**Passing the Baton – What About 3-D and Artificial Intelligence (AI)?**
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This article echoes points made in "Unmasking AI," a book by Joy Buolamwini, PhD, founder of the Algorithmic Justice League. In a small way, issues of algorithmic integrity as embedded in spatial data computations (surveys, maps, drones, driverless vehicles, etc.) parallel issues of social biases (facial recognition etc.) in artificial intelligence (AI) as described by Dr. Baolamwini. Some people claim that rapid advancements in using AI should be permitted while others recommend reigning in unbridled growth. OpenAI fired CEO Sam Altman on November 17th and he immediately resurfaced at Microsoft. Driven by the threat of rebellion by OpenAI employees over his departure, it was announced on November 21, 2023, that Sam Altman was returning to OpenAI as the CEO. Given the complexity of issues, it difficult to know how the "dust will settle." In any case, the fact remains that transparency and commonality in the underlying geospatial algorithms used in AI applications are hugely important. From my perspective, it includes being clear about the use of pseudo 3-D as opposed to using true 3-D – a point I attempted to make in an email sent to the National Institute of Standards and Technology (NIST) in January 2023 - http://www.globalcogo.com/NIST-memo.pdf.

I've enjoyed a satisfying career – surveying, engineering, etc. Retirement has been both rewarding and occasionally frustrating as I encounter others "marching to a different drummer." But "that's life" and I've come to terms with that. Of late, I've asked, "When is the best time to pass the baton?" I see it as inevitable, but I don't have a crystal ball. In preparation, I will do what I can to help anyone interested in 3-D to become familiar with the issues. I must also come to terms with the fact that maybe no one wants to accept the 3-D baton.

Many know that I am a staunch supporter of education, geometry, technology, and the surveying profession. As it turns out, those interests also include engineering and the use of 3-D digital spatial data. For example, as a surveyor licensed in Michigan, I applied for registration as an engineer. The board initially declined by application because, "you are a surveyor." After several rounds of communication, I asked the board, "Are the practices of surveying and engineering mutually exclusive?" The board relented and let me take the PE exam. I've been licensed as a PLS in 8 different states and dually licensed in 4 of them. A relevant question for both professions now is, "Who is responsible to the public for the algorithmic integrity of spatial data models being implemented in modern practice and especially in AI applications that rely on spatial data?"

Consequences of the digital revolution include circumstances that are vastly different than when I was first licensed. Attempting to keep current, I asked recently ChatGPT to discuss, "information, knowledge, wisdom, and intelligence." The AI answer was largely as I expected and did not conflict with my opinion that education involves "learning how to learn." Although I'm an advocate for formal education, I am convinced that learning also occurs at home, school, playground, church, high school, college, trade school, on-the-job, and self-study. Admittedly, various factors come into play and personal motivation should not be ignored. For me, curiosity was a large motivator and I've used that yardstick in my interactions with others.

Knowing that a sample of one is unreliable, I asked Bing GPT-4, "Curiosity is often given as a motivator for learning. What other motivations should be compared to curiosity?" The answer surprised me. GTP-4 confirmed that of which I was convinced by saying, in part, "Motivation is a condition that activates and sustains behavior toward to goal." But the surprising part of the AI answer was the description of various additional motivations:

- Challenge
- Control
- Fantasy
- Competition
- Cooperation
- Recognition

It seems I've missed many opportunities to understand the motivation of others better. Is your driving motivation on the list or is the list incomplete? Diversity in surveying is truly remarkable.

Another perspective. First, I hope we can agree that locating boundaries will always be a critical part of surveying. Early in my career I was involved in hundreds of parcel surveys. That instilled profound respect for land ownership rights, local history, and legal aspects of surveying. After graduating from Purdue, I joined academia where I pursued additional interests in teaching, geometry, geodesy, computations, and GPS (technology). Being curious, I looked at surveying in terms of the convergence of abstraction/technology/policy/practice. Development of the 3-D global spatial data model (GSDM) was the result of looking for "better" ways to use 3-D data.

Technology has provided quite a ride since I first started teaching at Oregon Tech in 1980. Underlying concepts of land ownership are largely the same, but measurement technology is radically different, and successful modern surveying businesses have been built around data collection. The vendors have done a remarkable job of providing both hardware and software tools for "getting the job done." That is all well and good but, reiterating, surveying is more than data collection. While the importance of boundary location and associated legal concepts are undisputed, surveying is also well-positioned to make a seminal contribution to the spatial data user community in promoting the use of an integrated 3-D datum for performing computations as opposed to more traditional, complex, and burdensome procedures associated with using separate horizontal and vertical datums.

On the surface, it is too simple. Starting with the assumption of a single origin (Earth's center of mass) and using well known rules of solid geometry, the location of surveyed points can be mapped either globally or locally with geometrical integrity. Using simple tools, computations in 3-D space avoid more complicated procedures needed for geoid modeling and low-distortion projections. See www.tru3d.xyz for more details.

Returning to AI. Well known author, Walter Isaacson, recently wrote a book, *Elon Musk*. It is a "must read" for anyone wanting to understand more about the onslaught of technology – including AI. But there is more. Elon Musk was also featured in the October 5, 2023, issue of Time magazine which describes his "fight for the future of AI." Incidentally, that Time magazine issue

contains a section describing "the 100 most influential people in artificial intelligence." Not to be outdone, the November 13, 2023, issue of Bloomberg Businessweek includes a lead article, "Elon Musk wants to put this (Neuralink) inside your head." The rush to implement AI continues. I would like to believe that we can trust the outcome of such fast-paced shenanigans. Maybe we can but I believe that we (surveying, engineering, and spatial data professionals) need to pay close attention to those developments – especially given our charge to protect the health, safety, and welfare of the public. Can government oversight and industrial exemptions be relied upon to guide development of AI? Maybe not. I'd like to think that practicing professionals in various disciplines will add a credible voice to the debate (competency, accountability, ethics, loyalty, etc). Unbridled and/or unregulated adoption of AI should be avoided.  Whether you like Elon Musk or not is beside the point. Undoubtedly Musk has made huge contributions to productivity and manufacturing efficiency in the United States. Will his vision of deploying AI for mankind's benefit be realized? I don't know.

Light at the end of the tunnel. As mentioned at the beginning, I just finished reading the book, "Unmasking AI: My Mission to Protect What is Human in a World of Machines" by Joy Buolamwini. In it she describes systematic biases that have been built into implementations of AI for facial recognition. The problem is well documented, and progress has been made. The National Institute of Standards and Technology has been involved by establishing benchmarks that can be used both internally when evaluating commercial products and externally by those desiring use of the NIST standard in development of their own products. Two relevant NIST publications include:

- "NIST Study Evaluates Effects of Race, Age, Sex on Face Recognition Software," NIST, December 19, 2019.
    https://www.nist.gov/news-events/news/2019/12/nist-study-evaluates-effects-race-age-sex-face-recognition-software.

- *Artificial Intelligence Risk Management Framework,*" NIST AI 100-1, January 2023.
    https://doi.org/10.6028/NIST.AI.100-1.

I am even more convinced that NIST could provide a valuable service to society by evaluating the geometry and characteristics of a spatial/geospatial data standard for the user community as proposed in the aforesaid email sent to NIST – see http://www.globalcogo.com/NIST-memo.pdf