Lecture 2:
1962 Report &
1968 Demo

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This seminar begins with a riddle...

The inventor who marked the computer age

ended his life feeling that only a small part ("3.6%") of his vision and ideas had been understood and implemented in practice

What's the remaining

96.4%

Program for the Future Challenge
Launched Dec. 9, 2013 at Googleplex

The PFTF Challenge extends three challenges called A, B and C

This seminar will explore

- Doug's core ideas and

- their contemporary extensions in order to

- create a perspective on the future of informatics

- and its potential to positively impact society

We will

- study Doug's not yet implemented ideas

- join an international project to complete them

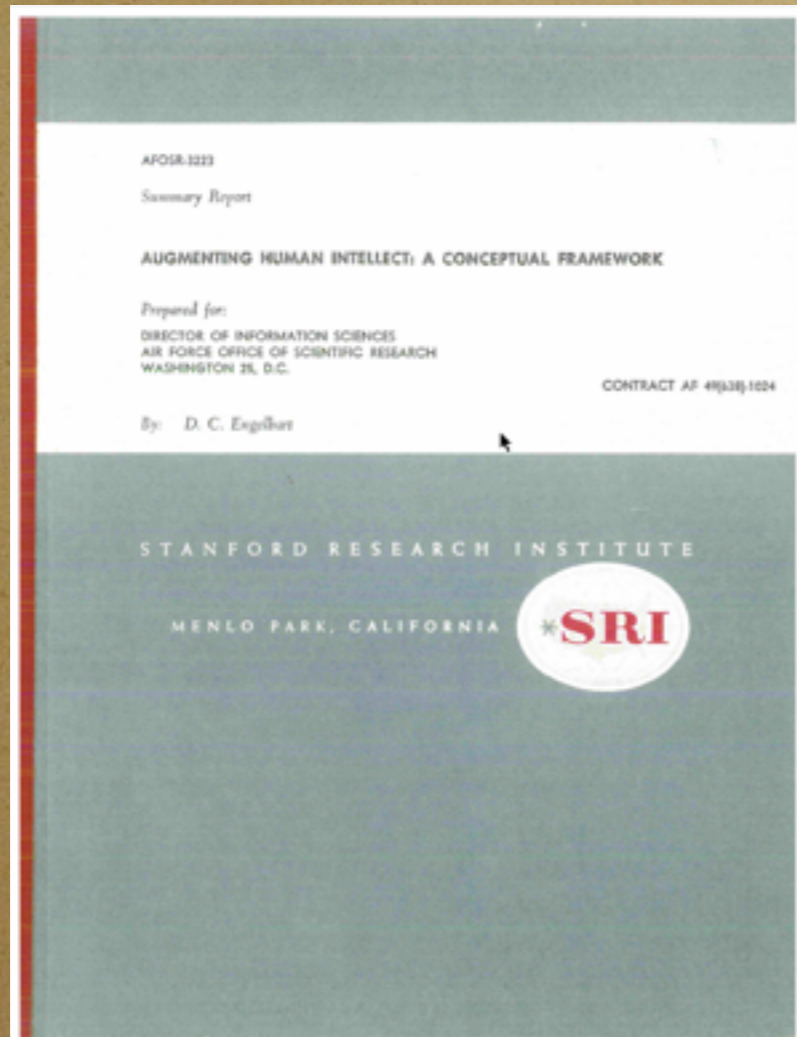- begin to develop projects of our own

We begin with

- historical introduction

- the 1968 demo

- Doug's main insight

- Doug's core technical ideas

and continue with

- contemporary developments

- project work

1962 Report

1968 Demo

Augmenting Human Intellect: A Conceptual Framework

Abstract

This is an initial summary report of project taking new and systematic approach to improving the intellectual effectiveness of the individual human being detailed conceptual framework explores the nature of the system composed of the individual and the tools concepts and methods that match his basic capabilities to his problems. One of the tools that shows the greatest immediate promise is the computer when it can be harnessed for direct online assistance integrated with new concepts and methods.

Augmentation

By "augmenting human intellect" we mean increasing the capability of a man to approach a complex problem situation, to gain comprehension to suit his particular needs, and to derive solutions to problems. Increased capability in this respect is taken to mean a mixture of the following: more-rapid comprehension, better comprehension, the possibility of gaining a useful degree of comprehension in a situation that previously was too complex, speedier solutions, better solutions, and the possibility of finding solutions to problems that before seemed insoluble. And by "complex situations" we include the professional problems of diplomats, executives, social scientists, life scientists, physical scientists, attorneys, designers--whether the problem situation exists for twenty minutes or twenty years. We do not speak of isolated clever tricks that help in particular situations. We refer to a way of life in an integrated domain where hunches, cut-and-try, intangibles, and the human "feel for a situation" usefully co-exist with powerful concepts, streamlined terminology and notation, sophisticated methods, and high-powered electronic aids.

Man's population and gross product are increasing at a considerable rate, but the complexity of his problems grows still faster, and the urgency with which solutions must be found becomes steadily greater in response to the increased rate of activity and the increasingly global nature of that activity. Augmenting man's intellect, in the sense defined above, would warrant full pursuit by an enlightened society if there could be shown a reasonable approach and some plausible benefits.

Motivation

Any possibility for improving the effective utilization of the intellectual power of society's problem solvers warrants the most serious consideration. This is because man's problem-solving capability represents possibly the most important resource possessed by a society. The other contenders for first importance are all critically dependent for their development and use upon this resource. Any possibility for evolving an art or science that can couple directly and significantly to the continued development of that resource should warrant doubly serious consideration.

Contents

Part I: INTRODUCTION

Hypothesis

The intellectual effectiveness of a human can be significantly improved by an engineering-like approach toward redesigning changeable components of a system.

Illustration

Augmentation is fundamentally a matter of organization.
   (typewriter, 7 seconds)

Augmentation is fundamentally a matter of organization. (cursive script, 20 seconds).

Augmentation is fundamentally a matter of organization. ("de-augmented" cursive script, 65 seconds).

Augmentation is fundamentally a matter of

[de-augmented cursive script, large size—42 seconds to complete whole passage (completed on separate sheet)].

Part II: CONCEPTUAL FRAMEWORK

*The conceptual framework we seek must orient us toward the real possibilities and problems associated with using modern technology to give direct aid to an individual in comprehending complex situations, isolating the significant factors, and solving problems. To gain this orientation, we examine how individuals achieve their present level of effectiveness, and expect that this examination will reveal possibilities for improvement.*

Principal elements of an augmentation system

- **Artifacts**--physical objects designed to provide for human comfort, for the manipulation of things or materials, and for the manipulation of symbols.

- **Language**--the way in which the individual parcels out the picture of his world into the concepts that his mind uses to model that world, and the symbols that he attaches to those concepts and uses in consciously manipulating the concepts ("thinking").

- **Methodology**--the methods, procedures, strategies, etc., with which an individual organizes his goal-centered (problem-solving) activity.

- **Training**--the conditioning needed by the human being to bring his skills in using Means 1, 2, and 3 to the point where they are operationally effective

Two-domain system

The human and the artifacts are the only physical components in the H-LAM/T system. It is upon their capabilities that the ultimate capability of the system will depend.
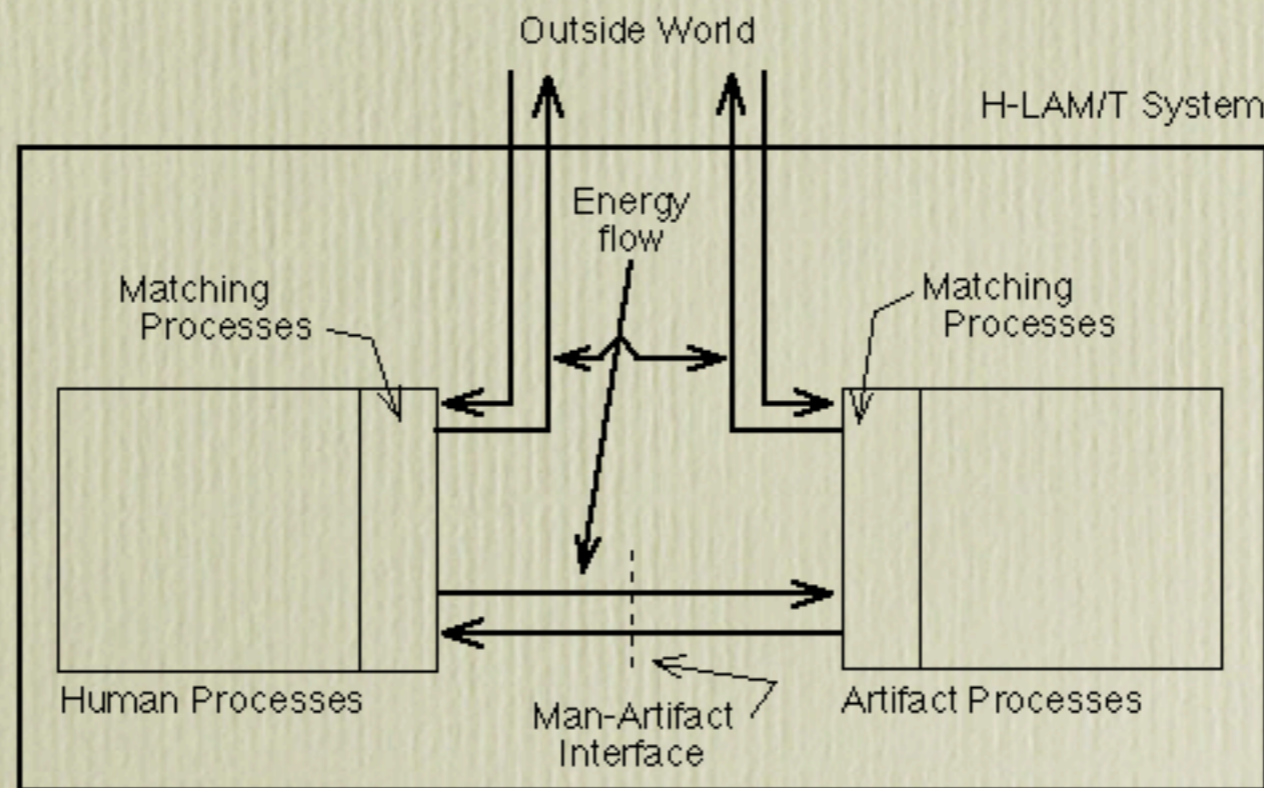
Hierarchy of process capabilities

When a man writes prose text (a reasonably high-order process), he makes use of many processes as sub-processes that are common to other high-order processes. For example, he makes use of planning, composing, dictating. The process of writing is utilized as a sub-process within many different processes of a still higher order, such as organizing a committee, changing a policy, and so on.

What happens, then, is that each individual develops a certain repertoire of process capabilities from which he selects and adapts those that will compose the processes that he executes. This repertoire is like a tool kit, and just as the mechanic must know what his tools can do and how to use them, so the intellectual worker must know the capabilities of his tools and have good methods, strategies, and rules of thumb for making use of them. All of the process capabilities in the individual's repertoire rest ultimately upon basic capabilities within him or his artifacts, and the entire repertoire represents an inter-knit, hierarchical structure (which we often call the repertoire hierarchy).

Automation of symbol manipulation is the 'leverage point'

- The elements are dynamically interdependent within an operating system.

- The structure of the system seems to be hierarchical, and to be best considered as a **hierarchy of process capabilities** whose primitive components are the basic human capabilities and the functional capabilities of the artifacts--which are organized successively into ever-more-sophisticated capabilities.

- The capabilities of prime interest are those associated with manipulating symbols and concepts in support of organizing and executing processes from which are ultimately derived human comprehension and problem solutions.

- The automation of the symbol manipulation associated with the minute-by-minute mental processes seems to offer a logical next step in the evolution of our intellectual capability.

Part III: EXAMPLES AND DISCUSSION

A: Background

1. What Vannevar Bush Proposed In 1945

He wrote as World War II was coming to an end, and his principal purpose seemed to be to offer new professional objectives to those scientists who were soon to be freed from war-motivated research and development. It would seem that he also wished to induce a general recognition of a growing problem-- storage, retrieval, and manipulation of information for and by intellectual workers--and to show the possibilities he foresaw for scientific development of equipment which could significantly aid such workers in facing this problem. He summarized the situation: "...There is a growing mountain of research...The investigator is staggered by the findings and conclusions of thousands of other workers. Professionally our methods of transmitting and reviewing the results of research are generations old...truly significant attainments become lost in the mass of the inconsequential...The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square-rigged ships."

B: Hypothetical Example

A good deal of Joe's time, though, seems to be spent with one hand on a keyset and the other using a light pen on the display surface. It is in this type of working mode that the images on the display frames changed most dynamically. You receive another real surprise as you realize how much activity there is on the face of these display tubes. You ask yourself why you weren't prepared for this, and you are forced to admit that the generalizations you had heard hadn't really sunk in--"new methods for manipulating symbols" had been an oft-repeated term, but it just hadn't included for you the images of the free and rapid way in which Joe could make changes in the display, and of meaningful and flexible "shaping" of ideas and work status which could take place so rapidly.

Guided tour through a hierarchy of augmented process capabilities

- Single-Frame Composition

- Single-Frame Manipulation

- Structuring An Argument

- General Symbol Structuring

- Process Structuring

- Team Cooperation

- Miscellaneous Advanced Concepts

Part IV: RESEARCH RECOMMENDATIONS

Objectives for a Research Program

- Test the Hypothesis

- Develop tools and techniques for designing better augmentation systems

- Produce real-world augmentation system that brings maximum gains over the coming years to the solvers of tough, critical problems

Whom to augment first

The experimental work of deriving, testing, and integrating innovations into a growing system of augmentation means must have a specific type of human task to try to develop more effectiveness for, to give unifying focus to the research. We recommend the particular task of computer programming for this purpose...