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Presentation Outline:

- I. Introduction to session
 - a. Brief introduction of presenters
 - b. Overview of contents
 - c. Distribution of materials

- II. Articulating the Engelbart Hypothesis
 - a. The historical context
 - b. The 1962 paper – Augmenting Human Intellect
 - c. The 1992 paper – The Open Hyperdocument System
 - d. The 21st century's unfinished revolution – NIC's and DKR's

- III. The Curriculum Infusion Project
 - a. Setting the stage – CAP at OSU
 - b. Creating the context - Nov 2003 'meeting of the minds'
 - c. Setting up the experience – readings, curriculum, technology
 - d. Deploying the plan – a review of the Spring course experiences
 - i. Polycom and the virtual classroom
 - ii. LIVE Journal, OPEN COURSE and the Pod Essays
 - iii. Media class projects

- IV. The Next Steps
 - a. Evaluating the experiment and the Engelbart hypothesis
 - b. Setting up lab based beta testing of the hyperscope
 - c. The establishment of EDNIC's
 - d. The continuing search for DKR's
 - e. Continuation of academic exploration of the hypothesis*

*Preliminary philosophical analysis attached below

Exploring the Engelbart Hypothesis
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Introduction

My journey to the exploration of the Engelbart hypothesis began many years ago with metaphysical questions I encountered as a young philosophy student. A Kantian scholar as an undergraduate, I had a fascination with that 19th century German idealist's notions of the concepts of space and time. For him, these were the two preconditions necessary for the human acquisition of experience and knowledge. Working feverishly in his Critique of Pure Reason to explicate the human knowing process, Kant had simultaneously constructed a metaphysic in which time and space became delineated and defined. Their contents were revealed to be at once fluid and dynamic - as attachable boundaries to transient experiences - while at the same time, static and permanent - as eternal attributes of cosmological reality. Whatever else there might be to the absolute nature of both was unknowable, or noumenal as Kant would call it, but one thing was clear. The a priori concepts of space and time, like the mind, were active participants in the acquisition and manipulation of knowledge. Human knowing was impacted by them and impossible without them.

With the advent of computer technologies which could make both time and space more malleable and flexible than ever before, I had to imagine that the Kantian conditions under which the knowledge processes occurred would have to be likewise subjected to altered states – or at least become different kinds of conditions - the likes of which Kant could have never imagined. At this point, the metaphysical questions with which I had been preoccupied became epistemological ones. If the conditions under which knowledge occurred were to be changed, what would happen to the products of the process? How might the acquisition of experience and ideas be impacted by a radical shift in the preconditions necessary for each? How might the increased computational and communication capabilities afforded to humans by computers come to change the very nature of time and space, and thus, the very nature of knowledge? Profoundly, I suspected; however, research measuring the precise depth and breadth of that change had yet to be done. There were, however, researchers and scholars thinking and dreaming about the possibilities. Among them was Douglas Engelbart.

Inspired by the sentiments of Vannevar Bush and others, Engelbart took to heart the post-World War II charge of using newly developed computer technology to create innovative ways with which to use information to make life better. From the first wooden mouse to his most recent invention, the Hyperscope, Engelbart has been attempting to perfect the augmentation of human capabilities through the use of information technology for nearly half a century. The pragmatic results of his work are well known. Every computer today is accompanied by its mouse, each click or tap enabling our easy access to paragraphs, pages, documents and menus. And it is only a matter of time before the programming complexities of Hyperscope become resolved, enabling the mass marketing of yet another tool with which sharing, communicating, and creating information will become more effective and efficient tasks. However, the philosophical ramifications of Engelbart's work are far less clear. The epistemological notions he posits through the concepts of human augmentation and the collective IQ, as well as Dynamic Knowledge Repositories and Networked Improvement Communities, have yet to be fully explored. The work presented here is a preliminary philosophical explication of the Engelbart hypothesis and an analysis of the rational and empirical ideas of which it is comprised.

The Engelbart Hypothesis

As early as 1962, Dr. Engelbart was already anticipating the impact computer technologies would have on the human knowing process. In the Stanford Research Institute Summary Report entitled, "Augmenting Human Intellect: A Conceptual Framework," he writes:

Existing, or near-future technology, could certainly provide our professional problem-solvers with the artifacts they need to have for duplicating and rearranging text before their eyes, quickly and with a minimum of human effort. Even so apparently minor an advance could yield total changes in an individual's repertoire hierarchy that would represent a great increase in over-all effectiveness...(and) the digital computer as a tool for the personal use of an individual...here there is not only the promise of great flexibility in the composing and rearranging of texts and diagrams...but also promise of many other process capabilities (5).

According to Engelbart in this summary report, 'a direct new innovation in one particular capability can have far-reaching effects throughout the rest of your

capability hierarchy.' He argues that higher-order capabilities that can utilize the initially changed capability can reorganize to take special advantage of the change. This change, then, can propagate down in the hierarchy, resulting in the use of latent capabilities which become usable because of the new capability at the higher level (4). By 1992, Dr. Engelbart's concept of the accumulative nature of augmentation had matured into the following observations regarding its application and impact on a larger scale. In the Bootstrap Institute publication entitled, "Toward High-Performance Organizations: A Strategic Role for Groupware" he writes:

...if the scale is changed for critical parameters within a complex system, the effects will at first appear as *quantitative* changes in general appearance, but after a certain point, further scale change in these parameters will yield even more striking *qualitative* changes in the system(4).

He goes on to state, "Expect surprising qualitative changes in structural assemblage and functional performance when a complex system adapts effectively to drastic changes in critical parameters." According to Engelbart, the most surprising – yet delightful – change which will ensue is an intelligence amplification process he refers to as 'bootstrapping.' Engelbart describes this process as follows:

An investment that boosts A Capability provides a one-shot boost. An investment that boosts the B Capability boosts the subsequent rate by which the A Capability increases. And an investment that boosts the C Capability boosts the rate at which the rate of improvement can increase (7).

Engelbart crafts the notion above from the assumption that the products of capability–improvement activities B and C can be used not only to boost the capability of their client activities, but can also be harnessed within their own activities to boost their subsequent capability.

And when bootstrapping can occur on a large scale for any number of individuals and organizations, the results can be profound. Engelbart describes those profound results as a system he calls CODIAK – The **C**Oncurrent **D**evelopment, **I**ntegration and **A**pplication of **K**nowledge (8). According to the CODIAK process, constituent individuals and/or teams or departments are engaged in the continuous exchange of information and communication. The organizational unit or individual is 'interacting with its external environment, scanning for and ingesting intell, as well as continuously analyzing, digesting, integrating, collaborating, developing, applying and re-using an evolving knowledge

base(9). The CODIAK process is collaborative, dynamic and continuous – and perhaps in its isolated components, not entirely new. What is new is Engelbart's vision of the exponential relationship between creating improvements and improvement of the improvement process itself. Improvement of the improvement process will be made possible not only through the recursive nature of augmentation, but also by the collective ways in which the power of improvement may be harnessed. Captured in presentation transcriptions from the Engelbart Colloquium at Stanford University in 2000, Dr. Engelbart's most recent observations have focused upon the power of the corporate CODIAK through NICs and DKRs. A NIC is a networked improvement community wherein individuals and communities of individuals undertake reciprocal, information-based relationships, the goal of which is to increase improvement capabilities. A DKR is a Dynamic Knowledge Repository which is the interactive, ever-evolving electronic archive of the idea artifacts or knowledge products of the CODIAKs and NICs. All of these ideas taken together make up the Engelbart hypothesis. For purposes of this study, it may be stated as follows:

Through augmentation (*systematically improving human capabilities by co-evolving tools, skills, organizational paradigms and culture*) and collective empowerment (*establishing dynamic knowledge repositories and networked improvement communities*) humans can approach complex, global problems in more effective and efficient ways, improving their ability to find workable and lasting solutions.

Although related in its infrastructure to More's Law (the power of computers doubles every month) and to Medcalf's Law (the value of a network goes up as the square of the number of connections), the Engelbart hypothesis is unique, and it is philosophical in nature for three reasons:

- 1) It challenges traditional ideas about the singular nature of truth (metaphysical)
- 2) It tests and tries traditional notions of the human knowing process (epistemological)
- 3) It proposes new value systems for the organization and manipulation of information (ethical)

The Metaphysical Nature of the Hypothesis

The metaphysical nature of the Engelbart hypothesis becomes apparent through an examination of the implicit premises upon which it rests. The first of these has to do with the technological landscape requisite for its implementation.

Critical to the creation of intrusive augmentation, NICs and DKRs is state of the art information technologies. As observed by Dr. Engelbart in a number of his essential writings, computerization opens up computational and communication possibilities which literally introduce us to whole new worlds of possibilities in terms of understanding the true nature of things. Speed and ease in information and data manipulation transform the possibilities for our interactions with the external environment. As a result, we can accomplish more tasks, multiple tasks, in less time, and sometimes even simultaneously. Repeating this pattern of increased tasking over and over again eventually causes an increase in the rate of change. This happening sets off a domino effect of auxiliary change-framed events, which eventually challenges those old Kantian concepts of space and time. If space and time are a priori knowable concepts which frame experience so that the mind can digest its contents, variables which impact the nature of space and time –like computerized computation and communication–would in turn eventually impact how we frame those experiences. To change the frame of the experience is to change the nature of the processing of the experience, which will eventually alter our perception and digestion of the experience itself. Experiences are that from which simple impressions derive, and as simple impressions are the first building blocks for the knowledge acquiring process, both empirically and rationally, then redefining the parameters for that initial happening has an incredible impact upon the nature of the knowledge product that comes out at the other end. For Dr. Engelbart, the excitement is exactly that – what comes out at the other end. He delights in the fact that we can take what's out *there* and bring it back *here* for application in solving problems to make life better. What is exciting philosophically, however, is the recognition and acknowledgement of new dimensions of truth – the discovery of additional attributes of reality previously inaccessible to the mind due to its computational and communicative limitations; put more simply, an acquisition of knowledge previously impossible due to our lack of processing speed. Computer technology provides the necessary friction by which to power the mind to the discovery of new truths.

The second premise implicit in the Engelbart hypothesis that invites metaphysical examination is its insistence on the limitless ways in which human capability may be increased through augmentation and empowerment. A few interesting arguments emerge. In the first place, to argue for the value of augmentation and empowerment through information manipulation makes a statement about the nature of that which is being augmented and empowered. The first statement being made is that the object of augmentation and empowerment is being targeted for improvement because in its original position, it is incapable of functioning at full power or at total capacity. Dr. Engelbart even says as much about humanity in the 21st century. In his most recent public lectures, he argues that humankind today is overwhelmed by the complexity and urgency of the

present, problematic global situation. His proposed solution: to give humans that which he intuitively they lack – more information. Here, two inherent arguments fall out, one having to do with the nature of humans, and the second having to do with the nature of reality. About humans: To argue for problem-solution through influx of information is to reduce human beings to information processing machines, and in the Engelbart argument, humans are information processing machines with infinite capacity for information ingestion and processing. The more the better. Simple infusion of information may not sufficiently capture all there is to nurturing the necessary human skill required to elevate problem solving capabilities.

That question is an interesting one to ponder, but perhaps more interesting is the second argument embedded in the hypothesis which has to do with the nature of reality. To argue that the total scope of information communicates the total view – or near total view - of the actual state of affairs in reality is to argue that the nature of reality is knowable, and knowable via externally accessed information. Continuing with this argument, what is revealed is that the total view of the actual state of affairs in reality is eventually inclusive of the true nature of all problems - and in the end, the Engelbart hypothesis wishes to posit the argument that the total view of all problems contains the paths to finding their solutions. That problems and solutions can be understood in such a way - laid against the same informational fabric with nothing delineating their nature other than human designation - reintroduces metaphysical problems with which both Aristotle and Hume struggled with regard to the nature of causes and their effects. Is there an actual relationship between cause and effect, or is the insistence that there is merely human musing? Are problems and solutions related in such a way as to argue that the examination of the contents of one gives an indication of the substance of the other? Hume would argue this must be necessarily so in order to argue that the two are related. According to Hume, to profess a solution is related to a problem would be to assert the problem contains the solution, thereby allowing for the cogency of the Engelbart argument: to examine every attribute of a problem would furnish forth a solution because the solution is embedded in the problem. However, what might be revealed upon closer examination is that Dr. Engelbart's hypothesis suffers from the same eventual, metaphysical dilemma as his 18th century counterpart. Hume's analysis revealed that causes and effects were NOT so related, that their relationship was a mere human contrivance. Although this examination may not be the time or place to conduct a Humian investigation into the precise nature of the relationship between problems and their solutions, what can and must be noted here is the need for further inquiry into the metaphysical cogency of the hypothesis in this regard.

The Epistemological Nature of the Hypothesis

Connections between problems and solutions are indicative of the connections Engelbart sees between the various incarnations and attributes of reality. In his view, reality is a complex of terrestrial and extraterrestrial forces, knowable in part through representative ideas (static information), but best understood through the multiplicity of relationships which exists between them (dynamic knowledge). This cosmological view of reality as complex, fluid, and constantly changing fuels the epistemological notions embedded in the hypothesis.

If we assume that reality is complex, fluid, and constantly changing, and we assume that its true nature can be captured and communicated through data and information, then it would follow that the processing of that data and information would have to be likewise multi-dimensional, highly flexible, and ever-evolving. From a traditional epistemological standpoint, this is an interesting proposition. Theories of knowledge have historically approached the knowing process rather myopically in terms of the manipulation of data and the derivation of information. From the rationalist's perspective, inherent capabilities enable our comprehension of concepts and their conversion into usable information, while empiricists rely on sensory input and experiential learning to determine truth about the nature of reality. Even when our old friend Kant proclaimed in his Critique that the knowing process took on both rational and empirical dimensions, the end result was still a version of idealism not that much different from the radical empiricism of his predecessor David Hume. What the Engelbart hypothesis is proposing is a new epistemological approach to the acquisition of truth and knowledge.

According to the Engelbart Hypothesis, to continue approaching the elegant nature of reality with only the raw intellectual tools of rationalism and empiricism will be to continue in failing to grasp the true nature of reality, and in turn, the true nature of the problems we are trying to solve. Their complex nature requires complex processing if we hope to render complete and usable knowledge. Equipping humans with powerful tools could emancipate them from trivial, mechanical tasks and provide them with complex processing capabilities. Augmentation via computing technology, combined with empowerment through the collective IQ and related tools (DKRs and NICs), could provide minds with the processing agility necessary to grasp the dynamic nature of reality. Specifically, the augmentation Dr. Engelbart has in mind would be accomplished through the application of tools like his newest invention, the hyperscope. With this tool, information in the form of electronic documents can be more easily shared and manipulated, both in terms of personal computing and interacting in local and wide area networks. This malleability is made possible through the conversion of input documents into an intermediate, or I-file, format. The I-file is then capable of being received in whatever format is called for by the user on

the other end. This feature, coupled with tagging which allows for the easy creation of links and easy navigation in documents, will revolutionize the way we create, use, and archive electronic information. These enhanced capabilities would create an informational environment conducive to increased collaboration and exchange between thinkers and problem solvers of different backgrounds, disciplines, talents and perspectives. This increased collaboration and rich exchange would culminate in what Dr. Engelbart calls the collective IQ, the corporate knowledge product of groups of individuals working on shared issues, problems, and concerns. These groups of individuals would be considered improvement communities, and their efforts could be enhanced through networking with other like-minded or similarly situated communities in what Dr. Engelbart calls Networked Improvement Communities (NICs). The archiving of the knowledge products of these organizations would be Dynamic Knowledge Repositories (DKRs). These dynamic repositories would be ever-evolving, interactive electronic environments designed to allow for the co-evolution of human capabilities and tools. The result of this co-evolution would be a continuous cycle of improvement, culminating in a better understanding of improvement, and resulting in the improvement of the improvement process itself.

What is epistemologically interesting here is this 'third' kind of knowledge introduced by the hypothesis, both in terms of the collective IQ and the tooling for improvement. The product of the collective IQ provides a provocative alternative to conventional ideas. Exposing the complex relationships which define the true nature of reality through the assimilation of numerous and diverse points of view provides for a clearer understanding. Information technologies like those proposed by Dr. Engelbart provide for a wider exchange among a more diverse pool of ideas than ever before. For this reason, the knowledge product of the collective IQ is really like nothing that has ever been imagined. It has an idea infrastructure such that the number of perspectives eventually possible through the application of the principle of the collective IQ is limitless. No matter how complex the true nature of reality is, the power of the collective IQ would eventually have the ability to catch up to and capture all of its attributes. Beyond simply rational or empirical information, the product of the collective IQ is most provocative because of its potentiality rather than its actuality at any given time. The fuller the understanding of the collective IQ, the greater the improvement in problem solving. As problem solving capability increases, so does the level of improvement with regard to the process for which we were solving problems. As improvement in one dimension can create improvement in other dimensions, general knowledge about improvement itself expands, and eventually, by virtue of this accumulative nature of improvement, improvement upon the improvement process occurs. This concept of the 'tooling' furnishing forth a new 'tool' to use on the tooling process itself makes the Engelbart hypothesis epistemologically unique.

The Ethical Nature of the Hypothesis

At the heart of the Engelbart hypothesis is the notion of collaboration. From the collective IQ to Dynamic Knowledge Repositories and Networked Improvement Communities, collaboration is central to Engelbart's strategies for collective empowerment. The degree of collaboration called for by the hypothesis invites a re-definition of personal and shared information and space. This re-definition would be especially challenging in a society such as America today because we live in a culture which promotes competition, individualism, and the pursuit of good for self. Because of this, the introduction of the Engelbart hypothesis to our society, and perhaps to many others, would likely force a value shift and present an ideological and behavioral challenge. Herein lies its ethical and moral content.

The Engelbart hypothesis proceeds from the assumption that the collective is more powerful than the individual in terms of its cumulative ability to better grasp the complex nature of a changing reality. Because of this, the value of the collective increases, and perhaps even beyond the value of the individuals of which is comprised. Individual identity and attributes have some standing, but their utility pales in comparison to the value of the collective in the overall empowerment and the success provided by the whole. This shift in the perception of value causes the rights and duties of both become changed. The value system which underlies collaboration is the normative, consequentialist theory of utilitarianism wherein the value of good for the many outweighs the value of the good for one. Or in the more accurate language of collaboration, the corporate product is superior to that which could be produced solely by the individual. As a consequence of this restructuring, a re-valuing of corporate space and rights occurs. In a collaborative relationship such as this, individuals sacrifice a certain degree of autonomy to make up the shared space that makes up the collaborate work.

Collaborative thinkers implicitly extend equal rights to one another. If the owners of two divergent points of view agree that they will collaborate to build a knowledge repository or form an improvement community, they are extending equal standing to one another, both in order to encourage free exchange, and to literally vacate some personal space to accommodate the ideas and beliefs of each other. The exchange of information and ideas creates a shared space within which both contributors have rights, but now their shared space becomes that to which others may want to have access. Within the idea architecture of the Engelbart hypothesis is the notion of open access to information and the promotion of the ready sharing of resources and electronic assets. The ethical implication of all of this is the immediate surrender of exclusive rights to

anything – any product of the collective IQ, any item in the Dynamic Knowledge Repository, any capability made possible through the Networked Improvement Community. In fact, the Engelbartian concept of collaboration challenges the traditional notion of ownership since the perpetual and interactive coevolution of DKR and NIC content and tools would be authored by and therefore legitimately owned by everyone involved in the collaborative endeavor.

Subscription to the ideologies and methods in the Engelbart hypothesis would result in somewhat of an ethical revolution with regard to the way most western societies conduct their business today. Rethinking the value of individual interests and pursuits would be requisite in light of the ethical demands inherent in total submission to collaboration. What should be the level of responsibility an individual has for solving group or global problems? How much individual interest ought be compromised in deference to the interests of the whole? Would the quest for sharing and for discovering new insights or common ground remain a positive force in society as it seems now that it would be, or would the perpetual support of collaboration distill individual creativity and encourage a less productive group think devoid of fresh ideas and innovation? Answers to those questions may yet to be determined, but their emergence makes the fact strikingly clear that the exploration of the Engelbart Hypothesis owns as many ethical dimensions as metaphysical and epistemological ones.

Conclusions

The exploration of the Engelbart hypothesis is a philosophical journey which in some senses has just begun. With a deeper inquiry into the elements of the hypothesis and further applied research through curriculum infusion, continued study and experimentation will hopefully yield a better and broader understanding of the hypothesis the elements involved. What this preliminary work has attempted to do is to establish the philosophical nature of the hypothesis and to explicate a few of the metaphysical, epistemological, and ethical arguments of which it is comprised.

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