Perspectives on increasing computational sophistication over the next 10-30 years and the evolution of issues in human-systems interaction.

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There currently exist a wide variety of touchpoints between humans and computational systems. These may include anything from the algorithm developer, to scientists or analysts who use outputs of data science algorithms (including machine learning), to "tip of the spear" operators who make use of autonomous or semi-autonomous systems when they make rapid, high-consequence decisions. Each of these touchpoints has its own unique set of issues.

In the future, as these systems becoming more seamless and more highly integrated (cf. some of the other topics of interest for this workshop), it is not clear whether there will be a larger or smaller diversity of these touchpoints. It could be that as systems become more intelligent, more integrated with one another, and more autonomous (e.g., Parasuraman, Sheridan & Wickens, 2000), the HSI problems become more difficult and more numerous. On the other hand, it could be that the design of said systems becomes easier – there are possibly harder human-system interaction (HSI) problems to solve, but fewer of them. If the latter materializes, it could be that fewer, harder HSI touchpoints lead us to discover something more fundamental about human-systems interaction because the complexity of the systems 10-30 years out is such that we will be able to identify fundamental principles where we could not before. What these principles might look like is anyone's guess, but my guess is that they will be much more closely informed by simultaneously developing understanding of how neurophysiology gives rise to cognition. There almost certainly will be a much tighter integration between the human brain and these higher-order computational systems – in fact, this type of interface has at least 20 years of research against it already (cf. the international Tools for Brain Computer Interaction conference; https://tobiconference.com, which is in its 11th year).

Regardless, the current issues of trust in automation as well as function allocation (what humans do and what machines do in a given task or job; also explored in the literature on supervisory control) will continue to require consideration, and these considerations will certainly evolve as these systems become more sophisticated, numerous, and integrated. Similarly, as additional control is ceded to these systems, up to and including whatever AI is developed, the research on function allocation is one that carries with it implications for systems as well as for human cognition and humans' abilities to develop and maintain situation awareness of what increasingly sophisticated systems are doing. With increasingly integrated, sophisticated, highly autonomous systems, human ability to perform critical tasks may erode, thus limiting their ability to mitigate risk due to system failure or error in high consequence situations.

My guess is that our current definitions of trust and function allocation will cease to hold meaning – that as the computational paradigms change, so do these HSI considerations, and in very fundamental ways. For example, existing literature on trust in automation indicates that anthropomorphism helps increase human trust and reliance on autonomous systems in some cases (e.g., de Visser, Monfort, et al., 2016). Thus, as systems become more human-like in their functional capabilities (even if not in the structures that give rise to these functions), the analogy to human-human trust may become more appropriate. However, as control is ceded to systems with more autonomy, system anthropomorphism may cease to be sufficient to optimize human-system teams. Humans will likely have to develop an increasingly intuitive understanding of when these systems can be trusted to do their jobs reliably before appropriate control is awarded, much the way we develop the same sense for new colleagues.

Finally, while we may succeed in developing AI that mirrors human cognitive capabilities in terms of flexibility and fluidity of knowledge use in the future, turning over control to those AI, especially when they are capable of functioning as well as humans but at machine speeds, will certainly give rise to significant cognitive as well as ethical and legal concerns.