Facilitating the Evolution of our Collective IQ

What Universities and Professional Societies Can Do

Douglas C. Engelbart
HT-04 Conference
Santa Cruz, CA, 11-Aug-04
Lifetime Goal

As much as possible, to boost mankind’s collective capability for coping with complex, urgent problems

Continuous, dedicated pursuit now for over 50 years
For Examples of “Large-scale, Complex, Urgent Problems,” See:

The Millenium Project – since the mid-90’s: Harnessing world-wide participation in isolating and clarifying what are the MAJOR CHALLENGES to humanity:

http://www.acunu.org/index.html
American Council for the United Nations University is a U.S. NGO that provides a point of contact between Americans and the primary research organ of UN - the United Nations University ( UNU) - which focuses intellectual resources from all nations on world problems.

Millennium Project of the American Council for the United Nations University is a global participatory futures research think tank of futurists, scholars, business planners, and policy makers who work for international organizations, governments, corporations, NGOs, and universities. The Millennium Project manages a comprehensive yet cumulative process that collects and assesses judgements from its several hundred participants to produce the annual "State of the Future", "Futures Research Methodology" series, and special studies such as the Future Scenarios for Africa, Lessons of History, Environmental Security, Applications of Futures Research to Policy, and a 500+ annotated scenarios bibliography.

 connects local and global perspectives via regional Nodes (groups of individuals and institutions) in Beijing (China); Buenos Aires (Argentina); Cairo (Egypt); Caracas (Venezuela); Essen (Germany); Helsinki (Finland); Kuwait (Gulf region); Lismore & Aspendale (South Pacific); London (U.K.); Tokyo & New Delhi (India); Maui (Hawaii); Moscow (Russia); Paris (France); Prague (Central and Eastern Europe); Rome (Italy); Sao Paulo (Brazil); Silicon Valley (U.S.); Tehran (Iran); and Tokyo (Japan). The Millennium Project was selected among the "100 Best Practice" by IDN Habitat, host of 7 foresight organisations (www.acunu.org/millennium/information.html)
AC/UNU Millennium Project

Futures Matrix

This page is continuously updated; your feedback is welcome. Click on the blue bullets in the table to get to the topic of your choice.

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If you know of excellent additions to any of these domains that address the long-range future, please send them to jglen@ige.org
INTEGRATION AND WHOLE FUTURES
- useful web sites -


- World Futures Studies Federation: [http://www.worldfutures.org](http://www.worldfutures.org)


- OECD Forum for the Futures: [http://www.oecd.org/sec/au/](http://www.oecd.org/sec/au/) - is committed to an inter-disciplinary approach and a systemic perspective as the most appropriate way of effectively tackling longer-term future challenges in a world of increasing interdependence and accelerating change


- The Futuribles Group [http://www.futuribles.com](http://www.futuribles.com) French web site on Futures Studies


- University of Houston (Institute of Futures Research): [http://www.cl.uh.edu/futureweb/](http://www.cl.uh.edu/futureweb/) - MS program in Future Study

- Global Options, California State University Dominguez Hills: [http://www.csuch.edu/global_options](http://www.csuch.edu/global_options)

- Institute for Alternative Futures: [http://www.alfutures.com](http://www.alfutures.com) - AF helps organizations and communities clearly understand the accelerating pace of change and focus their energies on clarifying their highest aspirations.

- Institute of Future Studies for Development, IFD [http://www.ifd.or.th](http://www.ifd.or.th) - is an independent academic research institute created for the purpose of communicatin

Solving any, truly large-scale problem requires COLLECTIVE CAPABILITY e.g. to:

• Develop an adequate, comprehensive understanding:
  – Of the problem situation
  – Of the possible solutions
  – Of the resources required
  – Of the resources available

• After selecting a solution approach:
  – Cyclic Process: Status; Next-Glitch Problem; …
Consider that human capability (individual or collective) depends upon an integrated infrastructure of component capabilities.

Essentially every capability is dependent upon a set of lower-level capabilities – usually shared with other higher-level capabilities.

I focus on **Capability**; 2\textsuperscript{nd} is **Ease of Use**
Humans’ Capabilities Depend Upon Their Augmentation Systems

Capability Infrastructure

Tool System
- Shoes
- Automobiles
- Traffic Lights
- Elevators
- Office Bldgs.
- Word Processors
- Eye glasses
- Hypertext

Human System
- Paradigms
- Organization
- Procedures
- Customs
- Methods
- Language
- Attitudes

Skills
Knowledge
Training

Basic Human Capabilities
- Sensory
- Perceptual
- Motor
- Mental

(This interface is much more significant than “HCI”)
Collective IQ: Emerged As The Primary Strategic Capability

External Environment

Dynamic Knowledge Repository

Ingesting
Interacting
Scanning

Recorded Dialog
Intelligence Collection
Knowledge Product

Collectively Developing, Integrating, & Applying Knowledge

CODIAK capability
“SCALE” – it matters a great deal when tackling a BIG problem:

• The “scale factor” has a huge impact on the way a problem can successfully be approached.

• Tackling a large-scale problem requires a “strategic” rather than a “tactical” approach.

• And the “paradigms” which shape our individual and collective perceptions of big problems -- and of their possible solutions:
  – They need to be appropriate -- and yet they evolve much more slowly than do the big-problem complexities.
This Augmentation Model is valid over huge scale!

Individual Human

Community Of Practice

A Complete Country

The World

Operative IQ

Collective IQ

Collective IQ

Collective IQ

Purposefully pursuing accelerated evolution of mankind’s knowledge development and application capabilities is a HUGE CHALLENGE, and requires very effective strategies in applying our resources
Critical Factor: “Concurrent” Evolution of Society’s DKRs

Concurrency:
Scaling Up --
actually, to

global scope

Recorded Dialog

Intelligence Collection

Knowledge Products

Dialog, Intell., Knowledge
Large-Scale Facilitated Evolution

• No one can specify the design for our future capability infrastructure
  – Far too many of the possible “improvement steps” will change the design environment for other improvement candidates.

• Have to depend upon an Evolutionary Process!

• BUT, we CAN learn to FACILITATE this evolutionary process!
The World’s Organizations in Human-Tool Space

Representative distribution of world’s societies
“Co-Evolution Frontier”

*Human-Systems and Tool Systems*

*Interactively Co-Evolving*

- Mind-boggling rate & scale of technology change generate *accelerating rate of opportunities*.

- Our *paradigms* already lag well behind opportunities.

- **Paradigm change has to be accelerated**: Human skills, culture, and governance are already severely stressed.

- **Needed**: A setup that can *effectively facilitate* … the *Human/Tool-System Co-Evolution of our Collective Augmentation Systems*. 
Emergent Co-Evolution Frontier

On a scale we can barely anticipate

Where best should your organization head? ....By what route? Who else is out there?

Uncharted, and Changing

- We need DKRs that provide the best possible understanding of the current and projected states of these frontiers.
- Every evolving organization can then make its own choice of movement in the frontier.

Human System Development

Tool System Utilization

Best Routes?

Outposts?
Meta approach to Improvement

A Activity - serves the customer

B Activity - improves product cycle time and quality

C Activity - improves improvement cycle time and quality
Identify Common-Interest Organizations

Multiple organizations, could pool “C-level” expenses to work collectively on common-capability improvements (Consortia; Prof. Societies).
Create new Improvement Community: Jointly Improving “C” Capabilities

- Common challenges, issues, requirements
- Share advice, strategies, lessons learned
- Common types of “Customers” -- their “Bs.”

A New Community focused on Improving “C” Activities across organizations
Networked Improvement Community (NIC)

What makes a NIC out of an IC? Actively employing a “NIC DKR” (Dynamic Knowledge Repository) focused on providing the best possible understanding of the possibilities and means for improving the specified common capability-improvement capability.

It’s DKR

- Investigate & collect intelligence
- Provide collaborative website
- Rich test bed for experimentation
Networked Improvement Community

NIC Central
Tools, Governance

Dynamic Knowledge Repository

Augmented, “C” Community focused on Collective Improvement

Sharing risk, cost, knowledge, experience

• Investigate & collect intelligence
• Provide collaborative website
• Rich test bed for experimentation, pilots
The Bootstrap Alliance – a Meta-NIC

A NIC whose members are NICs, teaming to improve their respective capabilities to be NICs.

Bootstrap Handbook
Assessment & Metrics
Standards & Audits
Interoperability Standards
DKR Application Support
Training & Education
Large-Scale Facilitated Evolution

- Common Goal: Continuous Improvement of Large-Scale Improvement Capabilities.

- Networked Improvement Communities (NICs) defined around specific areas of interest

- Prime Goal: Improve Collective IQ of NICs!

- Organize NICs into a large-scale, ever-improving, Improvement Infrastructure for facilitating the Concurrent Evolution of the associated Augmentation Systems.
Central Strategy: **Bootstrapping**

1. Currently available information about Collective IQ
2. Best DKR/knowledge about improving Collective IQ
3. NIC immediately utilizing the best Collective IQ improvement knowledge

**The Bootstrap Feedback Loop**

*The better we get at getting better, the better and faster we’ll get better*
Bootstrapping: Extension to Many NICs

NIC for Improving Collective IQ

NIC for Improving Capability A

NIC for Improving Capability Z

The Bootstrap Feedback Loop
The Need For An Open Hyperdocument System (OHS)

To support the implementation and use of DKRs

- **“Open”** - Scaleable, evolvable, interoperable across domains
- **“Hyper”** - To enhance access, maneuverability, and (re)utilization
- **“Document”** - To capture, integrate, and manage the emerging heterogeneous knowledge
- **“System”** - Provides a complete “knowledge workshop”

**OHS - the critical missing piece**
Some things we learned from twenty-five years’, active-use evolution of the NLS-AUGMENT System

Prime objective was “Capability,” with a UIS that provided effective evolutionary learning for what steadily extended as a natural-language vocabulary.

Enter a minimum string of characters for each the verb and then the noun – and the system recognizes the intent and automatically fills out the whole-word command expression. So the user knows she has established a well-formed command.
Example: “EXPERT-User” AUGMENT Command Verbs for the BASE subsystem (Text & File Manipulation)

- *Act Append Break *Check *Clear
- *COMment *CONnect Copy *Create Delete
- *DETACH *ENlarge EXECUTE *EXPunge
- Force *FReeze Goto Help Insert Jump
- Logout Move *Point Print *PROcess Quit
- *REName Replace *RESet *REVerse *SEt
- *SHow Sort *STArt *STOp *THaw
- Transpose *TRIm *TYpe *UNdelete Update

- NOTE: Type the Cap-noted letters (start with SPACE for the “*” terms) and the system will recognize the abbreviation and pop up the full-term command line.
Example: “EXPERT-User” AUGMENT Command Nouns for the BASE subsystem (Text & File Manipulation)

- Nouns: Branch Character *DIRective Directory File Group Invisible Link Number *Phrase Plex Statement Text Visible Word

- **Type Chars:**
  - Command Line:
  - `dw` Delete Word
  - `mb` Move Branch
  - `jl` Jump Link
Text-manipulation vocabulary
typical for a beginner

Verbs: Copy Delete Help Insert Jump Logout Move Quit Replace Sort

Nouns: Branch Character File Group Link Plex Statement Text Word
Example: “EXPERT-User” AUGMENT
Verbs & Nouns for the Mail subsystem

- **Verbs:** Answer Copy Delete Forward Goto Help Jump Logout Move *Pickup Quit Send *Sort Update

- **Nouns:** All CAtegory *Citation Fields Message
Expert User Verbs & Nouns for AUGMENT’s Table Subsystem
(Spread Sheets)

• Verbs: *Accumulate  *Act Add  *Automatic  
*Check  *Clear *Comment Copy *Create  
*Cutoff  *Delete Divide *Draw Execute  
Fillout Goto Help Insert Jump  *Justify Log  
*Magnitude *Mean *Move Multiply *Partial  
Percent  *Point Quit Replace *Reset  *Root  
*Set  *Show *Sort Subtract *Switch Total  
*Transpose Update Variance

• Nouns: Column Entry Field Line  
Modifications Numeric Row Profile Table  
Text Viewspecs
Powerful “Macro Commands” significantly extend the power of the AUGMENT user.

• Setting them up becomes quite simple – writing them utilizing the same “Command Language” and the same highly flexible and explicit addressing.

• E.g., evoke this one with four-char call, give it the initials for friend Joe, and it compiles the content filter which will show me all of Joe’s email that I’ve stored in a given file domain.
High-resolution addressability – Basic NLS feature from mid-60s

- Initial purpose, so that one could use a link to cite ANY OBJECT in ANY FILE.

- Then an increasingly flexible and powerful addressing scheme evolved.

- “Open Jumps” began to be supported – e.g., a user can type `Jump Item ph,JS.I` which leads to his phone-directory file, then to the node labeled “JS” (for Jim Smith) where there is a simple link leading to the Jim Smith entry.
Why aren’t “optional views” a natural part of “Hypertext”? 

Besides using computer-held information be “linked” – to whole Documents in the sense that Vannevar Bush’s Memex enabled ”jumping” to other photo-captured frames ..

Suppose we provide for our computer to re-shape, re-color, re-arrange, etc., our stored information …

... on the fly, with quick option-actions, ... portraying content in ways that help the human’s perceptual machiner better grasp the concepts and their relationships.
Lower-Case-Letter Viewspecs

a: show one level less
b: show one level more
c: show all levels
d: show first level only
e: show levels down to reference stat…
f: recreate window if necessary
g: show branch only
h: show all branches
i: filter statements
j: don't filter statements
k: show next filtered statement
l: show plex only
m: show statement numbers/SIDs

...
Upper-Case-Letter Viewspecs

A: show level indenting
B: don't show level indenting
C: show statement names
D: don't show statement names
E: paginate when printing
F: no paging; recreate display (display)
G: statement numbers/SIDs right
H: statement numbers/SIDs left
I: show SIDs, not statement numbers
J: show statement numbers, not SIDs
K: show statement signatures
L: don't show statement signatures
O: user sequence generator on
P: user sequence generator off

.....
Selected Reference Links

• Subset of our pubs that are on the Web: http://www.bootstrap.org/institute/bibliography.html

• – Special interest in Items below:


• #32: A Draft OHS-Project Plan (The HyperScope) Douglas C. Engelbart. 2000
Comparative use of Pub #32

• … From this Pubs listing: http://www.bootstrap.org/institute/bibliography.html

• … Let’s use the following publication for a brief demo of what HyperScope would do:

INTRODUCTION

Large-scale challenges are best served if there are appropriately scaled strategic principles to guide their pursuit. And special value results if the launch plan of a long-term and large-scale strategy produces significant payoff accrual early in the pursuit.

We are addressing the large-scale, pervasive challenge of improving the collective development and application of knowledge. Many years of focussed experience and conceptual development underly the strategic framework guiding this proposal.

Phase-1, OHS Launch Project: HyperScope
INTRODUCTION

Large-scale challenges are best served if

We are addressing the large-scale, Phase-1, OHS Launch Project:

Special Note: Implementation of the

The HyperScope will be a lightly modified

A Hyperscope user will be able to follow
INTRODUCTION

Large-scale challenges are
We are addressing the large-scale,
Phase-1, OHS Launch Project: HyperScope

Special Note: Implementation of the
The HyperScope will be a lightly modified
A Hyperscope user will be able to follow

Brief Functional Description of Phase-1

1. In response to what may be an ordinary
   For any community seriously interested
2. High-Resolution Addressability:
   E.g., here "http://xxx.xxx.xxx#aaa"
3. View-Specifications: The HyperScope
INTRODUCTION
Large-scale challenges are
We are addressing the large-scale,
Phase-1, OHS Launch Project:
    Special Note: Implementation of the
    The HyperScope will be a lightly modified
Brief Functional Description of Phase-1
Phase-2: Maturing/Evolving the
    Evolution of the Intermediary File format
An OHS "User Interface System" (UIS)
Provision for archiving, version control,
Now the VERY important feature of this
And the critical community-development
For the scale of utilization that will be
Show one-line, next-level content of “Brief functional description”

Brief Functional Description of Phase-1

1. In response to what may be an
2. High-Resolution Addressability:
3. View-Specifications: The HyperScope
4. Expanded set of HyperScope
5. Copying-Pasting HyperScope Links:
6. Back-Link Management: Provision will
7. Extended addressing conventions to
8. Same file in multiple windows -- no
INTRODUCTION
Phase-1, OHS Launch Project:
Phase-2: Maturing/Evolving the
Phase-3: Special Evolutionary
Provision:
OK, show all lines of top-level statements, with blanks between them.

INTRODUCTION

Phase-1, OHS Launch Project: HyperScope enhancement of Legacy Systems:

Phase-2: Maturing/Evolving the

Phase-3: Special Evolutionary Provision:
Key Launching Step in Creating a NIC’s “Knowledge Workshop”

• Co-evolve from NIC’s own starting point (legacy technologies, systems, cultures)
• Provide a direct useful entry step for the first stage of the human/tool co-evolution

Bootstrap Project - OHS

- Develop framework for hyperdocument architecture
- Develop framework for the functional tool systems

HyperScope is the smoothest first step, providing the least disruptive, best evolutionary potential
Stage 1: OHS-HyperScope Browsing

Over a wide variety of legacy files
- High-resolution linking
- Many viewing options

Intermediate “I-File”
Extended XML properties, including much new address tagging

And also, hi-resolution linking to audio, video …
Candidate Legacy Types For HyperScope Interaction

- HTML, e-mail & e-mail archives; Proprietary email Store (Open Office, MS Exchange, Lotus Notes)
- Docbook (XML), UBL documents, MS Word, Open Office Docs, RTF, Blogs
- MS Excel, Open Office Equivalent, PowerPoint, PDF Documents, News (NITF, NewsML)
- Audio and Video records, CAD Systems, Data Bases, Digitized book-page images
What the Link Database Holds

• For every HyperScope link that was actuated into a given I-File, the Link Database will record:
  – the target object
  – the high-resolution location of the link in its “home file”
  – the “link-type designation” embedded in the link syntax (whose significant usage will be part of the new working conventions of HyperScope users)
  – for some link types, also: optionally viewed “content” -- e.g. comments about the targeted object, or highlighting of objects on the targeted document, or even one or more useable links which the reader can exercise
The “Link Data Base”

• Can directly support full-scale “Argument Structuring” and its graphic portrayal.

• Including “Issue-based Information Systems” (IBIS), tracking the evolution/resolution of issue-oriented dialog

• Records by which back-tracking can determine:
  – “Attribution” for helpful ideas or assessments
  – Isolate bad ideas or problem assessments that steered an issue off target.

• Support more carefully *scrutinized* analysis and judgements
Cultivate Special Knowledge-Work Capability-Development Roles

1. Start building KW capabilities using the HyperScope

2. Actively develop role of Knowledge Workshop Architect within Communities of Practice

3. Emphasize their turning their Cs-of-P into NICs -- Networked Improvement Communities
Continuing Evolution towards a Full-Scale Open Hyperdocument System

- Start with the HyperScope
- Extend viewing and linking options
- Add optional User Interface systems – pursuing range from “Pedestrian Users” to highly trained, top-capability users.
- Steady extension of functional utility and corresponding file properties
- Aiming resolutely toward most effective development and maintenance of DKRs, for an increasing array of important knowledge domains.
About High-Performance Teams

• Explicitly recruited, equipped and trained, as though for competitive performance assessments.

• No limit to the unusual ways in which their fundamental sensory, perceptual, cognitive, motor capabilities are trained, conditioned and harnessed.

• Strategically, seems best at first to be engaged as SUPPORT TEAMS – providing special services to larger teams operating in “current mode.”
Key to our Capability Improvement: High Performance Support Teams

• Support a larger, “conventionally capable” community, organization, or project team.

• Facilitate the CoDIAK processes associated with developing and maintaining its Dynamic Knowledge Repository.

• Special strategic value if HPSTs focus on the CoDIAK “Integration” processes, toward making significant improvements in the effectiveness for “very heavy types of collective knowledge work.”
Towards Effective Facilitation
Where/How to Start the First “real” NICs?

NIC Candidates?

- Universities?
- Government Agencies?
- Professional Societies?
- Special Improvement Infrastructures?
- Philanthropic Organizations?
- Businesses?
 Kick-off: Education NIC (EdNIC)

- EdNIC “start-ups” currently operating in two universities:
  - CSUMB (Professor Valerie Landau)
    - Working on “Bootstrap Hypothesis” from tools & processes perspective
  - Indiana University East (Professor Mary Cooksey)
    - Working on “Bootstrap Hypothesis” from formal logic (epistemology) perspective
- Dialog about DKRs & Facilitated Evolution
- Discover DKRs for areas of interest
- Start working on form & functions for mature EdNICs
- Scout for additional university participants
Key, Central Activity: Learning how to build better DKRs

So why not get a bunch of different university groups building prototype DKRs for selected knowledge domains?

In different departments – domains relevant to their study areas …

In different universities – OK (preferable) to focus on same domains as other universities.

Each university has one special domain: A DKR about DKR development -- to facilitate the learning process about how better to develop and learn from DKRs.
Explore Current State of DKR Development & Use

Study organizations whose challenges are to improve their capability to cope with complex challenges

• How have they organized the knowledge they need to understand best those challenges? Look for examples of candidate DKRs associated with those domains.
  – Body of knowledge associated with domain, e.g. “handbook” or “encyclopedic” concept vs. simply results of Google search
  – Provides the means for skilled participants to use knowledge domain
  – Integrated knowledge, not just a list of sources

• Right now the “best available” might be:
  – the last published “textbook” on that knowledge domain; or
  – current design “status” of a complex product (e.g. design of an aircraft); or
  – the consolidated record of a deliberative group (e.g. standards body, professional society, etc.)
  – others, to be proposed by interested groups
Building, Using & Evaluating DKRs

The DKR is the integrated knowledge domain providing the current state of the frontier for that domain via dynamic integration of any new data observations, questions, proposals, and challenges that reflect the current state of the frontier.

- An appropriately skilled user must be able to follow the reasoning and verifiable data that lead to understanding the updated domain
- Discernible argument structure with linked citations to the specific passages that are components of the structure
- Helps to determine whether or not to accept the assertion made
- DKR updates might change the direction, future thinking, decisions, etc. for a project
- How well does DKR “machinery” support the need to learn about given sub-domains and answer questions

Are there examples of the best available early-model DKRs?
- Accessible and continually evolvable on-line
Challenges for DKR Development & Use: Rationale for Building a DKR of DKR’s

• Special sets of skills required for increased capabilities
  – Who will provide the integration & linking of disparate information into the solid, verifiable DKR structures

• Properties & structural principles for DKR knowledge containers will be critical part of DKR evolution

• Dynamic, seamless integration of new data while preserving the DKR’s evolutionary history

• Assessment and rating of the organization’s capabilities to develop and use its DKRs

• Capability Infrastructure – support a wide range of usage capabilities, e.g. multiple user interfaces that reflect increasing levels of user expertise
Engelbart Papers A to Z (updated 08 Aug 2004)

- Dust Or Magic 2004 : Frode Hegland - The Cynapse Project : Overview
- Enhanced a2h: Moving AUGMENT files and browsing functionality onto Bootstrap
- Draft OHS-Project Plan
- Engelbart's Unfinished Revolution
- Boosting Our Collective IQ
- Toward High-Performance Organizations: A Strategic Role for Groupware
- Knowledge-Domain Interoperability and an Open Hyperdocument System
- Douglas Engelbart Interview 4
- Douglas Engelbart Interview 3
- Douglas Engelbart Interview 2
- Douglas Engelbart Interview 1
- Workstation History and the Augmented Knowledge Workshop
- Authorship Provisions in AUGMENT
- Collaboration Support Provisions in AUGMENT
- Toward High-Performance Knowledge Workers
- Evolving The Organization Of The Future: A Point Of View
- Toward Integrated, Evolutionary Office Automation Systems
- A Software Engineering Environment
THE DEMO

On December 9, 1968, Douglas C. Engelbart and the group of 17 researchers working with him in the Augmentation Research Center at Stanford Research Institute in Menlo Park, CA, presented a 90-minute live public demonstration of the online system, NLS, they had been working on since 1962. The public presentation was a session in the of the Fall Joint Computer Conference held at the Convention Center in San Francisco, and it was attended by about 1,000 computer professionals. This was the public debut of the computer mouse. But the mouse was only one of many innovations demonstrated that day, including hypertext, object addressing and dynamic file linking, as well as shared-screen collaboration involving two persons at different sites communicating over a network with audio and video interface.

The original 90-minute video of this event is part of the Engelbart Collection in Special Collections of Stanford University. This original video has been edited into 35 segments and reformatted as RealVideo streaming video clips. A brief abstract of the subject matter treated in each segment is provided below.