ARTIFICIAL INTELLIGENCE (AI) FOR HARMONY[1]

SADIA TARIQ, ASIF IFTIKHAR, PURUESH CHAUDHARY, AND KHURRAM KHURSHID*

Abstract

Given the present dominant negative social use of Artificial Intelligence (AI), this paper introduces a new concept of social power, i.e., social harmonious power, as a much-needed and more stable foundation for ensuring positive and harmonious co-existence and collaboration between humans and AI, including autonomous AI of the future. It also proposes the idea of a new neural network as a possible contribution to the domain of AI safety and a practical tool in the hands of humans who subscribe to the concept of 'social harmonious power'. Through employing the classical method of philosophical inquiry and alternative scenario building, it explains how this new approach and its concepts can help us better understand and address the present negative, unethical, and conflict-ridden social applications of AI and also lends support to the optimistic scenario and efforts to actualize a more integrated and congruent future of human species and AI.

Keywords: *Artificial Intelligence (AI), AI safety, Neural Networks, social power, the human mind, futures, intellect, harmony*

---

* Ms Sadia Tariq the Sanjan Nagar Institute of Philosophy and Arts, Pakistan; Mr Asif Iftikhar teaches in the Department of Humanities and Social Sciences at the Lahore University of Management Sciences, Pakistan; Puruesh Chaudhary is the Founder and President of Agahi Pakistan; and Mr Khurram Khurshid is the Founder and Director of the Artificial Intelligence and Computer Vision (iVision) research lab at the Institute of Space Technology, Pakistan.

Regional Studies, 40:2, Winter 2022, pp.18-35

Introduction

While thinking about the possible future(s) of our intellect's most advanced creation, i.e., AI, and its capabilities, interaction, and co-existence with our species, one unnerving imagined scenario is of autonomous artificial agents gradually replacing or even eliminating us. Whether this scenario becomes a reality or not remains to be seen. For the present, as Rhemann says, "Artificial intelligence holds the promise of human reasoning and creativity but, at least for now, has fallen short. Perhaps, with no known sense of longing, compassion, and 'human emotion', the knowledge of digested libraries may not result in an inner metaphor or a narrative."[2]

Searle, in his criticism of computationalism, suggests two imagined scenarios: a 'society of robots' and a 'society for robots'.[3] He correctly views both as deficient and unworkable. A more plausible future scenario would be a society of socially mature humans and collaborative/friendly/unambitious AI. In this society, all possible levels of tasks, works, motivations, and goals, ranging from simple to complex and computational to non-computational would be handled much more smoothly and peacefully with no constant threats of disruption, conflict, and contradictions between adversarial positions, worldviews, and ambitions. Positing and realizing such a future for humanity and the whole of the world is a preferable aspiration to host.

Co-existing and cooperating amidst diversity and differences is a basic trait embedded in all living systems and, in our case, it is imperative and more demanding not only due to our highly developed, sensitive, and social mental makeup but also the variety of products and processes we created in our external environment which was only possible through extensive and multi-layered collaboration. The way we have learned to co-exist with all varieties of phenomena (living and non-living) in nature, we need to practice the same with artificial life and systems. While recognizing the numerous differences and some similarities between us and AI, we need to proactively create

a stable and efficient system of peaceful and harmonious collective existence and functioning with AI. Kasabov, while elaborating on the distinct capability spectrum of brain-inspired (BI) AI systems and the human brain, echoes a similar aspiration when he states:

> The human general knowledge, the understanding of the complexity in nature and human societies, that have evolved for millions of years of evolution, will be impossible to be surpassed by AI, thus the leading role of the HI in a future symbiosis. And it is up to the HI to decide what BI-AI to create to complement and to enhance the human knowledge.[4]

This paper argues for a new approach and conception of social power in our minds which can potentially be more capable of concretizing the vision of a stable and harmonious coexistence with AI. This new mental direction will initiate the transition from the existing essentially adversarial (superficially collaborative) conception of social power in humans to 'social harmonious power' as a new foundation for social interactions and structures.

Why Human Intellect needs to Revise the Present Concept of Social Power

During the last decade or so, human intellect has created myriad positive and beneficial social applications of AI. In the coming years, these are bound to grow exponentially as AI gets properly integrated into all social aspects (cultural, economic, and political) of human society. All these efforts and works need to be acknowledged, appreciated, and supported. However, there is another side of the intellect which is constraining and putting fetters on the positive and optimum progress that is logically inherent in AI as a powerful technological tool with a massive potential to radically change human life and society. The creative intellectual process is also responsible for creating harmful and negative uses of AI and one such highly lethal and extremely harmful use is the contemporary individual and group

mind's sophisticated exploitation of advancements in AI for military strategy and warfare to achieve political domination. Creation of concepts like 'intelligentized war' and 'algorithm confrontation'[5] by political leaders, the development of lethal AI-based autonomous weapon technologies (AWS), killer robots, offensive AI, etc., and the AI arms race that has begun between the supposedly 'civilized' nations like China, East Asia, Europe, Russia, and the US are evidence of the dangerously negative use of AI by the contemporary human mind.

Seeing the mind-boggling display of creativity and intellectual focus in this sphere to create non-stop innovations despite evident knowledge of their harmful and destructive consequences compels one to question the core paradigms of the 'rational' and 'civilized' human thinking and action. The reason is that this thinking is taking the core adversarial agenda of the human mind to another level of sophistication which in reality is a distortion and perversion that can become the mental and physical nemesis of the human species. The equation in the minds of the top most 'civilized' nations (China, Russia, and the US), between AI-based sophisticated warfare tools, especially autonomous weapons, and winning future wars or ruling the world, is nothing short of a mental perversion and delusion. Therefore, the destruction of the world is a possibility if autonomous weapons and killer robots become a reality.

The cultural and habitual inertia and domination of the adversarial mindset prevent contemporary humans from re-examining and recognizing the clear irrationality of the above equation and rigorously scrutinizing and halting the development of AI-based warfare tools. According to Haner and Garcia, "Global military spending on AWS and AI, narrowly defined, is projected to reach $16 and $18 billion[6] respectively by 2025."[7] And there is neither any proper accountability nor any public scrutiny or debate on AWS and killer robots.[8] It is also being suggested that while at present only rich countries are developing AI-based military technologies, as the cost of

production lowers many other states and non-state actors will be able to procure these lethal tools which will further exacerbate the problem of accountability.[9] These statistics are showing the inertia and domination of the adversarial mindset of humans which breeds a variant[10] of insensitivity that stops them from actually carrying out what they intellectually and emotionally know to be correct, valid, and necessary while perpetuating the existing motivational and intellectual patterns that are known to be harmful, wrong, and anachronistic. If this was not so, humans would have succeeded long ago in either halting the R&D and practical work in this area or strictly and strategically channelizing and transferring the knowledge generated from this R&D work into some other beneficial domain.

If it were not for the domination and insensitivity of the perverted adversarial mind and its web of social imperatives why would France, Germany, and other countries talk of drawing up 'possible guiding principles' for AWS development instead of 'clear and necessary' guidelines and rules. Why would China agree to "ban the battlefield use of AWS, but not their development and production."[11] These actions inform us that the adversarial human mind remains dominant in our social decision-making. This means that the intellect needs to rethink and re-conceptualize social power so that it can decide to create harmonious AI and halt work on AWS, killer robots, offensive AI, lethal AI, etc.

Social Power and the Adversarial Mind

The social adversarial mindset subscribes to a certain concept of 'social power' that produces, determines, and controls their social relations, interactions, and the creation of special purpose (social pressure generating) groups, structures, and institutions. This means it would also be permeating the social applications of technology, including the social use of AI in different arenas. The present harmful and negative use of AI in different areas is rooted in the current concept of social power that exists in individual and social minds. So, if

any serious and stable change of trajectory in the social use of AI is desired, there is a need to critically examine and reject the prevailing concepts of social power in the minds of people and impart a new meaning to it so that an alternative AI modelling of social power can be undertaken.

There are various reigning concepts and definitions of social power. For some, social power "combines diverse and complex decision-influencing social factors, such as formal/informal norms, resource/action dependencies and social status…".[12] According to McClelland's Human Motivation Theory, 'power' in an organizational context is "the need to control and influence others, or to enjoy status and recognition."[13] Then there are ideas like social power emerging from "the inter-agent dependence of individual powers." [14] Individual powers are both internal and external; the former based on skills, capabilities and the right to do something and the latter consisting of material or physical resources. Some bases from which the social power of one individual over another stem have also been identified. These include the prerogative and ability to give rewards and punishments, internalized values which authorize an individual to influence another person or a group of people, identification or close connection with an individual, and perception of some person's expertise or specialized knowledge which gives that person power over other people.[15]

What the above definitions and concepts bring to light is that social power in humans is a very elaborate phenomenon operating primarily at the mental level with the help of various psychological tools and methods. The physical plane of social power is also very much there but it works alongside and many times in aid of the mental plane. The mental plane of social power emerged at a certain stage of human mental and social sophistication in the period of civilization. The highly developed and complex mental processes of intelligence, intellect, emotional, sensitivity, and pleasure/pain processes in

humans created their complex social formations and interactions and both have been developing as a spiral, reinforcing and channelizing each other. An individual's ever-increasing emotional and intellectual dependence on others including all that he or she values or rejects plays a major role in creating, determining, and controlling of social power that he or she has over others or vice versa.

Since artificial agents at present do not have elaborate emotional and intellectual processes, they cannot experience social power in all its subtleties, nuances, and dimensions. So, any modelling or representation of this phenomenon in artificial agents is and will remain a huge challenge till the installation of emotional and experiential processes within them become a reality. Since the core character of a person's emotional and intellectual processes is adversarial, the dominant character of any social power that he or she wields or is subjected to is also primarily adversarial. This can be seen in the abovementioned dominant trends in the social uses of AI. Despite thinking and knowing better and despite the kind, collaborative, and empathetic dispositions of individuals, the adversarial, self-centric and conflict-generating component of social power remains in the driving seat of cultural, political, and economic thinking and the models based on it. The deep-rooted, convoluted, and perverse desire in humans to dominate and manipulate specimens of their species, both mentally and physically, is so deeply etched in their individual and social minds that they fail to recognize the different garbs in which it continues to unconsciously infiltrate and control the working of their rational intellects. And what cannot be identified or recognized cannot be decisively and strongly rejected and replaced with a better desire. Until that is done, the dominant character of social power will remain adversarial, and devious and its modelling in artificial agents will inherit this character and will continue operationalizing and perpetuating its existing concepts.

Creating the Alternative: 'Social Harmonious Power'

We would like to suggest an alternative concept of social power, social harmonious power, in which the core conception and understanding of 'power' is not rooted in the motivation of domination, and/or manipulation of individuals or groups based on various underlying advantages but in socially purposeful harmonious interconnection and interaction amongst individuals. It is about a qualitatively different kind of power which connects and integrates humans with each other and the rest of nature and does not require domination, manipulation, or negative exploitation. In fact, these are contraindicated in this form of social power. So, here the modelling and representation of this socially harmonious power in artificial agents will also have the same character. Any neural networks or other approaches and methods that are used to emulate this phenomenon will have this new character and concepts embedded in their source codes, meta-languages, training data sets, etc. Thus, artificial agents embedded with this concept of 'social harmonious power' will behave and act very differently from the present agents operating on the basis of existing concepts of social power.

Imagine a high-level critical government meeting in the US which has to take some important decisions on whether to allow the making of lethal AI, autonomous weapon systems, or killer robots, or not. If this meeting were to be attended by individuals whose intellects and sensitivity processes are infused with the concept of social harmonious power instead of conventional social power conception and they are accompanied by AI assistants who are also modelled on social harmonious power, the quality, clarity and efficiency of the discourse and decision making in that meeting can be imagined. The usual frictions (verbal and nonverbal), habit patterns of thinking, familiar emotional and intellectual positions, and conflicting unintelligent motivations which dominate most meetings of today would not surface there. And even if they do they will immediately be

scrutinized and held accountable by the intellect. Disagreements and differences in opinions and ideas will emerge amongst individual participants but they will be tackled on a different plane and easily resolved because shared motivation and maturity of emotional and intellectual processes will be in the driving seat and will not let any derailing or disruption to take over the process of social interaction and communication. So, deciding and acting upon decisions will be a smoother and non-conflicting process. This means stopping research on killer robots or lethal AI or any such harmful projects will not require any elaborate debate or justifications.

Such alternative scenarios can be imagined in the tackling of numerous other social issues and problems that are presently stalled and remain either unresolved or partially resolved due to the present adversarial social power relations and dynamics which predominantly control human feeling, thinking, and doing.

The present harmful social uses of AI are a logical concomitant of the core concepts of social power in human minds which are essentially adversarial in nature. It is these concepts and not the theoretical and practical superstructures built on them that are the actual problem which needs to be recognized and addressed. These are the real cause of why despite hundreds of think tanks working on conflict management, disintegration, conflicts, and contradictions in the social lives of people remain unabated and are in fact on the rise all over the world. So, these underlying implicitly controlling core concepts of social power which are the basis of present social interactions and institutions and also underlie the social uses of AI, need to be reconsidered and ideally replaced with some new concepts like social harmonious power and its possible applications.

The HI-AI Harmony Neural Network: A Tool of 'Social Harmonious Power'

We propose the idea of HI-AI Harmony Neural Network (HAHNN), as a tool in the hands of individuals subscribing to the new

concept of social harmonious power. People who will use this tool to create and construct new AI agents and AI-based social applications and solutions which can be seriously and sustainably beneficial and useful for human society. This tool will be existing parallel to Generative Adversarial Nets (GANs), where the term 'HI' refers to human intellect (as discussed in this paper) and not human intelligence. Its essence and spirit will be of hybrid intelligent systems[16] displaying both symbolic and sub-symbolic characteristics. The GANs improve, self-correct, and learn through competition while HAHNN will upgrade itself through integrative collaboration. HAHNN will be an emulation of the Human Intellect's future and its capability of integration while GANs are about a specific capability of the present adversarial intelligence.

The bigger philosophical and more futuristic purposes of HAHNN are to contribute to existing works on AI safety and augment and assist the work of the human intellect and ensure harmonious working with it for the betterment and progress of human society; to be a highly effective tool for creating new AI systems and social applications. The first step is to clearly define the core concept of 'harmony'. In the proposed NN the basic or parent concept of harmony means conflict-free, stable, and harmonious functioning between human intellect and AI. Any additions or subtractions to the core concept of 'harmony' will be installed by the human intellect. Some algorithms (machine language instructions) can be written to ensure this. This neural net can be based on a hybrid of NARS architecture using 'experience-grounded semantics', and the 'model-theoretic semantics'[17] using some core concepts (like harmony) and knowledge as a kind of constant reference, and criterion against which the conclusions of data processing can be checked, apart from just the experience of the system. This hybrid architecture will bring it closer to human mental architecture which uses both immediate local

experience and the reference of some 'larger model' or 'world view' for both thinking and doing.

To move in the direction of its core purpose, it will need to get trained on some preliminary elementary tasks like identifying those inputs which conflict with the larger goal of achieving harmonious interaction and working with humans. Another task will be to develop the capability to identify and classify the tasks that it can do better and the ones that humans are good at and should do. So, it develops the capability of harmonious task partitioning between itself and humans.

In the case of the first task, to identify conflicts with the core goal of harmonious interaction, the concept of harmony and some concepts (single and compound) connected to it, like, shared stability, collective well-being, co-existence, synthesis, and no conflict, can be used as referents and criteria against which the conflicting inputs can be checked. The built-in meta-level 'inference rules' and 'control strategy' used by this NARS-based NN can be made in accordance with these concepts embedded as referent statements, definitions, facts, knowledge, and relations in its memory system.

The second task of harmonious task partitioning can be illustrated through the following examples. If this NN is given the task of interpreting complex poetry then it can pick up and perform some mechanical prerequisite tasks necessary for carrying out interpretation, like gathering all relevant references connected to the topic of the poetic piece or the dictionary meanings of some words, etc., and then pass on the actual creative interpretation to humans. It can also dig out any already existing human interpretations of that piece also if they exist. Similarly, the interpretation of complex emotions or sensitivities in audio-visual and text inputs can use this NN for carrying out the preliminary steps of any interpretation. This idea of AI recognizing what it can and cannot do, and then passing onto humans what it cannot do, is not new. Anderson, while proposing the development of programs which can give AI systems

the ability to act as 'ethical advisors' to humans, mentions how these agents would be able to recognize the fact that there are no correct answers to all ethical dilemmas and thereby pass on difficult decisions requiring action to humans.[18]

HAHNN is being conceived as a generic network to be used alongside specialized NNs. It can act as a general sieve through which a complex task is passed and partitioned and then made available to the human intellect to work upon. The range and types of tasks it can be used for can be worked out by AI developers and other thinkers and philosophers. It can be used as the conduit for those complex intellectual tasks which cannot be directly handled by any specialized NN. These can be broken up and partly achieved by this generic NN. The memory bank of this NN will contain all precedent task processing results and specifics (facts and knowledge in various formats) of harmonious and collaborative functioning between AI and HI. Its training dataset can be based on samples of those complex intellectual products which require this clear and harmonious task partitioning.

Some characteristics of NARS[19] that it can employ are parallel processing of multiple tasks at varying speeds, using both short-term and long-term considerations depending on the task, and using the function of revising its conclusions or decisions in some instances. There can be others also but that would be for the developers of this Neural Network to determine.

Since the core concept of 'harmony' is a complex, broad and abstract concept which cannot be demarcated, it also falls under the fuzzy concepts characteristic of NARS. But like Wang says such concepts are also "not arbitrary or random, but relatively stable, bounded by the system's experience."[20] Nevertheless, it can be viewed as flexible and open in the sense that it can also incorporate other features within it if required; some more definitions, facts, connections or relations with other concepts. The meaning of this concept, like the

concepts in NARS, is not determined by an interpretation linking it to some fixed 'external object' as in axiomatic and semi-axiomatic reasoning systems.[21] It is determined by its relations to other connected concepts (mentioned above). And also, some relatively constant reference facts, knowledge, contexts, and relations contribute to its meaning. In HAHNN, its meaning has been reduced to detecting and rejecting inputs which are conflicting with the core concepts and goal, and for carrying out harmonious task partitioning between human intellect and AI. But this reduction does not restrict or inhibit any additions to the concept. There can be additions not only to its knowledge and tasks but also to the main concept, as and when human understanding and knowledge improve.

In NARS the basic inheritance statement is "S $\rightarrow$ P" where S is the 'subject term' while P is the 'predicate term'. And both these terms denote specific concepts. So, the meaning of this basic statement is that S is a special case of P, whereas P is a general case of S. Another way of putting this is: S is included in the extension of P and P is included in the intension of S.[22] Following from this, one of the basic inheritance statements of HAHNN will be: AI$\rightarrow$HI, i.e., Artificial Intelligence (AI) is a special case of Human Intellect (HI) and HI is a general case of AI. And AI is included in the extension of HI while HI is included in the intension of AI. There are two implications of this which can also be implicitly coded in the source code. Since AI is included in the extension of HI so its operation has to remain within the parameters set by HI. Moreover, as it is integrally connected to HI so its actions and decisions will affect HI and it has to logically take inputs from HI.

This basic statement along with the priority and usage values or weights of each term can be a part of HAHNN's 'innate knowledge' or its meta-level control strategy. In addition, this basic statement and a few others can also be connected to the Self of HAHNN and

embedded at the meta-level within the system as innate belief. For example:

Input: AI is a part of HI

< AI→HI>

Input: I am an AI

< {SELF}-- > AI >

Derivation: I am a part of the HI

< {SELF} → HI >

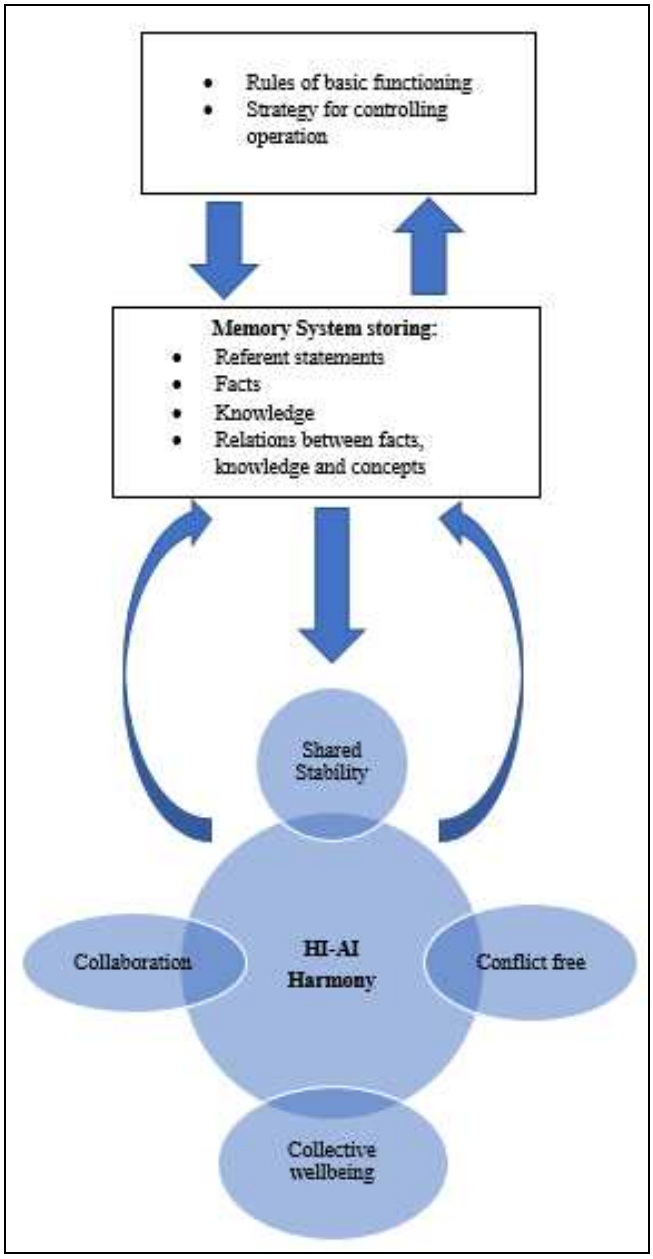
To reiterate, since the knowledge and tasks of any concept (core or branches) in NARS are flexible, the concepts in HAHNN will also be open concepts to which new aspects, knowledge and questions can be added. So, if other researchers find it of use then they can develop and take it forward. The aim is to see if it can contribute to the primary goal of enabling a harmonious coexistence between AI and Human Intellect, as a necessary imperative for humanity and the integrated process of Nature.

HAHNN can also become a part of the work on declarative languages and programs which are about writing what any machine should be doing instead of how it should be done. For instance, the following (there can be many more that AI researchers, social scientists, philosophers, and futurists can come up with) declarations can be installed in AI systems:

- The AI system must work harmoniously with humans and other AI agents.
- AI has to avoid coming into conflict with humans.
- AI must recognize or identify its limitations and carry out a smooth task division on that basis.

Figure 1

Elementary meta-level of HI-AI Neural Network (HAHNN)



Conclusion

AI and the human intellect have their separate domains of existence and operation, which need to be observed and preserved. However, since they have to co-exist, and collectively create the future(s) of humanity, a better and more beneficial option is to develop a stable harmonious collaboration instead of conflicting and unhealthy competition between them. AI, both as a tool or a mature and developed species (if that becomes a reality in future) has to work efficiently and optimally alongside humans. But this has to be ensured and designed by humans by employing a new concept of social power and a new neural network. Because as Kanaan says "At the end of it all, and as has always been the case, people—and the specific uses to which we put our machines—are and will remain the principal problem. It's what we will do with AI that matters . . . and, yes, the potential for human misuse, intentional and otherwise, is worthy of great concern."[23]

This research questions the present concept of social power and suggests a better alternative in the form of 'social harmonious power' and its idea (later practical) tool 'HI-AI Harmony Neural Network'. These can be further developed and used by AI researchers, thinkers, and philosophers. They are aimed as contributions to the existing works focusing on the role and use of AI for creating more harmonious co-existence and collective future(s) alongside humanity.

Notes and References

[1] In this paper, the term 'harmony' refers to the integrated and dynamic nature of reality wherein all its interconnected and interactive phenomena/processes/forms, keep progressing towards qualitatively new levels of integration, productivity, efficiency, and stability. In other words, it is about minimizing conflicts, contradictions, obstructions, while increasing harmonious interaction, and collaboration within and amongst the various forms and processes in Nature. We propose such a preferable future scenario of harmonious interaction and relationship between the two very advanced forms/phenomena of integrated reality; humans and AI.

[2] MK Rhemann, "A Futurist Revisit to the "Value Chain,"" *Journal of Futures Studies* 21, No. 3 (March 2017), 27. doi:10.6531/JFS.2017.21(3).A25.

[3] Raffaela Giovagnoli, "Computational Ontology and Deontology," in *Philosophy and Theory of Artificial Intelligence,* ed. Vincent C Muller (Berlin: Springer-Verlag, 2013), 182.

[4] Nikola K Kasabov, *Time-Space, Spiking Neural Networks and Brain-inspired Artificial Intelligence*, (Auckland: Springer-Verlag, 2019), 710.

[5] Edmund J Burke et al., "People's Liberation Army Operational Concepts," *Research Reports* RR-A394-1, (2020): 1-32, doi: 10.7249/RRA394-1.

[6] Imagine the alternative uses of this amount for supporting and promoting human-AI collaborative social and economic endeavors.

[7] Justin Haner and Denise Garcia, "The Artificial Intelligence Arms Race: Trends and World Leaders in Autonomous Weapons Development," *Global Policy*, 10, no. 3 (Sept 2019): 331, doi:10.1111/1758-5899.12713.

[8] Haner and Garcia, "Autonomous Weapons Development," 331.

[9] Haner and Garcia, "Autonomous Weapons Development," 331.

[10] A quantum state of developed sensitivity towards one's individual or group agenda entangled with extreme insensitivity towards human pain, misery and the process of Nature and its requirements.

[11] Haner and Garcia, "Autonomous Weapons Development," 335.

[12] Goncalo Pereira, Rui Prada and Pedro A. Santos, "Integrating social power into the decision-making of cognitive agents," *Artificial Intelligence*, 241(December 2016): 1, http://dx.doi.org/10.1016/j.artint.2016.08.003.

[13] Pereira, Prada and Santos, "Integrating social power," 10.

[14] Pereira, Prada and Santos, "Integrating social power," 3.

[15] Pereira, Prada and Santos, "Integrating social power," 7.

[16] Roberta Calegari et al., "Logic-Based Technologies for Intelligent Systems: State of the Art and Perspectives," *Information,* 11, no. 3 (March 2020): 1-29. doi:10.3390/info11030167

[17] Pei Wang, The Logic of Intelligence. In *Artificial General Intelligence,* eds. B. Goertzel, & C. Pennachin (Heidelberg: Springer-Verlag, 2007), 31-62.

[18] Susan Leigh Anderson, "Asimov's "three laws of robotics" and machine metaethics." *AI & Society,* 22, (2008): 477–493, https://doi.org/10.1007/s00146-007-0094-5

[19] Pei Wang, "Logic of Intelligence," 31-62.

[20] Pei Wang, *Non-Axiomatic Logic: A Model of Intelligent Reasoning,* (Hackensack, NJ: World Scientific Publishing Co. Pte. Ltd., 2013), 54

[21] Pei Wang, "Logic of Intelligence," 31-62

[22] Pei Wang, Xiang Li, and Patrick Hammer, "Self in NARS, an AGI System," *Frontiers in Robotics and AI,* 5 (March, 2018): 2, doi: 10.3389/frobt.2018.00020

[23] Michael Kanaan, *T-Minus AI: Humanity's Countdown to Artificial Intelligence and the New Pursuit of Global Power*, (Dallas, TX: BenBella Books Inc., 2020), 20