# Service in the humanity-centered AI era: Some thoughts and reflections

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**Abstract.** This article captures some thoughts and reflections on the topic of "service in the humanity-center AI era" presented Friday February 17th, 2023, in an online invited presentation to attendees of the 13th International Conference on Exploring Service Science (IESS 2.3) being held in Geneva, Switzerland [1]. A hoped-for promise of AI as a technology is to bring productivity and quality increases to what economists call the service sector, as previous generations of technology did for agriculture and manufacturing. Both service science and artificial Intelligence (AI) have made significant progress as communities of practice and academic disciplines in their respective, 20 years and nearly 70 years histories. Nevertheless, both AI and service science still have a long way to go to achieve their potential for transdisciplinary harmonization. Responsible actors, informed by progress in these two disciplines, are upskilling and learning to invest more systematically and wisely in improved win-win interaction and change for all stakeholders to get and give trusted service.

## 1 Introduction: motivation and goals

I'll begin by thanking Prof. Michele Leonard (U. Geneva) and retired IBMer Diem Ho for the invitation to speak today. Prof. Leonard's leadership in the service science community includes working with others to establish the International Conference on Exploring Service Science. Mr. Ho led IBM's University Relations for EMEA (Europe, Middle East, Africa) for years, and was an early and influential leader in advancing IBM's vision for SSME (Service Science, Management, and Engineering) as a new discipline to help advance IBM's Smarter Planet initiative [2]. I thank my colleagues and friends for the opportunity to share a few thoughts and reflections on the topic of service in the humanity-centered AI era. As a retired IBMer myself, I am delighted to have this opportunity and happy to still be active as a volunteer and Senior Fellow of the UIDP (University-Industry Demonstration Partnerships), as well as on the board of directors of two non-profits with a service focus, ServCollab and ISSIP (International Society of Service Innovation Professionals). Those who have heard me speak before will know that I like to recommend books at the start and throughout my talks, and I will do so today as well. My colleague Prof. Ray Fisk (U. Texas San Antonio), who is the founder of ServCollab, recommended Bregman's book "Humankind: A Hopeful History" to me, and I would like to recommend it to all members of the service science community as well [3]. For me, the message of that book is that we humans get the future we invest in – for better or worse; so, let's choose to invest in a future where all responsible actors that give and get service daily - individuals, businesses, universities, governments - aim to become better, more trusted and trustworthy, future versions of themselves.

For about twenty-years now, we in the fledgling service science community have seen the world as a collection of service systems entities, multi-scale actors that interact and change over time and where trust is fundamental to win-win, sustainable systems that give and get service. Preparing for today's talk, I reviewed two "word clouds" which I will share in my presentation today. The first word cloud was constructed using words from the abstracts of this year's IESS papers. The transformation to smart digital service for citizens living in a city comes through strongly as does the topic of sustainability. The second world cloud was one that was shared by Prof. Kelly Lyons (U. Toronto) as part of her panelist presentation at a recent US National Academy of Engineering online event that I helped co-organize on the topic of "Service Systems Engineering in the Human-Centered AI Era" [4]. A shift from manufacturing servitization to healthcare, platforms, ecosystems, trust, and AI for decision intelligence is clear, when comparing topics from the first handbook of service science to the contents of the second handbook, while a focus on service system remains constant and a strong topic in both handbooks [5, 6]. Despite the progress being made by the service science community, there is still a long way to go, including making service science a less nebulous topic to more stakeholders in industry, academia, and government [7]. Some have even suggested we should have called the new discipline "stakeholder science" because of the focus on transdisciplinary systems thinking focus as

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well as the focus on responsible multi-scale actors with legal status learning to invest systematically and wisely in improving win-win interaction and change in the world, and becoming better future versions of themselves to give and get better service; where service is the application of resources (e.g., knowledge) for the benefit of another, including ones future self and future generations – something that happens wherever people, businesses, universities, governments collaborate to achieve harmonization of diverse goals. Others have suggested that "innovation science" would have been a better name, because service innovations often use emerging technologies to scale up capabilities, new business models to scale up benefits, and new institutional arrangements to scale down harms. However, while we found many academic disciplines use the term "stakeholders" and "innovations" even more academic disciplines used the term "service" – from service marketing, service operations, service management, service engineering – all with a narrow view of service, that called out for a science of service, as IBM's service revenues had grown to dominate, and the US's service sector also dominated in jobs, GDP, and even positive balance of trade with China. For many reasons, the name service science – seemed challenging and worthy of study to help build a smarter planet. No name is perfect, not even "artificial intelligence" for the study of smart machines.

For almost seventy years now, those in the artificial intelligence (AI) community have experienced a series of AI summers, where enthusiasm and investment is high, and AI winters, in which enthusiasm and investment wanes. Today in early 2023, we are in the strongest AI summer yet. David Michaelis (I4J Forum) shared a diagram of OpenAI's ChatGPT reaching a hundred million users in about 60 days, a vertical spike on his diagram which also showed adoption curves for other technologies reaching a hundred million users (e.g., Instagram, Spotify, Facebook, Twitter, NetFlix), but all taking much longer from nearly 1000 days to 3500 days [1]. And now hundreds of billions of dollars are flowing from venture capitalists into startups working on generative AI and related technologies. Despite the progress being made by the artificial intelligence community, these is still a long way to go, including making impressive and imperfect systems like OpenAI's ChatGPT less prone to generating inaccurate and incorrect statements, as well as less prone to exploitation by bad actors – in short more trusted [8].

In the remainder of today's talk, I will focus on summarizing and sharing a few of my key take aways from two books. Spohrer, Maglio, Vargo, Warg in "Service in the AI Era: Science, Logic, and Architecture Perspectives" [9] and Norman in "Design for a Better World: Meaningful, Sustainable, and Humanity-Centered" [10], in different ways, make the same important point that systems thinking and transdisciplinarity are important:

> *Real-world problems do not respect discipline boundaries, so transdisciplinary systems thinking needs to be further developed by service researchers and designers.*

Real-world problems of sustainability are systems problems. Today's systems problems include multi-scale actors where local optimization (human-centered) rarely leads to global optimization (humanity-centered). Therefore, real-world problems do not respect narrow academic discipline boundaries, and it is increasingly important to take a transdisciplinary approach to improve our real but designed (and therefore artificial) systems and make them more sustainable. Multi-scale actors include people, businesses, universities, governments – legal entities that give and get service daily, and most have the multi-faceted goal of becoming better future versions of themselves.

Both books include a discussion of socio-technical systems and responsible actors working to improve systems that combine people, technologies, organizations, and information for coordinating behaviors such as standards and models for nearly everything. To make progress on some of the most challenging real-world problems of our times, more than ever we need to take a transdisciplinary approach – which does not replace existing disciplines, but instead integrates and combines them into a new whole for practical purposes [11]. In fact, Herbert Simon (1916-2001), who was awarded the Noble Prize in Economics in 1978 and who was one of the founders of the field of artificial intelligence, was well-known as an exemplar transdisciplinary researcher [10]. Nations and businesses are seeking to upskill their citizens and employees, respectively, to use AI to become more productive knowledge-workers – to give and get service better. Nations and businesses are also seeking to decarbonize the global energy infrastructure to make systems more sustainable. Education (upskilling thinking) and energy (powering AI) are essential infrastructures.

## 2 Three views on Service and AI

Over the years, colleagues have suggested that the roots of service science are in economics or computer science or some other single discipline. Certainly, economics has a view of service as a sector of the economy that needs to have productivity and quality improved via automation, which is a view on artificial intelligence. Economists have studied the way that advancing technologies have improved productivity in agriculture and manufacturing. Certainly, computer science has a view of service, including online web services and digital services, as capabilities that exist on computers, in the cloud, and someday robots that will surely automate tasks and work relieving humans of danger and drudgery of certain types of work. AI is a powerful capability that unlike others has the potential for self-improvement.

Even though economics and computer science as disciplines with communities of practice have a view on service and the role of artificial intelligence in business and society, each provides a narrow view of service compared to service science (see Figure 1). Service science is an emerging transdiscipline that studies the evolving ecology of multi-scale actors that give and get service; drawing on and integrating many views of service, both economics and computer science, as well as a wide range of others disciplines including management, marketing, operations research, information systems, game theory, psychology, social sciences, systems engineering, safety engineering, ethics, law, medicine, design, public policy, humanities and arts, and many more disciplines both theoretical and applied [9].

Because service science is based on service-dominant (S-D) logic, we can define service as follows [12, 13]:

S*ervice is the application of resources (e.g., knowledge) for the benefit of another.*

Artificial intelligence is a tool (i.e., resource) to augment multi-scale actors to allow them to give and get better service. Service innovations often use emerging technologies to scale capabilities to multi-scale actors that give and get service daily, new business models to scale benefits to providers and customers as they interact, and new institutional arrangements to scale down harms to stakeholders as they change and are changed. Augmenting multi-scale actors does require AI upskilling which is the topic of a later part of this talk. In general, a broader view of service science is not simply automation to improve productivity, but augmentation to improve capabilities, which requires responsible actors to learn to invest in improving win-win interaction and change that accelerates value-cocreation while mitigating harms.

| Discipline | View on Service | View on AI | Broader View |
|---|---|---|---|
| Economics | Service sector | Productivity<br><br>Sector productivity & quality – better economic systems | Automation<br><br>Technology improved agriculture and manufacturing, service sector is next up |
| Computer Science | Web services | Capabilities<br><br>AI provides human capabilities on tasks as technological capability – better tools | Automation<br><br>Robots will further automate agriculture and manufacturing, and eventually service sector as well |
| Service science, based on Service-Dominant Logic | Value cocreation<br><br>Service is the application of resources (e.g., knowledge) for the benefit of another | Augmentation<br><br>Responsible actors (service system entities) upskilling with AI to give and get better service | Humanity-Centered<br><br>Responsible actors learning to invest in improved win-win interaction and change |

**Figure 1.** Three views of service and artificial intelligence.

## 3 Transdisciplinary – Harmonization of disciplines

Before addressing AI upskilling in the next section of this talk, I would like to say a little more about transdisciplinarity and the harmonization of disciplines. Figure 2 shows three major schools at universities include a sampling of disciplines within those schools of practice.


**Figure 2.** Three schools of practice and sample disciplines.

Business and societal systems and supply chains are increasingly complex and interconnected. Real-world problems do not respect discipline boundaries. Scalable solutions require many schools of practice working together, and current solutions may have unintended consequences, short-term or longer-term, especially if perspectives are not invited/considered. Technological progress improved the scalability of agriculture and manufacturing, and next all types of service will be made more scalable (though also more energy intensive), powered by future AI capabilities and progress.

Just as AI's Large Language Models (LLMs) capabilities allow translation between different languages, such as translating Chinese, German, or Spanish to English, some members of the service science community, myself included hope that LLMs will also someday be able to translate the models and knowledge in the three main schools of practice into a common language accessible to all who study service science. In fact, while generative AI is impressive and imperfect, I am personally most impressed with their ability to generate essays from a particular point of view. When studying or designing systems, the ability to generate descriptions of the capabilities, benefits, and harms of systems from multiple disciplinary and stakeholder perspective is powerful and becoming more impressive. This is a reason for hope that AI progress will greatly accelerate transdisciplinary progress, and hence service science.

Furthermore, one of my personal favorite quotes from another great book, that I recommend everyone in the service science community read, especially if they want to understand multidisciplinarity and transdisciplinary systems thinking better, is Kline [11] and "the obligation of the elders:

> "*We live in an increasing complex and interconnected world that contains more and more large complex systems. Operations of large complex systems requires teams of managers with good working relations and overlapping skills. To prepare students for such a world by enculturating them in emic disciplinary views with no countervailing overview is mis-training. We elders have an obligation to provide the upcoming generation with overviews that are simultaneously understandable, realistic, forward-looking, and whole. I will call this "the obligation of the elders."*
>
> *—Stephen J. Kline, 1995, in Conceptual Foundations of Multidisciplinary Thinking*

In our book on service in the AI era [9], my co-authors, Paul Maglio, Steve Vargo, and Markus Warg, and I included this Kline "obligation of the elders" quote in part because we see the importance of building better models of the world into machines, into people, and into organizations. Better models are something that I think all responsible actors need to take seriously, if we are to increase trust in the world.

Another book that I would like to recommend and that addresses transdisciplinarity of workers who give and get service is "The Adaptation Advantage: Let Go, Learn Fast, and Thrive in the Future of Work" [14]. They have a great figure in the book that shows change in workers from stocks of knowledge (educated) to flows of knowledge (learning agility) and that illustrates the I-shaped to T-shaped to X-shaped expertise shift. When the world changed more slowly, I-shaped expertise was enough – workers educated in a single discipline could use that stock of knowledge for their whole career; but as the world speeded up and change became more common, T-shaped expertise was needed – workers educated in a single discipline but also able to communicate across multiple disciplines to collaborate on accelerating change; today X-shaped expertise is needed as workers use AI to increase productivity and quality of the service they give and get.

The futurist Ross Dawson [15] hammers home this point about learning agility as a key skill for the future, suggesting that a person connected to the internet can learn to become an expert in a wide range of topics. He gives a range of

examples, even suggesting that a "Google PhD" is becoming as good as a university PhD to some employers or to start a business.

## 4 AI Upskilling

AI upskilling is a priority for individuals, business, nations [16]. My recommendations for AI upskilling include some general advice and some specific advice.

My general advice related to AI upskilling deals with how to learn, what to learn, and why learn? How to learn increasingly depends on AI-powered search that can help people - motivated people – to learn about whatever they put their minds to learning. Even if you plan to get a university or college degree, first see what you can learn on your own. What to learn in the AI era certainly includes learning about AI technological capabilities and limitations, learning about foundational models, and AI applications that can actually improve processes for how things get done (e.g., case studies - productivity, quality, compliance, sustainability, decarbonization). So, use AI to learn and you will be learning about AI's capabilities and limitations. Besides learning about AI, everyone needs to learn about making investment cases. So, I recommend that people also consider AI-as-a-service investment cases to motivate stakeholders to change to better win-win interactions in business and societal service systems (e.g., study many successful and less successful investment pitches, and learn to build excellent investment pitches). Also, check out Reid Hoffman's book [17] "The Startup of You" as you learn to build investment cases, and learn to invest systematically and wisely in AI upskilling to give and get service better. Why learn? Besides learning for the challenge of it, and the opportunity to contribute to a more sustainable, decarbonized energy infrastructure, learning can be a lot of fun if you find an influencer who is sharing what they have learned in a way that you can relate and become more motivated. Universities will play an increasingly important role as industry research partners and venture testbeds even as learners can do more and more on their own with online curriculum.

My specific advice for AI upskilling is to share the many tools that I have experimented with, including OpenAI's ChatGPT and DALL-E and urge everyone to get started. My approach is to find online influencers who try out tools first and share their learnings (for example see, Mollick [18, 19]. It is important to keep in mind that:

> *Service providers will not be replaced by AI, but trusted service providers who use AI (well and responsibly) will replace those who don't.*

Today's generative AI tools are impressive but imperfect. In [20], I share an example of an email request that I received to write a short blog post essay and picture on "AI Upskilling." I used the request as a prompt to OpenAI's ChatGPT and got a bland essay on the topic, and then I requested ChatGPT generate a prompt that I could use with DALL-E to generate a picture for the blog post. Both of these steps took just a few minutes, about ten minutes total, including iterations to improve the picture.

As a responsible actor learning to give and get better service with the help of AI tools, I always verify what the AI generates (fact checking) and never pass it off for my own creation. I explicitly name the tools I used and the date, the exact prompts used, the results obtained, and what I had to verify and change if anything. In the case of the blog post, I rewrote the blog post entirely from scratch, but referred to what the AI tools were and were not able to help me accomplish. While I found using the AI tools fun and informative, it is important to keep in mind the dangers and harms possible in using AI – including what bad actors can do with AI [21].

## 5 Digital twins

Digital twins have been studied in servitization of manufacturing, especially for the task of predicting possible future state of equipment or more complex systems [22, 23, 24].

> *A digital twin of something is a special kind of synchronized interactive model of that thing with current state information as well as historical and predictive capabilities.*

As AI capabilities improve better and better digital twins are possible. In fact, most online platform service providers, such as online social media and retailers, are already building multidimensional digital twins of their users and

customers to give better service, such as predicting items of interest. However, this creates privacy and other potential harms to stakeholders [25]. An important challenge for responsible actors is to learn to invest in creating digital twins of people in an ethical way, that helps responsible actors give and get better trusted service [26, 27].

Since LLMs represent words as high-dimensions vectors, and appropriate prompts can generate grammatically well-formed expressions that reflect the compressed representations of many documents, it is possible to imagine digital twins as high-dimensional vectors that allow prompts on past, present, and future information. As digital twins of multi-scale actors are created, these digital twin models may help facilitate the give and get of better service by responsible actors.

As we use digital twins and AI to help us give and get better service, it is important to keep in mind that these technologies are energy hungry. The human brain performs about an exascale of computation (a billion-billion computations per second) on about 20 watts of power, whereas today's AI supercomputers that perform at the exascale use a million times more power [28]. The education service systems will change as we embrace AI upskilling, and the energy infrastructure will need to change as we embrace digital twins.

## 6 Concluding remarks

In conclusion, what is most essential about the topic "service in the humanity-centered AI era?" I believe we will get the future we invest in, so as responsible actors we need to learn to invest systematically and wisely using service innovation roadmaps to give and get better service [29]. Today that includes investing in AI upskilling and digital twin capabilities that help multi-scale actors give and get more trusted and sustainable service. The design of better service will require a transdisciplinary systems thinking approach to scale up benefits and scale down harms.

Figure 3 provides a summary of each of the main sections of the book [9]. The first section is about technology (learning to use AI to improve service), the second section is about science (learning to build better models of the world), the third section is about logics (learning to improve interactions), the fourth section is about architectures (learning to improve change), and the last section presents the X+AI vision (learning to build better digital twins to improve service).

| | Service in the AI era | Science science | Service dominant (S-D) logic | Service Dominant Architecture (SDA) | Service in the AI era revisited |
|---|---|---|---|---|---|
| Core message? | Better automation and augmentation improve service processes | Better science improves understanding (learning) processes | Better logics improve interaction processes | Better architectures improve change processes | X+AI requires learning to invest systematically and wisely to improve service |
| Where are the better models? | Technology | Disciplines | Minds | Enterprise | Disciplines + AI<br>Minds + AI<br>Enterprise + AI |
| What type of model? | Digital twins | Digital twins | Digital twins | Digital twins | Digital twins |

Figure 3: Summary of the book "Service in the AI Era: Science, Logic, and Architecture Perspectives" [9].

Figure 4 provides a summary of the difference between human-centered and humanity-centered design as explained in Norman [10]. The focus of design shifts from people to ecosystems of people, living things, and the planet, and

from a systems point-of-view to a long-term systems point-of-view when considering damages and harms that are not immediately understood. Finally, design with the community and not for the community.

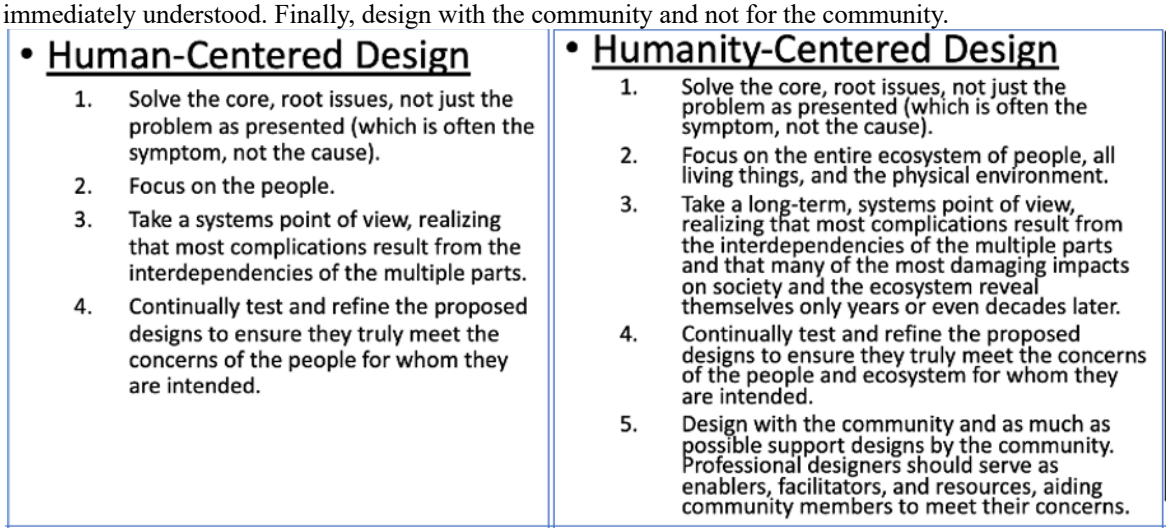


**Figure 4.** Summary of the book "Design for a Better World: Meaningful, Sustainable, Humanity Centered" [10].

In sum, better transdisciplinary models are needed to inform humanity-centered design for a better world. This will not be easy, and much work remains to be done. Nevertheless, digital twin technology is being used by businesses to reshape strategy towards the give and get of service [30]. I remain optimistic that AI upskilling can and will improve service in the humanity-centered AI era [31].

## References

1. J. Spohrer (2023) Service in the Humanity-Centered AI Era. Invited Online Presentation Slides for the 13th International Conference on Exploring Service Science (IESS 2.3) help in Geneva, Switzerland. URL: https://www.slideshare.net/spohrer/spohrer-iess-20230217-v9pptx

2. D. Ho (2009) Making Service Science Mainstream: A white paper based on the 2009 Service Science Summit. URL: http://service-science.info/wp-content/uploads/2010/03/Helsinki-Service-Science-Summit-White-Paper-v1.pdf

3. R. Bregman (2020) Humankind: A Hopeful History. Little, Brown and Company.

4. K. Lyons (2022) Engineering Considerations for Service Systems. Panelist Presentation. US National Academy of Engineering. Forum on Complex Unifiable Systems. Service Systems Engineering in the Era of Human-Centered AI – A Virtual Forum. URL: https://www.slideshare.net/issip/nae-service-systems-engineering-20221017-finalpptx

5. P.P. Maglio, C.A. Kieliszewski, J.C. Spohrer (2010) Handbook of Service Science. Springer.

6. P.P. Maglio, C.A. Kieliszewski, J.C. Spohrer, K. Lyons, L. Patrício, Y. Sawatani (2018) Handbook of Service Science Vol. 2. Springer.

7. I. Wladawsky-Berger (2022) The Current State of Service Science.
URL: https://blog.irvingwb.com/blog/2022/12/reflections-on-the-current-state-of-service-science.html

8. I. Wladawsky-Berger (2023) Is AI (Finally) Coming of Age?
URL: https://blog.irvingwb.com/blog/2023/01/is-ai-finally-coming-of-age.html

9. J. Spohrer, P.P. Maglio, S.L. Vargo, M. Warg (2022) Service in the AI Era: Science, Logic, and Architecture Perspectives. Business Expert Press.

10. D.A. Norman (2023) Design for a Better World: Meaningful, Sustainable, Humanity Centered. MIT Press.

11. S.J. Kline (1995) Conceptual Foundations for Multidisciplinary Thinking. Stanford University Press.

12. S.L. Vargo, R.F. Lusch (2004) Evolving to a New Dominant Logic for Marketing. Journal of Marketing 68: 1–17. [online at www.researchgate.net].

13. S.L. Vargo, R.F. Lusch (2016) Institutions and Axioms: An Extension and Update of Service-Dominant Logic.= Journal of the Academy of Marketing Science 44(1):5–23. [online at www.researchgate.net].

14. H.E. McGowan, C. Shipley (2020) The Adaptation Advantage: Let Go, Learn Fast, and Thrive in the Future of Work. John Wiley & Sons.

15. R. Dawson (2022) Will a "Google PhD" become as good as a university-granted PhD? URL: https://rossdawson.com/will-a-google-phd-become-as-good-as-a-university-granted-phd/

16. J. Spohrer (2023, in progress) AI Upskilling and Digital Twins: A Service Science Perspective on the Industry 4.0 to Industry 5.0 Shift. Draft for book in progress.

17. R. Hoffman, B. Casnocha (2012) The Startup of You: Adapt, Take Risks, Grow Your Network, and Transform Your Career. Currency.

18. E. Mollick (2022) ChatGPT Is a Tipping Point for AI. by Ethan Mollick. Harvard Business Review. December 14, 2022. URL: https://hbr.org/2022/12/chatgpt-is-a-tipping-point-for-ai

19. E. Mollick (2023) How to use AI to do practical stuff: A new guide. Substack - One Useful Thing. March 29, 2023. URL: https://www.oneusefulthing.org/p/how-to-use-ai-to-do-practical-stuff

20. J. Spohrer (2023) Upskilling With AI: Part 1. URL: https://service-science.info/archives/6377

21. T. Harris, A. Raskin (2023) The A.I. Dilemma - March 9, 2023. Speakers: Tristan Harris and Aza Raskin. Center for Humane Technology. URL: https://youtu.be/xoVJKj8lcNQ

22. S. West, O. Stoll, J. Meierhofer, S. Züst (2021) Digital Twin Providing New Opportunities for Value Co-Creation Through Supporting Decision-Making. Applied Sciences 11(9): 3750–3783.[online at www.mdpi-res.com].

23. J. Huang (2022) GTC 2022 Keynote with NVIDIA CEO Jensen Huang. URL: https://youtu.be/39ubNuxnrK8

24. IBM (2023) What is a Digital Twins? URL: https://www.ibm.com/topics/what-is-a-digital-twin

25. H. Berghel (2018) Malice domestic: The Cambridge analytica dystopia. Computer. 51(05):84-89. URL: http://www.berghel.net/col-edit/out-of-band/may-18/oob_5-18.pdf

26. Dataswift (2018) Hub of All Things (HAT). URL: https://youtu.be/aZBLTxS-RQc

27. J. Wakefield (2022) Why you may have a thinking digital twin within a decade. BBC News Online. URL: https://www.bbc.com/news/business-61742884

28. W.B. Rouse, J.C. Spohrer (2018) Automating Versus Augmenting Intelligence. Journal of Enterprise Transformation. 8(8):1–21.

29. J. Spohrer (2021) Service Innovation Roadmaps and Responsible Entities Learning. IESS 2.1. ITM Web of Conferences 38.
URL: https://www.itm-conferences.org/articles/itmconf/pdf/2021/03/itmconf_iess2021_01001.pdf

30. D.J. Smith (2013) Power-by-the-hour: The role of technology in reshaping business strategy at Rolls-Royce. Technology Analysis & Strategic Management. 25(8):987-1007.

31. J. Spohrer (2023) AI Upskilling (Part 2) – Readings. Section “Why I am optimistic” URL: https://service-science.info/archives/6410