

Improving Our Ability to Improve: A Call for Investment in a New Future

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September 2003

Summary

In the past fifty years we have seen enormous growth in computing capability – computing is everywhere and has impacted nearly everything. In this talk, Dr. Douglas Engelbart, who pioneered much of what we now take for granted as interactive computing, examines the forces that have shaped this growth. He argues that our criteria for investment in innovation are, in fact, short-sighted and focused on the wrong things. He proposes, instead, investment in an improvement infrastructure that can result in sustained, radical innovation capable of changing computing and expanding the kinds of problems that we can address through computing.

In this talk, Dr. Engelbart describes both the processes that we need to put in place and the capabilities that we must support in order to stimulate this higher rate of innovation. The talk closes with a call to action for this Co-Evolution Symposium audience, since this is a group that has both a stake in innovation and the ability to shape its direction.

This paper provides an extended transcript that expands upon the brief overview presentation made by Dr. Engelbart on September 24, 2003 at the IBM Co-Evolution Symposium organized by James C. Spohrer and Doug McDavid of IBM Almaden Research Center.

Good News and Bad News

The development of new computing technologies over the past fifty years – in hardware and software – has provided stunningly important changes in the way we work and in the way we solve problems.

I need to get this assertion out in front of you early in this talk, because most of the rest of what I have to say might cause you to think that I have lost track of this progress or that I don't appreciate it. So, let me get it said ... we have made enormous strides since the early 1950s, when I first began thinking seriously about ways to use computers to address important social problems. It has truly been a remarkable fifty years.

At my first job at NACA, the forerunner of NASA, right out of engineering school, there was no vision at all of electronic computers. In fact the term “computers” referred to the room full of women sitting at desks using desk calculators to process the wind tunnel data. This was in the late 40's. Later in my research, when I thought about using computers to manipulate symbols and language, rather than to do calculations on numbers, most people thought I was really pretty far gone. The idea of interactive computing – well, it seemed simply ludicrous to most sensible people.

So, we have made truly tremendous progress. It has been a marvelous 50 years to be in this business. But that is not what I am going to talk to you about. Not out of lack of appreciation – even a sense of wonder – over what computer technologists have developed – but because I can see that we are not yet really making good progress toward realizing the really substantial payoff that is possible. That payoff will come when we make better use of computers to bring communities of people together and to augment the very human skills that people bring to bear on difficult problems.

In this talk I want to talk to you about that big payoff, think a bit with you about what is getting in the way of our making better progress, and enlist you in an effort to redirect our focus. The rewards of focusing on the right course are great. I hope to show you that they can be yours.

The Vision: The Payoff

I need to quickly sketch out what I see as the goal – the way to get the significant payoff from using computers to augment what people can do. This vision of success has not changed much for me over fifty years – it has gotten more precise and detailed – but it is pointed at the same potential that I saw in the early 1950s. It is based on a very simple idea, which is that when problems are really difficult and complex – problems like addressing hunger, containing terrorism, or helping an economy grow more quickly – the solutions come from the insights and capabilities of people working together. So, it is not the computer, working alone, that produces a solution. But is the combination of people, augmented by computers.

The key word here is “augment.” The reason I was interested in interactive computing, even before we knew what that might mean, arose from this conviction that we would be able to solve really difficult problems only through using computers to extend the capability of people to collect information, create knowledge, manipulate and share it, and then to put that knowledge to work. Just as planes extend our ability to move, so does the computer extend our ability to process and use knowledge. And that

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knowledge production is a group activity, not an individual one. Computers most radically and usefully extend our capabilities when they extend our ability to collaborate to solve problems beyond the compass of any single human mind.

I have found that this idea of “augmenting” capability needs clarification for many people. It is useful to contrast “augmentation” with “automation.” Automation is what most people have in mind when they think about using computers. Automation is what is going on when we use computers to figure up and print telephone bills or to keep track of bank charges. That is not, in my mind, how we use computers to solve tough problems. We have the opportunity to harness their unique capabilities to provide us new and more effective ways to use our mind and senses – so that the computer truly becomes a way of extending our capabilities.

The shovel is a tool, and so is a bulldozer. Neither works on its own, “automating” the task of digging. But both tools *augment* our ability to dig. And the one that provides the greatest augmentation, not surprisingly, takes the most training and experience in order to use it really effectively.

In order to get a bigger payoff from our investment in computing, focusing on augmenting the ability of groups to solve problems is the right starting point.

Evidence of Trouble

Because we are so accustomed to thinking in terms of the enormous progress and change surrounding computing, when it comes to these broader, social and group-centered dimensions of computing, the picture looks quite different.

Difficulty in Doing Important Collaborative Work

As one example, my organization, the Bootstrap Alliance, works in loose collaboration with a number of other organizations to help them develop better ways to improve their ability to learn and to use knowledge – in short, we work with organizations to help them improve their ability to improve.

One organization that we work with is the Global Disaster Information Network – or “GDIN” – which is a consortium of regional and local disaster response organizations. Organizations that respond to disasters are tremendous examples of organizations that must learn to adapt and use new information quickly.

Computers and, in particular, the Internet, clearly play a key role in the efforts to coordinate such disaster response and to improve the ability to improve over the lifecycle of a disaster response effort. But what is striking, as GDIN grapples with these issues, is how difficult it is to harness all the wonderful capability of the systems that we have today in GDIN’s effort to improve its ability to improve disaster response. It turns out that it is simply very difficult to share information across systems – where “sharing” means both the ability to find the right information, when it is needed, as well as the ability to use it across systems.

Even harder is the ability to use the computer networks to monitor and reflect status. Anyone that regularly uses e-mail can readily imagine how the chaotic flow of messages between the different people and organizations during a disaster falls far short of creating the information framework that is required for an effectively coordinated response. Make no mistake about it, GDIN and its member disaster response

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organizations find computers to be very useful – but it is even more striking how the capabilities offered by today’s personal productivity and publishing systems are mismatched to the needs of these organizations as they work to coordinate effective response flexibly and quickly.

Structural Roots of the Problem

Perhaps the best study of the systematic and very basic conflict between markets and certain kind of innovations is Clayton Christensen’s classic and very valuable book, *The Innovator’s Dilemma* (Christensen, 1997). Christensen thesis is that “continuous” innovation – emerges when companies do a good job of staying close to their customers and, in general, “listening to the market.” This is the kind of innovation that produces better versions of the kinds of products that are already in the market. If we were all riding tricycles, continuous innovation would lead to more efficient, more comfortable, and perhaps more affordable tricycles.

But it would never, ever produce a bicycle. To do that, you need a different kind of innovation – one that usually, at the outset, results in products that do not make sense to the existing market and that it therefore cannot value. Christensen calls this “discontinuous” innovation.

Discontinuous innovation is much riskier – in that it is much less predictable – than continuous innovation. It threatens the positions of market leaders because, as leaders, they need to “listen” to the existing market and existing customers and keep building improved versions of the old technology, rather than take advantage of the new innovation. It is this power to create great change that makes discontinuous innovation so valuable over the long run. It is how we step outside the existing paradigm to create something that is really new.

In the past fifty years of history of computing, the one really striking example of discontinuous innovation – the kind where the market’s “intelligence” approached an IQ of zero – was early generation of World Wide Web software – and in particular, the Mosaic web browser. There were, as the Web first emerged, numerous companies selling highly functional electronic page viewers – viewers that could jump around in electronic books, follow different kinds of hyperlinks, display vector graphics, and do many other things that early web browsers could not do. The companies in this early electronic publishing business were actually able to sell these “electronic readers” for as much as USD \$50 a “seat” – meaning that, when selling electronic document viewers to big companies with many users – this was big business.

Then, along came the Web and Mosaic – a free Web browser that was much less functional than these proprietary offers. But it was FREE! And, more important, it could do something else that these other viewers could not do – it provided access to information anywhere in the world on the Web. As a result, over the next few years, everything changed. We actually did get closer to the goal of computers assisting with collaborative work.

In a little bit I will explain how we can overcome such systematic bias and open the doors to the very substantial rewards from continued, productive discontinuous innovation. But, before turning to solutions, I need to tell you about another dimension of systematic bias that is getting in the way of our making important progress in finding new ways to use computers.

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The Seductive, Destructive Appeal of “Ease of Use”

A second powerful, systematic bias that leads computing technology development away from grappling with serious issues of collaboration – the kind of thing, for example, that would really make a difference to disaster response organizations – is the belief that “ease of use” is somehow equated with better products.

Going back to my tricycle/bicycle analogy, it is clear that for an unskilled user, the tricycle is much easier to use. But, as we know, the payoff from investing in learning to ride on two wheels is enormous.

We seem to lose sight of this very basic distinction between “ease of use” and “performance” when we evaluate computing systems. For example, just a few weeks ago, in early March, I was invited to participate in a set of discussions, held at IBM’s Almaden Labs that looked at new research and technology associated with knowledge management and retrieval. Most of the presenters were looking to build a better tricycle – following the market to the next stage of continuous innovation – rather than stepping outside the box to consider something really new.

But there was another bias, even in the more innovative work – and that bias had to do with deciding to set aside technology and user interactions that were “too difficult” for users to learn. I was particularly disappointed to learn, for example, that one of the principal websites offering knowledge retrieval on the web had concluded that a number of potentially more powerful searching tools should not be offered because user testing discovered that they were not easy to use.

Why do we assume that, in computing, ease of use – particularly ease of use by people with little training – is desirable for anyone other than a beginner? What *is* surprising is that, in serious discussions with serious computer/human factors experts, who are presumably trying to address hard problems of knowledge use and collaboration, ease of use keeps emerging as a key design consideration.

Doesn’t anyone ever aspire to serious amateur or pro status in knowledge work?

Restoring Balance

I need to remind you of what I said at the beginning of this talk: we have made huge strides forward in computing. It has been a marvelous fifty years.

But I want to alert you to two very important facts:

1. We are still not able to address critically important problems – particularly if those problems demand high performance ability to collect and share knowledge across groups of people.
2. This inability is not an accident, but emerges from values and approaches that are “designed into” our approach to addressing innovation in computing.

We need to find ways to address the harder problems and to stimulate more discontinuous innovation.

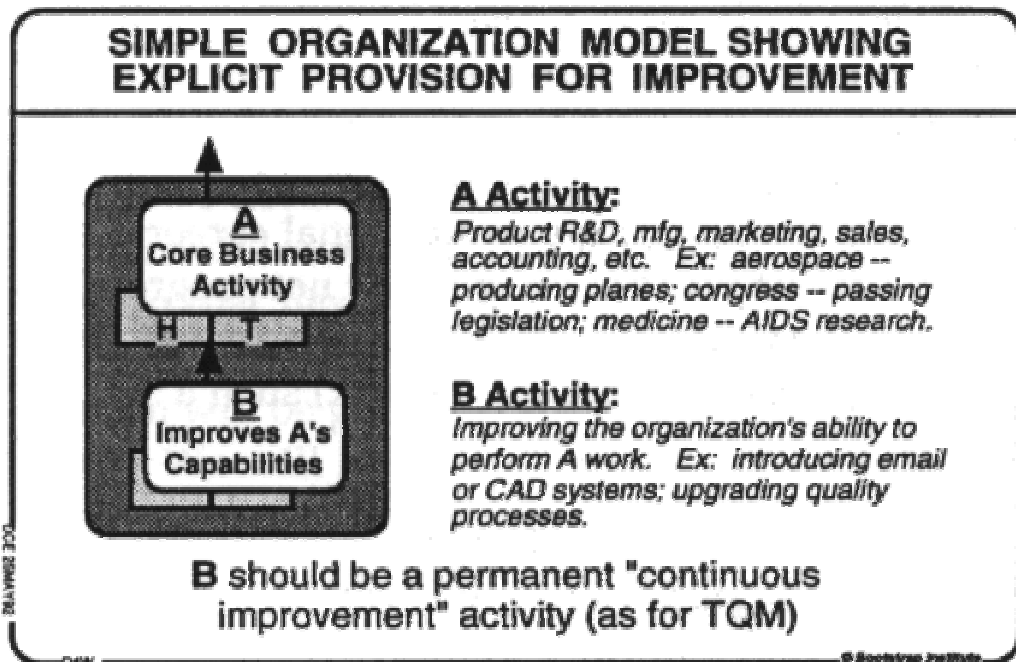
Moving from “Invisible Hand” to Strategy

The good news is that it is possible to build an infrastructure that supports discontinuous innovation. There is no need at all to depend on mystical, invisible hands and the oracular pronouncements hidden within the marketplace. The alternative is conscious investment in an improvement infrastructure to support new, discontinuous innovation.

This is something that individual organizations can do – it is also something that local governments, nations, and regional alliances of nations can do. All that is necessary is an understanding of how to structure that conscious investment.

ABCs of Improvement Infrastructure

The key to developing an effective improvement infrastructure is the realization that, within any organization, there is a division of attention between the part of the organization that is concerned with the organization’s primary activity – I will call this the “A” activity – and the part of the organization concerned with *improving* the capability to perform this A-Level function. I refer to these improvement efforts as “B” activities. The two different levels of activity are illustrated in Figure 1.



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Figure 1. Infrastructure fundamentals: A and B Activities (Engelbart, 1962, 1992)

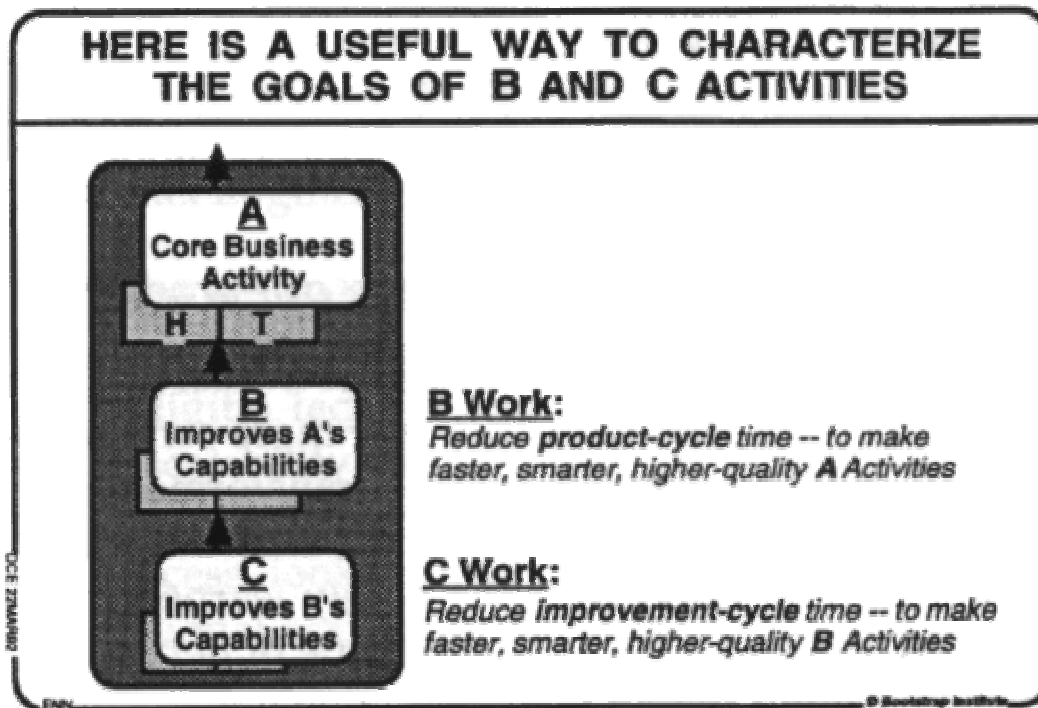
The investment made in B activities is recaptured, along with an aggressive internal rate of return, through improved productivity in the A activity. If investments in R&D, IT infrastructure, and other dimensions of the B activity are effective, the rate of return for a dollar invested in the B activity will be higher than for a dollar invested in the A activity.

Clearly, there are limits to how far a company can pursue an investment and growth strategy based on type B activities – at some point the marginal returns for new

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investment begin to fall off. This leads to a question: How can we maximize the return from investment in B activities, maximizing the improvement that they enable?

Put another way, we are asking how we improve our ability to improve. This question suggests that we really need to think in terms of yet another level of activity – I call it the “C” activity – that focuses specifically on the matter of accelerating the rate of improvement. Figure 2 shows what I mean.



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Figure 2. Introducing "C" level activity to improve the ability to improve (Engelbart, 1962)

Clearly, investment in type C activities is potentially highly leveraged. The right investments here will be multiplied in returns in increased B level productivity – in the ability to improve – which will be multiplied again in returns in productivity in the organization's primary activity. It is a way of getting a kind of compound return on investment in innovation.

The highly leveraged nature of investment in type C activities make this kind of investment in innovation particularly appropriate for governments, public service institutions such as libraries, and broad consortia of different companies and agencies across an entire industry. The reason for this is not only that a small investment here can make a big difference – though that certainly is an important consideration – but also because the investment in C activities is typically pre-competitive. It is investment that can be shared even among competitors in an industry because it is, essentially, investment in creating a better playing field. Perhaps the classic recent example of such investment in the U.S. is the relatively small investment that the Department of Defense made in what eventually became the Internet.

Another example, looking to the private sector, is the investment that companies made in improving product and process quality as they joined in the quality movement. What was particularly important about this investment was that, when it came to ISO 9000 compliance and other quality programs and measures, companies – even competing companies – joined together in industry consortia to develop benchmarks and standards. They even shared knowledge about quality programs. What emerged from this collaborative activity at the C-Level was significant gain for individual companies at the B and A levels. When you are operating at the C-level, collaboration can produce much larger returns than competition.

Investing Wisely in Improvement

Let's keep our bigger goal in mind: we want to correct the current bias, emerging from over-reliance on market forces and the related obsession with ease of use, which gets in the way of developing better computing tools. We want to do this so that we can use computers to augment the capabilities of entire groups of people as they share knowledge and work together on truly difficult problems. The proposal that I am placing on the table is to correct that bias by making relatively small, but highly leveraged investments in efforts to improve our ability to improve – in what I have called type C activities.

The proposal is attractive not only for quantitative reasons – because it can produce a lot of change with a relatively small investment – but also for qualitative reasons: This kind of investment is best able to support disruptive innovation – the kind of innovation that is necessary to embrace a new, knowledge-centered society. The acceleration in movement away from economic systems based on manufacturing and toward systems based on knowledge needs to be reflected in accelerated change in our ways of working with each other. This is the kind of change that we can embrace by focusing on type C activity and on improvement of our ability to improve.

Given all of that, what do we need to do?

The answer to such questions has two different, but complementary dimensions. The first dimension has to do with *process*: How do you operate and set expectations in a way that is consistent with productive type C activity? The second dimension has to do with actual tools and techniques.

Process Considerations

Making an investment in type C activity is not the same as investing in research into new materials or in an ERP system to provide better control over inventory and accounting. Those kinds of investments have very specific objectives and tend to proceed in a straight line from specification to final delivery. Sure, we know that there are usually surprises and unplanned side trips – but that is not the initial expectation. B level investments are supposed to be predictable. Nobody, for example, would think of installing *two* ERP systems – say, SAP and Peoplesoft – to discover which is better. In B-level investment, you make the design decisions up front and then implement the design.

That is not the way it works with C-level investments. Here, you typically do, in fact, pursue multiple paths concurrently. At the C level we are trying to understand how improvement really happens, so that we can improve our ability to improve. This

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means having different groups exploring different paths to the same goal. As they explore, they constantly exchange information about what they are learning. The goal is to maximize overall progress by exchanging important information as the different groups proceed. What this means, in practice, is that the dialog between the people working toward pursuit of the goal is often just as important as the end result of the research. Often, it is what the team learns in the course of the exploration that ultimately opens up breakthrough results.

Another difference between innovation at the C level and innovation that is more focused on specific results is that, at the C level, context is tremendously important. We are not trying to solve a specific problem, but, instead, are reaching for insight into a broad class of activities and opportunities for improvement. That means attending to external information as well as to the specifics of the particular work at hand. In fact, in my own work, I have routinely found that when I seem to reach a dead end in my pursuit of a problem, the key is usually to move up a level of abstraction, to look at the more general case.

Note that this is directly counter to the typical approach to solving focused, B-level problems, where you typically keep narrowing the problem in order to make it more tractable. In our work on improving improvement, the breakthroughs come from the other direction – from taking on an even bigger problem.

So, the teams working at the C-level are working in parallel, sharing information with each other, and also tying what they find to external factors and bigger problems. Put more simply, C-level work requires investment *integration* – a concerted effort to tie the pieces together.

That is, by the way, the reason that the teams that I was leading at SRI were developing ways to connect information with hyperlinks, and doing this more than two decades before it was happening on the web.—hyperlinks were quite literally a critical part of our ability to keep track of what we were doing.

Thinking back to our research at SRI leads me to another key feature of development work at the C-level: You have to apply what you discover. That is the way that you reach out and snatch a bit of the future and bring it back to the present: You grab it and use it.

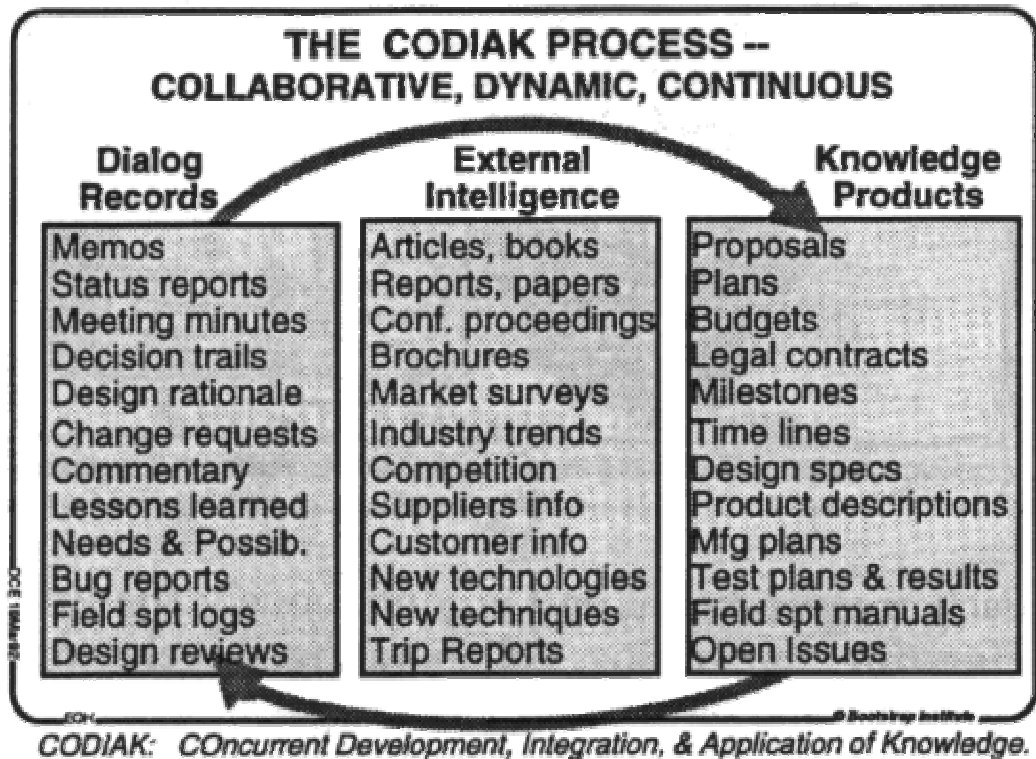
At the C level, then, the approach focuses on:

- Concurrent development
- Integration across the different concurrent activities through continuous dialog and through constant cross checking with external information
- Application of the knowledge that is gained, as a way of not only testing it, but also as a way to understand its nature and its ability to support improvement.

As a mnemonic device to help pull together these key features of the C level process, you can take “Concurrent Development,” “Integration,” and “Application of Knowledge” and put them together in the term “CoDIAK.” For me, this invented word has become my shorthand for the most important characteristics of the C-level discovery activity. Figure 3 illustrates the way that the CoDIAK process builds on

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continuous, dynamic integration of information so that the members of the improvement team can learn from each other and move forward.



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Figure 3. Key elements of the CoDIAC process (Engelbart, 1992).

Investment in Tools and Techniques

How can governments and institutions make a highly leveraged investment in a different kind of innovation – one that will open up new opportunities and capabilities in computing? Part of what is needed is a new approach to the process of innovation – that is what CODIAK is all about. But pursuit of CODIAK requires, in itself, some technical infrastructure to support the concurrent development and continual integration of dialog, external information, and new knowledge. If this sounds somewhat recursive to you, like the snake renewing itself by swallowing its own tail, be assured that the recursion is not an accident. As I just said, one of the key principles in CODIAK is the application and use of what you learn. That recursive, reflective application gets going right at the outset.

So, what do we need to get started?

One of the most important things that we need is a place to keep and share the information that we collect – the dialog, the external information, the things that we learn. I call this the “Dynamic Knowledge Repository,” or DKR. It is more than a database, and more than a simple collection of Internet web sites. It doesn’t have to be all in one place – it can certainly be distributed across the different people and organizations that are collaborating on improving improvement – but it does need to be accessible to everyone – for reading, for writing, and for making new connections.

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The DKR is a wonderful example of the kind of investment that you can start making at the C level, with modest means, that will pay dividends back as it moves up the line to the B and the A levels. This is exactly what I mean when I talk about “bootstrapping.” It is a very American term – the image is of someone able to perform the wonderful, impossible trick of pulling himself up by pulling up on his own bootstraps – but the idea is one that we put into practice every time that we “boot up” a computer. A small bit of code in a permanent read only memory knows how to go out to the disk to get more instructions, that in turn know how to do even more things, such as getting even more instructions. Eventually, this process of using successive steps to lead to ever bigger steps, building on each other, get the whole machine up and running. You start small, and keep leveraging what you know at each stage to solve a bigger and bigger problem.

This is precisely the kind of outcome that can come from investment in building a DKR at the C level. What you learn there can be used to improve work at the C level, which in turn improves ability at the B level, which then translates into new capability at the primary, A level of the organization.

Another key, early investment is in the development of tools to provide access to the knowledge in the DKR for all classes of users, from beginners to professional knowledge workers expecting high performance. This “hyperscope” – that is my term for it – allows everyone to contribute and use the information in the DKR according to his or her ability. It avoids the problem of making everyone, even the pros, play with the same, over powered tennis racquets that are helpful for beginners.

Tied to the hyperscope is the ability to provide different *views* of the knowledge in the DKR – and I do mean “views” – stressing the “visual” sense of the term. Moving away from words on a page, we need to be able to analyze an argument – or the results of a meeting – visually. We need to move beyond understanding the computer as some kind of fancy printing machine and begin to use it to analyze and manipulate the symbolic content of our work, extending our own capabilities. We already do this in specialized cases – one of the most spectacular recent examples was the use of high performance computing in the analysis of the sequences that make up the human genome. Now we need to extend that to the more general class of problems that groups of people encounter as they work together, try to understand each other, and reach collaboratively for decisions.

Another critical focus area for tool and technology development centers on the way that humans interacts with computers. As you know, it was in the course of trying to broaden the bandwidth of the connection between humans and computers, incorporating both visual and motor skill dimensions, that I developed my most famous invention, the computer “mouse.”

There is so much more to be done here – I feel that we have just scratched the surface. Figure 4 provides you with an overview of this very fertile field and opportunity for breakthrough innovation.

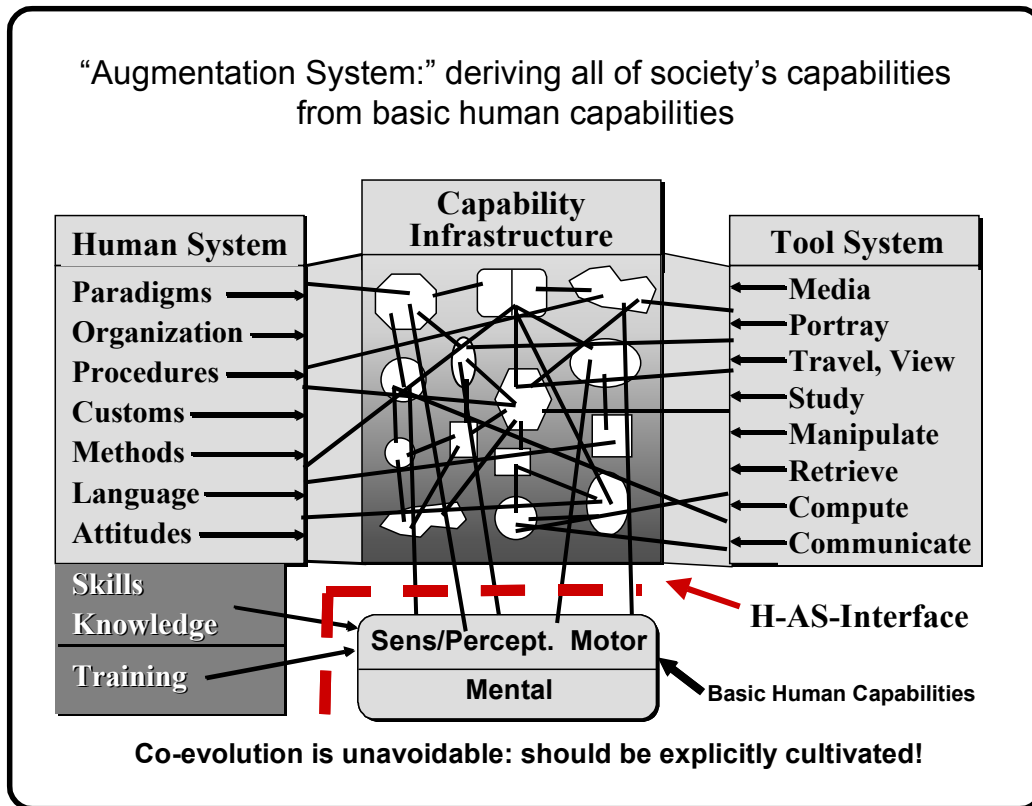


Figure 4, The Human-Augmentation System Interface (Engelbart, 1962, 1992)

The Capability Infrastructure – which is the thing in the middle of this picture and is what we are talking about improving when we are working at the C level of innovation – combines inputs from both the tool system and the human system. The tool system – that’s the contribution from the computer, provides access to different media, gives us different ways to portray information, and so on. The human system brings its rich store of paradigms, information captured in customs, and so on. The more static parts of this collection can be added directly into the Capability Infrastructure through construction of ontologies and other artifacts.

The human system, as the part of this framework that is best at learning, also brings the opportunity to develop new skills, benefit from training, and to assimilate and create new knowledge. These dynamic elements are the “magic dust” that makes the whole system capable of innovation and of solving complex problems. These are what make an “augmentation system” different than a mere automation system.

These valuable, dynamic, human inputs must of course come into the system through the human’s motor and perceptual capabilities. It is the boundary between these human capabilities and the rest of the infrastructure – represented by the heavy, broken line in this figure and labeled “H-AS Interface” that – in a very real sense – defines the scope of the capabilities of this augmentation system. If this interface is low bandwidth and able to pass only a small amount of what the human knows and can do – and what the machine can portray – then the entire system tends to be more “automation” than “augmentation,” since the computer and the human are being kept apart by this low-fidelity, limited interface.

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If, on the other hand, this interface can operate at high speed and capture great nuance – perhaps even extending to changes in facial expression, heart rate, or fine motor responses, then we greatly increase the potential to integrate the human capabilities directly into the overall system – which means that we can then feed them back, amplify them, and use them.

When you begin to conceive of the human-system interface in this way, the whole notion of “ease of use” – this matter that we are now so obsessed with – appears, as it should, as merely a single and, in the grand scheme of things, not terribly important dimension within a much richer structure. The key to building a more powerful capability infrastructure lies in expanding the channels and modes of communication – not simplifying them.

This is very powerful, exciting stuff. If we begin to act on THIS notion of our relation, as humans, to these amazing machines that we have created, we really begin to open up new opportunities for growth and problem solving.

The point here is that the commitment to the CODIAK process leads to very specific directions for investments in technology development – the kinds of investments that your companies, agencies, institutions, and governments can make. And the reason for making them is to open the doors to new kinds of innovation – giving you the power to address much harder, but potentially much richer kinds of problems.

Your Involvement Matters

I want to tell you again why this matters so much, with the hope of securing your commitment to help in moving us out of the dangerous, disappointing, narrow path that we seem to be stuck with following.

The feature of humans that makes us most human – that most clearly differentiates us from every other life form on Earth – is not our opposable thumb, and not even our use of tools. It is our ability to create and use symbols. The ability to look at the world, turn what we see into abstractions, and to then operate on those abstractions, rather than on the physical world itself, is an utterly astounding, beautiful thing, just taken all by itself. We manifest this ability to work with symbols in wonderful, beautiful ways, through music, through art, through our buildings and through our language – but the fundamental act of symbol making and symbol using is beautiful in itself.

Consider, as a simple, but very powerful example, our invention of the negative – our ability to deal with what something is NOT, just as easily as we deal with what it IS. There is no “NOT,” no negative, in nature, outside of the human mind. But we invented it, we use it daily, and divide up the world with it. It is an amazing creation, and one that is quintessentially human.

The thing that amazed me – even humbled me – about the digital computer when I first encountered it over fifty years ago was that, in the computer, I saw that we have a tool that does not just move earth or bend steel – but we have a tool that actually can manipulate symbols and, even more important, *portray* symbols in new ways, so that we can interact with them and learn. We have a tool that radically extends our capabilities in the very area that makes us most human, and most powerful.

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There is a native American myth about the coyote – a native dog of the American prairies – and how the coyote incurred the wrath of the gods by bringing fire down from heaven for the use of mankind, making man more powerful than the gods ever intended. My sense is that computer science has brought us a gift of even greater power – the ability to amplify and extend our ability to manipulate symbols.

It seems to me that the established sources of power and wealth understand, in some dim way, that the new power that the computer has brought from the heavens is dangerous to the existing structure of ownership and wealth in that, like fire, it has the power to transform and to make things new.

As the recipient of my country's National Medal of Technology, I am committed to raising these issues and questions within my own country.

We need to become better at being humans. Learning to use symbols and knowledge in new ways, across groups, across cultures, is a powerful, valuable, and very human goal. And it is also one that is obtainable, if we only begin to open our minds to full, complete use of computers to augment our most human of capabilities.

The Bootstrap Alliance

I come to this conference representing my own small organization, the Bootstrap Alliance. We don't sell a product – or anything else. But we do offer an opportunity for you to be actively engaged with other people and other institutions that are interested in understanding how to use this new fire that has been brought down from the heavens.

More specifically, the Bootstrap Alliance is an improvement community that is made up of other improvement communities – we are focused on improving the ability to improve, and on helping other groups that share those interests do a better job of it. We exist to help C-level organizations do a better job of being C-level organizations. Our approach to this, not surprisingly, is based on concurrent development, integration, and application of knowledge across those different pioneering communities.

If you are interested in investing in the kind of critically important, highly leveraged mechanisms for change that I talk about here – in using the fire brought down from heaven – please come up and talk to me or e-mail me at doug@bootstrap.org. We have a lot of work to do together, and no time at all to be patient.

References

I would like to recognize the assistance I had from Bill Zoellick in preparing this paper, particularly for his contributions concerning recent copyright activity and regarding the interaction of markets and innovation.

Christensen, Clayton. *The Innovator's Dilemma*. Harvard Business School Press, Boston, USA, 1997.

Engelbart, Douglas C. 1962. "Augmenting Human Intellect: A Conceptual Framework." 1962 <http://www.bootstrap.org/institute/bibliography.html>

Engelbart, Douglas C. 1992. "Toward High-Performance Organizations: A Strategic Role for Groupware" <http://www.bootstrap.org/augdocs/augment-132811.htm>

Zoellick, Bill. *CyberRegs*. Addison-Wesley, Boston, USA, 2002.

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