Accelerating the Convergence of Nanotechnology, Biotechnology and Information Technology and Cognitive Science – Larry Todd Wilson

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My goal is to focus on a single NBIC-oriented idea that, if actualized, would unleash massive capabilities for improving all varieties of human performances. Furthermore, the one thing should accelerate and strengthen all other biotech ideas and fulfill a self-referential quality for advancing itself.

It is difficult to negate the notion that some ideas, actions, or objects are more important than others. This perspective is characterized by statements like, “This is what should come first because if we had that ability or understanding, then we could (achieve these results)…and if we had those results, then we could accomplish…”

The “single idea” is this: *Minimize the limitations of a human’s ability to assimilate information*.

Why is this idea a priority? Advances in thinking performances are more important than advances in artifacts. This is due to the fact that the advances in artifacts area always a function of the human thinking system. The dynamics of innovation must be managed by human consciousness before it is “externally” managed at all. There are many naturally occurring phenomena that are not apparent to the senses or the imagination. However, a technology does not become technology until it enters the realm of human consciousness.

Examples below deliver “as-is” versus “could be” explanations of the importance of enhancing how we assimilate information. From the examples, it is not difficult to imagine the transformations that may result due to the ripple effects. Overall, the focus on ways to enhance how humans assimilate information will result in significant increases in a human’s ability to approach a complex need, achieve comprehension, and accomplish an intended result. Increased ability equates to gaining faster comprehension, better comprehension, comprehension in a situation that previously was unfathomable, faster solutions, and better solutions, and finding solutions to problems that seemed unsolvable.

As is…	Could / should be…
The span of judgment and the span of immediate memory impose severe limitations on the amount of information that we are able to receive, assimilate, and remember. In the mid-1950s, this was labeled as “seven, plus or minus two.”	The innate limitations of human short-term memory are irrelevant due to the synergistic reliance upon “external” working memory, which is embedded in everything around us.
Short-term memory is working memory that works to retain sensory information presented by the mechanism of attention. No human being can hold many concepts in his head at one time. If he is dealing	Increase the size and capability of working memory. Deliberate consideration of the items in external working memory can be called to mind upon demand. Manage how linguistic coding influences thought

with more than a few, he must have some way to store and order these in an external medium, preferably a medium that can provide him with spatial patterns to associate the ordering, e.g., an ordered list of possible courses of action.	processes. Quantitatively measure stimulus (primarily in the form of linguistic-based prompts) and response (reactions in the form of decisions or feelings or movements).
Content is lost from short-term memory in two ways: it will not be committed to long-term memory if interference takes place or time decay occurs. One of the by-products related to the limitations of short-term memory is that there is great relief when information no longer needs to be retained. Short-term memory is like a series of input and output buffers in which intermediate data can be stored during any thinking activity; this memory has very limited capacity and can be easily overloaded. In order to alleviate the anguish of overload, there is a powerful desire to complete a task, reduce the memory load, and gain relief. This event is referred to as "closure," which is the completion of a task leading to relief.	Minimize the losses that naturally occur. Consciously add or delete items in working memory. Regulate the need for closure because the human is confident that it's "still there" (although I don't remember exactly what *it* is). Increase the number and rate of working memory instances. Engineer a seamless human mind/external memory interface, and thereby make human and machine intelligence coextensive. Basic analysis and evaluation of working memory contents are achieved in partnership or alone.
Bounded rationality refers to the limitations inherent in an individual's thought processes when there are more than a few alternatives being considered at the same time. Bounded rationality occurs because an individual has limited, imperfect knowledge and will seek satisfaction rather than strive for optimal decisions.	Unbound "bounded rationality." The number and interrelationships of evaluations are dramatically expanded.
Individual thinking repertoires are limited (in their usefulness) and limiting (in their applicability).	Codify the elemental and compound thinking processes. Use the external working memory to manage the objects of the attention with novel ways of orchestrating the human's awareness of them. Increase the frequency, quantity (novel combinations), and throughput of these compounds. Gather more and more intelligence about the signals – the contextual nuances associated with variations of the compounds. Examples of compounds are: Abstract Accept Accommodate Adopt Advise Agree Align Apply Appraise Approve Arrange Assign Assimilate Assume Authenticate Authorize Calculate Catalogue Categorize Change Check Choose Classify Close Compare Compile Compute Conclude Conduct

	Confirm Consider Consolidate Construct Contrast Contribute Coordinate Create Decide Decrease Deduce Define Delete Deliberate Deliver Deploy Derive Describe Determine Develop Differentiate Direct Disagree Disapprove Discern Distinguish Elaborate Eliminate Emphasize Enable Enhance Enrich Establish Estimate Examine Exclude Execute Expand Explore Extrapolate Facilitate Find Focus Formulate Generalize Group Guess Guide Hypothesize Imagine Include Incorporate Increase Index Induce Infer Inform Initiate Insert Inspect Interpret Interview Invent Judge Locate Match Measure Memorize Merge Modify Monitor Observe Optimize Organize Originate Outline Pace Predict Prepare Presume Prevent Prioritize Probe Promote Provide Question Rank Rate Reason Receive Recognize Recommend Refine Reflect Regulate Reject Remove Report Resolve Respond Scan Schedule Scrutinize Search Seek Serve Settle Show Solicit Solve Sort Speculate Submit Support Suppose Survey Synthesize Translate Validate Verify Visualize.
Specialists often miss the point. The point is to swap advances among different disciplines. It's all about permutations and combinations. Discoveries from biology and chemistry are hooked up with synthesis and fabrication tools from engineering and physics. Each discipline has its own sets of problems, methods, social networks, and research practices. There are no effective ways in which the intellectual results of sub-disciplines can be managed and thereby accelerate consilience and cross-disciplined performance breakthroughs.	Progress towards a new sense of the complex system. The most obvious change will be the benefits of working with many kinds of associations/relations. More people will be able to perceive loops and knots. Sense the complex system with a set of universal constructs for systematically managing the interrelationships among disciplines. Accurate visualizations of many kinds of relations (not just parent-child relations) will shift the reliance of the satisficing mode of hierarchical interpretations to the closer-to-reality heterarchical structure. Continue to splinter the sub-disciplines and achieve convergence when needed for important insights.
Today, many physicists spend time translating math into English. They hunt for metaphors that can serve as a basis for enhancing comprehension of relatively imperceptible physical phenomena.	Integrate mathematics, verbal, and visual languages in order to allow individuals to traverse the explanation space. Aid the acceleration of new ways for more people to abandon their intuitive (perhaps innate)

	mode of sensory perception associated with the macro world. Achieve integration (and concise translation) between our symbol sets (math, verbal, and visual) and open up the chance to address more, apparently paradoxical, phenomena. The assumption is that many of these paradoxes are just illusions created when you look at an n-dimensional problem through a three-dimensional window.
Linguistic-based messages, which plod along the user's tolerance for listening, govern the rate of assimilation.	Establish the path more directly because all forms of intelligence, whether of sound or sight, have been reduced to the form of varying currents in an electric circuit.
Imaging modalities don't offer a concise way of observing the dynamics of how we assimilate information. PETs are more accurate in space, and EEGs are more accurate in time. EEGs can capture events on the scale of milliseconds, but they're only accurate to within centimeters. Scans are like slow motion – a thousand times slower – but they're accurate to the millionth of an inch.	Extend the visual languages to the actual visualization of localized neuronal activity. Understand the spatial-temporal nature of assimilation with a real-time movie stage where we watch thoughts as they gather and flow through the brain. Understand how the human perception of mind arises from the brain. Formalize in neural network models operating on traditional hardware. Thus, intelligences akin to humans will reside in the Internet. These intelligences, not being physically limited, will merge and transform themselves in novel ways. The notion of discrete intelligence will likely disappear.