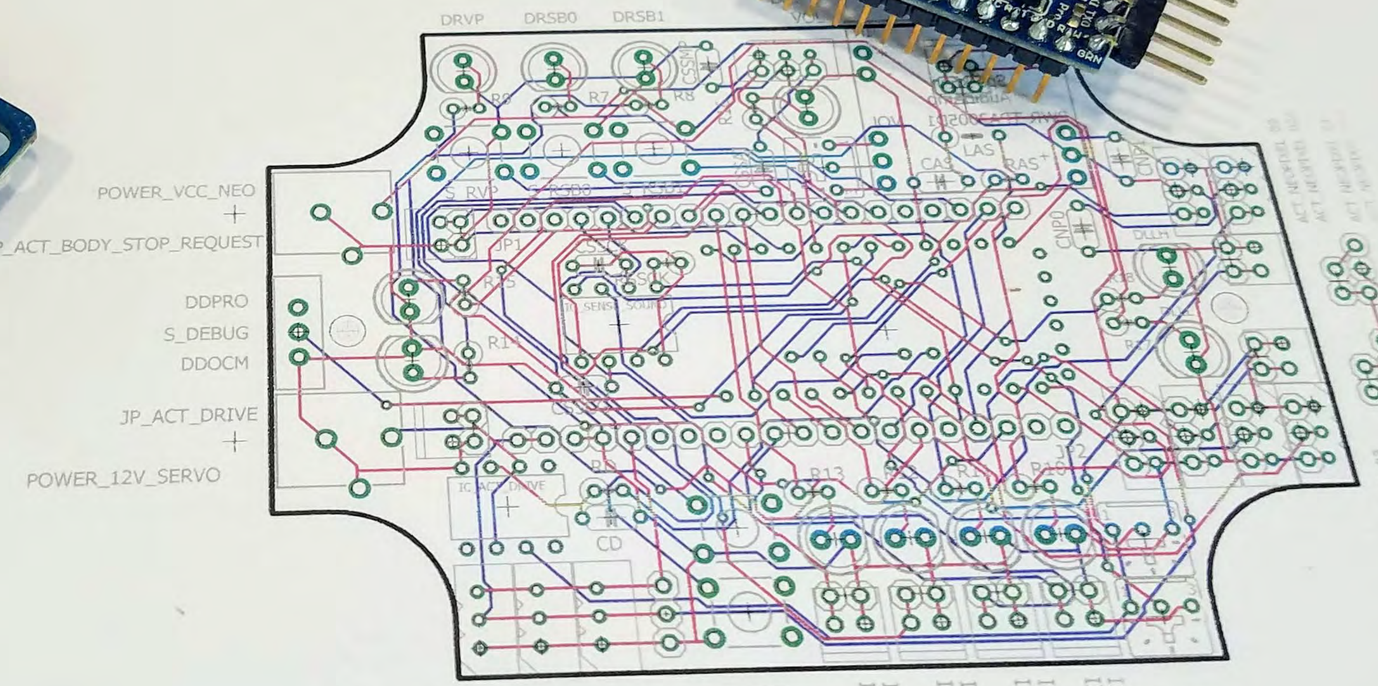
Assembling male mobiles
TJ McLeish
Gissoo Doroudian, MFA IxD Class of 2018
CCS MFA Interaction Design

Installing male mobile structure

Prototyping & building the electronics
TJ McLeish

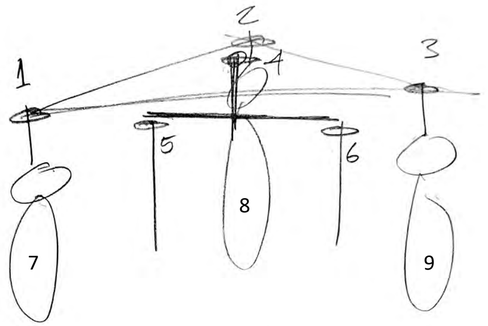



OpenCM9.04
ROBOTIS
3.3V
GND
ADC
RX3
TX3
AREF


DRVP
DRSB0
DRSB1
POWER_VCC_NEO
JP_ACT_BODY_STOP_REQUEST
DDPRO
S_DEBUG
DDOCM
JP_ACT_DRIVE
POWER_12V_SERVO
SERVO_COM_A
SERVO_COM_B
SERVO_COM_C
SERVO_COM
S_BSRI
S_BSRII
JP_SENSE_DRIVESTATE_I
DDSI
JP_SENSE_DRIVESTATE_II
DDSII
JP_SENSE_BODY_STOP_REQUEST_I
DBSRI
JP_SENSE_BODY_STOP_REQUEST_II
DBSRII
R_DSII
R_DS

Colloquy of Mobiles Replica

Design Development: Prototype / Model Movement and Control of Figures – Servo Motors

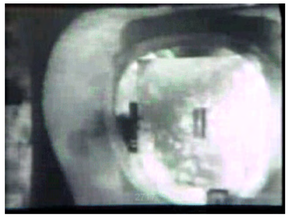


Rotation of figures about Z axes.

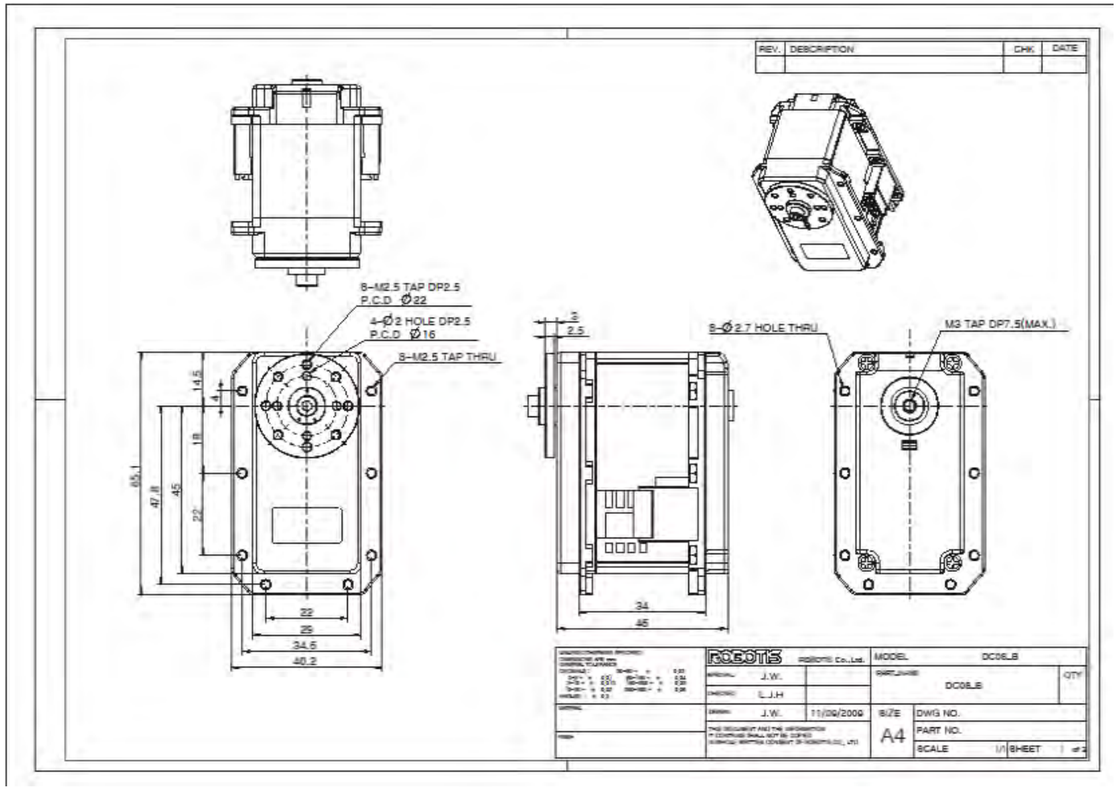
A total of 9 servo motors drive figures.

- 1 Drive motor for each of 3 Females
- 1 Drive motor for each of 2 Male figures
- 1 Drive motor for Male linkage bar
- 1 Drive motors for each of the 3 Female reflectors

Low torque will be required to turn the lightweight figures about their axes.



Female reflector



MX-106T Stats			
Operating Voltage	14.8V	12V	11.1V
Stall Torque*	102 kg·cm	85.6 kg·cm	81.5 kg·cm
	1,416 oz·in	1,189 oz·in	1,132 oz·in
	10.0 N.m	8.4 N.m	8.0 N.m
No-load Speed	55 RPM	45 RPM	41 RPM
Weight	153g		
Size	40.2 x 65.1 x 46 mm		
Resolution	0.088°		
Reduction Ratio	1/225		
Operating Angle	360° or Continuous Turn		
Max Current	**5.2A @ 12V**		
Standby Current	**55 mA**		
Operating Temp	-5°C ~ 85°C		
Protocol	TTL Asynchronous Serial		
Module Limit	254 valid addresses		
Com Speed	8000bps ~ 3Mbps		
Position Feedback	Yes		
Temp Feedback	Yes		
Load Voltage Feedback	Yes		
Input Voltage Feedback	Yes		
Compliance/PID	Yes		
Material	Metal Gears &		
	Engineering Plastic Body		
Motor	Maxon RE-MAX		
Manual Download	MX-106 Manual		
Controller List	USB2Dynamixel		
	CM-530		
	CM-700		
	Arbotix		

5.2A @ 12v = 62.4W
62.4W x 9 = 561.6W
561.6W = 4.68A @ 120v AC

Estimated MAX power requirement for Motors and Control is 5A @ 120vAC

estimated running power is 1A.

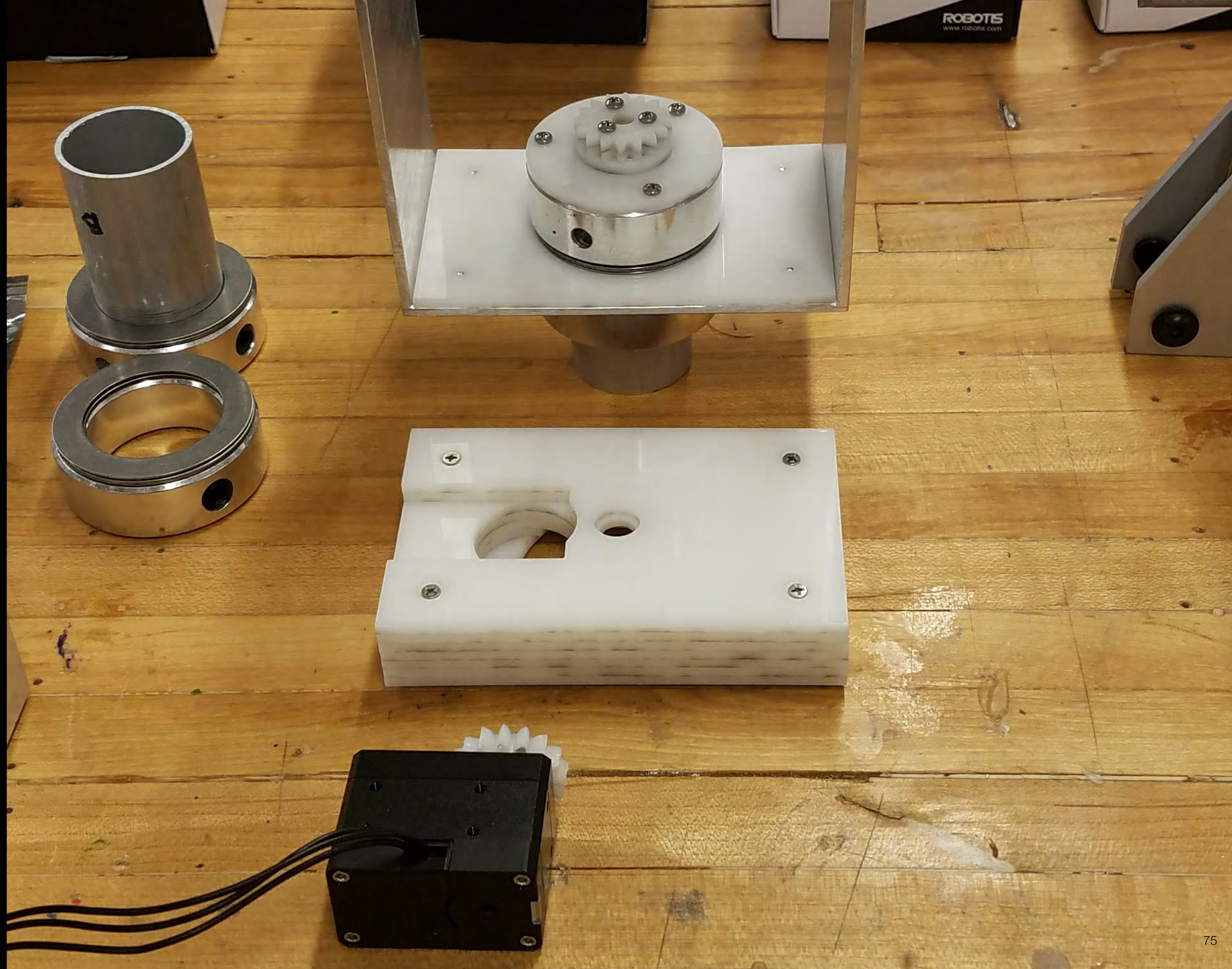
12V 5A switching power supply
PRODUCT ID: 352

Fabricating the mechanisms
Laser-cut gear tests with paper

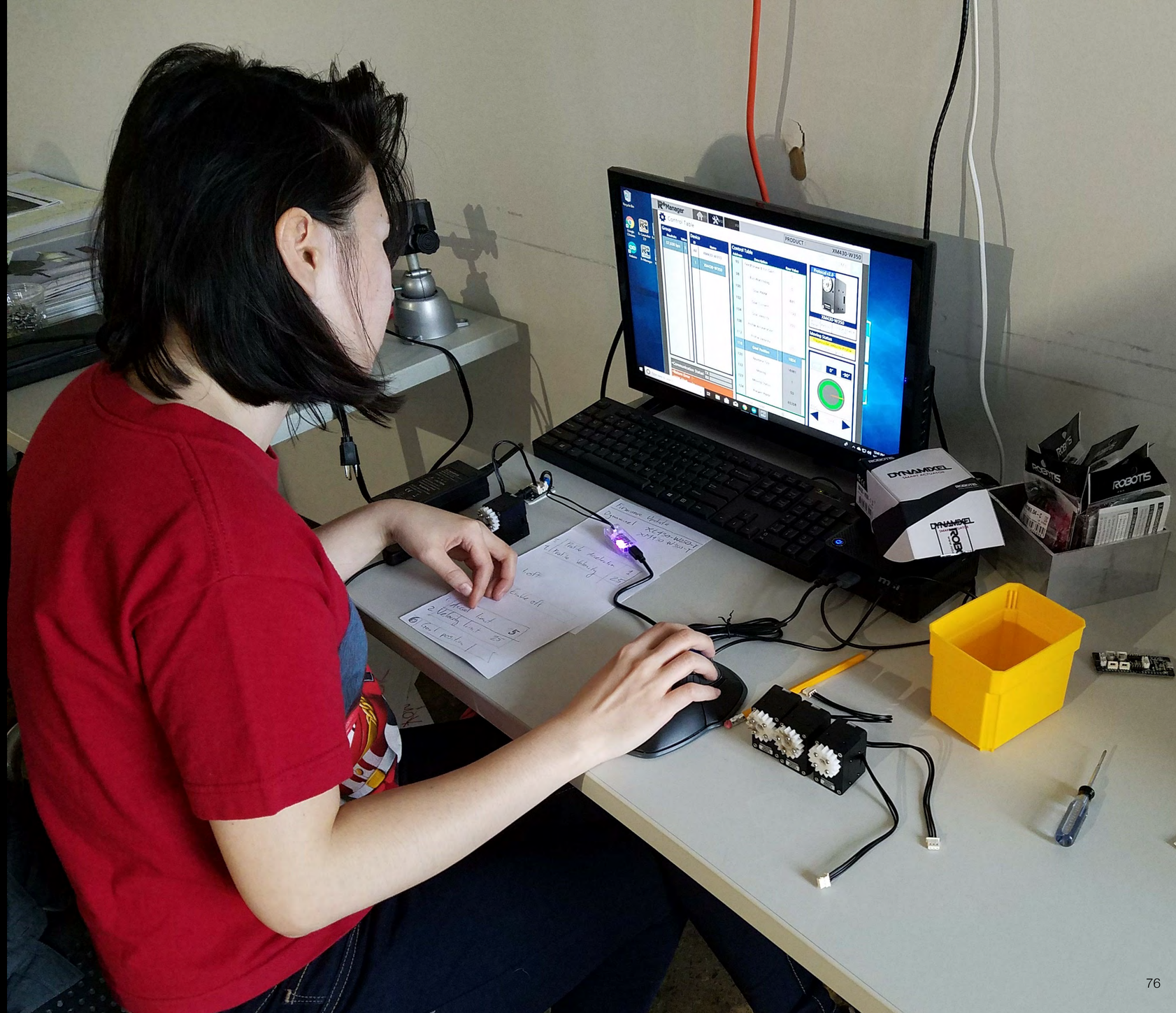
Design and fabrication
by TJ McLeish

Fabricating the mechanisms
Servo mount and gearing of Delrin

Design and fabrication
by TJ McLeish

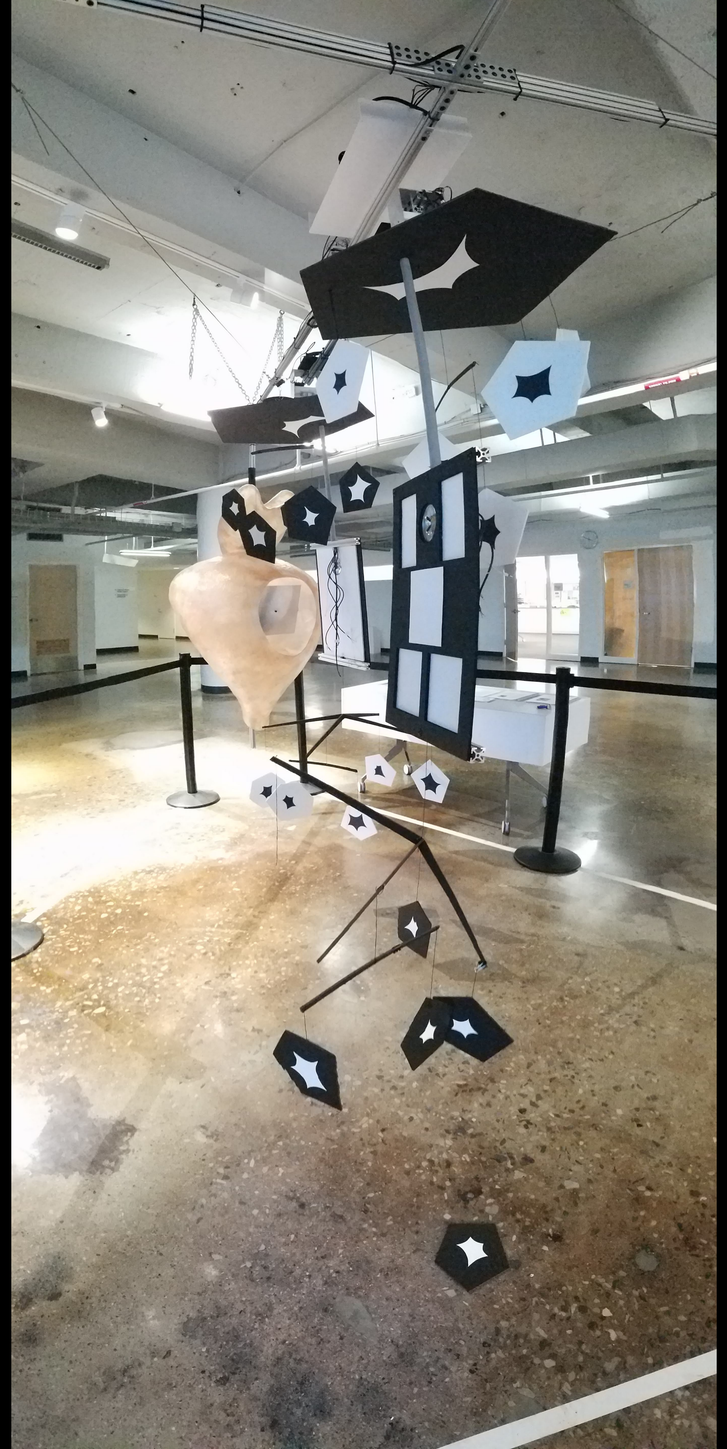


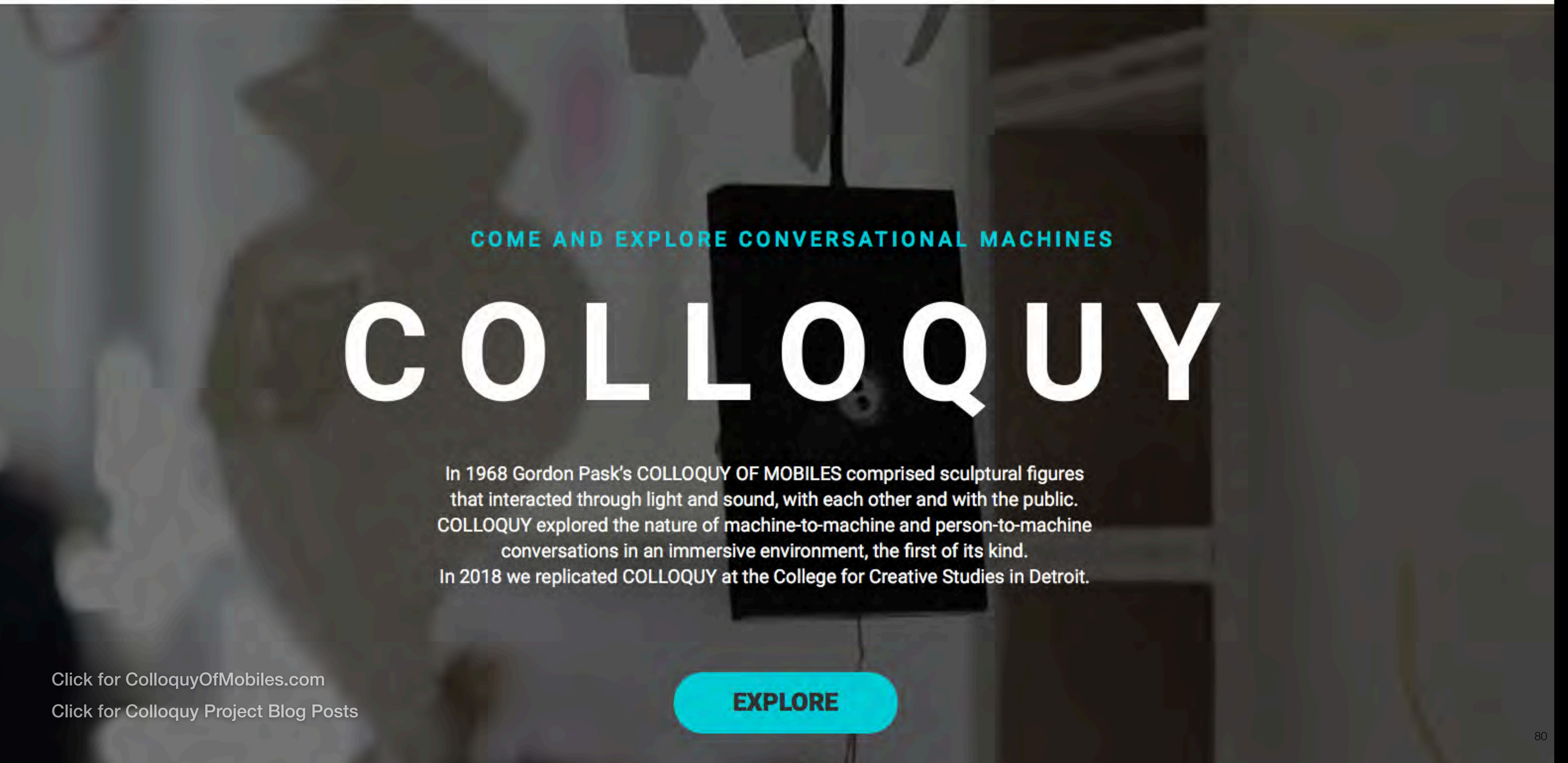
Testing the servo motors & circuits
Wendy Wu, MFA IxD Class of 2019
MFA Interaction Design



Wiring the mobiles
TJ McLeish

Testing the completed assembly

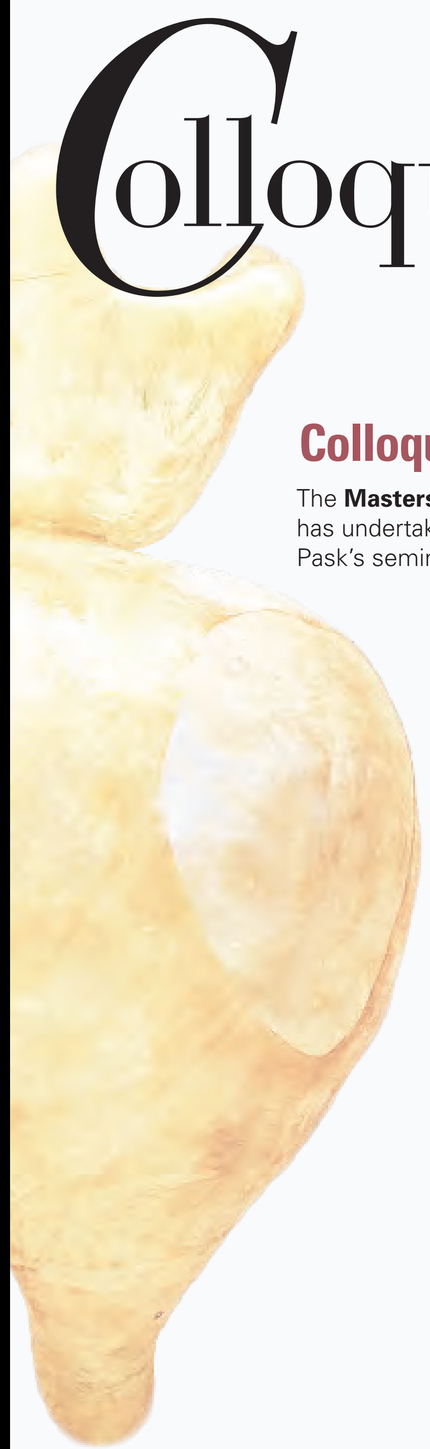




Click for ColloquyOfMobiles.com

Click for Colloquy Project Blog Posts

Opening the exhibit
MFA Interaction Design
College for Creative Studies
2018



Colloquy of Mobiles

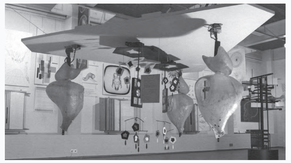
Colloquy 2018

The **Masters in Interaction Design** department at CCS has undertaken the full scale reproduction of Gordon Pask's seminal interactive work, **Colloquy of Mobiles**.

The work, then and now, explores:

- **the dynamics of conversing with machines, now occurring every day**
- **the impact of smart environments, which increasingly effect our lives**
- **the implications of artificial intelligence, inside of every device we use**

Colloquy 1968



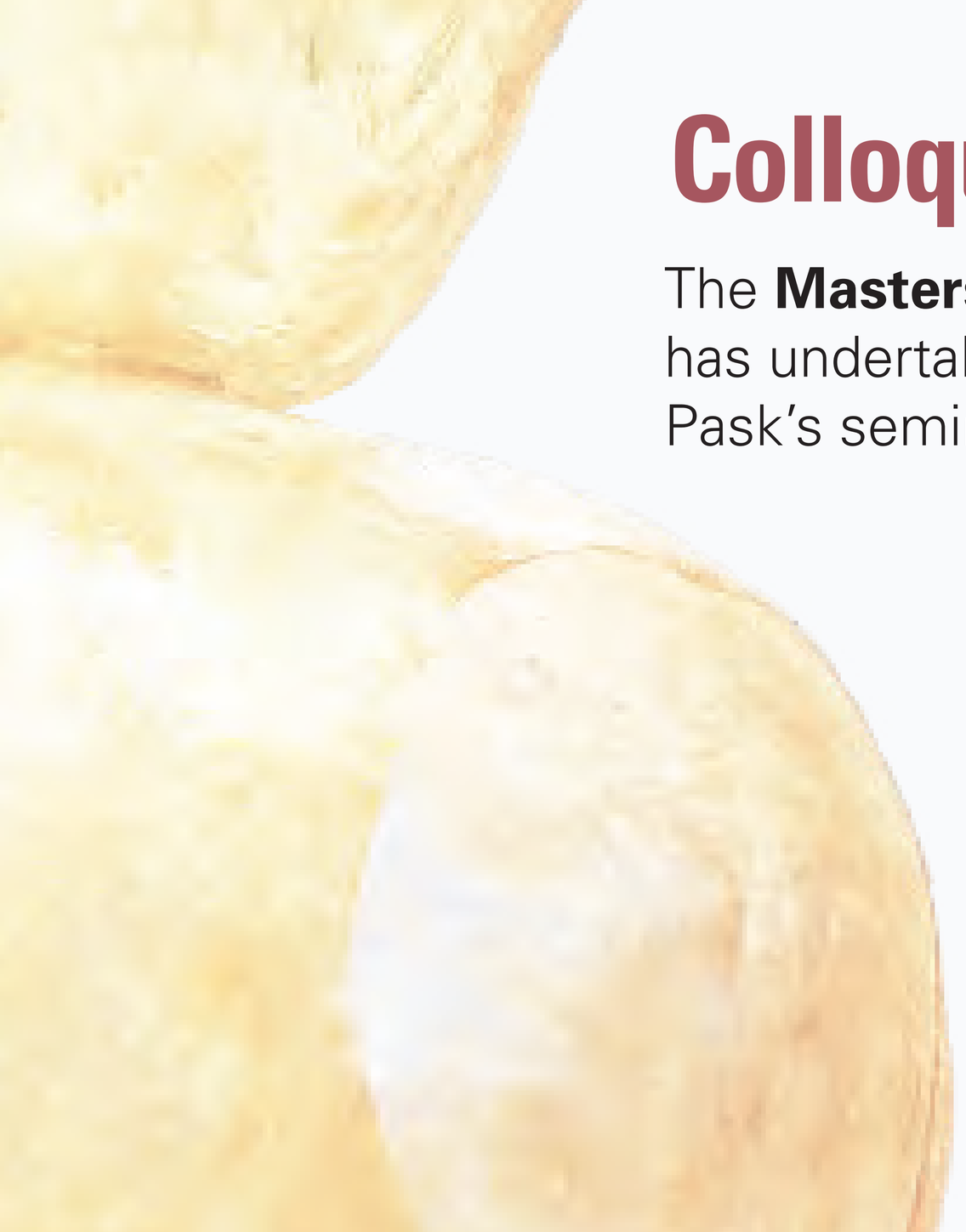
Colloquy of Mobiles was designed by Gordon Pask for the ground-breaking 1968 exhibition ***Cybernetic Serendipity*** at the Institute of Contemporary Arts in London. The installation comprises sculptural figures that move and interact through light and sound, with each other and with the public. Colloquy explores cooperative and competitive conversations, machine-to-machine and person-to-machine, in an interactive, immersive environment. Surprising and revolutionary in its day, **Colloquy of Mobiles** has influenced generations of artists and critics.

ADVISORY BOARD

Amanda Pask Heitler and **Hermione Pask**, *Gordon Pask's daughters* • **Jasia Reichardt**, *Curator of Cybernetic Serendipity at the ICA in 1968* • **Albert Müller**, *Curator of the Gordon Pask Archive, University of Vienna* • **Andrew Pickering**, *Author of "The Cybernetic Brain"* • **Guilherme Kujawski**, *Writer, Teacher, and Co-Curator of Emoção Art.ficial, ITAU Cultural* • **Hugh Dubberly**, *Design Planner and Teacher* • **John Plunkett**, *Designer and Co-Founder of WiReD Magazine* • **Marc Schwartz**, *Co-founder, DLECTRICITY* • **Vince Carducci**, *Dean of Undergraduate Affairs, CCS*

FUNDING

We have received $28,500 from individual donors and are seeking $6,000 to complete the full-scale **Colloquy of Mobiles**. Additional funding is sought to disseminate thorough documentation as widely as possible under an open-source license, as well as to hold symposia and foster deep conversations on the implications of conversational machines in our lives.
Contact us at **colloquy2018@gmail.com**



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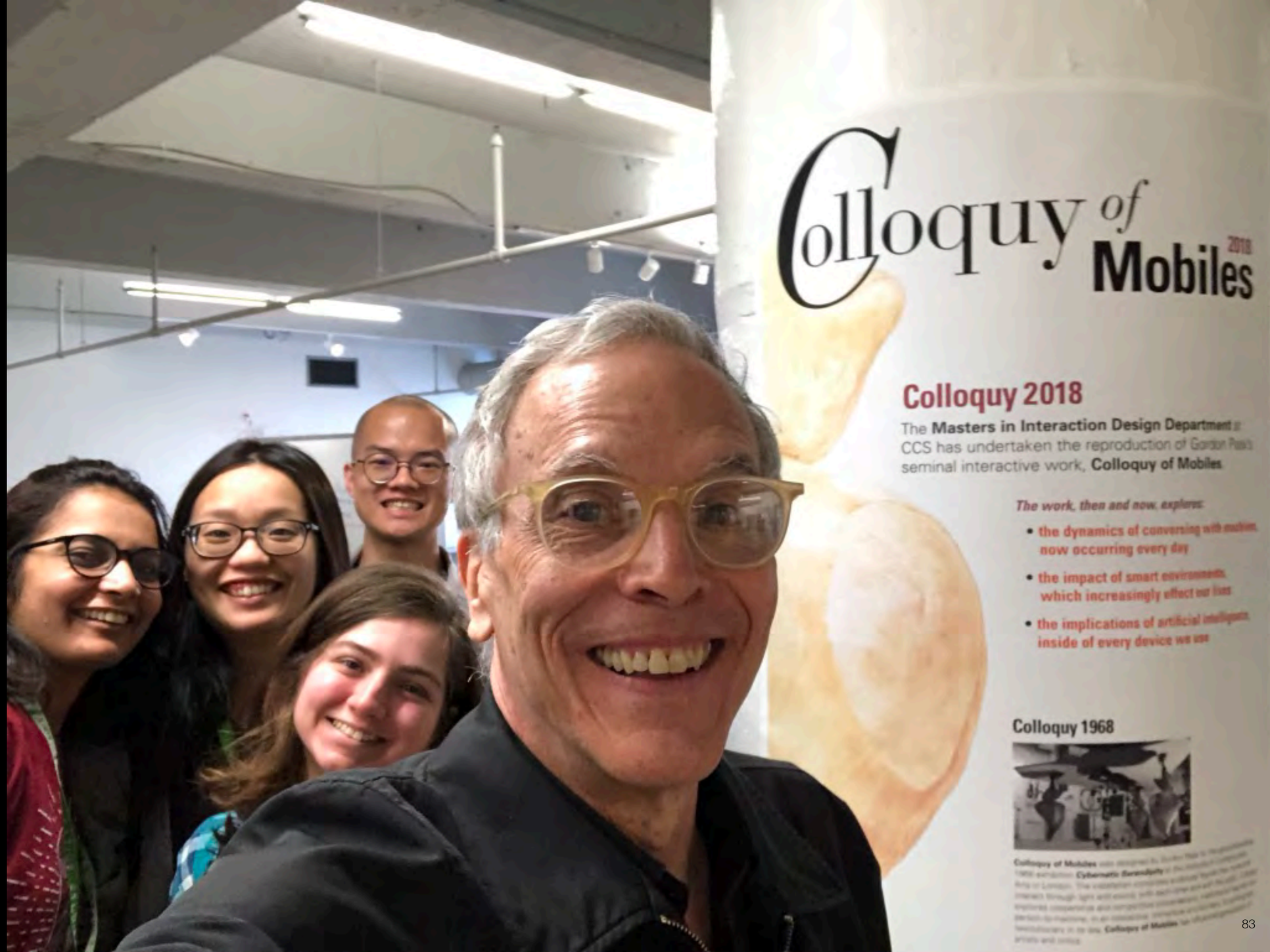
Opening the exhibit
Paul Pangaro, MFA IxD Chair
Students of Class of 2018
MFA Interaction Design
College for Creative Studies
2018



Press Coverage
HYPERALLERGIC.com
June 26, 2018
2018

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HYPERALLERGIC

ART

Interactive, Dancing Machine Sculptures Play Out Courtship Rituals

Interaction Design students at the College for Creative Studies created a function, full-scale replica of Gordon Pask's visionary 1968 installation "Colloquy of Mobiles."

Sarah Rose Sharp June 26, 2018

"Colloquy of Mobiles 2018" at the College for Creative Studies (all photos by the author for Hyperallergic)

DETROIT — Remember the last time you called Siri into action, and instantly large, Venus of Willendorf-like figures rotated gracefully around with graphic, black-and-white mobiles, attempting to win a

POPULAR

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Current State
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December 2018


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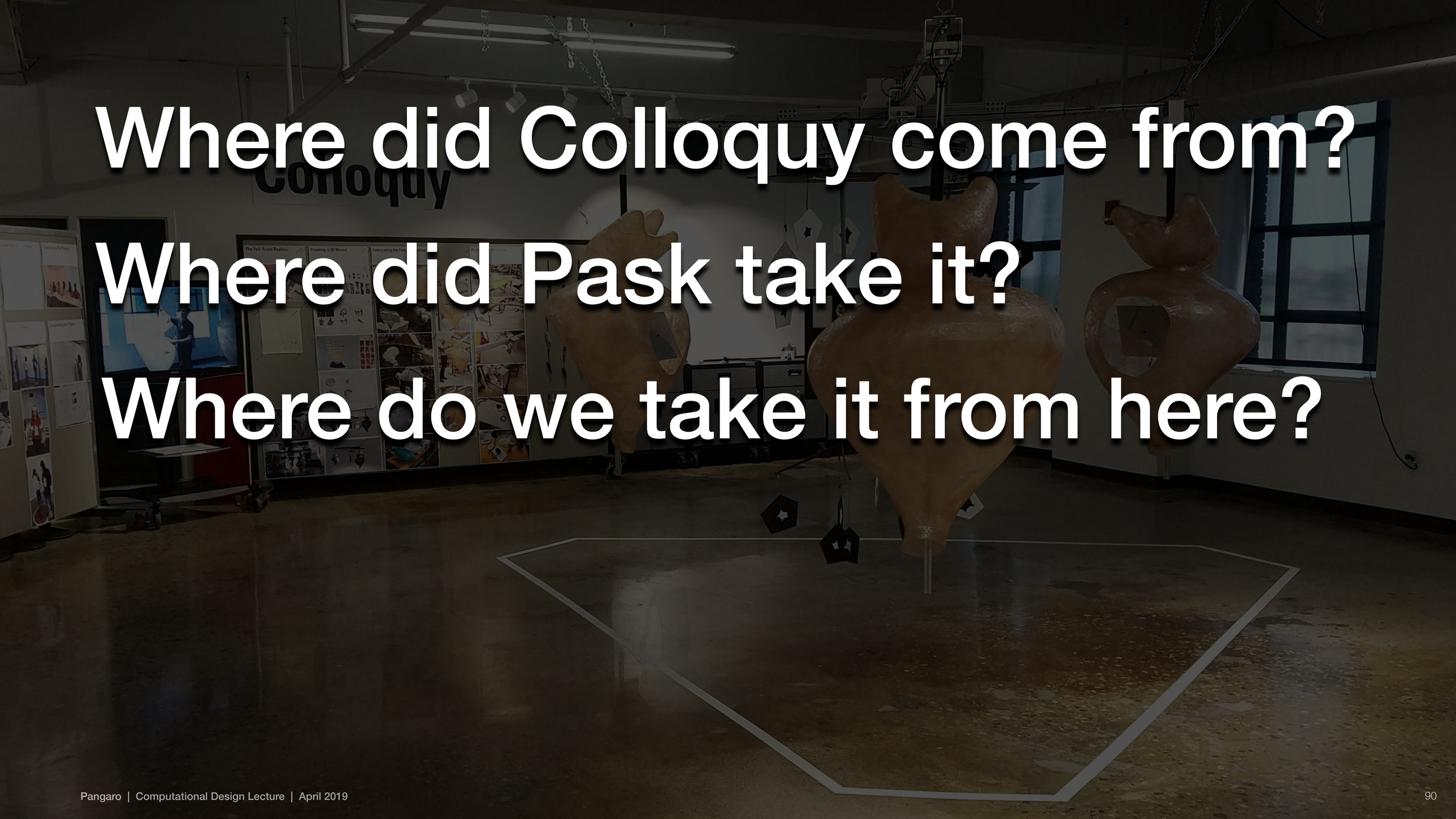
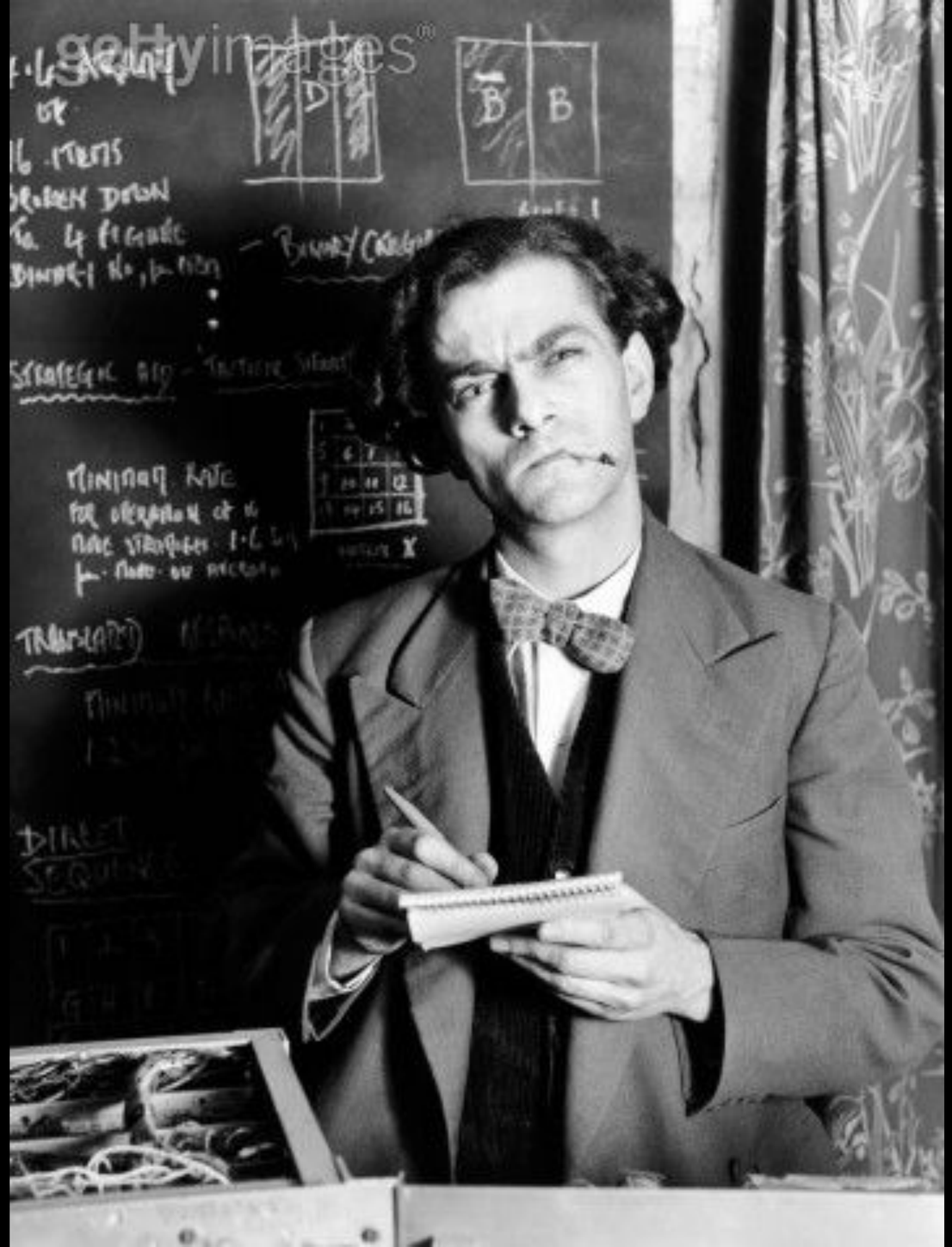
Colloquy
The Full-Scale Replica
Creating a 3D Model
Fabricating the Female Mobiles


Where did Colloquy come from?
Where did Pask take it?
Where do we take it from here?

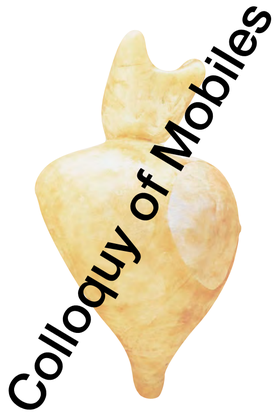
CONVERSATION

Gordon Pask
Early 1950s

Photo: getty images (R)

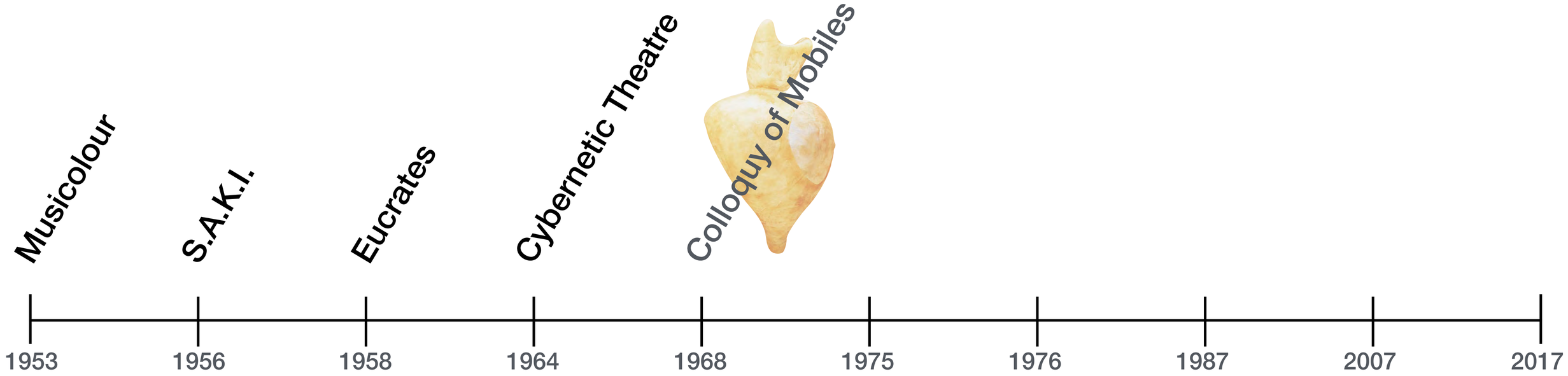


Gordon Pask – Computing Conversation

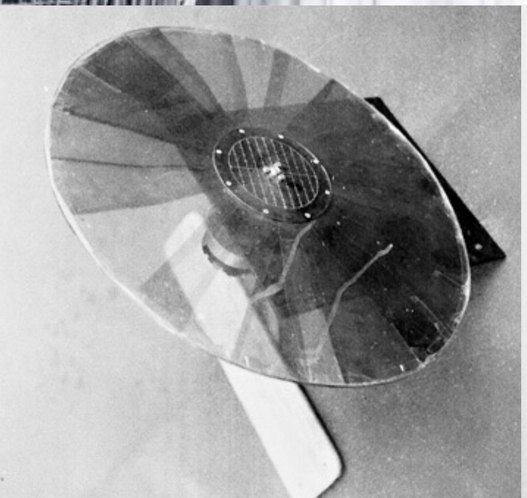


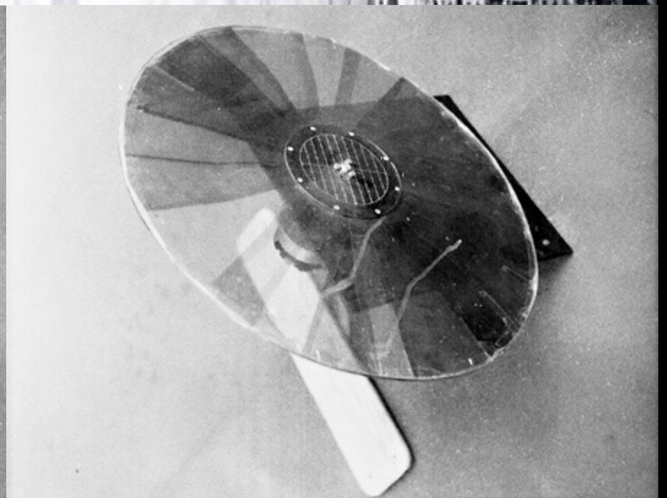
1953 1956 1958 1964 1968 1975 1976 1987 2007 2017

Gordon Pask – Computing Conversation



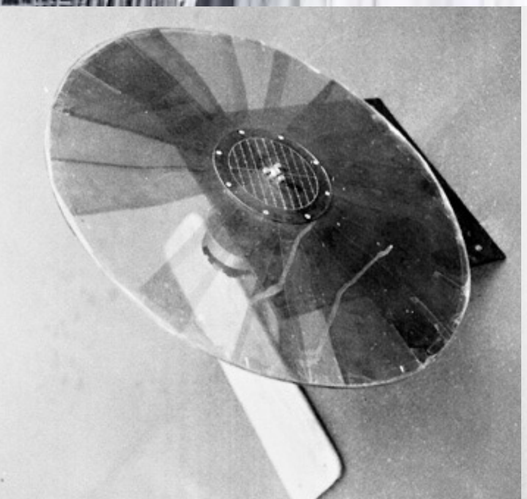
Pask installed Musicolour
in venues around England.

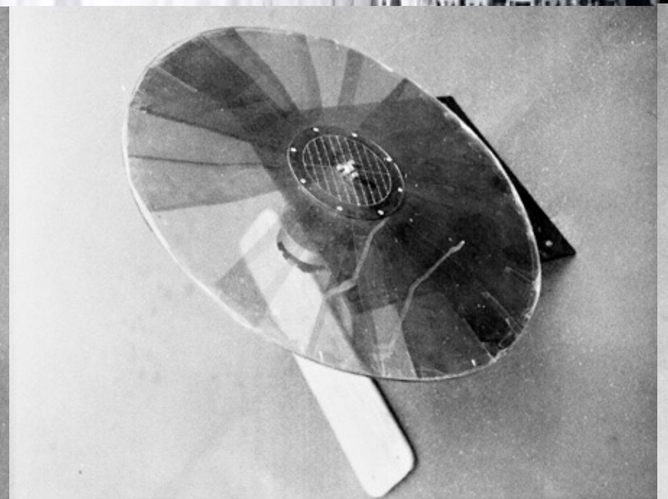


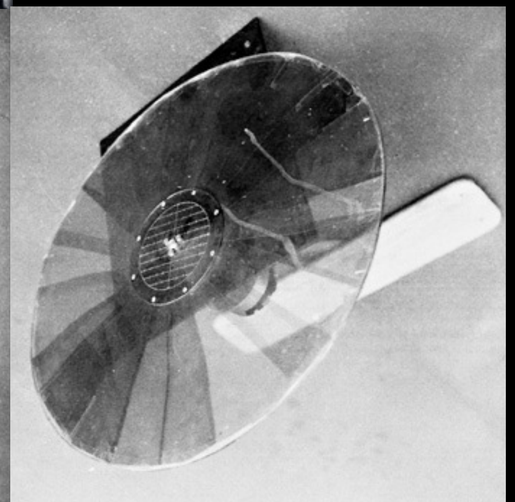


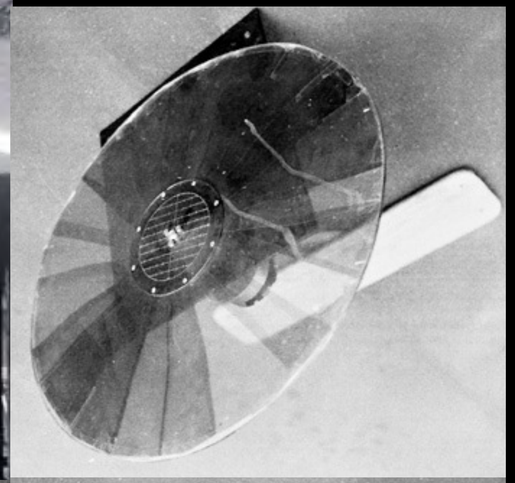
Lights were configured to shine on curtains.

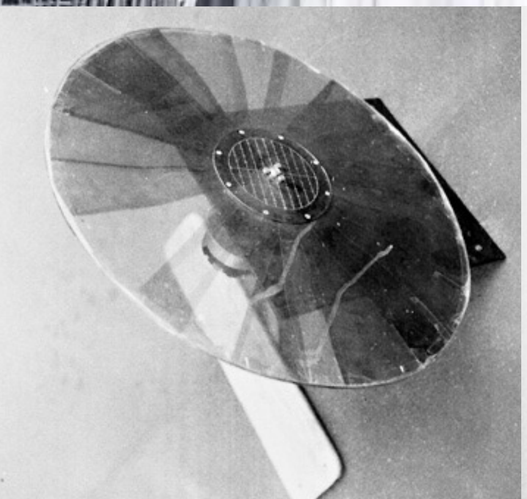
The electronics were bulky and complex and could malfunction or catch fire.

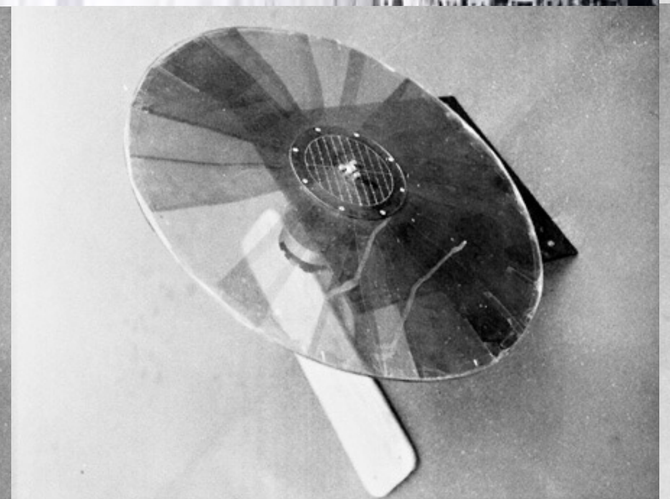


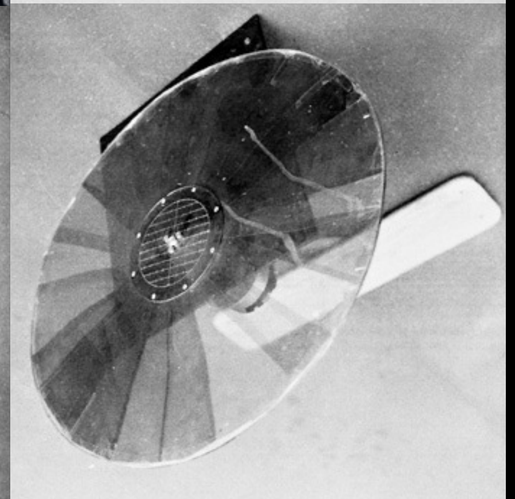












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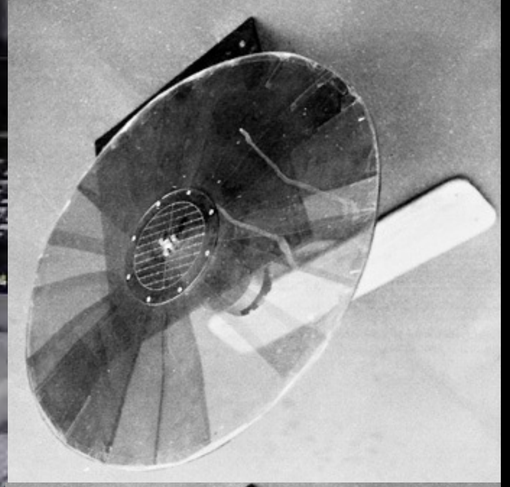
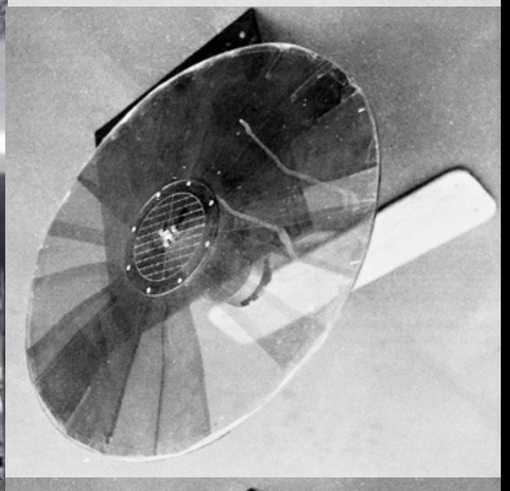
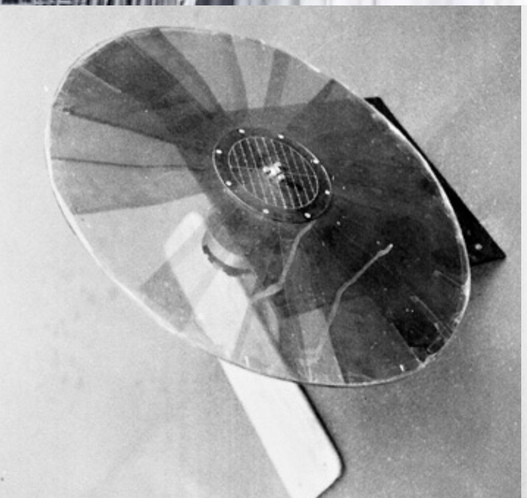
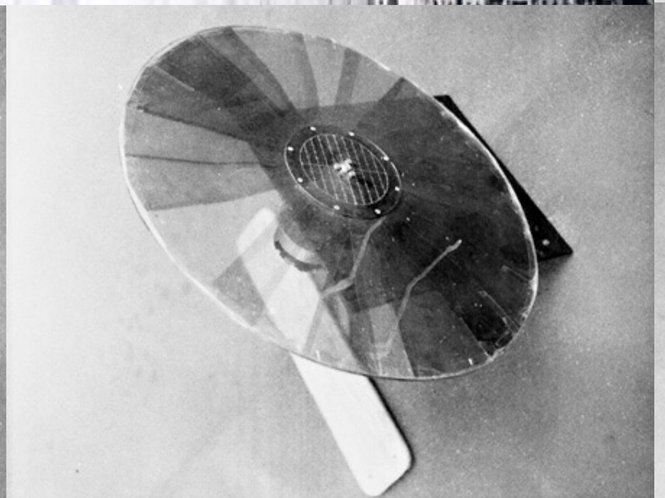
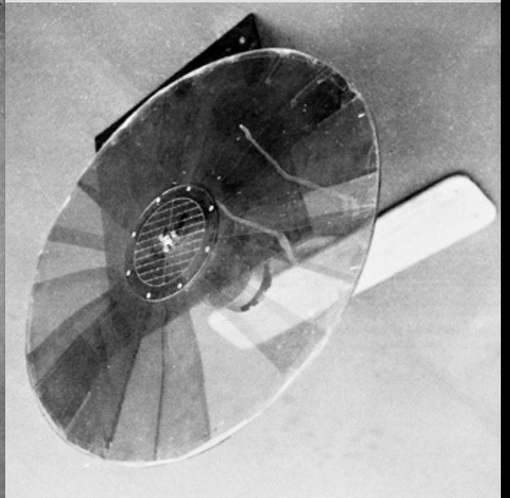






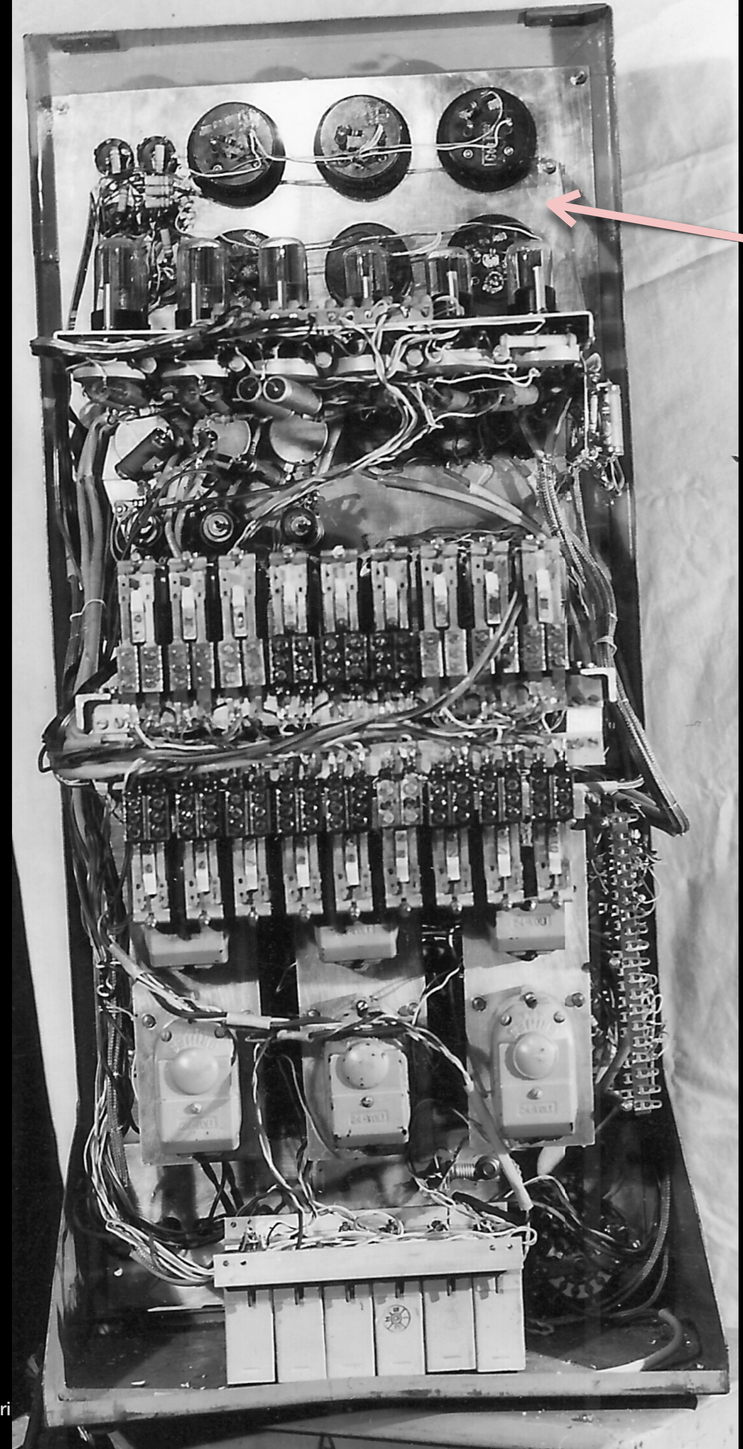




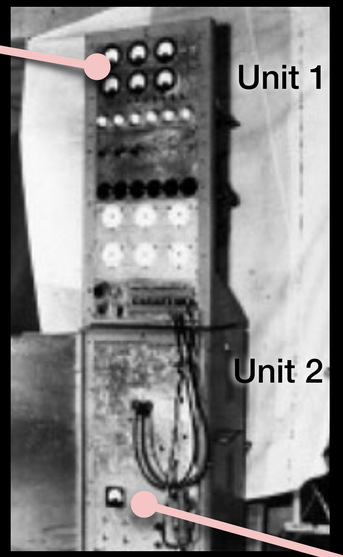
Lights were configured to shine on curtains.

The electronics were bulky and complex and could malfunction or catch fire.

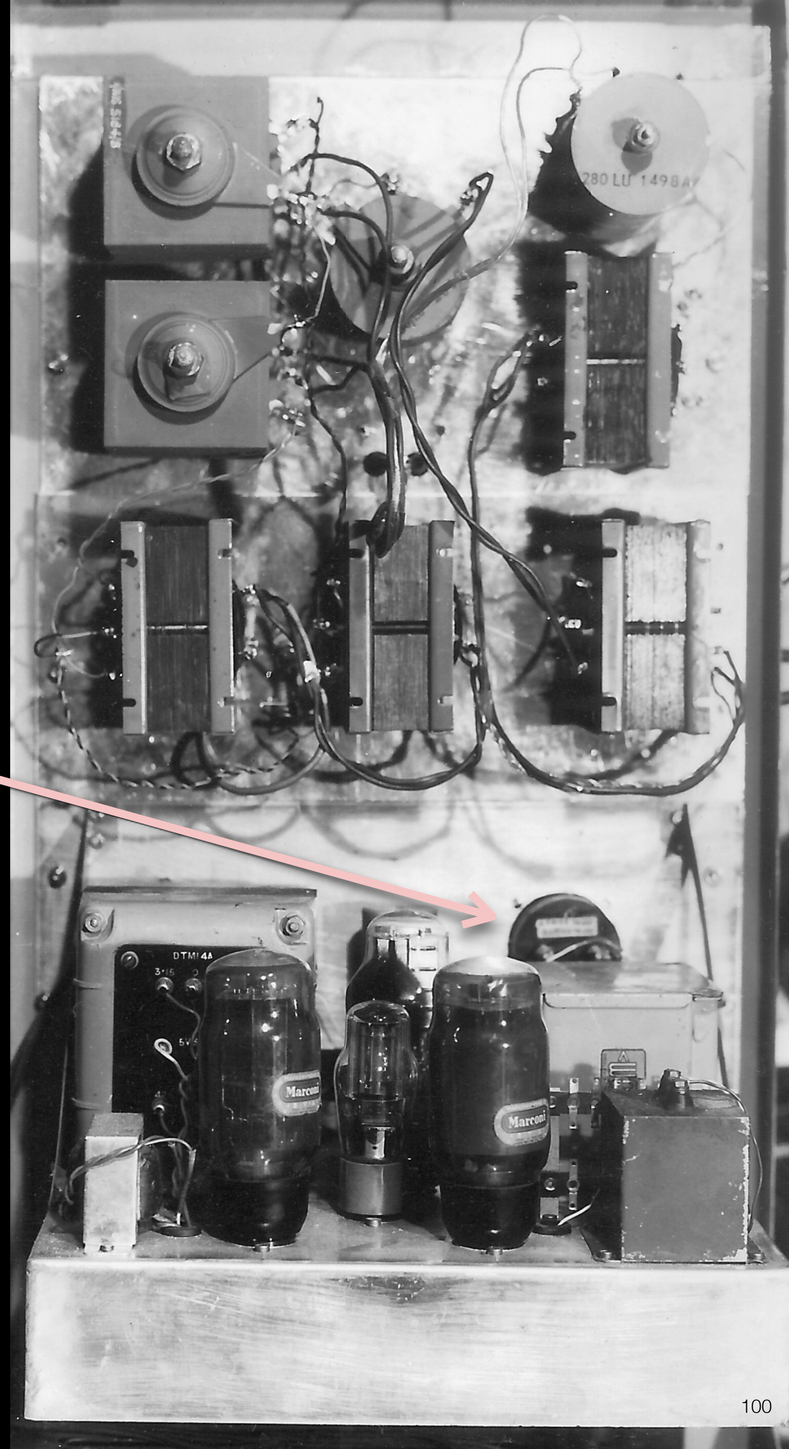
Musicolour Apparatus
mid-1950s



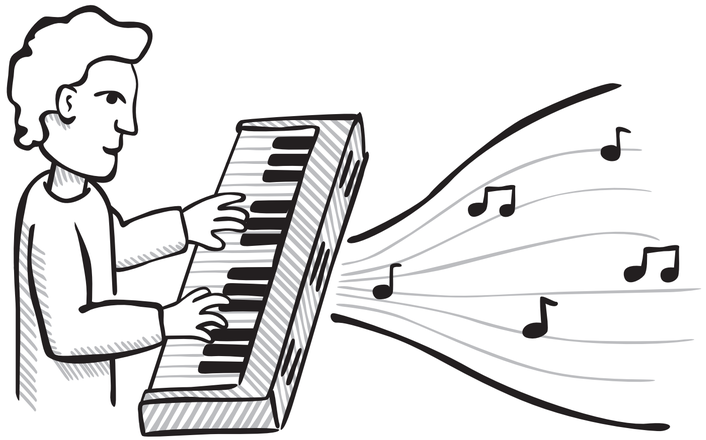
Rear
View



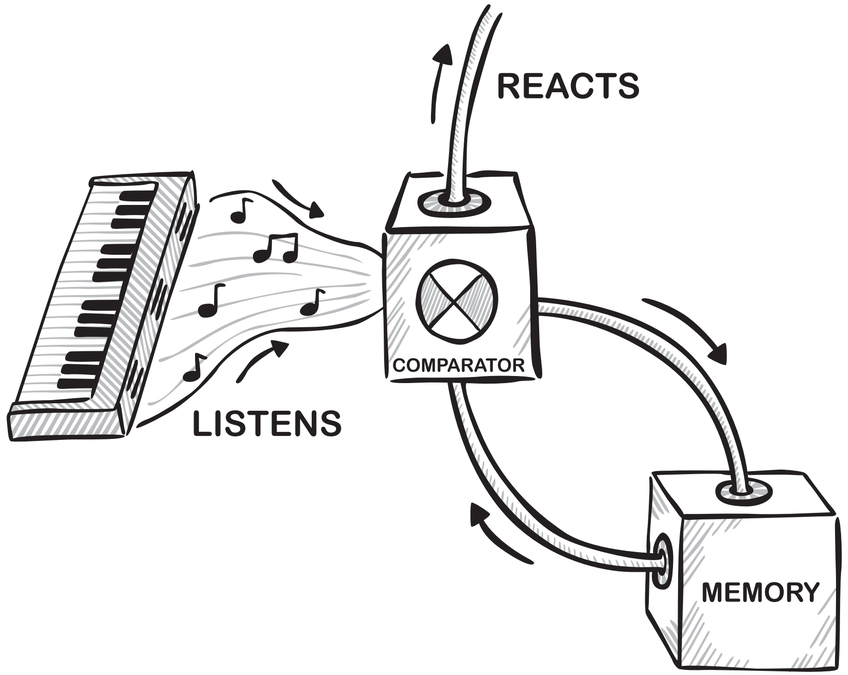
Front View



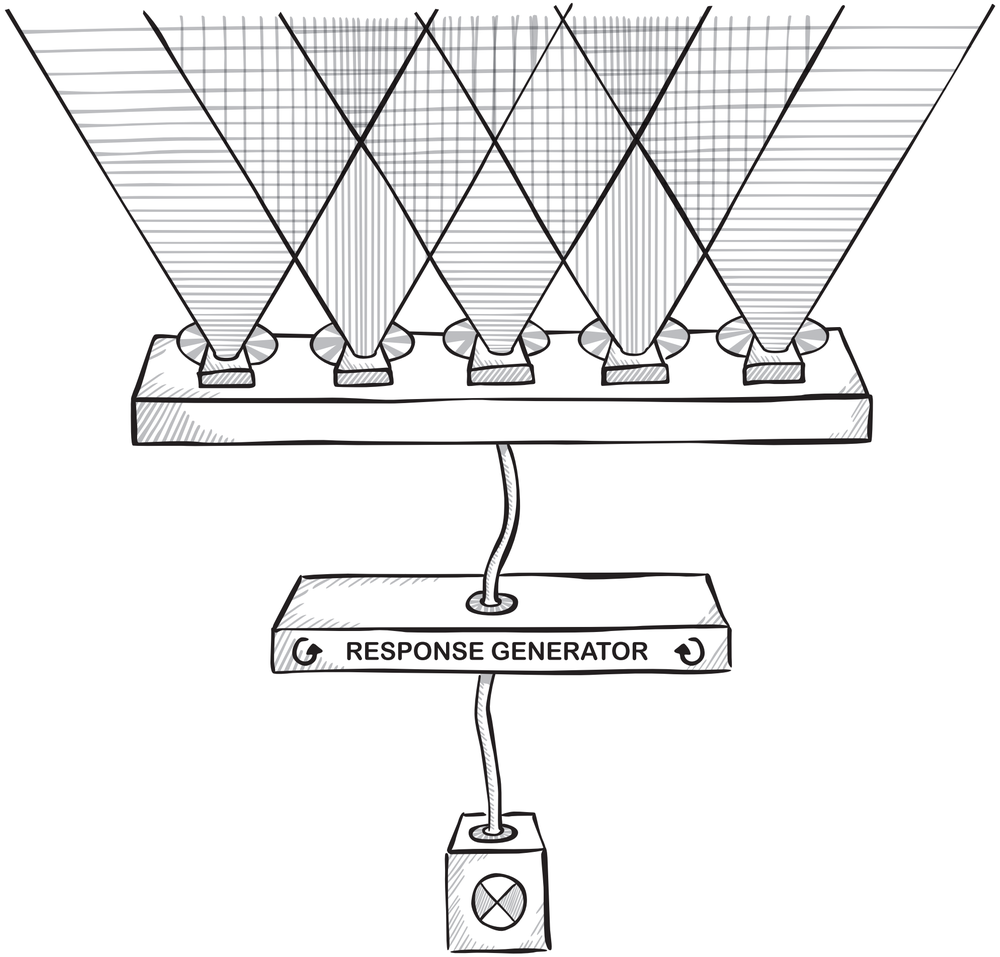
Rear
View



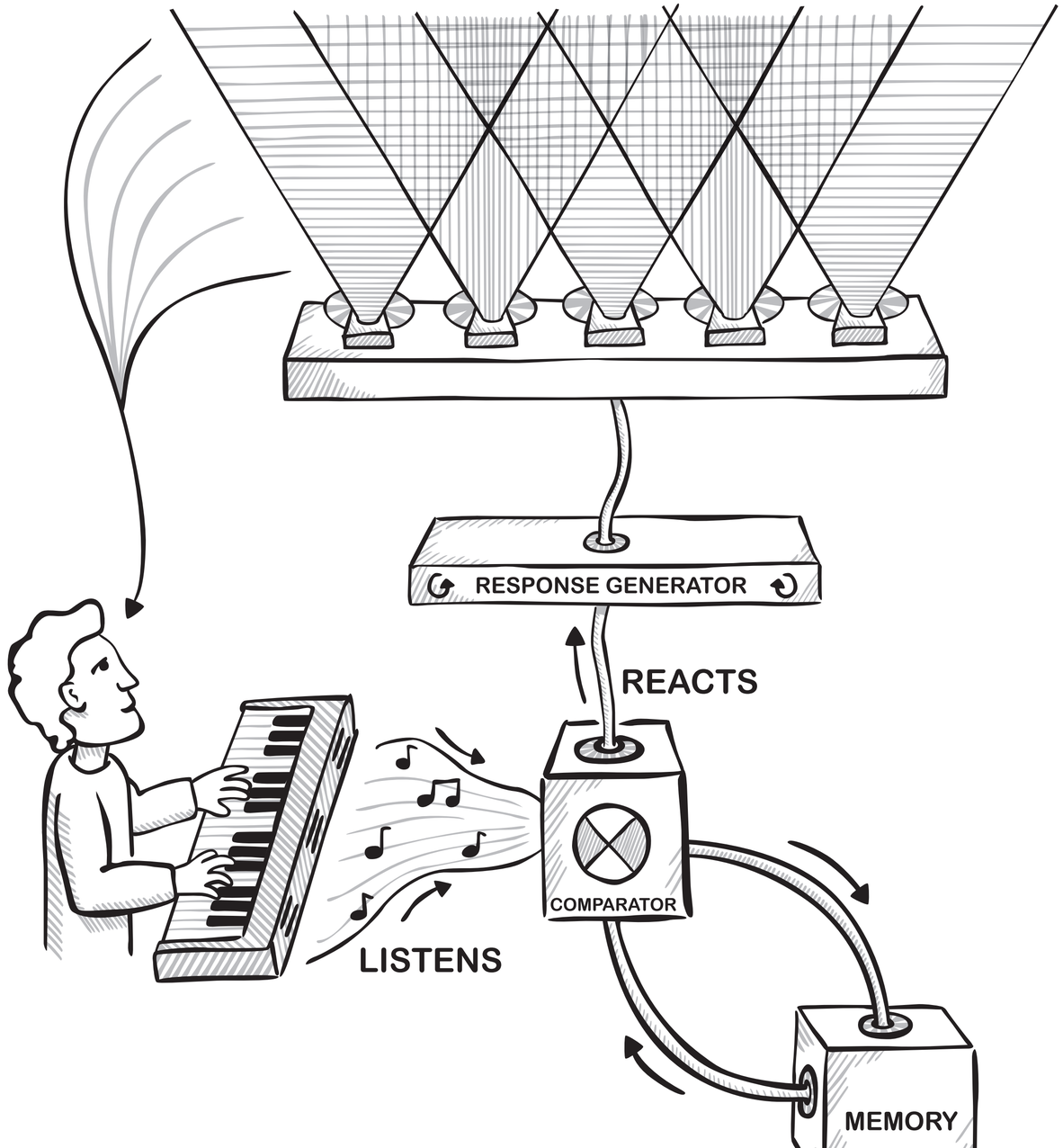
Musicolour
mid-1950s



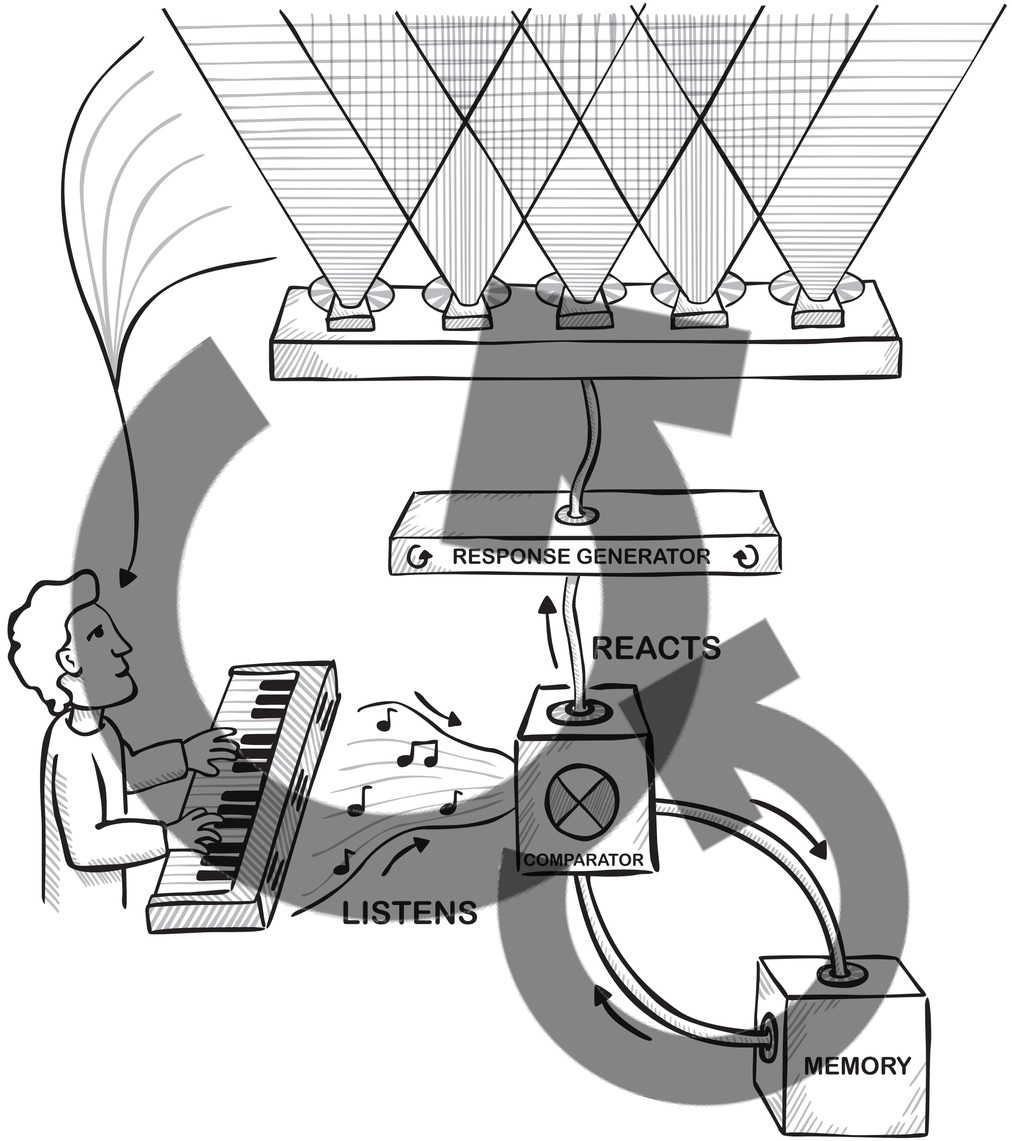
Musicolour
mid-1950s



Musicolour
mid-1950s



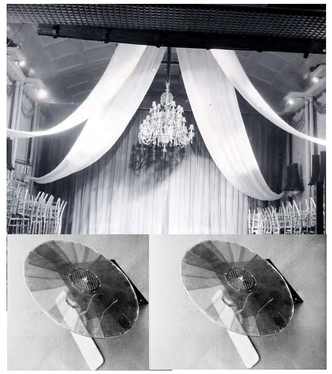
Musicolour
mid-1950s



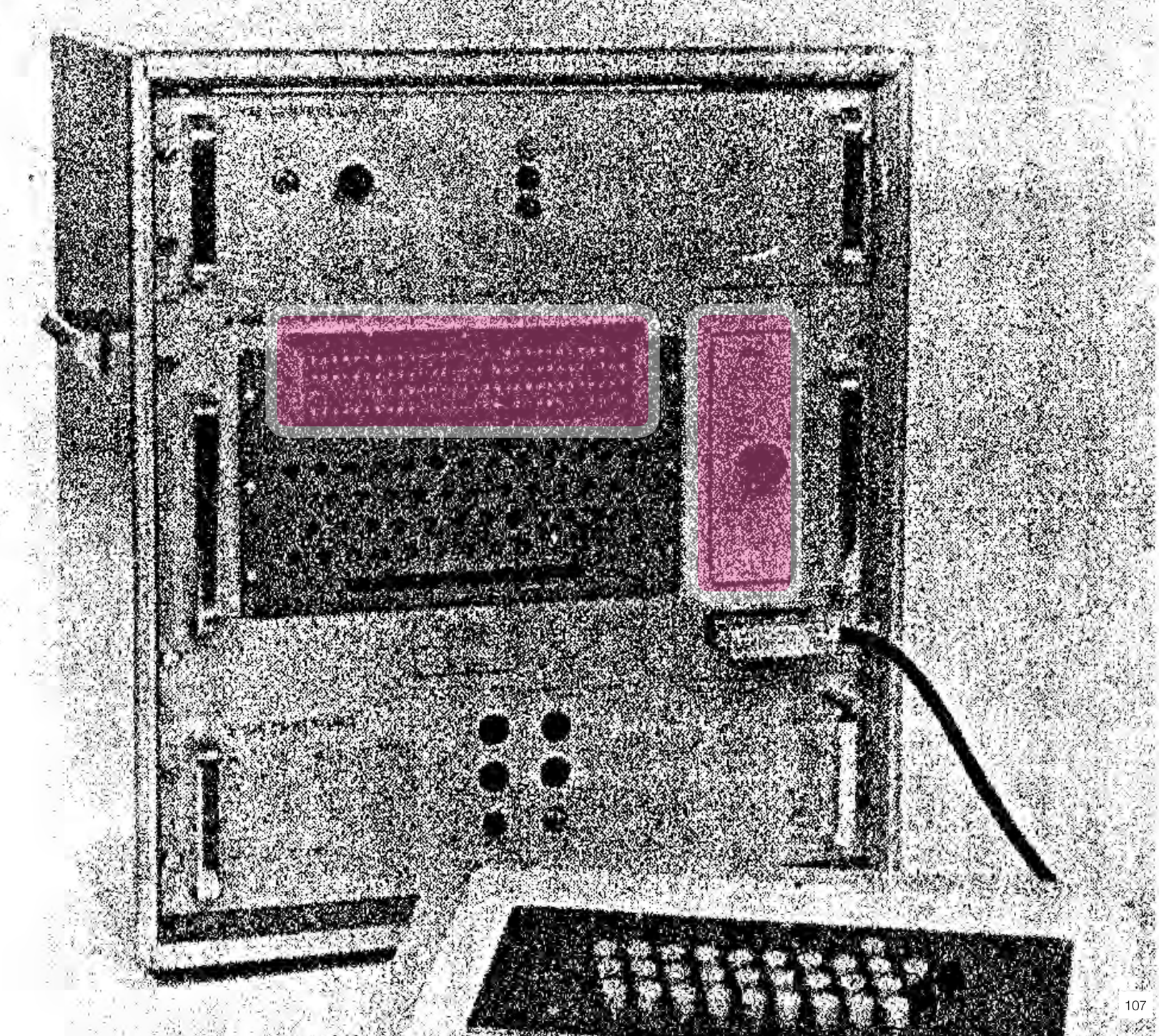
Musicolour
mid-1950s

Paskian Interaction Principle #1 — Novelty Regulation

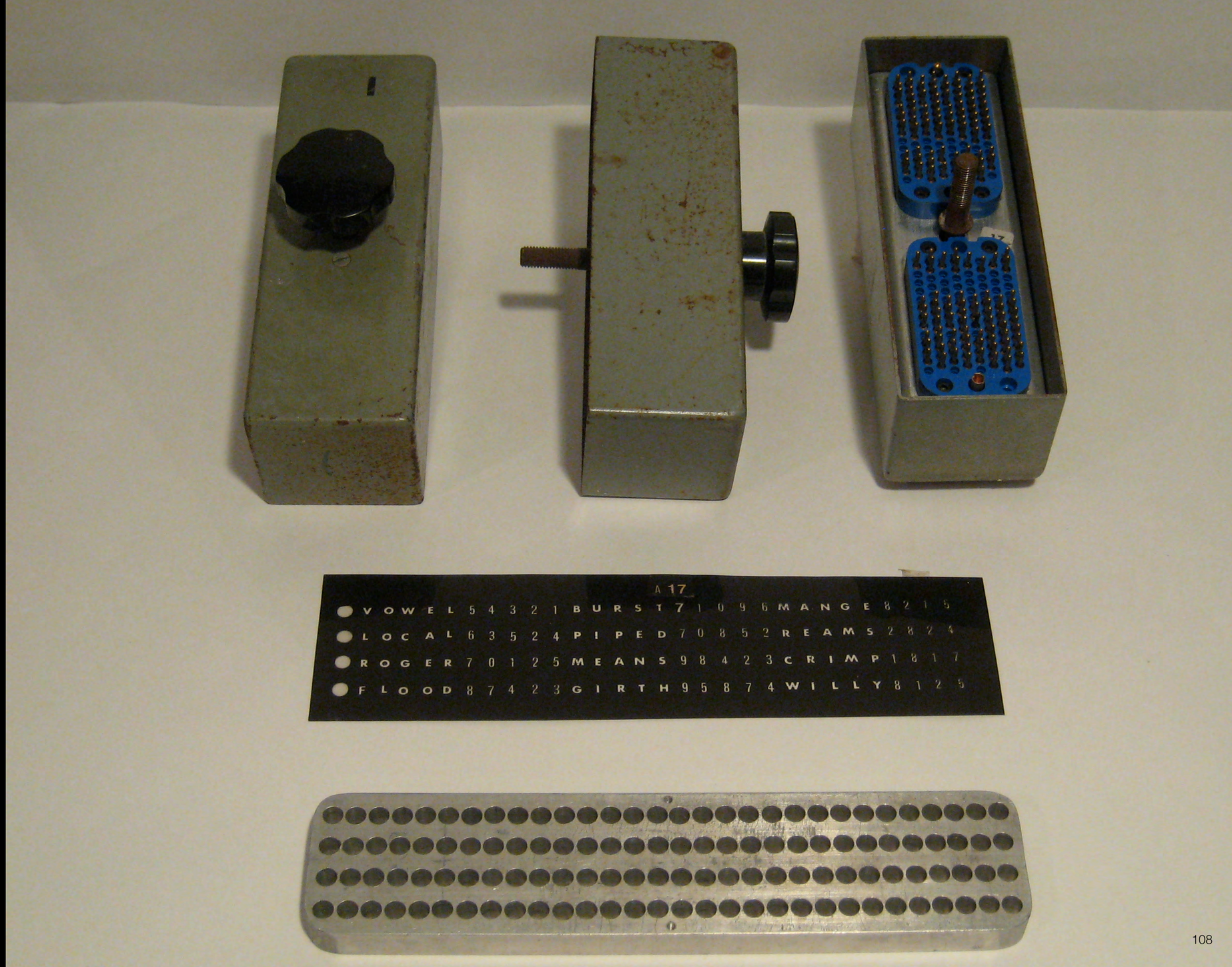
Musicolour implements Novelty Regulation because it detects repetition, gets "bored", and changes its responsiveness in order to maintain engagement of participants in a conversation.



Gordon Pask’s S.A.K.I.
Self-Adaptive Keyboard Instructor
1956



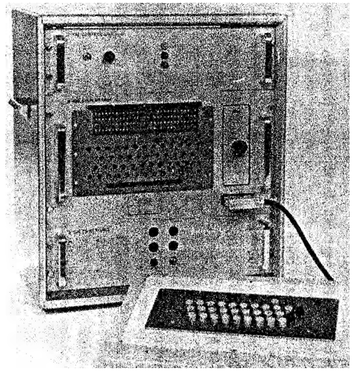
S.A.K.I.
Programming Modules
1956



#1 — Novelty Regulation

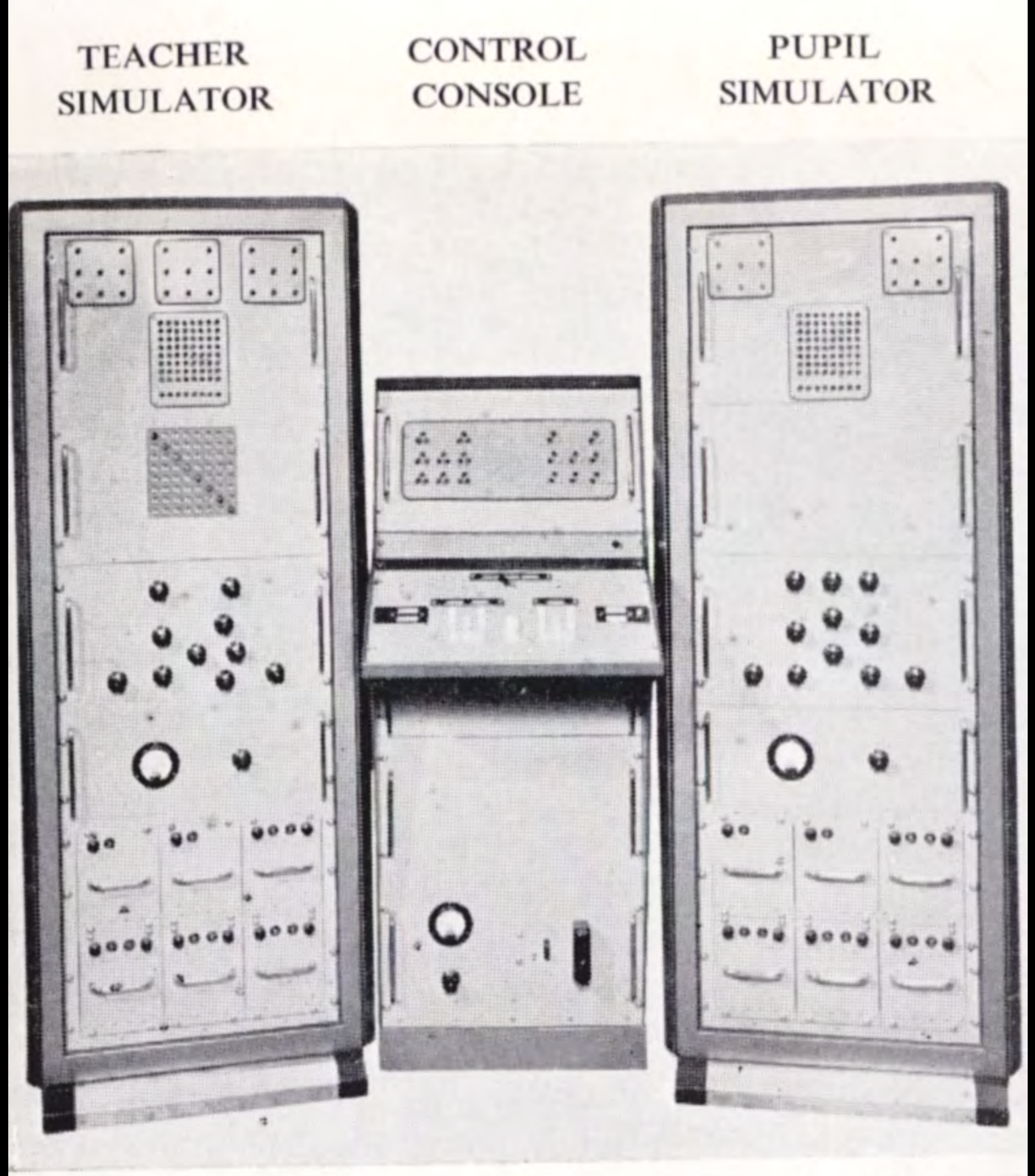
Paskian Interaction Principle #2 — Uncertainty Regulation

S.A.K.I. implements Uncertainty Regulation because it senses facility and failure, and then calculates how to modulate its responses in order to maintain consistent learning by a participant in a conversation.



Gordon Pask's
Eucrates

1958

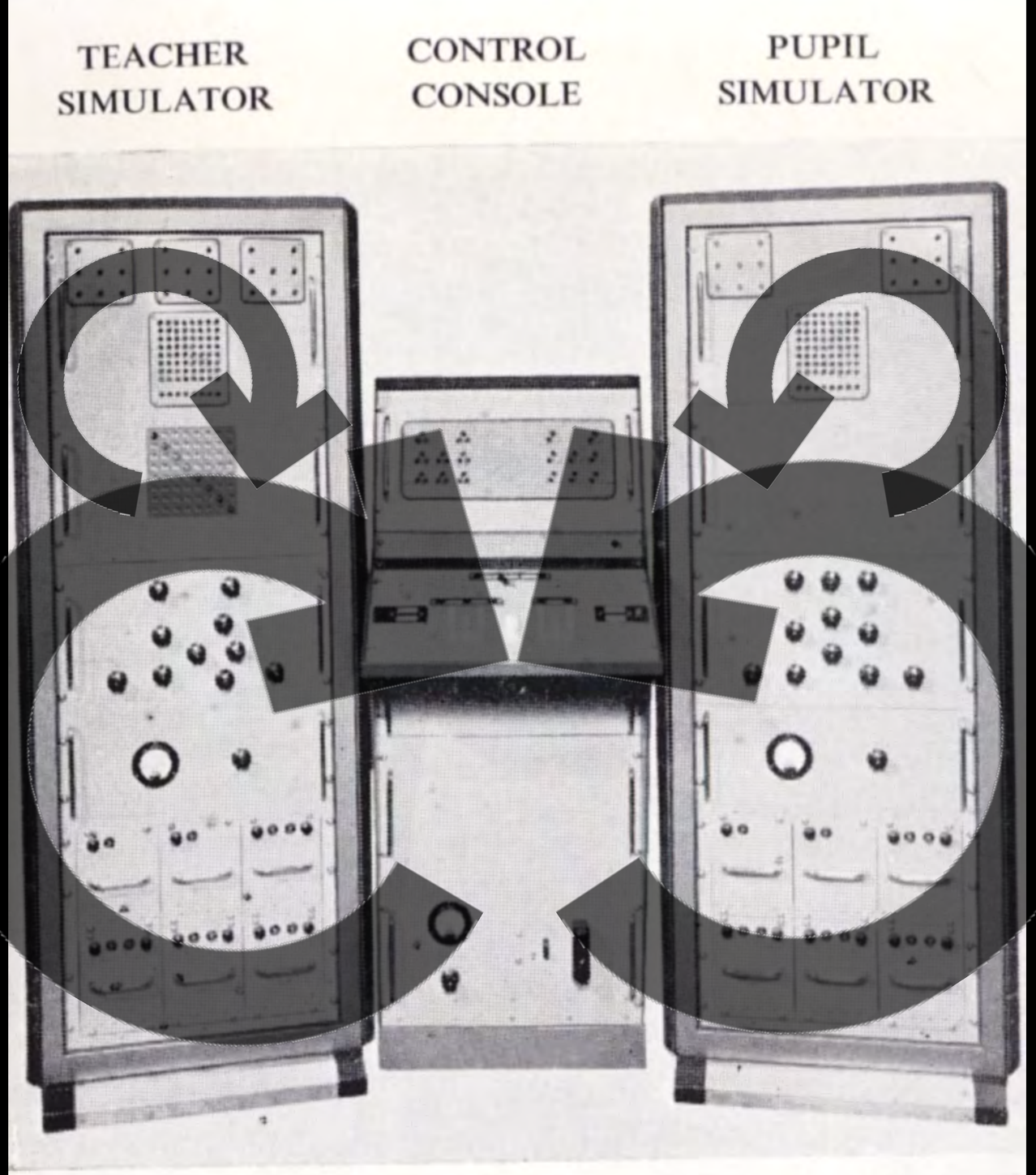


Pask created many conversational machines.

Here a teacher-machine converses with a pupil-machine.

Gordon Pask's
Eucrates

1958



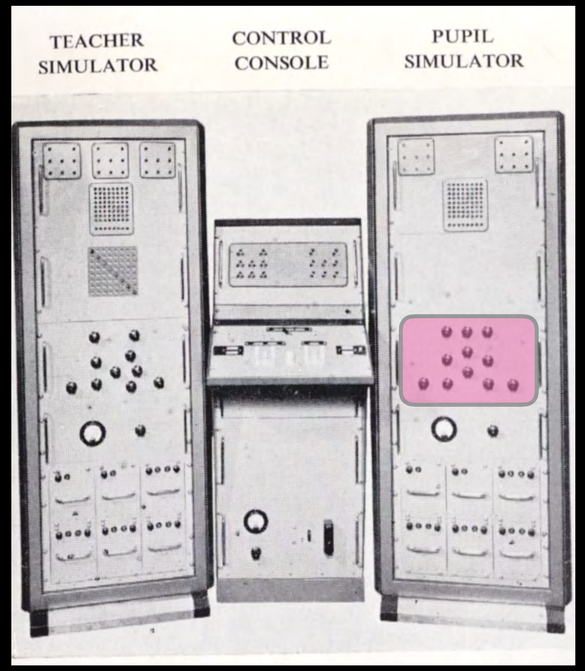
The conversation architecture was the same as Musicolour.

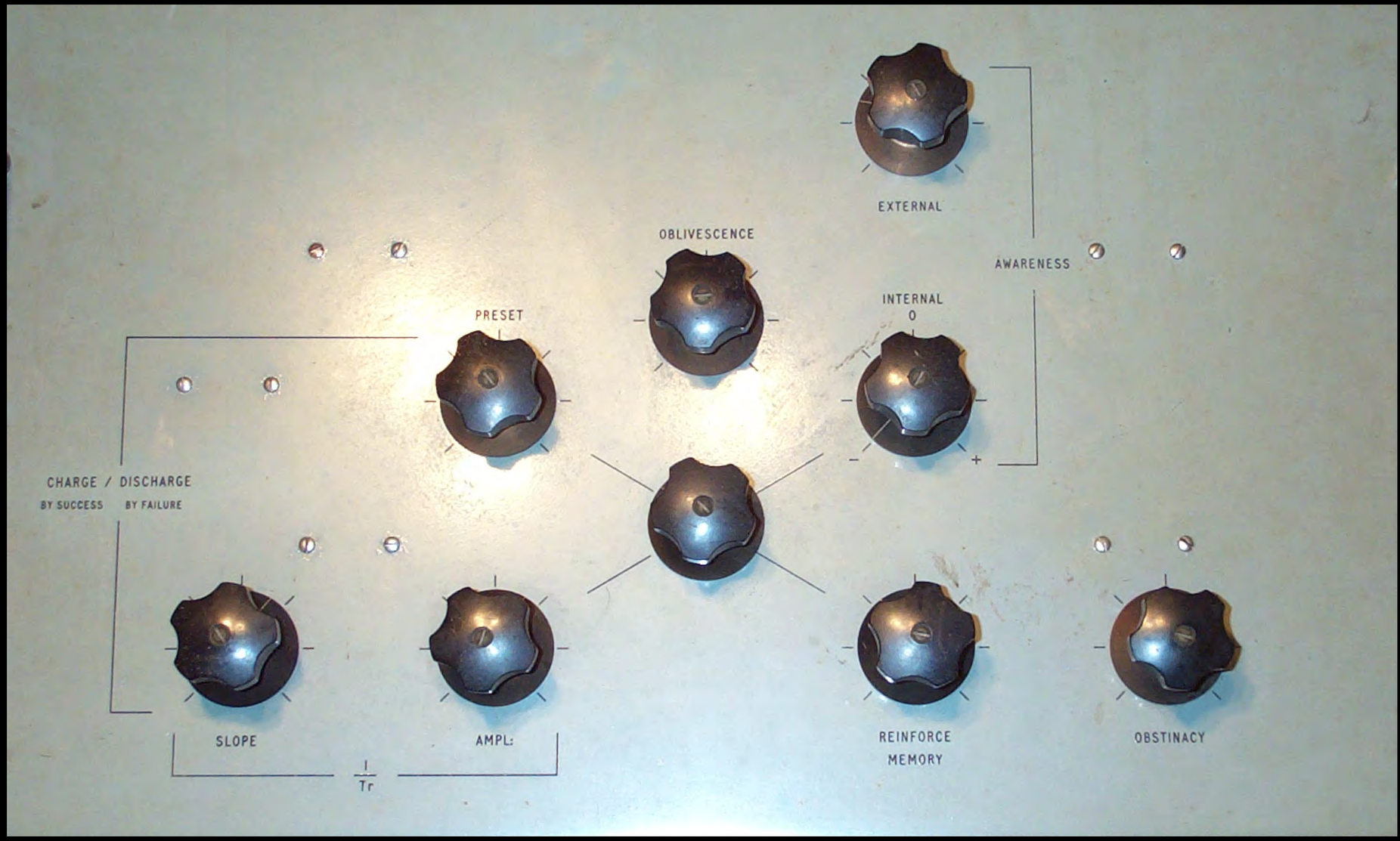
One loop applied feedback from actions and another applied feedback about goals.

Both machines appear to have had multiple loops.

Gordon Pask's
Eucrates

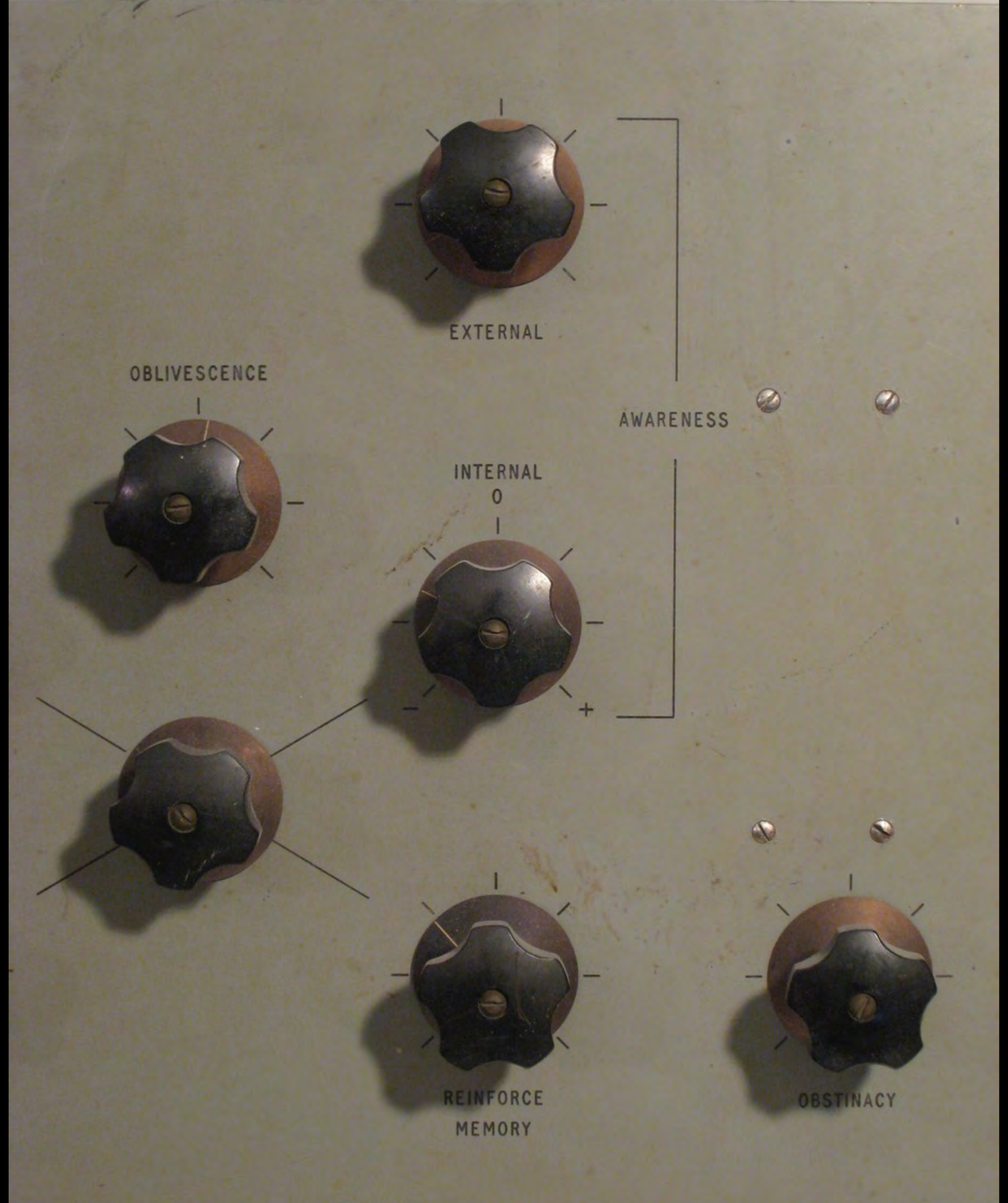
1958





Gordon Pask's
Eucrates

1958

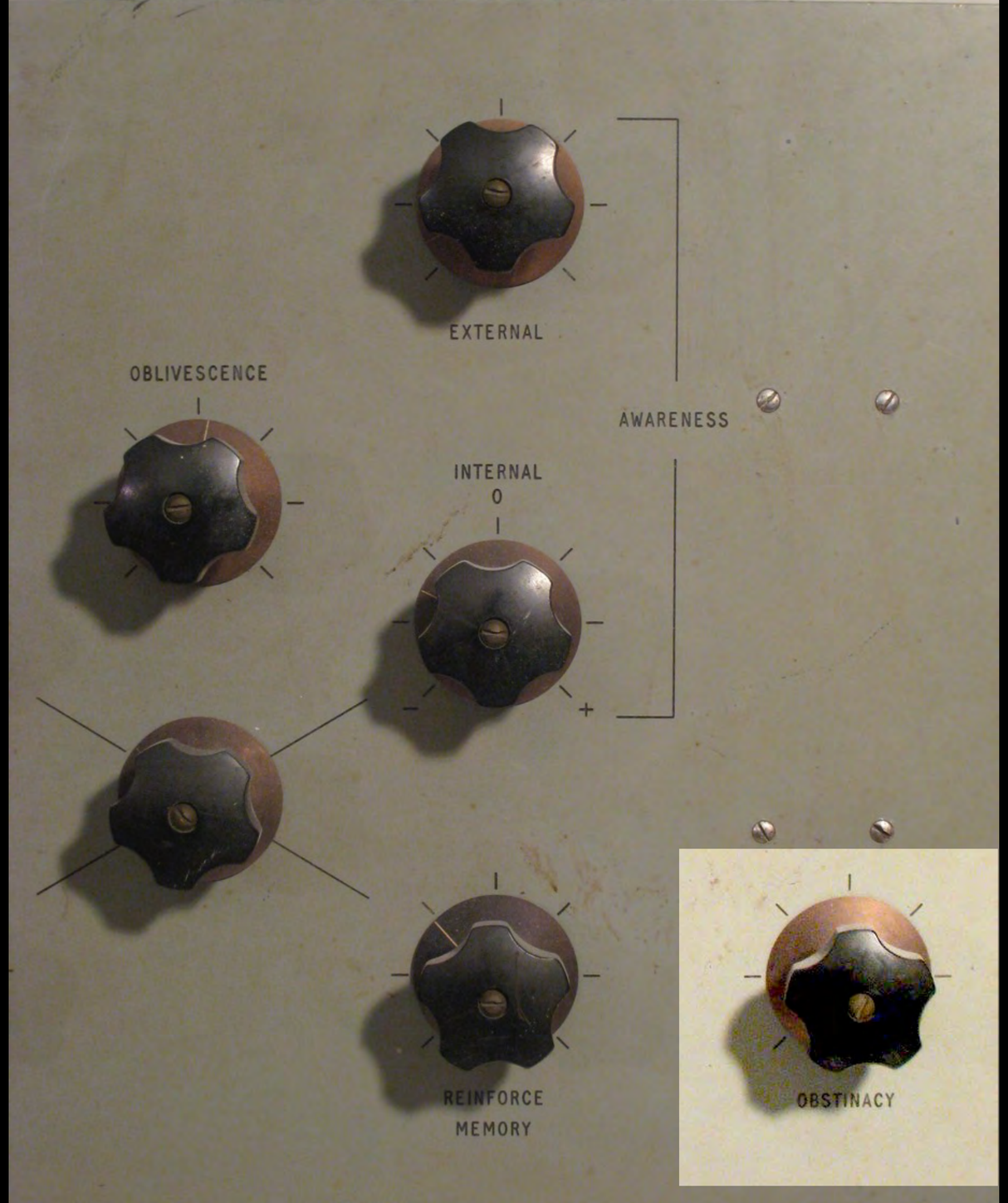


The control panel of the pupil-machine had a knob to control external awareness.

And another knob for internal awareness.

Gordon Pask's
Eucrates

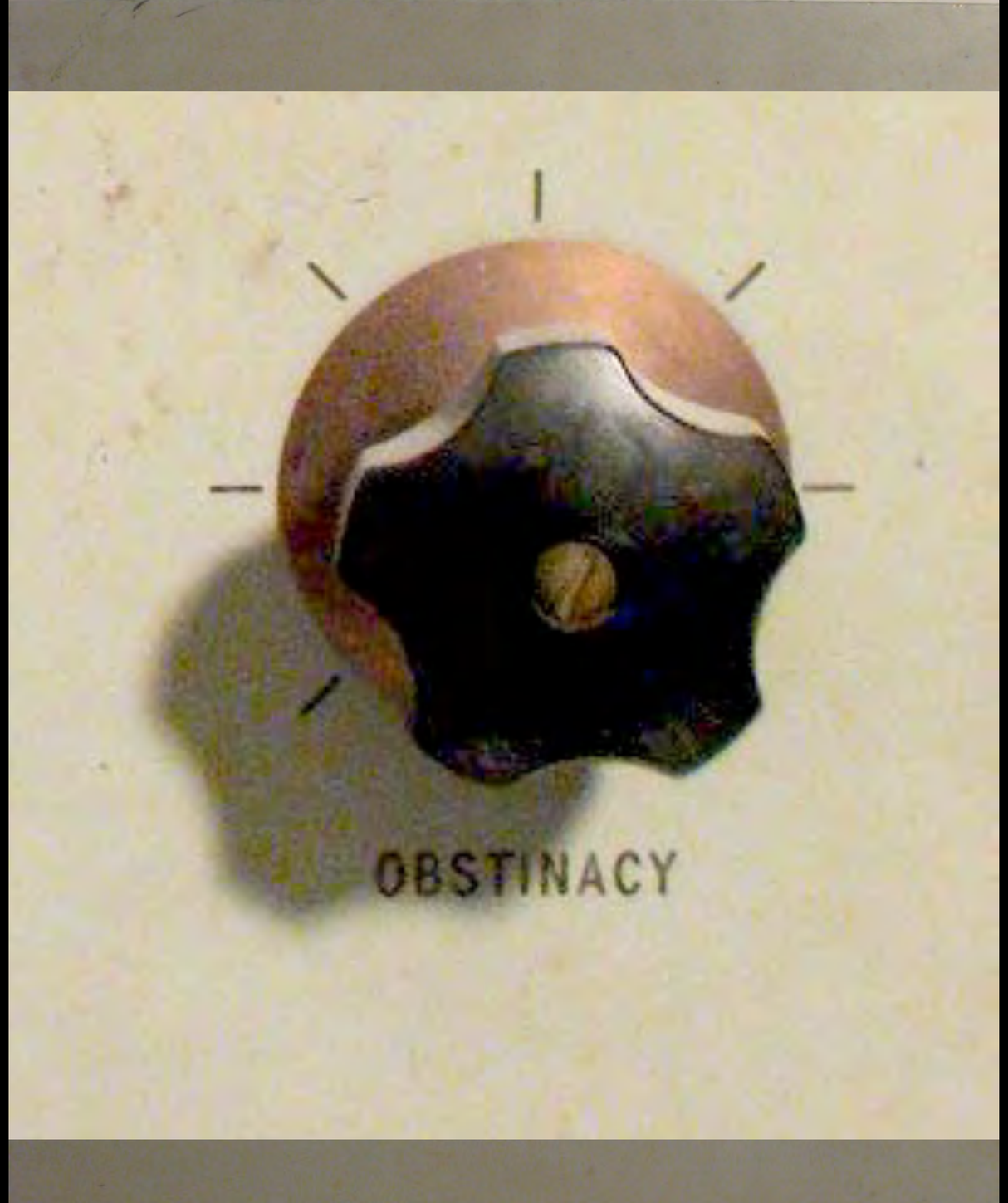
1958



Yet another knob controlled the degree of obstinacy.

Gordon Pask's
Eucrates

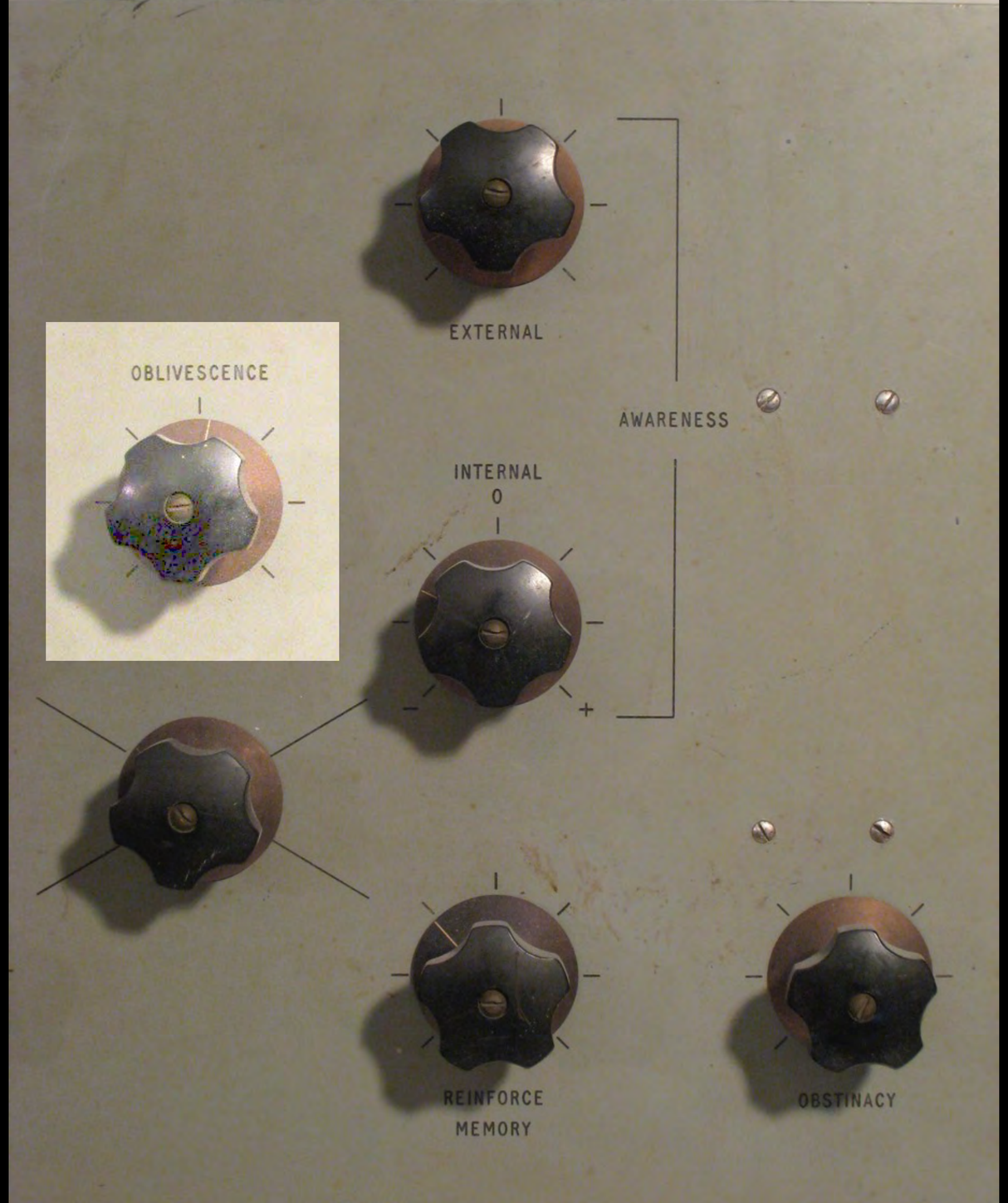
1958



Turning up this knob made the pupil-machine less willing to learn.

Gordon Pask’s
Eucrates

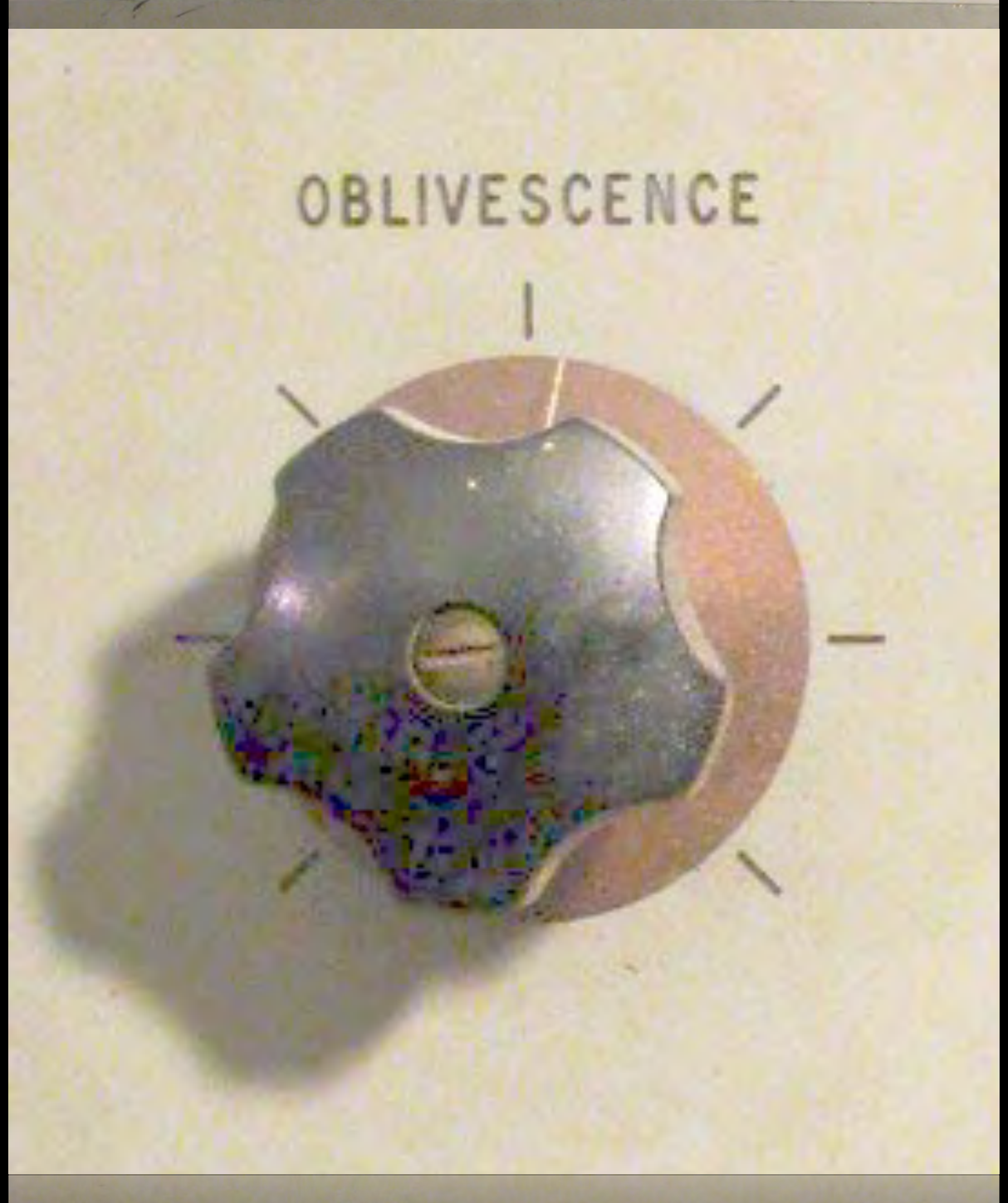
1958



But there was something
beyond obstinacy.

Gordon Pask's
Eucrates

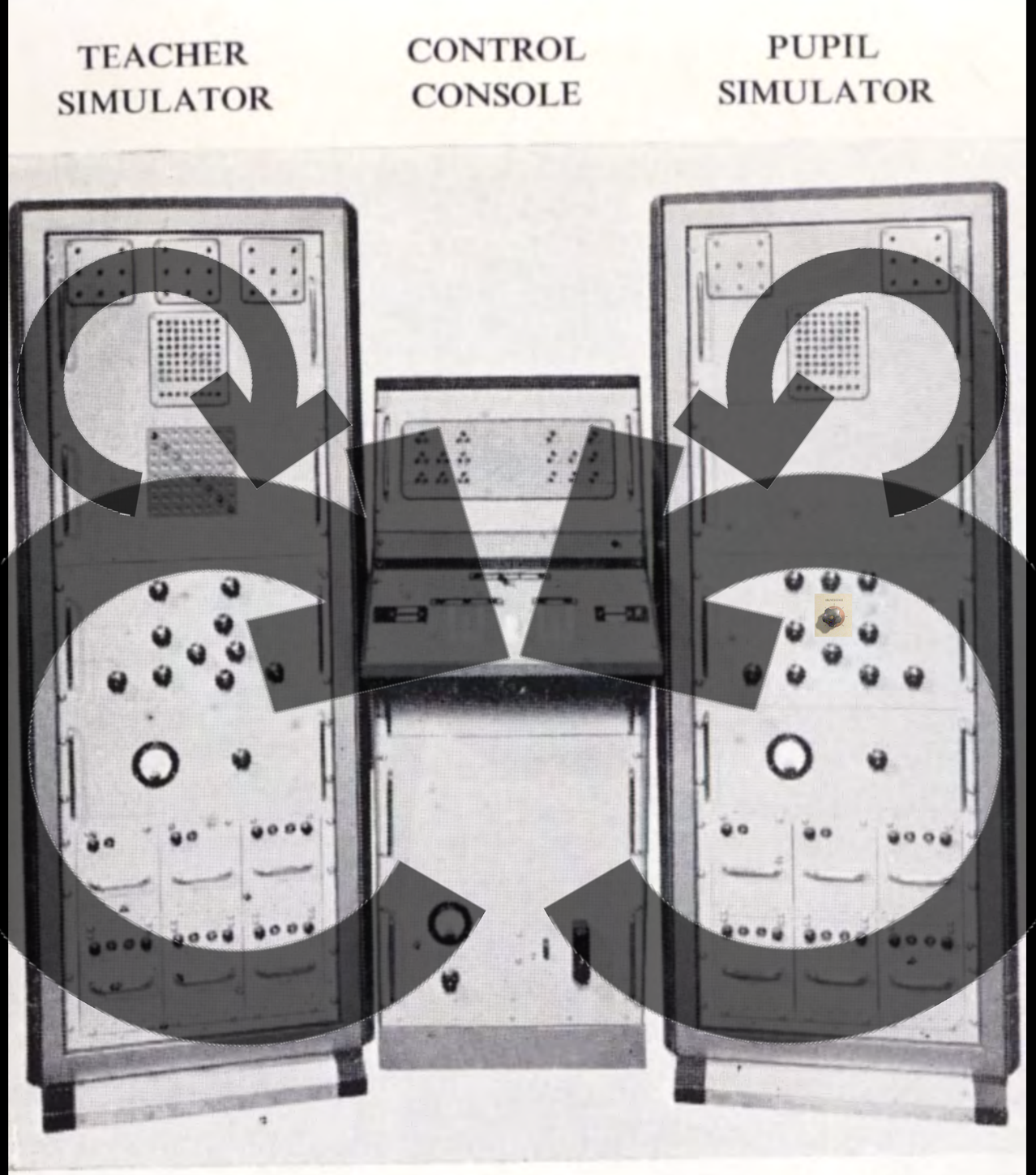
1958



"Oblivescence" means
"willful forgetfulness."

Gordon Pask's
Eucrates

1958



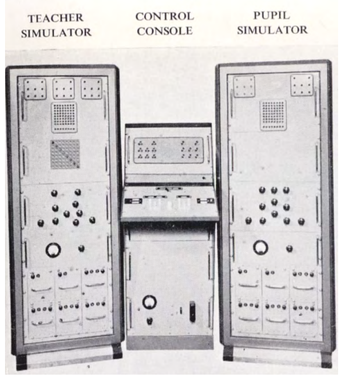
A machine conversing
with a machine

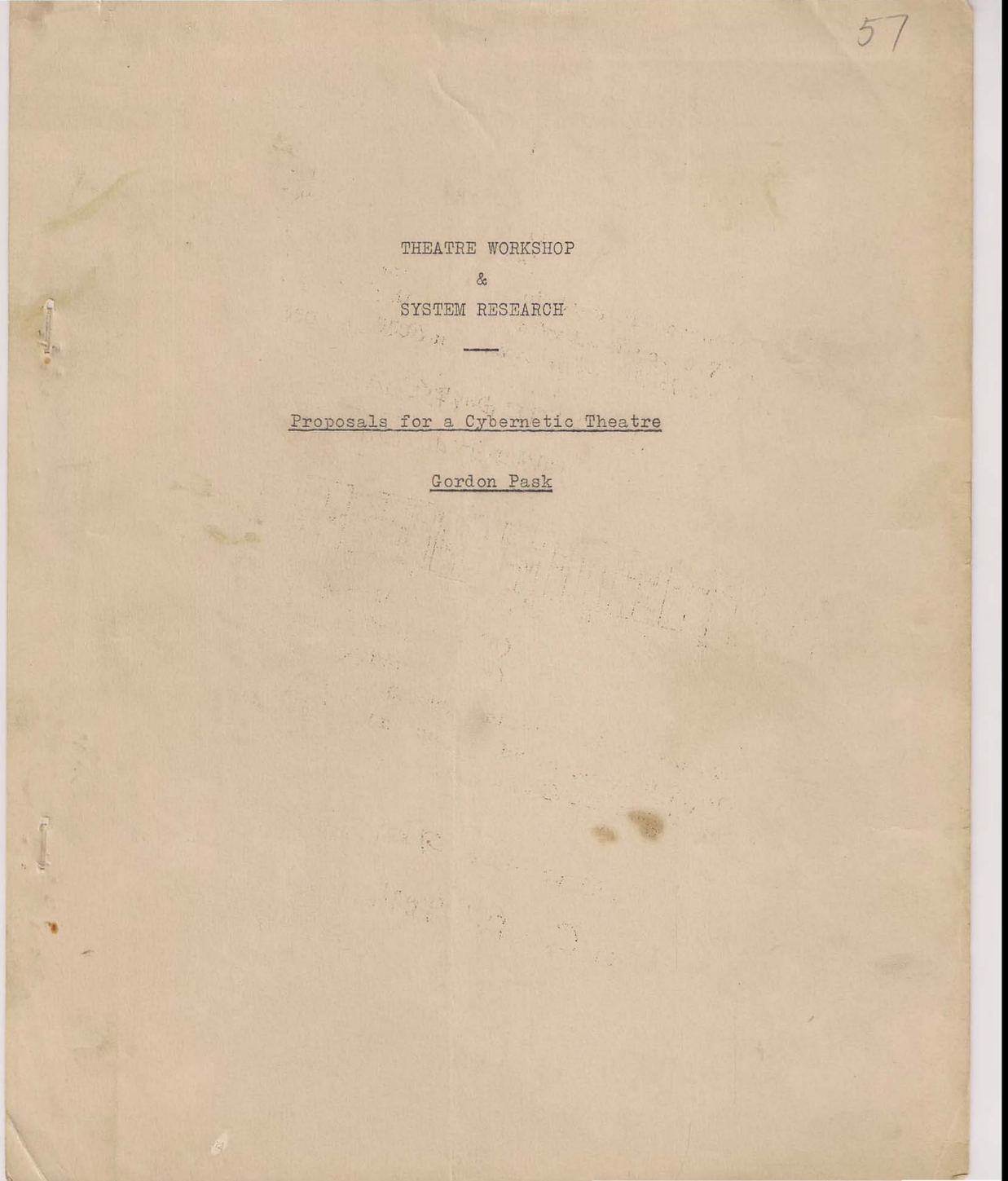
#1 — Novelty Regulation

#2 — Uncertainty Regulation

Paskian Interaction Principle #3 — Autonomy

Eucrates demonstrates machine autonomy as participants process multiple levels of feedback, engage in conversation, and maintain individualized goals (here, of teaching and learning).





Proposals for a Cybernetic Theatre
Gordon Pask
System Research Ltd.
Private Monograph, 1964

THEATRE WORKSHOP

&

SYSTEM RESEARCH

Proposals for a Cybernetic Theatre

Gordon Pask

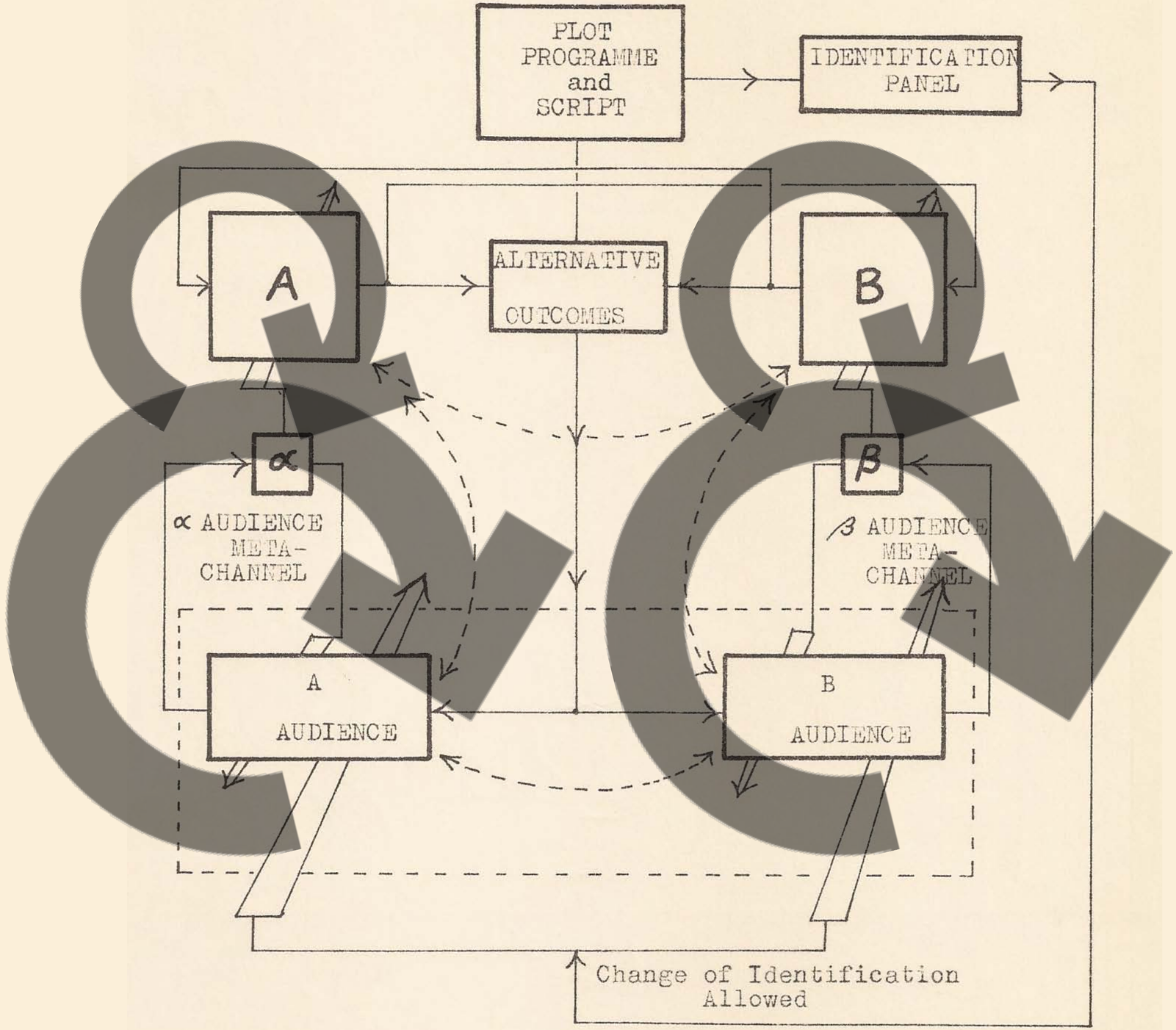
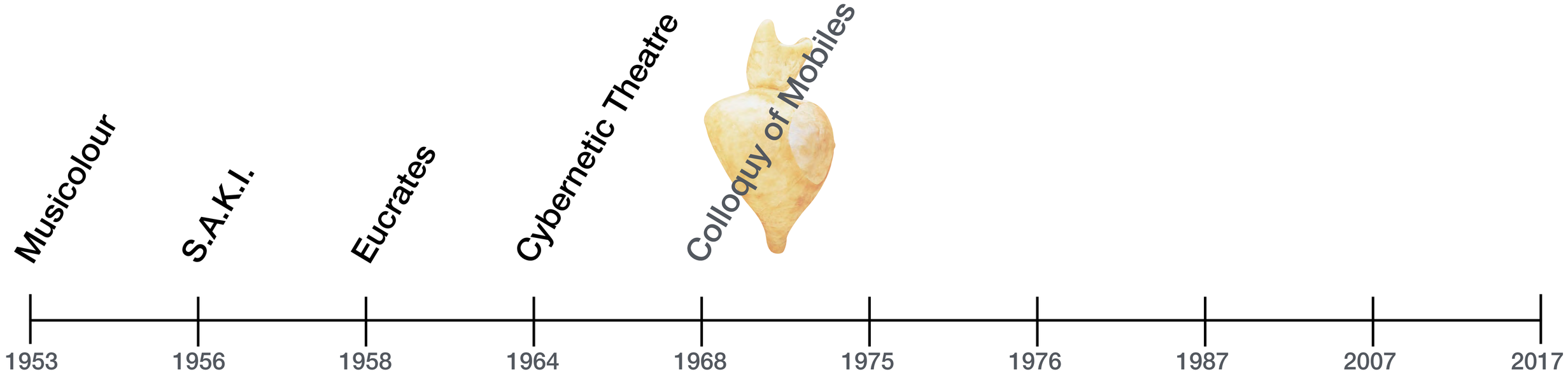
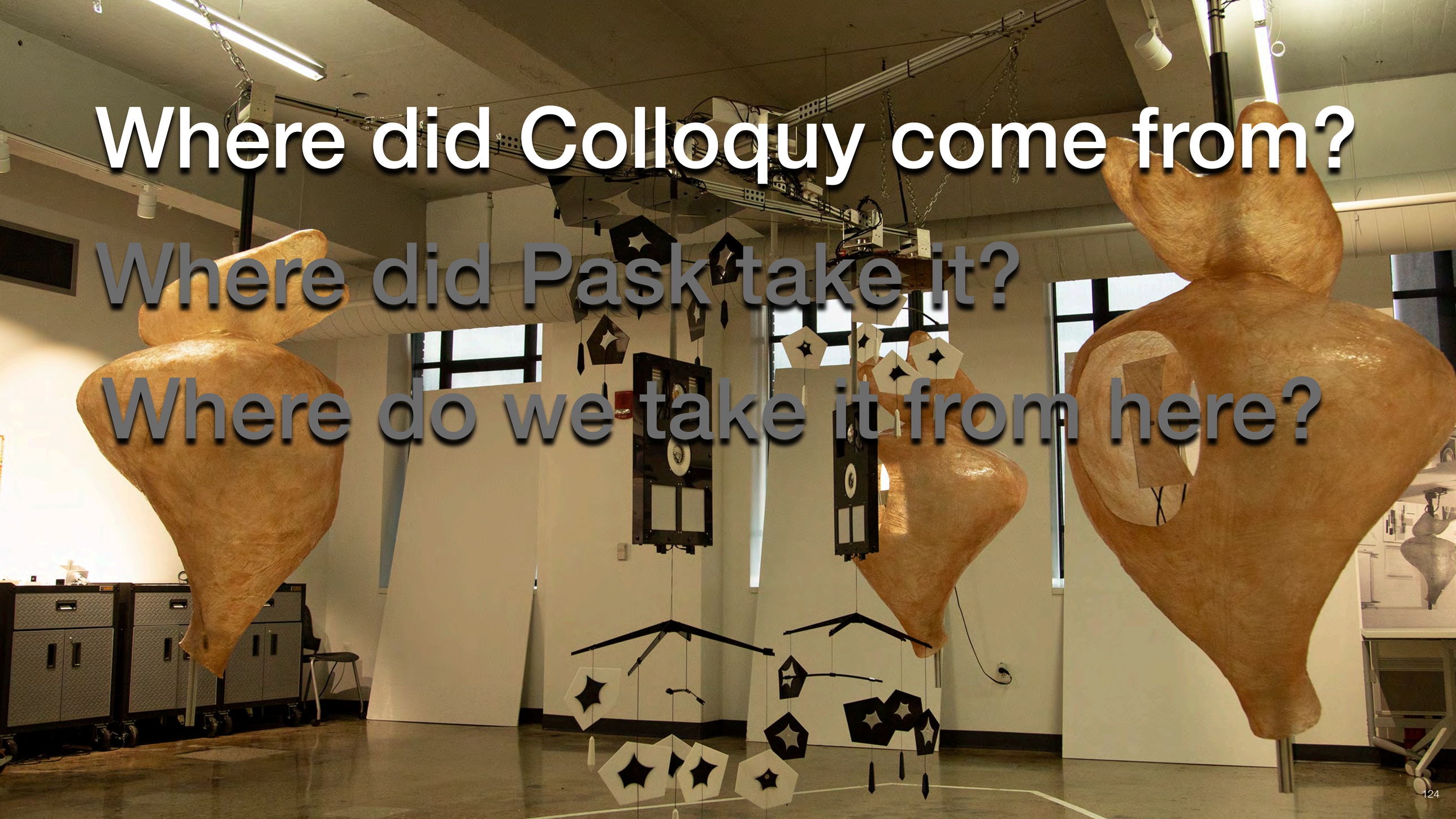


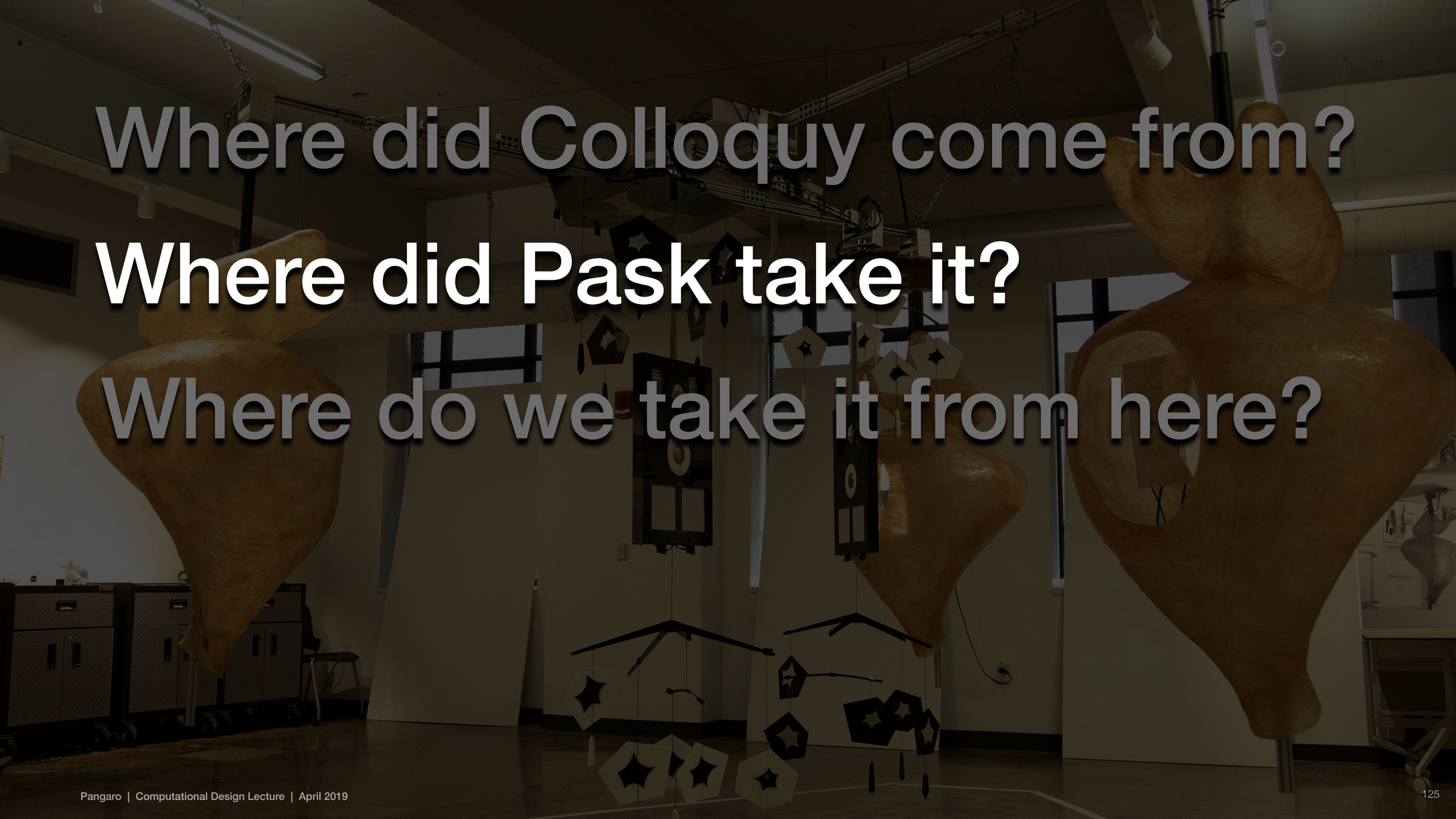
Diagram 10: Interaction architecture

"Proposals for a Cybernetic Theatre"
Gordon Pask
System Research Ltd.
Private Monograph, 1964

Gordon Pask – Computing Conversation

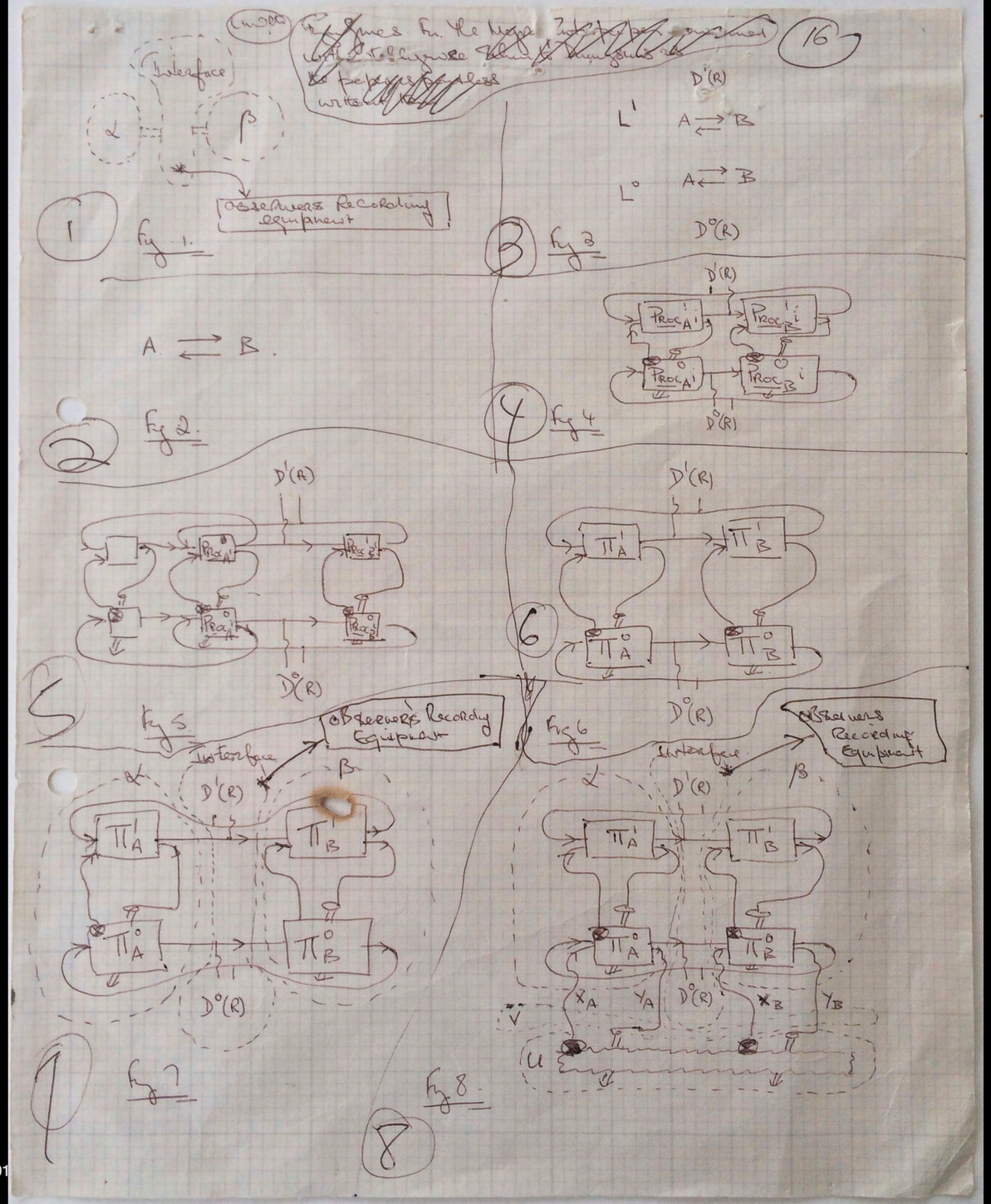



Where did Colloquy come from?
Where did Pask take it?
Where do we take it from here?


Where did Colloquy come from?
Where did Pask take it?
Where do we take it from here?

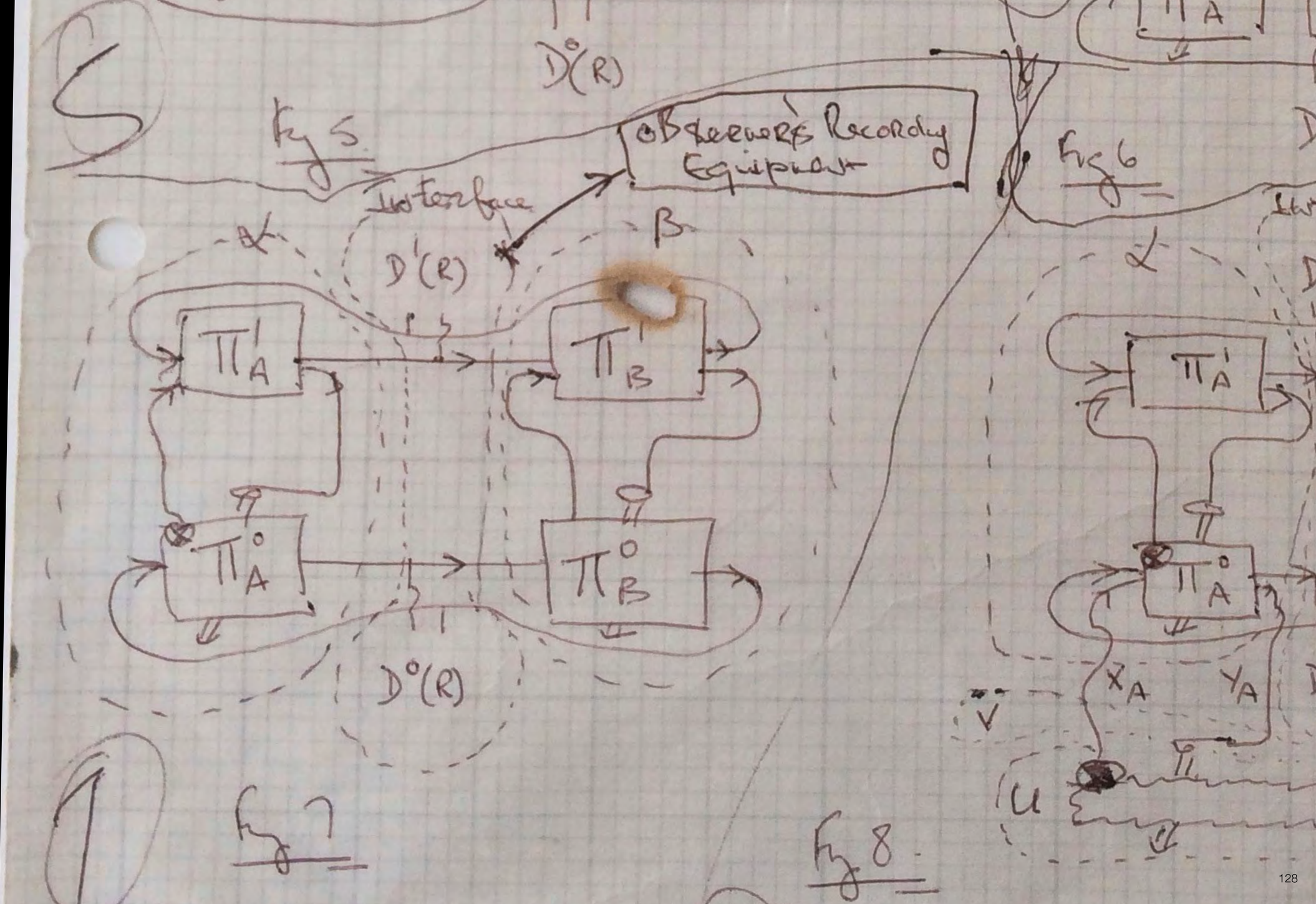
In 1975 Pask was the subject of an entire episode of the series The Experimenters by the BBC.

Click for video

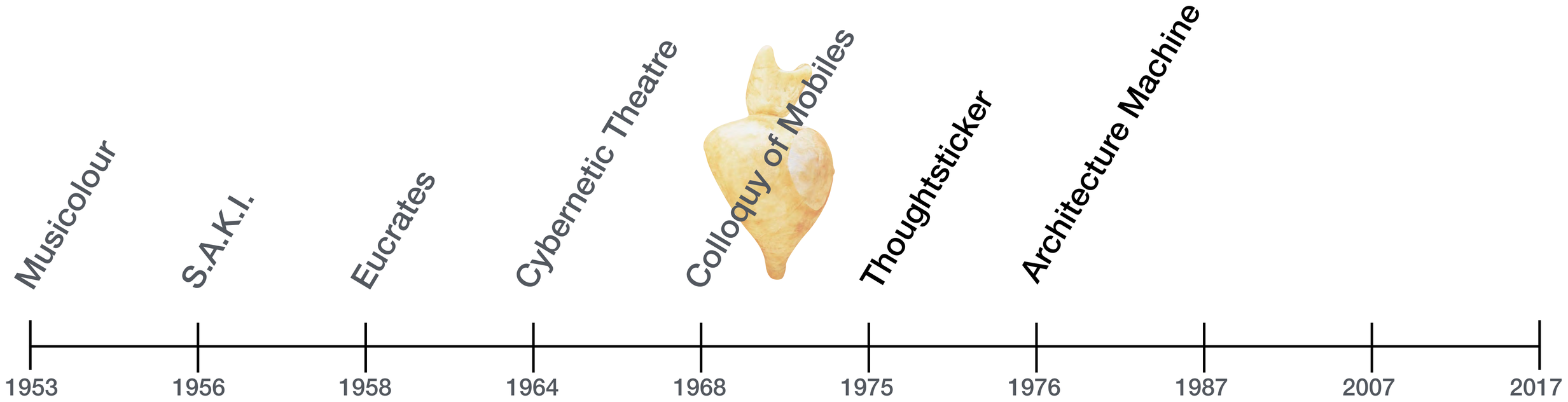


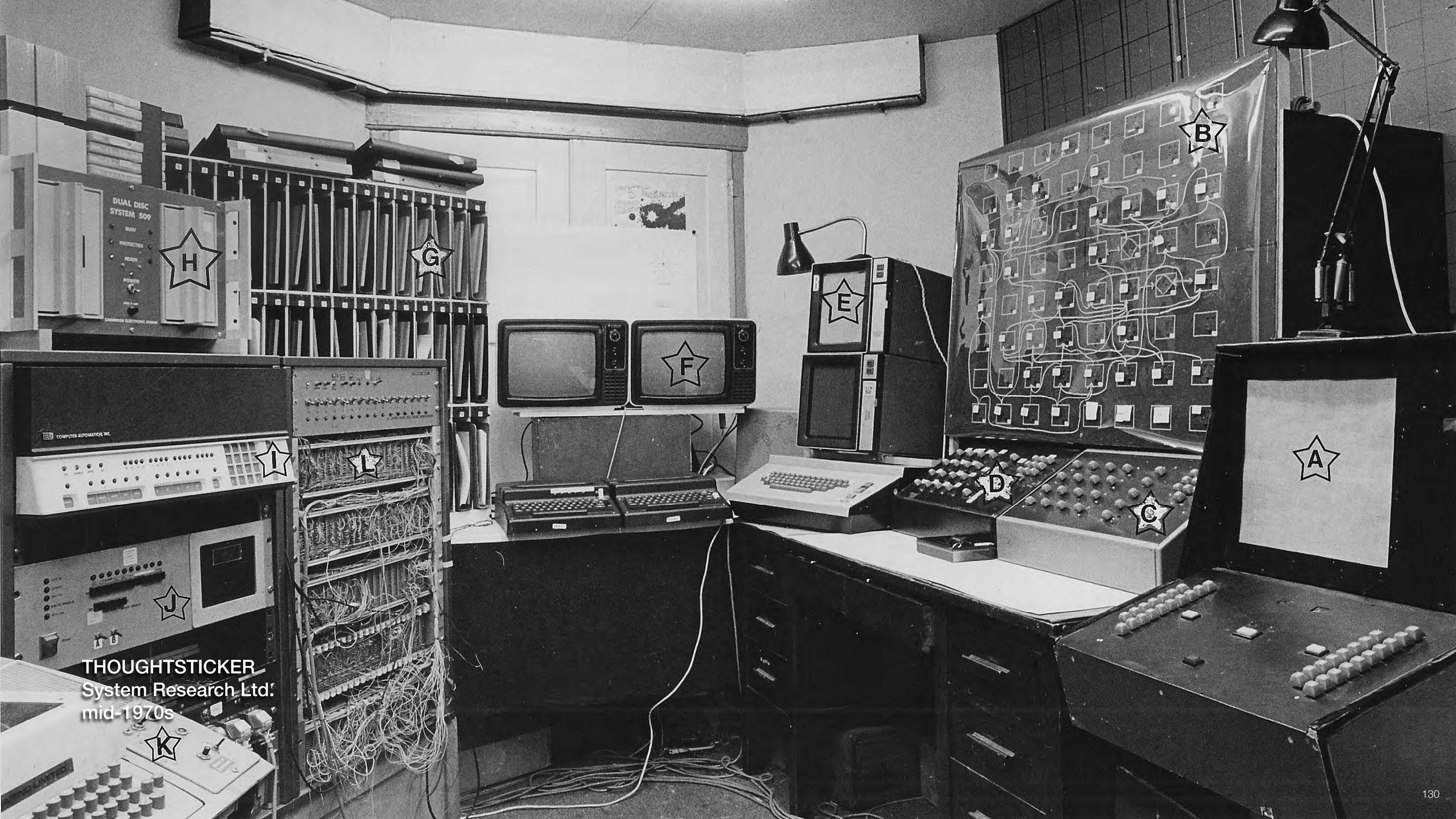
Pask's hand-drawn models of interaction are playful in spirit and rigorously complete.

They capture all types of interactions between participants in a conversation.

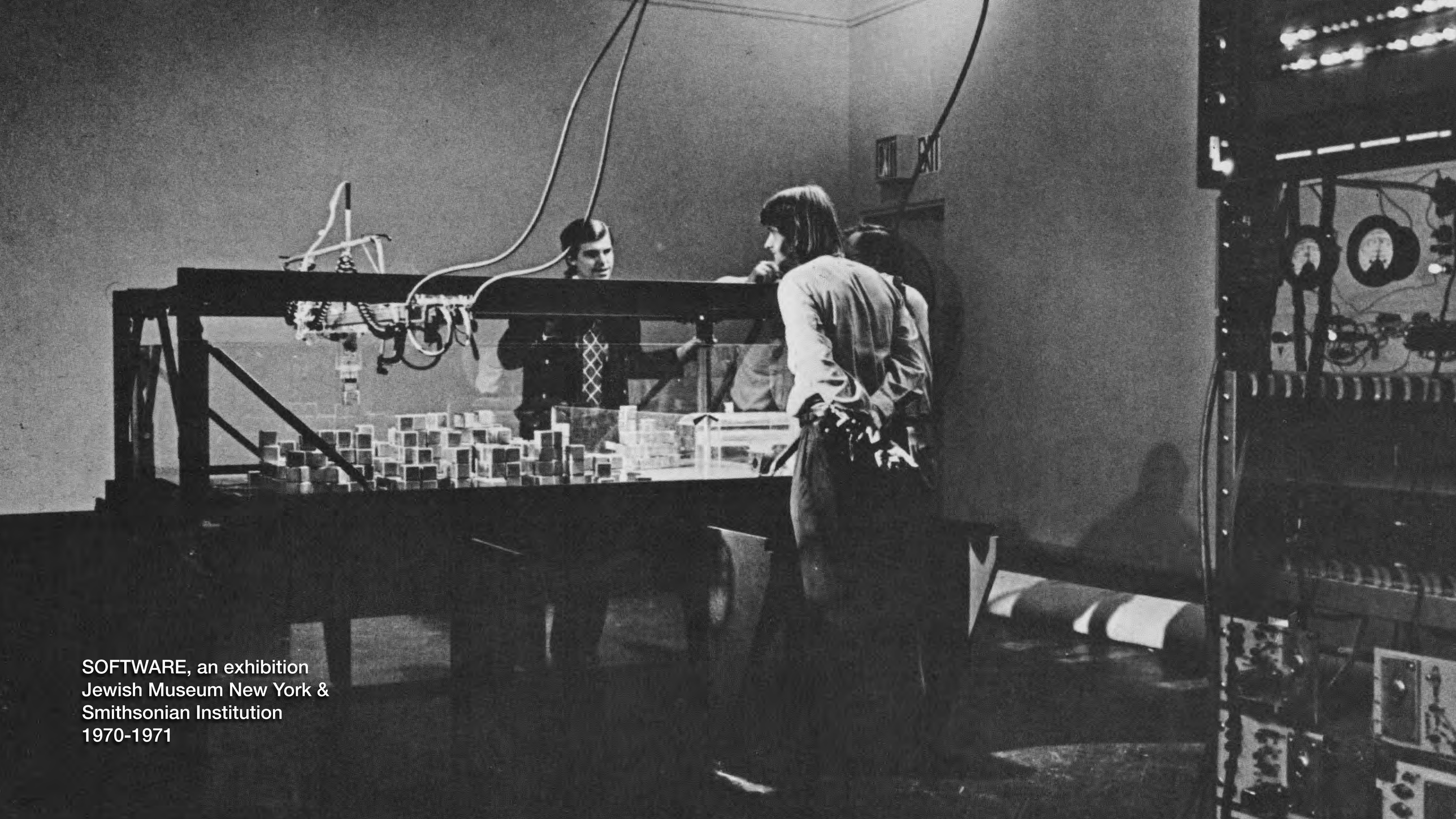

D°(R)
Fig 5
Observers Recording Equipment
Interface
D'(R)
α
β
Π'A
Π'B
Π°A
Π°B
D°(R)
Fig 6
Fig 7
Fig 8
XA
YA
V
U

Gordon Pask – Computing Conversation





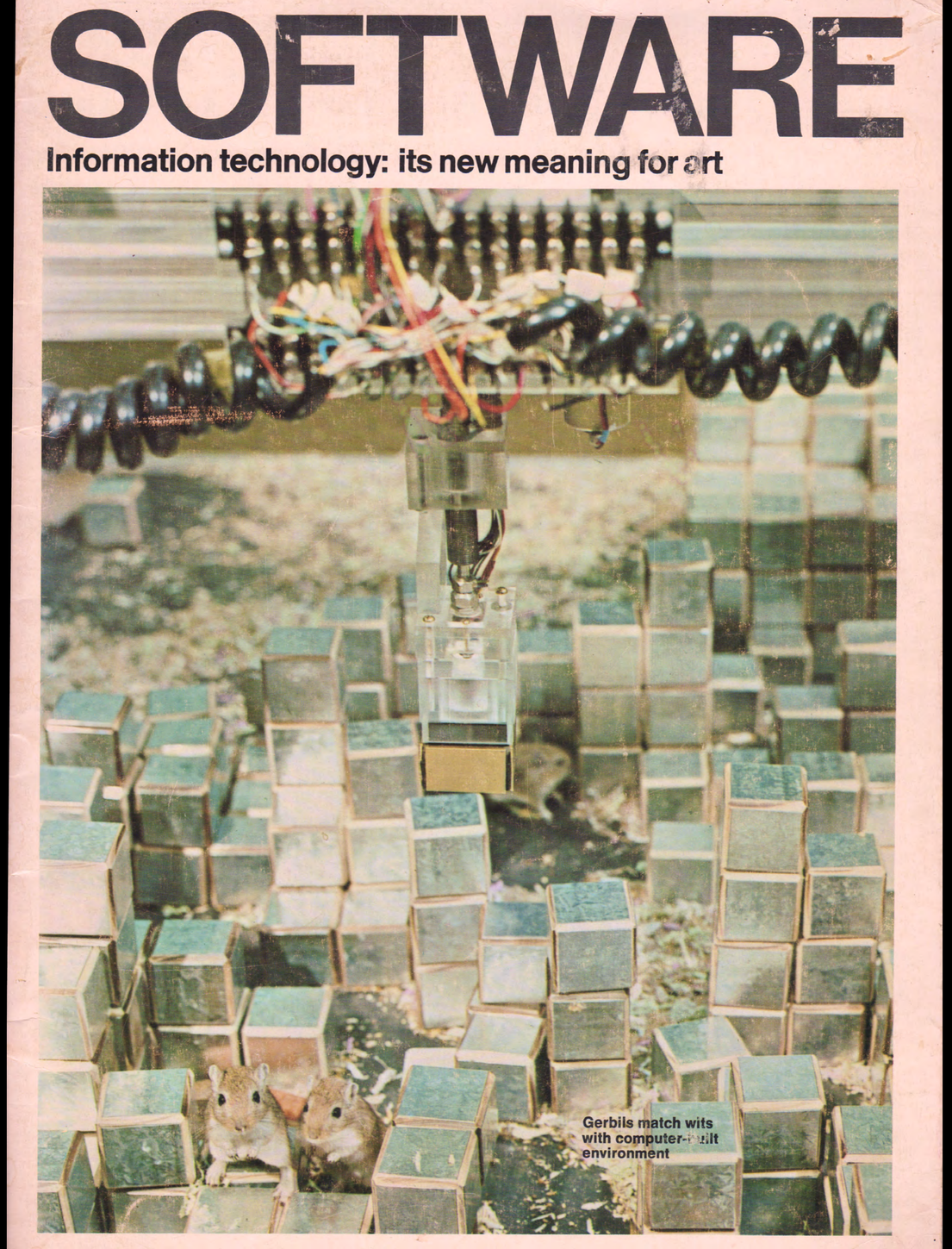
THOUGHTSTICKER
System Research Ltd.
mid-1970s



SOFTWARE, an exhibition
Jewish Museum New York &
Smithsonian Institution
1970-1971

LIFE IN A COMPUTERIZED ENVIRONMENT

SOFTWARE, an exhibition
Catalog
1970-1971




SOFTWARE
Information technology: its new meaning for art
Soft
Archi
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Ma
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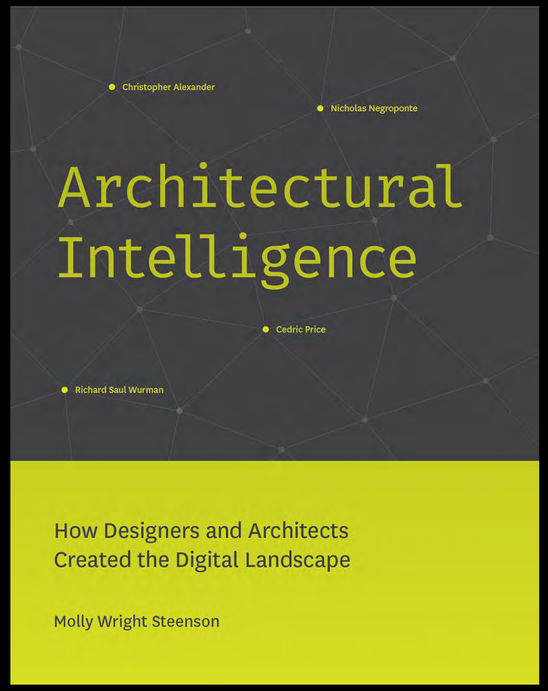
Nicholas
Negroponte
Soft Architecture Machines
Negroponte
Gerbils match wits
with computer-built
environment



Architecture Intelligence
Molly Wright Steenson,
MIT Press, 2017

Soft Architecture Machines
Nicholas Negroponte, ed.,
MIT Press, 1976
Click for PDF

Book Design: Muriel Cooper

1

Aspects of Machine Intelligence

Introduction by Gordon Pask

The current status of mindlike computer programs is summarized, at a philosophical rather than technical level, in the following short but authoritative papers: Minsky (1968), Simon (1966), Turing (1969). Whoever wishes to delve into this subject in greater depth may read the books where these papers are published in their entirety, augmenting them, to obtain comprehensive background, by Ernst and Newell (1969); Ashby (1960); Cohen (1966); Fogel, Owens, and Walsh (1966); Von Foerster and Zopf (1962); Uttley (1959); Von Foerster et al. (1968); McCulloch (1965); Oestreicher and Moore (1968); Amarel (1969); Rose (1970); Minsky and Papert (1969); Feigenbaum and Feldman (1963); Banerji (1969); and Garvin (1970). It is also worth perusing all volumes of the journal *Artificial Intelligence*.

Henceforward, it is assumed either that the reader knows the *kind* of symbolic operations performed by computer programs and other artifacts, that he will study the matter at leisure, or that he will take these operations for granted. With this supposition in mind I shall give a personal and possibly idiosyncratic view of the conditions under which *artificially intelligent* is a properly used term and offer an interpretation of these conditions with respect to *use* of the *architecture machine*. Apart from the pictograms or ikons developed in the text, the only special symbols used are the special brackets < and > which enclose *ordered* collections of objects; the equality sign =; and $\triangleq$, which is read as " *defined as equal to.*"

Overview

The contention is as follows: Intelligence is a property that is ascribed by an *external observer* to a *conversation* between *participants* if, and

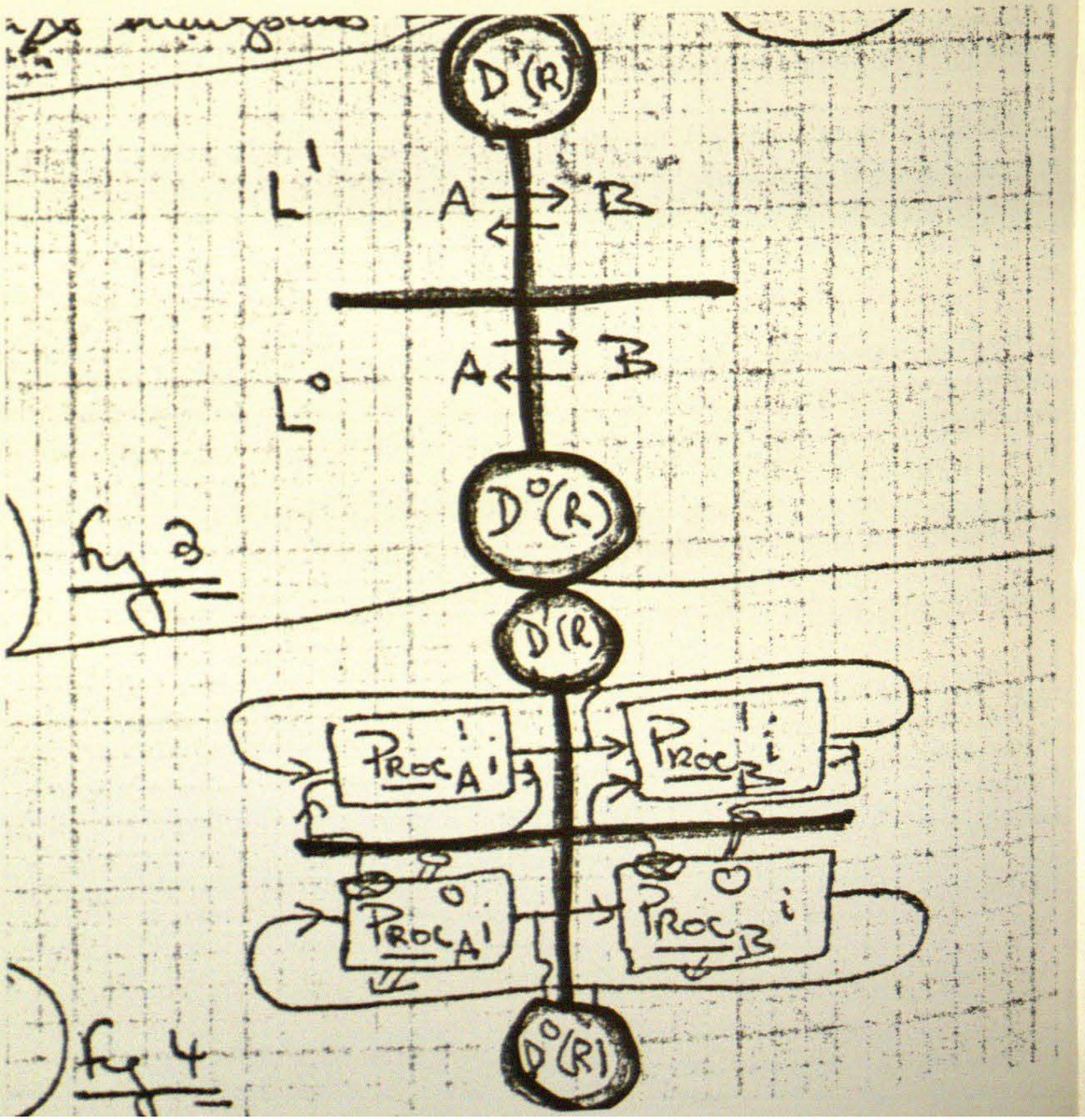


fig 3

fig 4

7.2. ♀ means "operates upon according to a hypothesis," and ⊗ means "gives a description (in the language appropriate to the level where the line terminates), which may or may not confirm the hypothesis."

7.3. Thus a complete circuit on one side of I , starting at ⊗, passing through — to a *Proc,* and returning by way of — and ♀ on the original *Proc* is a *causal* coupling, or, equivalently, it permits *reproduction* of the original *Proc.*

7.4. The unadorned, horizontal connections have a different meaning: they are *inferential* couplings, which, limiting cases apart, entail the notion of choice.

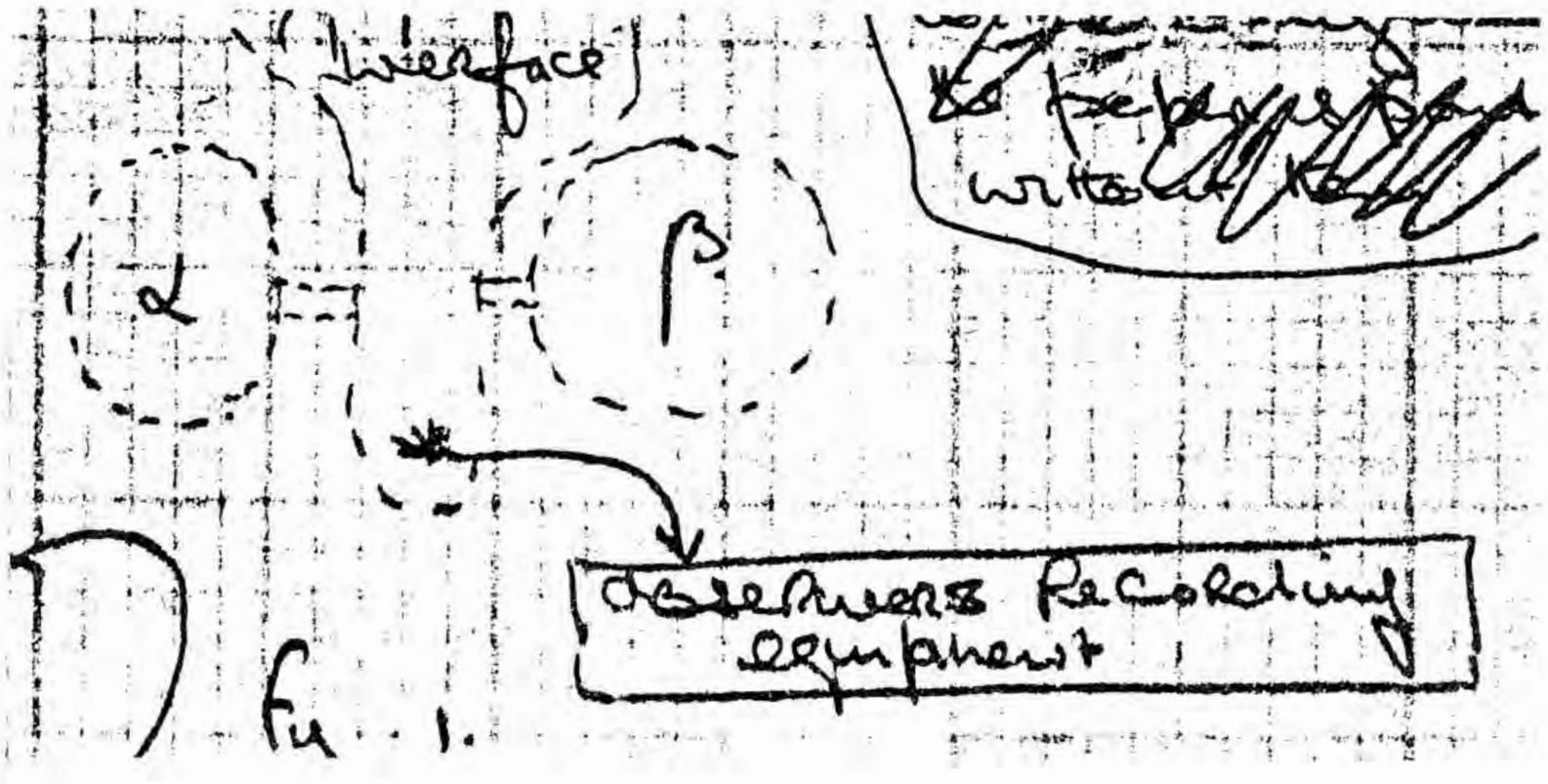
7.5. Hence, any complete circle (such as the line emanating from $Proc_A$ *i* to $Proc_B$ *i* and terminating on $Proc_A$ *i*) may be called a deductive chain.[5]

7.6. Finally, the lines to and from *D' (R)* and *D°(R)* indicate whatever is referenced by the inference, that is, whatever R_i in *R* is ostended by the participants *A* and *B* on occasion *n.*

7.7. Call this ikon (Figure 4) the conversational *paradigm.*

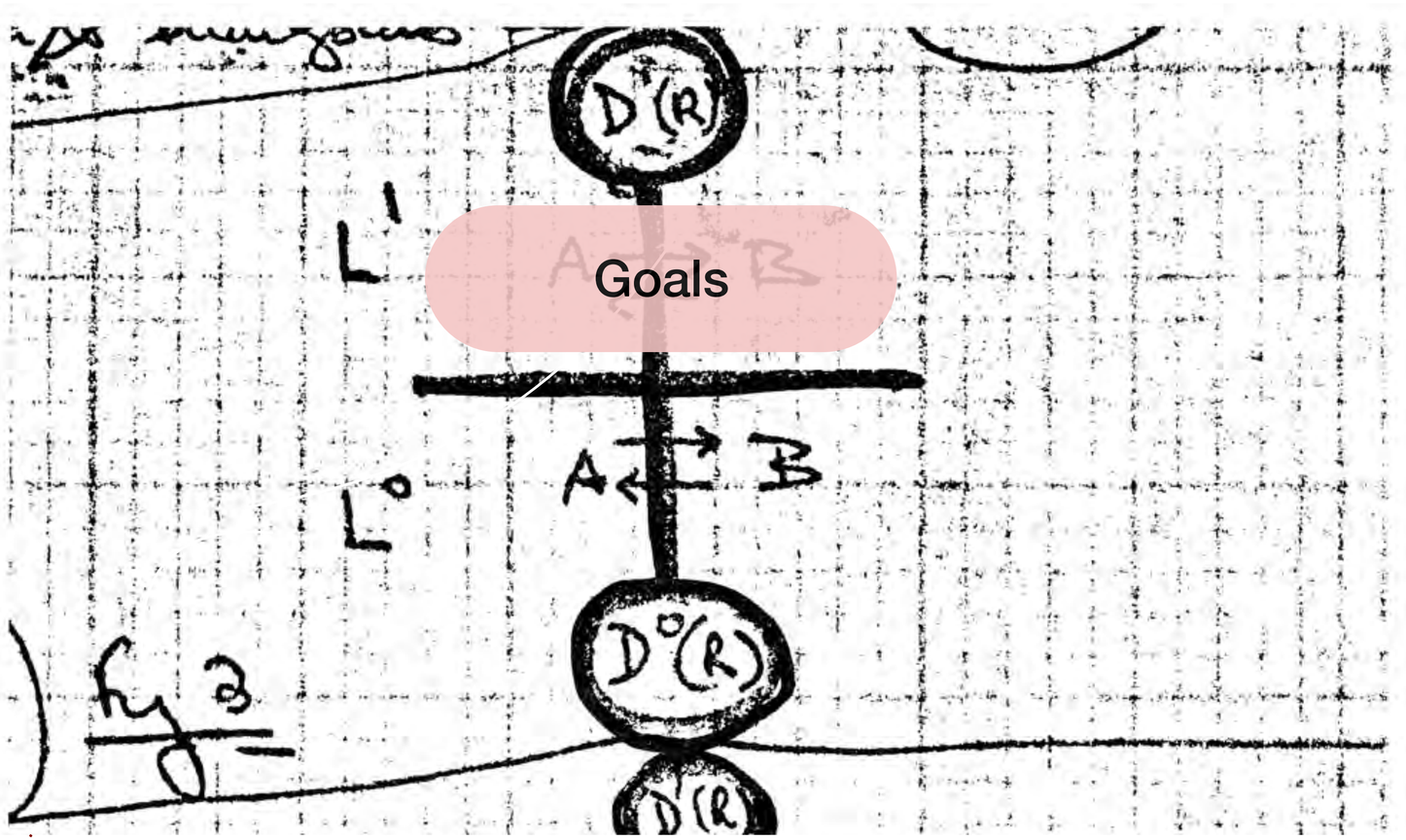
7.8. If one ikon is created by filling the spaces in Figure 3, then (obeying the proper rules) the process can be iterated laterally to yield a further *paradigm,* for example, the ikon in Figure 5. The motivation for doing so is noted in Section 2.1.1 ≙ to represent as much of mind as desired.

Interactions occur through an interface.



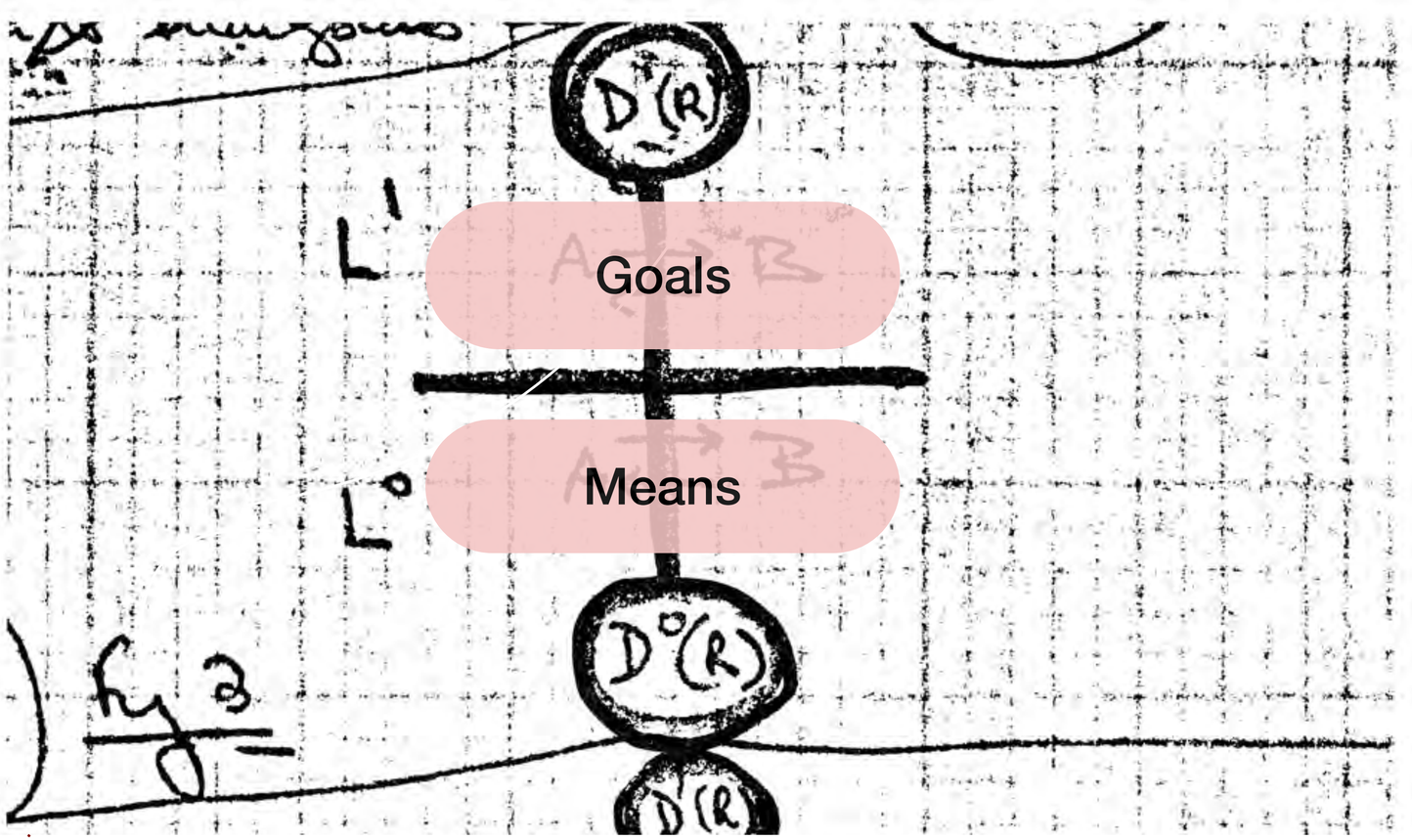
Gordon Pask.
“Aspects of Machine Intelligence”
In *Soft Architecture Machines*,
Nicholas Negroponte, ed., MIT Press
1976.

Interactions in a conversation can be observed to have levels of *goals* –



Gordon Pask.
“Aspects of Machine Intelligence”
In *Soft Architecture Machines*,
Nicholas Negroponte, ed., MIT Press
1976.

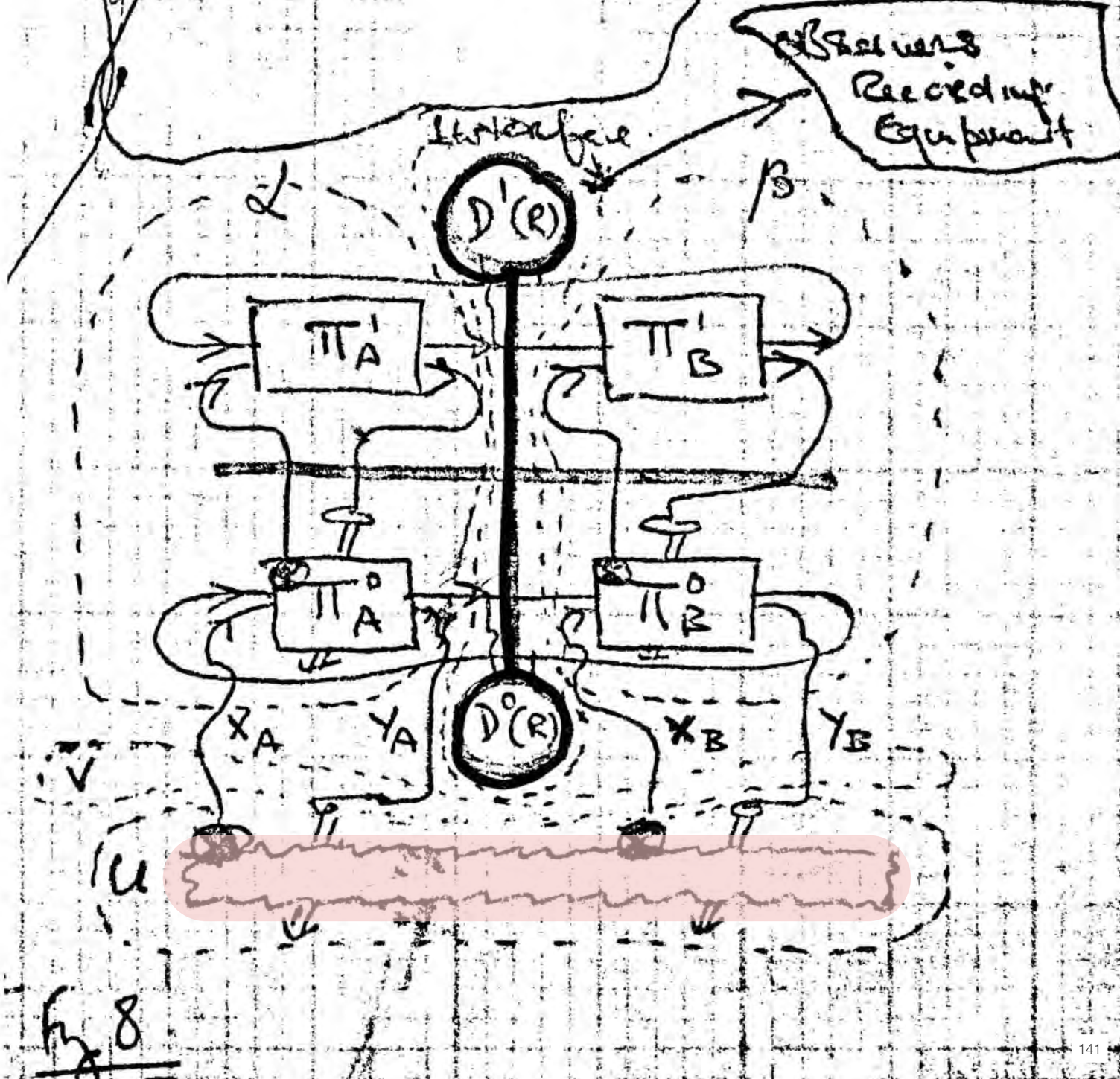
Interactions in a conversation can be observed to have levels of *goals* – and corresponding levels of *means* to achieve them.



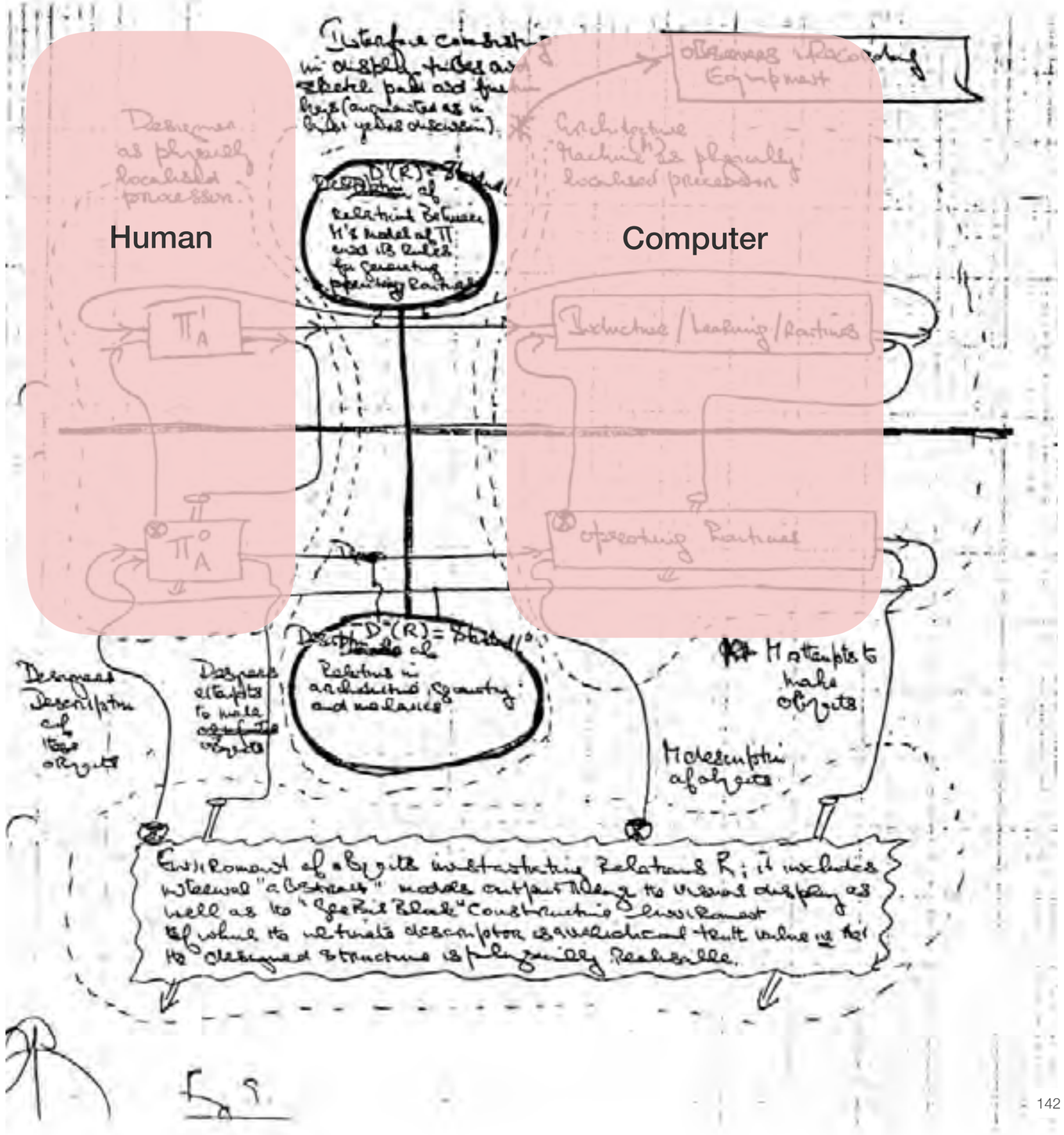
Gordon Pask.
“Aspects of Machine Intelligence”
In *Soft Architecture Machines*,
Nicholas Negroponte, ed., MIT Press
1976.

Conversations may result in actions taken in an environment.

Gordon Pask
“Aspects of Machine Intelligence”
In *Soft Architecture Machines*,
Nicholas Negroponte, ed., MIT Press
1976.

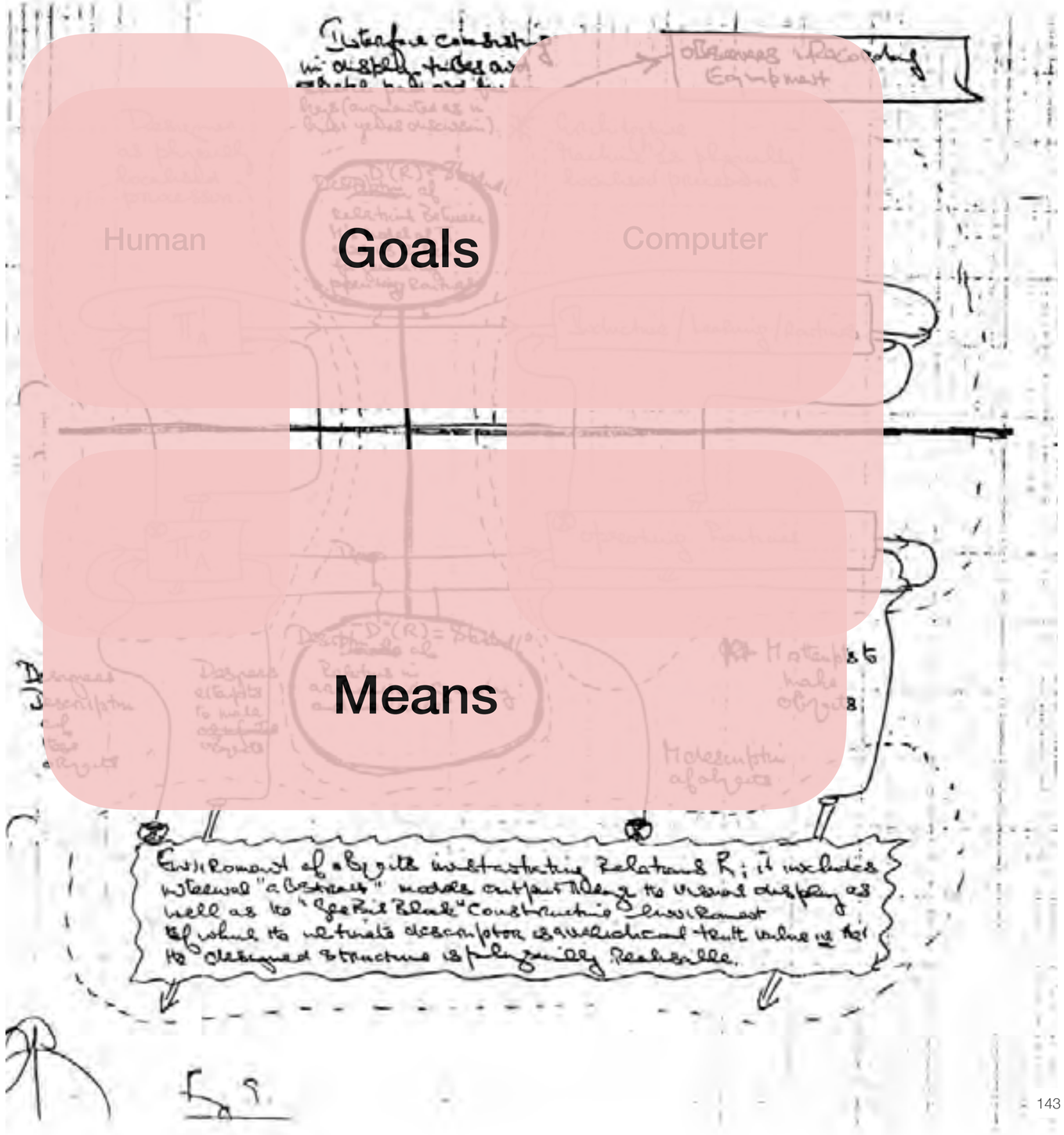


A computer can partner with a human in a conversation for design.



Gordon Pask.
“Aspects of Machine Intelligence”
In *Soft Architecture Machines*,
Nicholas Negroponte, ed., MIT Press
1976.

A computer can partner with a human in a conversation for design.



Gordon Pask.
“Aspects of Machine Intelligence”
In *Soft Architecture Machines*,
Nicholas Negroponte, ed., MIT Press
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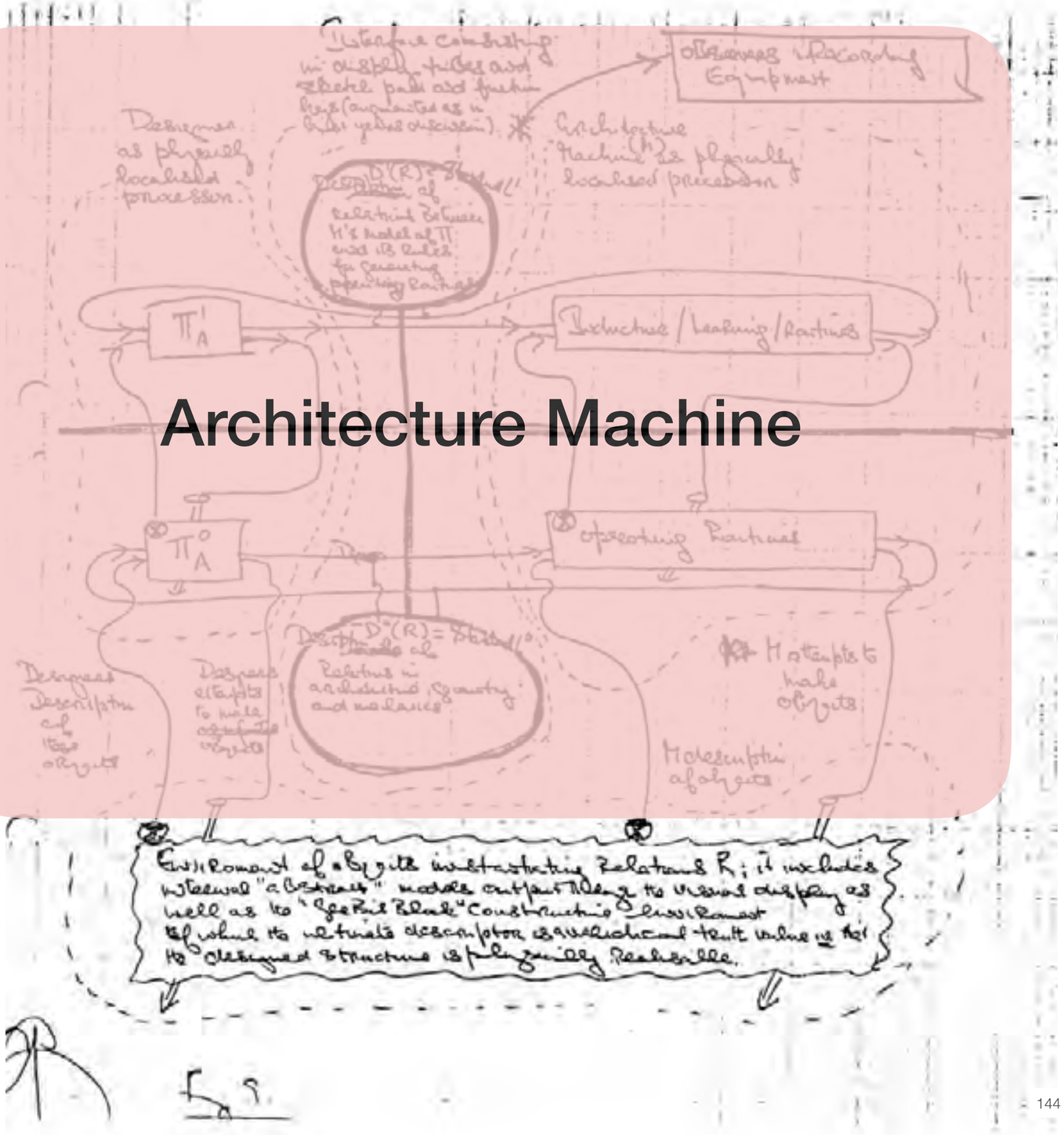


Gordon Pask.
“Aspects of Machine Intelligence”
In *Soft Architecture Machines*,
Nicholas Negroponte, ed., MIT Press
1976.

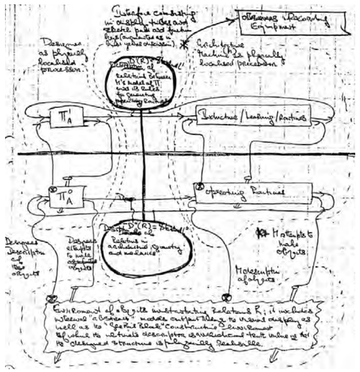
#1 — Novelty Regulation

#2 — Uncertainty Regulation

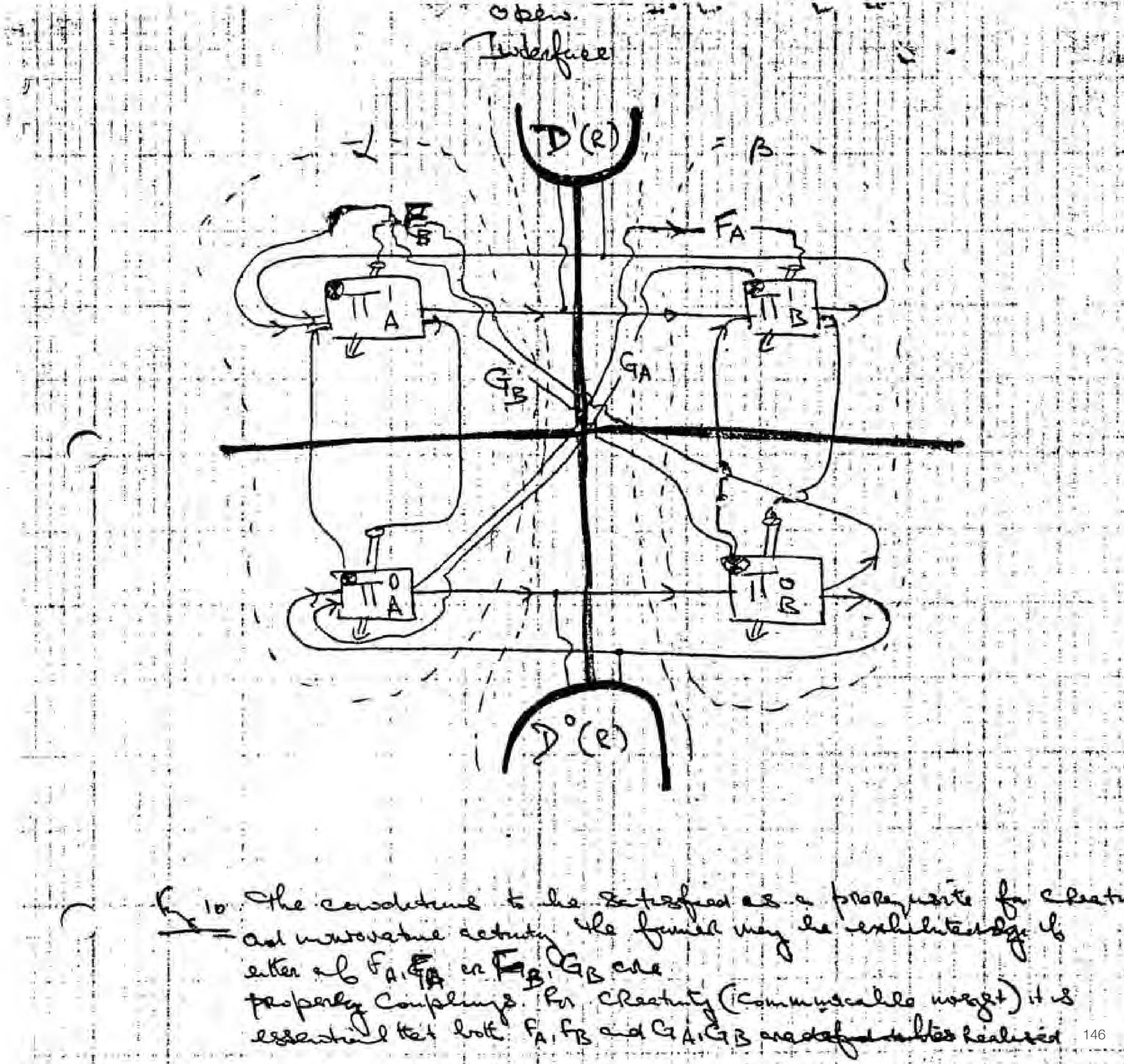
#3 — Autonomy

Paskian Interaction Principle #4 — Conversation for Design

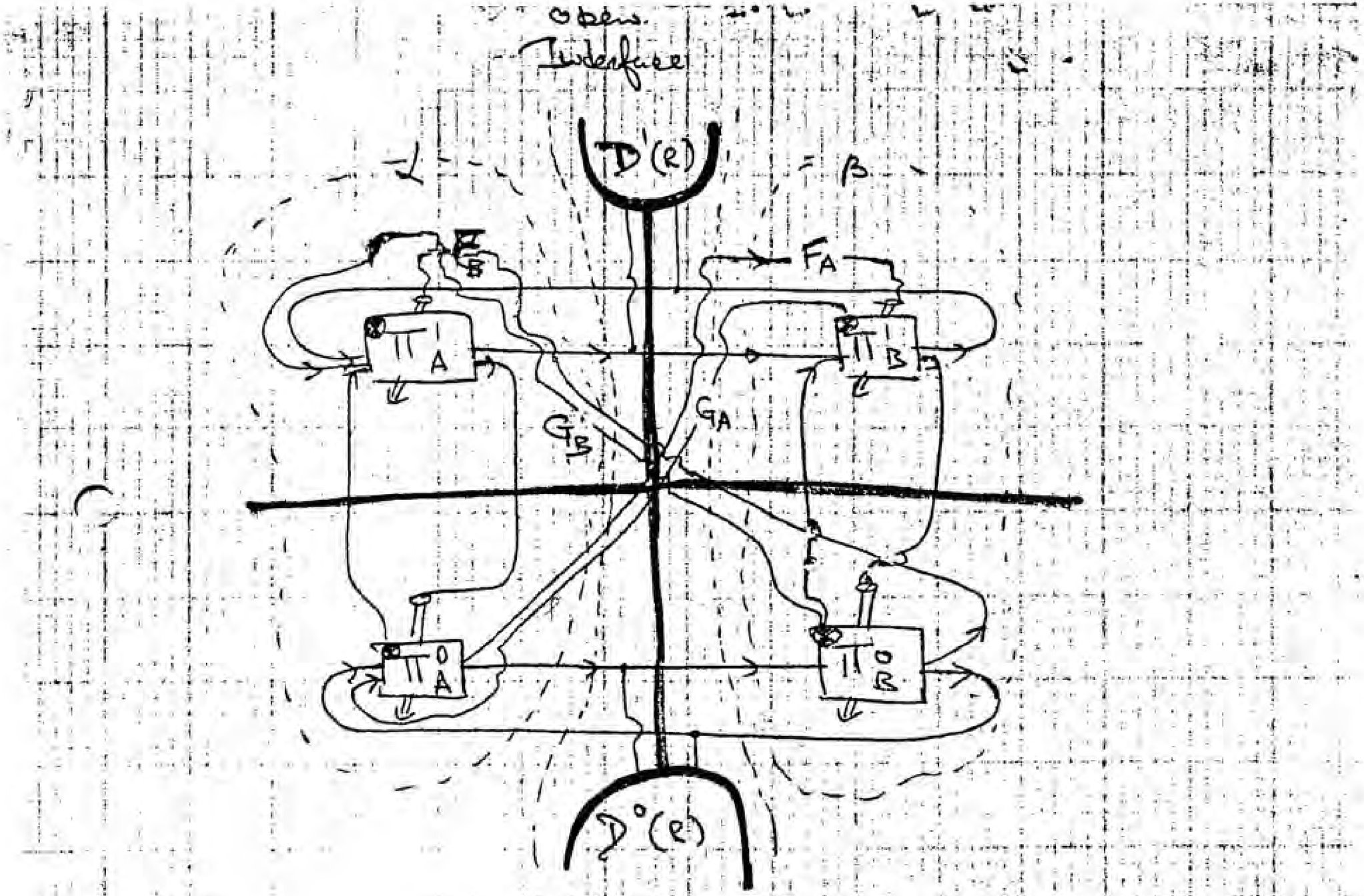
The Architecture Machine proposes a human-computer conversation for design where the machine co-participates in evolving goals as well as means (methods).



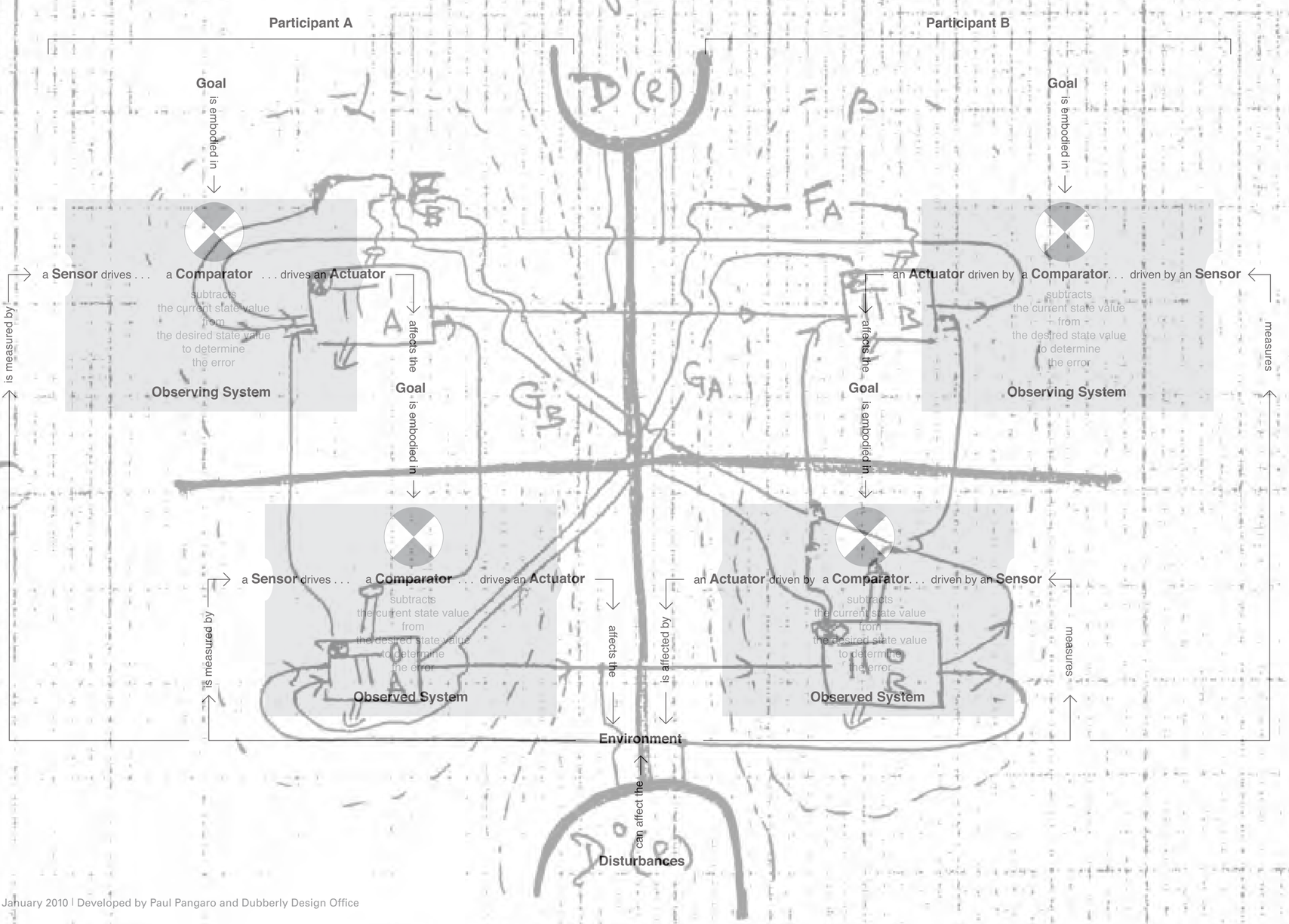
Conversation may be a dance where each participant construes the other to be part of a unified whole.



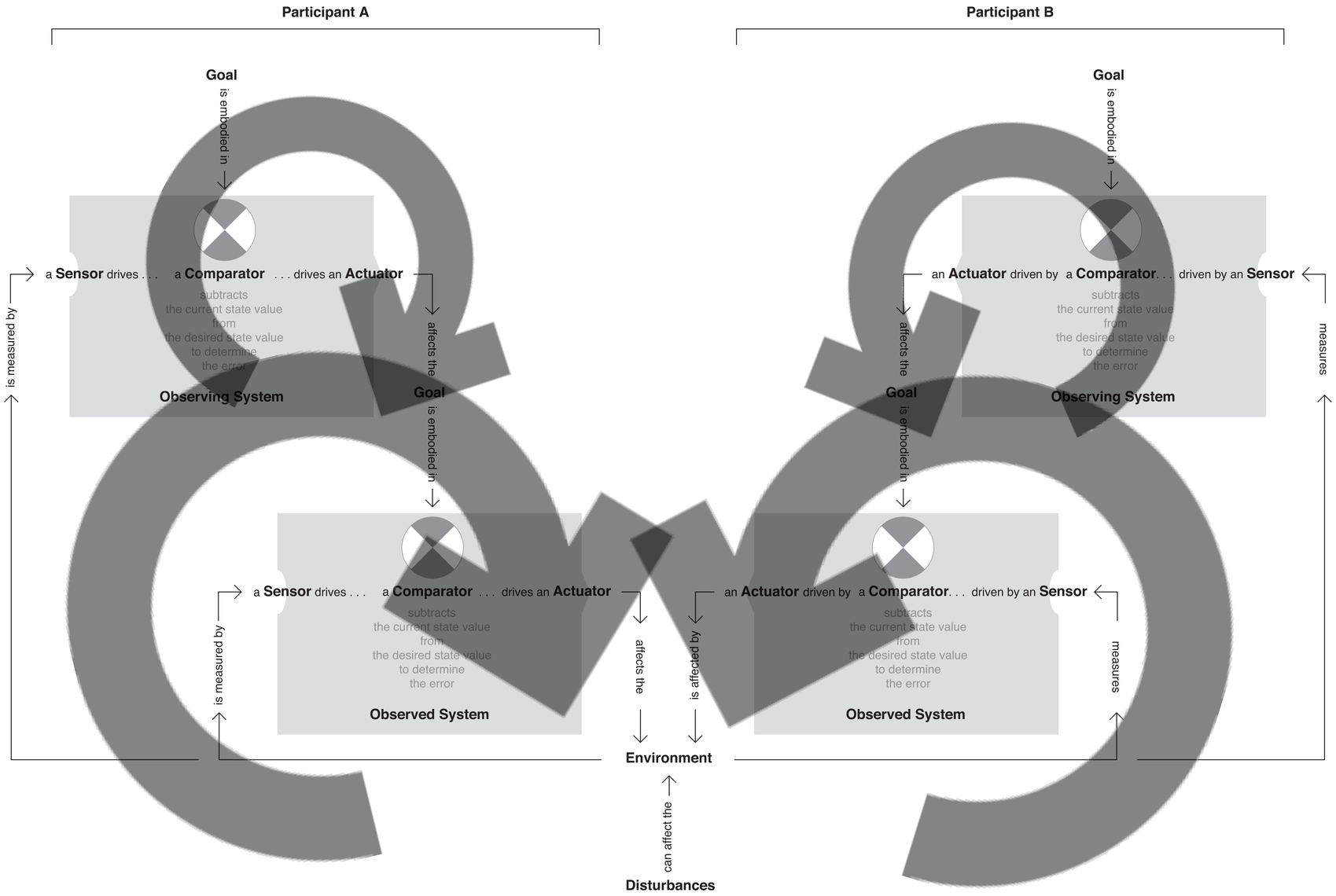
Gordon Pask.
"Aspects of Machine Intelligence"
In *Soft Architecture Machines*,
Nicholas Negroponte, ed., MIT Press
1976.


Obers.
Interface
D'(e)
= B
F_B
F_A
A
B
G_B
G_A
A
B
D°(e)

Conversation: Formal Mechanism



Conversation: Formal Mechanism



January 2010 | Developed by Paul Pangaro and Dubberly Design Office

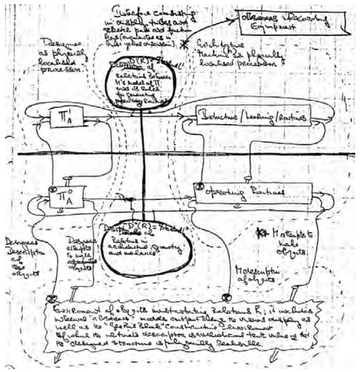
#1 — Novelty Regulation

#2 — Uncertainty Regulation

#3 — Autonomy

Paskian Interaction Principle #4 — Conversation for Design

The Architecture Machine proposes a human-computer conversation for design where the machine co-participates in evolving goals as well as means (methods).

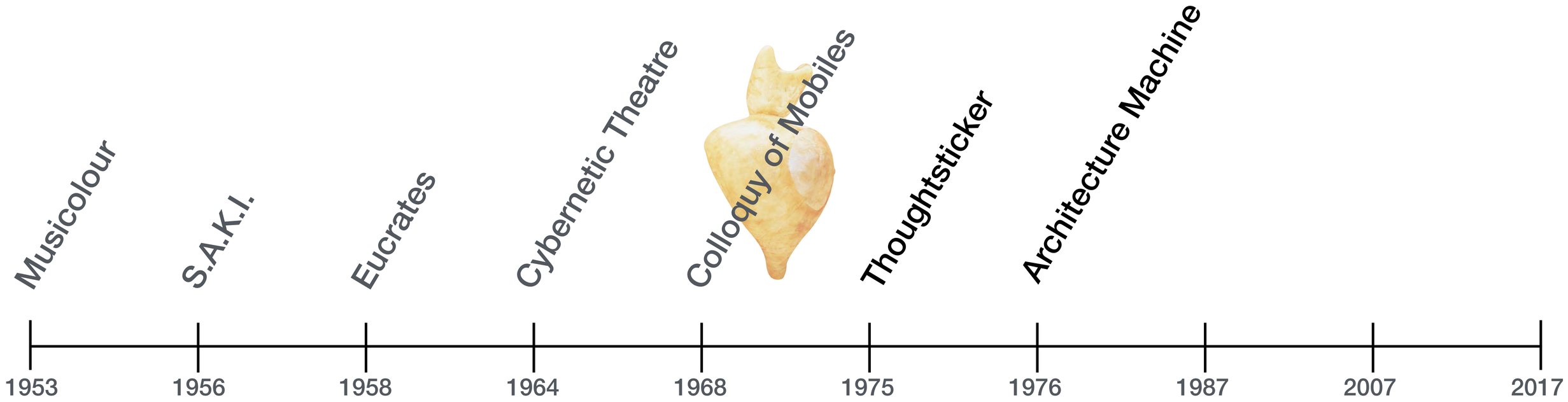


Paskian Interaction Principles

#1 — Novelty Regulation
#2 — Uncertainty Regulation
#3 — Autonomy
#4 — Conversation for Design

Paskian Interaction Principles – v1.0 – March 2019

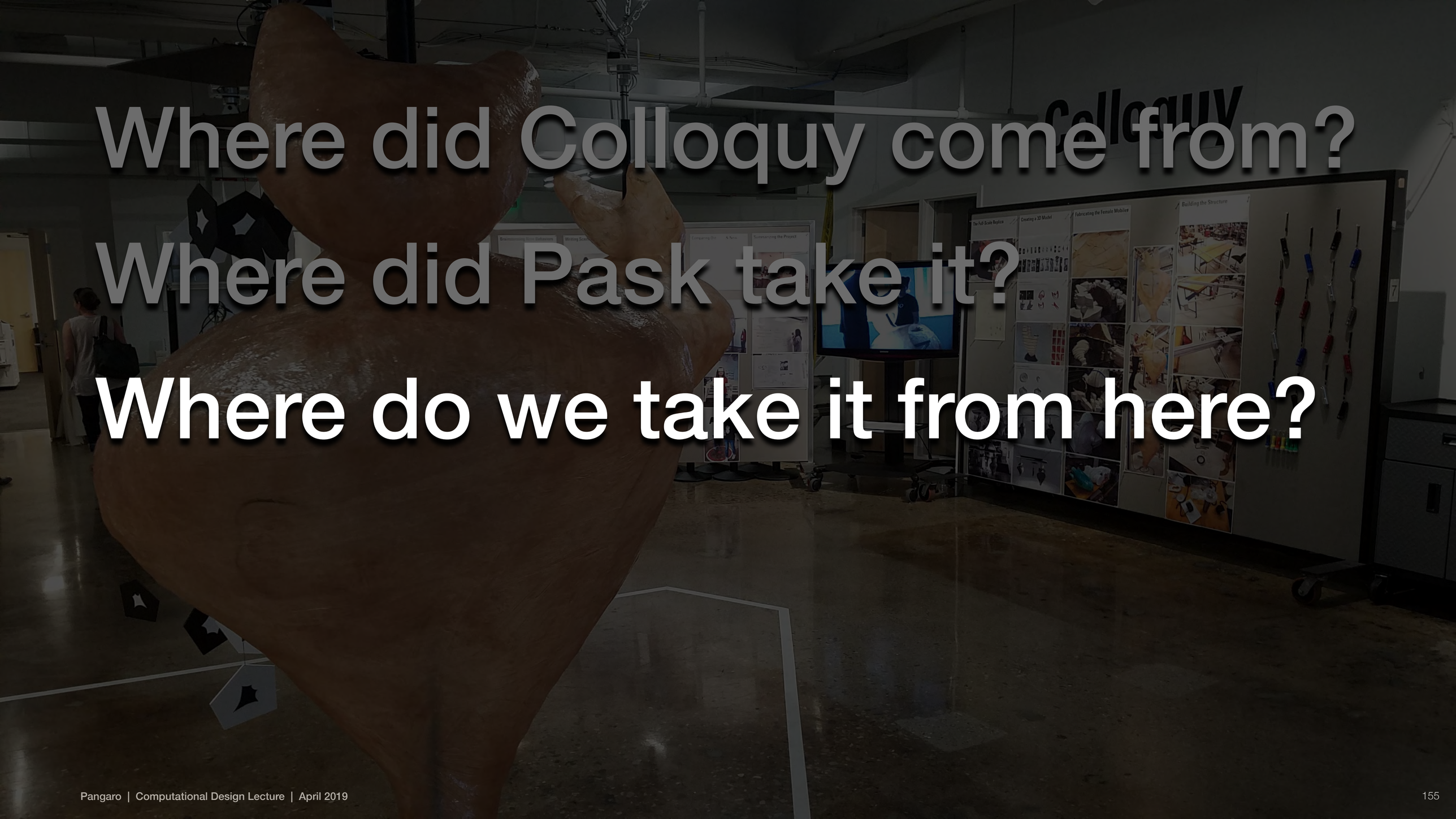
Gordon Pask – Computing Conversation



Gordon Pask & Elizabeth Pask
London
Late 1980s

Photo: Paul Pangaro


Where did Colloquy come from?
Where did Pask take it?
Where do we take it from here?
Colloquy
The Full-Scale Replica
Creating a 3D Model
Fabricating the Female Mobiles
Building the Structure



Where did Colloquy come from?

Where did Pask take it?

Where do we take it from here?

Alexa, can you define a “*good conversation*”?

- ***stays sensitive to your context & language***
- ***engages you — keeps continuity in the exchange***
- ***leads to agreements — even agreements-to-disagree***
- ***enables coordination — acting together with others.***

Alexa, why can’t AI + today’s “Conversation Interfaces”
do these things?

Cortana, can you define a “*great conversation*”?

- ***tells you things you enjoy learning — delights you***
- ***is surprising — energizes you***
- ***goes places you didn’t expect to go — is generative***
- ***evolves in ways you couldn’t evolve on your own.***

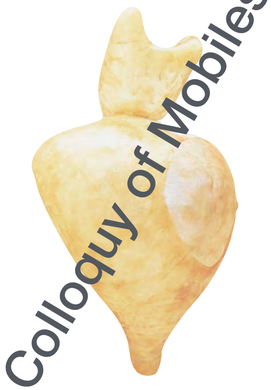
Cortana, why can’t AI + today’s “Conversation Interfaces”
do these things?

Siri, what makes a “*great conversational partner*”?

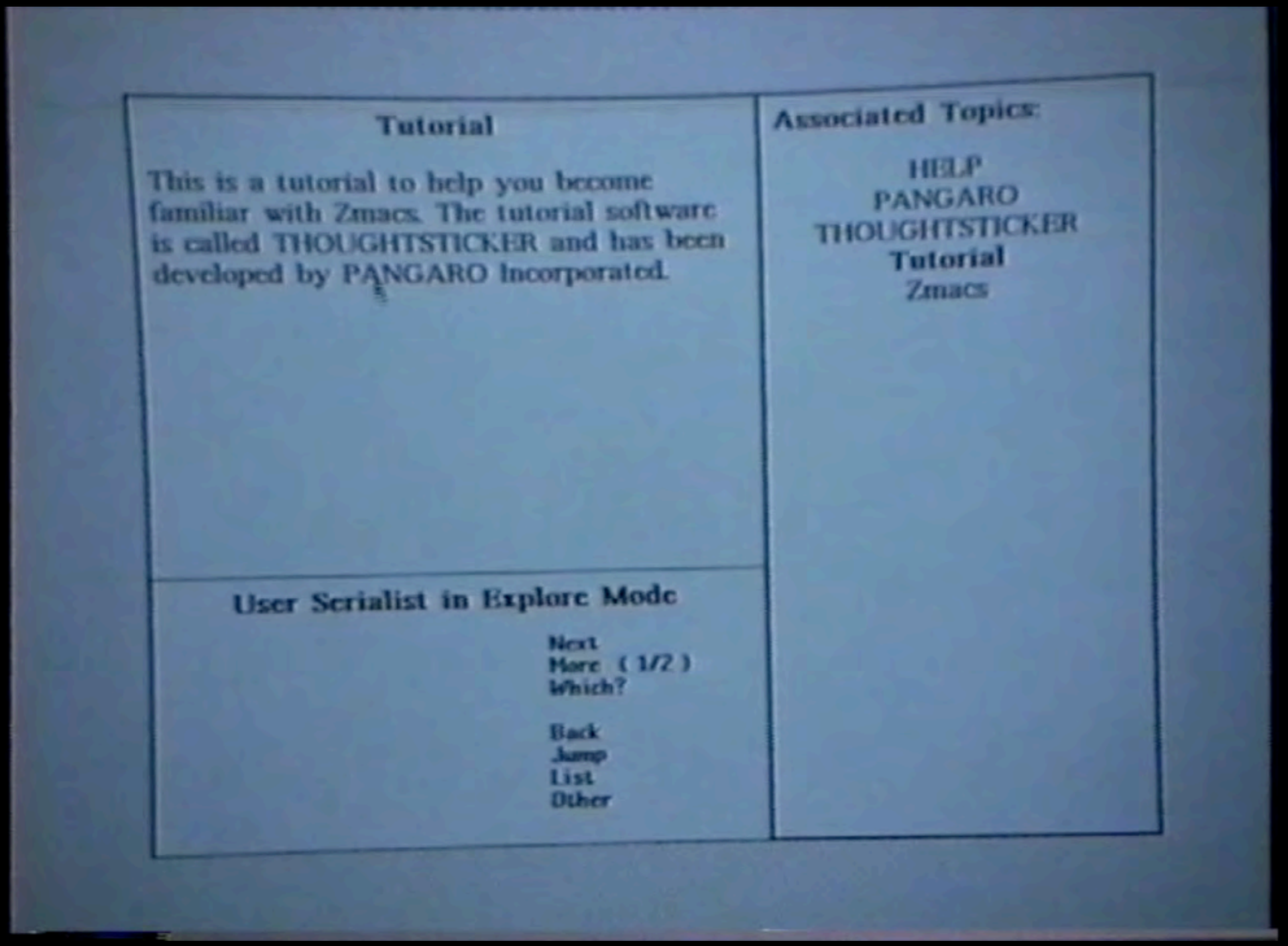
- ***asks great questions***
- ***offers different ways to achieve your goal***
- ***collaborates with you to define new goals***
- ***helps you to be what you want to be… or to become.***

Siri, will Conversational Interfaces become
great conversational partners?

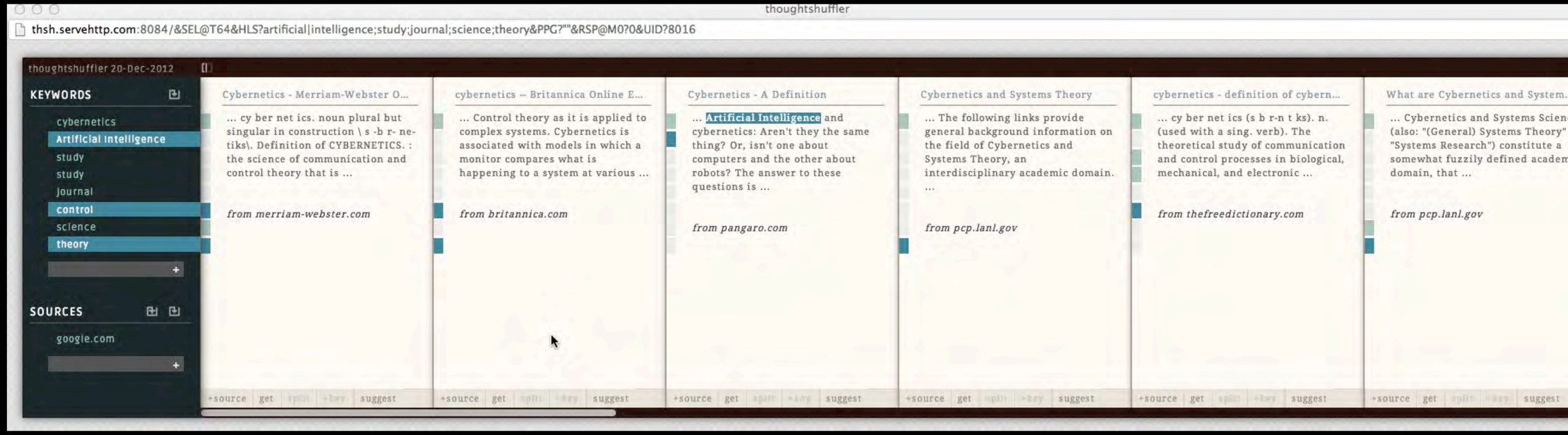
Gordon Pask – Computing Conversation



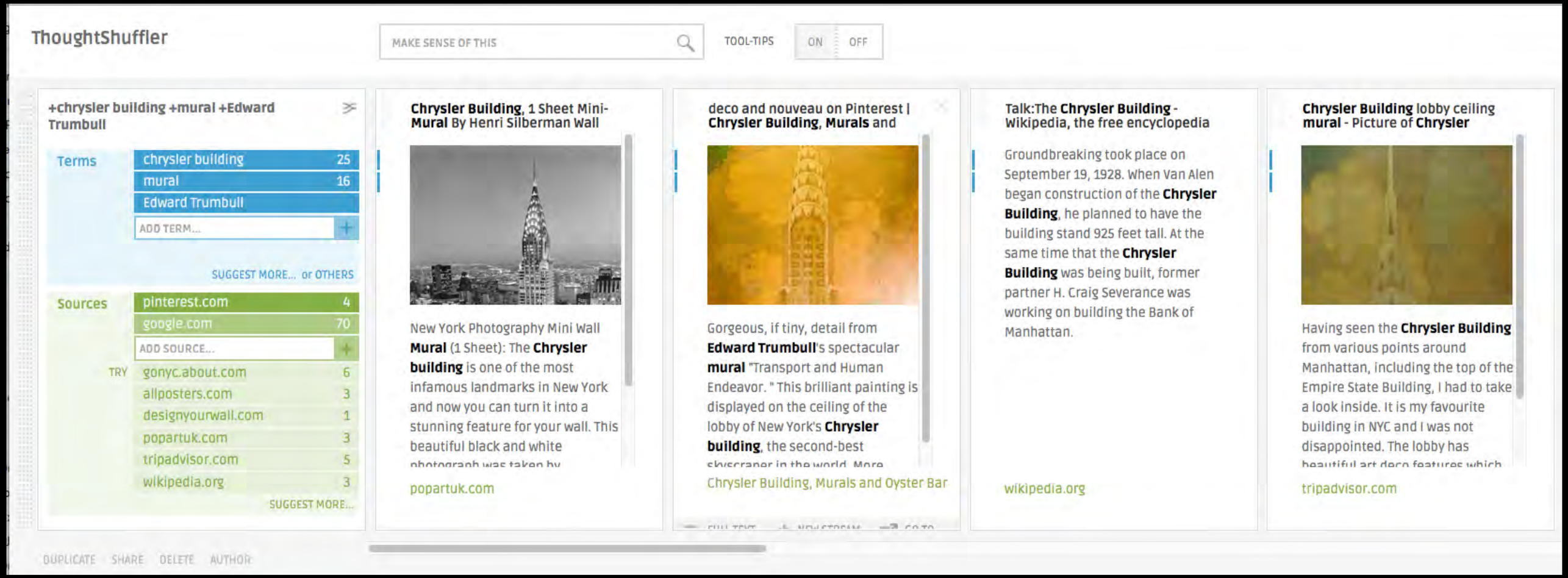
Musicolour 1953
S.A.K.I. 1956
Eucrates 1958
Cybernetic Theatre 1964
Colloquy of Mobiles 1968
Thoughtsticker 1975
Architecture Machine 1976
Thoughtsticker 1987
Designing Engagement 2007
Conversations for Design 2017



Thoughtsticker
Ph.D. Dissertation
Paul Pangaro
1987



ThoughtShuffler
UI design and coding by Jeremy Scott Diamond
UX & heuristics by Paul Pangaro
2012



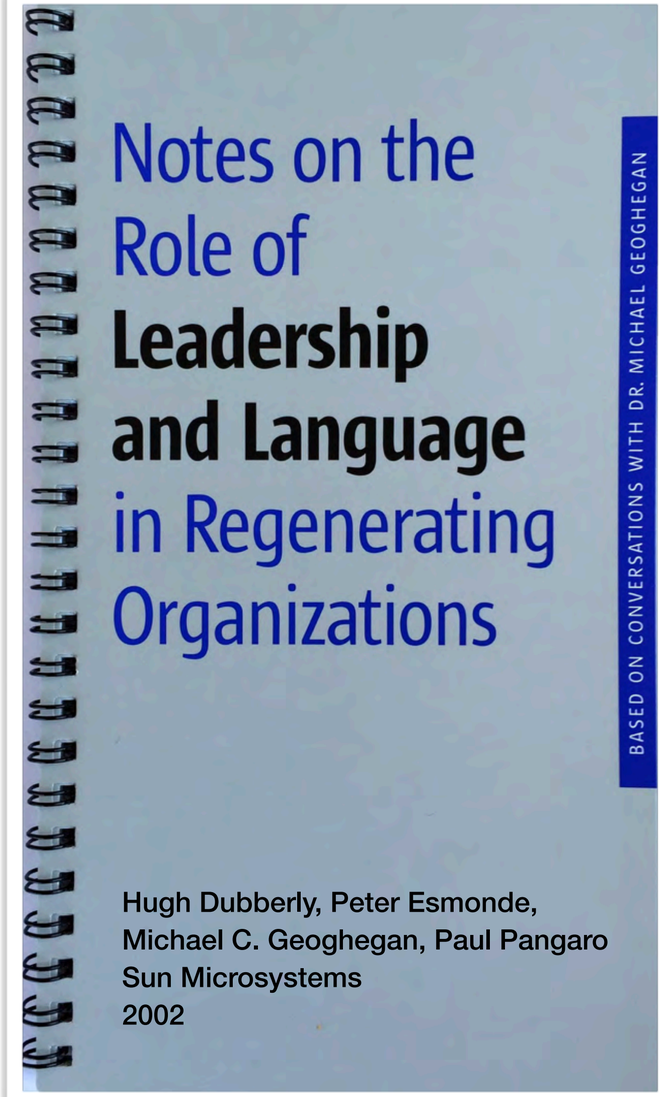
ThoughtShuffler v2
UX by See-ming Lee
concept & heuristics by Paul Pangaro
2013

thoughtshuffler v3 iOS
UX by Miriam Simun
UI by See-ming Lee
concept & heuristics by Paul Pangaro
2013

Streamfully
UI by Barbara de Wilde & John Katagawa
UI coding and AWS coding by John Katagawa
UX & heuristics by Paul Pangaro
2014

Streamfully mobile
UI design & coding by John Katagawa
UX & heuristics by Paul Pangaro
2014

Designing Engagement / Conversations for Organizational Change



An organization
is its **language.**

To regenerate,
an organization creates
a new **language.**

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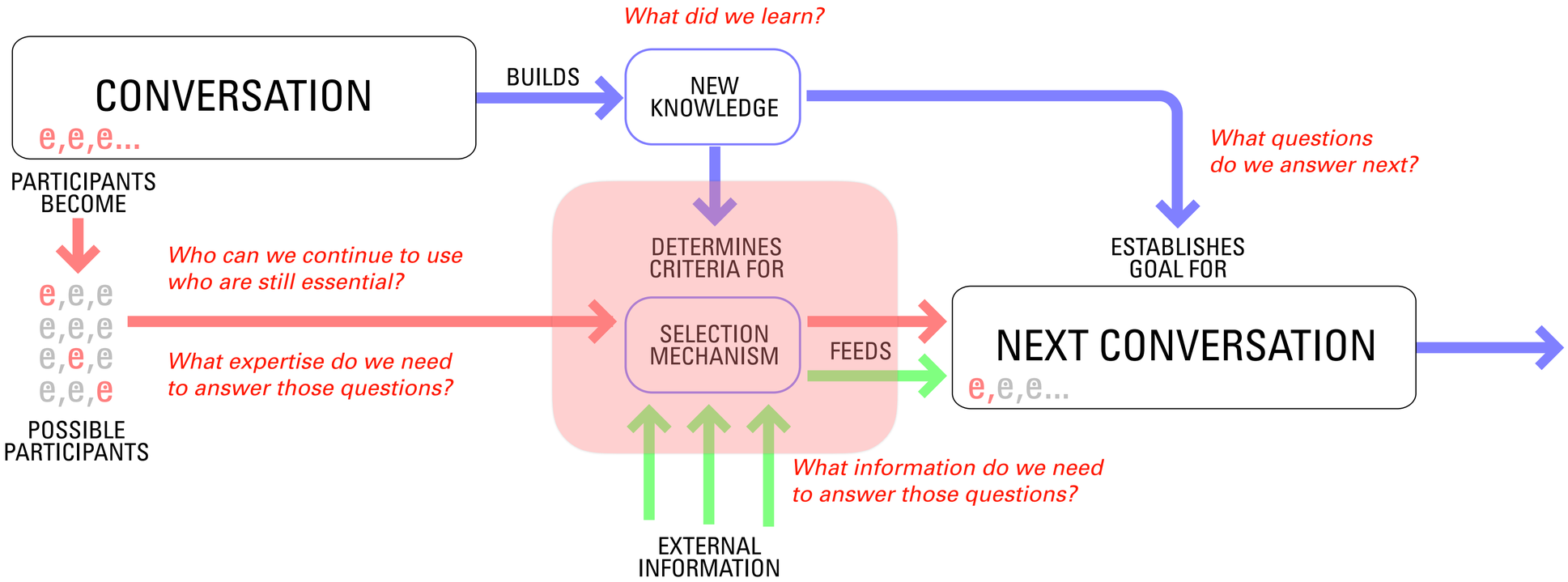
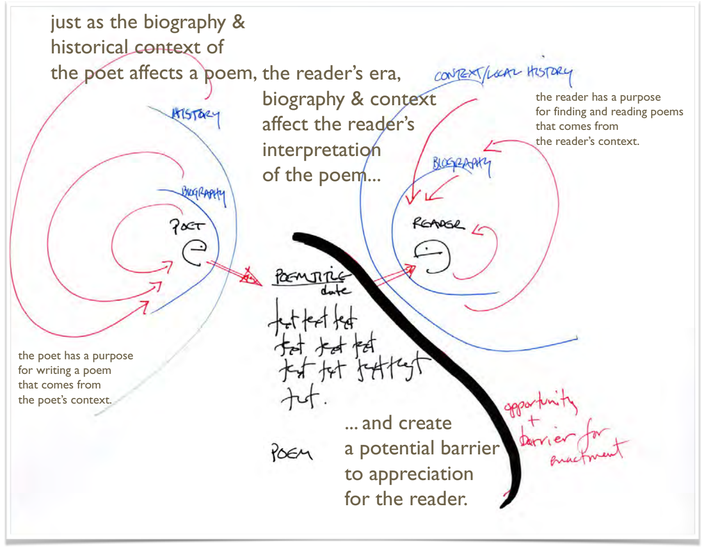
Designing Engagement / Cadence of Conversations



Paul Pangaro
Modeling Engagement Project
Ogilvy & Mather, New York
2007
Click for PDF

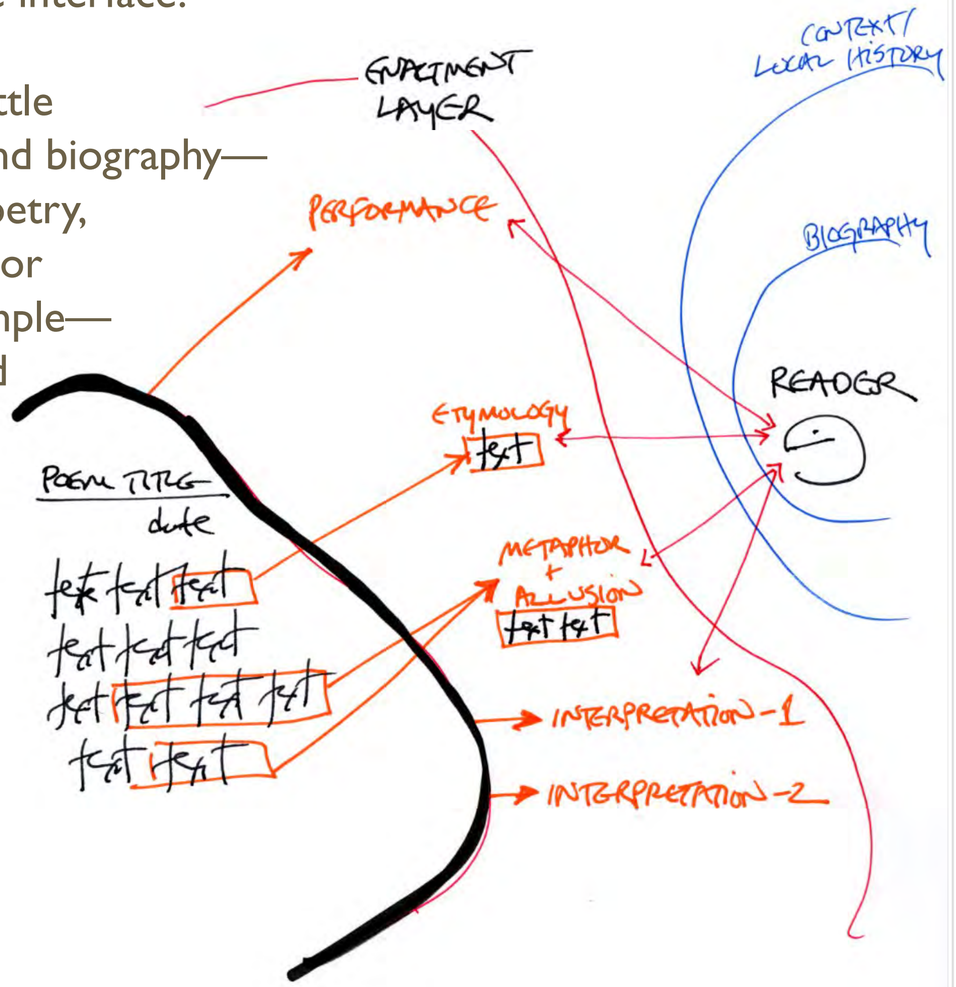
Designing Engagement / Poetry Machine



poetrymachine's storehouse of enactments
creates a dynamic software interface.

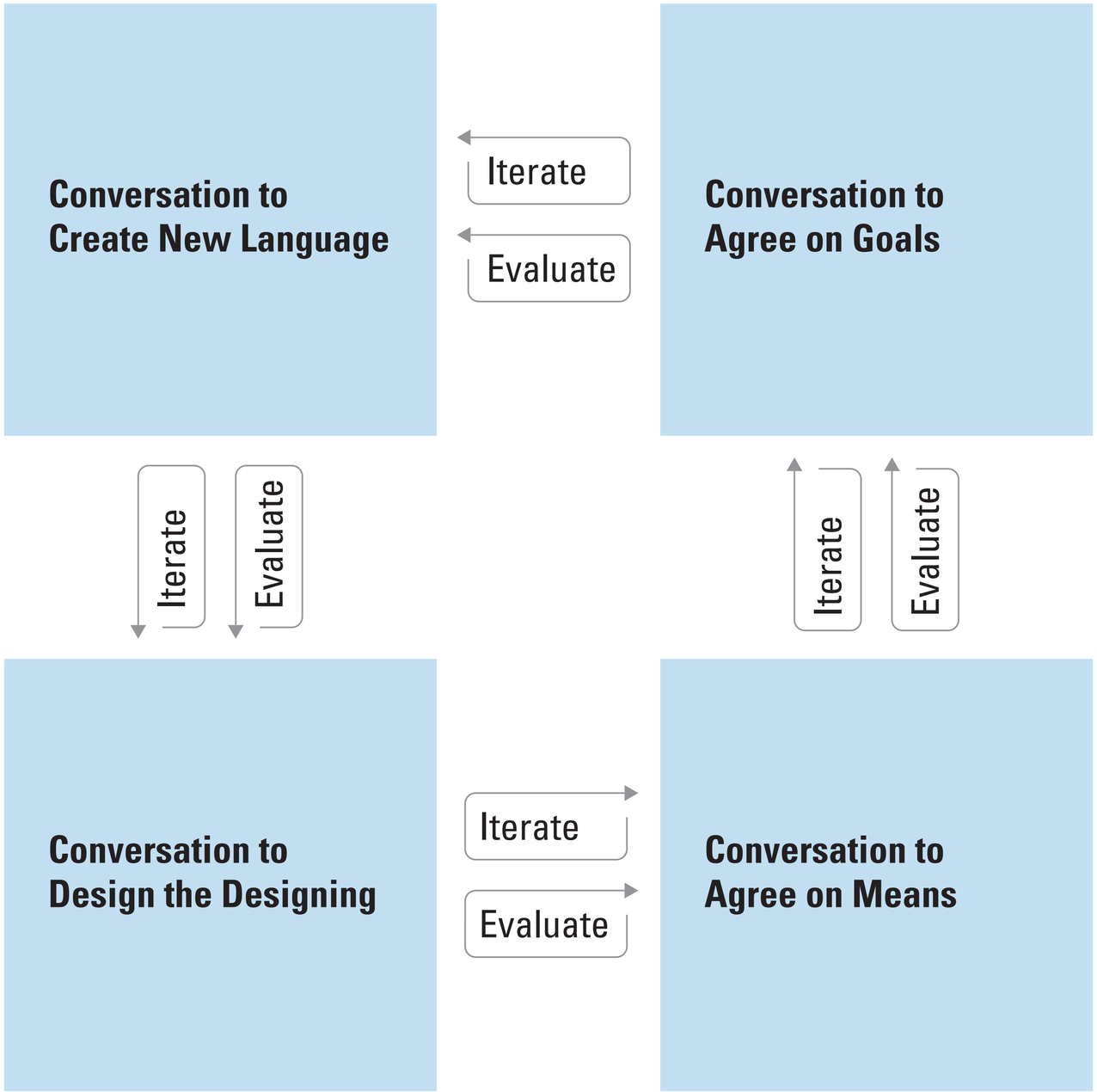
if poetymachine knows a little
about a reader's context and biography—
level of experience with poetry,
purpose in seeking poetry, or
prior poems read, for example—
it can create a personalized
enactment layer by
choosing specific elements
of enactment to present
to that specific reader.

the enactment layer
enables a dialog
that connects
poem & reader,
poet & reader,
reader & self.



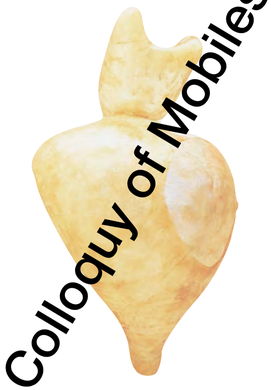
Paul Pangaro
Poetry Machine Project
PoetryMagazine.org, Chicago
2008

Design as Conversation / Conversations for Design



Paul Pangaro
“Designing Our World:
Cybernetics as Conversation for Action”
Heinz von Foerster Lecture,
University of Vienna
2017
Click for PDF

Gordon Pask – Computing Conversation



Musicolour 1953
S.A.K.I. 1956
Eucrates 1958
Cybernetic Theatre 1964
Colloquy of Mobiles 1968
Thoughtsticker 1975
Architecture Machine 1976
Thoughtsticker 1987
Designing Engagement 2007
Conversations for Design 2017

Computing Conversation / When, Why, How, Who?

A. Declare our Intentions

A. Declare our Intentions

Intention #1 — Build cooperative interfaces

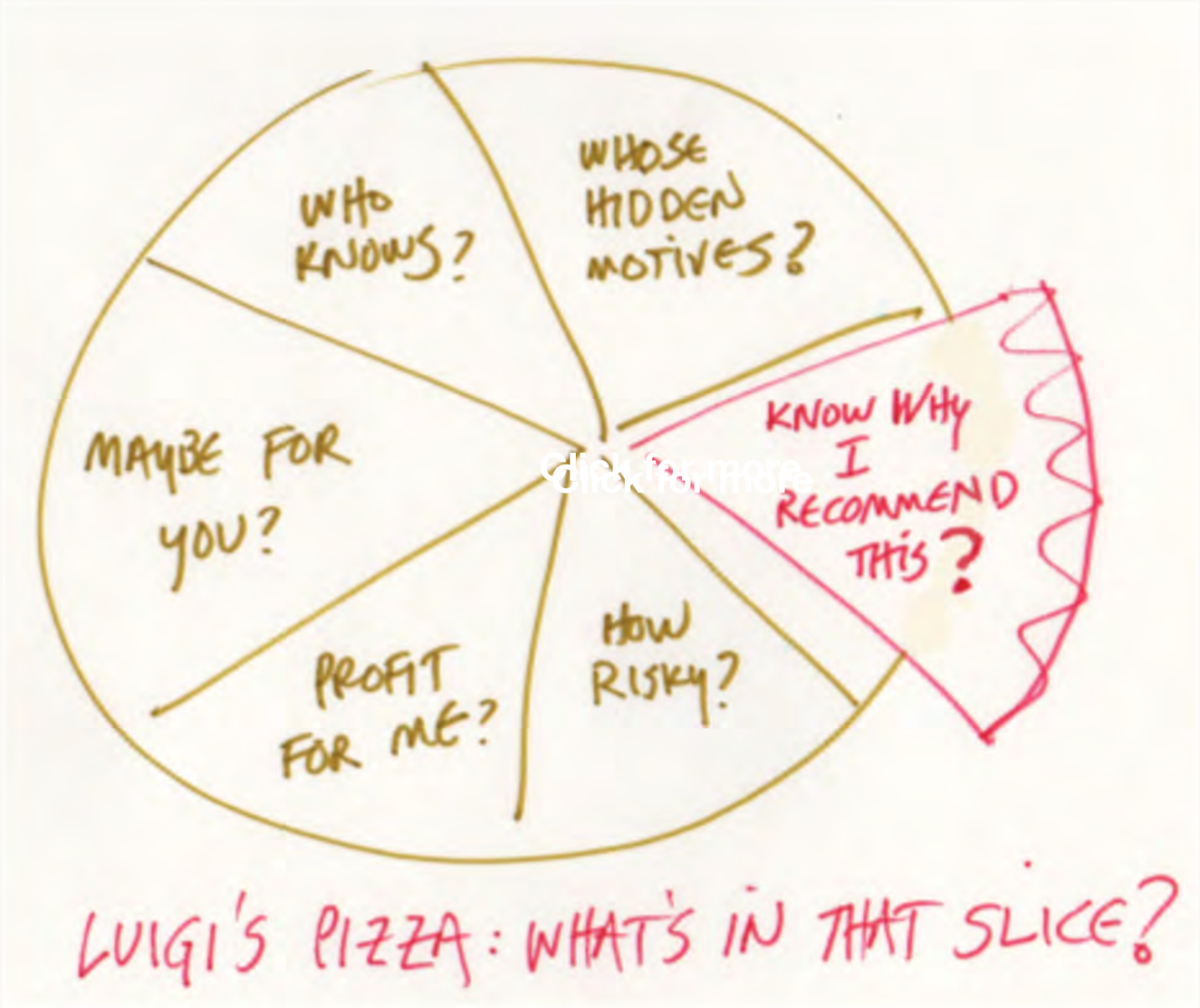
Conversation is a cooperative interface when sequences of coherent interactions enable participants to evolve their points-of-view such that understanding and agreement may arise.

Intentions of Interactions for Conversation v2.1 — March 2019

Luigi’s Pizza — A Parable about Human Conversation

Click for more

Luigi’s Pizza — A Parable about Interfaces



Click for more

A. Declare our Intentions

Intention #2 — Build ethical interfaces

Conversation is an ethical interface when there is reliable transparency of action & intent — what + why — such that trust may arise over time.

Intentions of Interactions for Conversation v2.1 — March 2019

Terms and Conditions

Privacy Policy

Last modified: December 18, 2017 (view archived versions) Hide examples

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- What information we collect and why we collect it.
- How we use that information.
- The choices we offer, including how to access and update information.

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Information we collect

Back to top

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We collect information in the following ways:

- **Information you give us.** For example, many of our services require you to sign up for a Google Account. When you do, we'll ask for personal information, like your name, email address, telephone number or credit card to store with your account. If you want to take full advantage of the sharing features we offer, we might also ask you to create a publicly visible Google Profile, which may include your name and photo.
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    - telephony log information like your phone number, calling-party number, forwarding numbers, time and date of calls, duration of calls, SMS routing information and types of calls.
    - Internet protocol address.
    - device event information such as crashes, system activity, hardware settings, browser type, browser language, the date and time of your request and referral URL.
    - cookies that may uniquely identify your browser or your Google Account.
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    When you use Google services, we may collect and process information about your actual location. We use various technologies to determine location, including IP address, GPS, and other sensors that may, for example, provide Google with information on nearby devices, Wi-Fi access points and cell towers.
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Information we collect when you are signed in to Google, in addition to information we

- Choose whether your Profile name and Profile photo appear in shared endorsements that appear in ads.

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Information you share

Back to top

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Back to top

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Information we share

Back to top

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  We will share personal information with companies, organizations or individuals outside of Google when we have your consent to do so. We require opt-in consent for the sharing of any sensitive personal information.
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  If your Google Account is managed for you by a domain administrator (for example, for G Suite users) then your domain administrator and resellers who provide user support to your organization will have access to your Google Account information (including your email and other data). Your domain administrator may be able to:
  - view statistics regarding your account, like statistics regarding applications you install.
  - change your account password.
  - suspend or terminate your account access.
  - access or retain information stored as part of your account.
  - receive your account information in order to satisfy applicable law, regulation, legal process or enforceable governmental request.
  - restrict your ability to delete or edit information or privacy settings.

  Please refer to your domain administrator's privacy policy for more information.
- **For external processing**

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When you contact Google, we keep a record of your communication to help solve any issues you might be facing. We may use your email address to inform you about our services, such as letting you know about upcoming changes or improvements.

We use information collected from cookies and other technologies, like pixel tags, to improve your user experience and the overall quality of our services. One of the products we use to do this on our own services is Google Analytics. For example, by saving your language preferences, we'll be able to have our services appear in the language you prefer. When showing you tailored ads, we will not associate an identifier from cookies or similar technologies with sensitive categories, such as those based on race, religion, sexual orientation or health.

Our automated systems analyze your content (including emails) to provide you personally relevant product features, such as customized search results, tailored advertising, and spam and malware detection.

We may combine personal information from one service with information, including personal information, from other Google services – for example to make it easier to share things with people you know. Depending on your account settings, your activity on other sites and apps may be associated with your personal information in order to improve Google's services and the ads delivered by Google.

We will ask for your consent before using information for a purpose other than those that are set out in this Privacy Policy.

Compliance and cooperation with regulatory authorities

Back to top

We regularly review our compliance with our Privacy Policy. We also adhere to several self regulatory frameworks, including the EU-US and Swiss-US Privacy Shield Frameworks. When we receive formal written complaints, we will contact the person who made the complaint to follow up. We work with the appropriate regulatory authorities, including local data protection authorities, to resolve any complaints regarding the transfer of personal data that we cannot resolve with our users directly.

Changes

Back to top

Our Privacy Policy may change from time to time. We will not reduce your rights under this Privacy Policy without your explicit consent. We will post any privacy policy changes on this page and, if the changes are significant, we will provide a more prominent notice (including, for certain services, email notification of privacy policy changes). We will also keep prior versions of this Privacy Policy in an archive for your review.

Specific product practices

Back to top

The following notices explain specific privacy practices with respect to certain Google products and services that you may use:

- Chrome and Chrome OS
- Play Books
- Payments
- Fiber
- Project Fi
- G Suite for Education
- YouTube Kids
- Google Accounts Managed with Family Link

For more information about some of our most popular services, you can visit the Google Product Privacy Guide.

Other useful privacy and security related materials

Back to top

Further useful privacy and security related materials can be found through Google's policies and principles pages, including:

- Information about our technologies and principles, which includes, among other things, more information on
  - how Google uses cookies.
  - technologies we use for advertising.
  - how we recognize patterns like faces.
- A page that explains what data is shared with Google when you visit websites that use our advertising, analytics and social products.
- The Privacy Checkup tool, which makes it easy to review your key privacy settings.
- Google's safety center, which provides information on how to stay safe and secure online.

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- **For legal reasons**

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Information security

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- We review our information collection, storage and processing practices, including physical security measures, to guard against unauthorized access to systems.
- We restrict access to personal information to Google employees, contractors and

A. Declare our Intentions

Intention #3 — Build humane interfaces

Conversation is an humane interface when any participant may influence its focus and flow such that cooperation and collaboration may arise.

Intentions of Interactions for Conversation v2.1 — March 2019

**Designers, can we enable conversation for others —
can we *design for conversation*? Enable interactions that…**

- ***are cooperative, humane, and ethical***
- ***create conditions for great conversations***
- ***increase the number of choices open to all***
- ***help us to be what we want to be… or become.***

Where do we look for direction?

Computing Conversation / When, Why, How, Who?

A. Declare our Intentions

B. Riff on Pask

B. Riff on Pask

Proposal #1 — Incorporate Paskian Interaction Principles

#1 — Novelty Regulation
#2 — Uncertainty Regulation
#3 — Autonomy
#4 — Conversation for Design

B. Riff on Pask

Proposal #2 — Build a Question Engine

Compute relevant and novel questions that invite a generative conversation for design such that new and valid choices are explored.

B. Riff on Pask

Proposal #3 — Build a Metric of Conversationality

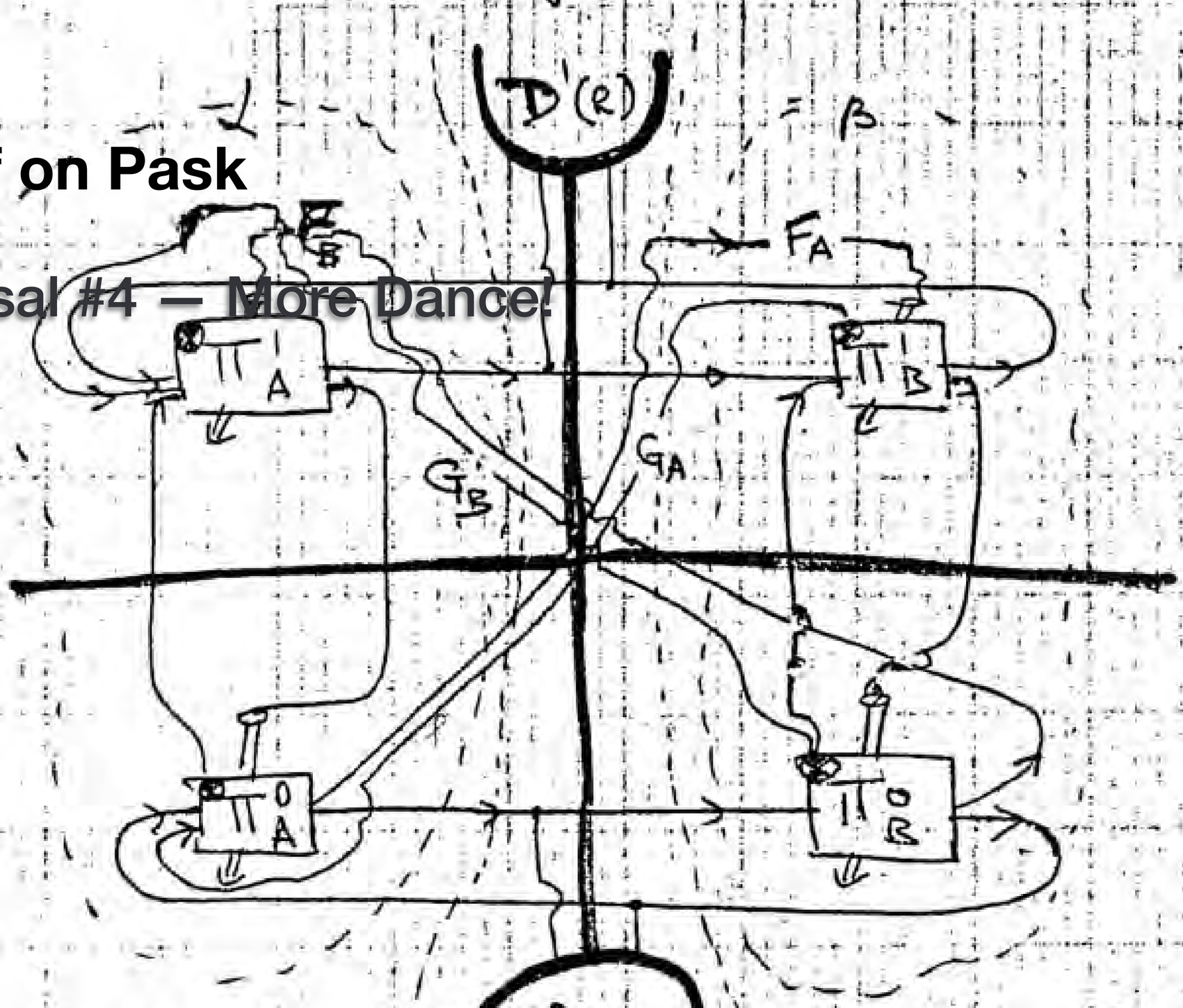
Implement a heuristic to evaluate a conversation in terms of its intelligence and value, such that we draw human attention to generative interactions.

In contrast to the “Turing Test, let’s build a “Turning Test.”

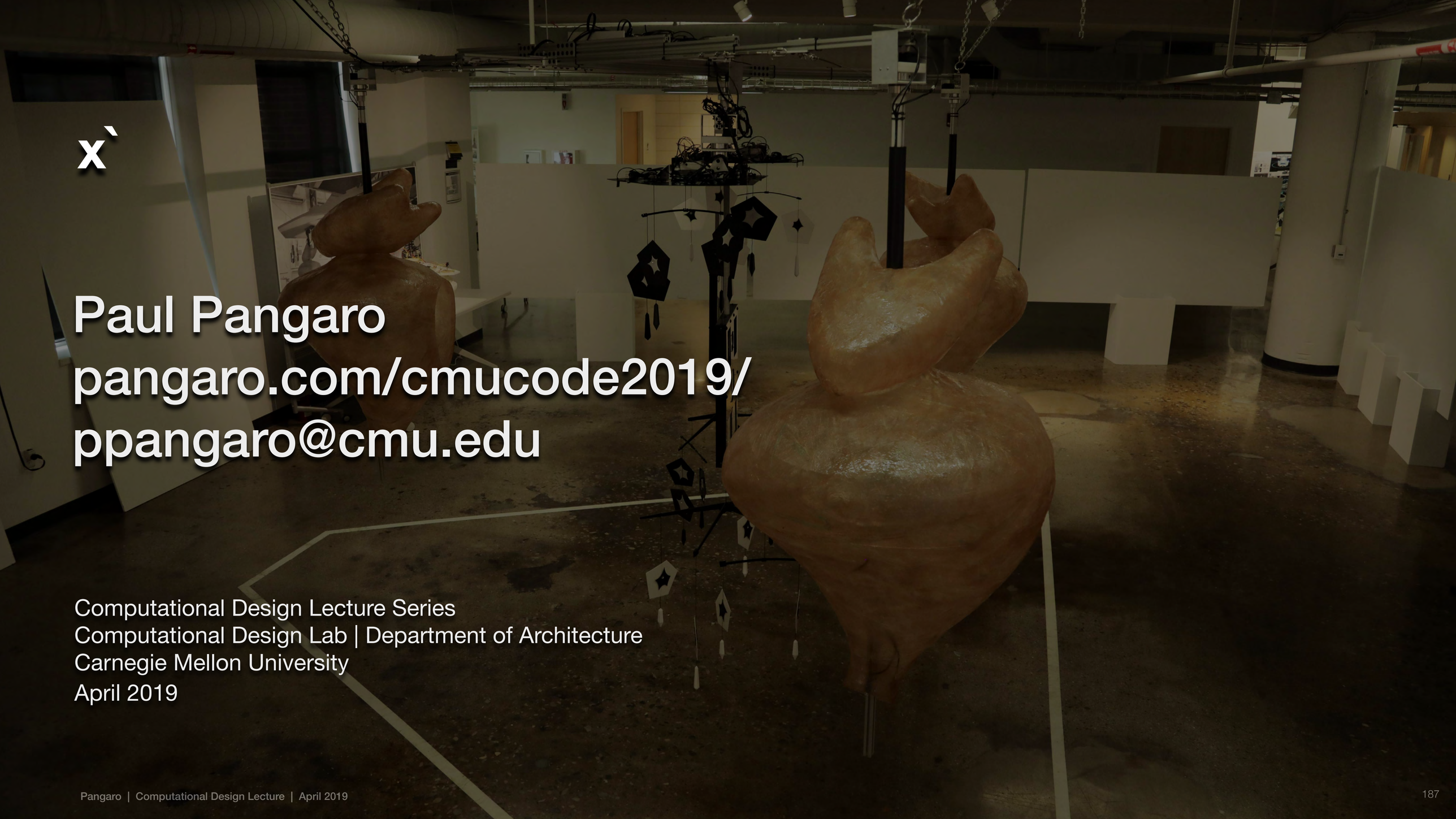
Click for more

B. Riff on Pask

Proposal #4 — More Dance!




Computing Conversation / When, Why, How, Who?



x`

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Computational Design Lab | Department of Architecture
Carnegie Mellon University
April 2019

Thank you.

Special Thanks to:

Daniel Cardoso Llach
TJ McLeish
Hugh Dubberly
Karen Kornblum Berntsen
Pooja Upadhyay
College for Creative Studies

In 2018 we live among machines talking to machines,
machines talking to people, and
people talking to people through machines.

Yet that is Pask's Colloquy—how could he have
foreseen our world as it is today?

From 1968 he chides us
with his vision of rich, humane interaction—
organic and analog, immersive and unpredictable,
conversational and emergent.

Would that today's digital interactions
have even some of those properties.

Colloquy of Mobiles appeared 50 years ago as an
apparition from a distant future. Living in that future,
what future shall we build from here?

COLLOQUY 2018 Project Advisory Board

Amanda Pask Heitler and Hermione Pask, Gordon Pask's daughters and executors of his scientific and artistic estate

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Appendices

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Computing Conversation / When, Why, How, Who?

> ***“I shall act always so as to increase the total number of choices.”***
>
> — Ethical Imperative, Heinz von Foerster

Computing Conversation / When, Why, How, Who?

> ***“If you desire to see, learn how to act.”***
>
> — Aesthetic Imperative, Heinz von Foerster

Second-order Design = Design for Conversation

The goal of second-order design 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, 2019

We believe cybernetics offers a foundation for 21st-century design practice, with this rationale:

— Dubberly & Pangaro, “Cybernetics and Design: Conversations for Action”, 2019

If design, then systems:

- The prominence of digital technology in daily life cannot be denied (or reversed).
  Digital technology comprises systems of systems (Internet of Things).
- Design has expanded from **giving-form** to **creating systems** that support interactions.
  Human interactions span thinking and acting, whether mundane or metaphysical.

We must model and tame this complex mesh of mechanisms.

Therefore: systems literacy is a necessary foundation for design.

If design, then systems.

If systems, then cybernetics:

- Digital interactions comprise reliable connections, communication, and feedback.
  Human interactions comprise purpose, feedback, and learning.
- The science of communication and feedback, interaction and purpose, is cybernetics.

We must model communication and intention in a common frame.

Therefore: cybernetics is a necessary foundation for design.

If design, then systems.

If systems, then cybernetics.

If cybernetics, then second-order cybernetics:

- Framing “wicked challenges” requires articulating human values and viewpoints. Values and viewpoints are subjective.
- Designers must offer a persuasive rationale for our subjective viewpoints.
- Modeling subjectivity is the province of second-order cybernetics.

We must embrace values and subjectivity at the heart of designing.

Therefore: second-order cybernetics is a necessary foundation for design.

If design, then systems.

If systems, then cybernetics.

If cybernetics, then second-order cybernetics.

If second-order cybernetics, then conversation:

- Taming “wicked challenges” must be grounded in argumentation.
- Argumentation requires conversation so that participants may understand and agree.
- Agreement is necessary for collaboration and effective action.

We must embrace argumentation and collaboration to the heart of 21st-century design.

Therefore: conversation is a necessary foundation for design.

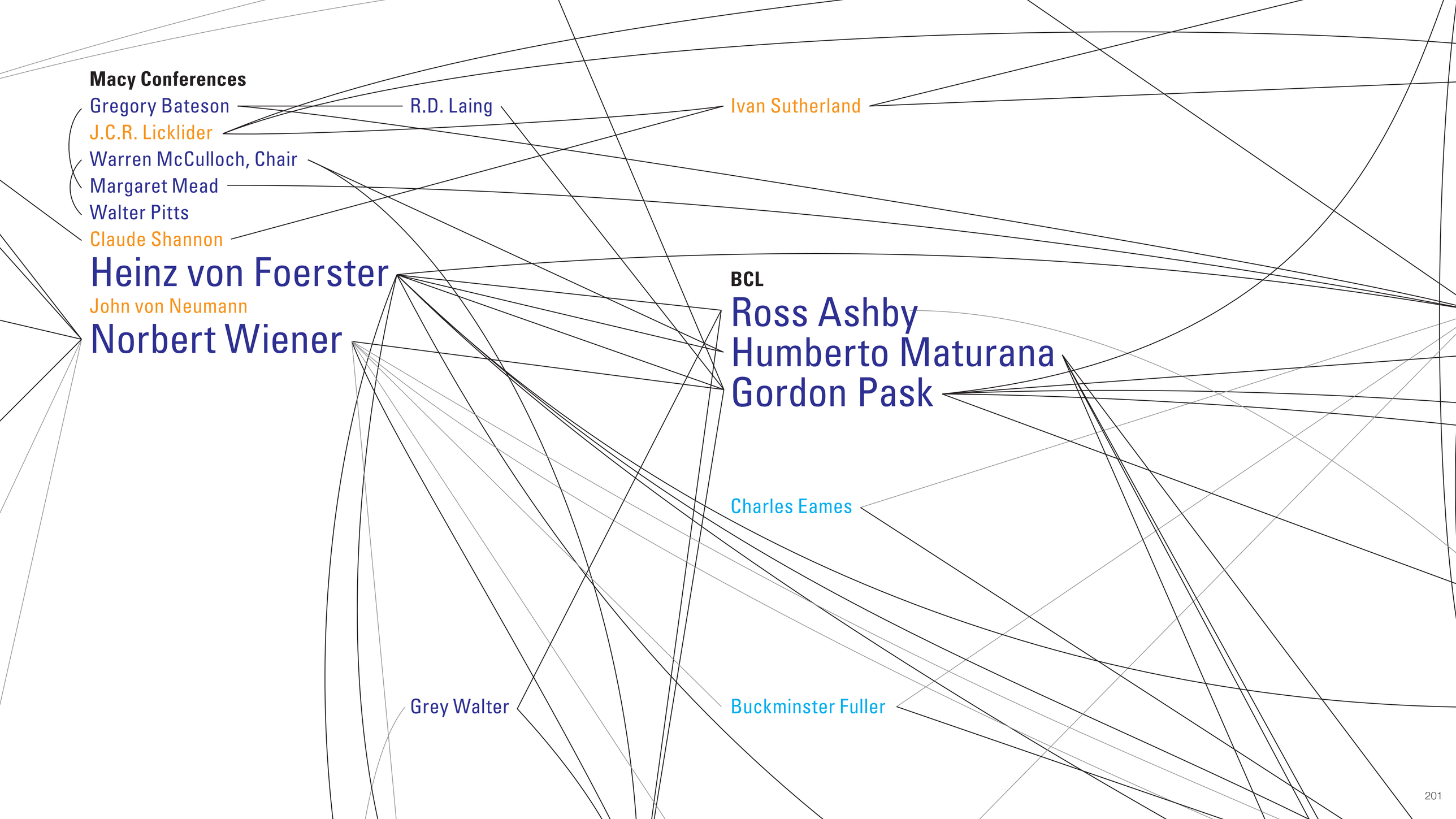
If design, then systems.

If systems, then cybernetics.

If cybernetics, then second-order cybernetics.

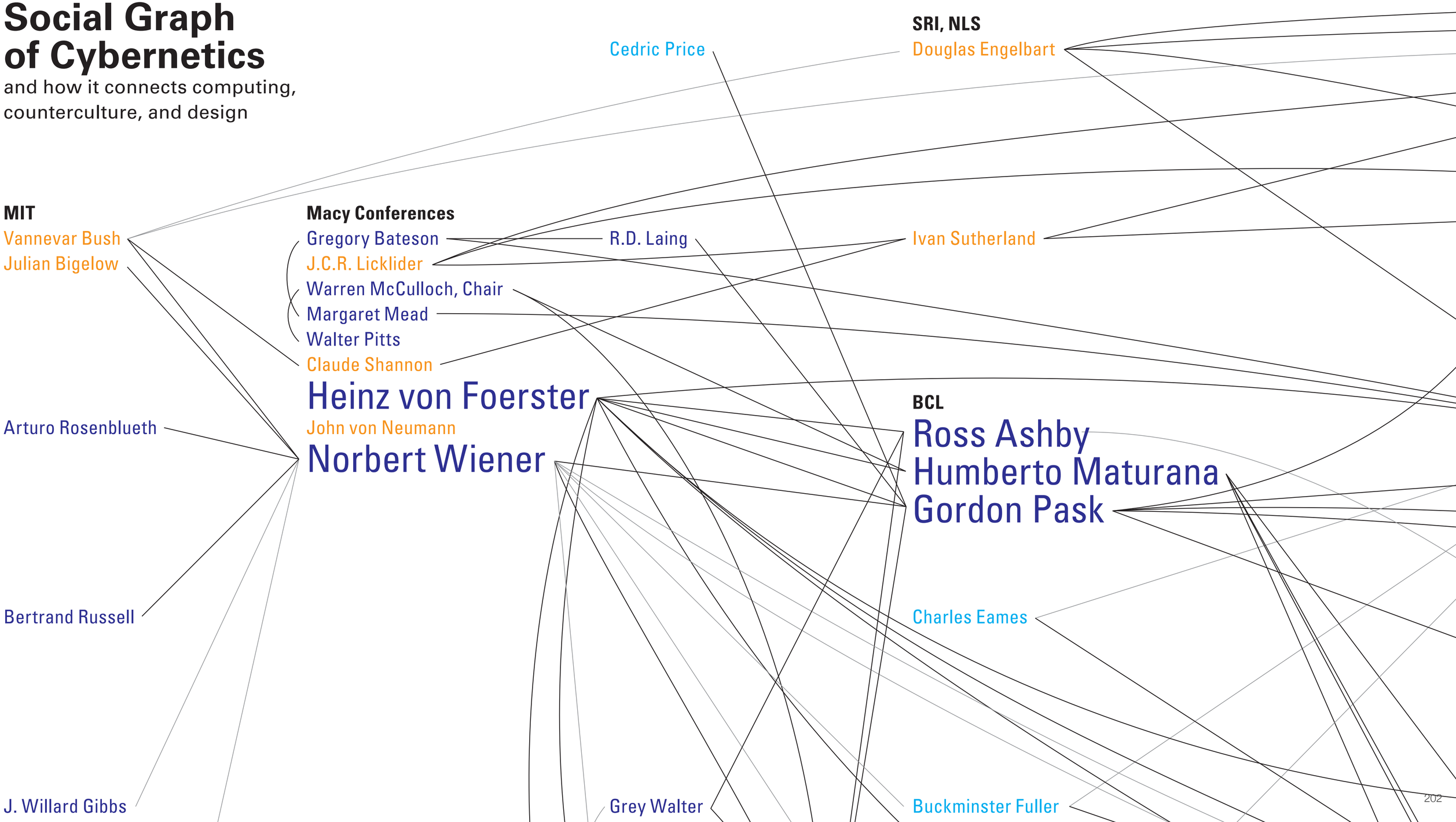
If second-order cybernetics, then conversation.

— Dubberly & Pangaro, “Cybernetics and Design: Conversations for Action”, 2019


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

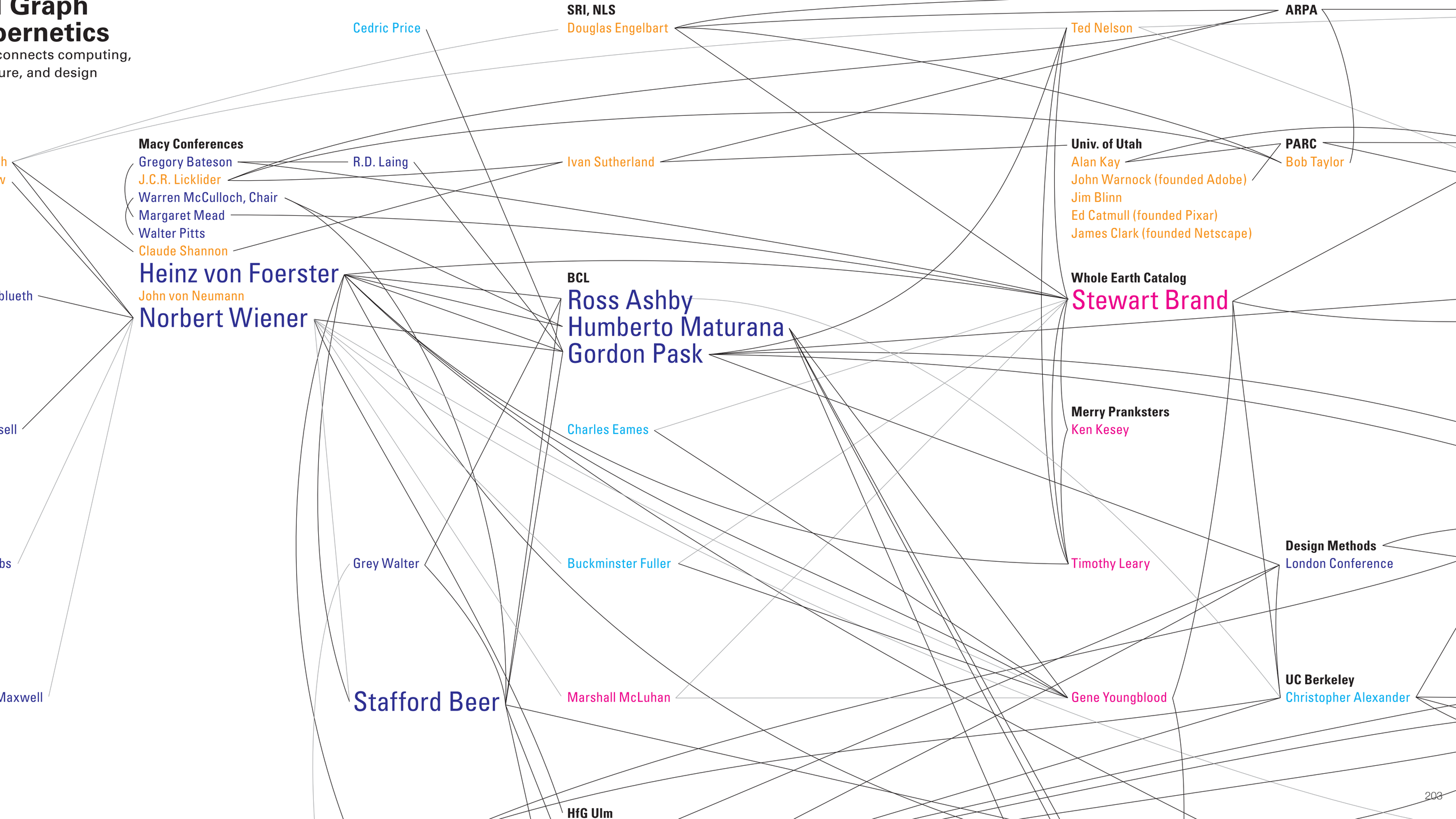
Social Graph of Cybernetics

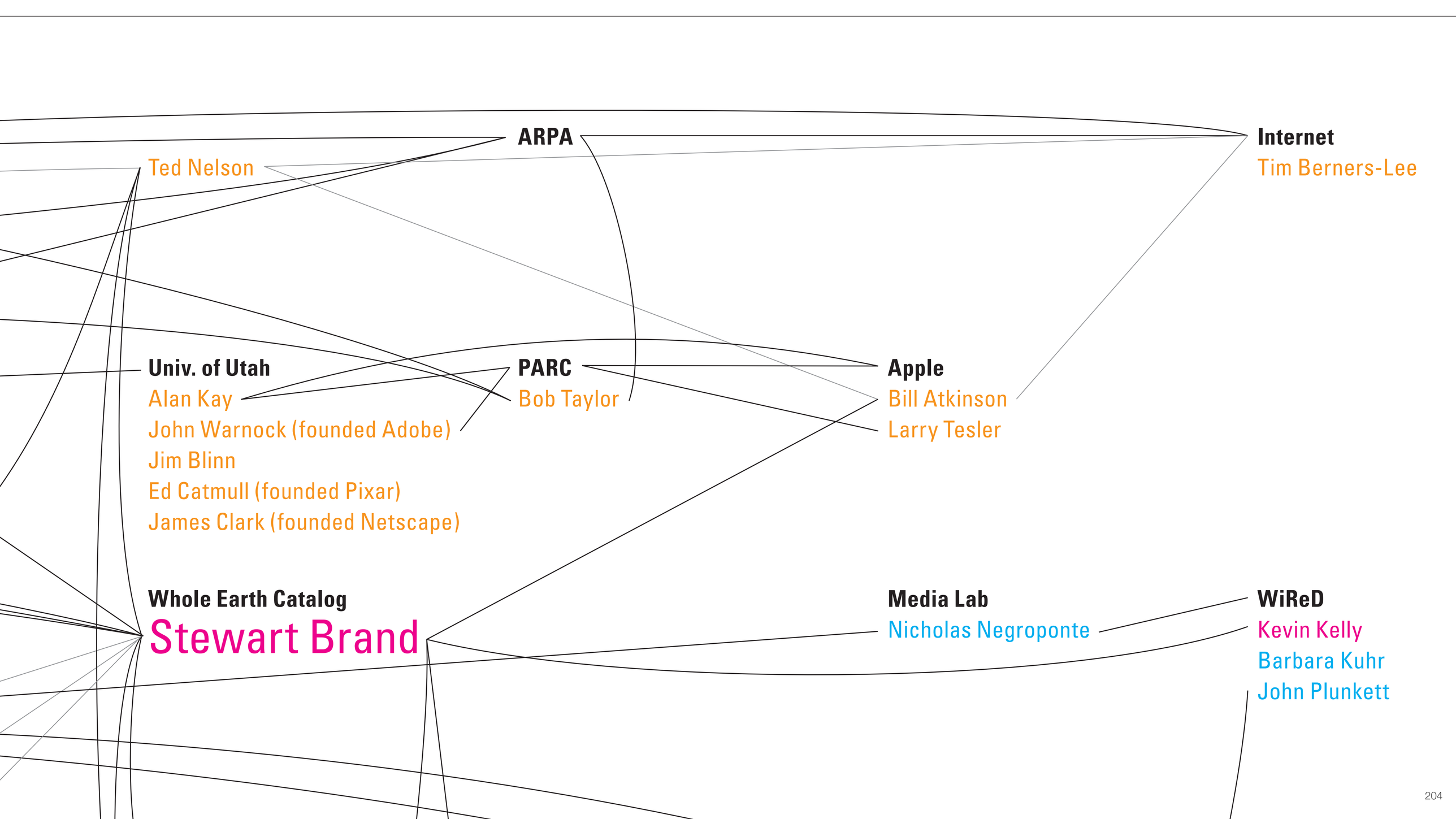
and how it connects computing, counterculture, and design



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
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Bill Atkinson
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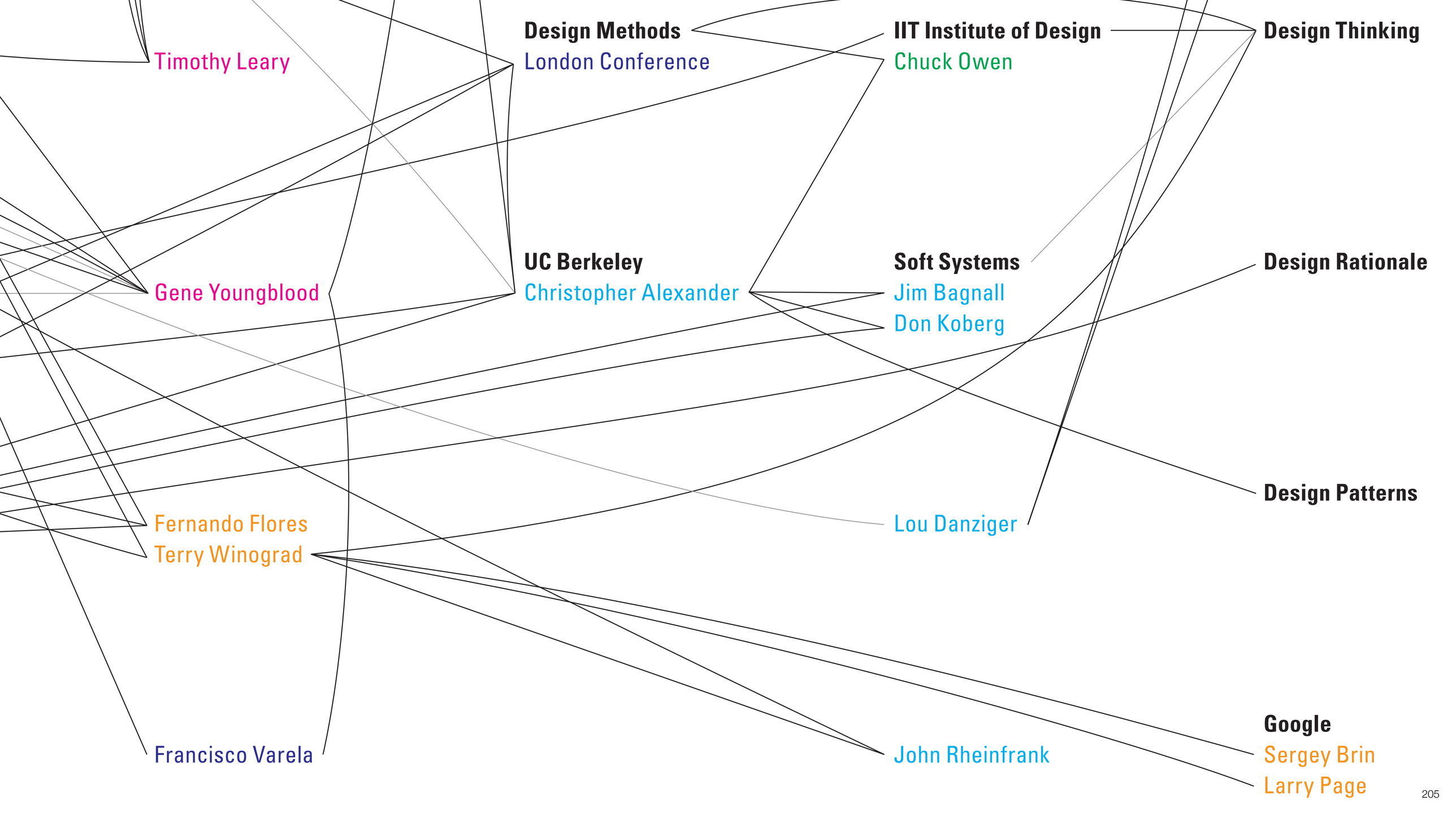
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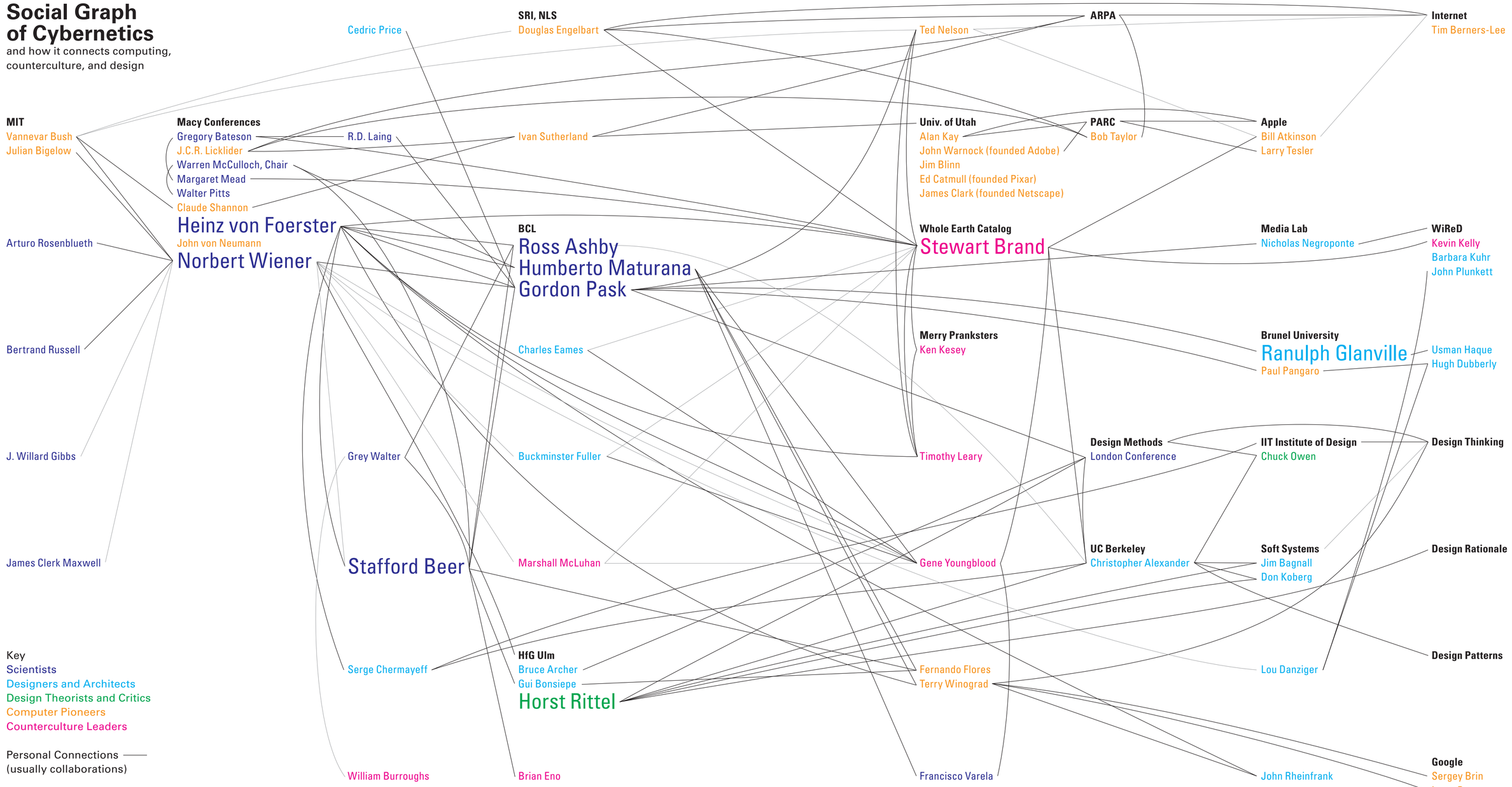
Social Graph of Cybernetics

and how it connects computing, counterculture, and design



Key
Scientists
Designers and Architects
Design Theorists and Critics
Computer Pioneers
Counterculture Leaders

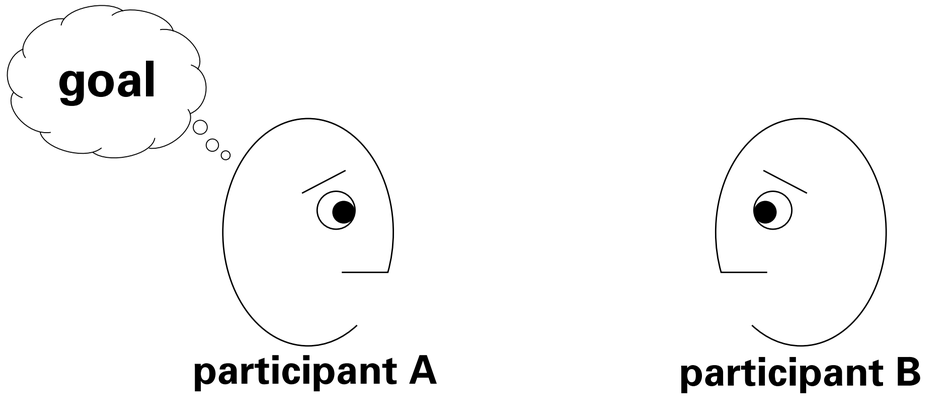
Personal Connections ——
(usually collaborations)

Influences ——
(usually publications)

Interactive version at
http://cybergraph.dubberly.com/

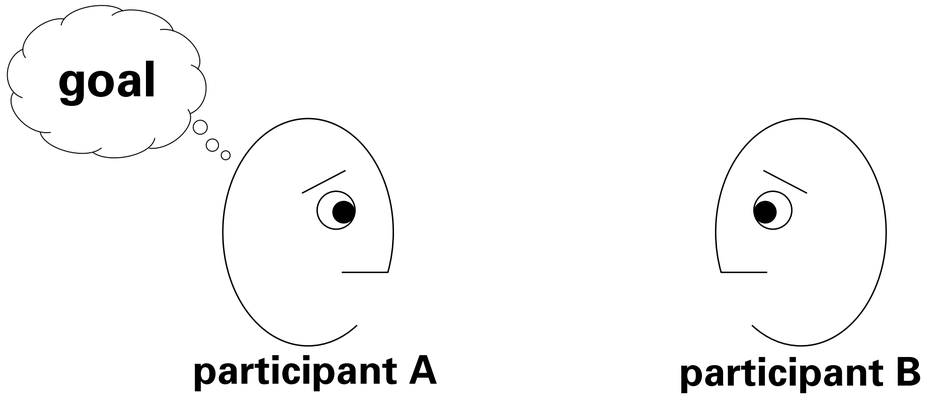
In Dubberly & Pangaro: How cybernetics connects computing, counterculture, and design

Conversational Frame



After Dubberly Design & Paul Pangaro

A participant has a goal.



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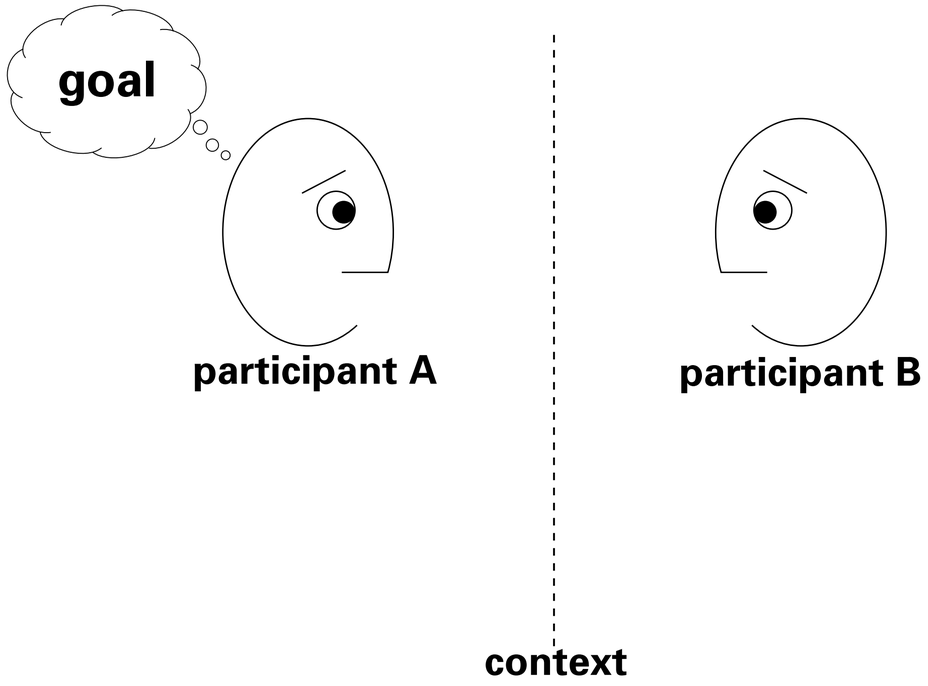
Chooses a context.



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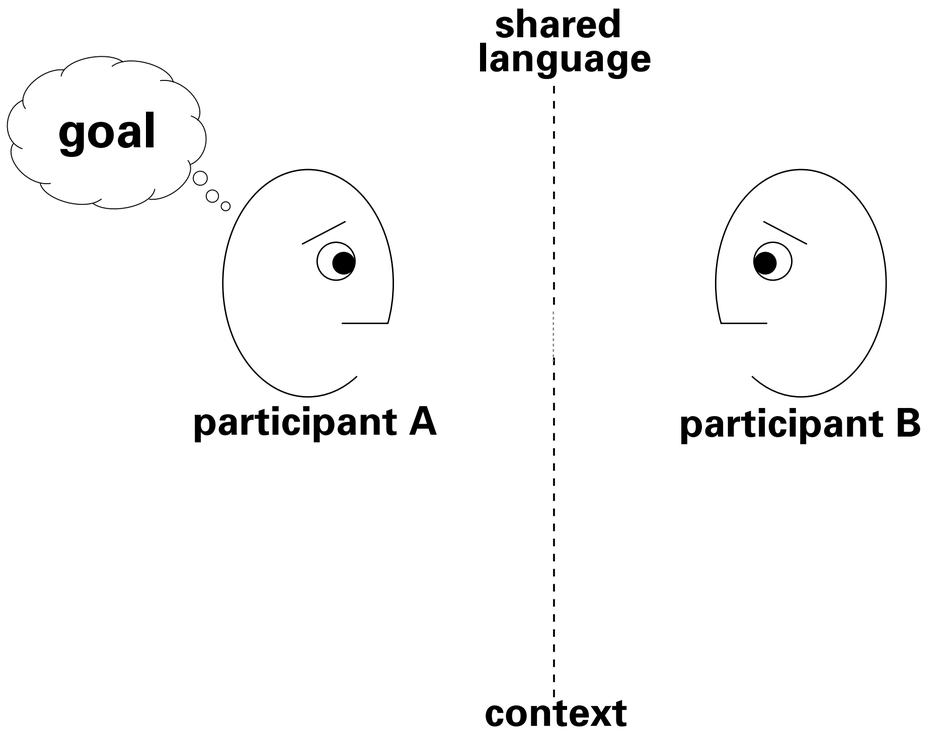
Chooses a language.



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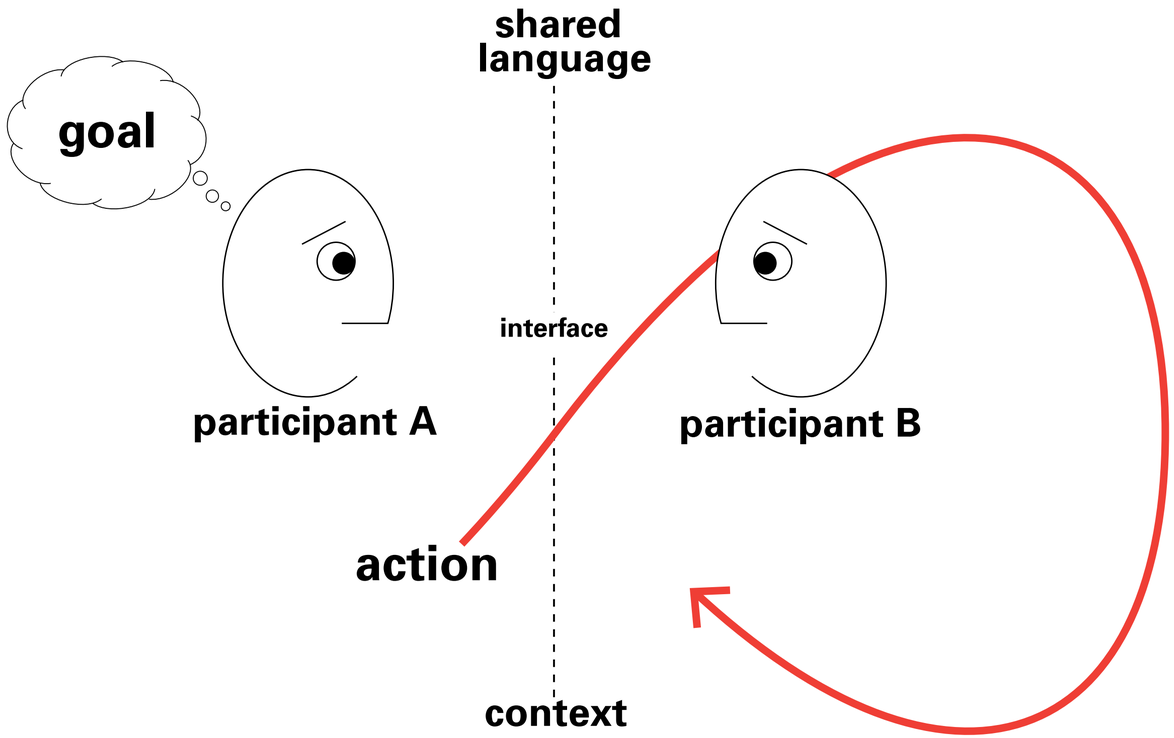
Begins an exchange.



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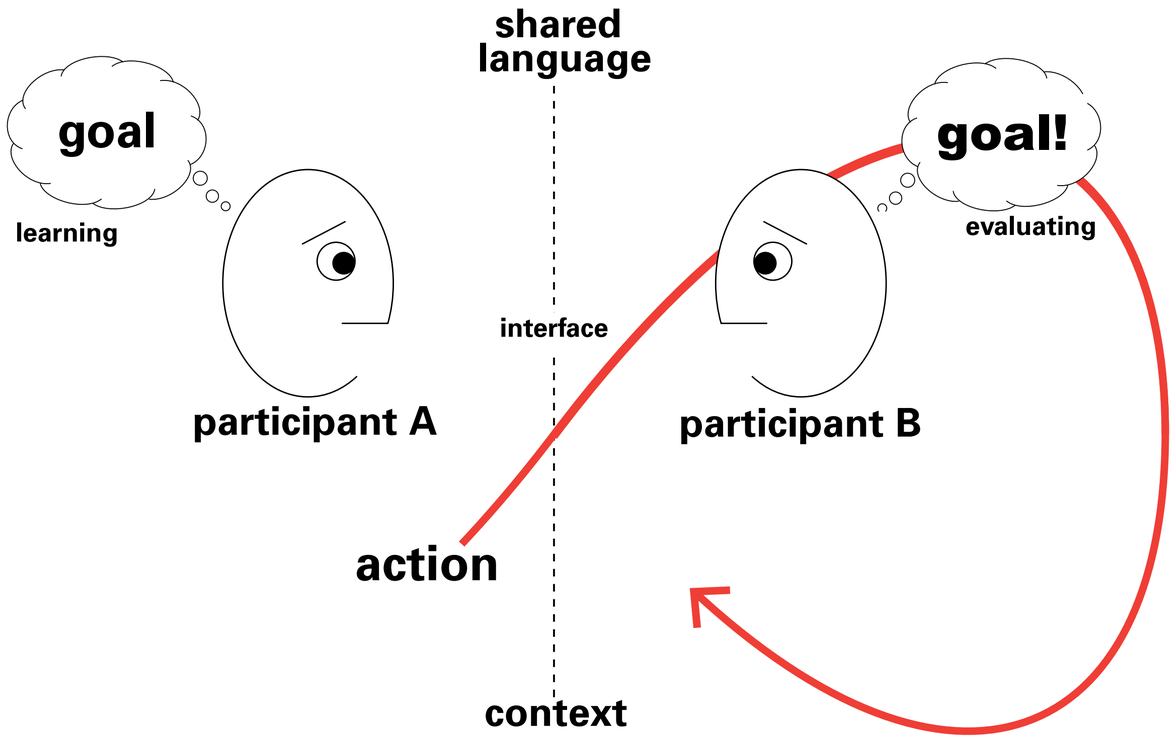
May evoke a response…



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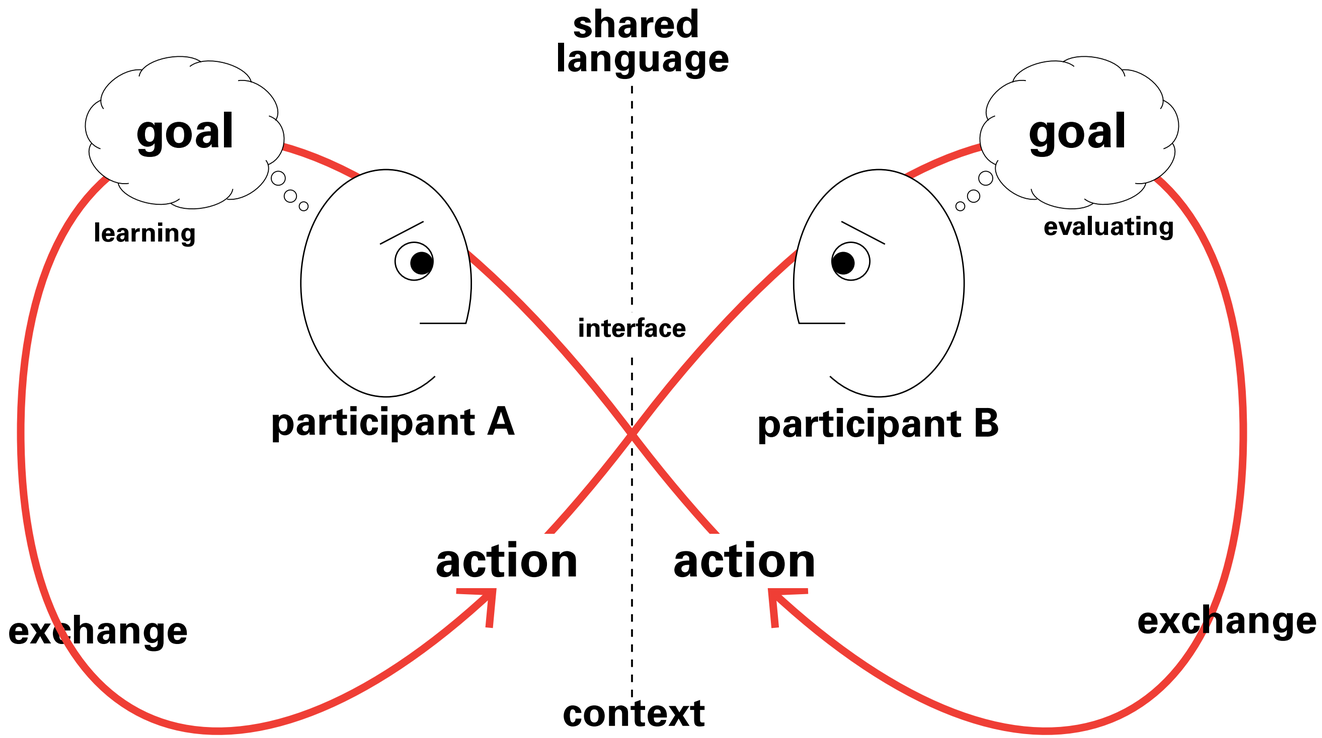
… and a reaction that evokes a reaction…



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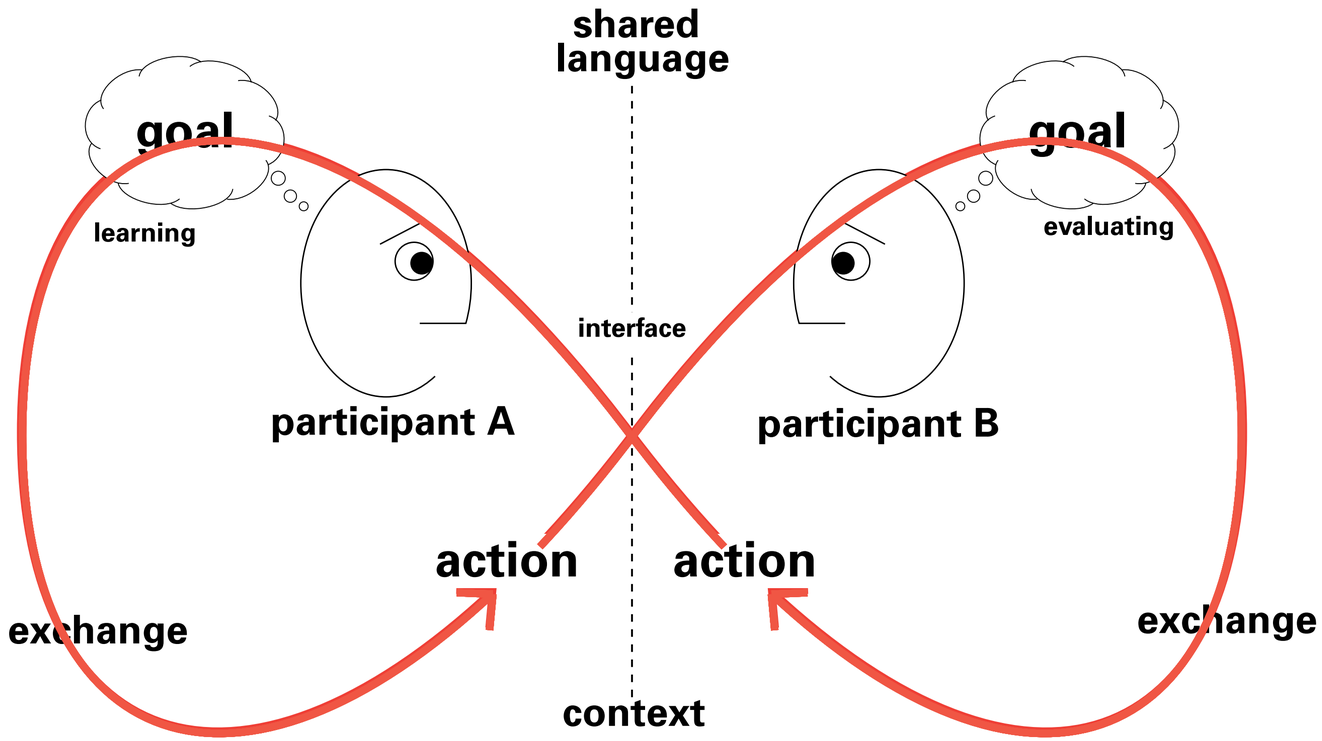
The engagement may continue.



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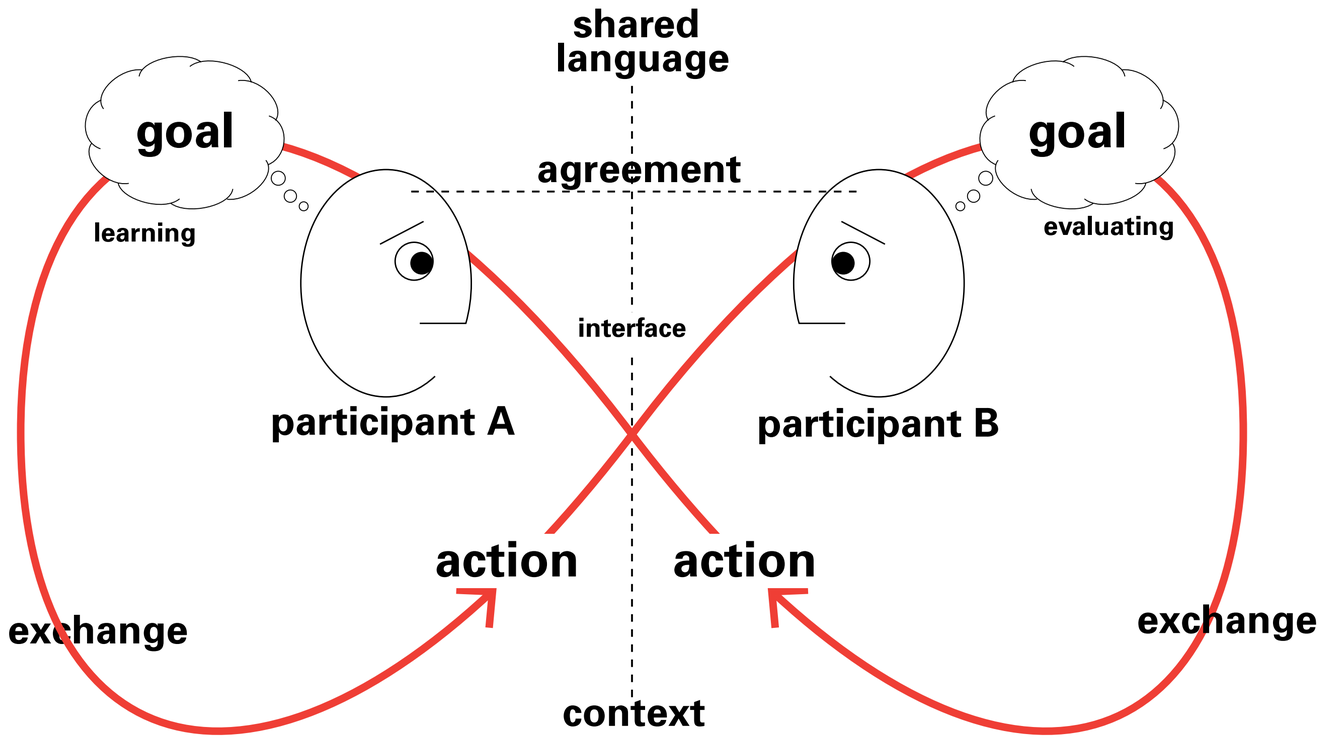
An agreement may be reached.



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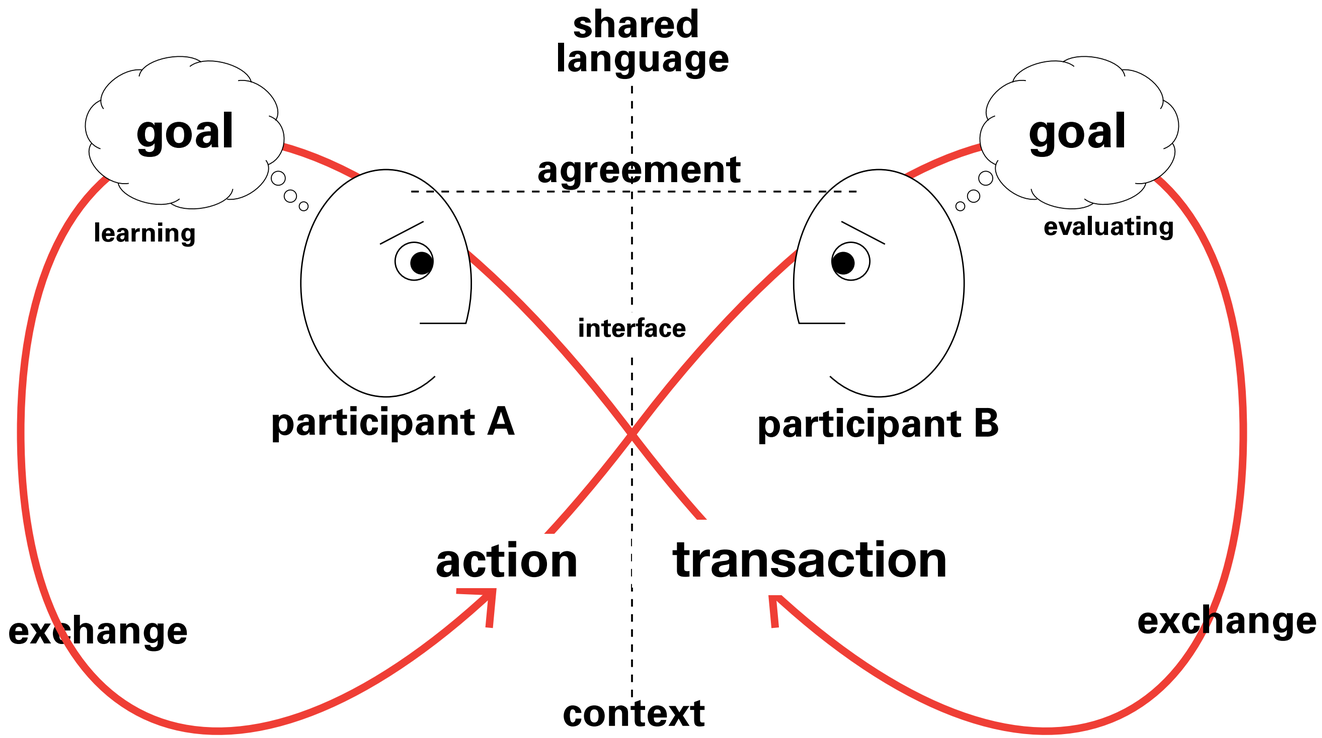
A transaction may occur.



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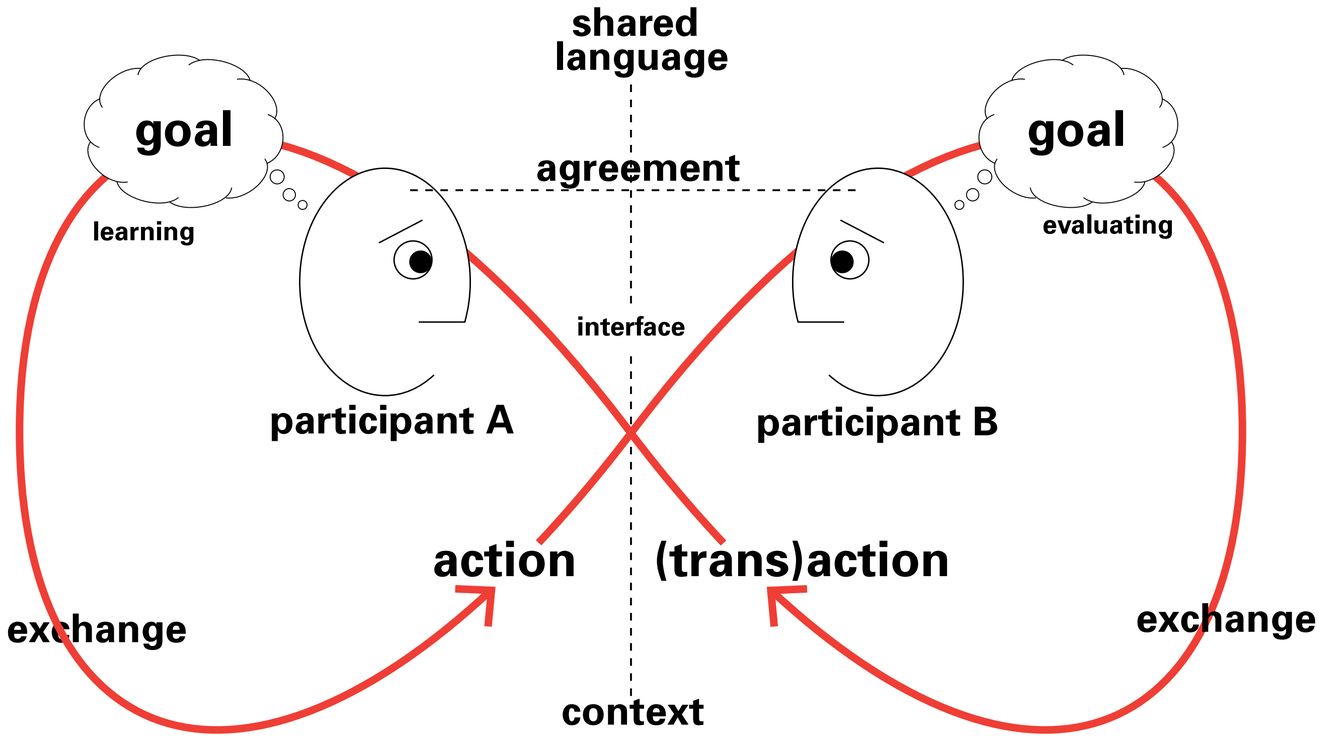
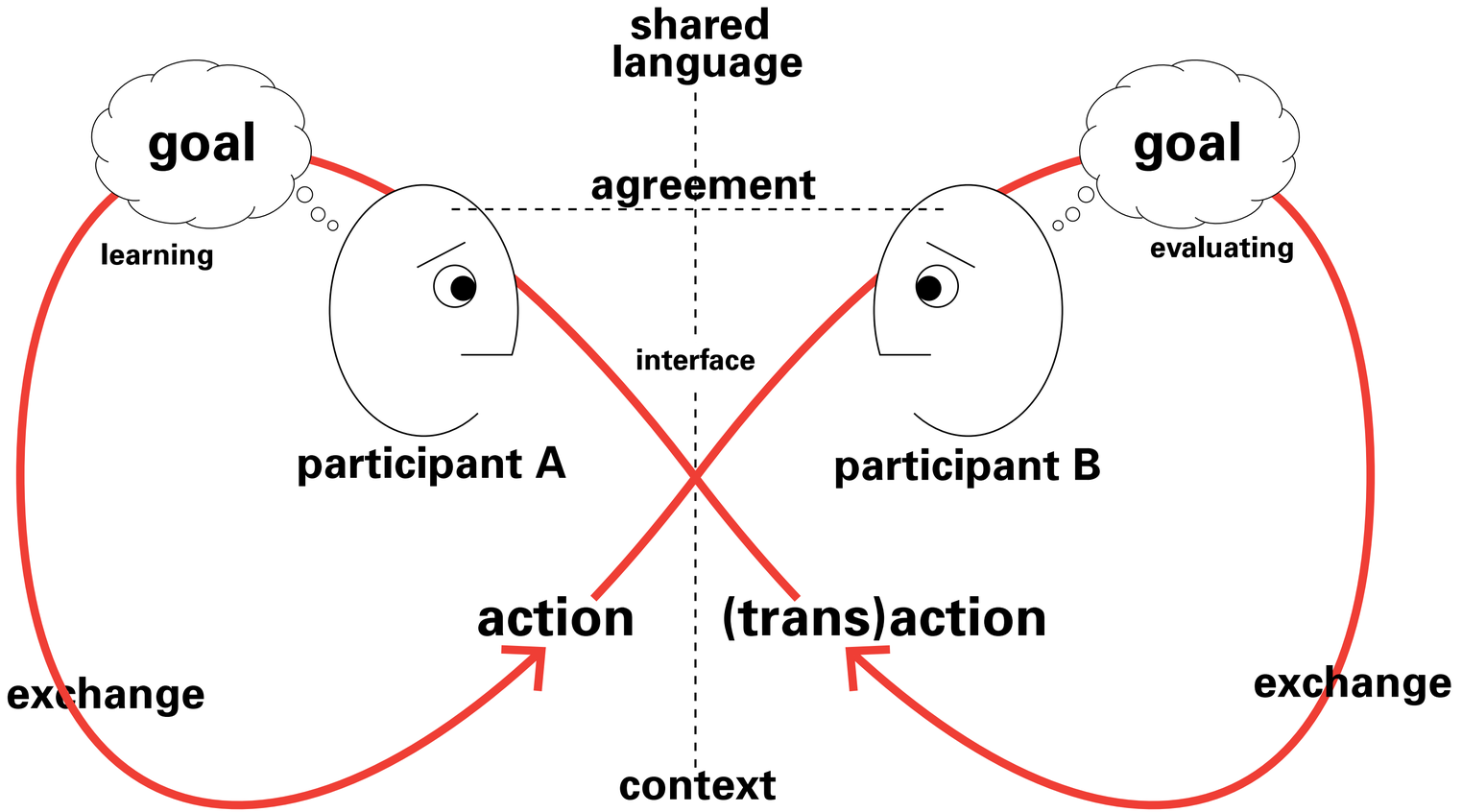
Conversation Model



See also Pangaro: Economy of Insight

Conversation Model— C-L-E-A-T

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



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