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Presentation
"All Artificial Intelligence is Dual Use – But a Ban is Not the Answer"

Technological advances in artificial intelligence (AI), automation, genomics, nanotechnology, and quantum computing are increasingly converging and enabling each other, with significant ramifications in health, economics, security, and governance. This transformative power reminds us of: the continued presence of a diverse array of threats to our country; lingering vulnerabilities in our defenses; the consequences of not adequately addressing these vulnerabilities; and the centrality that technological convergence will continue to play in our society.

The ongoing AI-biology-automation revolution thrives on the convergence of two scientific forces. Computer scientists are designing artificial intelligence (AI) algorithms that can recognize patterns within large training sets with superhuman efficiency. At the same time, biologists and social scientists are analyzing human cognitive and emotional intelligence, leading the automation effort towards more adaptive and affective forms of computing inspired by our biology. In preparation for the continued democratization of AI and converging technologies, we must evaluate and address the benefits and risks in a way that minimizes the transfer of human flaws and maximizes human values in the design, development, and application of AI systems.

AI can be thought of as a group of disruptive technologies that automate capacities associated with human thinking, such as perception, learning, decision-making and problem solving. The relationship between AI and robotics is symbiotic; robots are autonomous systems that can be augmented with a range of 'intelligent' capabilities. Current research in robotics and AI Labs[i] already aim to model algorithms on multiple layers of biological, neurological, and evolutionary processes. In a not so distant future, these labs might even succeed in building AI machines with enough cognitive sophistication to create a capacity of abstraction and predictive intelligence.

The convergence of automation, AI, biology, and neuroscience is progressively giving rise to autonomous systems that can analyze and effectively communicate with us – a bold and ambitious experience that will transform our societies, economies, and our selves. With the rise of affective computing, we have seen different forms of emotionally intelligent machines from personal assistants to robots that look like, sound like, and emote like any normal human being would.[ii] Such automated systems enhanced with emotional and cognitive equipment could increasingly nudge human beings into adopting certain behaviors and impact societal norms and interactions.

From smart cities, surveillance, to military intelligence and warfare, this merger between affective computing and technological convergence will be pervasive, connecting information superiority with military and economic power. Picture when intelligent and autonomous systems will be a strategic, functional element of most of the essential services in our cities. Scientists in remote areas are already controlling drones capable of bio-analysis with their smartphones. This vision conflicts with the narrative encapsulated in Hollywood's killer robots and is inspired by the performance of biological intelligence as witnessed in our ecosystems. Every species around us – whether insect, fish, bird or mammal – has evolved fine-tuned capacities including, perception (sensors), situational and emotional intelligence (interaction within groups and environments), and high-speed data processing and decision-making (brains). Harnessing the power of nature's evolutionary engineering coupled with human robotic and AI technologies could help us solve complex bio-remediation problems, and/or, it could be used in precision surveillance and multi-domain warfare. More adaptive drone swarms could be engineered to mimic flocks of birds to prevent detection. Since this reality is no longer firmly in the realm of science-fiction, we must consider the implications at the heart of the convergence between AI, biology, neuroscience, and robotics.

Inherently dual-use by nature of its design, the convergence of AI-powered robotic and biology will confront our society with its governance vulnerabilities and failure to anticipate emerging benefits and risks. By *dual nature*, we mean that AI-powered robotics itself, as it is designed, not only its applications, could do either good or harm. The same algorithm that is used to target consumers with increasingly accurate advertisements, which benefits Facebook financially, can be used, for instance, to target specific people or groups in order to sow discord based on their political and social stances. Facial recognition algorithms integrated into smartphones within networks of "comprehensive cognition" in our cities could be used for securing online transactions or for enacting surveillance and predictive policing.

Within the AI space, there is little consensus on how to preserve scientific and intellectual freedom and address the risks posed by the convergence of technologies, including AI, advanced robotics, and neuro-biology. This paper will rely on a series of case studies in affective computing and biology-inspired robotics to question and assess the extent to which such designs can be framed as dual-nature and dual-use. The authors will then confront the results of this dual-use analysis with the existing governance models for emerging and converging technologies, developing regulatory and policy recommendations. While technologists lean towards a sort of permission-less innovation when it comes to AI[iii, iv], scholars and policymakers (plus a couple of tech entrepreneurs like Elon Musk) tend to lean towards a more precautionary approach[v]. It's of paramount importance to bridge the gap between the technologists who design and develop artificially intelligent machines and the scholars and policymakers tasked with navigating the rapid pace of implementation. In light of AI's dual nature, we may begin to balance the regulatory scale by directing our focus to fostering responsible AI-powered robotics innovation and steering away from both permission-less innovation and

precautionary bans. An ethos of responsible AI innovation would bring technologists, scholars, and policymakers together in an effort to ensure that society reaps all of the benefits and avoids potential harms.

Panelists
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[i] A few examples of current research in AI and other converging technologies: Carnegie Mellon University, "CMU researchers are collaborating with an international team that's working to find ways to translate genetic findings into new therapies for Alzheimer's disease"; The Stanford Artificial Intelligence Laboratory (SAIL); Penn State University AI Lab, "Biologically Inspired Algorithms for Knowledge Representation, Memory, Language Processing, and Learning"; MIT Computer Science and Artificial Intelligence Laboratory (CSAIL), "Using Artificial Intelligence to Improve Early Breast Cancer Detection".

[ii] Sophia, designed by Dr. David Hanson of Hanson Robotics, is a robot that was specifically designed to look like, sound like, and emote like any normal human being would. And this is where the complexities arise, but they're present in even the reductionist AI systems that are already present in society. See Hanson Robotics website at, [http://www.hansonrobotics.com/].

[iii] Prableen Bajbai. 2017. "How Facebook Is Using Artificial Intelligence," NASDAQ, (20 September). [http://www.nasdaq.com/article/how-facebook-is-using-artificial-intelligence-cm848218]

[iv] David Kenny, Vice President for IBM Watson and Cloud. 2017. Letter to the House of Representatives Artificial Intelligence Caucus. (27 June). [https://www.ibm.com/blogs/policy/kenny-artificial-intelligence-letter/]

[v] Anthony Cuthbertson. 2017. "Elon Musk and Stephen Hawking Warn of Artificial Intelligence Arms Race," *Newsweek*, (17 January). [http://www.newsweek.com/ai-asilomar-principles-artificial-intelligence-elon-musk-550525]