Human/Artificial Intelligence Complementarity

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Artificial Intelligence has become an ubiquitous and towering facet of our modern cyber-physical lives. The average person is "touched" by some form of AI on both cognitive and physical levels multiple times daily. Generative AI has drawn much public attention, but many other forms of AI exist to facilitate our daily functioning and problem-solving. Our interaction with these embedded AIs or algorithms is often unperceived as they are embedded in cyber-physical systems.

We stand at the most amazing and potentially most impactful inflection point in history, as never before has humanity created a technology that offers a nearly symbiotic relationship with its user. New models of human/AI augmentation will power the advanced economies of tomorrow and enable us to both solve many of today's unsolvable problems and innovate in ways never imagined. Yet despite the awe created by generative AI and the obvious opportunities of the overall technology, there are fundamental flaws with our conceptualization and understanding of AI that will prevent its applications within organizational environments from achieving maximum benefits.

A flawed conceptualization

The largest gains from AI will come from novel Human/AI workplace models designed for problem-solving and innovation. Among the *a priori* determinants for success in creating new models of Humans & AI is an accurate conceptual framing of Human/AI complementarity.

AI is not artificial intelligence as it currently exists in form and function. AI today does not resemble Hollywood's vision nor recollect or solve problems like the human brain. AI is not intelligent; it does not possess knowledge or understanding as our brains do. Nor do Artificial Neural Nets (ANNs) represent the brain's structure and, more specifically, the brain region responsible for both memory and higher-order functions – the neocortex. How our brain learns, remembers, and solves problems vastly and categorically differs from how an AI learns from a Large Language Model (LLM)

Today's AI can more aptly be described as advanced information processing, synthesizing, and production systems vs. true general-purpose intelligence. A prime example of the difference between AI and the human brain is their categorically different problem-solving approaches. AI attempts to solve problems through probabilities, correlations, likeness, and other complex equations, often taking billions or trillions of "steps." Our brains solve problems by accessing memories, understanding relationships of variables, and time-sequenced occurrences in relation to the variables of the current situation. The brain does this utilizing a series of reference frames and associated emotional correlations, such as trust, perception, and beliefs, and it does this in 100 steps or less – never more. In short, our brains are intrinsically different yet uniquely complementary in that when we pair the human brain with AI, we have the most powerful combination problem-solving construct ever known in human history. This complementarity through augmentation will propel problem-solving, innovation, and organizational valuation and wealth for decades.

The key - uniquely complementary

We have entered the Age of Augmentation. This age is unparalleled in human history due to the uniquely complementary nature of humans and AI. Neither the Industrial nor Information Ages presented us with today's unique opportunities to create value at speed and scale. To do so will require more than a superficial understanding of how to pair humans and AI to achieve maximum results.

Central to achieving the most from integrating AI into the workplace is avoiding a singular focus on the technology while ignoring the human factors. Virtually every firm has a Digital Transformation (DX) strategy and implementation plan, few have a Human Factors Analysis to go along with the technology artifacts.

A central key to success will be to develop Human/AI capabilities through a deep understanding of how our human brain utilizes and trusts data/technology, makes associations, solves problems, remembers, and much more. It was a fool's errand to simply state "we want data-driven decision-making in the DNA of the firm," and hope people utilize data in their decision-making processes. For future success, we need a deep understanding of how the brain makes decisions with data, makes errors, trusts, and how our memory functions. This scientific foundation will enable the design of novel models of people and technology working together in truly complementary ways.

Many a wise person has said the "devil is in the details," which remains true as we embark on what is likely to be a never-ending journey of creating Human/AI working models. One aspect is enabling functions by creating interaction and user interfaces that enable the brain and computers to do what they do well while complementing the other's weaknesses. Walt Mossberg, the noted technology writer, prophetically stated, "Tech was once always in your way. Soon, it will be almost invisible."[1] Walt was correct in his assertion that keyboards, mouses, and screens pose some difficulty for the brain to navigate in its desire to create Understanding. We must purposefully evolve the interaction of human operators and AI to be human-centric and as natural as possible. This also means evolving our use of two-dimensional representations, which present data/information contrary to the brain's operation.

It is not well understood by those building decision-support systems that the brain seeks understanding in two ways, each specific to a hemisphere. First is confirmation of what it believes to be true with little context and great confidence; second is seeking what is actually present with remendous context.[2] The brain also does not precisely note occurrences but rather good and bad that occurred so it can repeat or avoid in the future. The brain also learns through movement, exploration, and sequences of its memories as such – time and location are always significant factors

in memory. Yet decision support systems often require multiple clicks, screens, or entire systems to present core and contextual information in ways that facilitate the brain's internal model formulation. Next-generation systems and workplace models must have this scientific understanding at their core.

The pivotal insight for designers of new Human/AI cognitive augmentation is that they directly complement each other. When paired with natural language processing and advanced visualization techniques, the potential to influence the brain's understanding, framing, and final decision-making is limitless.

Human/technology & AI fusion

A prime example of next-generation human/tech/AI fusion is the concepts underpinning the development of air dominance fighters for the U.S. Air Force and the U.S. Navy.

The United States Air Force and Navy are developing the Next-Generation Air Dominance (NGAD) fighter aircraft. Central to this development is the tenet of human/AI augmentation. The NGAD will represent a technological leap in the design of fighter aircraft on many levels; however, more importantly, it represents a fundamental shift in thinking away from a single unit or even team of units to what the U.S. Military frames as a "family of systems" intended to produce defined outcomes within an overall land, sea, air and space ecosystem. This conceptual thinking and unique Human/AI fusion model represents some of the most advanced concepts of multiple layers of human operators with all their uniqueness coupled with technology & AI seamlessly integrated to execute missions. Businesses in every industry vertical should be taking notes and applying the same thinking to their business models and missions.

The NGAD fuses a pilot with technology and AI in ways that eliminate traditional obstacles to mission objectives. One example is situational awareness in a 360-degree, 3D environment. Today, pilots rely on their sight, radar, and passive sensors and augmentation by Airborne Warning and Control Aircraft (AWACS) to provide information verbally or through flat displays or a virtual helmet. In the NGAD, all these will be radically elevated through an almost endlessly scalable and seamless integrated network of advanced sensors and connectivity on a distributed network of other fighters, satellites, radars, passive sensor arrays, drones, etc. The aircraft, its human pilot, and AI are at the center of the multi-dimensional, multi-spatial, cyber-physical universe of objects, platforms, AIs, and people distributed globally.

This new Human/Tech/AI cyber-physical fusion model is applicable to all organizations regardless of their industry as we can now re-design so much of our current value creation models.

Human augmentation/replacement

In discussions around the development and deployment of AI, few topics incite more vitriol than the topic of replacing humans in work roles. Soothsayers with inflammatory proclamations and those perpetually offended on the part of others often dominate the conversations, but the topic is valid, and the conversation needs to happen in every organization.

Again, framing is necessary for organizations seeking to create value and competitive advantage. The central tenet of this framing is simple – the exponential gains in value creation through problem-solving and innovation will come from *augmentation*, while only incremental gains will come from *replacement*. This is not to dismiss replacement, which will occur; it is simply to say that organizations seeking to replace humans with AI are confined to incremental gains in productivity and performance.

The most successful firms in the 21st Century will be those able to combine humans and AI to solve problems and innovate.

In conclusion

We stand at an inflection point in human history, the transition from the Information Age to the Age of Augmentation. At the center of this age is the central tenet that humans and AI are categorically different yet uniquely complementary. This central tenet will guide us to create value through problem-solving and innovation as never before. And while replacing people in the workplace will occur, the gains, while not trivial, will be incremental. We have examples of human/technology & AI fusion developing before our eyes, and they can act as thought catalysts for other industries and societal segments.

Low-resolution and inflammatory predictions of inevitable doom have sounded throughout history and now serve little purpose. We may one day have to concern ourselves with a sentient AI contemplating the extermination of our species, but that is likely a concern for the next century. For the present we should focus on uniquely combining human beings and AI in optimal ways to do what is currently undo-able and to create value in ways never contemplated.

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[1] https://www.theverge.com/2017/5/25/15686870/walt-mossberg-final-column-the-disappearing-computer

[2] See the works of Psychiatrist, neuroscience researcher Iain McGilchrist and Russian Psychologist Alfred L. Yarbus