AI Comments:
Leveraging the Global Knowledge Corpus, One Way or Another

Kenneth B. Tingey
Profundities LLC

Submitted to the White House and to the National Telecommunications and Information Administration of the United States Department of Commerce on May 11, 2023 and updated on June 5, 2023 in response to their April 13, 2023 Request for Comments, this paper makes the case for AI as a secondary tool in knowledge management. More central to the question is the need to provide tools for scientists and other knowledge workers to compose and direct the actions of computers and digital networks in their professional and organizational roles and make scientific and administrative processes available for use in integrative and reflective ways. As to AI safety, only when valid and reliable answers are known can AI outcomes be validated. Qualitative and quantitative methodologies, including peer review, are solely capable of being carried out by humans using their wide array of senses and abilities. Once organized and validated in these ways, computers, including AI, can instantly and readily derive contexts and support high-level classification and calculation to apply them at scale.

Keywords: artificial intelligence, AI, knowledge management

INTRODUCTION

It is important to consider AI in the context of information processing in general. It is also important to consider information processing in the context of organizational, institutional, and individual needs, desires, and legitimate operations. Considering artificial intelligence (AI) alone is problematic, partially because of its ill-defined nature. It is more profitable to consider the phenomenon of algorithms, of which artificial intelligence forms are a part.

For our purposes, it is important to consider algorithms with respect to machines. Machines provide speed as well as instantaneous distribution, both human weaknesses.

Commentary herein is provided in harmony with our recent T20 publication for the G20 Bali round, recently completed.[2] Under project *TF2 - Meaningful Digital Connectivity, Cyber Security, Empowerment*, the policy brief is titled "Capacity Development in Enhanced Multilevel Governance Based on a Tripartite 'Head (Cognitive), Hand (Digital), Heart (Music Performance)' Model" (See Figure 1).

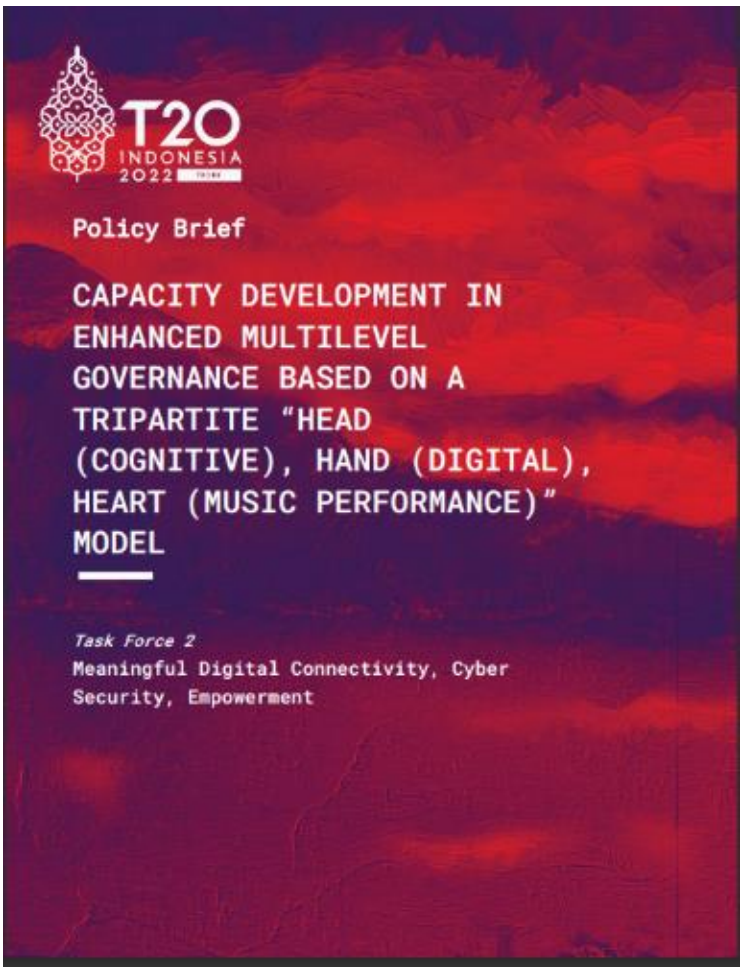
We published a book last fall that contains the G20 Bali paper as well as commentary on other G20 and G7 projects in which we were invited to participate.[3] This book, "Continuing Bali G20 Success: Knowledge to Digital" can be seen in Figure 2.

To understand the context of these comments, it is important to have a working understanding of the *Policy Brief.* Particular attention should be given to Figure 1 on page 7 and Table 1 on page 8. Table 2 on page 9 of the Policy Brief gives some idea of the kind of infrastructure needed, not only to stay ahead of potential AI problems, but to minimize any perceived need for machine-based reasoning in the first place.

We have proposed an international collaboration at the G20 level to close the gap between knowledge and digital capabilities of public and private organizations.

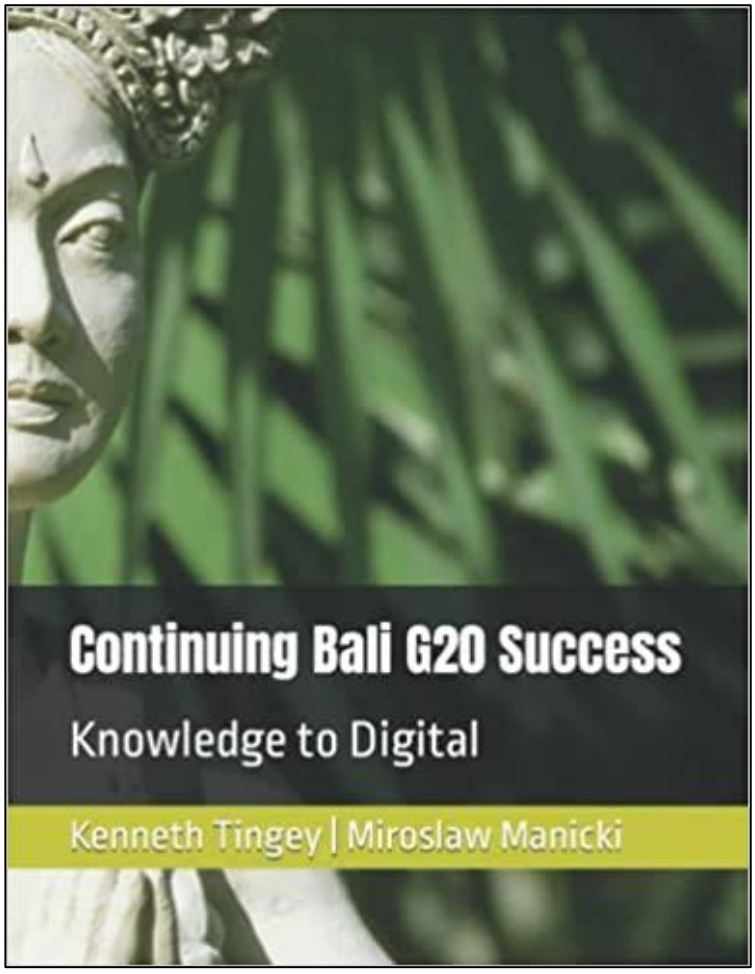
Works listed in the *References* section reflect the depth of understanding and the longevity with which my collaborators and I have considered the issues of algorithmic capabilities, AI representations, and knowledge-based computation in governance and administration.

FIGURE 1
G20/T20 2022 BALI POLICY BRIEF



Source: https://www.t20indonesia.org/publications/capacity-development-in-enhanced-multilevel-governance-based-on-a-tripartite-head-cognitive-hand-digital-heart-music-performance-model

FIGURE 2
G20/T20 2022 BALI SUMMARY PUBLICATION



Source: https://www.amazon.com/dp/B0BLYBK582.

UPDATES IN JUNE 5, 2023 SUBMISSION

Fast-moving developments in algorithms purporting to represent AI represent challenges and risks to society that warrant commentary. There are three major considerations currently.

First is to reiterate that the fundamental question of our time is why knowledge and expertise artifacts do not flow in useful forms to where they are needed.

Second is why is there a deluge of AI news and commentary now as opposed to any other time in recent decades, coupled with stark warnings from the self-same sources? Why do they offer up their 'Pandora's Box' at all?

The only prevalent argument is that widescale rollout of algorithms that are 'automatic' and hence AI-oriented is inevitable. Wouldn't such a decision be for the people to make?

Third are recent case studies that have already brought forth situations that have heretofore been inconceivable. The most egregious is the legal case involving prevaricated source citations. Public consideration of these, comically bizarre unforced errors in the public arena, is a travesty.

Lost Knowledge the Real Problem?

My colleagues and I have noted that there is no significant public discourse about the use of existing knowledge—or more to the point, the lack of use of existing knowledge—in digital systems. There is a good deal of attention to this issue in research fields but little in the public sphere.

We include in this commentary some discussion about the digital barrier to application of detailed knowledge and its effects. Why don't others publicly consider this? Isn't the problem of underuse of existing knowledge and expertise obvious? Why aren't the scientists and experts themselves complaining about the lack of closure on their work and that of their predecessors? Why aren't policymakers more adamant about the effects of such a profound loss—apart from vague stated concerns about possible future pandemics? Shouldn't widescale promotion of AI algorithms stimulate such discussions?

The Better Part of Valor—Don't Do It

As to the Pandora's Box, if risks of AI that they disclose as it is being presented and AI's potential to "end humanity" and play havoc with nature and society, why are we hearing about AI at all at this time? AI proponents presaging their presentations with wildly dark warnings. This is not normal. Think of the kinds of pernicious things that other kinds of commercial purveyors could provide to the world but for their better judgment: Ebola butter; suicide joy rides; certain death game shows; fast vehicles with faulty braking systems. These are bad ideas. They could be promoted commercially, certainly from technical perspectives. Are they inevitable?

It is one thing to warn the world about some foreseeable pernicious prospective condition or event, quite another to caution others of the effects of one's own product, which you plan to benefit from economically. This itself is unprecedented.

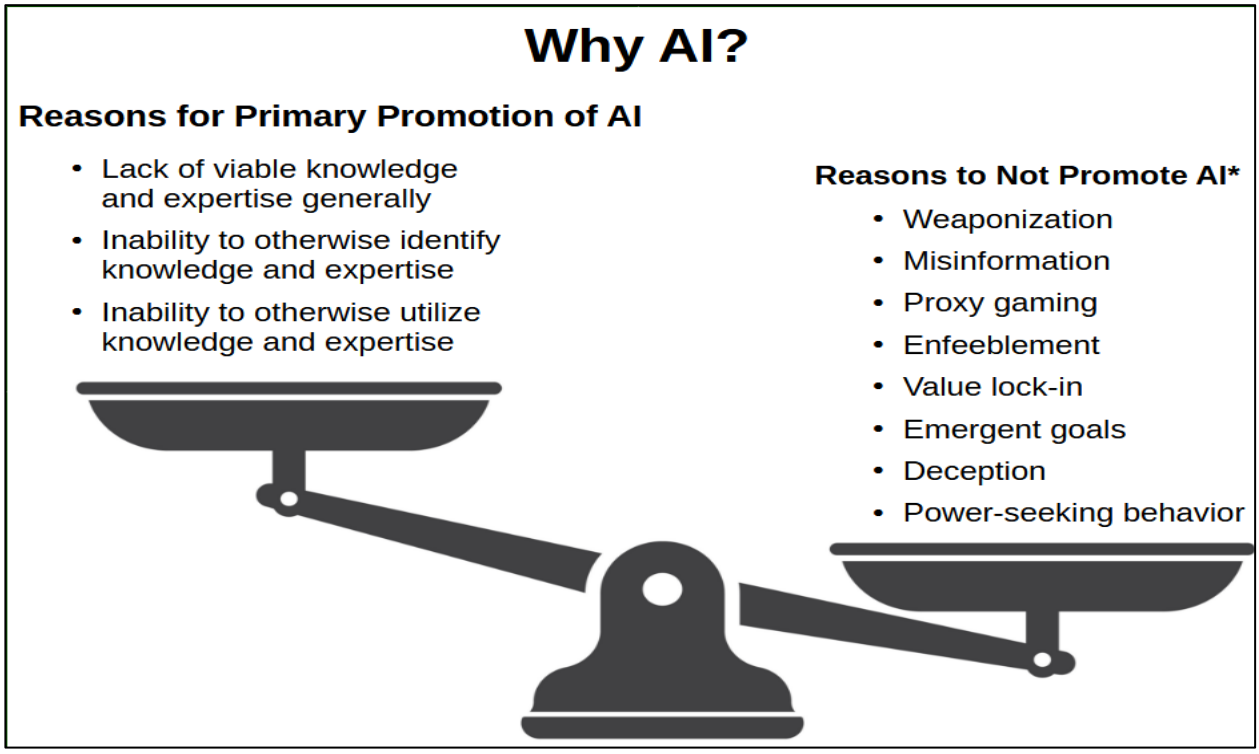
There are unstated rationale for the introduction of AI (See Figure 3). Items on the right of the Figure are documented by the Center for AI Safety.[4] Obviously, from the perspective of knowledge and cognitive advancement, mankind has failed. The presumption is that either knowledge does not exist, it cannot be identified, or it cannot be deployed effectively, which is to say, deployed digitally.

Are these valid presumptions? No. The idea that knowledge does not exist is preposterous; that it isn't more readily identified and utilized is a travesty, but not an impossibility. Take music, for example. The works of great masters of music, the Bachs, the Beethovens, the Mozarts, and the Brahms' are faithfully represented and performed to perfection for hundreds of years now.

As indicated herein, knowledge exists—it is actively promoted in all regions and in a plethora of fields. There is a digital barrier to its use in many cases, a source of great cost, pain, and suffering.

Is certain knowledge—organic or artificial—appropriate, is it responsive to needs, is it valid and legitimate? How should such questions be adjudicated? How should they be acted upon? As seen in the figure, reasons to not use AI outweigh its rationale—certainly in the absence of an available, credible system in support of valid knowledge in all fields.

FIGURE 3
UNEXAMINED RATIONALE FOR MASSIVE APPLICATION OF AI



*Center for AI Safety. 2023, June 1. 8 examples of AI risk. Author (CAIS) https://www.safe.ai/ai-risk

These are important questions. These are more significant than AI declarations on the right that bring little more than unforced risks onto society. Reasons to use AI by this measure are ephemeral and problematic. Those problems should be resolved directly. Reasons for not promoting AI are monumental. They reflect catastrophic outcomes far beyond possible benefits.

Weaponization of a soft kind is already taxing society and order. This has been fueled by unfettered technology that grants power based on popularity alone as judged by fervor of online quarrels. Tied to actual weapons, mayhem of many orders of magnitude are in the offing in an AI-driven regime. Misinformation has purposive and confusing origins. Humans are capable of misinformation on our own. Contemporary systems provide means of tracing bad information to the source, but AI systems as presented have a disturbing black box feature. No one, not even the creators of the AI products, knows why machines decide as they do.

This sets up a legitimacy conundrum of immense consequence. Once machines make decisions which are recycled into the knowledge framework, which information stream becomes authoritative? Do humans then need to cite computer-generated outcomes? What method should be cited, given the lack of rationale of any kind? What are the many knowledge workers to do under such circumstances? Funded for the moment to assiduously protect knowledge stores as they grow and develop, including the pruning of false conjectures, how are they to do their jobs under such conditions.

Enfeeblement, as outlined above by CAIS is related to this, to be sure, but it runs deeper than that humans won't look for answers and enlightenment, but that they cannot reliably engage in such endeavors.

The 'You Have Got to be Kidding' Department

New developments are listed in Appendix V -- There have been just a few weeks of available AI tools—or, it should be said of highly-promoted available AI tools, as there have been such things for decades.

Once again, as considered below, why do we see ubiquitous messaging in favor of artificial solutions in lieu of supporting and ensuring the use of human knowledge in all forms via digital networks and otherwise? Such capabilities and tools could serve as foundational elements in evaluating machine-based means of supplementing human capabilities. This is where attention, resources, and commitments need to be placed.

Consider the fact that in such uncertain times, when human institutions need reinforcement and revitalization, they are arguing for increased risk—especially to fundamental human interests.

AI AS SUBSET OF AVAILABLE ALGORITHMS

Algorithms have existed since before the first electronic computers were introduced. AI algorithms have been and continue to be a subset of these. Over the years, there have been many representations as to the characteristics and purposes of these. Some of these, including my experience with some aspects of AI research from 1999 to 2002 are included in Appendix I – History and considerations of artificial intelligence.

As to the current submission, your definition of AI is as follows:

> *This Request for Comment uses the terms AI, algorithmic, and automated decision systems without specifying any particular technical tool or process. It incorporates NIST's definition of an ''AI system,'' as ''an engineered or machine based system that can, for a given set of objectives, generate outputs such as predictions, recommendations, or decisions influencing real or virtual environments.'' This Request's scope and use of the term ''AI'' also encompasses the broader set of technologies covered by the Blueprint: ''automated systems'' with ''the potential to meaningfully impact the American public's rights, opportunities, or access to critical resources or services.''*[5]

In a sense, any algorithm could qualify as AI, as it might be configured to trigger functionality in an instant, without human effort in the process.

There has been a good deal of documentation under the banner of AI regarding human-like reasoning on the part of machines—like humans, but eventually more powerful. Sometimes this is referred to as "machine learning" or "reasoning", but these aren't explicitly listed here. It is difficult to ignore these, so we will consider a broader aspect of AI. In part, this has to do with my interaction with a DARPA AI project from 1999 to 2002. It was the Rapid Knowledge Formation program.[6]

I was not funded by them, but I was allowed to attend some meetings and I participated in the entire closing meetings in San Diego in 2002. They allowed me to present. I presented material with respect to interfaces between human experts and authorities and AI-related projects, with experts and authorities in the lead. This was not a matter of priority for the program and its participants. The experts were only to be used to provide facts and then leave—leaving the rest to the machines and to the technical specialists. Some of those experiences are summarized in recent Medium articles that I have published with Miroslaw Manicki.[7]

WHAT IS LACKING IN PUBLIC AND PRIVATE COMPUTING

There is no lack of knowledge. Its products are not particularly evident in actionable digital form, which is problematic. Once we understand problems as well as prospects, we can consider current and future AI implementations in relation to these, and to the needs and wants of providers as well as users of public and private systems.

The advent of pervasive AI marketing efforts and the reaction forced by them offers an opportunity to evaluate both problems and solutions in computing generally. The contemporary blitz of AI-related software offerings currently in lieu of human efforts is itself suspect. On its surface, it resembles many

campaigns of 'fear, uncertainty, and doubt' that have been characteristic of technology marketing for decades.

Technology is suspect in the current environment as to its effects on the legitimacy of governance, in part due to widely perceived shortcomings of social media offerings. There are also substantive limitations in enterprise technology/ERP environments, which are far more effective at imposing authority than in incorporating science, knowledge-based processes, and best practices.[8]

> *...clinicians have often been frustrated that the benefits of sophisticated information systems and technologies frequently do not extend to increased efficiency in clinical practice, but tend to be more oriented toward overall efficiency of the ... enterprise and the ... system as a whole. In the [context] of this background, the initiation of a specific innovation is often left to the individual ... to pursue in ways that he or she sees fit.*[9]

Non-technical specialists are left thus to make technological choices, which is problematic. Similarly, technicians are left to make knowledge-oriented decisions themselves—which is problematic. What are the chances of effectively integrating these on top of ERP inflexibility? This is not a viable proposition, although it is the norm.

A preferred approach is to heal the breach between humans and machines, to encourage knowledge-based, societally responsible application of technology. The dog needs to wag the tail in this regard. In that context, there are assuredly many applications for advanced algorithms, many that fit the rubric of AI.

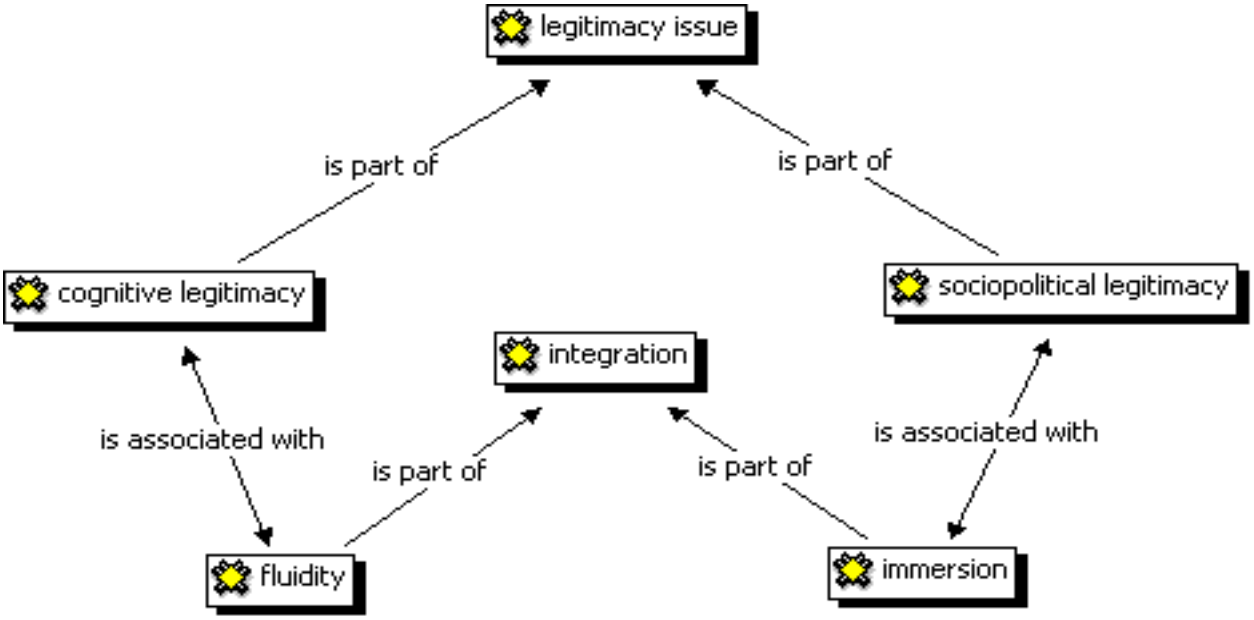
Need for Cognitive and Sociological Legitimacy in Public and Private Computing

From the turn of the century to the present day, two factors are critical to success. Organizations need to provide their customers and constituents with what is expected from them. If not, the customers will migrate elsewhere, as will all associates and customers. Organizations also need to be intrinsically connected to the Internet, to express all aspects of their existence and mission via networked, socially aware means. Otherwise, they will similarly be marginalized, not successful.

My dissertation[10] considered these two phenomena, largely based on the work of Aldrich.[11] (See Figure 4). Cognitive legitimacy is considered that which is expected of an enterprise or institution—or social network, for that matter. Sociopolitical legitimacy is in essence the officiality of the effort—the extent to which it is accepted by important elements of society in its area of activity. For operationalization purposes, my work used fluidity as a representative construct of fluidity and immersion, which is to say networked immersion and position, as representing sociopolitical acceptance and positioning.

There are dozens of underlying constructs supporting these as developed from the data in question using grounded theory, which will be discussed presently along with other qualitative and quantitative methods of knowledge development.

FIGURE 4
TINGEY 2006 ORGANIZATIONAL LEGITIMACY MODEL



Tingey 2006/2008, 20.

What Machines and Algorithms Can Provide

Computers act fast. Computers can exhibit high levels of accuracy, particularly regarding numbers. Appropriately configured, they can also navigate through symbolic strings equally rapidly. Castells outlined this decades ago, considering both logical and communications aspects of networked computers, which he declared as being ubiquitous throughout the world at the time of publication:

> *Networks are open structures, able to expand without limits, integrating new nodes as long as they are able to communicate within the network, namely as long as they share the same communication codes (for example, values or performance goals). A network-based social structure is a highly dynamic open system, susceptible to innovating without threatening its balance…*
>
> *…the network morphology is … a source of dramatic reorganization of power relationships. Switches connecting the networks … are the privileged instruments of power. Thus, the switchers are the power holders. Since networks are multiple, the interoperating codes and switches between networks become the fundamental sources in shaping, guiding, and misguiding societies. The convergence of social evolution and information technologies has created a new material basis for the performance of activities throughout the social structure. This material basis, built in networks, earmarks dominant social processes, thus shaping social structure itself.*[12]

Castells declared victory at the time. He has been more circumspect about unmitigated benefits of digital networking as he had previously described.[13]

There was likely at the time a general understanding at the time of his 1996 publication that Castells' switches were literally the interconnecting hardware that goes by that very name. Clearly, though, he refers to the gateways embedded in the software as to logic gateways embedded in the software, 'ifs and thens and elses' that guide sessions through their steps, to get something done.

One of the critical aspects of intelligence, even of expertise, is speed.[14] Relative speed is a characteristic of people with deep expertise, but there are severe limitations in the identification and use of knowledge product in multiple subject areas, considering the complex needs of living systems and other natural artifacts at scale, in real, adaptable situations. Computers can be used to bridge gaps if knowledge is organized in ways that reflect the knowledge of individuals and communities of practice in their areas of knowledge and expertise.

The Importance of a 'Head, Hand, and Heart' Approach to Computation

In this sense, the design barrier for subject matter experts and managerial representatives is a problem. How are they to achieve their objectives without hands-on design and monitoring capacity?

There are many ways to describe holistic ways of conducting the affairs of an organization. A thriving one will tend to provide mutually supporting channels of activity that can leverage cognitive, systematic, and emotional dimensions to achieve their objectives.[15]

We proposed such an approach. The 'head' part being application of a process design model called the 'generative taxonomy' model. This is described generally herein. There is substantive support for the importance and benefit of a process approach in all things.[16]

Detailed discussion of the model can be provided under specific conditions. The model was developed in the western United States in conjunction with major manufacturing corporations. I have made several efforts dating to the early 1990s to bring it into general use, with substantial apathy and resistance from prevalent technology companies and others with commitments to the status quo in information technology. Ignoring such issues in favor of a 'command and control' model—with loose management of data for semi-public sharing—clearly contributes to the current information technology conundrum.

As to the 'hand' aspect, this relates to building out a system based on the generative taxonomy model and other novel, but grounded approaches to functionality and security. This will require a major capacity development effort, extending the capacity of experts and authorities to convert their knowledge to process form and creating appropriate interfaces to existing networks and machines.

As to the 'heart', the most direct way of doing this is by leveraging the power and breadth of music performance as a parallel motivational, educational, and entertaining way of introducing functionality in the key areas of application—focused initially on personal and public health needs of the people.

These plans can be investigated from the website of the *2020 Program for Global Health*, which can be found here: https://2020globalhealth.com.

The Importance of Context with Respect to Algorithms

The lack of a systematic means of establishing context dooms the computing enterprise and its various implementations from the outset. Just as good science is dependent on comprehensive and appropriate literature reviews, all phenomena is subject to the rigors of time and place and the many alternative conditions that can present themselves.

The generative taxonomy model is based on classification trees that directly support action in the form of processes that can be readily integrated with one another, also that support recursion. They are native consumers of both symbolic and mathematical data in a way that integrates both. Two important characteristics of the model are 'context centering,' which clarifies the contexts of processes based on unlimited factors and conceptual dimensions. Using this feature, solutions in a networked environment can 'find' problem environments in a matter of course. This is called 'semantic pull', a feature that minimizes many forms of risk and cost that vex enterprises and institutions, their customers, and constituents.[17]

Algorithmic Shortfalls in Public and Private Computing and the Importance of Process

Global distribution in an instant is another aspect of computing. With respect to algorithms, there are sins of commission and sins of omission. With respect to sins of commission, these are in full display in the ways that lies and misrepresentations regularly spread to the ends of the earth in an instant, making digital access a pernicious thing, at least in that regard.

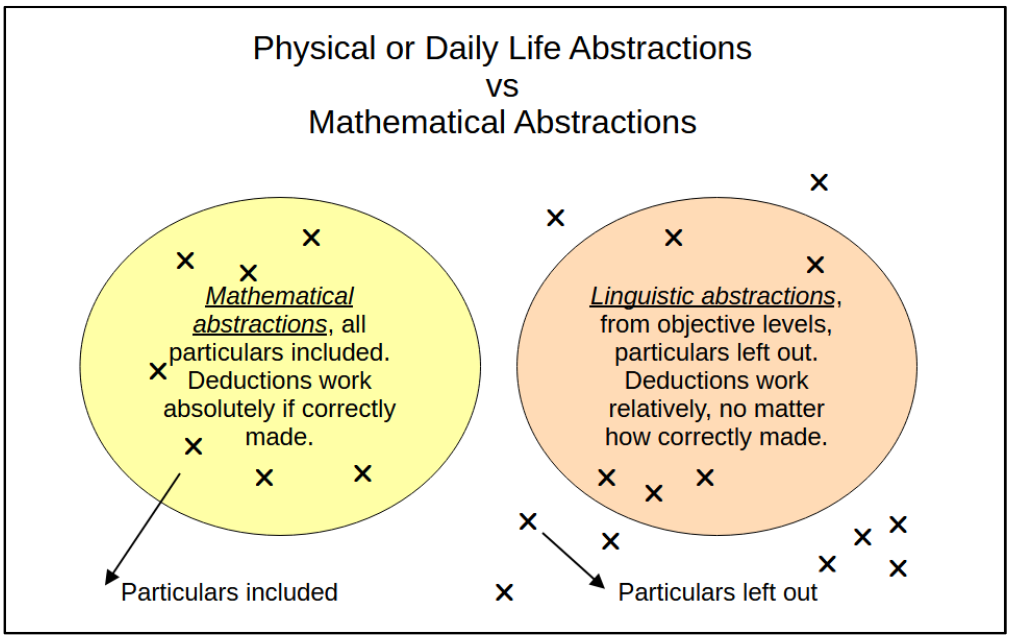
There is resounding silence regarding sins of omission. This in part can be traced to a lack of guidance in this regard. People do not know how knowledge and expertise can be directly presented by experts and authorities in a functional, networked environment such that it is both protected and useful.

There is an answer, based on fundamental principles and commonly available technologies, but used in different ways.[18]

The Problem of Symbols and Numbers—The Korzybski Problem

Alfred Korzybski was known as the father of general semantics.[19] In his first book, he introduced the concept of "time-binding," a capability of humans to pass learning down from generation to generation. Later, he wrote about the challenges of definition and understanding of things. He emphasized that the 'word' is not the thing that it describes (See Figure 5).

FIGURE 5
KORZYBSKI 1933 LINGUISTIC AND MATHEMATICAL INTEGRATION CHALLENGE



Korzybski 1933/1995, 68

As seen in the figure below, Korzybski outlines a fundamental problem characterized by the precision of mathematics, sans context and the meaning and positioning of linguistic abstractions, sans precision.

> *Only and exclusively in mathematics does deduction, if correct, work absolutely, for no particulars are left out which may later be discovered and force us to modify our deductions.*
>
> *Not so in abstracting from physical objects. Here, particulars are left out, we proceed by forgetting, our deductions work only relatively, and must be revised continuously whenever new particulars are discovered. In mathematics, however, we build for ourselves a fictitious and over-simplified verbal world, with abstractions which have all particulars included...*
>
> *Considered as a language, mathematics appears as a language of the highest perfection, but at its lowest development. Perfect, because the structure of mathematics makes it*

> *possible to be so (all characteristics included, and no physical content), and because it is a language of relations which are also found in this world. At the lowest development, because we can speak in it as yet about very little and that in a very narrow, restricted field, and with limited aspects.*[20]

Korzybski recognized that there was no useful way to bring semantics and mathematics together functionally, at least no way that had surfaced in his time. This results in both sins of commission and sins of omission. Korzybski further considers conditions in his time with a call for future innovation in integrative model development.

> *Our other languages [non-mathematical] would appear, then, as the other extreme, as the highest mathematics, but also at their lowest development—highest mathematics, because in them we can speak about everything; at their lowest development…and not based on asymmetrical relations. Between the two languages there exists as yet a large unbridged structural gap. The bridging of this gap is the problem of the workers of the future.*[21]

With generative taxonomies, we have such a tool. Our first task is to leverage this capability generally. As to AI, once we have accomplished that task—and leveraged the capacity for algorithms generally—there is space for consideration of prospects for machine learning opportunities, evaluated in the final analysis by digital processes designed and maintained by human experts and authorities.

THE DIGITAL KNOWLEDGE BARRIER AND PROSPECTS FOR AI

Implied in the enormous rush to embrace AI at some level is a sense that there is a need for more knowledge. While it is true that human desires for learning are strong and persistent, our current dilemma rests in our collective inability to make use of much knowledge that exists and that has been validated in a variety of ways, but that for one reason or another has not been applied in meaningful ways.

Knowledge Exists

There has been a longstanding, major commitment to knowledge by societies and governments, both regarding natural science and social commitments and conditions. It is important to reiterate these with respect to the knowledge requirements of enterprises and institutions and the environments in which they operate.

Globally, approximately $2.3 trillion was spent on research and development. In 2020, about a third of this was committed by the United States in various ways—China representing about three-fourths of the US commitment.[22] In the US, there are 646 universities that receive federal research funds of more than a million dollars. This is above and beyond their operating costs and other funding sources. Twenty-nine universities receive over a billion dollars annually from the federal government for research.[23]

Research work product is published in approximately 30,000 scholarly journals, which are sponsored by approximately 2,000 institutions.[24] The Scientific Science Index follows 3,738 journals; the Social Science Index follows 3,391 journals (See Table 1). Based on average number of journal submissions and the number of articles published per journal, approximately 800,000 individual research articles are published in journals listed in those indexes alone. As to the total number of journals, approximately 3.5 million individual research articles are published per year.[25]

TABLE 1
ANNUAL GLOBAL RESEARCH PUBLICATIONS

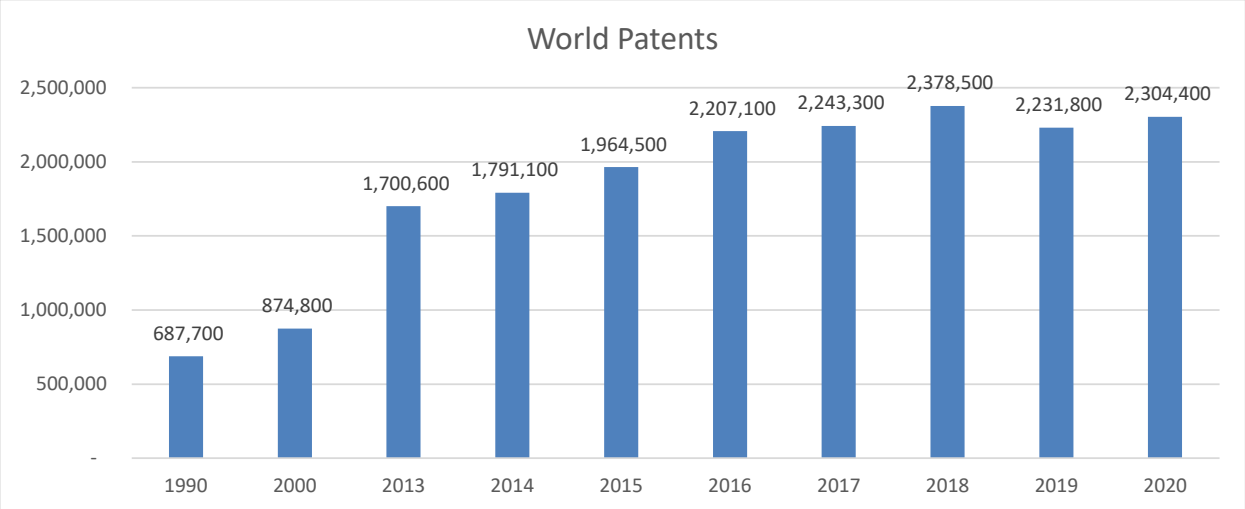
Estimates of Annual Global Research Publications (Chen, 2019)					
	Journals	Annual publications	Articles per publication	Total journal issues	Total research articles
Science Index (SCI)	3,736	10.96	15.34	40,947	628,120
Social Science Index (SSCI)	3,391	5.18	12.01	17,565	210,960
Total reported journals	30,000	8.210	14.34	246,297	3,531,979

This is a lot of product, a lot of knowledge. An additional way to look at this is in the volume of patents that are released in tandem. There are also about 3.5 million of these, issued annually. This is also a source of knowledge that can have important implications.

There is some overlap. This is an area of study, with concern for whether underpinnings for patents are 'science-based' or not. The distinction is not necessarily important for this analysis, other than to help to understand the scope of the diffusion problem, from knowledge to active, workable, digitizable processes that can be used regularly and dependably.

Science-based references in patents have decreased from 40.15% in the 1993-1997 period to 34.40% from 2008-2012 (See Figure 6). If one-third of global patents have science-based groundings.[26]

FIGURE 6
ANNUAL RATE OF WORLD PATENTS ISSUED 1990-2020



World Intellectual Property Organization, 2023, May 5

As seen under 2020 global patents, there were approximately 2.3 million. Two-thirds of those, those that did not have science-based groundlings, were approximately 1.5 million items. Potential knowledge-related opportunities could then amount to 5 million annually—the 3.5 million patents and the 15 million non-scientific patents.

Completing Out Drucker's Fourth Information Revolution

Ideally, this material would go straight into use, for the betterment of society. The impact of such a thing would be monumental. This can be considered by reflecting on work by Peter Drucker toward the end of his career.[27] He referred to future conditions as representing a "fourth information revolution" where "the emphasis … will shift from the 'T' in IT to the 'I,' as it is shifting in business and in the economy. Are the information people in MIS and IT prepared for this? I see no sign of it so far".[28]

The information revolution levels according to Drucker are as follows:

> *The first one was the invention of writing 5,000 to 6,000 years ago in in Mesopotamia; then—independently but several thousand years later—in China; and some 1,500 years later still, by the Maya in Central America.*
>
> *The second information revolution was brought on by the invention of the written book, first in China, perhaps as early as 1300 B.C., & then, independently 800 years later, in Greece, when Peisistratus, the tyrant of Athens, had Homer's epics—only recited until then—copied into books.*
>
> *The third information revolution was set off by Gutenberg's invention of the printing press and of moveable type between 1450 and 1455, and by the contemporaneous invention of engraving. We have almost no documents on the first two of these revolutions, though we know that the impact of the written book was enormous in Greece and Rome as well as in China. In fact, China's entire civilization and system of government still rest on it. But on the third information revolution, printing and engraving, we have abundant material. Is there anything we can learn today from what happened 500 years ago? The first thing to learn is a little humility…*
>
> *The cost and price reductions of the third information revolution were at least as great as those of the present, the fourth information revolution. And so were the speed and the extent of its spread. This has been just as true of every other major technological revolution.*[29]

Drucker emphasizes cost and price reductions of the earlier information developments; without resolving the digital barrier with respect to process, such benefits are not to be gained via computers. This calls to mind Drucker's point about the 'I' of IT as opposed to the 'T' of IT. It is the flow of useful information that is pertinent. As to Drucker's declaration of completion of the fourth revolution, it rings as hollow as Castells' 1996 declaration of networking success at that time.

AI has often been identified as a sign of yet another revolution based on a conception that the fourth revolution is complete. This is premature, to be sure. The fourth revolution needs to be solidified and completed, and fluidity of knowledge, tacit to explicit to expressive with respect to both knowledge and authority.

Diffusion as the Key to Success

Probably the most famous student of the diffusion of knowledge was Everett Rodgers (1962/2003) (See Figure 7). Understanding diffusion is a major research effort in the social network analysis community. As an early contributor, Rogers established a diffusion model to understand the prospects for widespread use of innovations.

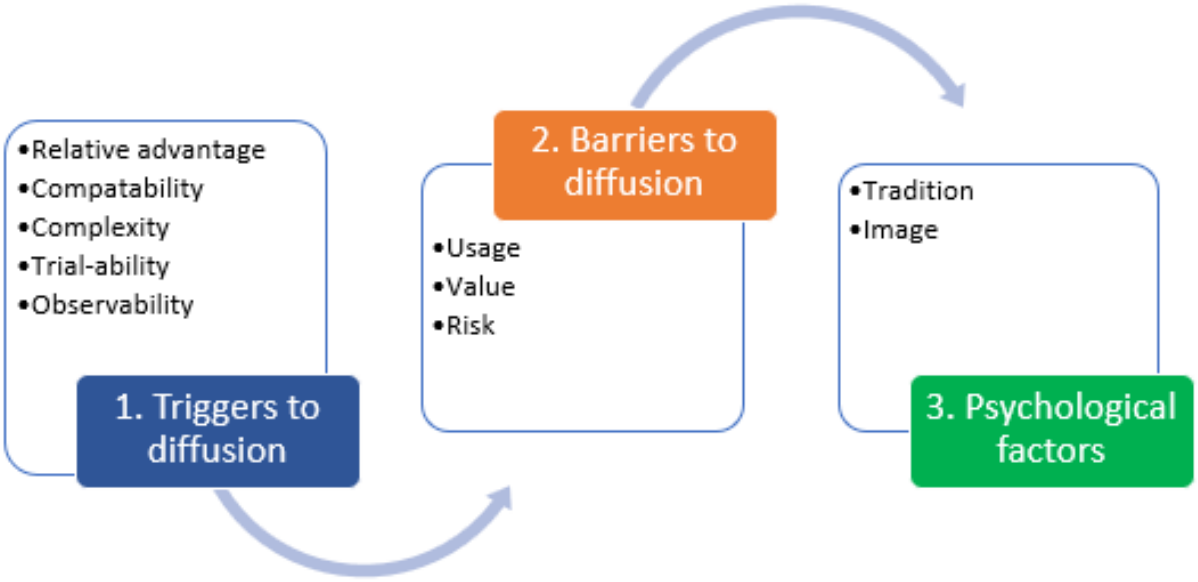
Rogers outlines three steps in the diffusion process as seen below.[30] First are triggers, five factors that support the legitimacy and feasibility of the new idea. Second come barriers, which involve practical and public access limitations. Finally, he introduced psychological factors, which can bring positive or negative implications.

Rogers' work has been expanded substantially.[31] Valente is a leading social network scholar regarding diffusion.[32] As is understood generally, dissemination is highly compromised where significant barriers exist. As seen below, not very well. As indicated by Valente:

> *...results indicate that social network influences on behavior are important and have consequences for the health and wellbeing of populations and individuals. These new insights have shed light on important aspects of how new ideas and practices spread within and between communities.*[33]

It isn't simply the logical aspects of networking and community efforts, but other factors. We refer to 'head, heart, and hand' aspects of these efforts. The object is to minimize barriers of all kinds in the process of knowledge dissemination and diffusion through appropriate social networks.

FIGURE 7
EXENDED ROGERS DIFFUSION MODEL



Sridharan, Maheshwari, and Mundhada, 2021

Knowledge is Systematically Subordinated

Indeed, viewed from the perspective of the diffusion of science, AI can be seen as an avenue to sidestep the normal process of evaluating algorithms for suitability by embedding it into the rubric of AI, which is a black box approach. In such a manner, machine-based guesses could well be matched up with human preferences that were themselves incorporated into the algorithms in question or in the data it used. This isn't to say that they are in a particular case, but clearly, they could be, sans some kind of review or evaluative steps.

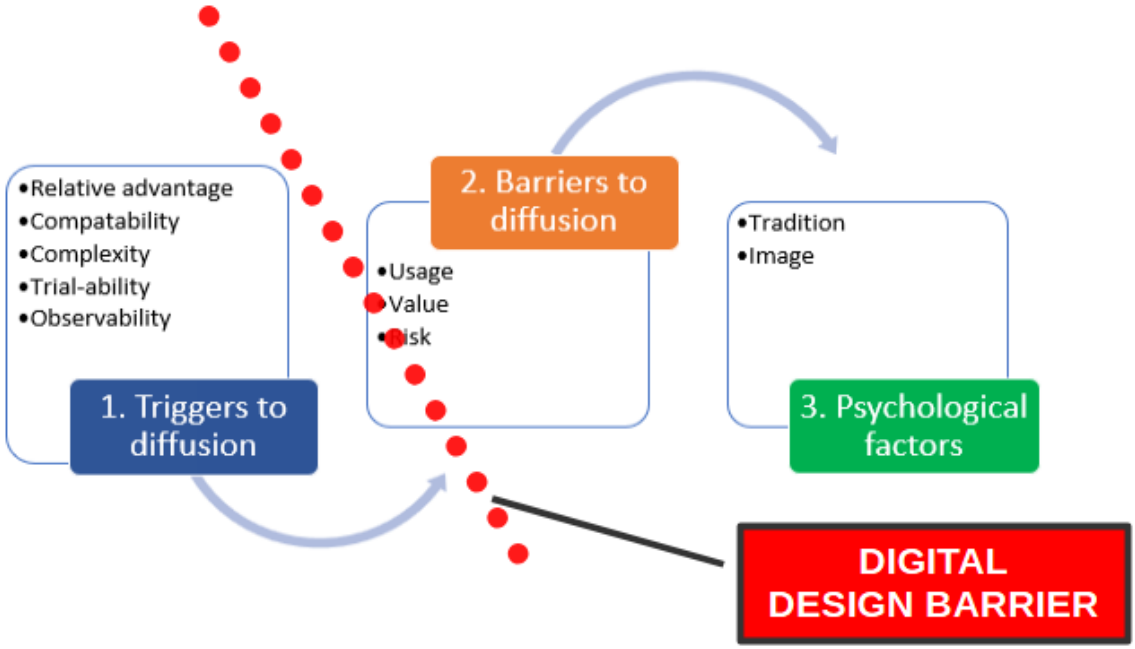
What are the implications of this? Legitimate research suffers from the digital barrier as described, but off-the-cuff and pernicious inputs do not (See Figure 8 and Figure 9). As considered earlier, many research products are available, but not readily converted for digital use.

Including published documents—many of them peer-reviewed—there are approximately 3.5 million per annum, coupled with about 1.5 million additional patents granted, bringing that total to about 5 million documented ideas for consideration. As seen in the image to the left, this represents a good deal of knowledge going 'down the drain', not generally understood nor used appropriately. A key for dissemination is to facilitate such functions, eliminating barriers while encouraging other forms of communication—following the head, hand, heart approach.

FIGURE 8
REPRESENTATION OF UNUSED KNOWLEDGE-RELATED CONTENT FALLING INTO AN ABYSS

Flow of many paper documents, messages falling into eternal deep dark hole. Inbox spam, lost information concept. Abstract flat vector illustration of deleting, throwing away, missing, losing stuff. Adobe Stock

FIGURE 9
ROGERS DIFFUSION MODEL WITH DIGITAL BARRIER



Sridharan, Maheshwari, and Mundhada, 2021

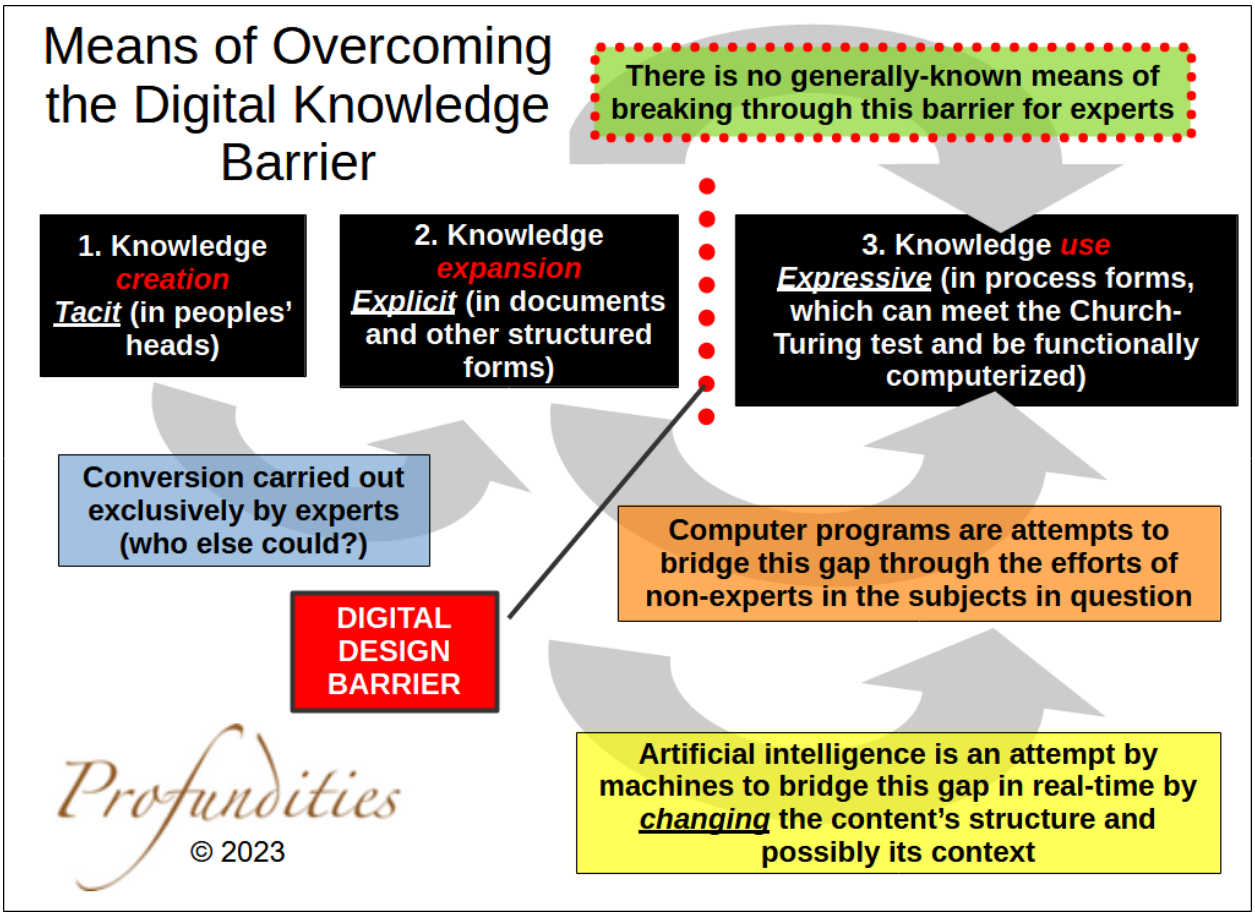
Tacit, Explicit, and Expressive Knowledge and the Digital Knowledge Barrier

The knowledge barrier is structural. As documented in the G20 Policy Brief knowledge traverses a path from tacit forms to explicit and then to expressive forms.[34] As seen in Figure 10, competent individuals can gain tacit knowledge, essentially 'in their heads,' through study and experience. Documentation of such knowledge can be readily carried out by such individuals, who can convert the information within communities of practice. This represents the state of the five million document estimate considered earlier.

Leveraging technology to store and distribute documents and other explicit information sources is not sufficient. As seen in the third black box from the left, the expressive knowledge category, there is virtually no capacity on the part of experts to carry out functional digitization of their knowledge and associated expertise. Reference to the Church-Turing capacity has to do with the ability to organize functional, repeating processes that can be understood and leveraged. Among other things, this allows for repeated use of processes.[35]

As seen in the center right of Figure 10, attempts are carried out to bridge the gap. As in the orange box, there are efforts to assign non-experts to program system features.[36] Similarly, in the yellow box below that, AI is seen as another way to compensate for an inability to arm the actual experts and authority to carry out this task. An important part of that is to query the corpus of research articles, patents, and other kinds of documents and other explicit knowledge, using natural language processing and other advanced algorithms.[37] The validity of this approach will be considered now.

FIGURE 10
MEANS OF OVERCOMING DIGITAL BARRIER



Can Qualitative and Quantitative Knowledge Generation be Synthesized?

Conventional algorithms dubbed as AI, then, can be considered in this context. By presumption, they would be justified by an ability to function better than humans in this task above all, to bridge the gap that exists because of the digital barrier. If the digital barrier did not exist, there would be a much higher-order benefit to society. Processing power, computational power, and instantaneous networked communications could convey existing and new knowledge in various forms in an instant.

Why wouldn't that be more preferentially performed by humans—by experts and authorities themselves—if the design process was relatively fast and solutions were stable. This would be like the catalogues of music that are available, in all genres and performance settings. Not only could the 'greatest hits' be available on demand, but they could also be mixed and matched based on need and desires. They could be readily adapted to differing conditions and they could be updated as scientific findings emerged, social settings changed, and underlying conditions were introduced.

Nonetheless, potential for use of AI in a primary sense is touted as being a timely and reliable thing:

> *The conventional wisdom around AI has been that while computers have the edge over humans when it comes to data-driven decision making, it can't compete on qualitative tasks. That, however, is changing. Natural language processing (NLP) tools have advanced rapidly and can help with writing, coding, and discipline-specific reasoning. Companies that want to make use of this new tech should focus on the following: 1) Identify text data assets and determine how the latest techniques can be leveraged to add value for your firm, 2) understand how you might leverage AI-based language technologies to make better decisions or reorganize your skilled labor, 3) begin incorporating new language-based AI tools for a variety of tasks to better understand their capabilities, and 4) don't underestimate the transformative potential of AI.*
>
> *Until recently, the conventional wisdom was that while AI was better than humans at data-driven decision making tasks, it was still inferior to humans for cognitive and creative ones. But in the past two years language-based AI has advanced by leaps and bounds, changing common notions of what this technology can do.*[38]

Consider the implications of the statement that "AI is better than humans" at something, anything—let alone decision-making of any kind. Such a facile statement reflects a simplistic approach to knowledge and human needs in general. It surely does not consider broader issues of sociality and humanity. It does not take into consideration the effects and risks associated with a detachment of knowledge and policy from human institutions established and dedicated for that purpose. Ultimately, the question can be raised, "In whose opinion is 'AI better than humans' at a particular task?" If that is the opinion of the machine, that is indeed a problem. Will a machine—or its makers who may be ignorant of the detail and complexity of qualitative and quantitative work products—be warranted in making such an assessment?

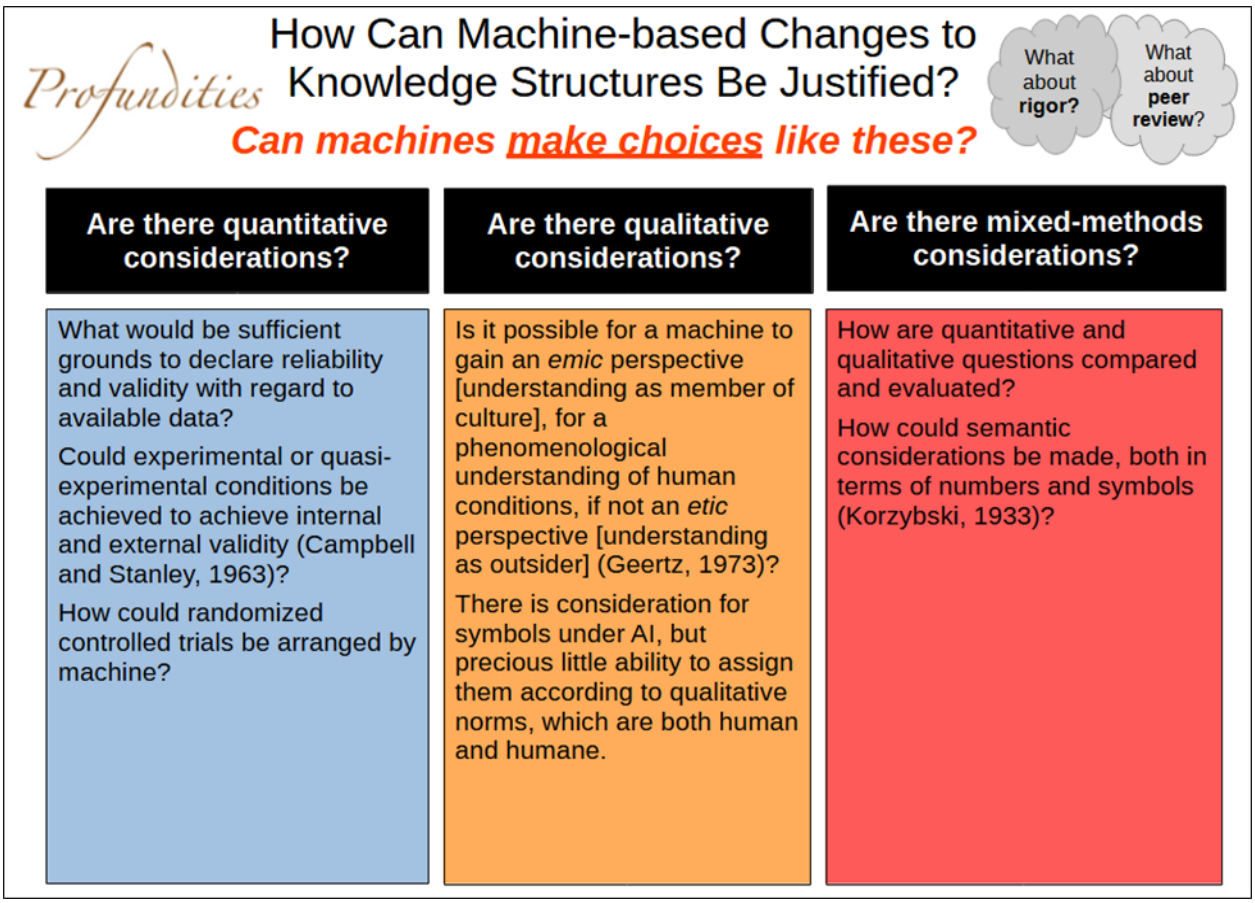
It is important to understand the underlying questions faced by scientists and others as they work to expand our use of accepted knowledge. As seen in Figure 11, quantitative and qualitative evaluation represent very different kinds of activity. In quantitative research, scientists struggle a good deal over the concepts of reliability and validity. This has to do with data to be sure, but also many other factors. There is the question of internal and external validity. Coming to grips with these is much more than a snapshot consideration.

Qualitative researchers work hard to gain either emic or etic perspectives with respect to any study in question. This is a task that is closely tied to a concept called phenomenology. A phenomenological approach is an effort to understand the situation of another person or people deeply and sincerely. This is where *etic* and *emic* perspectives apply.[39] It is very different from the typical attitude toward quantitative research, which is held to be dispassionate and largely mathematical.

How could machines carry out such tasks? How could one declare reliability and validity? Surely, they could generate data with respect to underlying conditions in one area, but they would have to have subject

matter expertise to understand even the most trivial and derivative of conditions, let alone complex and dynamics ones. Broader kinds of knowledge would be knowledge to act in the role of generalist in the subject areas in question. It would not always be obvious which subject areas applied to a situation, as that is not always obvious. For one thing, that would determine who should even be under consideration for judgments and design in the first place.

FIGURE 11
MACHINES INCAPABLE OF MAKING RESEARCH JUDGMENTS

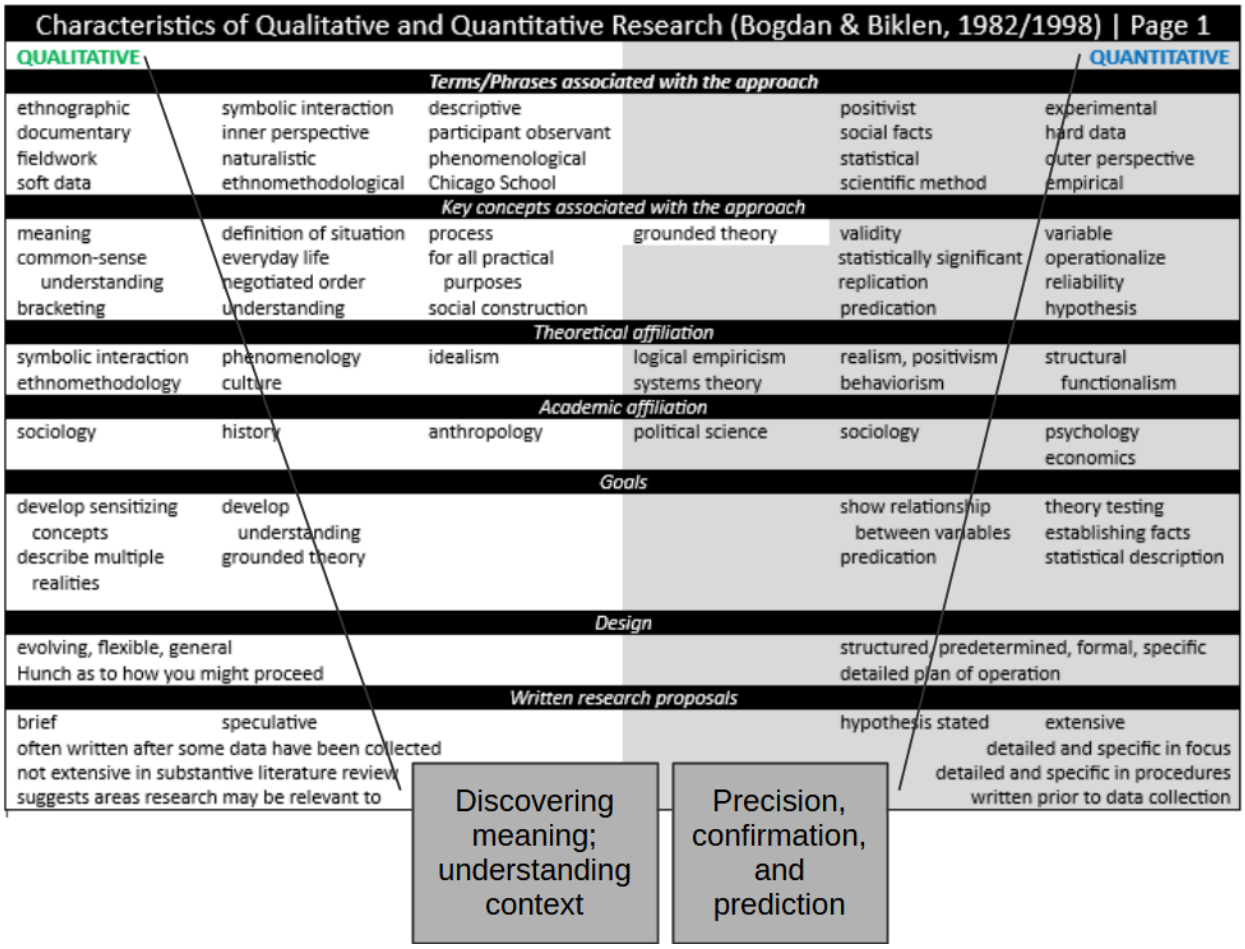


Qualitative and Quantitative Underpinnings of Knowledge

The following Figures 12 and 13 demonstrate principal conditions faced by researchers under both qualitative and quantitative realms. It is important to note that these activities are taking place currently on a large scale. These are reflected in the 3.5 million scientific publications—the 628,120 estimated SCI Index or physical science articles and the 210,960 SSCI or social science papers.

As page 1 of the research characteristics model of Bogdan and Biklen shows (Figure 12), qualitative study shows similar differences from quantitative research in the areas of terms/phrases associated with the approach, key concepts, theoretical affiliation, academic affiliation, goals, design, and written research proposals. The level of attachment on the qualitative side is notable. Scientists are probably more closely associated with quantitative work, working on natural science phenomena in dispassionate and distanced perspective. To the extent possible, qualitative research is immersive. The point is in gaining understanding. It is particularly difficult to see how machines could serve such a role.

FIGURE 12
COMPREHENSIVE VIEW OF QUALITATIVE AND QUANTITATIVE RESEARCH METHODS I



As can be seen in Figure 12, the qualitative effort is for discovering meaning and understanding context. Alternatively, quantitative study is oriented toward precision and definitive answers to the degree possible. Together, as represented by documented publications, they represent a massive, combined effort, one with incredible line-item support by dozens of countries throughout the year, along with commercial supporters. The AI proposition is to mine the depths of this material and to convert it to workable formats, along with other information that is available online.

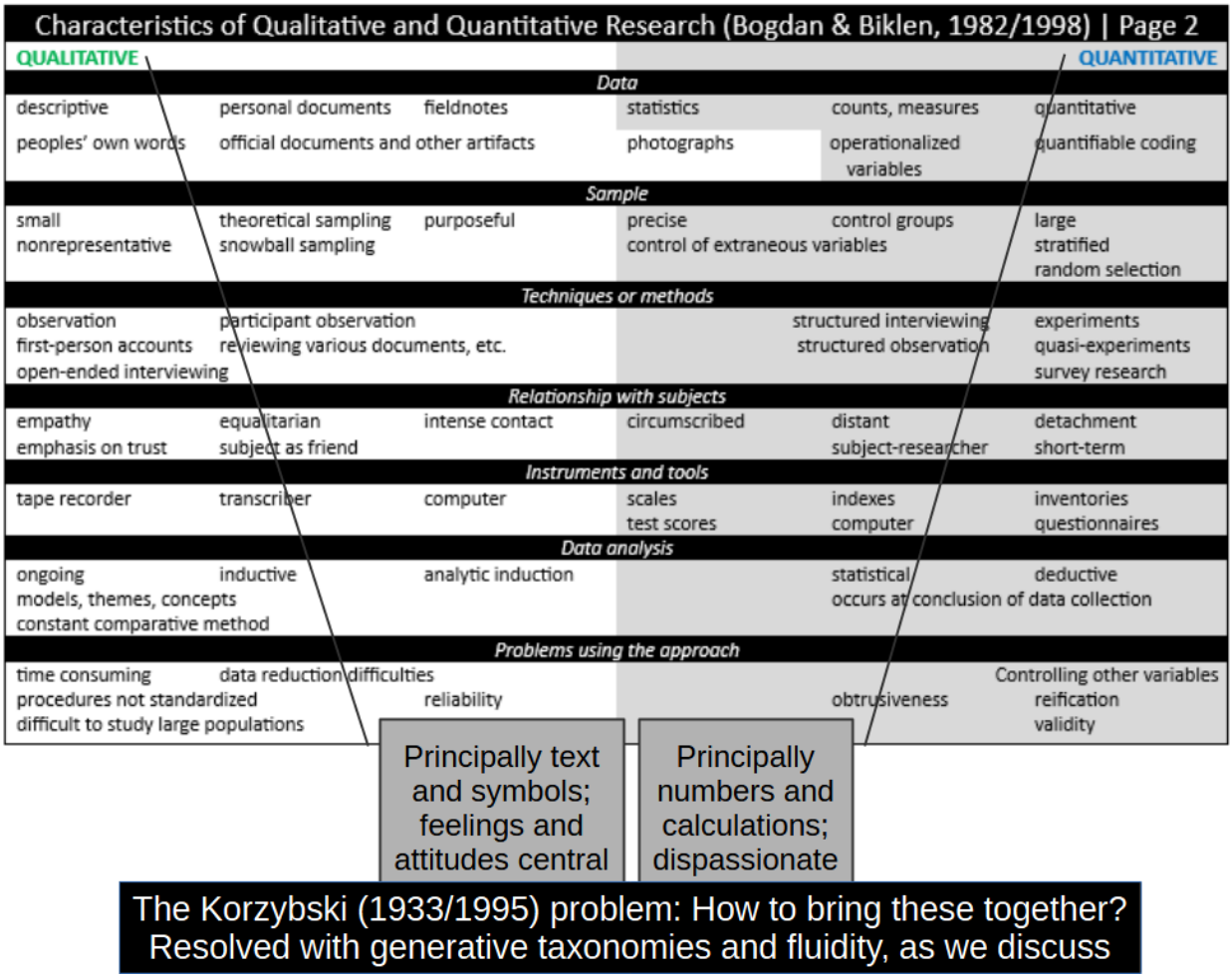
There is discussion that computers could do this work on their own. AI enthusiasts make this case and have done so for decades via all kinds of media and through many channels.[40] The argument is stronger on the quantitative side—at least as to the calculations involved—but there is little basis for charging computers with the task of doing ethnographic work, identifying meaning, understanding ideals, and engaging in other quintessentially-human activities. As indicated by Denzin and Lincoln:

> *Qualitative researchers stress the socially constructed nature of reality, the intimate relationship between the researcher and what is studied, and the situational constraints that shape inquiry. Such researchers emphasize the value-laden nature of inquiry. They seek answers to questions that stress how social experience is created and given meaning.*[41]

As Page 2 of the research characteristics model of Bogdan and Biklen continues (Figure 13), qualitative study shows similar differences from quantitative research in the areas of data, sample, techniques or methods, relationship with subjects, instruments and tools, data analysis, and problems using the approaches. The qualitative approaches are consistently more human, more inherently social, and more symbolic than mathematical.

Recapitulation of Page 2 of the qualitative/quantitative model calls attention to symbolic and numeric products of both qualitative and quantitative work. These can be mutually supportive but combined with care. It is challenging to reliably match populations and samples, to make sure that they are analogous and compatible. This requires careful study based on a broad understanding of techniques and methods, instruments, and tools. Understanding these can consume long periods of study, perhaps even the span of careers.

FIGURE 13
COMPREHENSIVE VIEW OF QUALITATIVE AND QUANTITATIVE RESEARCH METHODS II



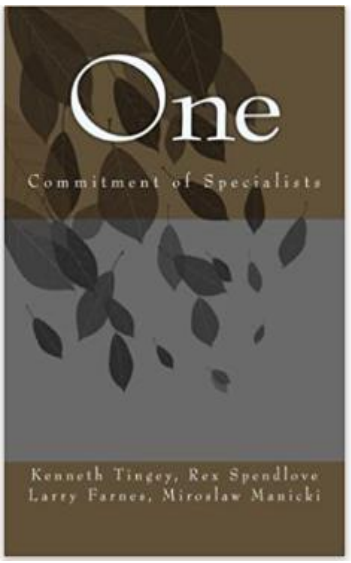
The Korzybski problem and fluidity as considered earlier factors in this challenge. My colleagues and I also hold that generative taxonomies provide a useful bridge between qualitative and quantitative worlds. The underlying trees of this model provide context. Careful design of trees in support of these can serve to leverage the computational and communications power of computers and networks without forcing a separation between subject matter experts and their work as it passes to a digital realm.

Once such knowledge is organized to bring text, other symbols, and numbers together in a functional way, computing power can then support operationalization of all such work. One key is in the integration of them, which we will not consider.

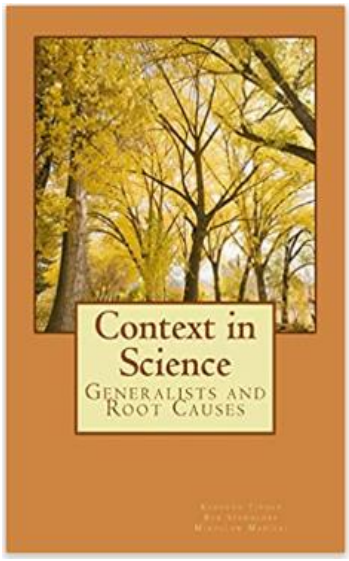
Specialist, Generalist, and Journeyman Scientific Work

There is a generalist task to be carried out here, as operational access to existing research has been rare. There is little opportunity in the current environment for generalists to exert influence in a meaningful way. The role that many seem to want to carve out for AI would be better served by encouraging the function of generalists, who above all are charged with gatekeeping in science and in creating the groundings for understanding and leveraging context at an operational level (See Figure 14).

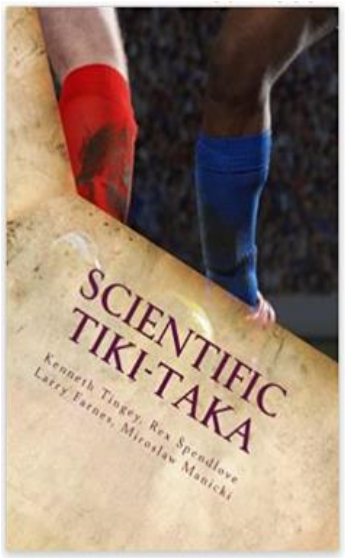
FIGURE 14
SPECIFIC SCIENTIFIC GUIDANCE FOR SPECIALISTS, GENERALISTS, AND JOURNEYMAN RESEARCHERS AND PRACTITIONERS



Specialists
https://a.co/d/dMNO9Vg



Generalists
https://a.co/d/4796o3t



Journeyman scientists
https://a.co/d/eGgZ1n6

It is possible that one scientist or a group could engage in both kinds of work but in truth many do not. Different kinds of studies demand different kinds of methods; communities of scientists commit to methods and traditions that seem to them to be most appropriate. Of course, there can emerge different communities who study the same subjects but using very different methods—qualitative or quantitative or mixed. They may come up with very different conclusions. It is the job of other kinds of scientists—generalists—to sort out the differences and to make judgments as to the relative merit of the work products of such groups. More about generalists will be considered presently.

Knowledge-generation is a complex task requiring input from various kinds of scientists, or knowledge-workers generally. There are specialists that do narrow, primary, and detailed work as to specific phenomena. Generalists then serve in a comparative and integrative function, evaluating the nature and context of specific work in nature or society. In an active scientific or knowledge-related environment, there are also journeyman scientists that take steps to study a new field or one that is potentially underserved.

These are considered now. As indicated elsewhere, I question the need for an extensive push for AI per se. What is essential at this point is a concerted, global effort to identify, empower, and encourage the work of scientific generalists, as well as specialists and journeyman scientists.

One: Commitment of Specialists

Specialists are the quintessential scientists.[42] They drill down into specific and detailed aspects of an area of science. Specialists are often the white-coat, laboratory people. They are the primary science or knowledge workers.

They represent the principal hands-on scientists as considered by the Bogdan and Biklen qualitative and quantitative model. Specialists tend to be the most well-known scientists, those that make discoveries and describe them to much acclaim.

Context in Science: Generalists and Root Causes

Then there are generalists.[43] They have the difficult task of evaluating the work of specialists and how they relate to each other. There probably aren't enough generalists in science fulfilling such a role.

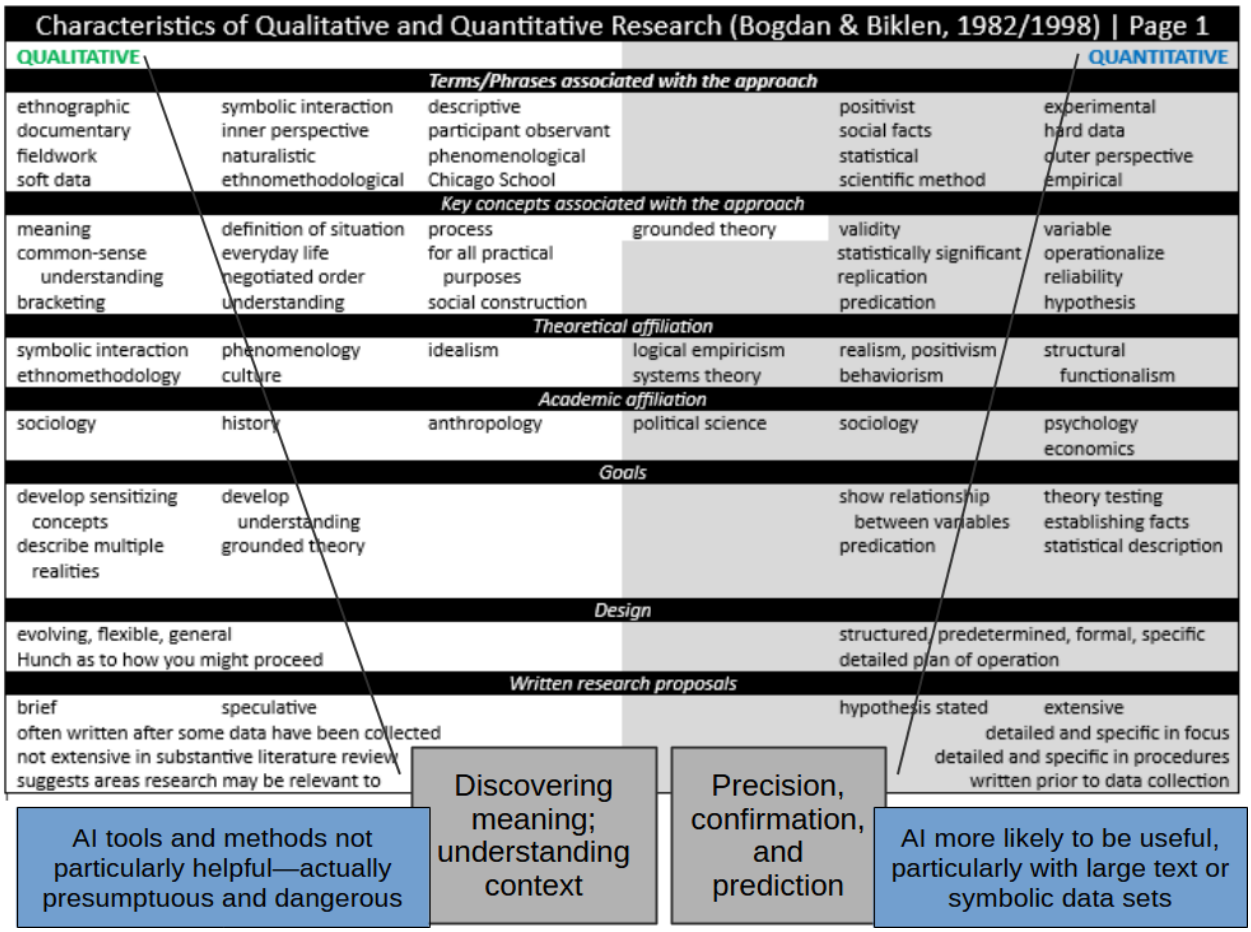
Scientific Tiki-Taka: Utility Roles in Achieving Fluidity and Dual Control

Finally, there are journeyman scientists.[44] These are knowledge workers that move into a new or underserved field as specialist or generalist. With time, some of these become specialists or generalists in the fields in question. In some cases, there are scientists who do well in and relish such roles. Tiki-taka is a flexible football strategy. It is designed to fill in the gaps and maximize the capabilities of all.

Possible AI Contributions to Qualitative and Quantitative Knowledge Applications

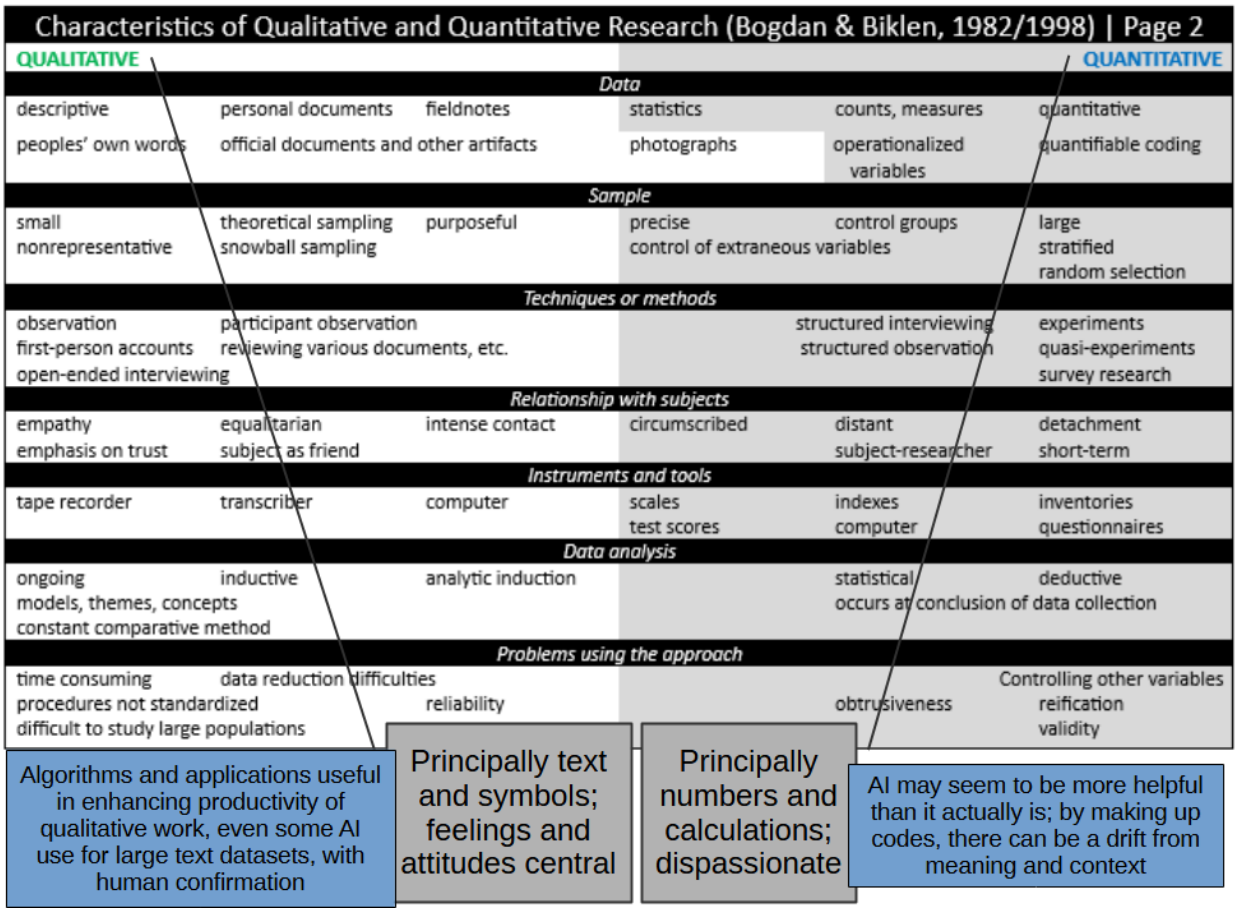
Advanced and automated algorithms of many kinds are clearly of benefit to knowledge development and dissemination.[45] Use of symbols and use and computation of numeric items are best carried out digitally—in terms of speed, cost, breadth, and completeness.[46] These can be seen in Figures 15 and 16, adaptations of Figures 12 and 13 with regard to machine-based tools in support of human research efforts.

FIGURE 15
COMPREHENSIVE VIEW OF QUALITATIVE AND QUANTITATIVE RESEARCH METHODS I – AI COMMENTARY



Understanding the tasks represented by qualitative and quantitative work can result in tools and algorithms, including AI, which can speed up the knowledge development process and improve on underlying tasks. In the process, it is important to not skip or avoid elements in the process that help to convey meaning and depth, particularly with respect to qualitative study.

FIGURE 16
COMPREHENSIVE VIEW OF QUALITATIVE AND QUANTITATIVE RESEARCH METHODS II – AI COMMENTARY



Under terms and phrases, there could be several useful tools. I use one. I use a software package called Atlas.ti, which is a qualitative research tool for coding of any number of documents. It is used to establish codes and models that span sources and to create such models as they "emerge" from the text data. *Altas.ti* has a new AI mode that creates a model of many concepts from the text as seen in Figure 17.[47]

The tool is useful. It created a comprehensive model from the combined contents of seventeen documents. Here is a view of the model, which has to do with public transportation.

FIGURE 17
ATLAS.TI AI CODES FROM TRANSPORTATION DOCUMENTS

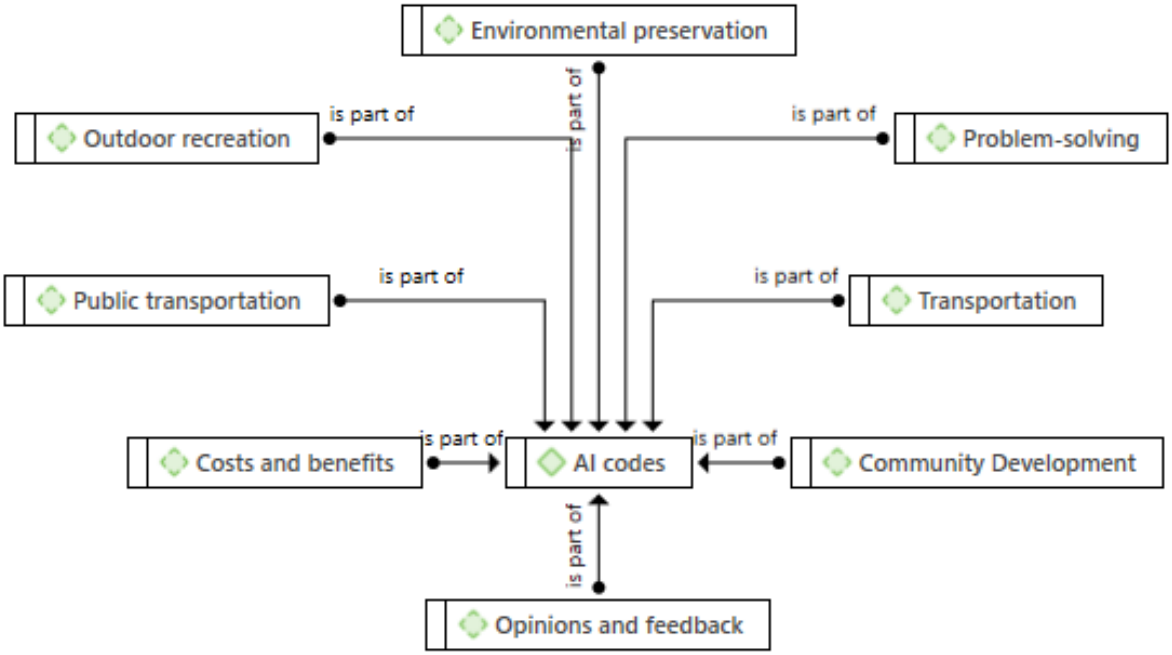
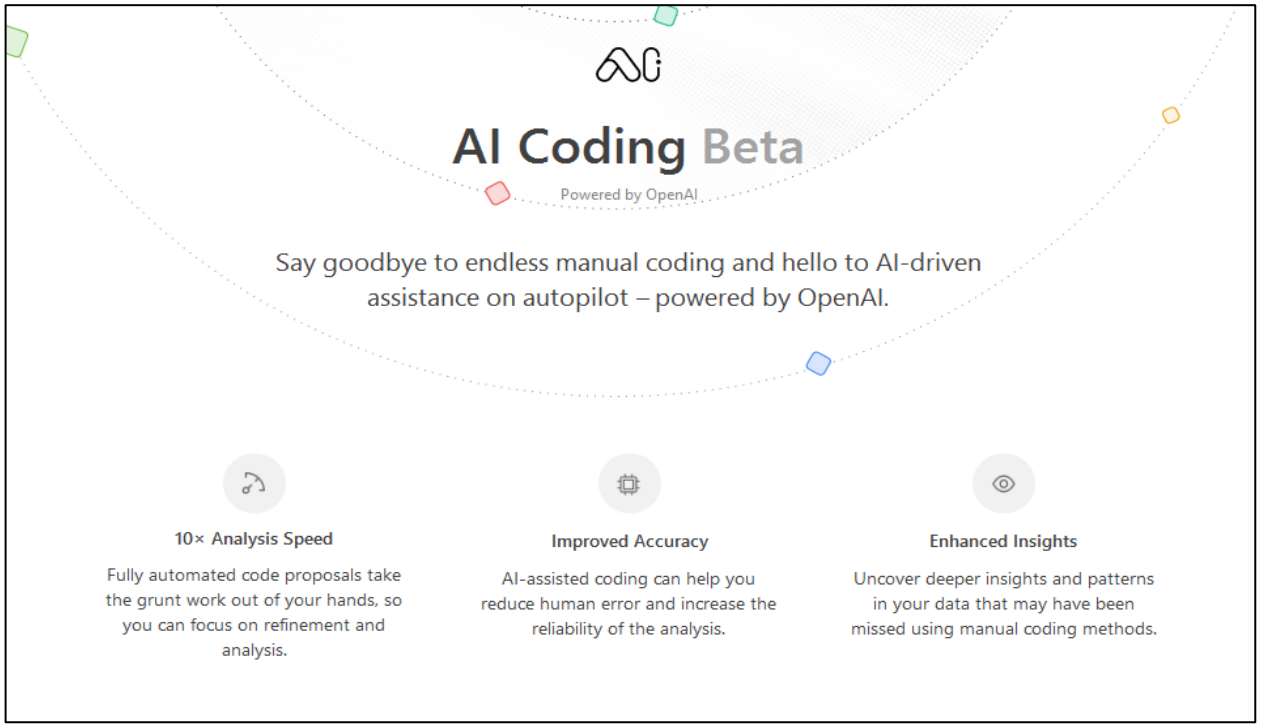


Figure 18 shows a splash screen that is intended to provide general information on Atlas.ti's AI capabilities. It emphasizes speed, accuracy, and the availability of enhanced insights. While these cannot be denied, it cannot be said that deep and meaningful insights can be obtained without reading the contents and interpreting the text via codes.

FIGURE 18
ATLAS.TI AI CODING SPLASH SCREEN



Atlas.ti product documentation

There may be overlaps in meaning and some levels of paradox, irony, and negation in the text that are not caught up in the process. By not investing time to experience and reflect on the content, deeper understanding is not possible. Thus, the codes do not reflect a level of reality that could be obtained through detailed effort. In the one sense, there is lived experience, which is immersive and profound. Then there may be a novel or other literary or cinematic product describing your experience. A step away from the action, it still may have impact and convey meaning. Then, further afield might be an outline or summary of the story. That may still be meaningful, but capable of having far less impact and effect than other levels of experience. Nonetheless, quick approaches such as AI are clearly useful, particularly when there is limited time.

FIGURE 19
ATLAS.TI TRANSPORTATION AI CODES

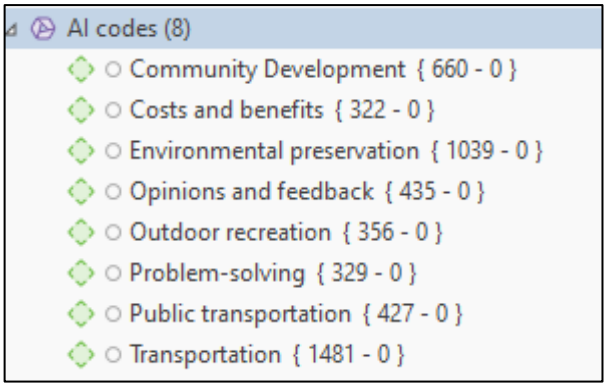


Figure 19 is a listing of the codes created automatically, from a low of 322 instances for 'Costs and benefits' to a high of 1,481 instances for 'Transportation'. The software allows user/analysists to navigate through the model by code, to review the text in each case for content, and to treat the entire corpus of documents as a unit according to the outline.

Whether the model is created painstakingly by reading the material or automatically using the AI feature, the result is explicit in nature. This is to say that it is static. As outlined earlier, to be useful in digital format, it must be converted. Doing so manually is what I refer to herein as fluidity. The same task may be carried out by technical specialists or by machine. All these build on qualitative and quantitative research.

Once established, knowledge can be expressed and made available in process forms that leverage the quintessential characteristics of networked computers: Computing speed, large scale queries and transformation, logical directions, and instantaneous worldwide distribution. These can serve to support the needs and wants of the people assisted and adjudicated by authorities and providers in areas of interest, expertise, and legitimate authority.

THE IMPORTANCE OF EXPERTS IN EVALUATING AI

Chi, Glaser, and Marshall have documented several key aspects of human expertise that are germane to the current question. Such expertise is useful in the primary knowledge corpus—the 5 million knowledge-specific documents published annually. Such expertise is earned through hands-on, extensive study, experimentation, and collaboration.

> *Experts excel mainly in their own domains.*
> *Experts perceive large meaningful patterns in their domains.*
> *Experts are fast; they are faster than novices at performing the skills of their domain, and they quickly solve problems with little error.*
> *Experts have superior short-term and long-term memory.*
> *Experts see and represent a problem in their domain at a deeper (more principled) level than novices; novices tend to represent a problem at a superficial level.*
> *Experts spend a great deal of time analyzing a problem qualitatively.*
> *Experts have strong self-monitoring skills.48*

Leonard and Swap provide some ideas of the depth of knowledge involved to qualify one for expertise as described.[49] They refer to 'deep knowledge' as a kind of capacity resulting from twenty years of dedicated effort—study as well as experience.

There is extensive literature on this subject. More can be provided. Suffice it to say that being in the presence of someone with such kinds of knowledge, experience, and expertise can be a thrilling as well as a taxing experience. They can cut right to the core of a matter, having both an understanding of underlying principles and facts and experience with a myriad of situations that can be faced.

Achieving Cognitive and Sociological Legitimacy in Public and Private Computing via Fluidity and Immersion

As outlined earlier, I devoted my doctoral dissertation to this subject.[50] This study came from a series of writings I engaged in in the early 1990s when I was introduced to a nascent version of the generative taxonomy model. I had had training in COBOL, Fortran, and Basic in accounting studies and had worked for over a decade with desktop computing tools—from spreadsheets using Apple II and CPM machines to personal computers and Apple Macintosh machines—weaving the effort into my work as a venture capital fund partner and a systems and operations consultant. I had recently started a software development firm specializing in UNIX and Informix databases as groundings for enterprise tools and systems.

I saw an opportunity to use the new tool for the design and implementation of complex compensation plans. Working about a third of the time for the next several months, I was able to create an 'expert system'

for defining and deploying any kind of complex, multilevel plan. In the process, I was able to think of alternative plan features that had never been deployed.

Using the trees was awkward and non-intuitive to me. With time, particularly because of training others to use the model, I concluded that the challenge was with differences between computer programming and tree design. It is easier to teach a non-technician than an experienced programmer how to use the trees. The process is a natural extension of writing a document, although it extends the knowledge to active processes that both consume time and allow for repeated looping through processes. The knowledge of the designer expands simply from the act of design.

I started writing white papers to describe my journey from someone with generic training in accounting, finance, and management to someone with deeper understanding of the prospects for management through mastery of processes. I learned of W. Edwards Deming and started to build a library of works about him. I started to send out copies of the white papers and enter discussions with others. I met with an accounting professor who was a proponent of 'event accounting', as colleagues saw some overlap and set me up with him. The accountant didn't seem too impressed. He said, "This looks like a simple inference engine." I responded, "Yes, but there is a lot of inferring going on." He pretty much ended the conversation there.

As to the white papers, I bound them together in the form of a book, "Dual Control"[51] It has served as a foundational element for the rest of this work in fluidity, immersion, and enhanced organizational legitimacy.

I have done a considerable amount of work in the event accounting literature as well. There are important overlaps and clarifications. George Sorter, who started the course of study in a 1969 study.

> *Proponents of the "Events" theory suggest that the purpose of accounting is to provide information about relevant economic events that might be useful in a variety of possible decision models. They see the function of accounting at one level removed in the decision-making process. Instead of producing input values for unknown and perhaps unknowable decision models directly, accounting provides information about relevant economic events that allows individual users to generate their own input values for their own individual decision models.*[52]

Although this is very much in line with the idea of fluidity—in essence it constitutes an early call for enhanced legitimacy—subsequent research in event accounting went down a very different path.[53] I have written about accounting models based on what I called the "Big E, little e" (BELE) data model. This is central to the underlying data model to be used with generative taxonomies as outlined in my book "The Angels Are in the Details: Control and regulation in a good way".[54]

Nine Layers of Institutional Information Processing

Figure 20 outlines the nature of the nine layers of institutional information processing, designed to support the combination of fluidity and immersion that underscores organizational legitimacy. From the top, the layers represent the task of understanding and supporting the needs and wants of customers, clients, etc. From the bottom, raw computing power is considered. The point is to maximize the power of the latter in meeting the requirements of the former.

This is not to be confused with the OSI model, which is uniquely technical in nature (https://en.wikipedia.org/wiki/OSI_model). These may apply to the bottom layers in this model, which is organized in a manner to support management and enterprise objectives specifically.

Layer 9. Customers/end Users

Customers—including clients, patients, or other kinds of beneficiaries, have more options in communicating with providers, including tools to communicate in dynamic and granular ways. This is typically only possible in perfunctory ways—via static commentary and limited survey tools. The legitimacy of the enterprise in question is largely subject to successful alignment with customer needs and desires. Providing tools, especially process-oriented capabilities, can help to ensure that their needs are met.

Layer 8. Governing Parties

This involves the translation of items and objectives of Layer 9 into workable and viable processes using both numeric and symbolic data. A key decision is selection of primary technology for the enterprise, a decision referred to as "high profile technology" or "HPT".[55]

Layer 7. Executives/Managers

These must be responsive to governing prerogatives and customer desires as filtered through them.

Layer 6. Logic Design

This is the key area with respect to fluidity and immersion. This is the area where processes are defined and deployed. This is analogous to a composition function in music. It is important that the experts and authorities called on to do this work are not suborned by technical inputs and technological personnel. Only those participate in this stage who have 'earned their way into the room' from a subject matter standpoint. It is useful to make use of social network analysis for this purpose, to assure that representative leadership participates and is uncoerced or unduly influenced in the process.

Layer 5. Gateway: Access/Security

This is typically in a web environment. Various forms of authentication and validation are needed. The heuristic in this sense is to beckon from the 'front door' battening down the 'back door'. Media can make up much of this layer—including various visual and audio effects. AI may serve well in this arena. Related to this, data-driven media can provide custom content. Generative taxonomies can provide a useful framework for such custom content.

Layer 4. Application Infrastructure

Such applications are designed to support specific functionality, such as email, accounting, customer relationship management, web services, or any of several fixed functions. As a rule of thumb, as knowledge-based functionality is introduced under efforts on Layer 6, they can be scaled back at this layer. Many IT infrastructure applications fit int this layer, including databases, email and communications packages, and systems utilities. Content management systems can be helpful, but it is wise to avoid hosting documents and other digital assets on the file system in statis forms.

Layer 3. Data Management

Data is principally in the form of records in databases, directories, and file systems. It is good for various reasons to minimize filesystem content, such as documents and static media from such systems. Data stores are best configured to deal with streams of data rather than static 'fields' of data. Sophisticated algorithms, bordering on AI, can be serviceable in this activity.

Layer 2. Operating and Network Systems

There are many choices with respect to operating systems; Linux is almost always a good option. The operating system should be configured to minimize ports; it is best to channel content through a secure web gateway. Hardening the operating system and eliminating ancillary functions are important. This is also where the dictum 'beckoning from the front door while shutting down the back door' is germane. Biometrics and multiple sign ins should be used where possible.

Layer 1. Processors and Devices

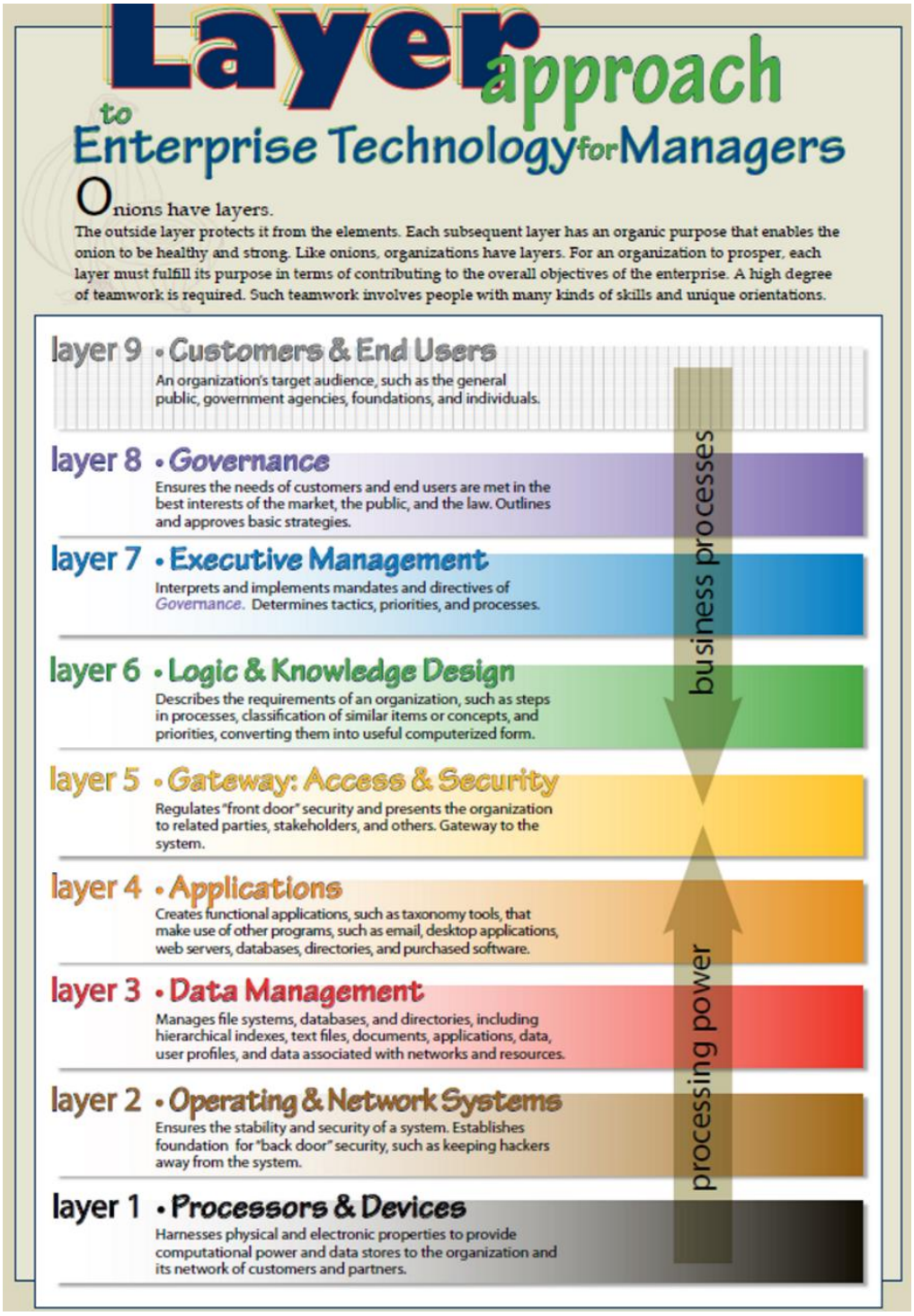
The server market has coalesced around a few powerful models. All efforts should be entered into to harden them and to house them in dedicated, ultra secure data centers.

It is important that each layer be independently managed and that the layers themselves are secure from one another. Much of the problem with contemporaneous system implementation is that sandboxes exist within such systems that allow users with administrative rights to wander around the system or a part of it and try things. This should not be allowed. This is in part why a color-based security and classification

system is used. People should not be able to interface with the system from outside of their layer assignment. Their credentials should reflect this, and the difference should be enforced.

Additional commentary on the layers concept can be found here: http://library.profundities.info/layers.

FIGURE 20
LAYERED APPROACH TO ENTERPRISE MANAGEMENT



Tingey, 2009

Issues With Respect to AI and Other Algorithms According to Information Processing Layers

The question, then, relates to the nine layers. How can or should AI affect these, or not be allowed? (See Figure 21). The last term is purposive; the importance of information processing to inputs as well as outputs in all domains of nature and knowledge and sectors of geopolitical, social, and corporate authority does not allow for untethered functionality.

As seen above, there are potential AI applications at all levels of system design and administration. In all cases, it will be important to feature dashboards that can support 'Big E, little e', or BELE data structures to focus on either documents and processes rather than individual elements of them ('Big e" events), or 'little e' events, which can be evaluated as ledgers and journals on their own. Using tree-based configurations, access to Big E as well as little e details may be controlled according to relevant enterprise models. I have done a good deal of work in this area using trees, storing the primary data in LDAP directories.

AI and Layer 9. Customers/End Users

There are and can be many effective algorithms for these purposes that are not strictly AI. There is also a crossover requirement from devices on Layer 1 to customers and end users on Layer 9 that could call for effective algorithms that could enhance knowledge transfer and facilitate optimum outcomes. Care must be taken that machine learning isn't conducted without verification trees that are overseen by experts and authorities. Good, substantive work could thus be undermined.

AI and Layer 8. Governing Parties

Governing parties must deal with a myriad of domains that require understanding and synthesis. They need to have access to data represented by expert-and-authority-validated algorithms with advanced features. There will need to be a means of evaluating streams of data on the fly, mixing and matching, and comparing them both at BELE data levels and at the macro level.

AI and Layer 7. Executives/Managers

This group needs to have access to similar tools as Layer 8 and 9, but with more detailed access to processes and display structures within the firm.

AI and Layer 6. Logic Design

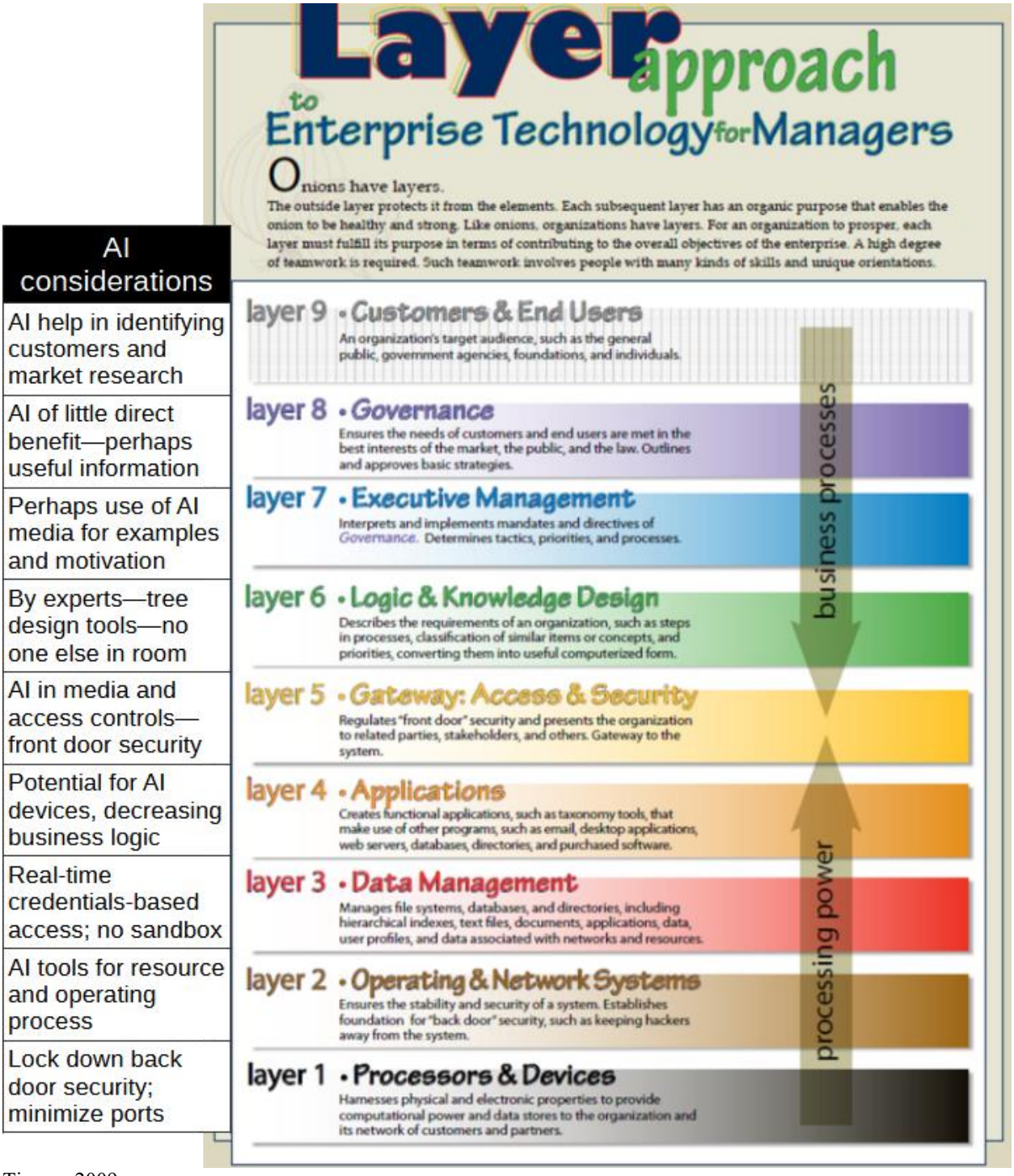
It is possible that AI tools could assist experts and authorities create processes and related content. Certainly, there is a need for useful integrated hardware/software solutions to reduce the labor required to design, integrate, test, and deploy processes. The challenge is not unlike beneficial tools, tooltips, and accessories associated with desktop publishing or integrated software design workstations.

The challenge with respect to Ai in this design layer is not to make status quo cloning of content too easy, such that designers automatically copy prior work. It would be of great benefit to be able to lay out a templated tree structure with an ability to modify aspects of the arrays using search terms and other macro tools.

AI and Layer 5. Gateway: Access/Security

AI tools could be particularly useful here. If the system could anticipate problems that could lead to compromise of protocols and interface algorithms, the functions of Layer 5 would be strengthened. Depending on the protocols and web service packages in use, AI-aware capabilities to anticipate problems and prepare solutions.

FIGURE 21
LAYERED APPROACH TO SYSTEMS WITH COMMENTARY ON AI IMPLICATIONS



Tingey, 2009

A key interface is the act of linking processes with underlying data. This is the key interface between Layer 6 and the data management layer, Layer 3. We have designed a 'query request form' for this purpose. This could benefit from AI-like capabilities.

AI and Layer 4. Application Infrastructure

The various applications selected in support of the enterprise system, to that degree that they are modern and contemporary, will have algorithms and tools that border on AI if they are not entirely oriented toward templating, if not reasoning. It may be useful to create super-installation macros or tools to anticipate these and support system-wide standards that reduce areas of conflict or undue complication.

As the content of Layer 6 growth and matures, programmatic functions in general purpose applications at Layer 4 will be phased out. This will need to be carried out with some foresight that could benefit from intelligent algorithms, either via the expert trees or AI. If subject matter oriented, they would be best served through tree design; if associated with the architecture, a systems-oriented algorithm or machine-based solution would be preferable.

AI and Layer 3. Data Management

The three main data stores—databases, directories, and file system structures—will each have different implications with respect to AI.

Databases principally need to be locked down outside of processes. Processes would control all rights. Processes themselves would also thus be housed in database trees. Processes would be controlled according to role, which would have strict GUID limitations. Everything would only be accessible via need-to-know rules. AI conceivably could assist in this.

Directories are all about access control limitations. The full Lightweight Directory Access Protocol (LDAP) suite needs to be dusted off and deployed. At a university research foundation, I oversaw the deconstruction of all the major directory products and found that they all were comprised of macros on top of LDAP. This is another area where sophisticated, AI oriented algorithms could be useful.

Ideally, file systems should not house documents. Authorized personnel should be able to access information made available in structured form in real time based on contextual, GUID conditions, but making such documents permanent—storing them openly—is a massive security problem. There needs to be a sophisticated archiving function, but the idea of storing documents—especially sensitive and classified documents—on file systems is unsupportable. A favorable solution is to provide for recreation of the documents based on credentials that are adjudicated by processes designed for that very purpose under conditions defined for the knowledge and practice domains in question. This is perhaps where expert processes and AI tools were configured to function together.

AI and Layer 2. Operating and Network Systems

AI tools exist at this layer and there is probably little risk from using them. This layer is isolated from knowledge domains. Industry and practice standards across-the-board should be applicable. As mentioned of this layer earlier, a minimum of ports is desirable. There may be an advanced kind of 'cat-and-mouse' interaction between operating systems and outside networking protocols. We want to stack the system in favor of security by hardening the system, simplifying, and hardening administrative access, and using advanced surveillance tools to minimize intrusion risks. As mentioned in Layer 3 commentary, open access to any kind of open 'sandbox' in the system is to be eliminated. There simply are not to be documents on accessible file systems for even administrators to access.

AI and Layer 1. Processors and Devices

Use of secure server facilities is important, including cloud services. Care needs to be taken to ensure that any virtual servers are adequately configured and protected. This could benefit from AI tools that were designed to support typical risks of breach or failure.

Machines and Changing the Structure of Knowledge

Ultimately, the difference between AI and other algorithms and tools is that AI is capable of self-organizing, of changing the structure of processes and knowledge representations, not just details and descriptions about them. Brooks some time ago described the question in terms that resonate with what we hear now about AI:

> *Artificial intelligence as a field whose goal was to replicate human-level intelligence in a machine. Early hopes diminished as the magnitude and difficulty of that goal was appreciated. Slow progress was made over the next 25 years in demonstrating isolated aspects of intelligence. Some recent work has tended to concentrate on commercializable aspects of "intelligent assistants" for human workers.*
>
> *No one talks about replicating the full gamut of human intelligence anymore. Instead we see a retreat into specialized subproblems, such as knowledge representation, natural language understanding, vision, or even more specialized areas such as truth maintenance or plan verification. All the work in these subareas is benchmarked against the sorts of tasks humans do within those areas.*[56]

This is essentially the same message as from current purveyors of ChatGPT and other new AI tools. As we can see, they are not new. The new tools may be incrementally better, but there is no declaration that they work fully and dependably. Care must be taken, particularly in cases where the software is designed to take steps beyond those indicated by their inputs.

Countering Rogue AI Algorithms

There is the phrase "you can't trick a trickster". How else can you reign in fallacious AI outputs than with expert knowledge? Van Gelder used the example of 19th century mechanized technology, the Watt steam engine in particular. Humans were tasked to oversee equipment, but the task was found to be better suited to making the adjustments:

> *To keep engine speed uniform the throttle value would have to be turned, at just the right time and in just the right amount, to cope with changes in boiler pressure and workload. How was this to be done? The most obvious solution was to employ a human mechanic to turn the valve as necessary. However, this had several drawbacks: mechanics required wages, and were often unable to react sufficiently swiftly and accurately. The industrial revolution was confronted with a second engineering challenge: to design a device that could automatically adjust the throttle valve so as to maintain uniform flywheel speed despite changes in steam pressure or workload. Such a device is known as a governor.*[57]

Through handshakes and APIs, wrappers and other interfaces, similar functionality can be achieved—with AI and expert-designed processes filling this kind of role.

Achieving "Permanescence", or Perfected Systems, as Can Be Seen in Music

The music performance model is an example, not a metaphor. This came into view early in my investigative process in 1993, when I first became a student of process, having purchased, and worked with, an early version of the tree-based software. The learning process was documented by means of nine white papers, which were ultimately published under the name "Dual Control: Science as Applied to Organizational Performance".[58]

Understanding the trees led to enhanced perception of processes. I had learned of this in recent studies at University of California, San Diego in international relations. I had taken a course in competitiveness from Peter Gourevitch, where we had studied lean production based on the book "The Machine That Changed the World".[59] This led to a deep dive into the work of W. Edwards Deming and Walter Shewhart in statistical quality control and the definition of process there.[60]

I saw the pieces come together in support of a performance model in line with the performance environment enjoyed by musicians. Musicians of all kinds use the same model, and it is a direct functional means of defining and controlling sound in varied and pleasing ways. Symphony orchestras, jazz bands, rock-and-roll groups, and opera performers—for all it is the same. For piccolo players and violinists and tube players and drummers, all the same.

Such elements point to similar conditions for organizations and enterprise and their operational and performance requirements. There are large and small groups. Integration is important. Guidance is important, as well. Skills are involved—different ones. The same is true of technologies. Historically, when businesses were simple and relatively small, such issues could be resolved informal and I grew up in music performance. My first college degree was in music education, with a focus on trumpet performance—and some singing, as well. The trumpet being a universal instrument, I participated in all genres in all kinds of venues and experienced the joys and challenges presented by the music performance model. Music theory is a direct expression of the science of sound. Notation reflects this directly. Performing on the instruments involves skill and adaptability, as sounds, especially pitches, are affected differently by pressures, temperatures, and other natural conditions.

Nonetheless, the music performance system and the resulting music performance culture allow for demonstrably perfect performances much of the time-virtually always in the case of professional musicians. The performers all use the same information system even though the technologies reflected by their instruments and the skills involved are very different from one another.

The point is, what music theory and notation provides for in the narrow range of the electromagnetic spectrum covered by sound frequencies, generative taxonomy trees and associated functions can deliver for the rest of the spectrum. Processes are ever-present in nature and the tree-based model serves as a foundation for processes of all kinds. This provides the basis for similar cultural conditions for all workers as musicians enjoy—common language, high levels of integration and cooperation and a tradition of success and fulfillment.

This contributes to the 'head, hand, heart' model. We recommend equivalent investment in and attention to all three. Resources need to go into tree design, which is logical and thus head oriented. There needs to be activity to activate such material digitally—to develop a system. This is hand oriented. Finally, there needs to be a program of introduction, motivation, and education. This last element is heart oriented. We recommend actual parallel music composition and other artistic expression in tandem with projects in health, governance, climate, etc. This may include literary composition, music composition, choreography and dance, and other means of describing program elements to persuade people to participate. It is important that programs be continued if the initiative continues in order to support ongoing viability and provide motivation to carry on.

SUMMARY AND CONCLUSIONS

There may be aspects of computing in the foreseeable future that justify machine-based reconfiguring of knowledge and knowledge-based processes, but for now, the biggest challenge faced by organizations, communities, and individuals is the use of existing knowledge in timely and useful ways.

Due to the open and chaotic nature of social media platforms in particular, a defensive strategy at least is necessary. This can only be done effectively from an organized perspective. Various layers of protection are warranted, including metadata, objects, and strings associated with incoming sessions, behavior and content of the incoming artifacts, and contexts represented by such data and available GUID properties. There are many and varied aspects of context that will be determinative in such actions and these must be recognized and acted upon to keep the organization and its systems on the right track.

ENDNOTES

[1] Tingey, K.B., Manicki, M., & Asllani, N. (2018). *Humanity 2.0 vs Golem 2.0.: The dawn of a new era of civilization (Basileus revisited*). Logan, UT USA: Fluidity Finance.

[2] Tingey, K.B., & Manicki, M. (2022). *Capacity development in enhanced multilevel governance based on a tripartite "head (cognitive), hand (digital), heart (music performance)" model*. T2 - Meaningful Digital Connectivity, Cyber Security, Empowerment. Bali, Indonesia: G20 Bali 2022. https://tinyurl.com/6z2mxv7f.

[3] Tingey, K.B., & Manicki, M. (2022). *Continuing Bali G20 success: Knowledge to digital*. Logan, UT and Piotrków Trybunalski: Profundities LLC, CIMH Global. https://www.amazon.com/dp/B0BLYBK582.

[4] Center for AI Safety. (2023, June 1). 8 *examples of AI risk.* Author (CAIS) https://www.safe.ai/ai-risk.

[5] National Telecommunications and Information Administration (NTIA). (2023, April 13). AI accountability policy request for comment. *Federal Register, 88(*71), 22433-22419.

[6] Tecuci, G., Boicu, M., Marcu, D., Stanescu, B., Boicu, C., & Barbulescu, M. (2004). Parallel knowledge base development by subject matter experts. *Proceedings of the 14th International Conference on Knowledge Engineering and Knowledge Management, EKAW 2004. 5-8th October 2004*; Tingey, K.B. (2024, April 20). Anticipating a pervasive AI casino: The rhapsodic reveries about artificial intelligence always include dire warnings. *Medium*. https://medium.com/@ken-tingey/anticipating-a-pervasive-ai-casino-c5311144b6bb.

[7] Tingey, K.B., & Manicki, M. (2023, March 11). Chipping away at the great iceberg of human knowledge: Do we need AI to 'pick the brain' of our civilization? *Medium.* https://medium.com/@ken-tingey/chipping-away-at-the-great-iceberg-of-human-knowledge-b6a6b203149c; Tingey, K. B., & Manicki, M. (2023, April 14). The AI 'Letter' in a long line of such letters: Artificial intelligence is indeed artificial, but it is in no way intelligent *Medium.* https://medium.com/@ken-tingey/the-ai-letter-in-a-long-line-of-such-letters-8a1442e3bb97; Tingey, K.B., & Manicki, M. (2023, April 20). Experts tend to not be stupid: AI amounts to piecing together facts from brain-picking sessions. *Medium. https://medium.com/@ken-tingey/experts-tend-to-not-be-stupid-81be64977394.*

[8] Azevedo, P.S., Romãob, M., & Rebeloc, E. (2012). Advantages, limitations and solutions in the use of ERP systems (enterprise resource planning) – A case study in the hospitality industry. *CENTERIS Conference on Enterprise Information Systems / HCIST 2012 – International Conference on Health and Social Care Information Systems and Technologies;* Paper, D., Tingey, K. B., & Mok, W. (2005). The relationship between BPR and ERP-systems: A failed project. *Journal of Cases on Information Technology 5*(1),45-62. DOI: 10.4018/978-1-59140-061-5.ch003.

[9] Armstrong, G., Cave, A., & Delany, R. (2012). Electronic decision support in diagnosis of heart disease. *Procedia Technology 5*. CENTERIS Conference on Enterprise Information Systems / HCIST 2012 – International Conference on Health and Social Care Information Systems and Technologies, 679-685.

[10] Tingey, K.B. (2006/2008). *Model for information systems legitimacy in rehabilitation counseling: A study of information processing needs of rehabilitation counseling organizations and social networks with regard to cognitive legitimacy*. Saarbrücken, DE: VDM Dr Muller.

[11] Aldrich, H.E. (1999). *Organizations evolving.* London: SAGE Publications Ltd.; Aldrich, H. E., & Ruef, M. (2006). *Organizations evolving*, 2nd ed. London: SAGE Publications Ltd.

[12] Castells, M. (1996). *The rise of the network society.* The Information Age: Economy, society, and culture, Vol. i. Malden, MA: Blackwell Publishers 470-471.

[13] Castells, M., & Himanen, P. (Eds.). (2014). *Reconceptualizing development in the global information age.* Oxford, UK: Oxford University Press.

[14] Chi, M.T.H., Glaser, R., & Marshall, J.F. (1988). *The nature of expertise.* Hillsdale, New Jersey: Lawrence Erlbaum Associates, Publishers.

[15] Scherkenbach, W.W. (1991). *The Deming road to continual improvement*. Knoxville, TN: SPC Press.

[16] Whitehead, A.N., & Griffin, D.R., & Sherburne, D.W. (Eds.). (1928/1978). *Process and reality,* corrected edition. New York: Free Press.

[17] Tingey, K.B. (2009). *Methods-based management: Breakthrough performance on leaner budgets.* San Diego, CA: University Readers.

[18] Tingey, K.B. (2014). *The solution: Permanescence.* Logan, UT: Profundities LLC.

[19] Korzybski, A. (1921). *Manhood of humanity.* New York: E.P. Dutton & Co.; Korzybski, A. (1933/1995). *Science and sanity: An introduction to non-aristotelian systems and general semantics*, 9th ed. Lancaster, PA: The International Non-aristotelian Library Publishing Company.

[20] Korzybski, 1933/1995, 68-69.

[21] Ibid, 69.

[22] Organization for Economic Co-operation and Development (OECD). *Dataset: Main science and technology indicators*. Data extracted on 13 May 2023 03:30 UTC (GMT) and 13 May 2023 03:33 UTC (GMT) from OECD.Stat.

[23] National Center for Science and Engineering Statistics (NCSES). (2023, May 12). *Higher education R&D survey*. Washington, DC: Author.

[24] Zui, M. (2021, October 23). How many academic journals are there in the world? *PublishiingState.com.*

[25] Chen, X.T. (2019). Scholarly journals' publication frequency and number of articles in 2018-2019: A study of SCI, SSCI, CSCD, and CSSCI journals. *Publications, 7*(58),1-10.

[26] Sung, H.Y., Wang, C.C., Huang, M.H., & Chen, D.Z. (2015). Measuring science-based science linkage and non-science-based linkage of patents through non-patent references. *Journal of Informetrics, 9*(2015), 488-498.

[27] Drucker, P.F. (1998). The next information revolution. *Forbes, 162*(4), 46-58.

[28] Ibid., 6.

[29] Ibid., 6-7.

[30] Sridharan, M., Maheshwari, P., & Mundhada, P. (2021, December 7). Rogers' five factors – How to appraise innovations? https://thinkinsights.net/strategy/rogers-five-factors/.

[31] Sridharan, M., Maheshwari, P., & Mundhada, P. (2021, December 7). Rogers' five factors – How to appraise innovations? https://thinkinsights.net/strategy/rogers-five-factors/.

[32] Valente, T.W. (1995). *Network models of the diffusion of innovations*. Creskill, NJ: Hampton Press; Valente, T.W. (2009). Diffusion processes in social networks. In R. A. Meyers, 2008, August 22.

[33] Valente, 2009, 112.

[34] Tingey, K.B., & Manicki, M. (2023a). *Smart Banking: Putting Money in its Place.* Logan, UT and Piotrków Trybunalski: Profundities LLC, CIMH Global. https://www.amazon.com/dp/B0BRLYJY5N.

[35] Copeland, B.J., Posy, C.J., Shagrir, O. (Editors). (2013). *Computability: Turing, Gödel, Church, and beyond,* 1st edition. Cambridge, MA: The MIT Press.

[36] Belfo, F. (2012). People, organizational and technological dimensions of software requirements specification. CENTERIS Conference on Enterprise Information Systems / HCIST 2012 – International Conference on Health and Social Care Information Systems and Technologies. *Procedia Technology 5*, 310-318. Doi: 10.1016/j.protcy.2012.09.034.

[37] Gruetzemacher, R. (2022, April 19). The power of natural language processing. *Harvard Business Review*.

[38] Ibid., 1.

[39] Geertz, C. (1973). *The Interpretation of cultures.* New York: Basic Books.

[40] Brooks, R.A. (1991). Intelligence without representation, In J. Haugland, 1997, *Mind design ii: Philosophy, psychology, artificial intelligence,* Rev and enlarged. Cambridge, MA: A Bradford Book, MIT Press, 395-420.

[41] Denzin, N.K., & Lincoln, Y.S. (Eds.). (2000). *Handbook of qualitative research*, 2nd ed. Thousand Oaks: SAGE Publications Inc., 8.

[42] Tingey, K., Spendlove, R., & Manicki, M. (2014). *Context in science: Generalists and root causes.* Logan, UT/Piotrków Trybunalski: CIMH Global/2020 Program for Global Health. https://www.amazon.com/dp/1499222572.

[43] Tingey, K.B., Spendlove, R., Farnes, L., Manicki, M. (2015). *One: Commitment of specialists.* Logan, UT/Piotrków Trybunalski: CIMH Global/2020 Program for Global Health. https://www.amazon.com/dp/1499221835.

[44] Tingey, K.B., Spendlove, R., Farnes, L., Manicki, M. (2015). *Scientific tiki-taka: Utility roles in achieving fluidity and dual control.* Logan, UT/Piotrków Trybunalski: CIMH Global/2020 Program for Global Health. https://www.amazon.com/dp/149926948X.

[45] Cormen, T.H., Leiserson, C.E., Rivest, R.L., & Stein, C. (1990/2001). Introduction to algorithms, 2nd ed. Cambridge, MA: The MIT Press.

[46] Hopcroft, J.E., Motwani, R., & Ullman, J.D. (2001). *Introduction to automata theory, languages, and computation*, 2nd ed. Delhi, India: Pearson Education, Inc.

[47] *ATLAS.ti Scientific Software Development GmbH* [ATLAS.ti 23 Windows]. (2023). Retrieved from https://atlasti.com.

[48] Chi, G., & Marshall, 1988, xv-xx.

[49] Leonard, D., & Swap, W. (2005). *Deep smarts: How to cultivate and transfer enduring business wisdom.* Boston: Harvard University Press.

[50] Tingey, 2006/2008.

[51] Tingey, K.B. (2008). *Dual control: Science as applied to organizational performance.* Logan, UT: Profundities LLC. https://www.amazon.com/dp/3639069315

[52] Sorter, G.H. (1969). An 'events' approach to basic accounting theory. *Accounting Review, 44*(1), 13.

[53] McCarthy, W.E., David, J.S., & Sommer, B.S. (1996). The evolution of enterprise information systems: From sticks and jars past journals and ledgers toward interorganizational webs of business objects and beyond. *Business Object Workshop II*. http://jeffsutherland.org/oopsla96/mccarthy.html

[54] Tingey, K.B. (2013). Chapter 5: George Sorter's 1969 "event accounting" idea. In *The angels are in the details: Control and regulation in a good way.* Logan, UT: Profundities LLC, 110-162. https://www.amazon.com/dp/1492214205

[55] Paper, Tingey, & Mok, 2003.

[56] Brooks, 1991, 395.

[57] van Gelder, T. (1996). Dynamics and cognition. In J. Haugland, (Ed.), *Mind design ii: Philosophy, psychology, artificial intelligence,* Rev. and enlarged. Cambridge, MA: A Bradford Book, MIT Press, 422-423.

[58] Tingey, 2008.

[59] Womack, J.P., Jones, D.T., & Roos, D. (1991). The machine that changed the world: The story of lean production. New York: Rawson Associates.

[60] Deming, W.E. (1982/1986). *Out of the crisis.* Cambridge, MA: Massachusetts Institute of Technology, Center for Advanced Engineering Study.

[61] Copeland, Posey, and Shagrir, 2013.

[62] Ifrah, G., & Harding, E.F. (Tran.). (1994/2001). *The universal history of computing: From the abacus to the quantum computer.* New York: John Wiley & Sons, Inc.

[63] Drucker, 1998.

[64] Allen, D.K., Millet, R.P., Hansrusik, S., & Burge, W. (1983). *DCLASS information system: An introduction.* Provo, UT: Brigham Young University, BYU CAM Software Laboratory.

[65] Allen, D.K., & Tingey, K.B. (2004). *Taxonomy development: Classification, a superscience?* Logan, UT: Utah State University Center for E-Commerce. https://youtu.be/7Dg5qFb4KLc

[66] Genesereth, M.R., & Nilsson, N.J. (1988). *Logical foundations of artificial intelligence.* Palo Alto, CA: Morgan Kaufman Publishers, Inc.

[67] Kinder, T., & Hammond, G. (2023, April 11). Silicon Valley VCs tour Middle East in hunt for funding: Liquidity crunch leads investors such as Andreessen Horowitz to sovereign wealth funds in Saudi Arabia, Qatar, and UAE. *Financial Times*. https://www.ft.com/content/567ca518-b138-4273-bfe6-0712ef31e01d.

[68] Drucker, 1998.

[69] Manicki, M., Putri, A.E., Ostojic, D., Tingey, K.B. (2014). *The big step forward: To knowledge-driven universal coverage.* Logan, UT/Piotrków Trybunalski, Poland: CIMH Global/2020 Program for Global Health.

[70] Tingey, K.B., & Manicki, M. 2022c. *Operationalizing "Empowering digital citizens: Making humane markets work in the digital age."* Logan, UT USA and Piotrków Trybunalski, Poland: Profundities LLC, CIMH Global. https://tinyurl.com/2p8ptzz5.

[71] Tingey and Manicki, 2023a.

[72] Tingey, 2009.

[73] Weiser, B. (2023, May 27). Here's what happens when your lawyer uses ChatGPT. *New York Times.*

[74] Edwards, J. (2023, April 3). Top ChatGPT fails (and why you should avoid them. *Information Week*.

[75] Ibid., 2.

[76] Page, L. (2001, September 4). *Method for node ranking in a linked database*. United States of America. ULS 6,285,999 B1.

[77] Boettcher, J., Leek, L., Matson, L., Holmes, E.A., Browning, M., Macleod, C. Anderson, G. Carlbring, P., (2013, September 30). Internet-Based Attention Bias Modification for Social Anxiety: A Randomised Controlled Comparison of Training towards Negative and Training Towards Positive Cues. *PLoS ONE 8*(9): 1-16. https://doi.org/10.1371/journal.pone.0071760.

[78] Edwards, 2023, 2.

[79] Ibid., 3.

[80] Ibid.

[81] Ibid., 4.

[82] Kurzweil, R. (2005). *The singularity is near: When humans transcend biology.* New York: Penguin Books; Kurzweil, R. (2012). *How to create a mind: The secret of human thought revealed.* New York: Viking.

[83] Criddle, C. (2023, May 30). AI executives warn its threat to humanity rivals 'pandemics and nuclear war'. *Financial Times*.

[84] Center for AI Safety. (2023, June 1). *8 examples of AI risk.* Author (CAIS) https://www.safe.ai/ai-risk.

[85] Castleman, T. (2023, May 30.) Prominent AI leaders warn of 'risk of extinction' from new technology. *Los Angeles Times*.

[86] Ibid.

ACKNOWLEDGEMENT

This paper is a pre-press submission on June 10, 2025.

REFERENCES

Ackoff, R.L. (1978). *The art of problem solving: Accompanied by Ackoff's fables*. John Wiley & Co.

Anthony, R.N. (1965). *Planning and control systems.* Boston: Division of Research, Graduate School of Business Administration, Harvard University.

Beaney, M. (Ed.). (1997). *The Frege reader.* Oxford, UK: Blackwell Publishers.

Bogdan, R.C., & Biklen, S.K. (1982/1998). *Qualitative research for education: An introduction to theory and methods*. Boston: Allyn & Bacon.

Bogue, R. (2005, April 12). Anatomy of a software development role: Subject matter expert. *Developer.com*.

Boole, G. (1847/1998). *The mathematical analysis of logic: Being an essay towards a calculus of deductive reasoning*. Bristol, UK: Thoemmes Press.

Boole, G. (1854/1958). *An investigation of the laws of thought on which are founded the mathematical theories of logic and probabilities.* New York: Dover Publications, Inc.

Campbell, D.T., & Stanley, J.C. (1963). *Experimental and quasi-experimental designs for research.* Boston: Houghton Mifflin Company.

CBC News. (2009, October 7.) *EHealth scandal a $1B waste: Auditor*.

Church, A. (1936). An unsolvable problem of elementary number theory. *American Journal of Mathematics*, *58*(2), 345–363.

Codd, E. (1970). A relational model of data for large shared data banks. *Communications of the ACM*, *13*(11), 377–387.

Cohen, D.P. (1991/1997). *Introduction to computer theory* (2nd ed.). New York: John Wiley & Sons, Inc.

Cohen, P., Schrag, R., Jones, E., Pease, A., Lin, A., Starr, B., . . . Burke, M. (1998). The DARPA high-performance knowledge bases project. *American Association for Artificial Intelligence*, *19*(4), 25–49.

Collier, K. (2023, May 30). AI risks leading humanity to 'extinction,' experts warn. *NBC News*.

Copeland, B.J. (1997). The broad conception of computation. *American Behavioral Scientist*, *40*(6), 690–717.

Copeland, B.J., & Proudfoot, D. (1999). Alan Turing's forgotten ideas in computer science. *Scientific American*, *280*(4), 98–104.

Coyne, I.T. (1997). Sampling in qualitative research. Purposeful and theoretical sampling; merging or clear boundaries? *Journal of Advanced Nursing*, *26*, 623–630.

Committee of Public Accounts. (2009, January 14). *The National Programme for IT in the NHS: Progress since 2006. Second report of Session 2008-09.* London: House of Commons/The Stationery House Limited.

Creswell, J.W. (1998). *Qualitative inquiry and research design: Choosing among five traditions.* Thousand Oaks, CA: SAGE Publications.

Creswell, J.W., & Miller, D.L. (2000). Determining validity in qualitative inquiry. *Theory into Practice*, *39*(3), 124–130.

Denzin, N.K., & Lincoln, Y.S. (2000). Introduction: The discipline and practice of qualitative research. In N.K. Denzin & Y.S. Lincoln (Eds.). *Handbook of qualitative research* (2nd ed.). Thousand Oaks: SAGE Publications Inc.

van den Ende, J., & Dolfsma, W. (2005). Technology-push, demand-pull and the shaping of technological paradigms: Patterns in the development of computing technology. *Journal of Evolutionary Economics*, *15*, 83–99.

Farnes, L., Manicki, M., Lee, S., Spendlove, R., Ostojic, D., & Tingey, K.B. (2014). *Optimum performance living: We can have it if we want it*. Logan, UT/Piotrków Trybunalski, Poland: CIMH Global/2020 Program for Global Health.
Franklin, S. (1995/1997). *Artificial minds.* Cambridge, MA: A Bradford Book, MIT Press.
Gibbs, W.W. (1994). Software's chronic crisis. *Scientific American*, pp. 86–95.
Glynn, M.A. (1996). Innovative genius: a framework for relating individual and organizational intelligences to innovation. *Academy of Management Review*, *21*(4), 1081–1111.
Gould, S.J. (1999). *Rocks of ages: Science and religion in the fullness of life*. New York: The Library of Contemporary Thought, The Ballantine Publishing Group.
Greenhalgh, T., et al. (2010). *The devil's in the detail: Final report of the independent evaluation of the Summary Care Record and HealthSpace programmes*. London: University College.
Grigg, J.R., & Harris, F.T.C. (Eds.). (1964). *Form and strategy in science: Studies presented to Joseph Henry Woodger on the occasion of his seventieth birthday.* Dordrecht, NL: D. Reidel Publishing Company.
Harnad, S. (1994, November). Computation is just interpretable symbol manipulation; cognition isn't. *Minds & Machines*, *4*(4), 379–390.
Haugland, J. (1989/1985). *Artificial intelligence: The very idea*. Cambridge, MA: A Bradford Book, MIT Press.
Haugland, J. (Ed.). (1997). *Mind design ii: Philosophy, psychology, artificial intelligence*. Rev and enlarged. Cambridge, MA: A Bradford Book, MIT Press.
Holsapple, C.W. (1977). *Framework for a generalized intelligent decision support system*. Dissertation. West Lafayette, IN: Purdue University.
Jackson, D. (2006, May 22). Dependable software by design. *Scientific American*.
Jacobs, B. (2005, March 8). *"Computer science" is not science and "software engineering" is not engineering*. Findy Services. Retrieved from https://www.oocities.org/tablizer/science.htm.
Jonassen, D.H., & Land, S.M. (Eds.). (2000). *Theoretical foundations of learning environments.* Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.
Joyce, B., Weil, M., & Calhoun, E. (1972/2000). *Models of teaching* (6th ed.). Boston: Allyn & Bacon.
Kozen, D.C. (1997). *Automata and Computability.* New York: Springer-Verlag.
Langa, F. (2000), April 24. Redefining 'human'. *Byte*.
Langer, S.K. (1937/1953). *An introduction to symbolic logic*(2nd ed.). New York: Dover Publications, Inc.
Laplante, P.A. (1993). *Real-time systems design and analysis: An engineer's handbook.* New York: IEEE Press, IEEE Computer Society Press.
Lenat. D. (1998). *The dimensions of context-space.* Austin, TX: Cycorp.
Leonardo, A.M., Tabachneck, H.J.M., & Simon, H.A. (1995, July). A computational model of diagram reading and reasoning. *Proceedings of the 17th Annual Conference of the Cognitive Science Society*.
Lincoln, Y.S., & Guba E.G. (1985). *Naturalistic inquiry.* Newbury Park, CA: SAGE Publications.
Mann, C.C. (2002). Why software is so bad. *Technology Review*, *105*(6), 32–38.
Manicki, M., Stevens, D., Farnes, L., & Tingey, K.B. (2014). *Prospering in an OPL environment. ... seeing growth in growth.* Logan, UT/Piotrków Trybunalski, Poland: CIMH Global/2020 Program for Global Health.
Manicki, M., Tingey, K.B., Farnes, L., & Ostojic, D. (2014). *Dual control or certain derailment ... speed is a given*. Logan, UT/Piotrków Trybunalski, Poland: CIMH Global.
McCarthy, J. (1958). Programs with common sense. In J. McCarthy (ed.), *Mechanization of thought processes* (Volume 1, pp. 77–84). Proc. Symposium, National Physical Laboratory, London.
McCarthy, W.E. (1978). *A relational model for events-based accounting systems.* Dissertation. Amherst, MA: University of Massachusetts.
Miller, J.G. (1978). *Living systems*. New York: McGraw-Hill.
Minsky, M. (1985/1986). *The society of mind.* New York: Touchstone Books, Simon & Schuster.

Morse, J M., et al. (2002). Verification strategies for establishing reliability and validity in qualitative research. *International Journal of Qualitative Methods*, *1*(2), 1–19.
Nader, J.C. (1995). *Prentice Hall's illustrated dictionary of computing* (2nd ed.). New York: Prentice Hall.
Newell, A., & Simon, H. (1972). *The theory of human problem solving.* Englewood Cliffs, NJ: Prentice-Hall.
Newen, A., Nortmann, U., & Stuhlmann-Laeisz (Eds.). (2001). *Building on Frege: New essays on sense, content, and concept.* Stanford, CA: CSLI Publications.
Nilsson, N.J. (1998). *Artificial intelligence: A new synthesis.* San Francisco, CA: Morgan Kaufmann Publishers, Inc.
Office of Science and Technology. (2022, October). *Blueprint for an AI bill of rights making automated systems work for the American people.* Washington, DC: White House, Office of Science and Technology Policy.
Oreskes, N., & Conway, E.M. (2010). *Merchants of doubt: How a handful of scientists obscured the truth on issues from tobacco smoke to global warming.* New York: Bloomsbury Press.
Ostojic, D., Farnes, L., Lee, S., Tingey, K.B., & Manicki, M. (2014). The full enjoyment economy: Mastering growth, maturity, and decline. Logan, UT/Piotrków Trybunalski, Poland: CIMH Global/2020 *Program for Global Health, 7*.
Pappas, G.S., & Swain, M. (1978). *Essays on knowledge and justification*. Ithaca, NY: Cornell University Press.
Patton, M.Q. (1980/1990). *Qualitative evaluation and research methods* (2nd ed.). Newbury Park, CA: SAGE Publications.
Pour-El. (1978). Computer science and recursion theory. *Proceedings of the 1978 Annual Conference.* Washington, DC: ACM/CSC-ER.
Pressley, M., & McCormack, C.B. (1995). *Advanced educational psychology for educators, researchers, and policymakers*. New York: HarperCollins College Publications.
Reed, S.L., & Lenat, D.B. (2002). *Mapping ontologies into Cyc*. Austin Texas: Cycorp, Inc.
Regalado, A. (2013, February 18). The brain is not computable: A leading neuroscientist Kurzweil's Singularity isn't going to happen. Instead, humans will assimilate machines. *MIT Technology Review.*
Rodgers, E.M. (1962/2003). *Diffusion of innovations* (5th ed.). New York: Free Press.
Sargent, Jr., J.F. (2022). *Global research and development expenditures: Fact sheet*. Prepared for members and committees of Congress. Washington, DC: Congressional Research Service.
Simonyi, C., & Fallows, J. (2013, September). Why is software so slow? *The Atlantic*, pp. 26–27.
Simpson, G.G. (1962). *Notes on the nature of science by a biologist.* New York: Harcourt, Brace & World, 7–12.
Sipser, M. (1997). *Introduction to the theory of computation.* Boston: Thompson, Brooks/Cole.
Stojmanovska, M. (2021, December 27). *10 biggest software bugs and tech fails of 2021*. Riga Latvia: TestDevLab.
Sudsawad, P. (2007). *Knowledge translation: Introduction to models, strategies, and measures.* Austin, TX: Southwest Educational Development Laboratory, National Center for the Dissemination of Disability Research. Retrieved from https://ktdrr.org/ktlibrary/articles_pubs/ktmodels/ktintro.pdf.
Sussman, J. (1991). Instruction manual. In T.H. Corman, C.E. Leiserson, & R.L. Rivest (Eds.), *Introduction to algorithms*. Cambridge, MA: MIT Press.
Tabachneck, H.J.M., Leonardo, A.M., & Simon, H. (1997). CaMeRa: A computational model of multiple representations. *Cognitive Science*, *21*(3), 105–350.
The Public Accounts Committee. (2009, January 27). *The National Programme for IT in the NHS: Progress since 2006. Second Report of Session 2008–2009*. London: House of Commons, The Stationery Office Limited.
Tingey, K.B. (2018). *Humanity 2.0 vs Golem 2.0.* Logan, UT/Warsaw, Poland: Fluidity Finance.
Tingey, K.B., Allred, A., & Manicki, M. (2020). *Finance 4.0: Knowledge-driven governance*. Logan, UT/Warsaw, Poland: 2020 Program for Global Health.

Tingey, K.B., & Manicki, M. (2023, March 1). The solution isn't 5G (or 10G now), it is 5D: Taking the G20 to a new level of relevance via "some kind of forum" *Medium.* Retrieved from https://medium.com/@ken-tingey/the-problem-isnt-5g-or-10g-now-it-is-5d-321d0863a5f9.
Tingey, K.B., & Manicki, M. (2023, March 17). The global narrative problem: How we can situate and work out a beneficial primary narrative for our times *Medium.* Retrieved from https://medium.com/@ken-tingey/the-global-narrative-problem-fbdd0517b08.
Tingey, K.B., & Manicki, M. (2023, April 14). Don't lay out the money on the front stoop of the bank: Documents themselves are a source of risk *Medium.* Retrieved from https://medium.com/@ken-tingey/dont-lay-out-the-money-on-the-front-stoop-of-the-bank-9a07e7ce668f.
Tingey, K.B., & Manicki, M. (2023, April 17). We must achieve permanescence by 2030, which is to say, perfection: Our goal, as soon as possible, should be perfect systems—not some artificial gambit *Medium.* Retrieved from https://medium.com/@ken-tingey/we-must-achieve-permanescence-by-2030-which-is-to-say-perfection-e19a2482ca0e.
Tingey, K.B., & Manicki, M. (2015). *Rational war: The fabric of society, dual control and legitimacy, and the big zipper.* Logan, UT/Warsaw, Poland: CIMH Global.
Turing, A.M. (1936). On computable numbers, with an application to the Entscheidungsproblem, *Proceedings of the London Mathematical Society, Ser. 2-41*, 230–265.
Tyson, N.D.G. (1998), November. Belly up to the error bar. *Universe, Natural History*, 70.
Tyson, N.D.G. (1998), October. Certain uncertainties: The frontier of science is a messy place. *Universe, Natural History*, 86–88.
Usher, T.J. (1971). *Decision tables in the design of generalized management information systems. Doctoral dissertation*. Pittsburgh, PA: University of Pittsburgh.
Encyclopedia of complexity and systems science. (n.d.). Entry 207. New York: Springer.
Vulliamy, G. (2004). The impact of globalization on qualitative research in comparative and international education. *Compare*, *34*(3), 261–284.
Wagman, M. (1997). *The general unified theory of intelligence: Its central conceptions and specific application to domains of cognitive sciences*. Westport, CT: Praeger.
Weed, L.L., & Weed, L. (2011). *Medicine in denial.* Washington, DC: Authors/Createspace, Amazon.
Wenger, E. (1987). *Artificial intelligence and tutoring systems: Computational and cognitive approaches to the communication of knowledge.* Los Altos, CA: Morgan Kaufman Publishers, Inc.
Wenger, E. (2008). February. *Communities of practice in and across 21st century organizations.* NCRE Conference. Retrieved from https://sitios.itesm.mx/va/dide2/enc_innov/doctos/Article21_century_organizations.pdf.
Werkmeister, W.H. (1990). *Nicolai Hartmann's new ontology.* Tallahassee, FL: Florida State University Press.
World Intellectual Property Organization (WIPO). (2023, May 5). *WIPO patent report: Statistics on worldwide patent activity*. Geneva
Woodger, J.H. (1939). The technique of theory construction. *International Encyclopedia of Unified Science*, *1/2*; *Foundations of the Unity of Science*, *2*(5).
Woodger, J.H. (1952). *Biology and language: An introduction to the methodology of the biological sciences including medicine.* Cambridge, UK: Cambridge University Press.

APPENDIX 1: HISTORY AND CONSIDERATIONS OF ARTIFICIAL INTELLIGENCE

Artificial intelligence emerged as a concept in 1955 in anticipation of the now-famous Dartmouth conference in 1956, which launched this brand-new field.

There had been previous activities to leverage machines for human use. The very Church-Turing method that linked potential computation with recursion was intended as a means of mimicking human thought processes. Alan Turing himself had mused about prospects for improving on machine-based ways of enhancing outcomes.[61]

It is not clear that early AI efforts considered the breadth of ways that humans interact with one another and nature itself and how such activities affect decision-making and collective if not individual problem solving.

Church/Turing and Recursion

Recursion from the end of a process to its beginning provides for reflection, a key aspect of human decision-making, which allows for reflection, repetition, improvement, and adaptation.

Bletchley Park and the War; The UNIVAC and the Election

It is important to reflect on why computers are so well-thought-of. Defeating the Enigma machine in WWII went a long way to establish a mystique of computing among the people, as did the prediction that Eisenhower would defeat Stephenson in in the 1952 American presidential election.[62]

Peter Drucker and Original Computing Expectations

Drucker said that he and others were disappointed with the limited impact of computers in their early years in the postwar period.[63]

Priorities of the AI Group

AI leaders have long 'swung for the fences' in terms of machine-based reasoning. The strategy has been to make the case for large-scale, independent automation, then pull back when adoption did not result at anticipated levels.

Certain Kinds of Success

AI programs have been effective in gaming and in powerful querying, such as in its success with the television game show Jeopardy. Situations involving fixed rules and static exogenous conditions brought noted successes. Reality does not present itself in such a fashion.

The Problem of the Expert

Artificial intelligence have missed the opportunity to enlist the efforts of experts over the years. This is a major oversight. Even now, many scientists and practitioners sit on the sidelines even when they have knowledge and experience that could be brought to resolve many vexing social, natural, and financial crises.

DARPA and Rapid Knowledge Formation

This was an effort, once again, that failed to enlist the cooperation and collaboration with experts. It was carried out from 1999 to 2003 under DARPA sponsorship, following a similar project called the High-Performance Knowledge Base project.

Broadening AI Algorithms

Enlightened AI resulted from more targeted efforts. Few would likely have a problem with this. The lack of openness, however, gives rise to some concern as to machine-based-reasoning as lurking in the background.

The Promise of Improved Computing Models

In the early 1990s, I became aware of an alternative software design method that had been developed at Brigham Young University. It had been brought together in the field of manufacturing engineering by BYU faculty in collaboration with dozens of the leading metals manufacturing and transportation manufacturing companies in the United States. This included major participants Boeing Corporation, Black & Decker, Grumman Aerospace, Caterpillar Tractor Company, Westinghouse, Texas Instruments, Tektronix, and General Motors. There were about 100 corporate members and supporters of the effort which participated during the 1980s, organized under the name "Manufacturing Consortium".[64]

I have materials regarding those early efforts including a VHS recording outlining the early efforts, including the Boeing connection, which is based on classification. That recording is available on a YouTube video regarding the initiative that I created in 2004 when I was the head of the Utah State University Center for E-commerce in the business school there.[65]

I licensed the BYU model in 1997 and developed a desktop version of the model using Java 1. Later, in 2004, I worked with the Utah State University Research Foundation to develop a J2SE web-based client-server version of the software model, which has basic functionality. Under Profundities LLC, I worked with Timken Corporation in 2013 to convert their tree data from the original BYU/Fortran implementation to the Java 1 tool, which they continue to use in their operations.

APPENDIX 2: POSSIBLE MOTIVATIONS IN THE CURRENT PUSH FOR UBIQUITOUS AI

Tools purported to support AI objectives have been available for decades.[66] The question arises as to why there is such a broadscale effort to push AI applications now. Why are the providers in question looking to correct misinformation? Why are they not on their own working to resolve concerns for privacy, security, credibility, civility, and improved discourse and policy? Why are they so interested in promoting something artificial, rather than working to make their systems more supportive of what is real?

Lack of IT-Related Products at Scale

The Silicon Valley infrastructure is in a slump. Although a considerable amount of money is dedicated to venture capital funds, few investments have been made of late. The lack of deal flow has contributed to the failures of several financial institutions, including Silicon Valley Bank, Credit Swisse—which has long been a leader in funding initial public offerings, and Republic Bank, which provided private banking services to many principals and affiliates of venture-backed enterprises in the region.[67]

As per the Kinder-Hammond article in the *Financial Times*, Saudi Arabian leaders are wondering why leading venture capitalists are visiting them. As reported, with $300 billion under management in the field, it is not like they do not have any money to invest.

Failures of Large-Scale IT Projects

Computers have a way to go before they are fully dependable. In this age of open discourse and unfettered contributions on all subjects, much disinformation creates harm. This is unquestionably going to become worse due to both textual and media-related products from expected AI tools.

Financial Implications of Overheated IT-Related Enterprises at Scale

The current banking crisis has its roots in flailing, overheated Silicon Valley capital markets. From the perspective of legitimacy, our position is that prevalent offerings from Silicon Valley enterprises have served to undermine the interests of the people in general and have undermined both the cognitive and sociopolitical legitimacy of governments, private enterprises, and not-for-profit organizations.

APPENDIX 3: IT-RELATED CHALLENGES, AI RELATED AND OTHERWISE

Participation in the G20 process reinforced that global priorities make improved governance necessary as never before. We propose an underlying infrastructure to knit together knowledge worldwide with individual country governance based on process. Such an approach supports concrete progress in many public and private sectors.

As Peter Drucker indicated in 1998, the missing element in IT lies more on the side of ‘information’ than it does in ‘technology’.[68] This dovetails with our emphasis on fluidity of knowledge within a system, of efforts to bring expert-based and authority-based processes together in cooperative and conclusive ways.

Medicine and Health

There are several keys to success. Dr. Miroslaw Manicki of our program has unique experience and expertise. He established a regional health finance fund in Poland in the late 1990s based on collaboration with professionals in each of thirty practice areas. The program was successful and expanded to include all of Poland in the early 2000s. He was then tasked by several international development institutions to bring similar capabilities to countries throughout Asia in particular. The most notable success has been in Indonesia, where universal health coverage for 274 million people. This has been documented in the book "The Big Step Forward"[69] and is a major part of the *2020 Program for Global Health* (https://2020globalhealth.com).

Climate Science and Sustainability

There is an enormous gap between thinking and doing. This is a major problem in the application of climate science and the application of science-based solutions generally. In the Bali G20 2022 Policy Brief in Table 2: Program development worksheet for capacity development based on G20 priorities" we outlined that the Intergovernmental Panel 6 on Climate Change (IPCC6) there are 8,700 pages of primary documentation on desired policies.[70] Our point is that these need to be directly converted to digital process form by their creators.

Once this is accomplished, they could be readily used by organizations and people in their needed contexts. Furthermore, incentives—financial and otherwise—could be established to reward those who are compliant and penalized if not. In a process-based environment using generative taxonomies, science could be provided independent of policy, which could be country- and region-specific.

Global Financial Crisis

Finance needs to be knowledge-based and process based. Banking needs to be based on value. We have published a book on this based in part on our findings from participation in G20 2022 Bali. It is called "Smart Banking: Putting Money in its Place."[71] The point of smart banking in this case is to focus on identifying and supporting value, this through defining and deploying mutually-agreed-upon processes. This is the essence of the Manicki health finance model—only authorized payments are made based on standards as established by providers, scientists, etc.

Global Governance Crisis

There is an abiding challenge in balancing knowledge and authority throughout the world. This is a problem that can only be resolved through concerted collaboration by multilateral institutions and leading governments. This has been considered in a myriad of ways in the library of the 2020 Program for Global health and associated writings: Books: https://www.amazon.com/stores/author/B0043JHKQG

Other writings: https://documents.2020globalhealth.com/

Governmental Administration and Enterprise Management

There needs to be a strong and useful connection between governments and businesses. This needs to be process-based, for clarity, for integration, and for optimal outcomes. There is an opportunity in this to make use of blockchain technology with or preferably without crypto currency. There is an opportunity to integrate and use processes in general, but to combine the many elements of management, technology, and method for a whole new level of legitimacy and performance.[72]

APPENDIX 4: AUTHOR BACKGROUND AND CREDENTIALS

Kenneth B. Tingey is the Chief Executive Member of Profundities LLC, a digital technology and education provider and a principal in CIMH Global. He has overseen publication of the library of the 2020 Program for Global Health as well as research and technical development for the 2020 Program and CIMH Global. Previously he was the Chairman of Board and CEO of the Spendlove Medical Research Institute.

He has served as Research Assistant Professor of the United States Clearinghouse of Rehabilitation Training Materials at Utah State University. Prior to that, he was the CEO of OpenNet Corporation, a software development firm specializing in integrated, multifunctional enterprise systems and complex compensation plans, and General Partner of Ventana Growth Fund, an early-stage venture capital fund specializing in medical, health care, and energy ventures. Much of the biotechnology infrastructure in the San Diego, California area, including Pfizer, Inc., can be traced to Ventana investments, most of which originated at the University of California, San Diego.

His undergraduate majors at Utah State University and Brigham Young University were music education and accounting, respectively. He has a Master of Business Administration with emphasis on corporate finance and strategy from the Marriott School of Business at Brigham Young University, a Master's of Pacific International Affairs with specializations in China and Latin America from the School of Global Policy and Strategy at the University of California, San Diego, and a PhD in education with focus on cognitive psychology and organizational legitimacy from the Emma Eccles Jones School of Education at Utah State University.

He had two postdoctoral assignments, one with Michael Millington at Utah State University in social networking among rehabilitation counselling state agencies and with Rex Spendlove at the Spendlove Medical Research Foundation in immunoassay testing and application of multiplex testing results in an integrative medical and health environment.

For more information, see his LinkedIn profile: https://www.linkedin.com/in/kentingey/.

Books: https://www.amazon.com/stores/author/B0043JHKQG

Other writings: https://documents.2020globalhealth.com/

APPENDIX 5: RECENT CASE STUDIES

Ubiquitous promotion of algorithms classified as AI is resulting in many examples of problematic consequences of AI use. These do not arise from conjecture, but of unprecedented and undesirable outcomes. Three notable developments are represented here.

New York Attorney Use of ChatGPT Scripts in Actual Litigation

An attorney used a ChatGPT document in a legal proceeding.[73] He did this without validating the content or any other significant act of validation. This alone is problematic. His dereliction was discovered by the court, which took steps to validate his sources.

Audaciously, the lawyer submitted the contrived work as if it were his own—or at least under the cloak of his professional credentials. Then, it was discovered that the work created its own source materials without any underlying investigation or critical evaluation. This calls into questions unanticipated shortcomings of AI in the first version of this document. At that time, I assumed that AI algorithms would be trained to engage in comprehensive queries and interpret such content to create a final work—taking advantage of inherent meanings in the terms in question and in computing, if not evaluating any numeric relationships as they are presented in the data—including meta-analysis of multiple works. This is what scientists and analysts would need to do.

The outcome of this project means that little to none of such cognitive tasks are under way in ChatGPT. This being the case, the 'high-minded' nature of this document's original analysis, particularly with respect to scientific method, qualitative and quantitative research, and the like, vastly overshot the mark regarding the current state of AI. This makes its conclusions even more valid.

Specific Failings of ChatGPT

There are significant innate limitations with respect to ChatGPT that warrant concern, long before people take steps to use such tools. This includes limitations of machines in innovative thought, accurate insights, motivating people, balancing outcomes, dispensing specialized knowledge.[74]

Innovative thought. Models like ChatGPT function to summarize existing information, not to engage in critical thinking. "…there's an inherent risk that models can be informed by inaccurate data,

misinformation, or biases."[75] Internet tools are typically based on a form of page ranking, a social network analysis metric based on popularity as measured by usage. This stems from the success of the famous Google patent.[76] Given that misinformation famously "sells" better than truthfulness, there is an inherent bias against truthfulness in such data.[77]

Accurate insights. ChatGPT has difficulty with rare and artificial topics. "A lot of its output is very bland; missing the surprising connection and elevation of new ideas that can occur in human writing"[78]

Motivating people. ChatGPT's outputs notably lack persuasive prose.[79]

Balancing outcomes. The technology can summarize text-based information, but it cannot evaluate it, especially when there are competing and alternative questions with complex implications.[80]

Dispensing specialized knowledge. ChatGPT is bad at nuance, as it is at context. The models "often rely on statistical patterns and associations rather than a true understanding of the underlying concepts".[81]

Increasingly Dire Warnings from Insiders

Dire warnings date to early stages of AI investigations.[82] Such warnings have vacillated over time. These include some of the most extreme and outlandish statements that could be made, including prospects for extinction[83] and destruction and devastation tantamount to pandemics and nuclear warfare.[84] Such comparisons are telling. Pandemics and nuclear risks arise from very different sources. For one thing, as a fundamental aspect of nature and biology, pandemics were not representative of human initiative, while militant nuclear power did.

Extreme commentary itself is suspect. In the current international sociopolitical environment, such statements are hardly timely. On the other hand, looked at from another perspective, it can be seen to be an optimal time for introducing such commentary, not to the general benefit.

> *Tech writer Alex Kantrowitz noted on Twitter that the Center for AI Safety's funding was opaque, speculating that the media campaign around the danger of AI might be linked to calls from AI executives for more regulation. In the past, social media companies such as Facebook used a similar playbook: ask for regulation, then get a seat at the table when the laws are written.*
>
> *The Center for AI Safety did not immediately respond to a request for comment on the sources of its funding.*
>
> *Whether the technology actually poses a major risk is up for debate, Times tech columnist Brian Merchant wrote in March. He argued that, for someone in Altman's position, "apocalyptic doomsaying about the terrifying power of AI serves your marketing strategy".*[85]

That the threat is further evidence of artificiality in the furor over AI, also inconsistency in the public effort and its purposes.

> *Altman's calls for regulation have had their limits. Last week, he said that OpenAI could leave the European Union if AI became "overregulated"*[86]

They do want regulation, but on the other hand they do not. They warn that once unleashed, AI would be uncontrollable, but not to the degree that they couldn't be removed from use in Europe. They want regulation on the one hand but warn that they might withhold the technology if such regulation does not meet their approval. None of these presumptions are viable.

Such double talk should be seen considering the timing and the extreme nature of the AI promotion movement and associated, ironic, warnings.