Something old, something new

CS 347

Maneesh Agrawala

Announcements

Quiz 5 on Wednesday

- Worth 20%
- Comprehensive
- Closed book
- 8-10 questions
- 60-90 minutes

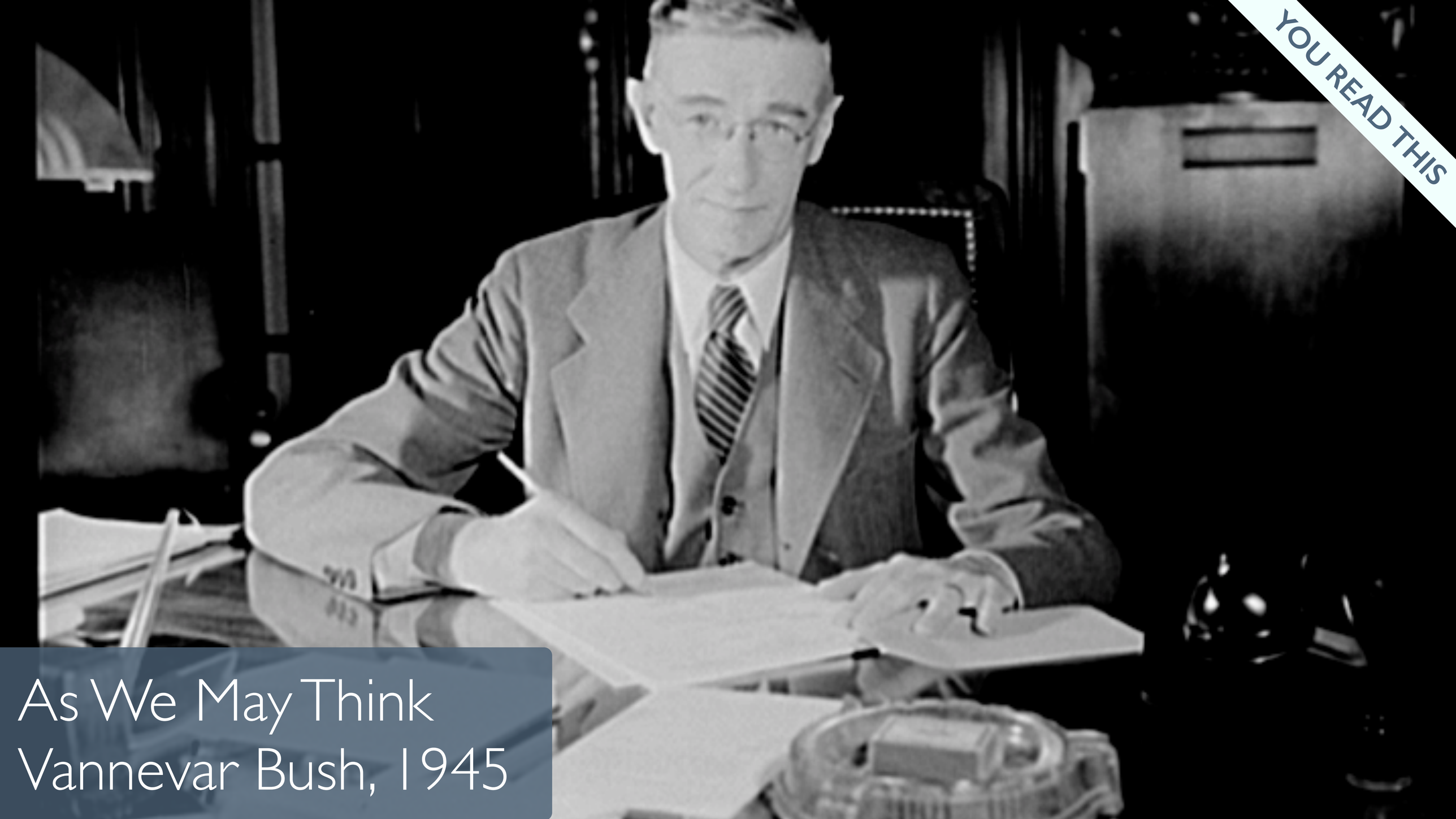
Something old

Let’s tie this all together.

Let's start with Vannevar Bush in 1945

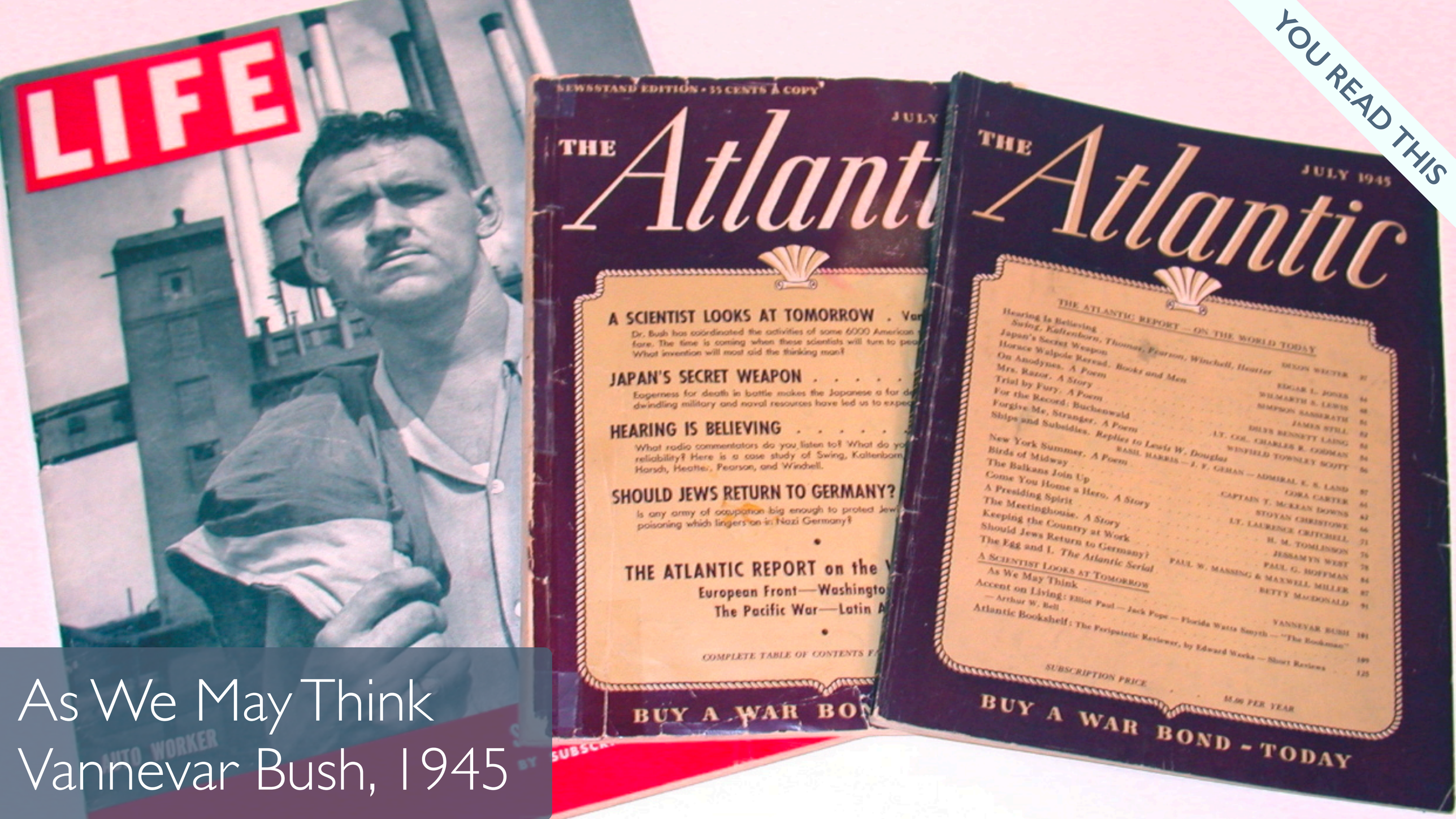
MIT Professor who established the social contract for science: government funds universities, universities do basic science, basic science benefits the national interest

Bush had been in charge of the scientific effort for WWII, and returning to peacetime, was left thinking about what role technology really should play in society.



YOU READ THIS

As We May Think
Vannevar Bush, 1945



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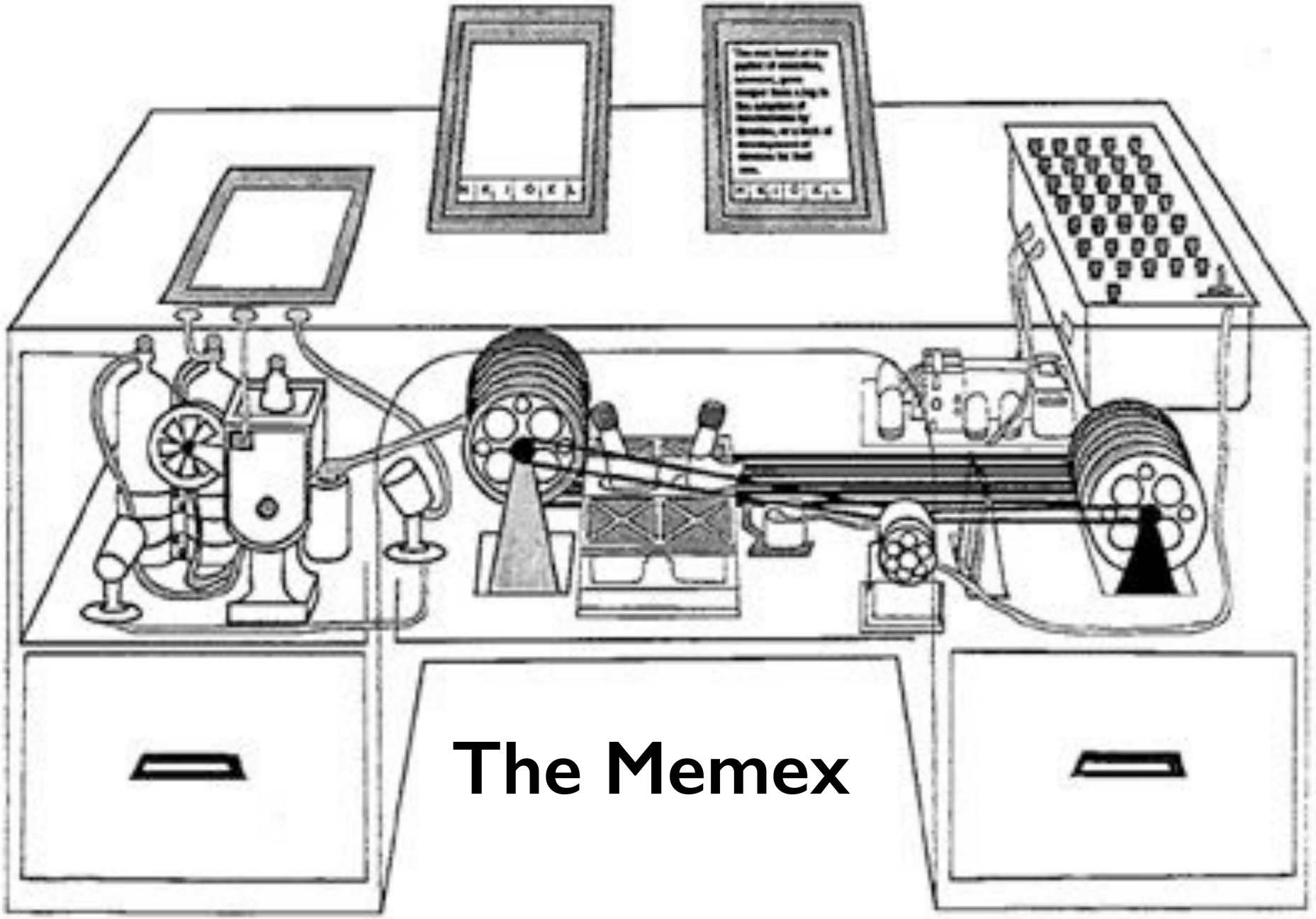
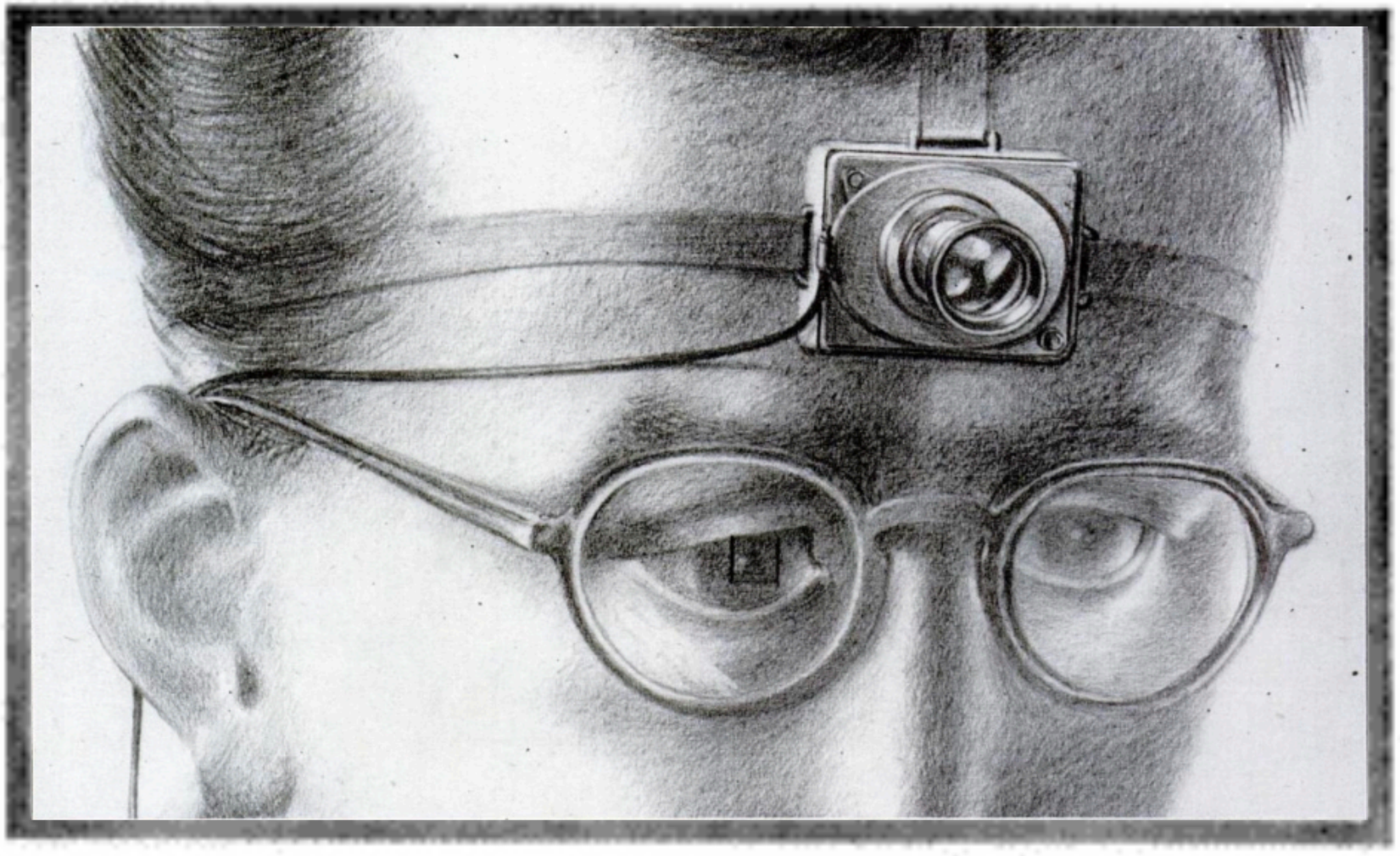


The Memex



A scientist of the future records experiments with a tiny camera fitted with universal-focus lens. The small square in the eyeglass at the left sights the object (*LIFE* 19(11), p. 112).

"There is a new profession of **trail blazers**, those who find delight in the task of establishing useful trails through the enormous mass of the common record. The **inheritance** from the master **becomes**, not only his **additions to the world's record**, but for his disciples the entire scaffolding by which they were erected."

“Wholly new forms of encyclopedias will appear, ready-made with a mesh of associative trails running through them.”

Memex inspires Ivan Sutherland

Bush: 1945
Sutherland: 1963

Sketchpad
Ivan Sutherland

Sword of Damocles
Ivan Sutherland

Bush and Sutherland inspire Doug Engelbart

Reads Bush's article right after starting as a Navy technician

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Introduction

Overall about Program
NLS as an "Instrument"
Control techniques
NLS Implementation
Usage
Activities
Credits

NLS: Mouse, Hypertext

CONTROL TECHNIQUES
CONTROL DEVICES
CONTROL DIALOGUE
CONTROL METALANGUAGE

NLS Demo

Doug Engelbart, 1968

AUGMENTING HUMAN INTELLECT: A CONCEPTUAL FRAMEWORK

Prepared for:

DIRECTOR OF INFORMATION SCIENCES
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH
WASHINGTON 25, D.C.

CONTRACT AF 49(638)-1024

By: *D. C. Engelbart*

STANFORD RESEARCH INSTITUTE

MENLO PARK, CALIFORNIA

Man-Computer Symbiosis*

J. C. R. LICKLIDER†

Summary—**Man-computer symbiosis is an expected development in cooperative interaction between men and electronic computers. It will involve very close coupling between the human and the electronic members of the partnership. The main aims are 1) to let computers facilitate formulative thinking as they now facilitate the solution of formulated problems, and 2) to enable men and computers to cooperate in making decisions and controlling complex situations without inflexible dependence on predetermined programs. In the anticipated symbiotic partnership, men will set the goals, formulate the hypotheses, determine the criteria, and perform the evaluations. Computing machines will do the routinizable work that must be done to prepare the way for insights and decisions in technical and scientific thinking. Preliminary analyses indicate that the symbiotic partnership will perform intellectual operations much more effectively than man alone can perform them. Prerequisites for the achievement of the effective, cooperative association include developments in computer time sharing, in memory components, in memory organization, in programming lan-**

will be coupled together very tightly, and that the resulting partnership will think as no human brain has ever thought and process data in a way not approached by the information-handling machines we know today.

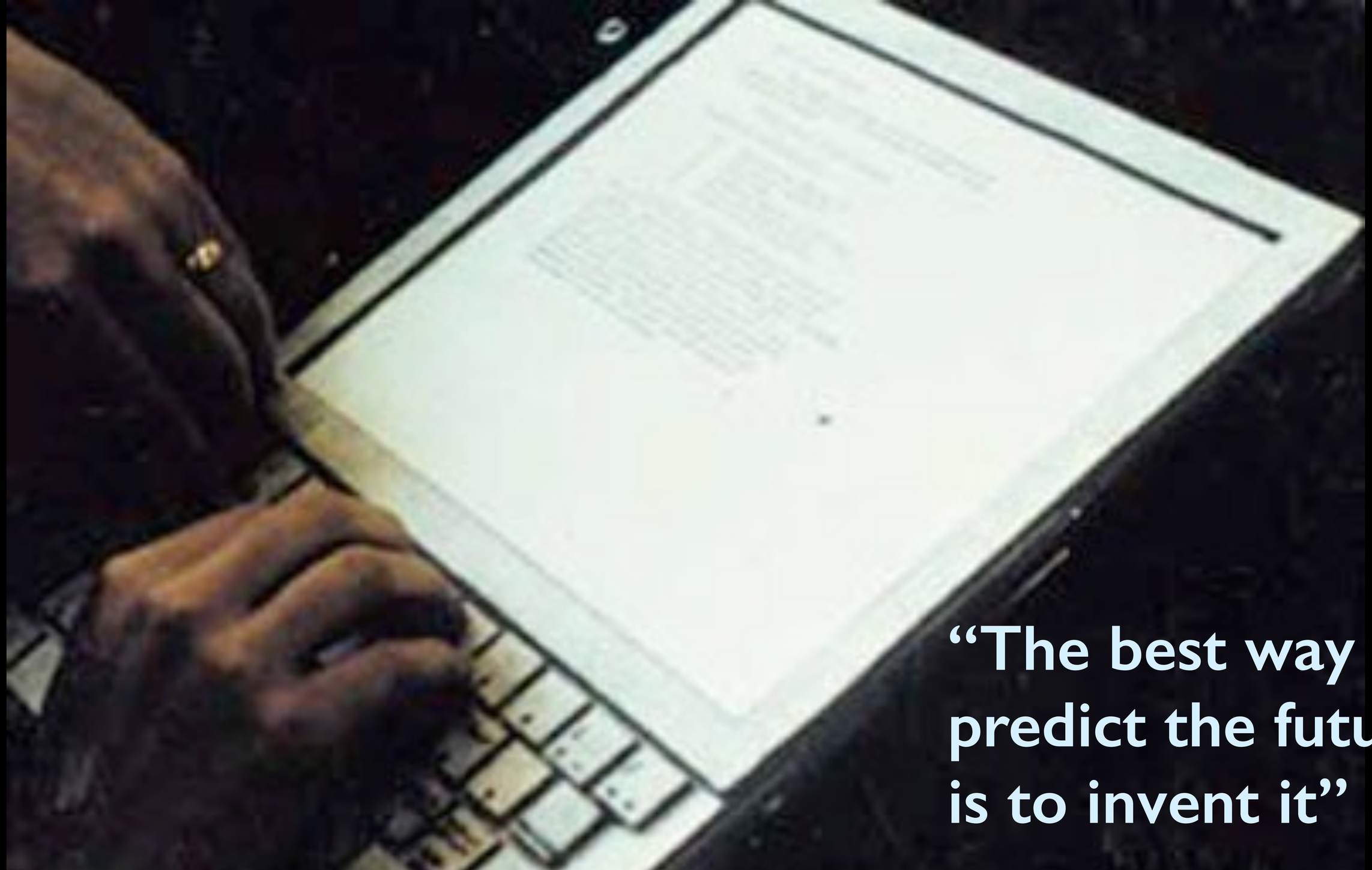
B. Between "Mechanically Extended Man" and "Artificial Intelligence"

As a concept, man-computer symbiosis is different in an important way from what North[2] has called "mechanically extended man." In the man-machine systems of the past, the human operator supplied the initiative, the direction, the integration, and the criterion. The mechanical parts of the systems were mere extensions, first of the human arm, then of the human eye. These systems certainly did not consist of "dissimilar organ-

Engelbart inspires Sutherland's PhD advisee Alan Kay

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Kay: 1972



“The best way to predict the future is to invent it”

Xerox Star draws on Engelbart's and Kay's ideas

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Kay: 1972
Xerox Star: 1981

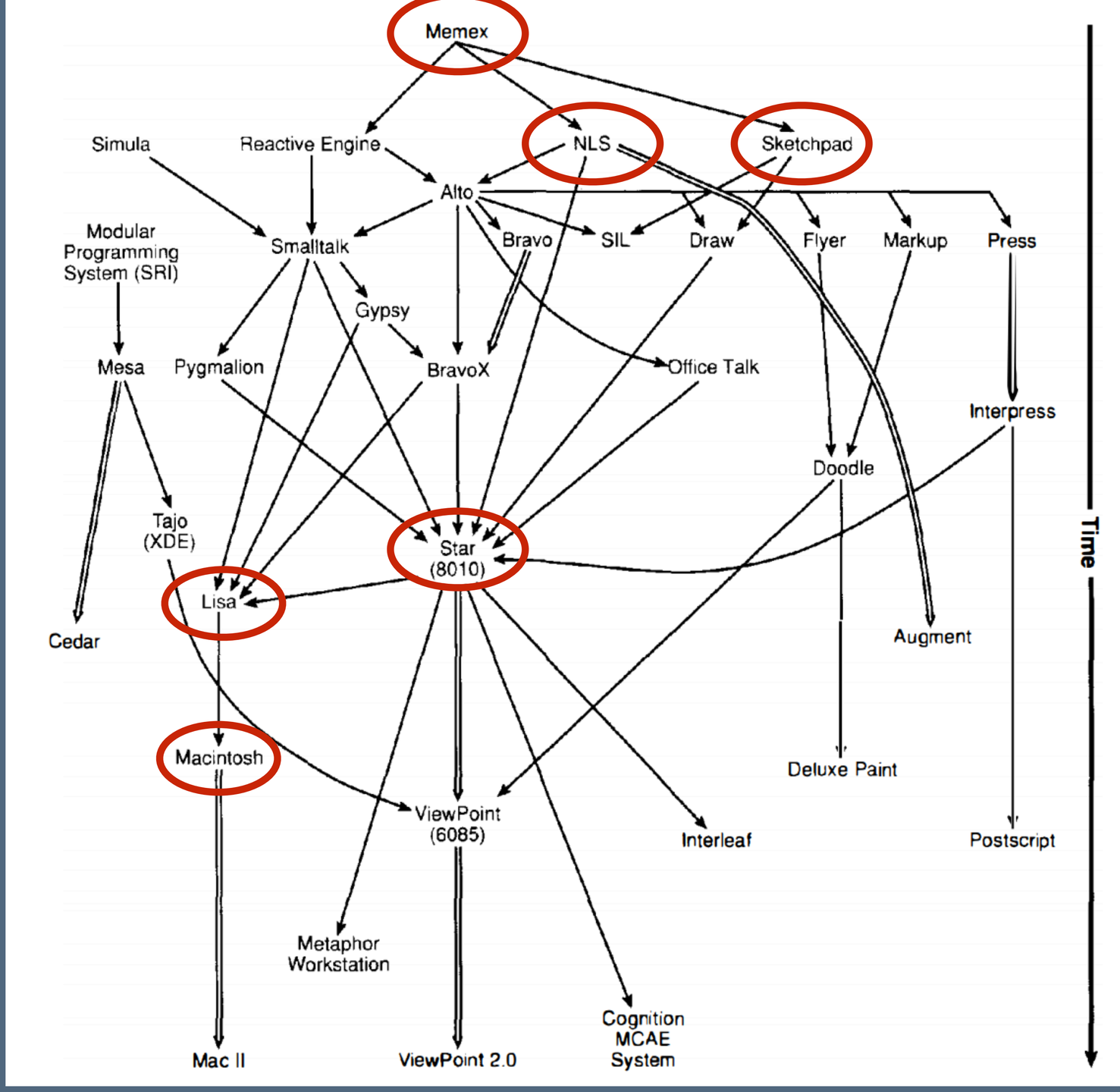
Xerox Star

Invented or popularized:

- Desktop metaphor
- Direct manipulation
- Bitmapped display
- Windows
- WYSIWYG
- Two-button mouse

Xerox Star

The Xerox Star's ancestors and descendants [Johnson et al. 1989]



Steve Jobs, 1990

Steve Jobs, 1995

Meanwhile, in Pittsburgh…

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Newell: 1971
Kay: 1972
Xerox Star: 1981

Xerox
Note 1
(Correction Copy)

Allen Newell
(retyped 11 Feb

Notes on a Proposal for a Psychological Research Unit

The purpose of these notes, of which this is the first, is to act a working vehicle to explore the notion of a psychological laboratory wi a computer science oriented industrial research laboratory. The specific context is the Xerox Research Laboratory in Palo Alto.

I consider these notes to be working documents -- not the record o prior analysis, but an integral part of an analysis in progress. Hence expressed in them may be exploratory ar ' stipulative, to be contradicted ideas expressed subsequently. They may also be somewhat discursive.

Basic proposition. The central idea that these notes are to explo contained in a set of somewhat independent propositions:

(1) There is emerging a psychology of cognitive behavior that wil permit calculation of behavior in new situations and with new humans (called information processing psychology currently).

(2) Several of the tasks that are central to the activities of computing -- programming, debugging, etc. -- are tasks that appear to be within the early scope of this emerging theory.

(3) Computer science in general is extremely one-sided (for under

Stu Card does his PhD with Allen Newell

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Newell: 1971
Kay: 1972
Xerox Star: 1981

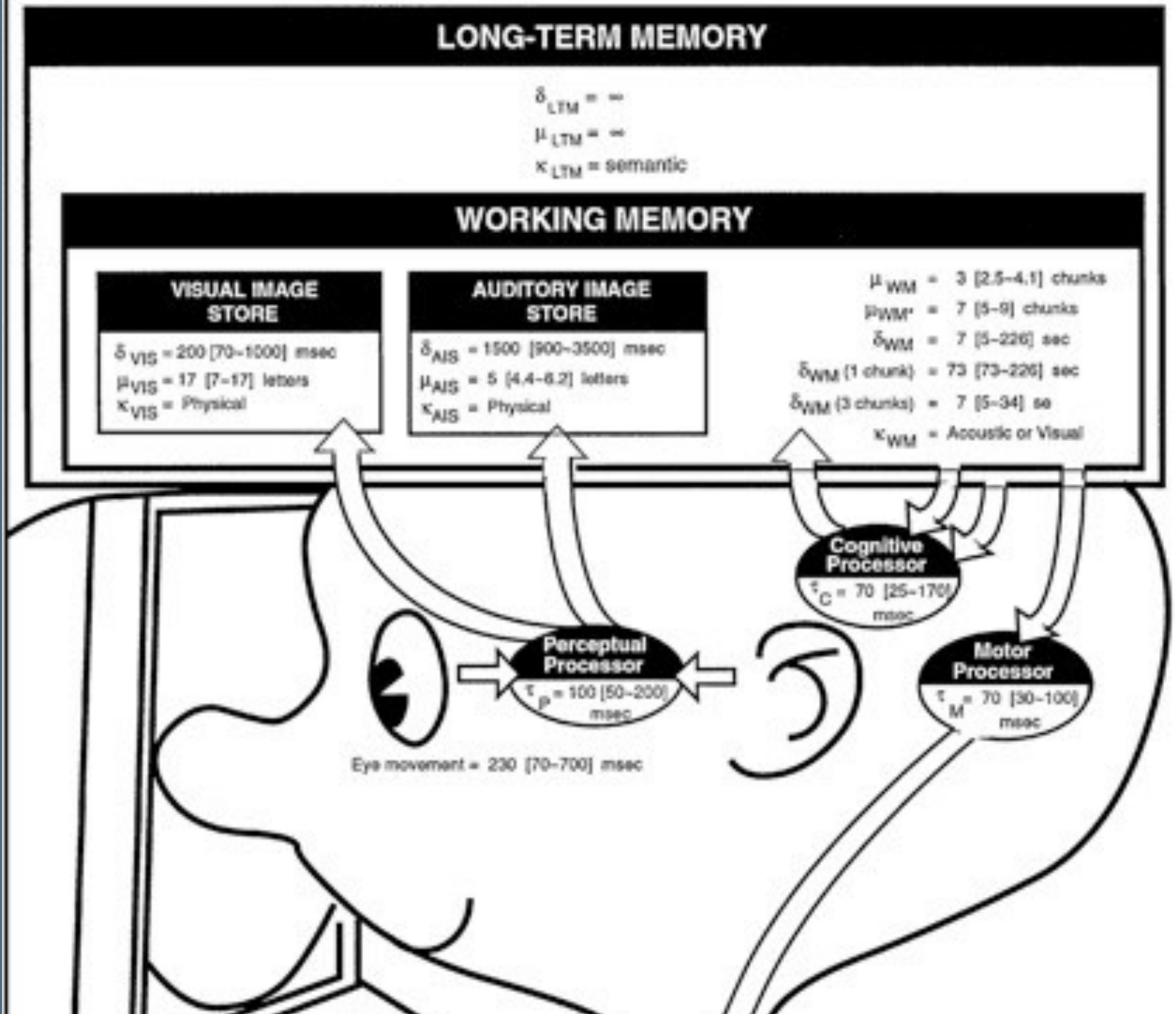
Psych. of HCI: 1983

GOMS

Book: The Psychology of Human-Computer Interaction

Popularized the term human-computer interaction

Engineering science of HCI



CHI becomes a conference

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Newell: 1971
Kay: 1972
Xerox Star: 1981

Psych. of HCI: 1983
First CHI: 1982/83

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Direct manipulation

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Newell: 1971
Kay: 1972
Xerox Star: 1981

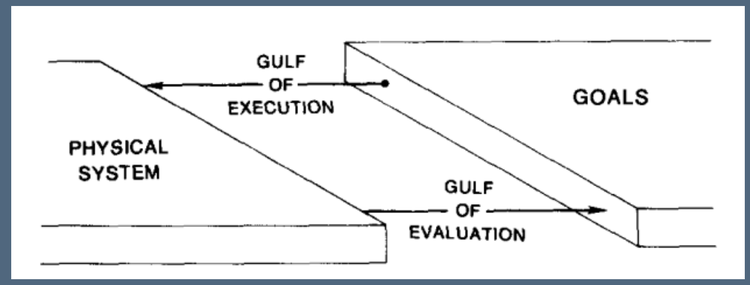
Psych. of HCI: 1983
First CHI: 1982/83
Direct manip.: 1985

Gulfs of execution and evaluation [Hutchins, Hollan, and Norman 1985]

Direct manipulation: act directly on visible objects via physical, reversible, incremental actions

Argument: direct manipulation is a good idea because it minimizes semantic gulfs that users must traverse

- Execution: how do I do this?
- Evaluation: what does this feedback mean?



Theoretical accounts of HCI arise

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Newell: 1971
Kay: 1972
Xerox Star: 1981

Psych. of HCI: 1983
First CHI: 1982/83
Direct manip.: 1985

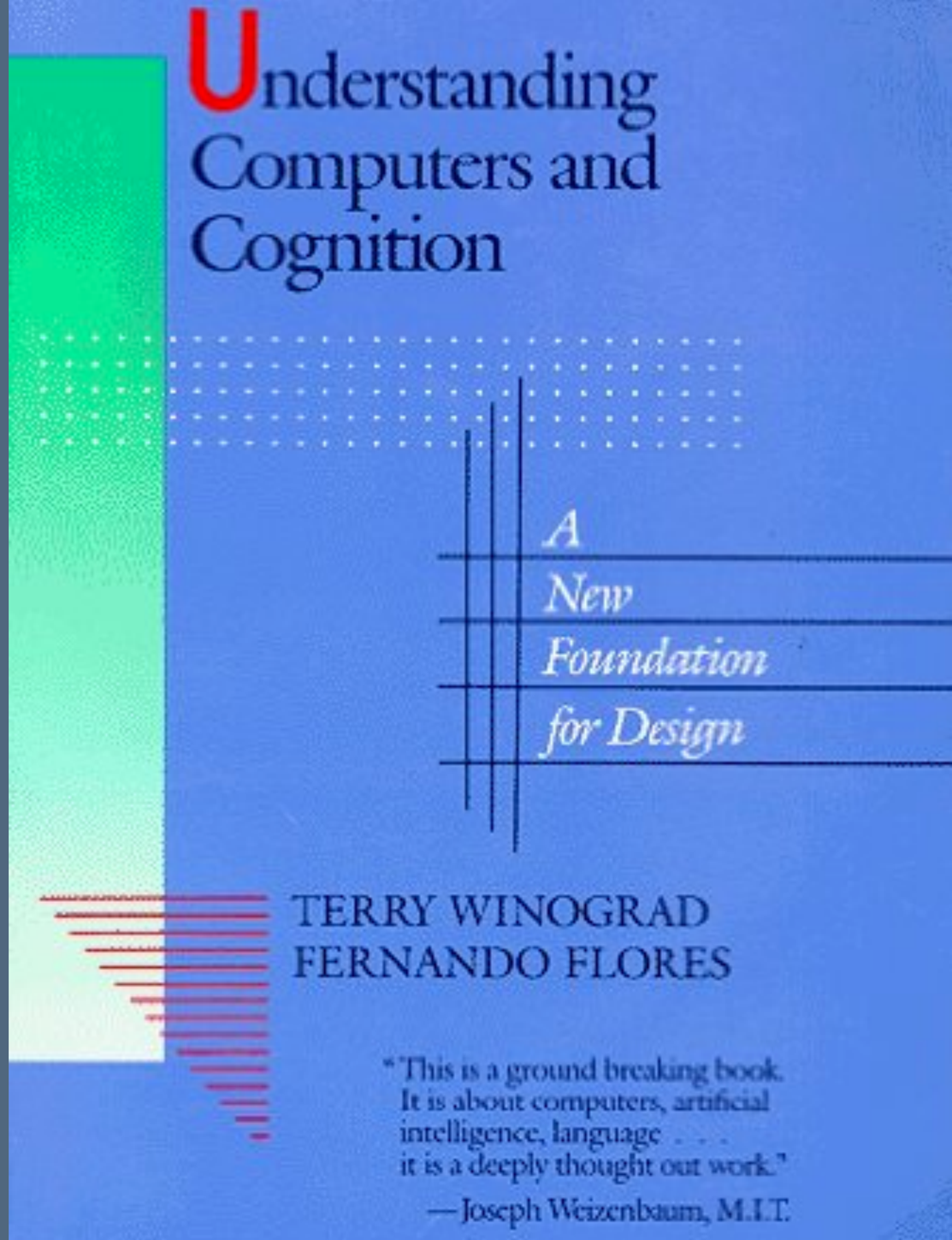
Winograd: 1986
Suchman: 1987

Breaks from AI

Terry Winograd, an NLP faculty member at Stanford, teams up with philosopher Fernando Flores

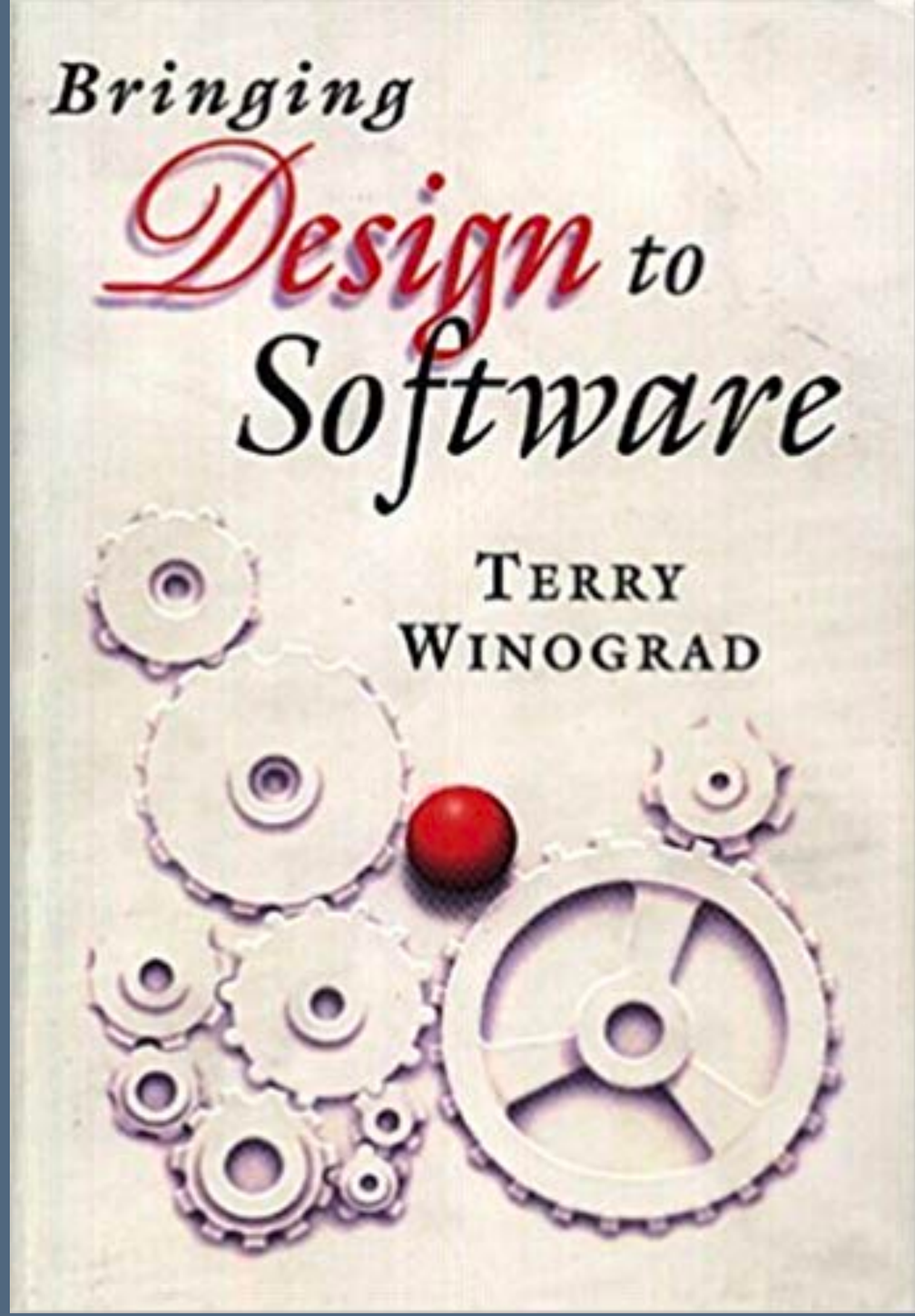
The result: a philosophical account drawing on phenomenology to argue that AI is not a path to success

> Being-in-the-world and thrownness: we are embedded in our activities and environments until we are pulled out of them by a breakdown



Breaks from AI

In 1991, Terry founds the Project on People, Computers, and Design, starting HCI at Stanford.

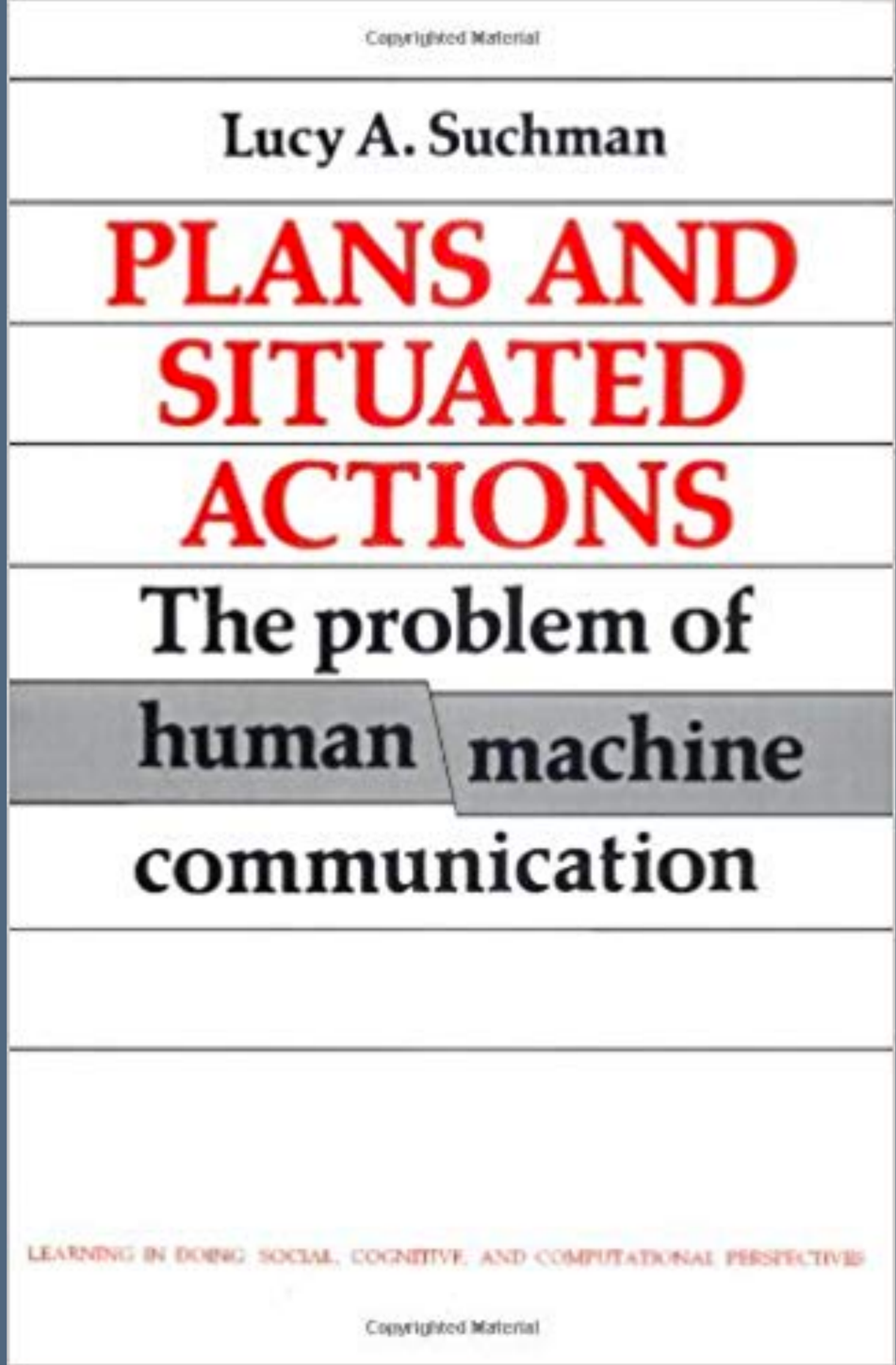


Breaks from AI

Lucy Suchman, an anthropologist at PARC, studies the technologies being developed [1988]

The result: an argument that AIs, which follow **plans**, cannot succeed in complex environments, which require **situated action**

> Anthropological comparison: how people perform wayfinding



The field starts looking familiar to 347 students…

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Newell: 1971
Kay: 1972
Xerox Star: 1981

Psych. of HCI: 1983
First CHI: 1982/83
Direct manip.: 1985

Winograd: 1986
Suchman: 1987

Design

Design of Everyday Things: 1988

Reflective Practitioner: 1983

Wizard of Oz: 1980

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Newell: 1971
Kay: 1972
Xerox Star: 1981

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Direct manip.: 1985

Winograd: 1986
Suchman: 1987

Ubicomp

First UIST: 1988

Computer for the 21st Century: 1991

Bush: 1945
Sutherland: 1963
Engelbart: 1968

Newell: 1971
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Xerox Star: 1981

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Winograd: 1986
Suchman: 1987

Social

First CSCW: 1986

Beyond Being There: 1992

Bush: 1945
Sutherland: 1963
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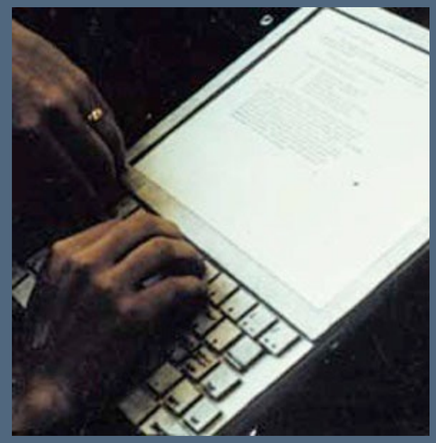
Inheritance of the Memex

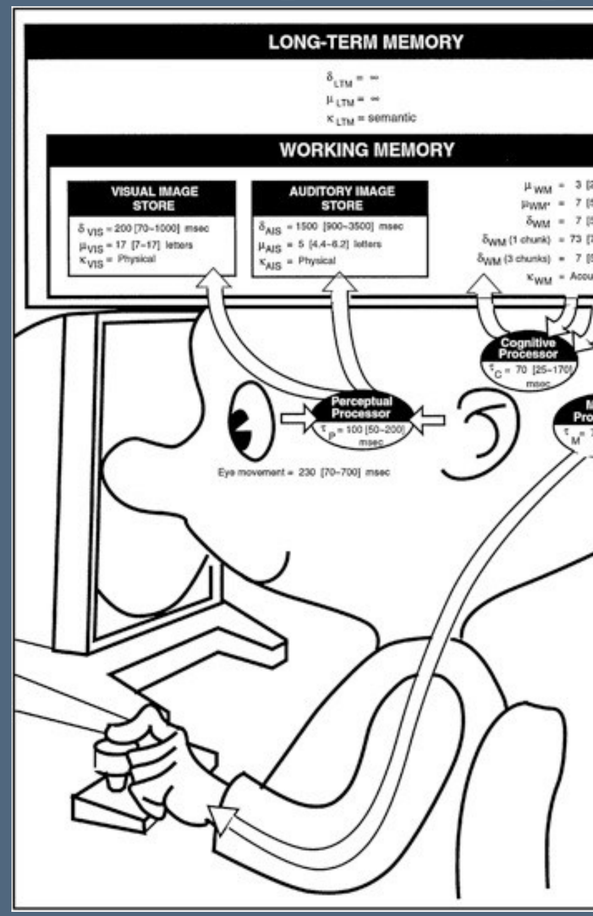
Sketchpad [Sutherland]

NLS [Engelbart]

Dynabook [Kay]



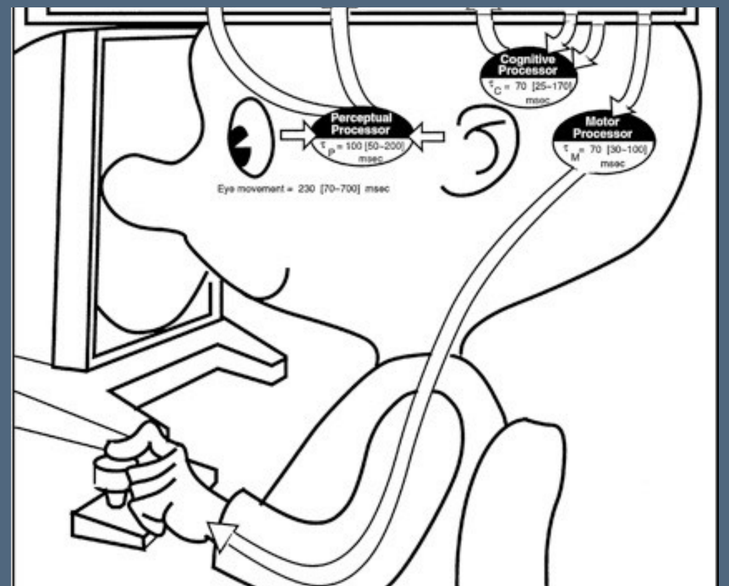
Model Human Processor [Card et al.]



And further… [Bødker 2006]

First wave HCI
80s-90s

Cognitive science
Human factors
Models, pointing

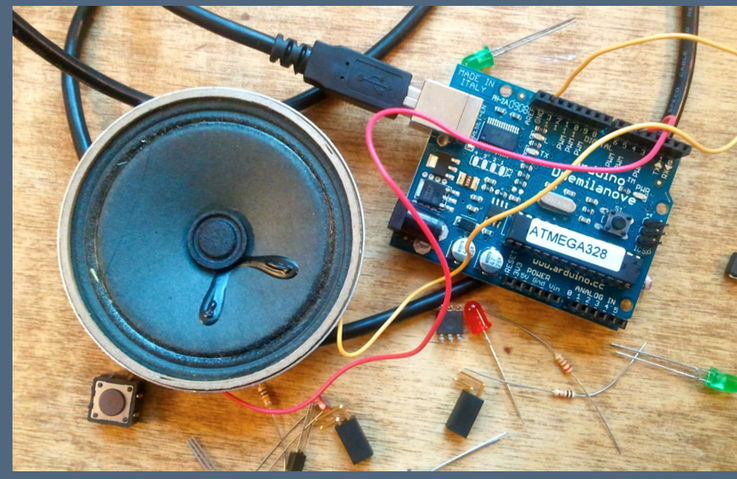


Second wave HCI
90s–00s

Focus on work
Groups of people using
a collection of applications
Ubicomp, CSCW

Third wave HCI
00s-10s

Multiplicity: of use contexts
and application types
Makers, crowds, religion,
assistive, ICT4D, …



And further… [Bødker 2006]

Second wave HCI
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Ubicomp, CSCW

Third wave HCI
00s-10s

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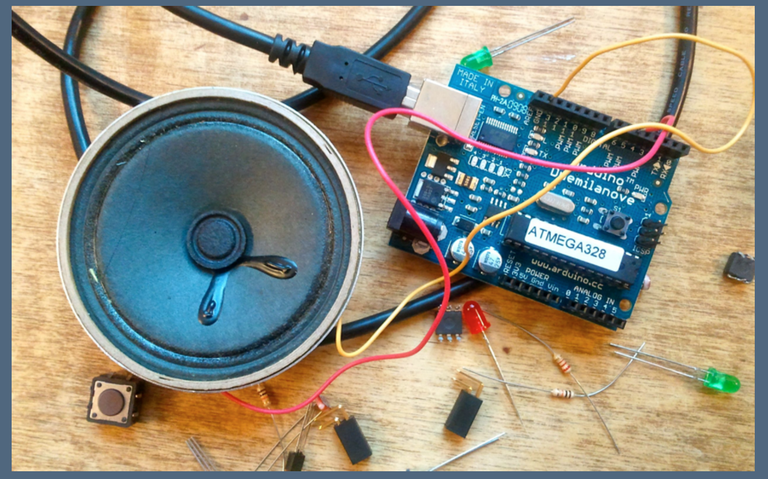


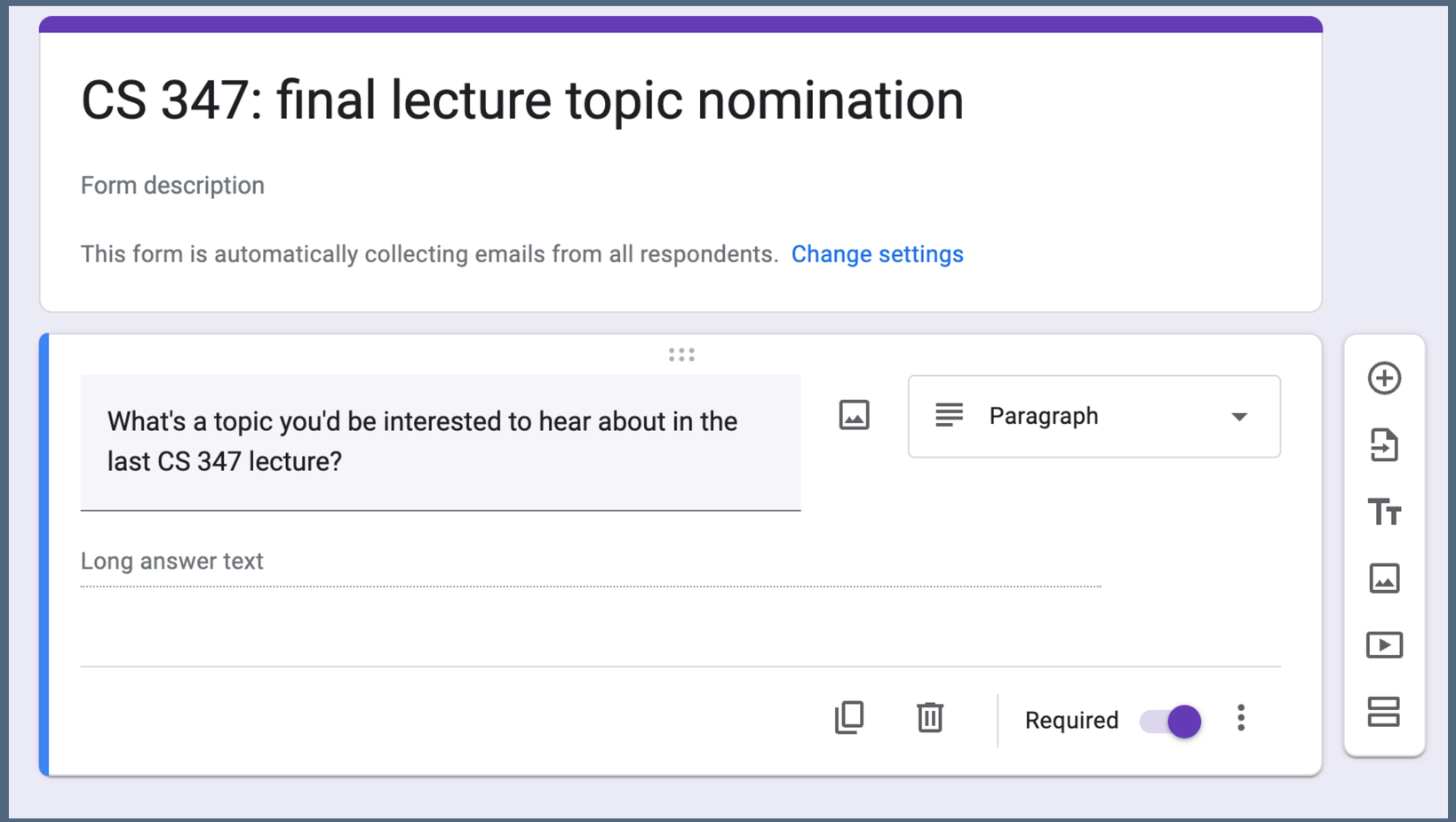
Fourth wave HCI
?

My hope: A return to cognitive/social theory with connections to design (e.g. identifying design principles)

Also interaction in society — normative positions on pro- and anti-social interaction contexts that we ought to empower

Something new

I asked you what you wanted me to discuss. Here are some of the topics…


CS 347: final lecture topic nomination
Form description
This form is automatically collecting emails from all respondents. Change settings
What's a topic you'd be interested to hear about in the last CS 347 lecture?
Paragraph
Long answer text
Required

Ethics in HCI

Ethics

Why no clear code of conduct/ethics in HCI?

Research on ethical uses of technology coalesces around the specific computing technologies:

Deepfakes
Misinformation/Disinformation
Social Media
Crowd/Gig work
…

Ethical issues often context specific. Need to be considered and handled on a case-by-case basis.

Jennifer Doudna - Nobel Prize 2020 for co-developing CRISPR.

Haptics and Brain-Computer Interfaces

Mouth Haptics in VR using a Headset Ultrasound Phased Array

Vivian Shen Craig Shultz Chris Harrison

FUTURE
INTERFACES
GROUP

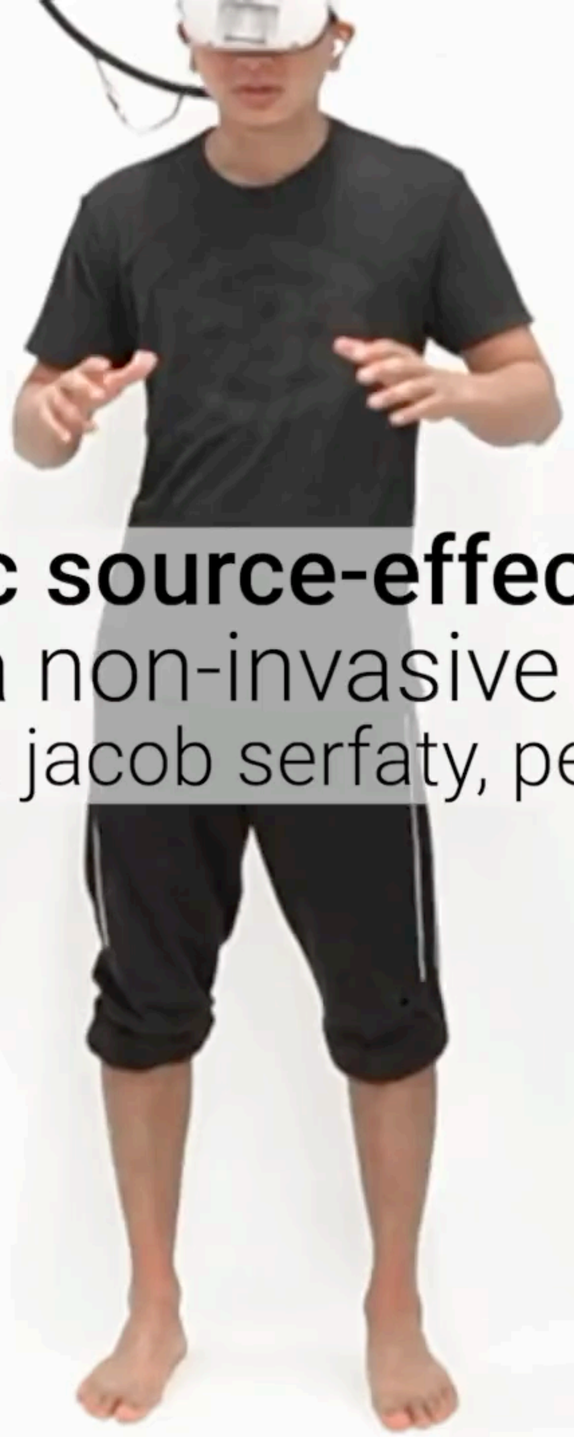
Carnegie
Mellon
University

SplitBody

reducing mental workload while physical multitasking

romain nith, yun ho, pedro lopes

THE UNIVERSITY OF CHICAGO



haptic source-effector

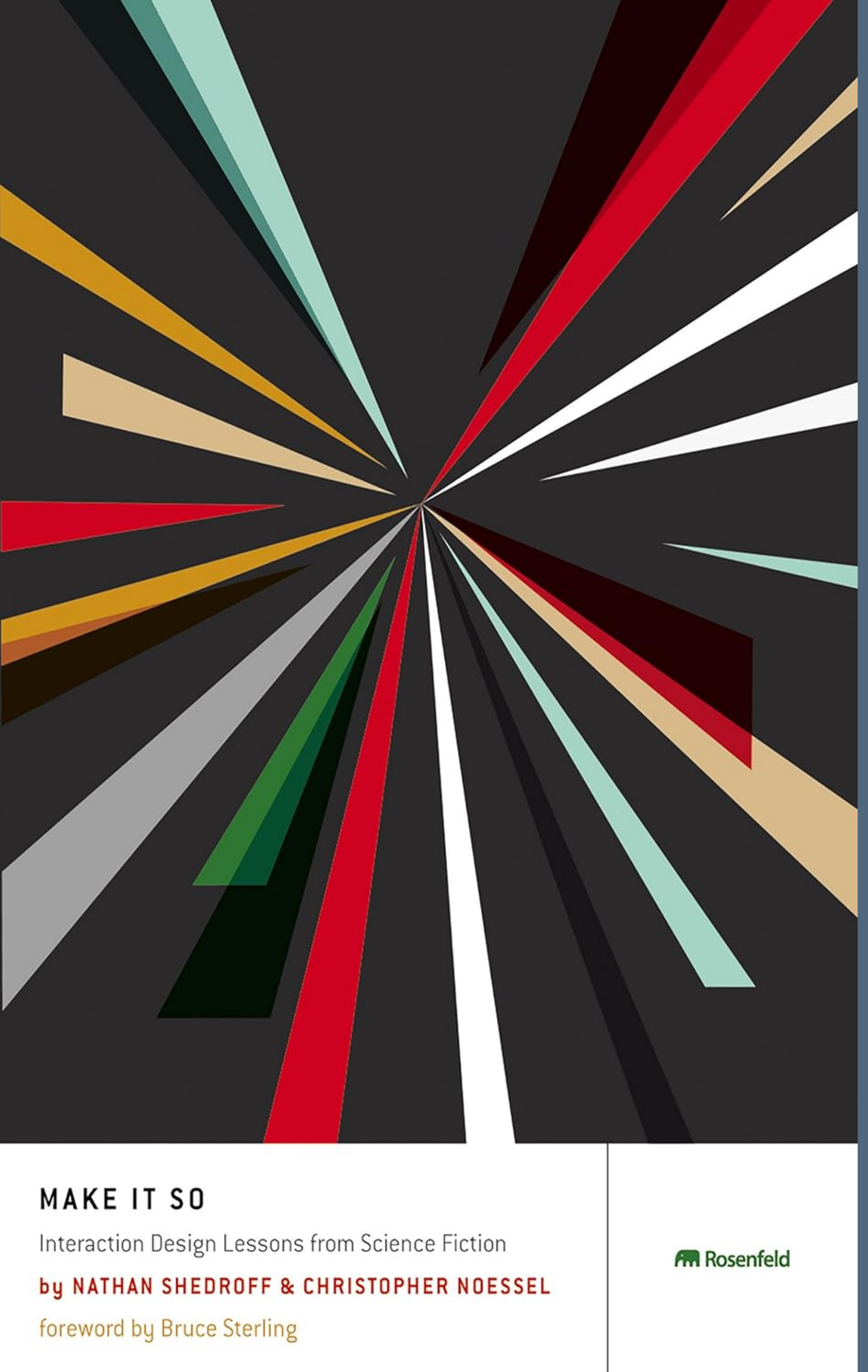
full-body haptics via non-invasive brain stimulation

yudai tanaka, jacob serfaty, pedro lopes

(VR visuals captured real-time
and added in post-production)

THE UNIVERSITY OF CHICAGO

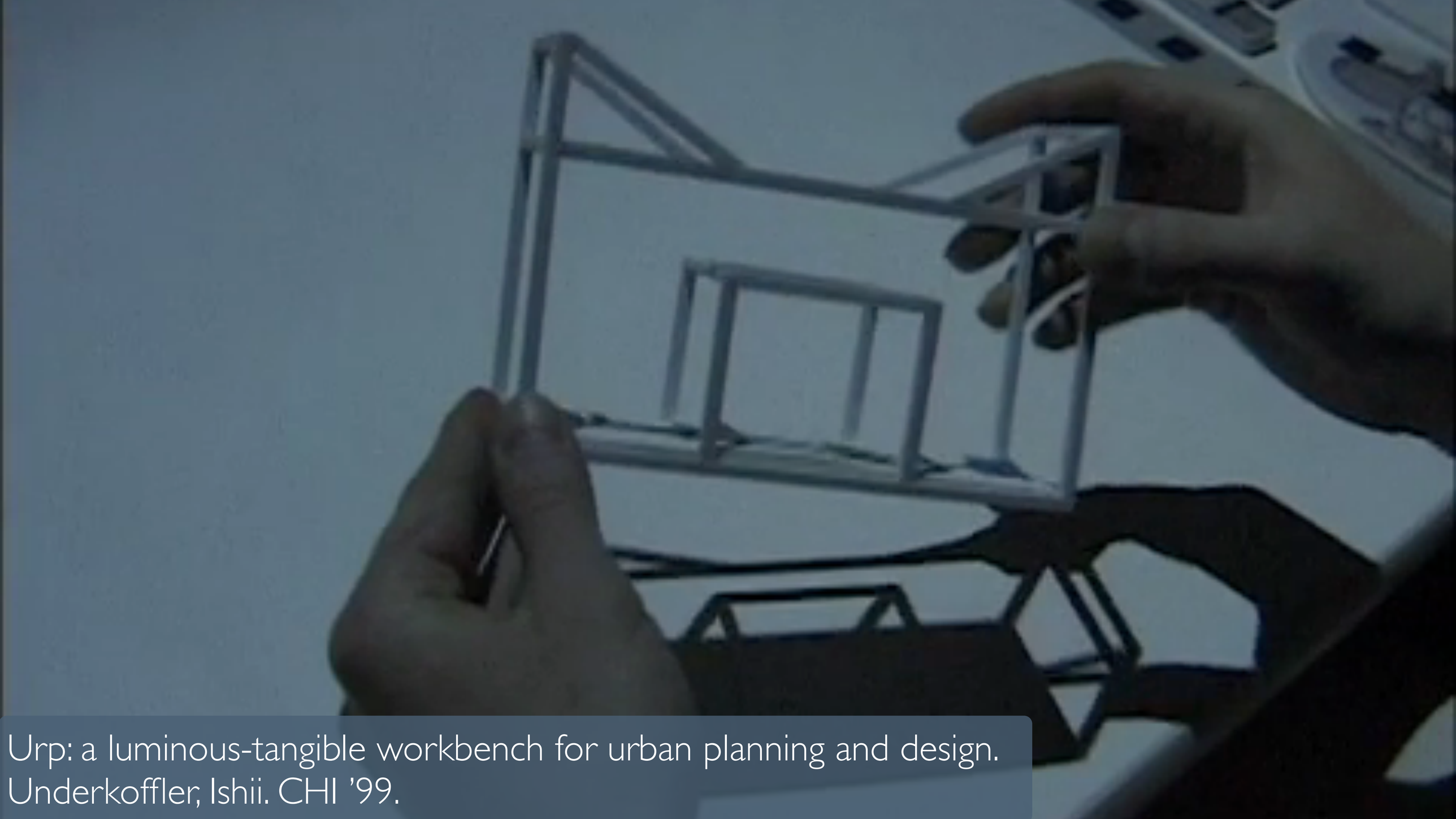
HCI in movies/popular media



Design and science fiction do much the same thing. Sci-fi uses characters in stories to describe a possible future. Similarly, the design process uses personas in scenarios to describe a possible interface. They're both fiction. Interfaces only become fact when a product ships.

The **main differences** between the two come from the fact that **design mainly proposes what it thinks is best, and sci-fi is mostly meant to entertain**. But because sci-fi can envision technology farther out, largely freed from real-world constraints, **design can look to it for inspiration and ideas** about what can be done today.

Minority Report 2002



Urp: a luminous-tangible workbench for urban planning and design.
Underkoffler, Ishii. CHI ’99.

Urp: a luminous-tangible workbench for urban planning and design.
Underkoffler, Ishii. CHI ’99.

overview: g-speak

oblong industries

G-Speak. Underkloffer's UI Company ca. 2008

Her. 2013

Closing

This class

Envisioning and understanding
the future of interaction
between people, society, and technology

This class

Teaches foundational theories
and modern frontiers

This is not like other HCI classes.

Your goal is not just to fashion an alignment between people and technology.

Your goal is to articulate, critique, and generate entirely new ideas about that relationship.

Foundations and frontiers

You will learn the major theories and concepts that underpin HCI

You will engage in critical analyses of these theories and concepts

Big ideas in HCI

Ubiquitous computing

Tangible computing

Ubicomp sensing pipeline

Commodity vs. infrastructure-mediated sensing

Design fixation

Demand characteristics

Gulfs of execution and evaluation

Analogical transfer

Wicked problems

Participatory design

Design patterns

Reflective practitioner

Beyond being there

Grudin's paradox

Distance matters

Socio-technical gap

Crowdsourcing / coordination at scale

The Johansen Matrix

Feminist HCI

AI vs. IA

Direction Manipulation vs. Agents

Mixed Initiative Interaction

End-user programming

Threshold and ceiling

Programming as problem representation

Design principles for visual communication

Encodings, marks, and visual variables

Graphical perception of information

Cognitive models

Embodied cognition

HCI methodological plurality

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