Things That Make Us Smart:
Implications for Record-Keeping by Organizations

Owen Ambur, February 9, 2003

In his book entitled *Things That Make Us Smart*, published in 1993, Donald Norman asserted: "Today we serve technology. We need to reverse the machine-centered point of view and turn it into a person-centered point of view." (p. xi) He also noted: "Technology ... gives power to those who have it, thereby disenfranchising those who do not." (p. 5) The same can be said of information, and that is one reason people choose *not* to share it freely.

Aside from the issue of sharing information to foster common understandings among groups of people, Norman makes another important point with respect to the mental processes of *individual* human beings: "There are many modes of cognition, many different ways by which thinking takes place. The two modes [that are] particularly relevant ... are called *experiential* cognition and *reflective* cognition." (pp. 15-16)

While Norman does not address records or records management explicitly as an organizational discipline, he hints at its importance, beginning with the following observation: "... the use of external aids facilitates the reflective process by acting as external memory storage, allowing deeper chains of reasoning over longer periods of time than possible without the aids." (p. 25)

With respect to the more "cerebral" of the two cognitive modes, he notes: "The reflective mode is that of concepts, of planning and reconsideration. It is slow and laborious. ***Reflective cognition tends to require both the aid of external support – writing, books, computational tools – and the aid of other people***." (p. 25, emphasis added) Contrasted to the experiential mode:

> Reflection is best done in a quiet environment, devoid of material save that relevant to the task. ***Rich, dynamic, continually present environments can interfere with reflection***: These environments lead one toward the experiential mode, ***driving the cognition by the perceptions of event-driven processing, thereby not leaving sufficient mental resources for the concentration required for reflection***. In the terms of cognitive science, reflective cognition is conceptually driven, top-down processing. (p. 25, emphasis added)

Norman suggests, "From a practical point of view, the distinction between experiential and reflective thought is worth considering, in part because much of our technology seems to force us toward one extreme or the other. With proper artifacts, we can enhance each mode." Toward that end, he avers: "... tools for reflection must support the exploration of ideas. They must make it easy to compare and evaluate, to explore alternatives."[1] (p. 26)

The implication is that people will not go very far out of their way or expend significant effort to break out of the experiential mode in order to consider alternatives and engage in reflective

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[1] Dawes says failure to consider sufficient alternatives leads to irrational decision-making. See http://ambur.net/irrationality.pdf

thought.

Indeed, Norman says, "...the tools must be invisible: They must not get in the way. If tools are designed inappropriately, or for that matter, if appropriate tools are used in inappropriate ways and places, various dangers may arise ..." (p. 26) For example, with respect to the available automated tools, he suggests: "Many electronic decision aids tend to restrict the availability of information to small segments visible on the relatively limited display. This makes it difficult to integrate disparate sources of information, difficult to explore and to make comparisons." (p. 27)

The implication is that people may not have clear and complete records upon which to make decisions. Moreover, since there is a natural tendency to favor experiential over reflective cognition, people may *prefer not to have* such records.

In support of that line of thought, of the various dangers associated with the ill design and misuse of cognitive tools, the one Norman believes poses ***the greatest peril is that of "experiencing when one should be reflecting ... where entertainment takes precedence over thought."*** (p. 27, emphasis added)

The implication is that individuals and groups of people, both in organizations as well as in ad hoc meetings, may be more interested in being entertained than in engaging reflective thought that contributes to learning, innovation, increased productivity, and excellence.[2]

With respect to how we add to our mental store of knowledge, Norman cites "Accretion [as] the accumulation of facts." However, he noted, "...when there isn't a good conceptual background, then accretion is slow and arduous... It requires repeating the material over and over again (rehearsing), using mnemonic strategies, or writing down the information." (p. 28) Note the reciprocal nature of the *recording* of information (i.e., creating records) with respect to learning. Not only does it facilitate the sharing and reuse of knowledge, but it also aids the retention of knowledge in our heads.

And that begs the question of why we should worry about accreting, much less retaining many kernels of knowledge in our heads – particular matters of fact – if they are readily available in records whenever and wherever we need them. That may have been impractical prior to the widespread availability of the Internet and further maturation is still required to make records readily available via parametric searches, rather than merely via full-text searches and/or finite and arbitrary indices of hypertext links. However, rapid expansion of the use of Extensible Markup Language and the potential usage of XML metatags embedded within records throughout the Web holds the promise to make reality of the vision of anywhere, anytime

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[2] For additional information on the use of technology to facilitate collaboration, see Michael Schrage's book entitled *Shared Minds: The New Technologies of Collaboration*, which was updated and republished under the title *No More Teams! Mastering the Dynamics of Creative Collaboration*. Some of the points made by Schrage are discussed in my papers at http://ambur.net/Persist.html, http://ambur.net/irrationality.htm, and http://ambur.net/Discuss.html.

information on demand.

Toward that end, Norman observed, “The difficult part of learning is forming the right conceptual structure ...” and that the “reflective mode is essential for restructuring.” (p. 30) Although his frame of reference was individual learning, in the context of organizations and the Web, the term “conceptual structure” can be interpreted to mean a taxonomy, which can be represented in the form of XML data elements organized as an XML schema. Moreover, the relevant elements of the taxonomy can be represented directly within each kernel of knowledge (i.e., each record) – in XML metatags and/or in external indices that point to the relevant records.

External indices and internal metatags are complementary: Metadata embedded within individual records can be “harvested” (copied) and stored in external indices, to enhance search and retrieval speed as well as to provide specialized libraries of knowledge for myriad communities of interest/practice. At the same time external taxonomies can be used as controlled vocabularies to assist with embedding the appropriate elements of metadata within individual, widely distributed records on the Internet – thereby helping to establish a virtuous learning cycle in the generation and dispersal as well as the accretion and aggregation of knowledge.

With reference to virtuous cycles in human life, Norman says studies show “... the quality of life depends upon two factors: how we experience work and our relation with other people.” That implies a natural preference for experiential rather than reflective cognition. On the other hand, he suggests activities supporting positive experiences are those that “have built in goals, feedback, rules and challenges, all of which encourage one to become involved in one’s work, to concentrate and lose oneself in it.”

Norman argues leisure time generally does not have such properties. Moreover, he notes the disruptive nature of tools that require users to “experience” and attend to them while engaged in meaningful activities: “... in performing a task, the person has a focus and a goal. All attention should be concentrated upon the task itself, not upon the tool. When the tool calls attention to itself, that creates a breakdown in the work flow. Tools should stay in the background, becoming a natural part of the task.” (p. 34)

Norman observes one of the powers of the experiential mode: “The mind is externally driven, captured by the constant arrival of a barrage of sensory information.” (p. 35) By contrast, he points out: “... to learn, to improve, to train oneself ... requires reflection upon the performance, the better to know what to change and what to keep.” (p. 36) In that respect and contrary to popular celebration, Norman observes: “***The power of the unaided mind is highly overrated. Without external aids, memory, thought, and reasoning are all constrained***.” (emphasis added)

With a reflective mind toward improvement, he asks, “How have we increased memory, thought, and reasoning?” And he responds that it is “by the invention of external aids.” In short, he says, “***It is things that make us smart***.” (p. 43, emphasis added)

Again without really getting at the nub of the issue – which is the creation, management, sharing, and use of records – he comes close to making that point in the following assertion: “Probably

the most important of our external aids are paper, pencil, and the corresponding skills of reading and writing." (p. 44) Note that, writing in the early part of the last decade of the 20th century, Norman did not place computers and the Internet on par with the value of paper and pencils. (Presumably, he placed pens in the same class of importance as pencils.) However, he does credit "modern technology" with enabling us to find and retrieve information once it has been recorded, a point addressed in further detail below.

Taking up a converse line of reasoning, Norman notes that "Socrates ... argued ... books would destroy thought." He points out that "Socrates is famous for his dialogues between teacher and student in which each questions and examines the thoughts of the other... But the author doesn't come along with a book, so how could the book be questioned if it couldn't answer back? This is what bothered Socrates... Socrates was concerned with reflective thought: the ability to think deeply about things, to question and examine every statement. He thought that reading was experiential, that it would not lead to reflection." (p. 44-45) Norman quotes Socrates as follows:

> ... anyone who leaves behind him a written manual, and likewise anyone who takes it over from him, on the supposition that such writing will provide something reliable and permanent, must be exceedingly simple-minded; he must really be ignorant ... if he imagines that written words can do anything more than remind one who knows that which the writing is concerned with... once a thing is put in writing, the composition, whatever it might be, drifts all over the place, getting into the hands not only of those who understand it, but equally of those who have no business with it; it doesn't know how to address the right people, and not to address the wrong. (p. 45)

It is somewhat ironic that Socrates thought the dialogue must be directly *experienced* in order to foster reflection, whereas Norman suggests over-reliance on the experiential mode of cognition *distracts* from reflection. It is even more ironic that what Socrates thought or said would be of little note, nor long remembered if someone like Plato had not taken the time and trouble to write it down, in which case we would never have *heard* of Socrates, much less what he *thought* or said.[3]

In the light of the modern version of Plato's cave that is the Internet, the dynamic of which Socrates spoke sounds more like rumors – which are orally and secretively communicated and often contain only shreds of truth – than of documentary evidence, which by very nature of its "permanence" is readily subject to reflection, by well-informed people, individually and

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[3] The phrase "little note, nor long remember" is a quote from Lincoln's Gettysburg Address, which, contrary to Lincoln's assertion, *has* been widely noted and long remembered – because it was inscribed (recorded) on paper. Were it not so, even those of us who may have memorized it in school would have long since forgotten much of it, and the *password effect* may have altered many of its words, if not also its basic concepts. For example, in my own mind the words "long remember" had been replaced by "oft remembered"; perhaps because the word "oft" is associated with speech in "olden days". The actual text of Lincoln's landmark address is available at http://www.loc.gov/exhibits/gadd/4403.html.

collectively.[4] At the very least, Socrates' notion is elitist, as if only a select few are qualified to determine the true state of reality. Be that as it may, Norman turns the shadowy confines of Plato's cave into an unbounded strength, even in pre-historic times, by pointing out:

> The cognitive age of humans started when we used sounds, gestures, and symbols to refer to objects, things, and concepts. The sound, gesture, or symbol is not the thing itself, rather, it stands for or refers to the thing: It represents it. The powers of cognition come from abstraction and representation: the ability to represent perceptions, experiences, and thoughts in some medium other than that in which they have occurred, abstracted away from irrelevant details. This is the essence of intelligence, for if the representation and the processes are just right, then new experiences, insights, and creations can emerge. (p. 47)

With respect to the power of abstractions, Norman notes:

> ***A good representation captures the essential elements of the event, deliberately leaving out the rest***... A representation is never the same as the thing being represented, else there would be no advantage to using one. The critical trick is to get the abstractions right, to represent the important aspects and not the unimportant... Herein lie both the power and the weakness of representations: Get the relevant aspects right, and the representation provides substantive power to enhance people's ability to reason and think, get them wrong, and the representation is misleading, causing people to ignore critical aspects of the event or perhaps form misguided conclusions. (p. 49, emphasis added)

He points out that the "ability to represent the representations of thoughts and concepts is the essence of reflection and of higher-order thought. It is through metarepresentations that we generate new knowledge, finding consistencies and patterns in the representations that could not readily be noticed in the world." (p. 51) For better or worse, in support of truth or fiction, Norman avers:

> Reflective artifacts allow us to ignore the real world and concentrate only upon artificial, representing worlds... The ***danger occurs whenever we fool ourselves into believing that the representation is the reality***... When we concentrate only upon the information represented within our artifacts, anything not present in the representation can conveniently be ignored. In actuality, ***things left out are mostly things we do not know***

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[4] Dr. Tom Kerns evokes the image of Plato's cave: People are in a cave, chained to a wall and watching shadows cast on the back wall of the cave, and this is their whole life. Behind them is a raised walkway on which people walk carrying statues of dogs and tables and mountains, and books and trees and everything else in the world. Behind those people with their statues is a fire whose light casts shadows of the statues onto the wall. So what the people are actually seeing are shadows of statues of things. That is, what they are seeing is something several removes from the real, namely an image of an image of a real thing. Kerns sums up Plato's view as follows: "Plato thinks of our physical world as a kind of shadow world, one that is a little bit real, but not ultimately real. For Plato, our world is (and we all are) moving images of eternity." http://students.washington.edu/tkerns/waol-phi-website/lecsite/lec-plato\'scave.html.

> ***how to represent, which is not the same as things of little importance***. Nonetheless, things not represented fall in importance. They tend to be forgotten or, even if remembered, given little weight. (pp. 52-53, emphases added)

Indeed, with respect to what is and is not included in representations, Norman reiterates a point often made by others: "***Solving a problem simply means representing it so as to make the solution transparent***." (p. 53, emphasis added) In other words, the incomplete, shadowy, and *ephemeral* representations of Plato's Cave must be replaced with representations capturing and recording the most essential and relevant aspects of reality, while *maintaining* those representations in unaltered form long enough to facilitate reflection, consideration of alternatives, and establishment of previously unrecognized relationships.

The implication is that by over-reliance on experiential cognition, story telling, tacit knowledge, personal relationships and other abstractions that exclude important elements of reality, organizations and individuals are a condemning themselves to experience the Sisyphian dilemma of failing to solve problems and continually reliving the past.[5]

With respect to relationships, Noman notes: "The mind is well equipped to retain large amounts of meaningful material, as long as the material has pattern and structure. It is the meaningless, arbitrary stuff of modern life that gives so much trouble." (pp. 77-78)

Thankfully, computers are highly adept at divining patterns in vast quantities of seemingly unrelated data. We are just beginning to tap the potential of pattern recognition software to glean as yet unidentified meanings embedded but masked in the vast quantities of cognitive artifacts (records) being created every day by virtue of the rapidly growing use of computers to conduct our business and social affairs.

Implications include fear and resistance by organizations and individuals who are insecure and unsure of their own self-worth and contributions to society, as well as those who knowingly and willfully prey upon the good will and/or weaknesses of others. The last thing such individuals and organizations desire is persistent, readily available artifacts (records) enabling others to hold them accountable for their behavior, much less forcing them to face the essential realities of their own existence themselves.

With respect to the power of artifacts, as representations of meaning, Norman points out:

> There are two views of a cognitive artifact: The *personal* point of view ... impact the artifact has for the individual ... and the *system* point of view (how the artifact + person, as a system, is different from the cognitive abilities of the person alone). From a person's *personal* point of view, artifacts don't make us smarter or make us have better memories; they change the task. From the system point of view, the person + artifact is more

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[5] Sisyphus was a tragic figure in Greek mythology who was condemned eternally to pushing a heavy stone up a steep hill, only to have it roll back down again. http://www.pantheon.org/articles/s/sisyphus.html

> powerful than either alone. Performance of the *system* of person + artifact is indeed enhanced, but that of the individual person is not. (p. 78)

The implication is that ***insecure and self-centered individuals do not need or want good records – because their focus is on their own existence, experience, personal advancement, and self-reinforcing view of the world, rather than participation in a virtuous cycle in collective pursuit of an enhanced, higher-order sense of reality and truth, much less honor and justice***.

However, faced with an onslaught of information technology that records every mouse click and keystroke, such individuals (as well as organizations that share their self-directed focus) will have a harder and harder time avoiding the documentation of their words, actions, and deeds, if not also their intentions. Less and less will it be possible for them to remain "invisible" or missing in action when called upon to act responsibly or to account for past actions/inaction.

Turning to a more mundane, impersonal type of invisibility, Norman highlights the fact that "...before all this electronic and computer stuff came along with its invisible representations, we used to be able to see just how our artifacts worked." (p. 79) However, that has changed, as he observes:

> The abstraction possible with today's electronic devices means that there doesn't have to be any natural relationship between the appearance of an object and its state. When a physical file folder is open, it is visibly different from when it is closed. When it is stuffed with paper, it looks different that when it is empty, even when closed. Not so with electronic files... The difference is that with the physical folder, the visible properties are an automatic intrinsic part of its existence, whereas with the electronic folder, any perceivable existence is dependent upon the goodwill and cleverness of its human designer, who provides a perceivable interpretation of the underlying invisible information structures. (p. 79)

Relative to the visibility of the meanings represented in cognitive artifacts, Norman posits: "The natural visibility of artifacts divides them into two broad categories, *surface* and *internal* artifacts. ... With surface artifacts, what we see is all there is: They only have surface representations... In contrast to surface artifacts there are internal artifacts, in which part of the information is represented internally within the artifact, invisible to the user." (p. 80)

Again touching on the relevance and importance of records without making the point directly, he observes: "... human surface representations are temporary. Sound fades away, gesture and actions disappear once completed. ***External surface representations can overcome the limitations of human surface representations. External representations, such as marks and images, can be permanent... proper artifacts ... have the virtue of being forever repeatable.***"[6]

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[6] Due concerns about the quality of information disseminated by Federal agencies, Congress passed a law requiring the Office of Management and Budget to information dissemination quality guidelines applicable to all Executive Branch agencies. A key aspect of those guidelines is that the information should be *reproducible* (i.e., repeatable) upon

(p. 82, emphasis added)

The implication is that "shallow" individuals as well as organizations whose products and services are based more on hype than substance will naturally resist documentation of the lack of depth and substance to their contributions to society and the future of humankind.

Norman addresses two attributes of external surface representations, or what might be called "records":

> *Memory permanence* ... external memory, maintaining an accurate record of the words and concepts ...
>
> *Memory quantity* ... the effective presentation of more information than can be kept active within a person's memory, allowing the viewer to examine different areas selectively, confident that material passed over can be quickly and easily retrieved simply by moving the eye fixation to the appropriate location. (p. 83)

With respect to what is "seen," he makes a very important point: "... ***what you perceive is not necessarily what is there***. The *psychology* of perception is very different from the *physics* of perception." (p. 91, emphasis added) That is another reason why good records are important – so that they can be reviewed as often as necessary while engaging in reflective thought aimed at ensuring that what is interpreted is what was actually meant.

Of course, too, it is equally important to ensure that what is meant is what is actually recorded. Some cultures place the burden disproportionately upon the recipient to fill in the blanks with respect to implicit (undocumented) meanings, and those who are unable to do so are perceived to be socially inept.[7] However, logic suggests that the burden is first and foremost upon the person instigating the communication, simply because causes precede effects.

In that regard and with reference to perceptions of the possible functions of objects, Norman

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independent analysis by those who are unbiased and capable of producing such information. See http://xml.gov/documents/completed/OMBinfoquality.htm. Thus, as if the relationship were not already sufficiently clear, OMB's guidelines reinforce the connection between Norman's concept of cognitive artifacts (i.e., records) and the quality of information created, disseminated, and shared by individuals and organizations.

[7] In *The Cultural Dimension of International Business*, Gary Ferraro addresses Edward\ Hall's conceptualization of high- versus low-context cultures. In high-context cultures most of the message is embedded in the physical context or internalized in the people, while relatively little is in the explicit, coded portion of the message. Communicators use restricted codes and rely on contextual cues, demonstrating inexact, implicit, and indirect communication patterns. Conversely, in low-context cultures rely on elaborated verbal messages and demonstrate precise, explicit, and straightforward communication patterns. For further discussion of this topic, see references to Hall and Ferraro at http://ambur.net/reflectionjournal625.htm.

introduces the concept of *affordances* and says: "In design, the critical issue is perceived affordances: what people perceive the object can do. We tend to use objects in ways suggested by the most salient perceived affordances, not in ways that are difficult to discover." (p. 106) For example, he notes: "Television organizes its information in time, newspaper in space. The result is that television paces the reader (it is event-paced), whereas with the printed page, it is the reader who sets the pace (it is self-paced). This is why the printed page provides better affordances for reflection than does the television show." (p. 107)

Regarding the present state of human intellect, Norman observes: "... ***human intelligence*** has evolved through a series of evolutionary steps to its present form – a form, moreover, that ***is highly dependent upon external, artificial representations for its power***." (p. 121, emphasis added)

Of the future potential, he proffers: "Today our abilities to mime, use language, and reason are expanded through the power of writing, external representations, and tools. ... we have taken evolution into our own hands, providing external devices ... 'cognitive artifacts' – to expand our abilities beyond that which our biological heritage alone makes possible. ***The future of human evolution is through technology.***" (p. 123, emphasis added)

Distinguishing humans from other animals, Norman notes: "Animals that work together must learn to synchronize and coordinate their activities. In highly social animals such as the baboon, a considerable part of each day is spent establishing and maintaining social roles. The most fruitful interaction requires that each animal knows what the other animal knows and plans to do." (pp. 123-124)

In the context of human systems, having to devote so much time and effort to becoming "socialized" is counterproductive if the goal is to advance the state of knowledge, as opposed simply to maintaining current organizational hierarchies, power structures, and so-called "legitimate" means of conducting business.[8]

More specifically, with respect to group dynamics, the implication is that project/task teams need to spend less time in the forming and norming stages so that more effort can be focused on storming and performing. The "agile corporation" is a buzzword used to describe businesses that have adopted such a philosophy in order to add greater, more cerebral (reflective) value and keep ahead of the competition in a marketplace where lower order (experiential) organizational skills may no longer be highly valued, because they have become commodities.

As Norman points out: "Simple synchronization and cooperation do not necessarily require much brainpower. Ants cooperate in an impressive variety of tasks, but this cooperation is built in, part of the wiring of their nervous systems and not a result of any conscious desire to work together... ***The problem with*** these ***built-in cooperative patterns is that they are fixed and unvarying. They***

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[8] The higher-order legitimacy of so-called legitimate sources of social power are questionable in the cyberage. For a discussion of that topic, see http://ambur.net/French&Raven.htm.

do not change even when the conditions requiring cooperation no longer exist. It is this lack of flexibility that distinguishes evolutionary, biological cooperation (the wired-in kind) from intentional, cognitive cooperation." By contrast, "True cooperative behavior requires some sort of shared knowledge and conscious desire to cooperate." (p. 124, emphasis added)

Consider those requirements and the weakness of "built-in cooperative patterns" in relation to the current state of our organizations, where power structures are still based largely upon fixed hierarchies and restrictive policies for sharing of information.

With regard to sharing and reflecting upon information, Norman points out that "... language allows us to go beyond simple statements about world states. ... thereby setting up a comparison of the not-yet-happened world state of today with the remembered one of yesterday, communicating our hopes and desires. There is no way to express such thoughts without language... The important point is that humans have a rich, though limited, representational capacity, one that can be expanded upon through external structures."[9] (p. 125-126)

On the other hand, he reiterates, "the human brain is ... limited in how much advance planning it can do. Our working memory is limited in capacity." (p.126) To overcome those limitations, he says, "We expand the mind's representational power through the use of external structures and representations, through cognitive artifacts." He reiterates: "... ***the real power of the human mind, today and in the future, lies with our technologies***. Through technology, we develop external representations and systems that join with our cognitive abilities to provide skills far beyond what can be accomplished through the unaided mind." (p. 127, emphasis added)

Regarding our strengths, Norman observes:

> We are excellent perceptual creatures. Experiential mode is our preferred way of working: See a pattern, immediately understand it... This is a marvelous facility, but it can be a dangerous one, for there really is not enough information in that fragment to make a precise identification. The rapid identification process usually works because the number of different events or different people that we are apt to encounter is limited. Moreover, the events are not evenly distributed: Some are a lot more frequent than others. It is those frequent events that we can identify so rapidly. Infrequent events are much more difficult... The problem with infrequent events is that they are indeed infrequent. When they occur, our fast-working recognizing apparatus is apt to have already sprung into action and classified it – as something we already knew, something that was more frequently encountered. Worse, we are usually so confident that our initial judgment is correct that we seldom even question it. This tendency not only contributes to some types of error, but it then makes it difficult to *discover* error. (pp. 127-128)

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[9] Norman also highlights the fact that "Artificial languages tend to have a nice, formal structure." (p. 117) The formal, standardized structure of Extensible Markup Language (XML) enables the sharing of information across organizational and system boundaries far more efficiently than possible without such structure.

In a related line of argument, Robyn Dawes says we habitually engage in irrational thought, by ignoring obvious alternatives.[10] In that respect, Norman observes: "Much of our decision making and problem solving is done by analogy, by comparing the current situation with some earlier experience. What kind of earlier experience? One that matches on the major features, one that is available in memory. But ***human memory is flawed: The things available in memory are apt to have one of two characteristics – they happened recently, or they had some unique, emotional impact.***"[11] (p. 128, emphasis added)

Moreover, with respect to Norman's assertion that we are usually so confident our initial judgment is correct that we seldom question it, Dietrich Dorner asserts:

> An individual's reality model can be right or wrong, complete or incomplete. ***As a rule it will be both incomplete and wrong,*** and one would do well to keep that probability in mind... ***People are most inclined to insist they are right when they are wrong and when they are beset by uncertainty***... People desire security. ... And this desire prevents them from fully accepting the possibility that their assumptions may be wrong or incomplete... ... ***the ability to make allowances for incomplete and incorrect information and hypotheses is an important requirement for dealing with complex situations***. This ability does not appear to come naturally, however. One must therefore learn to cultivate it. (p. 42, emphases added)[12]

In a similar vein, Norman says:

> We function by creating mental models – mental explanations of the things we interact with – and if the technology does not provide the information required to create a proper model, we may very well create an improper one. In addition, ***feedback is essential to keep us informed*** ... (p. 138)

Essential to Norman's concept of *feedback* is the availability of current and relatively complete information having the characteristics of a record, as outlined in ISO 15489. With respect to feedback, Charles Savage has addressed the concept of *push-back*, which he characterizes as follows:

> The ***truth is often buried in the confluence of a variety of human perceptions. Only through the give-and-take of hard dialogue can it be discovered***... When someone makes a statement or takes a position, others are expected to push back until the truth of the matter is discovered... A push-back is not a put-down, but signifies an openness and a

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[10] See http://ambur.net/irrationality.htm.

[11] For more information on the flaws or what Schacter calls the "sins" of human memory, see http://ambur.net/MemorySins.htm.

[12] *The Logic of Failure: Recognizing and Avoiding Error in Complex Situations*. My paper on Dorner's book is in progress. [Now available at http://ambur.net/failure.pdf.]

willingness to stick with the issue until the truth is known.[13] (p. 248, emphasis added)

While push-back may not be a put-down, it certainly may be obnoxious and even counterproductive if it is not based upon reasonably sound logic and at least *som*e factual evidence, i.e., records. Likewise, having good records management systems is vital to Dorner's notion of cultivating the capability for dealing with complex systems in which failure is likely. With respect to the logic of failure, Norman points out:

> There are two major classes of error: slips and mistakes. A slip occurs when the action that is performed is not the one intended ... A mistake occurs when the action that is intended is wrong. Mistakes tend to be more serious than slips. People err, that is a fact of life. Another fact is that ***some situations seem as if they were designed to cause errors*** ... (p.131, emphasis added)

That is certainly the effect, if not also the unspoken *intent* of communications and information systems that are ill-designed to manage records in a business-quality manner. Moreover, it is a fact of life that ***those in positions of power, benefit from such systems***, at least in the short-term. We see evidence of that fact in news media reports of business-related scandals every day. We can only speculate about the scope of those that remain undiscovered because the organization's records management system is truly hapless.

Norman cites terms "*functional fixedness, cognitive narrowing, tunnel vision*" to describe a phenomenon that reinforces the dynamic of self-delusion – leading in turn to faulty *groupthink*, *superstition,* and other forms of implicitly and perhaps secretively shared *tacit* "knowledge." With respect to that phenomenon, he notes:

> People tend to focus upon the active hypothesis and, once focused, find it very difficult to change, even in the face of contradictory evidence... as new information comes in, it is interpreted into the picture given by that initial diagnosis. Discrepant information is explained away. The more people involved, the more likely the false trail will be maintained. Each person cleverly thinks of new ways to keep the old hypothesis going...***one of the strengths of human intelligence is that we can diagnose something rapidly, even before all the evidence is in***, then quickly sift the relevant information from the irrelevant... ***The problem is that whenever this wonderful property gets sidetracked by the wrong explanation, it becomes very difficult to get it redirected***. (p. 134-135, emphasis added)

Norman suggests one possible solution to faulty groupthink, but highlights difficulties associated with it and proposes another alternative:

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[13] *5th Generation Management: Co-Creating Through Virtual Enterprising, Dynamic Teaming, and Knowledge Networking*. For additional information on Savage's concept of push-back, see my papers on knowledge management and French and Raven's bases of social power, respectively, at http://ambur.net/6thGenKM.htm & http://ambur.net/French&Raven.htm.

> One way of trying to avoid this trap is to have an outside person come in and review things, deliberately questioning every assumption and decision... The role is difficult to perform, however, for two reasons. First, it is natural for the new person to fall into the same trap as the others did. Second, unless great care and skill are exercised, ***a person who questions every statement and action is apt to be judged a troublemaker***... Here is one case where an intelligent machine has some benefits: It can question the actions and offer advice in a nonthreatening manner... ***What we need is a machine that could maintain a rich, interactive database of past statistics and incidents that would be automatically available when making decisions***. (p. 137, emphasis added)

In short, what we need are automated electronic records management systems that are pervasive both in terms of: a) capturing and securing in inalterable form the information used and decisions made in ongoing business processes – particularly those made by "officials" in the upper echelons of our organizational hierarchies who have the power to make decisions disproportionately affecting the rest of us – and b) making those records widely available to all of the organization's stakeholders.

Indeed, a term has been coined to capture that concept – *open-book management*.[14] However, there are powerful psycho-sociological forces mitigating against truly transparent management.

The specter of "Big Brother" using information inappropriately against us is commonly raised as an excuse for failure to monitor, record, and report the actions of individuals. The thought of holding people accountable for their actions and inactions is commonly said to be "undemocratic" or un-American.

Such concerns are well-taken with respect to the involvement of government in truly personal and purely social activities, but they are not a valid excuse for failure to fully document the actions of individuals in the course of carrying out their responsibilities to the organizations that employ them and/or other individuals or organizations with whom they are engaged in business transactions. The failure to properly manage such records is particularly inexcusable if those activities and transactions are already being carried out by electronic means.

By their very nature, electronic system *automatically* create records. Thus, all that is additionally required is to ensure that those records are properly managed, maintained, and made readily accessible to those who have valid interests in them. At some point, failure to do so begins to imply willful misconduct.[15] Again, though, such behavior should not be surprising in light of the

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[14] See, for example, John Case's book entitled *Open-Book Management: The Coming Business Revolution*. When time permits, I plan to write a paper on it. [Now available at http://ambur.net/openbook.htm.]

[15] For a discussion of malfeasance in the management of records by the U.S. federal government, see http://web.archive.org/web/20000831112042/computer.org/proceedings/meta97/papers/oambur/malfea1.html

psychological and sociological factors supporting it. Having clear and complete records that accurately and fully enable the replication of history goes against the very nature of our being.

For, as Norman notes, "***Highly accurate repetition is not our strength: Imaginative, insightful interpretation is.***" (p. 138, emphasis added) Inevitably, records will eventually and often conflict with our own creative reconstructions of the past, thereby constraining our "freedom" to think, believe, and act as we "wish" (imagine).

In that respect, *Grudin's law* is noteworthy, as Norman explains: "When those who benefit are not those who do the work, then the technology is likely to fail or, at least, be subverted." (p. 113) The implication is that people will subvert systems that maintain records conflicting with their own self-interests, as they perceive them.

In addition, as Norman points out, "The human side of work activities is what keeps many organizations running smoothly, patching over the continual glitches and faults of the system." Taken in that light, systems maintaining highly accurate and complete records may tacitly be viewed with disdain – if the objective of avoiding psychological discomfort to members of the "in-group" is tacitly valued more highly than the truth.

Indeed, as Norman laments, "... inevitable glitches and faults are usually undocumented, unknown." (p. 145) Perversely, that may actually be considered a benefit to the psycho-sociological well-being of the group, at least in the short-run – since its members protected from unpleasant realities that remain unstated and thus unacknowledged, if not exactly unknown.

Moreover, with respect to that which *is* stated, the dynamics of our minds and our organizational constructs fill in any gaps necessary for comprehension. As Norman highlights: "... ***even when communications are ambiguous, they are usually not perceived as such by either speaker or listener, even though both may have different interpretations of the meaning***." (p. 147, emphasis added)

Thus, lacking clear evidence (records) to the contrary, both the speaker and the listener are free to apply his or her own interpretation to whatever is said, which is a win/win situation for both – at least ***until reality interjects itself in terms of consequences that are significantly negative for either or both individuals, as well as other stakeholders whose interests may be adversely impacted***.

Aside from the issue of who gains and who loses from representations of the truth, Norman highlights the power of cognitive artifacts: "Information in the world can be thought of as a kind of storehouse of data... When we need a particular piece of information, we simply look around, and there it is." (p. 147) If only it were that simple. Unfortunately, as we all know and experience on a daily basis, it is anything but easy to find the exact information we need at the exact moment when we need it in order to make good, well-informed decisions.

However, to the degree that information is in fact readily available in the world, as Norman

suggests: “This eases the burden on initial data collection, eases the requirements on learning and memory, and avoids the need for complex indexing or retrieval schemes. Moreover, it guarantees that the values so obtained will be the most timely available at the moment of need.” (p. 147)

With respect to timeliness as well as conservation of cognitive capabilities, he notes: “Of course, it is important to plan ahead, but postponing decisions until the point of action can simplify the thought processes: Many alternatives that would have had to be thought of ahead of time will turn out not to be relevant. Moreover, the physical structures available in the world can then guide the selection of relevant choices.” (p. 147)

In other words, individuals and organizations should take effective steps in advance to ensure that they are creating, maintaining, and making readily accessible records of sufficient quantity, quality, and relevance so as to inform efficient and effective (i.e., relatively productive and successful) decision-making in the future. Of particular relevance and importance with respect to the need for records and records management are the following points made by Norman:

> ***Approaches to reasoning and planning that rely heavily upon thought***, and therefore internal information, ***run into fundamental problems*** ... (p. 147, emphasis added)
>
> ✦ In most real tasks, it simply isn’t possible to know everything that is relevant...
>
> ✦ There is no way that we can have precise, accurate information about every single relevant variable...
>
> ✦ Inability to keep up with change...
>
> ✦ A heavy memory load ... Timely access to the information becomes the bottleneck...
>
> ✦ Even if all the relevant variables were known with adequate precision, the computational burden required to take them all properly into account would be onerous. (p. 148)

Regarding the implications of these limitations, Norman observes:

> The negative side ... is that ... world-based decisions must be made and actions must be taken quickly, which can cause oversimplification and incomplete analysis... Clearly, we need to plan ahead, but not to follow ... plans rigidly. We need to respond to the situation, to be flexible in the face of unexpected occurrences, to change our activities as the world dictates...[16] (p. 148)

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[16] In *Sources of Power: How People Make Decisions*, Gary Klein argues that rational comparison of alternatives is not the way that people actually make decisions in natural settings. Instead, he says naturalistic decision making (NDM) is based upon serial visualization of single potential solutions, until one is perceived as reasonably likely to succeed. Both Norman and Klein highlight the fact that time simply may not permit rational consideration of alternatives in

With respect to the dictates of the world, he notes: “In the real world, it is not possible to do actions that are not possible. This sounds trivial and obvious, but it has some profound implications when we move into the artificial world of cognitive artifacts.” (p. 148) For example, “Much of the effort of writing programs that simulate the world must be devoted to ensuring that the simulation cannot do impossible things.” (p. 149)

More specifically: “The point is that in the real world, the natural laws of physics allow only the appropriate things to happen. There is no need to compute whether you are walking through a wall: You simply can’t do it.” (p. 150) However, the imagination is not similarly constrained and, as Norman notes, in some cultures the confines of reality are not considered to be particularly important:

> ... storytellers were famed for prodigious feats of memory, for they could often tell stories that lasted for hours to an enthralled audience... But then the stories were tape-recorded and compared, any particular story varied tremendously from telling to telling... To the listener and teller both, ***word-for-word accuracy was unnecessary. The very notion is not even understood by a completely oral culture***. It is only with the advent of writing and tape recorders that we care about such things. It is only the scholar who carefully writes every word of one telling and compares it, word for word, with the next. (p. 151, emphasis added)

The highlighted words speak volumes with respect to why many people prefer not to have and may even abhor the thought of current and complete records. Norman explains why such a reaction is natural but at the same time unaffordable in modern business affairs:

> ... we are social, interacting people, always alert to interpretations, meanings, and reasons. We need stories and context. Who cares whether the details vary? Who cares whether there is word-for-word accuracy? That is simply not important for everyday life. Human memory is organized around the important things in life: the excitement, the meaning, and the experience itself. Word-for-word accuracy is simply not important, and it is difficult to accomplish. However, this is no longer true in today’s technological world. Great accuracy is required. Lawyers watch every step. Machines are sensitive to every deviance. We are forced to use memory in ways not natural to its evolutionary biological history. And so, we must turn to artifacts. (p. 152)

And, thus, it is not surprising that we may feel overwhelmed by the amount of information captured and represented in modern, printed records, much less other cognitive artifacts whose surface representations are more oblique. Inevitably, we will be barraged with representations that conflict with what we think we “know” as well as what we feel “in our hearts.” It is only natural that we might feel inadequate, if not threatened, and thus the need to try to insulate ourselves from having to face too much precisely documented reality.

Indeed, establishing a bit of historical context, Norman says that information overload was a

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real life, as opposed to in theories and laboratories.

serious problem even as long ago as the end of the 1800s. (p. 156) Continuing his brief gambit into the historical antecedents of modern day information management realities, he comments:

> The telephone was fine for keeping in touch, but the lack of a written record was a problem. ... the mail system also improved, in both speed and reliability, especially with the expansion of the railroad system. Now written records could be sent to distant locations. As companies expanded to serve larger geographic areas, they needed better record keeping, especially as the amount of correspondence increased... The most successful invention was the "press book," a bound book of blank tissue paper. You placed the original letter under a moistened blank page of tissue paper, then pressed the two together hard with a screw-wheel device. The wet tissue picked up some of the ink from the original, and the resulting mirror-image impression of the text could be read through the back side of the tissue paper. (p. 156-157)

Another innovation cited by Norman was the "Wooton patent desk, which had a large number of slots and drawers of various sizes and which was advertised as having "a place for everything, and everything in its place. However, as Norman notes, "The problem is that so many categories exceed the number of places that a person can easily remember. Three slots, fine. Five slots, maybe. Ten slots, no." (p. 158) Moreover, he explains:

> ... the desk provides no external aids to help users remember those categories. Yes, most of these desks have label holders, but ... very few labels. Labeling is a nuisance, and the desk provides little aid to this essential task. Even if labels were in place, it would be difficult to scan sixty to one hundred labels. But even finding the correct pigeonhole or drawer does not solve the problem. When the contents of the slot are extracted or the drawer opened, it was difficult even to figure out whether the item was there or not. The pigeonhole desk provides surprisingly little assistance because it puts most of the burden of organizing the material on the user. Too much knowledge has to be retained within the user's head. The result is error and confusion. (pp. 158-159)

Unfortunately, the same is true of many more "modern" information management tools. Fortunately, technologies such as XML metatags, relational databases, and full-text search engines provide means of overcoming such limitations. They provide greatly enhanced information search and retrieval capabilities relative not only to the pigeon hole desk but also its successor technology, the filing cabinet. As Norman explains:

> The vertical filing cabinet wasn't practical until the copying problem was solved... Even once the copying problem was improved (by the development first of carbon paper, eventually of copying machines), there still had to be other developments before the filing problem was eased, such as standards for paper sizes ... And even once paper sizes were standardized, people had to learn how to file. (p. 160)

He highlights, "The power of modern technology is that there need be no order: The order could come on command, in whatever fashion the reader requested." (p. 173) He terms such capabilities "navigation by description ... We describe what we care about ... and the system

works with that." (p. 179) And he explains further:

> ... retrieval by description provides alternatives to navigation by pathfinding or by arbitrary orderings, such as by date or letters of the alphabet. Prior to the age of computers, such a development was not possible. Today it is... What matters is that the users be permitted whatever descriptions are most relevant to themselves and that the system accommodate itself to the users. (p. 180)

Moreover, in his first explicit reference to *records*, he points out: "Prior to the computer, the affordances were nil. Records might be scattered all over the world, and to research any given question would take years, enormous energy, and vast sums of money." (p. 182) Now, he asserts, "It is easy to keep a record of individual actions..." (p. 183)

The implication is that organizations that fail to do so, particularly with respect to the actions of their top officials, prefer not to hold themselves accountable. Certainly, such a preference would be understandable in the context of a society that values creative (experiential) interpretations over factual (reflective) representations of reality.

Yet if it is easy to keep records of the past, Norman argues it is virtually impossible to foretell the future impact of technological advancement. Indeed, judging from the history of technological failures, he says: "Even when the technology is predicted properly, it is rare that anyone truly understands its real impact, how it will be used. In fact, I use the word *rare* just to be safe: I have never seen a prediction that was correct about the usage." (p. 186)

With respect to new technologies, he avers, "Everything that happens can be predicted by what is taking place now in university, government, and industrial laboratories" but "the ability to figure out ahead of time which ideas will succeed and which will not is very limited." (pp. 194-195) Under the circumstances, it is not surprising that many people might be techno-adverse while others who are advocates of technology may prefer not to have to contend with records that clearly document its failures.

Among the changes that Norman said (in 1993) were easy to predict was: "An increase in the availability of 'digital information,' information encoded electronically in a form that is readily stored, transmitted, and displayed." (p. 195)

However, he notes, "Those who benefit most from a technology and those who must do the work to make it function are different people. No wonder these things are continually introduced, no wonder they continually fail. The interests of the parties who must cooperate are very different." (p. 216)

That is particularly true with respect the interests of those who *create* records versus those who may *benefit* from their preservation and accessibility, or at least may be protected from harm as a result of their existence in inalterable form.

Explaining why new technologies often don't live up to their hype, Norman suggests:

> ... until we learn how to provide stable external representations that can be examined, contrasted, and transformed into higher-order, more powerful representations, these new technologies will remain devices of exploration and entertainment and fail in their power to enhance cognition. (p. 219)

"Stable" means reliable; that is, representations we can count on finding in exactly the same state tomorrow as they were yesterday, the day before, and the day before that, for as long as they have existed. Reliability is one of the attributes of a record, as outlined in ISO 15489. Reliable records are required for enhanced cognition not only by individuals but, even more so, by organizations.

Norman observes, "As soon as one takes the machine-centered point of view, everything automatically leads to a focus upon human weaknesses rather than strengths." (p. 223) By contrast, in a human-centered approach, he suggests, "Decisions are flexible because they are based upon qualitative as well as quantitative assessment, modified by the special circumstances and context." (p. 224)

In other words, the implication is that factual accuracy is not important because human beings will generally give each other the benefit of the doubt and act reciprocally in the best interest of each other. That is a positive, humanistic view of human existence – one that seems generally appropriate for purely social interactions, at least among those who are well-known to each other and are engaged in relatively long-lasting relationships. However, history is replete with examples of business and political affairs in which those having the power to do so have applied creative interpretations to benefit themselves, often to the grave disadvantage of others.

Moreover, the problem is not limited to those who have "absolute power" to engage in "absolute corruption." Each of us has various degrees of power in each of our interactions with others – including the power to engage in corruption of reality for the benefit of our own psychological comfort, if not also our physical well-being. Thus, if a higher degree of truth, honor, and justice is an aim for which we are striving as human beings, it is entirely appropriate that we focus on how information technology can be used to overcome our weaknesses – especially in and through the organizations we form to conduct our business and political affairs.

With respect to the effectiveness of the tools (i.e., the cognitive artifacts) themselves, Norman highlights: "One of the principles of human-centered design is that the visible, surface representations should conform to the forms that people find comfortable: names, text, drawings, meaningful naturalistic sounds, and perceptually based representations." (p. 226) Continuing in that vein, he says: "Each part of the system, human and machine, should be able to use whatever representation it finds most efficient, but it is the machine (and its human designers) that should take the extra steps to do the translations from the machine-centered form internally to the human-centered form at the surface." (p. 226)

In other words, even if human beings are not expected to be precise and direct in their verbal representations, the *machines* we create should be very explicit as to their appropriate uses. Another implication is that the records we create to capture and maintain the essential aspects of our business affairs should be very explicit with respect to the desires and intents of the parties to

each transaction. It is certainly logical that our cognitive artifacts should convey very explicit representations of meaning, since logic and clarity are not particular strengths of human beings and thus are aspects of life with which we can use assistance. Norman asserts:

> Logic is most definitely not a good model of human cognition. Humans take into account both the content and the context of the problem, whereas the strength of logic and formal symbolic representation is that the content and context are irrelevant. Taking content into account means interpreting the problem in concrete terms, mapping it back onto the known world of real actions and interactions. The point is not simply that people make internal mental models, stories, or scenarios of the problems they are attempting to solve but that they make special kinds of models: People map problems back onto their own personal knowledge and experiences. (p. 228)

Indeed, Dawes asserts over-reliance on personal anecdotes and "good stories" *results* in irrational thought.[17] And Dorner says, as a rule, the reality models that each of us holds in our heads are both incomplete and wrong.[18] Thus, it is understandable, if not exactly justifiable, that we may prefer cognitive artifacts that map to our own understanding of the world, even if it is wrong, and that we might be uncomfortable being confronted with records that do not – even if they represent our own best interest in the long run.

Norman makes another interesting point along these lines of thought: "We do more than work out the meaning of the words: We also try to figure out why they were said. If orders tell us something, we assume it's for a reason. In fact, when others do not tell us something, especially if we know that they know it, the omission is also meaningful." (p. 229) That is all well and good with respect to routine social interaction but it is also the root cause of many disagreements in business and political affairs, culminating in lawsuits and warfare.

In business and politics, clearly it is better to be explicit about our intentions. Otherwise our adversaries are likely to interpret our words and actions in terms of the worst case scenarios for them and their interests. With respect to the words we use, Norman observes:

> Language has to serve human needs, which means it must allow for ambiguity and imprecision when they are beneficial, be robust in the face of noise and difficulties, and somehow bridge the tradeoff between ease of use ... and precision and accuracy ... Ease of use tends to win. Language has other interesting constraints. First, it must be learnable by young children without formal instruction. ... Second, language has to be malleable, continually able to change and adapt itself to new situations... Third, human language has to be very tolerant of error. People often use the wrong words, use inappropriate grammar, change their minds halfway through an utterance and restart, yet all with minimal effect upon the listener or upon the accuracy of the communication. Finally,

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[17] See http://ambur.net/irrationality.htm.

[18] *The Logic of Failure: Recognizing and Avoiding Error in Complex Situations*, Dietrich Dorner, p. 42.

> language has to fit the cultural context within which it is spoken. (p. 231-232)

Indeed, Norman notes:

> Many statements are intentionally ambiguous. Thus, many disagreements are eased by stating the resolution in deliberately ambiguous language that allows each party to claim satisfaction. The ambiguity fools nobody (except, perhaps, the onlooker), but it smoothes the social interactions. This tactic is widely used by legislative bodies. (The ambiguities are then left for law courts to interpret.) (p. 232)

In other words, people do not want the record to be clear, in the hope they will gain the benefit of the doubt and that the ambiguity will accrue to their interest.[19] In addition to politicians, others who benefit from poor records include lawyers, judges, accountants, auditors, and reporters as well as tyrants and dictators, and, of course, common thieves.

While the direct participants in each exchange may benefit temporarily from imprecise, inaccurate, and/or ambiguous communications, over the longer-term the results may be decidedly negative for some or all concerned. In particular, ***the lack of good, reliable records enables people not only to escape accountability to others for their actions and inactions, but even more basically, it enables us to avoid changing our own attitudes and behaviors so as to lead more productive lives***.

To state an obvious but oft overlooked principle with respect to the design of systems and the innovation of technology, Norman says, "The correct approach, ... is to start with the needs of the human users of the system, not with the requirements of the technology." (p. 237) Indeed, he suggests, "In a proper system, the process of exploration will let us discover the question as well as the answer." (p. 239)

Recall the previous assertion that when problems are fully and properly described their solutions suggest themselves. Extending that assertion logically to apply to the language and artifacts we use to communicate with each other, the implication is that clear, explicit, and complete records engender not only the proper inquiries but also the reasonably optimal answers.

Incisively, Norman notes, "... each technology poses a mind-set, a way of thinking about it and the activities to which it is relevant, a mind-set that soon pervades those touched by it, often unwittingly, often unwillingly." (p. 243) In that regard, he suggests: "Printed text has a number of limitations as a tool for reflective thought. It is only a display medium: The words are fixed, unchangeable. ... they cannot respond." (p. 244) He allows: "This does not mean that you have to accept everything you read unquestioningly, but it does make sustained debate difficult, if not impossible. In this sense, reading does not afford the same kind of prolonged, reflective debate and argument possible with an interactive medium ..." (p. 245) Nevertheless, he reiterates:

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[19] Charles Ford observes that "everybody lies." Indeed, he asserts "... lying is part of the interface between a person's internal and external worlds ..." http://ambur.net/lies.pdf.

> One method for expanding the power of the unaided mind is to provide external aids, especially notational systems, ways of representing an idea in some external medium so it can be maintained externally, free from the limits of working memory... The power of external representations is that you do not have to keep the material in mind – the piece of paper on which it is written keeps it for you. (p. 246)

It seems that Norman has understated the case by suggesting that external aids are *one* way of expanding the power of the unaided mind. Unless one considers the notion of implants within our brains, it is difficult to imagine what other alternatives there might be to "expand the power of the unaided mind." Indeed, even implants might still be considered to be "external" aids in the sense that they are not natural, biological parts of the human anatomy.

Regardless of whether the aids are external or internal, though, the point is to assist human beings to make better, more informed decisions and that requires the ability to review and *reflect* upon past experiences as well as factual information supplied by others throughout history. Toward that end, Norman says: "Reflection requires more than a compositional medium: It requires the time and ability to elaborate upon and compare ideas. The medium must afford the time for reflection... Reading affords reflection by coupling the self-paced nature of the act with the compositional powers of the mind." (p. 247)

Finally, he allows: "Although reflection can be done with the unaided mind, the power is greatly enhanced by external representations provided through technology – but only if the technology is appropriate." (p. 249) He concludes by asserting: "Appropriate tools are designed by starting off with human needs, working with those who will be using the tools to fashion them into the most effective instruments for the task. Above all, such tools allow people to be in control." (p. 252)

As Norman suggests, human beings should indeed be in control of the *tools* contributing to the *prospective* course of their destinies. On the other hand, *no one has the right to rescript history*. In the sense that cognitive artifacts are the best available representations of history, ***creating a record of which we can be proud is an objective to which all of us should subscribe***. However, none of us should be granted the right to "control" the past, in the sense of altering the cognitive artifacts that are the only "tools" by which we can record and understand historical reality.

By virtue of their very design principles, the systems we use to conduct our business affairs should *disallow* any of us the power to re-create reality as we see fit by altering the artifacts of its existence *ex post facto*. Yet the reality in practice today is that most, if not all information systems used by organizations do, by designed or default, enable "insiders" to change the records those systems contain, after-the-fact.[20] It would be one thing if the objective and results were for the greater good of the greatest number. However, considering the fact that organizational hierarchies are elitist, by definition, and exist primarily to support themselves, such an outcome seems highly unlikely.

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[20] The National Security Agency has identified an inherent weakness in all commercial computer operating systems and has attempted to address it in Security Enhanced Linux. See http://www.nsa.gov/selinux/.

In short, the current state of affairs with respect to the design and usage of business information systems is simply unacceptable. History should speak for itself, in current and complete records having the attributes outlined in ISO 15489, and that should be the primary design principle for the systems by which we conduct business and political affairs. As Norman says: "***... the real power of the human mind, today and in the future, lies with our technologies ...***" In particular, the real power of the human mind lies in the "cognitive artifacts" that are the true and inalterable records of our explicit knowledge, individually and collectively.

It is *records* that make us smart.