ARTIFICIAL PROMETHEANS:
A COMPARITIVE CASE STUDY ON THE SIMILARITIES AND DIFFERENCES IN ARTIFICIAL GENERAL INTELLIGENCE PROJECTS WITHIN THE UNITED STATES AND CHINA

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Introduction:

In 1955, the Dartmouth Research project defined artificial intelligence (AI) as "making a machine behave in ways that would be called intelligent if a human were so behaving." (McCarthy, Minsky, Rochester, Shannon, 1955). To study artificial intelligence is to not only examine oneself as solely a mere creator but to examine oneself so thoroughly that you are able to replicate human intelligence within an inanimate object. Like Prometheus, modern AI (artificial intelligence) developers seek to create human-like figures from the glorified mud and stone of computers. The question arises, "Is it inevitable that mankind will meet the same fate as Prometheus, a bondage to the very object that we animated?". As different organizations and countries obtain access to the mud and stone (computers) and race to the actualization of AI, does it then even matter who is creating AI? Do these groups understand the existential implications that lie within their acts of creation? This paper aims to identify the parameters of this formation through examining the AI/AGI (artificial general intelligence) policy paths via examining the two countries leading the way – the United States and China. In doing so, I identify similarities and differences of AGI projects in these two countries. Furthermore, I examine the complex interconnections involved in the research and development of these AGI projects within their respective policy environments.

Based on prior literature, I seek to answer these novel questions using a qualitative approach, whereby I assess the two contexts of the United States and China then identify specific AGI projects interaction within each context. Qualitative research allows flexibility in gathering scoping data and managing the research process, while also having a foundation built off of our humanity thereby accentuating its value in this analysis. Case studies are recommended for research questions asking what, why, or how; especially those relating to complex issues and

real-world settings such as AGI (Merriam, 1998). These analyses culminate in a structured taxonomy of the AGI project.

My analysis begins with a brief outline on global economic competition and geopolitical struggles as it relates to China (Bruton, Ahlstrom 2003) and the US (Peng, Sun 2019). Building on Dani Rodrik's Institutional theory, I develop a better understanding of the two environments which these AGI projects are embedded in (Rodrik, 2012). Through qualitative examinations on AI/AGI policy in China and the US I build on theory and offer practical implications. This will be expounded upon directly through examination of five areas: 1) Research and Development, 2) Talent, 3) AI Adoption, 4) Data, 5) AI Ethics/Consequences.

Furthermore, to understand the forms of these organizations, I utilize the recent academic literature discussing the layers of the AI/AGI Value Chain in practice: foundation, technology and application (Foster 2018; Xu, Li, Lu 2019; Ding, 2019). In continuation, I then analyze the source and flows of the human capital capable of developing and piloting AGI related projects as to ascertain where contributions reside in the creations of AI and AGI technologies, as well as the policy interpreted leadership of these groups. I gathered this information through the 40 Years of Cognitive Architecture Research report (Kotseruba, Gonzalez, Tsotsos 2016) and through the AGI taxonomy (people, groups) websites (Baum 2017). I pair this with a comparison on the number of humans capable of achieving such tasks as well as the general location of these (1-Nodes) people and (2-Modules) projects to glean possible environmental connections and (3-Task Managers) policy effects. This gives an idea of the institutional paths developed to train and recruit new talent for AGI projects in the United States and China.

Finally, I utilize case studies of specific AGI projects from a dataset of the 45 worlds' known AGI R&D projects compiled by the Global Catastrophic Risk Institute (Baum 2017)

alongside the 40 Years of Cognitive Architecture Research report containing 54 cognitive architectures to create an interconnected taxonomy of selected United States and China AGI project case studies (Kotseruba, Gonzalez, Tsotsos 2016). This taxonomy allows for a comprehensive graphical comparison on the similarities and differences as well as the further questioning of the connections between (1) individuals, (2) environments and (3) policy within AI and AGI projects. From this, I find that China mainly had Government run AGI projects. This is due to the large involvement of the Chinese Communist Party wanting to directly influence the AGI projects as well as make sure their highly detailed policy goals are met. Contrarily, most United States AGI projects were in academic institutions and corporations. These findings follow the intuition involved with the directing, reclusive Chinese Communist Party (CCP) and the laissez-faire, cooperative United States. Through the use of inductive qualitative studies, this paper contributes to existing literature by addressing the implications of a revolutionary technology, AGI, in comparison to the political and economic factors that influence its developmental process and eventual outcome.

Theory and Literature Review:

AI and AGI:

Cognitive scientist Marvin Minsky defined AI as "the science of making machines do things that would require intelligence to be done by men" (Minsky, 1968). Following the development of the electronic computer in 1941, the first AI was developed in the 1950's at Carnegie Mellon and was aptly named 'The Logic Theorist'. However, it would take 40 years for AI to once again return to the public eye. Appearing through Deep Blues victory over chess

grandmaster Garry Kasparov in 1997 and ever since AI has been beating humanity at its most complex games, such as IBM's Watson, the 2011 Jeopardy victor, or Alpha Go, the AI who bested skilled masters of the game Go, a game that possesses over 10^170 possible board configurations. This makes the game of Go a googol (1.0×10^{100}) times more complex than chess (Silver, Hassabis, 2017), as well as having more variations than there are atoms in the known universe. Furthermore, a United States futurist entrepreneur, Peter Diamandis, estimates that 40% of jobs are destined to be lost to AI in the next 20 years. While these numbers seem astronomical upon first impression, the International Federation of Robotics (IFR) predicts that the growth of industrial robot jobs will accelerate on average by 14% every year between 2019 and 2021 (Malvina, 2020). These statistics make it no wonder that AI attracted US $12 billion of investments sourced from venture capitalists from all around the globe in 2017, double the volume found in 2016 (Yu, 2018). In July 2017, China unveiled a national plan in which AI will be built into a US$152.5 billion industry by 2030 (Yi, 2017). According to Columbus (2017), 80% of enterprises have some form of AI today. Alongside this, 30% of enterprises plan on expanding their investment in AI, and 62% expect to hire a Chief AI Officer." (Wang, Siao, 2018).

Born out of AI was AGI. AGI is the most important technological development of the late 20th early 21st century (Clancey, Smoliar, Stefik 1994). Currently, exact definitions of AGI are hard to procure, and seldomly is the definition found to be in accordance with more than just a fraction of the AGI's communities view on AGI. In reality, the AGI community still only broadly agrees on the conceptual definition of AGI first described in Japanese by Ben Goertzel (2014); and later being re-articulated into English as what is currently described as the "Core AGI Hypothesis", i.e. that:

> "the creation and study of synthetic intelligences with sufficiently broad (e.g. human-level) scope and strong generalization capability (Artificial GENERAL Intelligence), is at bottom qualitatively different from the creation and study of synthetic intelligences with significantly narrower scope and weaker generalization capability (Artificial Intelligence-AI)" (Goertzel 2014).

With such a general definition, it comes as no surprise that the current gamut of AGI projects include general cognitive architectures such as LIDA created at the University of Memphis (Snaider, McCall, Franklin 2011), brain emulation techniques from the Blue Brain project based in China (Baum 2017), and synthetic superintelligence(Bostrom 2017). Some AI experts believe that AGI is still centuries away, others believe it is more likely to occur in the 21st century than some might think.

> "Experts have different opinions about how soon AGI will become a reality. For instance, AI researchers Muller and Bostrom report in a survey that AGI will have a 50% chance to be developed between 2040 and 2050, and 90% by 2075" (Health, 2018).

In consequence, AGI is just beginning to get discussed thoroughly in the scientific realm, meaning the vast majority of policy related to any synthetic intelligence is related to the more generally known AI. While fierce debates continue in the scientific community over whether the methods of developing AI can be applied to the creation of AGI, one thing becomes clear; the factors involved in the creation of both are one and the same: humans and their environments. As a consequence of the relative infancy of AGI projects and their discussion in public forums, I opt to use AI policy and data to lay the base for understanding AGI projects.

The Antecedents of AI/ AGI Consciousness:

Consciousness is the awareness of self (Zeman, 2006). This awareness is both present and able to imagine future scenarios of being. Consciousness begins with the slow formation of self-image that is developed through and connected to environmental stimuli. One word lends an understanding to this phenomenon, qualia. Qualia is defined as an individual instance of subjective and conscious experience. Hod Lipson, a robotics engineer at Columbia University, describes Qualia as basic notions of the world that we do not have words for. For instance, humans may think of the taste of chocolate, the feeling of the hot sun on a cold day, or the smell of the ocean. Hod states that computers will also have similar qualia experiences. However, computers are outfitted with sensory peripherals that interpret stimuli in a manner beyond our basic (human) five senses, meaning that AI will have notions of the world that we cannot perceive and thus do not have the words for. In accordance to the concepts detailed in the following paragraph, the environments from which the AI/AGI manifests its own qualia will influence the final evolution of its 'consciousness', or, at least, the form of it that humans can perceive as conscious. As a result, the ultimate nature vs. nurture debate now projects onto our own creation of AI/AGI –does the end-product reflect its creators and developmental environment?

The principal factor contributing to the formation of the AI/AGI consciousness is the individuals behind it. AI is a human creation, made with human prejudices. Mariya Yao explains this problem in her co-authored book *Applied Artificial Intelligence* (2018: 120),

> *"*When Timnit Gebru attended a prestigious AI research conference last year, she counted 6 black people in the audience out of an estimated 8,500. And only one black woman: herself. As a PhD candidate at Stanford University who has published a number

of notable papers in the field of artificial intelligence, Gebru finds the lack of diversity in the industry to be “extremely alarming”.

Yao has narrowed down most problems of AI today to three root causes, homogenous development teams, insular thinking, and ethnocentrism that leads to a lack of perspective. The example above shows the underlying danger that algorithms designed by an unvarying team of top talent may have, as they overlook the needs and desires of underrepresented groups and unintentionally amplify discrimination against them; while also setting themselves back by having a narrow outlook on diversity-oriented strengths.

The subsequent factor driving AI/AGI consciousness is the context and setting in which it is fostered. AI/AGI reflects on the culture and organizations involved in its development, as the innate goal of learning and processing in the same fashion as a person is going to be heavily influenced by the selection of people it is surrounded with. Consequently, AI/AGI would differ from organization to organization and from country to country, opening up opportunities to attract problems stemming from insufficient diversity. Accordingly, the pitfalls of this are reflected in current projects wherein a single nation or group of allies’ top specialists (homogenous development team) with a singular goal, often to develop a technology before a competitor (insular thinking), undergo limited reflection on their creation due to the competitive and time-sensitive nature of the project (lack of perspective). As a consequence of this, the environments where AI/AGI are being developed need to be understanding and welcoming to allow for a discussion on their implications as the creators’ and contextual biases create unforeseen variations of AI/AGI which permeate their final creations.

The Push for AGI:

The variations mentioned above are currently being played out as organizations in a multitude of areas are rushing to pilot and adopt AGI into their planning, manufacturing and automation processes in order to edge out competitors (Makridakis 2017). Two national players have emerged as leaders in this area – the United States and China. Until recently, the United States has led China, with China only recently (within the past 5-10 years) attaining similar developmental levels (Baum 2017). The result of this surge is that China has now become the global public sector leader with a $1.5 trillion USD investment benchmark set for 2030 (Duettmann 2018). The United States now lags behind in a relatively distant second place with no current AI policy USD benchmarks (Duettmann 2018), but with a stronger private sector spearhead on AGI investment through Google, Apple, Amazon etc. (Westervelt 2019). An example of this stated difference between public sector consideration of AGI between the US and China being the $2.5 billion difference of investment into AGI over the next 5 years between Shanghai (a Chinese city government who has invested $7.5 billion) and DARPA (a United States advanced research project agency who has invested $5 billion) (Westervelt 2019).

As seen in the numbers above, a lack of funds or innovation opportunities is not an issue, but rather the rigorous timelines filled with incessant innovation and piloting process hurdles is (Duettmann 2018). Specifically, a combination of individual abilities, intrinsic differences in educational/ training opportunities in the field of AI/AGI, socio-cultural circumstances of a workplace (views in regards to regulation, implementation, research methods), and the institutional policy prioritizing goals and management efficiency at each government, company or institution. With increasing awareness of the potential of AI/AGI, the competing global hegemony of China and the United States has increasingly sparred over this domain.

Subsequently, in an increasingly globalized and technological world, the field of AGI is becoming a crucial competitive arena for China and the United States.

To examine the competition between these two superpowers, I embark on an exploratory qualitative study of AGI within these two contexts aimed at: 1) identifying similarities and differences in AI/AGI policy, 2) articulating a taxonomy of all known AGI projects within both countries and 3) understanding the implications going forward. First, I examine the similarities and differences of AGI projects in China and the United States across several key criteria. These include:

1) **R&D** what do you want the AI/AGI to do, is the AI/AGI being created suited to your needs.

2) **AI Talent**, the need for technical talent extends beyond the initial research and development, specialists are needed for ongoing maintenance and performance monitoring.

3) **AI Adoption**, what is needed to ensure a well-rounded AI can be deployed and taken care of.

4) **Data**, having tons of data does not mean you have the right data how is data acquired and utilized.

5) **AI Ethics**, how much are you willing to sacrifice to develop, implement and maintain an AI and its creators?

Second, enlightened by the similarities and differences across these criteria, I create a taxonomy of projects within China and the United States. This allows for a better understanding of AGI projects and their development. Furthermore, my insights offer theoretical and practical implications of interest to practitioners in the public and private sectors. Finally, these analyses

allow for a better ground up understanding of AGI projects by examining China and the United States AGI policy, environment, projects, and inter-organizational ecosystems. From this I can derive insights and implications of AGI across contexts.

Rodrik's Institutional Theory (Globalization Paradox):

Rodrik's Theory lays down the framework that explains the differing pathways of AGI development in regards to country level, global level cooperation, and development. The following sections are based off of his book *The Globalization Paradox: Democracy and the Future of the World Economy* and his associated blog. To begin, Rodrik asserts that full globalization (complete global market integration) is only possible through two principles: 1) regulation and 2) solidarity. The conceptual idea of regulation (ensuring economic outcome) and solidarity (ensuring fair, legitimate competition) encompasses not only complete global market integration, but also subsidiary components: international trade, geopolitics, and international research and development. Despite this idea, each country has its own motives and desired outcomes; when paired with varying conceptual definitions of good and bad, regulation and solidarity are, in essence, subjective terms that adhere to each country's constantly evolving vision. In summation, it is impossible to fully assimilate markets, as the very concepts globalization must adhere to, institutions of regulation and solidarity, undermine themselves through what globalization entails, the full integration of individual countries motives and goals.

Globalization has winners and losers. China and the United States differing perceptions of greatness will inevitably lead to what values they project to be a winner or a loser. Possessing such varied government frameworks, such as different governmental institutions, market systems and social institutions only enforce the differing outcomes of each country. Nonetheless, in order

to compete, these countries must operate in international institutions: WTO, WHO, GATT and the OECD, a group specifically related to AI/AGI. There are certain institutions that are created in order to increase internal collaboration by standing in solidarity together to stay away from the bustle of individual countries' influence by providing a rigorous set of regulations to all members. This means there are two easily apparent avenues for United States and Chinese development moving forward; either through increasing collaboration between countries through the ideals of increasing collaboration when unified by shared goals and values (USA), or single-minded growth with limited collaboration (CH). The possible reasons for each are numerous; maybe a country does not “play well” with others, therefore finding it more beneficial to have complete control over themselves, or perhaps a country finds that giving up control for increased flexibility is more advantageous to development. Either way, both countries seek the same goal (development) and utilize international power/ influence (economy, geopolitical clout, etc.) and cultural values (historically/ mythos-based values and narratives) to influence the pathways created to achieve a goal, in this paper's case, AGI.

Data sources:

The Global Risk Institute report is a basis for case study selection and research, for it houses all the world’s (45) publicly known AGI projects in one consolidated meta-analysis (Baum 2017). This paper utilizes a condensed version of Baum’s AGI taxonomy to highlight and compare details between Chinese and United States AGI projects. The sources of data are sourced from governmental agencies in both respective countries. The 40 Year Report on Cognitive Architecture supplies information on individuals and their contributions to specific cognitive architectures, and therefore their contributions to AGI projects using information that

is gathered from the reports and white papers of scholastic institutions and private tech companies (Kotseruba, Gonzalez, Tsotsos 2016). Documentation on policy has been gathered from governmental agency reports such as the Governmental Accountability Office in the US and multiple Chinese governmental ministries (GAO 2019; Li 2019; Ding 2018). Further documentation has been accessed from non-governmental entities such as the Foresight Institute, Future of Life Institute and university academics (Duettmann 2018; FLI 2019). These differing sets of affiliated and non-affiliated information will give a reasonably unbiased and comprehensive view on policy and its current and future effects on AGI. Upon interpreting this data, this paper describes where AI personnel are currently located as well as their denoted affiliations. In summation, these combined data sources offer an effective understanding of the relationship between AGI and these two very different contexts.

Methodology:

This thesis relies upon the compiled secondary data and corroborative case studies of selected AGI projects in China and the US. The qualitative component examines data on governmental policies, human leadership, and the organizational environments of tech companies. Upon interpretation, this allows for an examination of how these two countries' views, at a base level, compare in juxtaposition to the pursuit of AGI projects in policy. This includes effects of policy, investment, and the geopolitics on the implementation of AGI not described in quantitative measures. This data substantiates a taxonomy through the subjective reality of AGI startups and institutions. Supporting this, I use a collation of corporate reports and white papers(Li 2019; Foster 2018; Deloitte 2019) alongside data sets from The Global Catastrophic Risk Institute and 40 Year Review of Cognitive Architectures (Baum 2017;

Kotseruba, Gonzalez, Tsotsos 2016) to examine the investments, individuals, and groups involved within each project. From this, parallels between the pathways of AI/ AGI development in China and the USA are then ascertained (Snaider, McCall, Franklin 2011).

Context:

China:

China experienced three major developments in AI policy over recent years. In December 2017, China released a three-year action plan for promoting the development of the New Generation Artificial Intelligence Industry Plan, which highlights major goals for the future of China's AI/AGI development (2018-2020). In September 2018, China released a list of innovative projects entailing deep integration of artificial intelligence within the real economy, and in November 2018, the central government released a work plan for the new generation of AI industry innovation priorities. China's New Generation Artificial Intelligence Industry Plan lists out five key points that will be the basis for Chinese AI hegemony by 2030 (FLI 2018). These are: organized implementation, improve the degree of support, encourage innovation and pioneering work, accelerate training of personnel, optimize the development environment, promote the formation of a positive development environment, ensure the successful implementation of the Action Plan, realistically advance AI industry development, and assist in the transformation and upgrading of the real economy (China MIIT, 2017). This formation of policy also seeks "to strengthen the linkages between ministries and provinces… and foster a group of leading enterprises in AI to and explore the construction of AI industrial clusters." The Chinese report states that "We will strive by 2020, to achieve the goal of: scaled development of

key AI products, significant enhancement in AI overall core fundamental capabilities, deepened development of intelligent manufacturing, and basic establishment of an AI industry support system." (Triolo, Kania, Webster, 2018).

This ambiguous yet positive terminology allows significant leeway for self-assessment into China's future while maintaining a guarantee of forward growth. However, at the beginning of the report, China details four main AI entry barriers that needed to be developed to meet these goals within the allotted time frame (2030). The first two are summarized into developing 'hard' AI tech: more advanced neural chips, promoted integration of 'smart' products into industry and society, and development of platforms to lay a hardware and software foundation for AI. (China MIIT, 2017). The third point focuses on a deepening of intelligent manufacturing through the use of AI. Lastly, the fourth developmental point is about developing AI talent, "build a public support system for industry training resources, standard testing, and an intellectual property service platform, intelligent network infrastructure, cybersecurity, and other industries, to improve the environment for the development of AI."

In November 2017, China's top tech companies teamed up with the government to set up China's very own AI 'national team' to assist with the country's bid to become the leading global AI innovator. This team is aptly named "China's AI industry Alliance" and is led by the Chinese center for information industry development. Backed by over 240 Chinese tech companies, including tech giants: intel China, iflytek, JD.com, SAP China, ecovacs robotics. This alliance set goals of incubating 50 AI enabled products, 40 firms, launching 20 pilot projects and setting up a general tech platform in the next three years (Triolo, Kania, Webster, 2020). This demonstrates the effects that cohesive, driven policy has on the path of development within China by incentivizing private sector entities to coalesce on specific technologies.

Another example of China's immense movement within its private sector to integrate and develop AI in accordance with its stated goals, is the informally named BATH Alliance. Previously known as the BAT (Baidu, Alibaba, Tencent) alliance, the new BATH Alliance consists of the four Chinese tech giants: Baidu, Alibaba, Tencent and Huawei. Beginning in the second half of 2018, the BATH four have made large-scale internal organizational structure and technical system adjustments, becoming their own conglomerate intelligent group. (McKinsey 2017). BATH's internal AI team provides data source, information security and computing power services for small and medium-sized AI start-up enterprises with the help of cloud computing and big data technologies shared between the four companies. The alliance has a varied portfolio of research around artificial intelligence that it uses to nurture the growth of these companies before collaborating with them.

Alongside the BATH alliance, in 2018 China's government took the remarkable step of announcing that Baidu, Alibaba, Tencent, iFlytek, and SenseTime were officially the country's "AI Champions." (Allen, 2019). The title of 'AI Champion' entails that these companies will not have competition from state-owned enterprises, they will have more influence on national guidelines for AI/AGI policy, but they will have to be extensively intertwined with China's national security community (Allen, 2019). This domestic cooperation shows the pathway China is currently assuming in regards to AI/AGI development, one of increasing internal collaboration alongside the steady reduction of dependence on outside cooperation.

United States:

United States AI policy had its formal beginnings in 2016 with the Obama administration's publication of three articles: 1) Preparing for the future of AI, 2) National AI

research and development strategic plan, and 3) AI, automation and the economy. Since then, the United States has made slow progress. Most recently, the United States hosted a summit for AI in American industry and discussed key points such as: funding AI research, removing regulatory barriers to the deployment of AI-powered technologies, training the future American workforce, achieving strategic military advantage, leveraging AI for government services, and working with allies to promote AI R&D (FLI, 2018).

In May 2019, the United States joined dozens of other countries in adopting the OECD AI Recommendation, the first intergovernmental standard for AI. The OECD AI Recommendation includes five complementary values-based recommendations to governments. These being: AI should benefit people and the planet, AI should respect and promote fairness, AI should be transparent so people can discuss AI-based outcomes, AI should be controllable and Organizations developing AI should be held accountable for following the aforementioned principles (OECD, 2019). The following month the United States also joined the G20 countries in supporting the G20 AI Principles, which are drawn from the five OECD Recommended principles above (FLI 2018). The OECD member countries are composed of some of the United States closest allies: United Kingdom, Germany, Australia, Canada and Japan (OECD). China is considered a partner in the OECD but has no other affiliation.

China and the United States:

On all fronts of expenditure, China appears to far outpace the United States in the research and development of AI and AGI technologies (Mckinsey, 2019). One reason for this discrepancy in growth is that the entry into AI/AGI tech is very pricey. For example, China expects to invest USD $1.5 trillion by 2030 for an AI/AGI enterprise with an expected return of

USD $152.5 billion (see Figure 1). Compared to the expected economic output of AI and AGI technology by 2030, this is an expected loss of 90%~ ($1.35 Trillion) of expenditure on AI and AGI technologies. This not only highlights the cost of entrance into the AI/ AGI marketplace, but also displays the lengths to which developed countries are willing to go in order to develop this technological cornerstone of the future. This loss is seen as acceptable due to the immeasurable benefit that it would provide China. It is due to these exorbitant costs that only economically powerful nations are main players in this new technological realm.

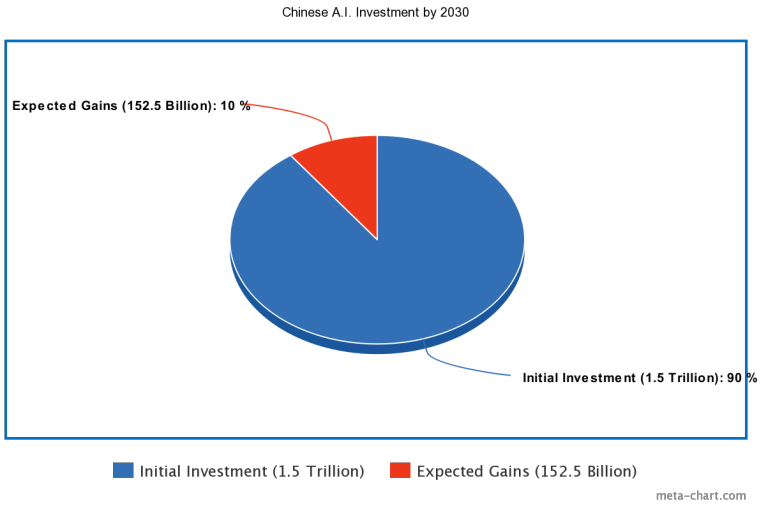

Figure 1 Chinese AI Investment by 2030

While competing internationally on multiple fronts, China and the United States are both moving to home-brew symbolic hybrid technological forms of AGI. AGI driven architectures spawn the possibilities to begin transforming whole businesses or governmental operations into Cognitive Enterprises (Molnar, 2018). These Cognitive Enterprises would then assume a leading role in human governmental systems, and therefore, the development of themselves. However, there is enormous risk in regards to the development of AGI. The following excerpt from the Global Catastrophic Risk Institute adds that the AI/AGI development in China and the United States is of the utmost importance:

> "One common concern is that competing projects will race to launch AGI first, with potentially catastrophic consequences (Dewey 2015). Desire to win the AGI race may be

> especially strong due to perceptions that AGI could be so powerful that it would lock in an extreme first-mover advantage. This creates a collective action problem: it is in the group's interest for each project to maintain a high safety standard, but it is each project's individual interest to skimp on safety in order to win the race. Present game theoretic analysis of the AGI race scenario, finding that the risk increases if (a) there are more R&D projects, (b) the projects have stronger preference for their own AGI relative to others', making them less likely to invest in time-consuming safety measures, and (c) the projects have similar capability to build AGI, bringing them more relative advantage when they skimp on safety (Dewey 2015)."

With such a powerful first mover advantage predicted, it is necessary to engross the whole of Chinese and United States AGI projects as these two countries will be heavily affiliated if not the primary creators of flagship AI/ AGI technology through their current and near future research and developments in AI/AGI.

Policy Principles:

Policy is to AI/ AGI projects as roads are to vehicles; they clarify and expedite a route from point A to point B. Policy constructs the environment in which AI and AGI will develop in the future, thereby maintaining a position of utmost importance for understanding the future of AI/AGI's development and sustainability thereof. In the following diagrams, it is seen that policy encompasses all other aspects of the AGI projects developmental cycle. However, present policy also influences itself by affecting the understanding of the future. These diagrams (see figure 2, figure 3) give visual representation to the encompassing nature of policy that influences the progression of AI/AGI developmental pathways currently and in the future. This policy is self-

actualized through affecting its later state, for example, the GDPR, a strict regulation enacted by the EU, affects current companies AI/AGI related processes within the EU and by proxy global industries that interact with the EU, which will affect these companies' future operations in the area. These future operations will then influence the formation of new policy. In consequence, future policy begins where the effects of current policy end. This is why the charts are made in circular shapes, to represent the constant affect that current decisions have on future pathways.

In order to further understand the collation of AI/AGI projects in the United States and China, it is vital to understand the pathways that guide all public AI/AGI projects; policy, as well as analyzing the limitations to the study thereof. Limitations to the study of AI/ AGI policy include limited access to audits or direct connections between policy and outcome. While many AI and policy papers lay out the effect that AI/AGI will have on industries, societies, and civilizations overall (Lauterbach, 2019), few papers overview the pathways of policy diffusion, thereby ignoring a critical step to even achieving the effects that are thoroughly analyzed.

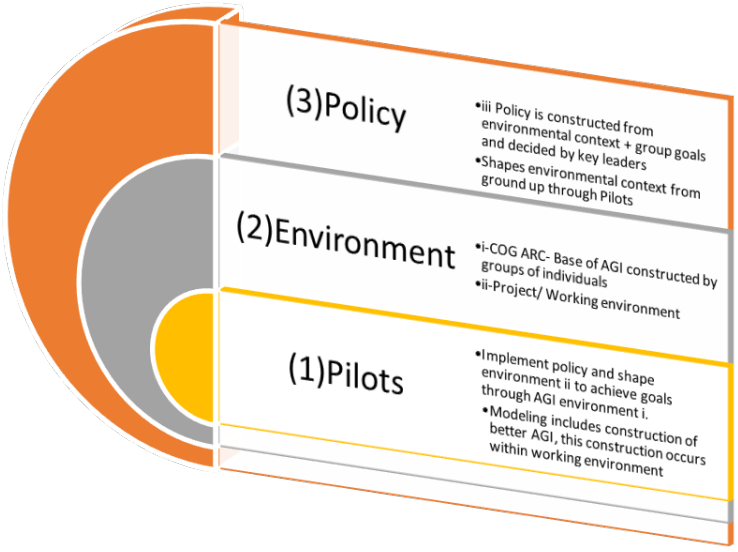

Figure 2 Policy Environment

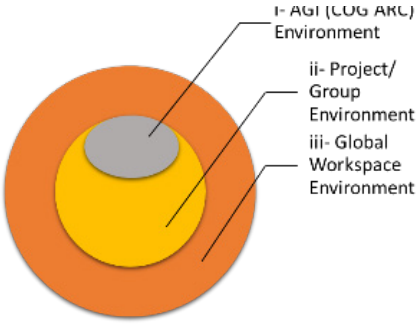

Figure 3 Policy Environment

The main aspects of AI policies are shown in the following diagram, with the top three being initial stage AI and the bottom three being later-stage AI (see figure 4).

1) R&D

2) Talent/ Future of Employment Skills

3) AI Adoption

4) Data

5) AI ethics

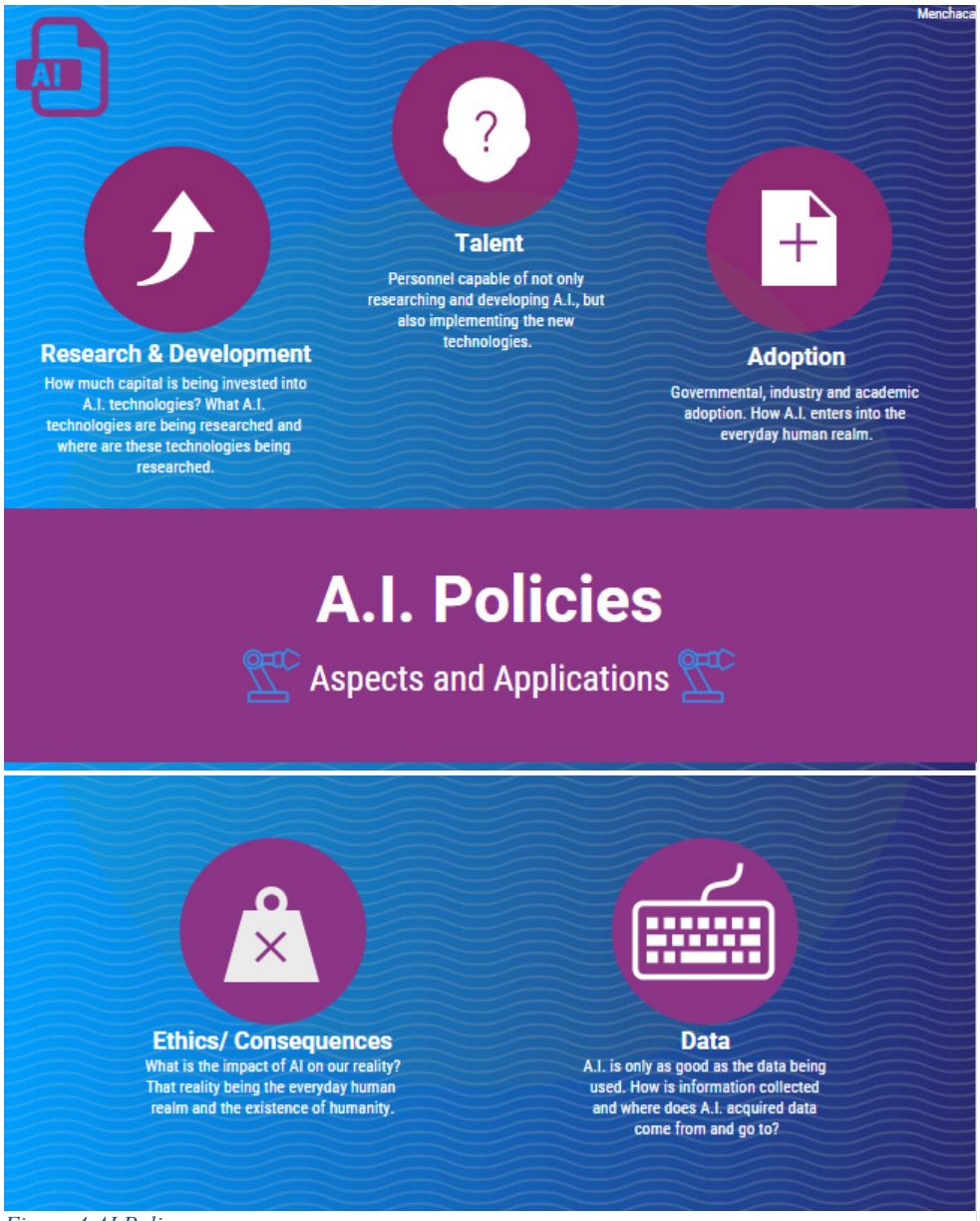

Figure 4 AI Policy

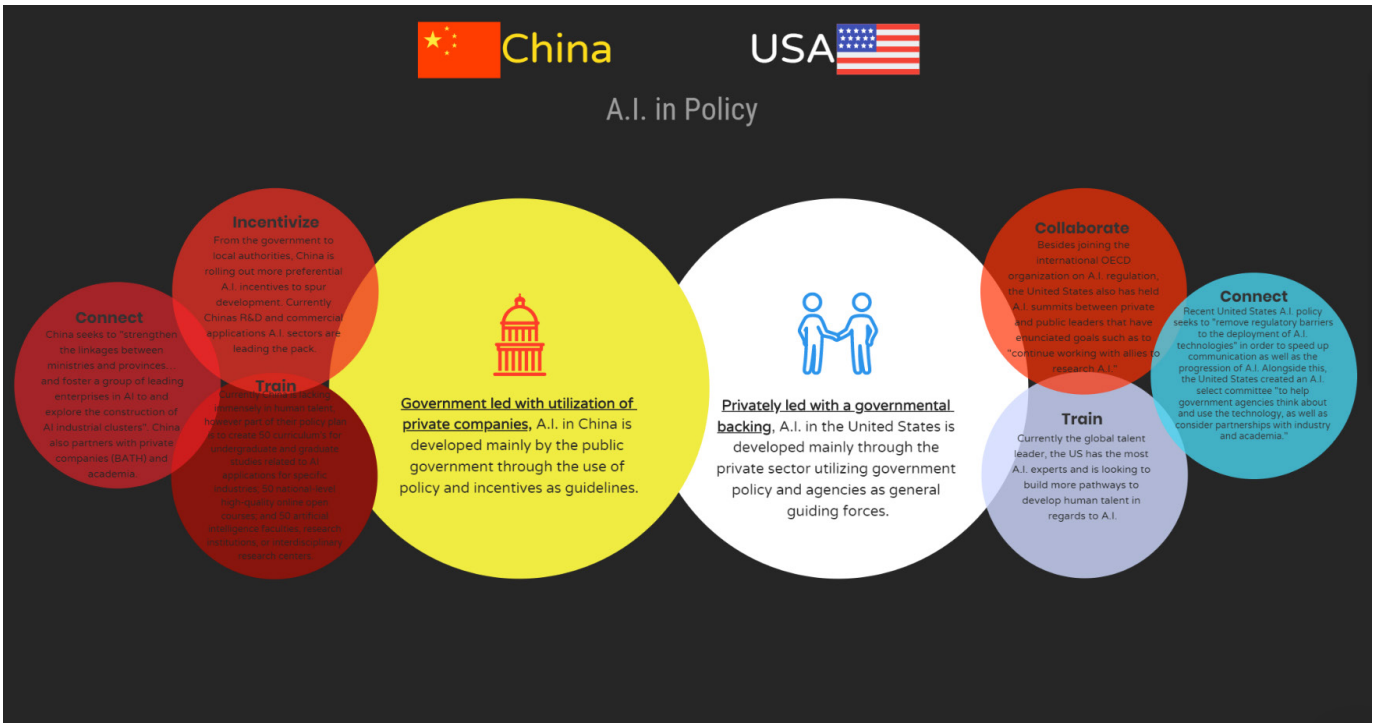

Figure 5 Brief China, US Comparison

Similarities between AI policy in the United States and China is attributed to three main factors: 1) Promotion of research and development, 2) Improve private, governmental and academic cooperation, 3) Train AI talent and personnel. These are shown in figure 4 and motivate the findings in my results above (see figure 5). The points of importance are connecting and training personnel through incentivization and collaboration. This affects how they influence the overall progression of an entity's research.

Results:

1) R&D:

R&D is the moving force and basis of technological advancement, as well as being the quantifiable measure of a country's investment into the future. The amount of capital that an entity devotes to a R&D project is a reflection of that group's values and policy goals. China's

total R&D expenditure witnessed an almost 30-fold increase from 1991 to 2016 – from $13 billion to $410 billion. Presently, China spends more on R&D than Japan, Germany, and South Korea combined, only trailing the United States in total global R&D spending by 6% in 2016 (US 26.4%, CH 20.4%) (IRI, 2016). However, many believe that China will overtake the United States as the principal R&D spender by 2020 (OECD 2016).

Oyiou think tank, a self-described “Chinese technology and industrial innovation service platform dedicated to promoting the introduction of new technologies, new concepts, and new policies into the real economy...”(Li, 2019), states that, upon burgeoning out of a period of large-scale investments from 2014 to 2017, the number of investment events in the field of artificial intelligence in China's private market dropped an abrupt amount in 2018, down 20.7% from 2017. The number of investment events from the initial half of 2019 is only 23.7% of that of the whole year of 2018 (Li, 2019). However private investors moved away from startups to more mature companies in their investments due to the volatility that is found from the investment into companies that have not garnered much renown. Artificial intelligence in the private investment market began to falter as it became increasingly difficult for China's Science and Technology Board to broaden financing channels for AI/AGI enterprises to raise funds, due to the returns of investment for artificial intelligence being inherently low at This governmental pathing setback is what seems to have caused the slow matriculation of funds from artificial intelligence startups within China. However, the lull in progress was eased with the opening of the Board of Science and Innovation, the registration system that replaced the approval system for the review of new shares, which had the effect of improving listing efficiency, thereby broadening the financing channels.

The private sector is currently driving significant investment in AI/AGI R&D. Baidu itself invests 15% of its revenue into R&D – around USD $1.5 billion – all of which “is AI related”, whilst other major players including Alibaba and Tencent have established their own AI-dedicated labs. Many top tech companies in China also continue to acquire AI-related technology and “know-how” through notable investments abroad, showing a change in diversity which is previously shown to have numerous benefits. Collaboration with overseas companies is increasingly commonplace in the United States as well, with a recent collaboration being a partnership between NVIDIA, Alibaba, and Huawei.

Amongst general equity investments, the United States continued to lead with investments having a cumulative sum of USD $8 billion, in contrast to China’s USD $2.5 billion, according to OECD estimates from early 2018. In comparison to China, the United States has more investments into AI, but at a smaller initial investment amount, highlighting a tendency geared towards safety, this is partially due to the United States now investing in specific AI/AGI technologies as opposed to the support architecture that powers foundational level AI/AGI related technologies and applications (Ding, 2019). For example, in 2017, Chinese start-ups across all industries raised USD $200 million on average per investment round, while start-ups in the United States raised an average of USD 22 million (OECD 2018).

While the United States is seeing a smaller amount of new investments than China, much of the spending that China is directing its financials into is based around building a base of AI/AGI R&D that the United States has already invested into due to beginning its AI/AGI R&D as early as the 1950's, while China's comparative AI/AGI R&D did not begin til the early 1990’s. (Mitchell, 2019; White, 2020). By the time China entered the world markets in the 1980’s, a top official at the Defense Advanced Research Projects Agency (DARPA) had proclaimed, “I

believe that this technology (AI/AGI) …is more important than the Atom bomb (Johnson, 1988)". This longer developmental time period allowed for the accumulation of more AI/AGI R&D even though it has received a smaller amount of new investments, due to the compounding nature of AI/AGI R&D. As a benefit of the time advantage, the United States finds itself in a position where it is able to shift current AI/AGI investments into more precise R&D applications in comparison to China's focus on the broad spectrum of foundational R&D investments.

China does not have a disadvantage that is impossible to overcome. China is able to use the already present R&D research from the United States to ignore many of the initial barriers the United States faced. China acquires these blocks through organizational and private partnerships with foreign entities. Also, by being more willing to expend massive amounts of capital, China attracts partnerships and cooperative R&D opportunities that allow them to maintain a competitive position while being faced with the disadvantage of having to simultaneously create their own personalized block of AI/AGI R&D. This allows China to enter the AI/AGI field much later and still be able to achieve many of the same results as the United States.

The United States has led in the investment of AI for a number of years, this is partially due to the United States' history of constant international collaboration. By collaborating with other entities, the United States is giving itself access to a larger talent pool of people with various knowledge of AI/AGI. This cooperation gives the United States the complementing ability to share the economic burden of AI/AGI with other entities. This collaborative behavior allows the United States to avoid entry barrier limitations while also gaining the advantages of diverse cultural behaviors and the technological results that are experienced from this.

2) Talent/ Future of Employment Skills:

The "AI practitioner" is an individual with the general skills needed to develop and implement AI technologies. Ding summarizes the AI talent, saying:

> "Using this broader definition of "AI practitioner", Tencent Research Institute found that China boasts 39,200 AI talents (13 percent of the global total) and the U.S. has 78,700 AI talents (26 percent of the global total). This global total amounts to 200,000 active AI practitioners and 100,000 still studying (Tencent 2017). "

When defining AI in terms of 'experts', ElementAI's 2018 global talent report traced only a little over 2% of the world's AI experts to China, while ElementAI traced 41% of the world's AI experts to the United States. Researchers at China's Tsinghua University, a renowned institute that has contributed much AI/AGI R&D, backed up both claims. Based on their methodology, China ranks second globally with an AI talent pool at around 65% of the United States' talent pool ("AI practitioners") and sixth globally in terms of top AI talents ("AI experts"), with the United States ranking first in both. (Ding, 2019)

According to another report by Tsinghua University that uses a new talent pool statistic to determine AI top talents, 'top talents' being classified through the H-index (a measure of scholarly impact) it is found that China has 977 of their 18,232 AI practitioners classified as AI top talent, compared to the United States' having 5,158 out of their 28,536 AI practitioners classified as AI top talent. The United States' numerical advantage stems from its international collaboration. The close allies and cooperative partners of the United States (UK, Germany, France, Japan, Canada, Australia) all combine to have a talent pool of 62,901 total AI practitioners, with 10,282 of them being AI top talent.

Chinese universities and institutions, a vital part of their talent pool, are increasingly conducting specialist academic exploration on AI (Ding, 2018). A Nikkei and Elsevier list released in November 2017 ranks two of China's universities among the global top 10 most frequently cited research papers on AI. Chinese academics even surpass their American peers in terms of comparative productivity (papers, patents, etc.) of AI research. For example, in 2018 China released over 27,000 papers, increasing over 25% from their output in 1998, while the United States released a little over 23,000 papers, a 10% drop in output since 2002 (Simonite, 2019). In their "Three-Year Action Plan" China outlined their objective to "speed up personnel training" through attracting high-end talent for AI in a "variety of ways" and to support the growth and interconnection of "schools, enterprises, colleges, and universities to support the construction of AI-related disciplines" (Triolo, Kania, Webster, 2020). These statistics conclude that they are maintaining progress to their 2030 goals.

In general, AI talent creation and pathway development appear to be the most important factor to the United States and China in the immediate future. Developing the pipelines from academia to AI/AGI R&D in the public and private sector is a main goal and is being approached in similar ways within both countries. Since academia is the base of nearly all technological research and development, they have the utmost precedence, and this is reflected by the country's willingness to expend time and money on academia to fuel their future developmental possibilities.

3) AI Adoption:

AI adoption is the way and manner that AI is brought into a society overtime. This is not directly addressed in policy papers in any variation, with most only detailing which industries

countries want AI to be developed in. Matt Sheehan from Macropolo, a site that analyzes China's economic arrival, states that “Beijing’s AI plan serves less as a ‘plan’ and more as a ‘wish list’ of technologies the central government would like to see built.” In order to complete this wish list, China issued a list of incentives for the development of technological milestones relating to AI in cities, provinces, and the whole country (MIIT, 2017). Contrary to what many believe about the hard handedness of China concerning state-wide projects, Sheehan states the following, detailing China’s approach and how it allows experts to operate with increasing freedom:

> “The central government isn’t issuing detailed marching orders to local officials for carrying out a master plan. Instead, it’s giving them hundreds of ideas for “gifts” that it would like to receive, and saying, “surprise me.” The hope is that if local officials cough up a sufficient number of these gifts—factories adopting smart robots, new research centers pursuing natural language processing, autonomous agricultural drone demonstration projects—they will eventually add up to the plan’s headline goal: global leadership in AI.”

Many in China understand that much cash will be burned throughout the process due to the nature of the consequences of rapid development, however, as long as AI is being adopted in a timely manner, China sees that the benefits outweigh all else.

The United States has a diverse approach to AI implementation that is deeply inspired by its long history with the development and adoption of AI (FLI, 2019). The focus of the United States is more direct, as their desires have had time to be accurately ascertained. The United States government has adopted AI as a backbone of many of its intragovernmental agencies and they continue to expand upon this with regularly updating guidelines, such as the recently enacted Executive Order on AI that was signed in February 2019, which served to detail the

United States approach to developing, promoting, and implementing AI technologies through the coordination of government, private, academic, and international entities (EO 13859, 2019). This plan created what is known as the American Artificial Intelligence Initiative, the agency responsible for the execution of these goals. This report was followed by a Year One Annual Report, in which it is seen that the government backing resulted in a surge of adoption of AI across a diverse span of fields, such as the Food and Drug Administration developing and using AI to detect diabetes, or the Department of Transportation creating a set of guidelines and laws strictly for AI cars, easing the barriers faced by autonomous vehicles (OSTP, 2020). The Year One Annual Report gives an analysis of the current issues that face the agency, such as the proper methodology of creating a universal standard for AI. For these issues, they published a request for comments on a draft memorandum to obtain more advice on their approach methods from public citizens of the United States. With the cultured consistency of a half century of development serving as a reliable base to current AI/AGI, the lowering of barriers to the progression of AI/ AGI research and adoption is now the primary goal of the United States (White House, 2020).

In conclusion, Chinese and United States governments have different driving forces in their implementation of AI technologies, as well as different intentions for the adoption in general. China, through a government driven set of directives providing incentives throughout the different bureaucratic levels, has garnered results by giving a vast array of targets that they will benefit from that are then achieved by a growing labor force that is backed by substantial funding. The United States now takes a revitalized approach towards the implementation and adoption of AI, with its goals finally being given clarity after many years of relying on previous success to maintain a lead in the development of AI.

4) Data:

There is a common statement amongst internet-users today, "If a product is free, then you are the product". The 21st century is the information economy, and the trading of ideas and data is becoming a primary motivation for developing technology, though the misuse of the results has led to backlash from individuals in defense of their data privacy. Data and privacy in the 21st century have become a point of tension for individuals, companies, and governments around the world. This section will discuss the data related AI policy by the Chinese and United States governments, and the following section on ethics will discuss moral implications around such actions.

AI has aided China in control of accessibility of the internet for their civilians, allowing a constantly updating method of determining if the government deems the material fit for the public eye. The use of AI-aided facial recognition in China is extremely prevalent, and it is used to not only enforce the social credit system, but also to create databases of specific groups for the purposes of monitoring, such as the Uighurs in *Xinjiang* (Feng, 2019).

The United States has proven to be much the same. Snowden's revelations about the NSA's surveillance and general infiltration techniques following (and possibly preceding) the controversial Patriot Act displayed the power and importance of data in modern times to the entire world. More recently in the private sector, the Cambridge Analytica scandal displayed that companies are accumulating data on users at their often-unbeknownst expense. (Privacy Intl., 2019). This so-called "attention economy" is used by Google, Facebook and Twitter to gather consumer data and increase their hold on the global market. These companies use an individual's harvested data to compile into specific data models that optimize the effectiveness of their

advertisement targeting to often uncomfortable degrees, which they then allow advertisers to buy in order to profit from. One example of the data analytics models often utilized is the Bayesian Model (see figure 6), which reinforces areas of interest via the clustering of information through assigned values. (Ghahramani, 2012).

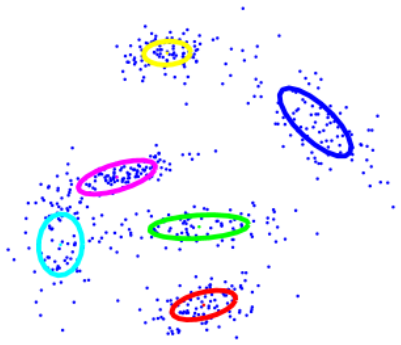

Figure 6 Bayesian Model

The "attention economy" led to the Cambridge Analytica scandal, an incident where the public found out about the nonconsensual collection of their individual data that was then leaked into the public domain, which consequently spurred the following General Data Protection Regulation, GDPR, in the EU. The GDPR exemplifies policy and its possible constraints on AI/AGI. The GDPR requires businesses to explain decisions made by their algorithms which must abide by a set list of rules and regulations. The strict regulation is set with good intentions, and forced a global response due to the swift and heavily punished consequences of violating this act; even slight misinterpretations will lead to the permanent loss of the entire EU market for the violator. The GDPR has led to public coercion for companies to share the data they harvest, thus allowing other countries to see what data is being harvested on them and opt out of its use. While this eased the fears of the consumers, it caused companies and other groups that relied on the quick accumulation of data to lose profit and slow almost all AI/AGI R&D they funded, as these companies needed to focus on establishing an organized infrastructure for data collection with traceable, auditable databases that comply with regulations (Lauterbach, 2019).

This example elucidates the implications of policy on the AI/AGI R&D process as the enactment of this policy resulted in creating numerous entry barriers into the field of AI, as well

resulting in enormous strain on the economy of member countries. For example, the Global Fortune 500 is likely to have spent an estimated €7 billion in compliance costs for GDPR (Forbes, 2018). In reference to the general sectors affected by GDPR, between May 2018 and April 2019, the monthly amount invested per member state decreased by $7.9 million (€7.0 million) for the healthcare sector, by $6.8 million (€6.0 million) for the financial sector, and by $8.2 million (€7.3 million) for the IT sector (Jia, Jin, and Wagman, May 2019). The GDPR—which the EU has touted as the gold standard for data protection rules—has failed to increase trust, six months after GDPR went into effect, consumer trust in the Internet was at its lowest in a decade (European Commission, 2018). Corporations, countries and individuals are then faced with a tough question: Do we sacrifice our privacy and liberties to release all reigns on the limitations to potential progress?

5) AI/ AGI Ethics:

AI/AGI Ethics relate to the net positive and negative effects on individuals. Many countries have addressed ethics in their policy, with China stating that they need to "strengthen research and establish laws, regulations and ethical frameworks on legal, ethical, and social issues related to AI and protection of privacy and property" in their New Generation Artificial Intelligence Plan (Duettman, 2018; Triolo, Kania, Webster, 2020). Another way to look at ethics is by questioning if AGI R&D should be used to advance the forefront of technology or to benefit the society (Ding, 2017). While these two goals often overlap, the point where it does not is where mankind runs into the problems stated in this research's introduction; who has access and ability to create AGI, and does it matter?

Developers of any technology have a tendency to be goal oriented, meaning that their creation must serve a specific purpose. As learned from Maria Yao's statements, three factors are at the root of almost all AI/AGI related problems: homogenous development teams, insular thinking, and lack of perspective. Ethics are much the same; development environment and human-led purpose results in the majority of ethical dilemmas concerning AI/AGI. Some argue whether AGI should be created in the first place if it has such a potential for enormous existential risk to mankind. This is where the argument of science vs. societal benefit enters again, if the potential societal benefit from AGI is almost infinite, is it worth the potential risk?

	Similarities	Differences
AI R&D	R&D is the cornerstone of AI, therefore both countries spend large amounts of money and manpower developing the environment to support and quicken the R&D process.	PRC: Public led investment, larger-government directed-budget. ($1.5 Trillion)
		USA: Private led investment, more international cooperative ventures.
Talent/ Future of employment skills	Besides R&D, talent creation and pathway development are the second most consistently discussed subject of AI policy. Both countries seek to culture pipelines of AI study to increase the quality and quantity of AI practitioners. Humans make AI.	PRC: More production of academic literature and STEM students than the United States.
		USA: More AI top talent and academic pipelines between government, corporations and academia.
AI Adoption	Both countries want private and public groups to implement a system for AI tech to be readily deployed in. AI adoption is developed from a combination of R&D and talent/ personnel implementation.	PRC: Incentivize leaders to meet a wish list of goals in order to gain edge in AI.
		USA: Remove regulatory barriers and let the private sector conduct themselves with little interference.
Data	As data is the catalyst to understanding and prediction, both countries want to get as much data as possible whenever possible, even at the expense of individual privacy.	PRC: The great firewall (a closed internet), social credit system and facial recognition are the main tools of data collection in China.
		USA: Surveillance of individuals through the internet, mobile and even camera.
AI Ethics/ Consequences	Both countries have already infringed on individual privacy, but both countries also address the issues that could come from AI related consequences directly in policy. Whatever way, at the very least both countries want to put up a public face of abidance to ethics.	PRC: Some argue that China is already infringing on individual human rights and therefore would be less likely to abide by 'correct' ethics. Government mostly collects information on individuals with private sector backing.
		USA: The United States has done the same but it could be more pervasive as understood by Snowden. Private companies and the government collect information on individuals.

Figure 7 Chinese and United States AI policy comparisons

AGI Taxonomy:

Based on my broad spectrum of analyses above, with inspiration from Baum's Project Taxonomy, I created a taxonomy of AGI projects across the two contexts of interest. Out of the original 45 projects given on the Global Catastrophic Institutes survey on AGI projects in 2017, 37 projects, or 82.22%, are either cooperating or originating from the United States and China. 23 of these projects are led by the United States with 7 more projects being cooperative ventures not led by the US. 6 of these projects originate in China with 1 more being a cooperative venture led by the US (total being 7). These are assembled into a taxonomy shown in Figure 7 below. The dimensions of the AGI project taxonomy include group (profit, non-profit) and type (humanitarian, intellectualist and other). This data is formatted to compare direct profit and non-profit AGI projects between China and the United States. The profit group is composed of both public and private corporations (those being corporations with and without public stock) that operate for-profit. The non-profit group consists of governments, non-profit organizations, and academic institutions. While academic institutions can be argued to be for-profit because they conduct secondary education that involves tuition (e.g., colleges and universities), academic institutions are more linked with non-profit entities such as state and federal government, therefore they are placed in the non-profit group. As for the types, these were selected by Baum through explicit statements by the AGI project. If the site did not explicitly say it was intellectualist, but it was implicit that it would be (i.e., academic institution) then it was not added to the intellectualist type.

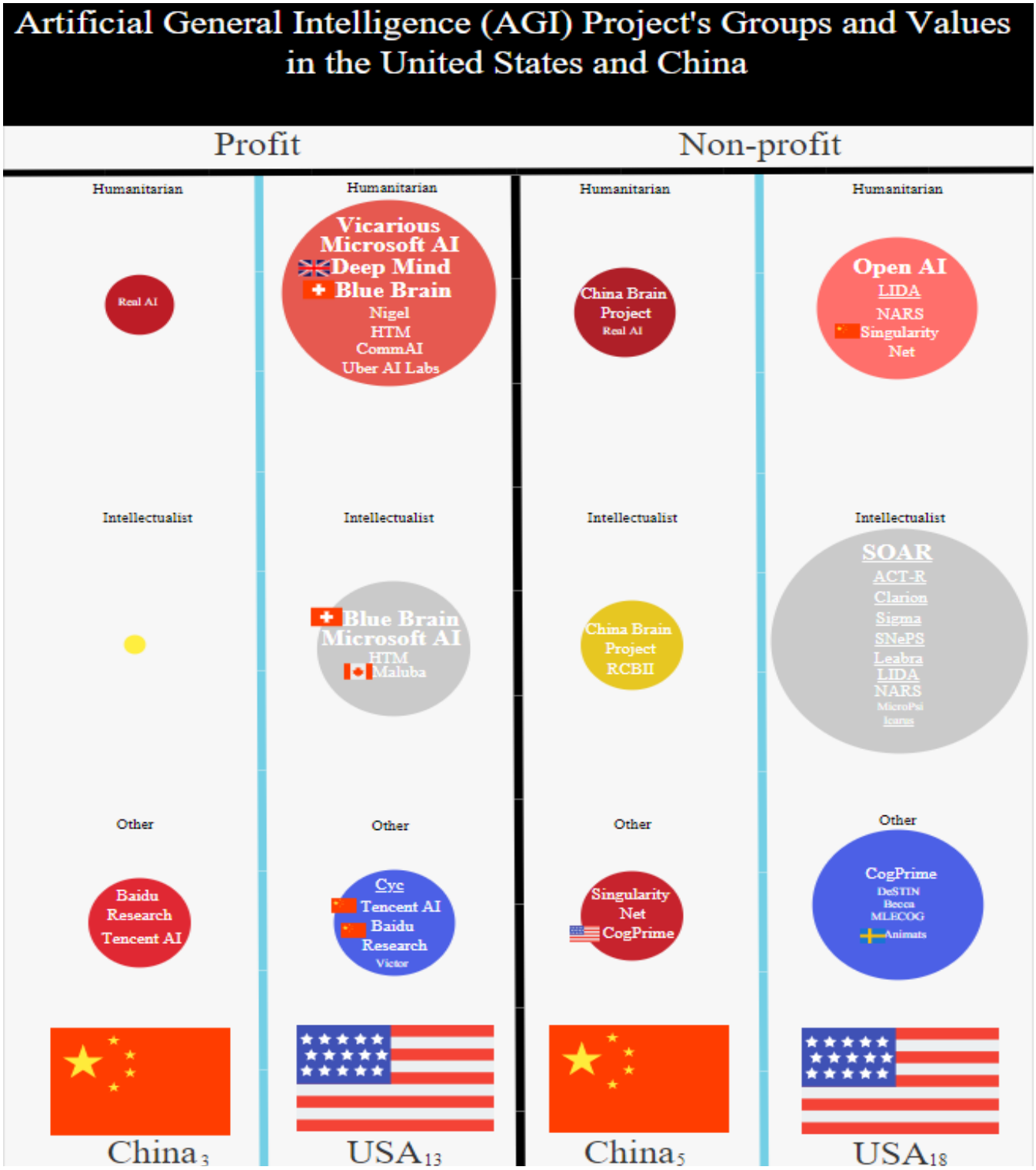

Figure 8 AGI Project Grouping

Figure 8 Legend:

Size of project:

Large = Big Font and

Medium = Medium font, not bolded

Small = Smallest font

Bolded Underline = Military Involvement

Flag = Country leading project that USA or China is a subsidiary partner to.

Limitations:

While an extensive amount of literature and data was examined, several limitations of this study must be acknowledged. First, a limited amount of information describing types, groups, size and military involvement were given on each of these AGI projects websites. Some of these project websites chose to not disclose certain information, therefore I researched each AGI project and their connections if the prior work used did not seem correct. Furthermore, since data limitations may bias the sample examined in this study, the proposed taxonomy only represents a portion of the actual AGI projects in existence as they may not include certain (potentially secret) government and corporate projects. However, there was enough information related to all the projects described to successfully cover all of the public AGI projects and provide this research with a large number in which to analyze.

The size and scope of projects was also difficult to measure as many of the sites did not have substantive statistics. In order to combat this, I researched each project individually and examined the size and scope again to re-qualify the data. Finally, the audit and financial records of each AGI project were not available. Meaning that exact monetary expenditure to each grouping (Academic, Corporate, Gov/Nonprofit) were not apparent. Therefore, only R&D expenditure explained through policy and given on some corporation's websites were available for analysis and reasoning. There was enough individual company and governmental information available publicly to provide well founded data for analysis.

Contributions:

China is composed of majority Government/ Nonprofit AGI projects, these comprising 4 out of the 7 total projects. The remaining 3 projects are all within the corporate sector of China. In regards to academic grouping, China has many AGI projects researched in the academic sector, however, these results are managed by the CCP, therefore research foundations do not always correlate to grouping. This is in-line with the direct and systematic way that China develops and implements its policy. These Governmental projects are more easily controlled and allocated resources because they are closer to the policymaker, the CCP. The United States is partnered with three of China's seven projects, Baidu Research, Tencent AI, and Singularity Net.

Out of the United States' and Chinas' combined scope of 37 projects, including China's partnership with the US based CogPrime, the US is involved in over 90% of AGI projects between the countries (34 out of 37 projects). That means that American AGI projects account for three quarters of all AGI projects within this survey. China is only the sole leader on three AGI projects: Real AI, China Brain Project and Research Center for Brain Inspired Design. Meaning that China accounts for 15% of the total AGI projects in this survey.

The United States AGI projects are mostly located in the academic and corporate grouping (26 out of 30 projects). Out of the academic grouping (13 projects), eight of the projects (61.54%) are involved with the military. This academic-military sub cluster within the United States is a grouping made up of 8 of the United States AGI projects: SOAR, ACT-R, SNePS, Clarion, Sigma, Leabra, Micropsi and Icarus (Baum, 2017).This is due to the funding granted to academia by the military to study and pursue different AI tech since the early 1950's. The United States has an equal amount of corporate AGI projects, 13. In a weighted comparison, corporate AGI projects in the United States and China constitute nearly the same overall

percentage of AGI projects. Overall, the United States has five AGI project partnerships compared to China's one. Baum states that this is due to the large grouping of AGI projects with the United States and its allies who mainly compose the OECD. Only four countries that are not United States allies have AGI projects: Brazil, China, Ethiopia and Russia.

Besides data, this project contributes to existing literature by asserting ideas that policy, culture and shared values influence the eventual outcome of AGI by affecting its current developmental environment. The AI policy analysis compares and contrasts the current situation within the United States and China, through using the five points of: policy, talent, adoption, data and ethics. This research contributes to general AI literature by speaking on already standard points through a comparative lens supported by accepted data from both countries. This lends researchers a scoping understanding of general motives, goals and pathways of each country that can then be further studied. Rodrik's Institutional Theory shows the complex interconnections that are involved within the operation of international organizations. This paper elucidates these connective pathways and creates a theoretical framework using a comparison of AI policy between the United States and China to lend a starting point for future researchers to analyze. The interconnections between AGI projects in academia, government, and corporations gives future researchers a series of further directions to explore and draw information from. With all of these different possible ways to study AI/ AGI, this paper's broad format with specific data allows readers and researchers to draw novel connections and continue researching the immensely impactful topic of AI/ AGI.

Further Directions:

As access to new information pertaining to these AGI projects and their components becomes increasingly publicly available, future researchers will have a more in depth look into AGI project function and greater ability to dissect their roots and purposes. This ability will further implicate Rodrik's institutional theory as more information is available to analyze in regards to each country's individual and cooperative AGI projects. This information may come from new AGI projects that begin after data for this study was available – in 2017. Additional data could also be accessed for AGI projects that had no public face, or where researchers can gain first-hand access. When this info becomes available, this report may serve as an opportunistic starting point for future researchers.

A worthwhile direction for understanding the importance of AGI to China and the United States is the amount of money spent on the process of AI/AGI R&D. While scoping data is available, being able to pinpoint, in at least some fashion, where the money is coming from and going to would elucidate the key players in the AGI field, and the motivations behind the research. These findings will reinforce how prevalent Rodrik's institutional theory is in relation to international competition/ cooperation amongst AGI projects. Also, from the above taxonomy's policy and theory, it is implicit that the size/ productivity of an AGI project positively correlates to the amount of money/ resources that are available to the project. These resource values lie in three primary areas: partnerships, personnel, and money. Data on partnerships, source of funds, and quality/ source of personnel is essential to provide in order to find out if the economically intuitive statement that more resources equates to more productivity is true. Alongside this, the amount of resources an AGI project is positively related to the AGI project group. This displays what groups China and the United States policy focused on. Another

intuitive tangent that is related to size and groups is academics. The academic group is the base of AI/AGI R&D within both countries studied. A series of questions are then presented; Does this hold true in other contexts? If academia is the base and developing area of personnel, does the flow of all AI personnel stem solely from academic institutions, or do other third-party sources exist in some relevance? Employee and personnel data have potential to provide interpretation for these questions as it would give direct connections between individuals and their developmental backgrounds, as well as exact sizes of each AGI project giving another viewpoint by which their productivity could be measured. The demographic data of international institutions such as the OECD would highlight an organization's internal makeup, which has potential to provide a source for an analysis of the influence of culture on various aspects of the international organization, such as what goals are set and what they deem fair. This would have the result of demonstrating the numerous factors involved within Rodrik's institutional theory.

The flows of money are attributed to policy/ funds pipelines. If more information on the source of funds were available, a more concrete analysis could be ascertained about the concept of the use of policy to transfer goals and funds to these AGI projects. This parameter setting would theoretically allow the building of a typology that associated certain types of funds allocation to certain types of AGI projects. Finally, to approach a more philosophical viewpoint of this study, these pipelines would highlight the environments that Chinese and United States leaders are creating for their in-country personnel to work in. This study posits that the environments surrounding the development of an AGI directly affect the end result of the AGI. Therefore, if money allocation elucidates goals, the pipelines would frame the interconnected mesh of transactions that forms the international AGI project environment. Giving a basis on which to assess if an AGI projects environment does, or does not, affect its end result.

Conclusion:

The development of AI/AGI is a competition backed by governmental regulations and organizations. The Chinese and United States governments are utilizing their position to back private sector entities in a global competition for the development of AI/ AGI, though they must maintain their role of ensuring public interest by creating guidelines that may limit progress. However, these guidelines can be thought of more as pathways within a forest. These pathways offer private companies the opportunities to hastily connect with academia, other companies, and the government. The main purpose of policy is to form inter-organizational highways of communication on a set path of development that is determined to still maintain public interest.

In comparison, the United States has a more mature AI industry due to its longer existence, as well as a more formally established large talent pool of AI top talent. However, heavy Chinese investment is setting China up on what many have interpreted to be a trajectory to surpass the United States, if China finds methods to increase either their native talent pool or their access to the global talent pool. Due to the United States' current standing on international collaboration, the United States already has the infrastructure and talent pool to maintain a lead in AI, but only lacks the seemingly larger investment that China is currently receiving. Therefore, Chinese investment is domineering and only leaves a shortage of human talent, whilst the United States human talent is domineering and only has a relative shortage of investment.

Overall, the present study shows that the study of AGI projects can be correlated to general AI/AGI development and specific country-led policy. Given the high stakes involved in the Promethean construction of AGI, there must be hope that this research will be used productively towards improving future AGI possibilities. Maintaining focus on this research and ensuring the motivation of the goals must be maintained. On a parting note, AGI in some form

has proven to be a part of humanity's future. Whether it is a net positive or negative to humanity depends solely on people confronting the hard to answer questions now. The search of what it means to truly be human has shown relevance and will continue to as long as consciousness exists, making the implications of AGI (human-level intelligences') equal parts exciting and terrifying.

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