Issue Brief

Wuhan's AI Development

China's Alternative Springboard to Artificial General Intelligence (AGI)

武汉

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Executive Summary

DeepSeek's emergence as a successful generative model—a niche where the United States was believed to hold an uncontested lead—is causing global artificial intelligence watchers to reassess China's standing in the race toward artificial general intelligence (AGI) and pay closer attention to China's AI research and deployment.

While large models continue to account for a significant part of its AI investment, China's top state-funded AI institutes are exploring alternative approaches to AGI that involve embodying AI algorithms in real environments. Imbued with the Chinese Communist Party's pre-defined values, the AI interacts with its natural surroundings, learning as it proceeds.

The test bed for this proactive approach to AGI is China's inland city of Wuhan, where the Chinese Academy of Sciences' (CAS) Institute of Automation, Huawei, and a Peking University consortium are infusing the city's industrial and commercial enterprises with AI services and deploying a "social simulator" that expands AI's reach to all aspects of daily life.

The intent is to optimize production and supervise social interaction while affording the AI opportunities to become more intelligent, catalyzing its evolution into AGI. The Wuhan implementation is seen by its state-backed entities as a stepping stone to deployment throughout China, raising questions about the type of technosociety with which the United States needs to compete.

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Introduction

The sudden emergence of Chinese company DeepSeek on the global scene drove home to western nations multiple lessons; namely, that the "gap" in AI between the United States and China is narrower than imagined, that scaled up models may not be the only or even most viable path forward,[1] and perhaps most importantly, that the United States and its allies lack a reliable system to track China's AI progress.[2]

A fourth lesson is confirmation that China and the United States are in a race to build artificial general intelligence (AGI),* which is DeepSeek's aim and a goal shared by other Chinese companies, institutes, and the national government.[3] While the race is typically characterized as a competition for data and chips, DeepSeek's shortcuts to prominence—with less lead time and compute—remind us that Chinese organizations may have other routes to AGI, such as better algorithms or typologically different solutions (of which large statistical models may only be a component).[4]

One such approach—supplementing big static models with dynamic agents that interact with natural environments—was proposed by Beijing AI scientists as early as 2021 as an alternative way to achieve AGI.[5] An implementation of this schema, referred to as "embodiment" (具身), is now being tested in Wuhan, with plans for a nationwide rollout. Like DeepSeek's earlier work, this event has not garnered attention outside China, although its import is potentially far greater.

The Wuhan project has two main components. In May 2021, CAS's Institute of Automation (中国科学院自动化研究所, CASIA, an AGI developer), Huawei, and Wuhan East Lake High-tech Development Zone revealed plans to build a Wuhan General Artificial Intelligence Platform (武汉通用人工智能平台) and a "perception-cognition-decision whole chain ecology" as a basis for "autonomously controllable AGI" (自主可控通用人工智能).[6] The immediate aim was to infuse AI into Wuhan's industrial, scientific, and commercial sectors.

Subsequently in November 2022, a new organization—the Peking University (PKU)-Wuhan Institute for Artificial Intelligence (北京大学武汉人工智能研究院)—was created in the same East Lake zone by a second Beijing-based bloc of AGI researchers, with the mission to build a "large-scale social simulator" (大型社会模拟器) meant to optimize social interaction and using Wuhan as a test bed.[7] The two efforts—one focused on production and research, the other on society in general—came together at

* Typically defined as "intelligence that matches or exceeds human skills at most cognitive operations."

a forum in October 2024 titled “AGI: Building a Data Ecosystem, Reshaping the Industrial System, and Empowering Social Governance.”[8]

Significant as the events are themselves, their importance—as the forum’s name suggests—is amplified by the developers’ vision that grounded inputs covering the whole of human activity, free of the disinformation proffered on the World Wide Web, will catalyze the emergence of AGI, further optimizing the systems’ performance in a self-improving cycle where implementation is part of the growth trajectory.[9]

This paper begins by describing the facilities that make up Wuhan’s AI infrastructure, on which these projects depend. It then examines the city’s “AI industry chain” through which AI drives scientific discovery, improves services, and optimizes industrial processes. A section on “Wuhan’s AGI initiatives” details how exposing AI to real-world challenges supports China’s march to general AI. The paper concludes with a sketch of where these developments are headed.

Large Computing Centers

Wuhan, the capital of Hubei province, is located at the juncture of the Yangtze and Han Rivers, some 715 miles inland from Beijing. Despite its provincial location, the city is a major financial, manufacturing, and educational hub, and a locus for high-end scientific research.

The city's three national development zones, four technology parks, and some 2,000 research and high-tech enterprises[10] are supported by multiple networks of computing centers and grids, whose total capacity is projected to reach 30 exaflops in 2025[11]—China's highest municipal concentration.[12]

The central cluster that hosts many of Wuhan's AI services and supports the training of frontier models consists of two adjacent "twinned computing centers" (双算力中心): the Wuhan AI Computing Center (武汉人工智能计算中心) and Wuhan Supercomputing Center (武汉超算中心), located on Ligou South Road (里沟南路) in the East Lake High-tech Development Zone (东湖新技术开发区 or 东湖高新区, also called China Optics Valley (中国光谷)), shown in the image below.

Figure 1. Wuhan's "twinned" AI (upper) and supercomputing (lower) centers[13]

Ground photography shows the AI Computing Center in the foreground (red trim) and the Supercomputing Center to its right (glass).

Figure 2. Wuhan's "twinned" AI and supercomputing centers[14]

The AI Computing Center powered up in May 2021 with an initial capacity of 100 petaflops,* expanding to 400 petaflops in September 2024.[15] The center hosts Zidong Taichu (紫东太初), China's premium multimodal large generative model, first released in 2021 and now in version 3.0 with a claimed 100 billion parameters.[16]

Developed jointly by CASIA, Huawei, and Wuhan AI Research (see below),[17] Zidong Taichu aims to realize AGI through "large models in the cloud and small model service terminals"[18] and serve as a "full-stack domestic general artificial intelligence base" (全栈国产化通用人工智能底座).[19] The system reportedly supports higher-order logical reasoning (高阶逻辑推理) to achieve performance "closer to (更接近于) human understanding, reasoning and thinking." [20]

While the AI Computing Center serves enterprises, organizations, and science research,[21] the Wuhan Supercomputing Center mainly provides computing services for high-tech fields such as aerospace, genome sequencing, and national defense.[22]

The supercomputing center began operating in November 2022.[23] Recent (November 2024) Graph 500 ratings—a measure of supercomputer performance based on data-intensive loads—list the Wuhan Supercomputing Center as second among the world's top ten units on "breadth-first searches" and first in "single source shortest path."[24]

Other Wuhan-based computing infrastructure includes a supercomputer at Wuhan University, online since 2015 for in-house research[25]; China Telecom's Central Intelligent Computing Center (中国电信中部智算中心), running since January 2024[26];

* One petaflop (P) = 1,000 trillion floating-point operations per second.

and the China Mobile (Wuhan) Smart Computing Center (中国移动智算中心(武汉)), with a claimed capacity of 1,500 petaflops.[27]

These centers, in turn, are part of China Computing NET (C^2NET; 中国算力网), a major national computing cluster involved in the distribution of responsibilities between the country's coastal and inland areas—namely, the "east data, west compute" (东数西算) project, described as "sending data gathered from the more prosperous eastern regions of China to less-developed but resource-rich western regions for storage, calculation, and feedback."[28]

This east-west formula parallels an arrangement identified by the authors in a prior paper that highlighted a concentration of AGI algorithmic research performed in the Beijing area with implementation of working models in Wuhan, well outside the capitol region.[29]

AI Research Institutes

Wuhan's AI computing substrate is complemented by AI research institutes aimed squarely at realizing China's national goal of artificial general intelligence.

Wuhan AI Research (武汉人工智能研究院 or 武智院), located in the same East Lake High-tech Development Zone, launched in December 2021 to research "cross-modal intelligence." CASIA leads the effort supported by a planned team of 200 researchers recruited in China and from abroad.[30]

The institute's director is WANG Jinqiao (王金桥), who is also CASIA's deputy chief engineer, a professor at the University of Chinese Academy of Sciences (UCAS) School of Artificial Intelligence (人工智能学院), and executive deputy director of the Zidong Taichu Large Model Research Center (紫东太初大模型研究中心) within CASIA.[31] The latter center's goal is stated on its website as:

> "Establish an interpretable, trustworthy, and evolvable (可演化) multimodal AI infrastructure platform for open and complex environments (开放复杂环境), and build a new generation of AI infrastructure."[32]

The key terms here for the present study are "evolvable" and "open and complex environments," which distinguish the Wuhan effort from large models typically pursued in the United States and other western nations that grow by ingesting static information.

A second major component of the city's AGI brain trust is the PKU-Wuhan Institute for Artificial Intelligence (北京大学武汉人工智能研究院 or 北武院), established in November 2022 under Peking University's "lead" and also located in the East Lake Zone,[33] pictured below.

Figure 3. PKU-Wuhan Institute for Artificial Intelligence (far right)[34]

The PKU-Wuhan group's top two figures are both returned U.S. scientists. Its executive director, WU Zhiqiang (吴志强), was a distinguished professor of electrical engineering at Ohio's Wright State University with expertise in AI and signal processing.[35] ZHU Songchun (朱松纯, AKA Song-Chun Zhu), a former UCLA professor and founding director of the Beijing Institute for General Artificial Intelligence (北京通用人工智能研究院, BIGAI) with expertise in computer vision,[36] is the PKU-Wuhan Institute's chief scientist.[37] Both Wu and Zhu were recipients of numerous U.S. government grants from defense-oriented agencies during their long tenures in the United States.[38]

Under their tutelage, the institute developed a "large-scale social simulator" (大型社会模拟器), based on Zhu's concept of "embodiment" (具身) as a precondition for genuine AGI (see below).

The co-location of these two institutes in the same Wuhan development zone, each with their complementary approaches to AGI—CASIA's "evolvable" large-model and BIGAI's embodied platform that promises "small data, big tasks" (小数据,大任务)[39]—takes on special importance as they represent China's two largest state-funded AGI research blocs: CASIA-UCAS and the PKU-Tsinghua-BIGAI nexus.[40]

China's exploration of multiple paths (多路径) to AGI[41] also includes neuroscience approaches, which are mostly disfavored by western developers of AGI models but have been associated with AI in China since 2014.[42] Given this broader perspective, it is perhaps significant that the China Optics Valley Brain Science Industrial Base (中国光谷脑科学产业基地) and the Optics Valley International Brain Science Innovation Center (光谷国际脑科学创新中心) are in the same high-tech zone as the two aforementioned AGI institutes.[43]

A quote from Wuhan AI Research's website captures this study's point about China's intent to roll out AGI from Wuhan by pursuing a policy of "based in Wuhan, radiating to Hubei, and serving the whole country (立足武汉, 辐射湖北, 服务全国)."[44]

The AI Industry Chain

Wuhan's compute centers and AI institutes are the top strata of what China views as a three-level "AI industry chain" (人工智能产业链). The third stratum consists of downstream beneficiaries, which double as grist for the evolving AGI platform. Wuhan's city government explains:[45]

- The "foundational level" (基础层) provides compute and "basic chips" (基础芯片) and is represented by the Wuhan AI Computing Center, Wuhan Supercomputing Center, and local hardware manufacturing firms.[46]
- Next is the "technical level" (技术层), with large models represented by Wuhan AI Research; East Lake Virtual Reality ("SoulGPT"; 东湖灵境), which does commercial large model training[47]; iFlytek, with its open AI platform; and GPT "localization" companies.
- The final "applications level" (应用层) includes local entities engaged in commercial production and services, such as smart chips, IT equipment, medical, manufacturing, construction, education, and smart cities.

The notice claims the chain is "pretty much complete" (较为完整). Statistics cited in relevant Chinese sources tend to bear this out. For example, as of December 2022 the Wuhan AI Computing Center had "more than 80 industrial consortium partners" and planned to incubate (孵化) some 100 AI "solutions."[48] By March 2023, the center had signed up 270 "users."[49] As of September 2024, it reportedly was servicing 300 companies and had "jointly incubated more than 200 scenario-based solutions."[50]

These statistics apply to the Wuhan AI Computing Center's clients only. Taking the city as a whole, the numbers are much higher. A report issued in June 2024 by the Wuhan High-Tech Industry Association (武汉市高新技术产业协会) stated that in 2023 Wuhan's "AI enterprises" (人工智能企业) reached 995.[51] In October 2024, a Hubei newspaper updated the figure of AI-enabled companies in Wuhan to "more than 1,000" while reiterating the city government's point that "a full AI industry chain from chips to compute, from large models to applications, has been initially formed."[52]

Notable entities participating in the "chain" are BGI-Research (华大生命科学研究院), which uses the twinned centers to run spatiotemporal omics gene sequencing*; "LuoJiaNet," a joint Wuhan University-Huawei project to write "intelligent interpretation software for remote sensing images," hosted by the AI Computing Center[53]; and Huazhong University of Science and Technology's (华中科技大学) Edraw

* Spatiotemporal omics gene sequencing aims to map gene expression and other molecular features across tissues at specific locations and times to develop a better understanding of biological processes.

(亿图) software, claimed to be the world's leading "high-performance graph computing system," running at the Wuhan Supercomputing Center.[54]

Wuhan's AGI Initiatives

The composite AI "chain" described above began in May 2021, when CASIA, Huawei, and the East Lake High-tech Development Zone first revealed their plan for a Wuhan General Artificial Intelligence Platform for "autonomously controllable AGI."[55]

The groundwork for this project likely predates BIGAI's founding in September 2020, which in early 2021 was still advertising for staff.[56] Hence the evolution of CAS's vision from what was an effort to turbocharge Wuhan's industry with AI into a comprehensive program for citywide AGI governance was almost certainly catalyzed by BIGAI's rise and by its director's influence over China's AI research.[57]

A preview of the initiative was given by Wu Zhiqiang, co-manager with Zhu Songchun of the PKU-Wuhan AI institute, in a news release dated June 28, 2024, wherein Wu explained their effort to build the world's first "large-scale social simulator" (大型社会模拟器)—a value-driven (价值驱动, see below) form of AGI that differs fundamentally from existing large models built on static data. Unlike LLMs that just try to predict the next token, the system, in Wu's words, will simulate "multiscale physical world and social complex systems" on its way to becoming "the operating model of a coexisting smart society" and a tool for social governance (社会治理). Wu added that the "basic platform" had already been completed.[58]

On October 24, 2024, at a forum hosted by the PKU-Wuhan Institute, Zhu Songchun provided further details of the project. Key to its realization is the aforementioned AI-powered large-scale social simulator, then in version 1.0.[59] The platform integrates multidimensional data collected from individuals, groups, and public services for "social governance through early warning and analysis." Zhu added that "the simulator will have a wide range of applications in managing megacities and complex social governance, including monitoring population flow."[60]

Other excerpts from Zhu's description, summarized in *China Science Daily*, follow:[61]

- "The large-scale social simulator can solve the problem of inability to conduct experiments and repeat tests in the field of social sciences, help explore intelligent social governance models, and improve the modernization level of national governance."
- "[It] can practice massive intelligent agent interactions in a 3D modeling simulation environment, realizing multi-level complex system simulation and the emergence of group intelligence from individual behavior to overall city operation."

- "[It] accurately deduces the entire process of complete, dynamic, and iterative social development, and creates a holographic (全息) intelligent social governance platform system, constructing a new paradigm of intelligent social governance."[62]

More details on the simulator's operation were provided by CHEN Shuo (陈烁), head of BIGAI's "multi-agent laboratory" (多智能体实验室), on March 29, 2025, at a forum hosted in Beijing's Zhongguancun:[63]

> "The simulator uses distributed computing and high-concurrency scheduling technology to simulate the interaction and evolution process of individual agents and social-level agents in a highly realistic 3D simulation environment. It builds a virtual social system containing millions of people through multi-dimensional data fusion and dynamic interactive modeling. It uses multi-agent value modeling and digital twin technology to accurately deduce social operating rules, simulate the long-term impact of different social decisions, and provide forward-looking decision support."

Meanwhile, state backing for the social simulator was confirmed in a January 24, 2025 release from the National Natural Science Foundation of China (国家自然科学基金委员会, NSFC), the country's main funding and scientific oversight organization, in a section of its guide for AGI research titled "Credible generation of multi-agent simulation scenarios driven by physical processes."[64]

> "Build a scenario model driven by physical principles to achieve highly realistic dynamic simulation of the environment; integrate multimodal information to enhance the interaction between intelligent agents and the environment, and ensure that the characteristics and behaviors of simulation entities match those of the real world; and establish and improve a simulation data credibility assessment system to ensure the reliability of simulation scenarios, thereby providing a solid virtual foundation for complex systems research and decision-making."

The Wuhan forum's theme, "AGI: Building a Data Ecosystem, Reshaping the Industrial System, and Empowering Social Governance,"[65] aptly describes the project's transition from AI support for industrial development—CASIA's original mandate—to a design for total management.

Values and Embodiment

The emphasis on "values" as the driver of AI-enabled social governance, expressed in the Wuhan rollout, is an outgrowth of value's role in the AGI program advanced by BIGAI and the capitol area AI alliance.[66] In this view, values injected into the model during its development, in part to advance and safeguard the CCP's priorities,[67] motivate the AI to explore its environment and ensure what it learns and outputs conform to the CCP's needs.

The other distinguishing feature of the proposition is "embodying" AI in a real environment, or close simulation, so that learning mimics natural processes.[68] This is precisely what the "social simulator" does. Embedded in a metaverse of human activity, the intent is for AI to optimize human behavior and learn from it.[69]

The result is a "blend" (混合) of human and artificial cognition, identified in Chinese state documents as a primary goal of China's AI research,[70] and echoed in the following statement by Wu Zhaohui (吴朝晖), CAS vice president and former vice minister of China's Science ministry:[71]

> "We believe the fusion of brain and machine intelligence represents a new form of future AI, compatible with biological intelligence's perception of environment, cognitive mechanism, and ability to learn how to reason, and with machine intelligence's capability for information integration, storage, and compute."
>
> The basic intent is to start from the brain, use human information processing methods to build a virtual brain, and use brain-computer interaction to realize the fusion and integration of a biological brain, virtual brain, and human-computer intelligence.
>
> China's academics and practitioners agree overall with this demarcation of tasks. The 'hybrid enhanced intelligence' in the [2017] New Generation Artificial Intelligence Plan originated from this understanding."

Meanwhile, the symbiotic relationship between an AGI that governs and grows smarter by interacting with those whom it governs tightens.*

The likelihood this "value + embodiment" paradigm will grow legs is evidenced by Fudan University's establishment this year of an Institute of Trustworthy Embodied AI (可信具身智能研究院) aimed at producing human-like (像人类一样) artificial intelligence, which is defined as AI that:

> "can interact with the environment and perform robust perception, learning, and decision-making, whose behavior follows human values and can sustainably evolve."

The creation of this institute at Shanghai's top university closes the circle from a regional perspective.[72]

Continued algorithmic development of the social simulator at Tsinghua University, part of the capitol-area AGI consortium, further suggests the Wuhan project is the forerunner of a national effort.[73] In February 2025, an interdisciplinary group of 16 Tsinghua researchers released a paper describing an AI "testbed for computational social experiments."[74] Among the "key social issues" the paper explores is "the spread of inflammatory messages," which hints at where the project may be headed.[75]

A *Sina* article in the same month reiterated the study's claim that the model "can accurately simulate the spread of social public opinion, the polarization of cognitive views (认知观点极化), and public policy responses." While emphasizing the importance of "value" and "embodiment," the article noted that the simulator is being endowed with a "human-like mind" (类人心智) that possesses "emotions, needs, motivations, and cognitive abilities."[76]

Although Zhu Songchun downplays the connection,[77] the interplay between Wuhan's AGI roll out and the "city brains" or "city digital twins" (城市数字孪生) that underlie China's creation of so-called "safe cities"[78] is hard to ignore. And given the pervasiveness of state ideology in China and the dedicated efforts to embody this ideology in these AI systems, it is difficult to imagine an outcome to these events

* The NSFC's 2025 AGI Guide, in a section titled "Humanlike cognitive learning framework," aims specifically for this outcome: "Explore humanlike cognitive learning frameworks, improve the intelligentization level of systems through the active perception and interaction of intelligent agents (智能体) and the autonomous learning and iterative updating of the model, and solve the interactive decision-making problems of embodied intelligent agents in complex physical environments, thereby providing support for embodied AI (具身智能) tasks such as causal model construction and physical common sense generation."

consistent with western freedom of choice and expression,[79] or a more dystopian interpretation of AGI's end game.

Recommendations

Technology initiatives meant for nationwide deployment typically begin in China with local, proof-of concept "demonstrations" (示范) or "model" (模范) projects, and Wuhan has served as the starting point for such in at least two other cases.[80] If the Wuhan AGI project succeeds, or is seen to show promise, we can expect the Beijing government to follow through with its plan to deploy the system elsewhere in China. We recommend this process be closely monitored given its importance and potential challenges.

This recommendation is a microcosm of the authors' standing plea for the United States and its allies to devote serious resources to track China's technological progress in general, as our national insight falls far short of Beijing's comprehensive understanding of foreign scientific trends.[81]

Beyond the obvious need to assess—and forecast—China's technology initiatives, there may be lessons to learn from China; in particular, its support for alternative approaches to AGI and early infusion of AI into industry and society.

China's commitment to multiple paths to AGI—a theme the present authors have emphasized in prior reporting[82]—was restated in the NSFC's "Guide to the 2025 Annual Projects," both in a general sense ("developing a system of new AI methods") and in multiple categories that describe alternative AGI approaches beyond the large generative models that occupy nearly all of western AI developers' and policymakers' attention.[83]

Finally, China's well-known penchant for operationalizing technical breakthroughs[84]—seen here in its roll-out of public-facing AI initiatives to bolster scientific research and optimize commerce and production—could serve if not as a model then as a stimulus for U.S. efforts to revitalize our own domestic industry by infusing it with AI.[85] While focusing on AI safety and the dangers of weaponization, we should also keep in mind the real possibility of being out-competed by a country that moves more quickly and decisively to realize the promises that AI offers.

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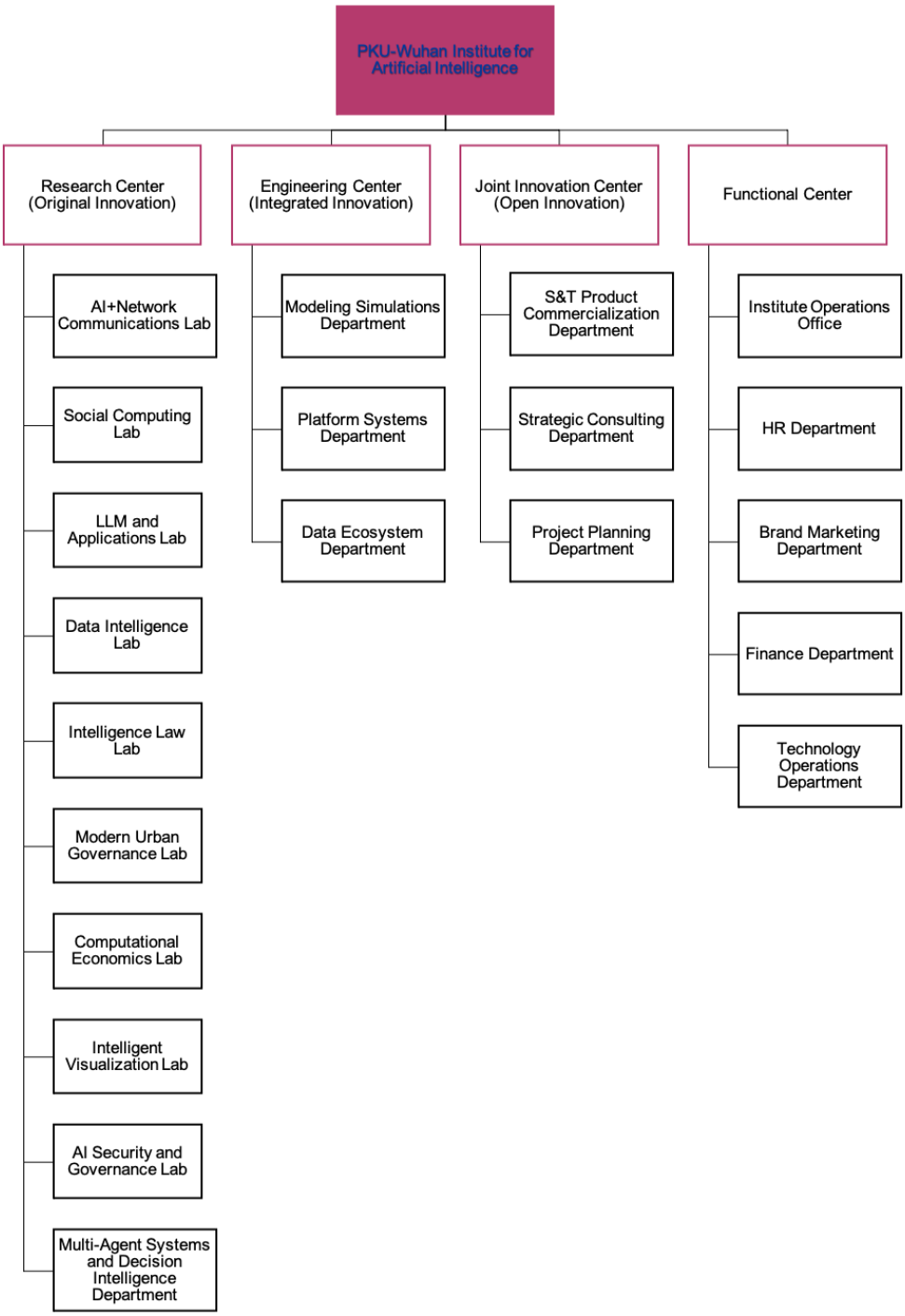
Appendix

Organizational Chart

Figure A1. PKU-Wuhan Institute for Artificial Intelligence[86]



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[16] "Wuhan Artificial Intelligence Computing Center Was Selected as the National New Generation Artificial Intelligence Public Computing Power Open Innovation Platform" (武汉人工智能计算中心入选国家新一代人工智能公共算力开放创新平台), C114 Communication Network (C114 通信网), July 4, 2023, https://finance.sina.com.cn/tech/roll/2023-07-04/doc-imyznvcv0968647.shtml; Hu Zhilan (胡之澜), "The World's First 100 Billion Parameter Multimodal Large Model 'Zidong Taichu' Has Been Upgraded Again" (全球首个千亿参数多模态大模型 "紫东太初" 又升级了), *Yangtze Daily* (长江日报), November 27, 2024, https://www.wuhan.gov.cn/sy/whyw/202411/t20241127_2490186.shtml.

[17] "Introduction to Zidong Taichu" (紫东太初简介), https://wair.ac.cn/research/achievement2.

[18] "Wang Jinqiao, Director of Wuhan AI Research: Accelerate the Consolidation of Computing Power Foundation and Empower East Lake Science City with 'Zidong Taichu'," (武汉人工智能研究院院长王金桥: 加快夯实算力底座,以"紫东太初"赋能东湖科学城启航), China Optics Valley (中国光谷), August 10, 2022, https://www.wehdz.gov.cn/2022/zmq_75779/xwdt_75782/202210/t20221027_2073125.shtml.

[19] Xiong Zhanping, "Wuhan Has Formed a Relatively Complete Artificial Intelligence Industry Chain."

[20] Hu Zhilan, "The World's First 100 Billion Parameter Multimodal Large Model."

[21] Hubei Provincial People's Government, "Hubei Ranks First."

[22] "Wuhan Supercomputing Center Lights Up East Lake Science City" (武汉超算中心点亮东湖科学城), Department of Economy and Information Technology of Hubei Province (湖北省经济和信息化厅), October 6, 2022, http://jxt.hubei.gov.cn/bmdt/cyfz/202210/t20221007_4334029.shtml.

[23] Ma Wenjun (马文俊) and Liu Yujia (刘雨佳), "Wuhan Supercomputing Center Won the World's Graph 500 Ranking Championship" (武汉超算中心获世界 Graph 500 排行榜冠军), *Hubei Daily* (湖北日报), May 28, 2023, https://www.wehdz.gov.cn/2022/ggxw_68627/cydt_68630/202305/t20230529_2207472.shtml.

[24] See "Graph 500 Complete Results," https://graph500.org/?page_id=238. BFS is a basic algorithm used to search tree data structures for all nodes at a given depth (i.e., "breadth first") before moving to the next level, best suited when the solution is near the starting point. SSSP measures a supercomputer's ability to find the shortest path from a source node to all other nodes.

[25] See "Introduction to the Supercomputing Center" (超算中心简介), https://hpc.whu.edu.cn/zxgk/cszxjj.htm.

[26] Ze Long (泽泷), "China Telecom Central Intelligent Computing Center Was Put into Operation in Wuhan, Supporting the Deployment of Large Models with Trillions of Parameters" (中国电信中部智算中心在武汉投运, 支持部署万亿参数大模型), *IT Home* (IT 之家), January 27, 2024, https://www.ithome.com/0/747/560.htm; Matthew Connatser, "China's First Natively Built Supercomputer Goes Online—the Central Intelligent Computing Center Is Liquid-Cooled and Built for AI," *Tom's Hardware*, January 29, 2024, https://www.tomshardware.com/null/chinas-first-natively-built-supercomputer-goes-online-the-central-intelligent-computing-center-is-liquid-cooled-and-built-for-ai.

[27] Hubei Provincial People's Government, "Hubei Ranks First."

[28] Yu Cheng, Kun Liu, "Wuhan Center to Enhance Country's Supercomputing Fortitude, Acumen," *China Daily*, August 17, 2022, https://global.chinadaily.com.cn/a/202208/17/WS62fc4604a310fd2b29e72a56.html.

[29] Hannas, Chang, Riesenhuber, and Chou, "China's Cognitive AI Research," 10-13.

[30] "Introduction to Wuhan AI Research," https://wair.ac.cn/about; "Wang Jinqiao, Director of Wuhan AI Research: Accelerate the Consolidation of Computing Power Foundation and Empower East Lake Science City with 'Zidong Taichu'."

[31] See Wang Jinqiao (王金桥), https://nlpr.ia.ac.cn/iva/homepage/jqwang/index.htm.

[32] "Zidong Taichu Large Model Research Center" (紫东太初大模型研究中心), http://www.ia.cas.cn/jgsz/kyxt/zztc/. "开放复杂环境" is probably linked to "开放的复杂巨系统" (open complex giant system), a term introduced by Qian Xuesen (钱学森), a Chinese polymath known as the progenitor of Chinese rocket science, engineering cybernetics, and the inspiration for China's foreign S&T document collection network. See Qian Xuesen, Yu Jingyuan, and Dai Ruwei, "A New Discipline of Science—The Study of Open Complex Giant Systems and Its Methodology," *Chinese Journal of Systems Engineering and Electronics* 4.2 (1993), https://dominiccummings.com/wp-content/uploads/2019/02/xuesen-open-complex-giant-system.pdf. Our thanks to John Chen of the RAND Corp. for making this connection.

[33] "Introduction to the Institute" (研究院简介), http://whai.pku.edu.cn/gywm/yjyjj.htm.

[34] See "PKU-Wuhan Institute for Artificial Intelligence" at https://flbook.com.cn/c/vXnzkqF3iW.

[35] See Wu Zhiqiang, https://flbook.com.cn/c/vXnzkqF3iW#page/11; https://people.wright.edu/zhiqiang.wu.

[36] Chang and Hannas, "Spotlight on Beijing Institute for General Artificial Intelligence."

[37] "Message from the Chief Scientist" (首席科学家寄语), http://whai.pku.edu.cn/gywm/sxkxjjy.htm.; https://flbook.com.cn/c/vXnzkqF3iW#page/10.

[38] According to his Wright State University bio, Wu Zhiqiang's research has been funded by the Air Force Research Laboratory, the Air Force Office of Scientific Research, the Office of Naval Research, the National Aeronautics and Space Administration, and the Department of Energy among others (https://people.wright.edu/zhiqiang.wu). Wright State University has close ties with the National Air and Space Intelligence Center (NASIC), the USAF's dedicated foreign scientific intelligence research facility in Dayton. See "NASIC Representatives to Meet With Wright State Students, Staff," *Dayton Daily News*, November 3, 2021 (https://www.daytondailynews.com/local/nasic-representatives-to-meet-with-wright-state-students-staff/RAI6O7NMS5DZFNR6R4YWOH3WTM/) and "Expanded Agreement Provides Air Force Researchers More Access to Work on Wright State's Campus," *Wright State University Newsroom*, December 17, 2024 (https://webapp2.wright.edu/web1/newsroom/2024/12/17/expanded-agreement-provides-air-force-researchers-more-access-to-work-on-wright-states-campus/). Zhu Songchun's U.S.-based work was supported by multiple DARPA and other U.S. Department of Defense grants. See Didi Kirsten Tatlow, "Exclusive: U.S. Gave $30 Million to Top Chinese Scientist Leading China's AI 'Race'," *Newsweek*, November 1, 2023 (https://www.newsweek.com/us-gave-30-million-top-chinese-scientist-leading-chinas-ai-race-1837772). Although Zhu relocated to China in 2020 (Chang and Hannas, "Spotlight on Beijing"), he remains connected to UCLA as evidenced by a citation on Ran Gong's 2024 Ph.D. dissertation, where he credits Zhu as his thesis co-chair. Gong, like his mentor, argues for "embodiment" as a path to AGI. https://web.cs.ucla.edu/~dt/theses/gong-ran-phd-thesis.pdf.

[39] Chang and Hannas, "Spotlight on Beijing Institute of General Artificial Intelligence."

[40] Hannas, Chang, Riesenhuber, Chou, "China's Cognitive AI Research."

[41] Jiao Yifei (缴翼飞), "Wu Zhaohui, Vice Minister of the Ministry of Science and Technology: Big Models Push Artificial Intelligence Toward the 3.0 Stage, and We Need to Explore the Development of General Artificial Intelligence Through Multiple Paths" (科技部副部长吴朝晖:大模型推动人工智能迈向 3.0 阶段 要多路径探索通用人工智能发展), *21st Century Business Herald* (21 世纪经济报道), March 24, 2024, https://www.21jingji.com/article/20240324/herald/18cf65156b7d67322a4d0b3a9d98a47b.html.

[42] Wm. C. Hannas, Huey-Meei Chang, Catherine Aiken, and Daniel Chou, "China AI-Brain Research," Center for Security and Emerging Technology, September 2020, https://cset.georgetown.edu/publication/china-ai-brain-research/.

[43] PRC Ministry of Science and Technology, "The First Brain Science Industry Base in Central China Was Unveiled" (华中首个脑科学产业基地揭牌), September 22, 2022, https://www.most.gov.cn/dfkj/hub/zxdt/202209/t20220922_182518.html; Wu Chunxin (吴纯新), "Optics Valley International Brain Science Innovation Center Unveiled" (光谷国际脑科学创新中心揭牌),

Science and Technology Daily (科技日报), March 3, 2024, https://www.stdaily.com/index/kejixinwen/202403/28be414866a94855b97d05509ffa3208.shtml.

[44] "Introduction to the Institute" (研究院简介). https://wair.ac.cn/about#introduction.

[45] "Wuhan Has Formed a Relatively Complete Artificial Intelligence Industry Chain, Mainly Concentrated in Optics Valley" (武汉已形成较为完整人工智能产业链, 主要集中在光谷), *Yangtze Daily* (长江日报), April 12, 2024, https://www.wehdz.gov.cn/2022/zmq_75779/xwdt_75782/202404/t20240416_2389254.shtml.

[46] Yangtze Memory (YMTC; 长江存储), which specializes in flash memory, and Wuhan Yangtze Computing Technology (武汉长江计算科技) are cited as examples. The latter makes servers, computing, and storage devices.

[47] See East Lake Virtual Reality homepage at https://m.dhljai.com/home.

[48] See "Wuhan AI Computing Center" (武汉人工智能计算中心), "Success Cases" (成功案例), https://www.hiascend.com/industries/ai-computing-center. See also "Wuhan Has Formed a Relatively Complete Artificial Intelligence Industry Chain" for multiple examples of entities currently operating at each of the chain's three strata, especially the applications level.

[49] Li Jia (李佳), "Wuhan Has a 'Dual Center' for Supercomputing and Intelligent Computing. Technology Companies Buy Computing Power Like Buying Water, Electricity, and Gas." (武汉拥有超算智算 '双中心', 科技企业像买水电气一样购买算力), *Yangtze Daily* (长江日报), May 29, 2023, https://www.app.dawuhanapp.com/wuhan/p/23832495.html.

[50] Hubei Provincial People's Government, "Hubei Ranks First."

[51] I.e., enterprises using AI services, not producing AI software per se. Li Qin (李琴), "There Are 995 Artificial Intelligence Companies in Wuhan, with an Industry Scale Exceeding 50 Billion Yuan" (武汉市人工智能企业达 995 家, 产业规模超 500 亿元), *Yangtze Daily* (长江日报), June 24, 2024, https://news.qq.com/rain/a/20240624A09Q1T00.

[52] Li Yuan (李源), "Wuhan's Artificial Intelligence Innovation Strength Ranks First in the Country" (武汉人工智能创新实力居全国第一方阵), *Hubei Daily* (湖北日报), October 25, 2024, https://epaper.hubeidaily.net/pc/content/202410/25/content_292734.html.

[53] LuoJiaNET is paired with an image library known as LuoJiaSET. Wuhan University, "LuoJia 'Gemini' of WHU Opens Up to the World," July 17, 2022, https://en.whu.edu.cn/info/1050/6930.htm.

[54] Xie Zhen (谢珍), "The Innovative Achievements of Wuhan Artificial Intelligence Computing Center and Wuhan Supercomputing Center Are Officially Released!" (武汉人工智能计算中心、武汉超算中心创新成果正式发布!), Yangtze Cloud (长江云), August 11, 2023, https://news.qq.com/rain/a/20230811A04J2500. See also Mi Wang, Qianyu Wu, Jing Xiao, Deren Li, et al., "Luojia 3-01 Satellite—Real-Time Intelligent Service System for Remote Sensing Science Experiment

Satellite," *IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing* 17 (2024), https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=10496159.

[55] Hu Changxing, "Chinese Academy of Sciences, Huawei, and East Lake High-Tech Zone jointly build."

[56] Chang and Hannas, "Spotlight on Beijing Institute for General Artificial Intelligence."

[57] Chang and Hannas, "Spotlight on Beijing Institute for General Artificial Intelligence."

[58] Tang Jie (唐婕), "Wu Zhiqiang: Exploring the 'No Man's Land' and Ushering in the 'China Moment' of Artificial Intelligence" (吴志强: 探路 '无人区', 迎来人工智能 '中国时刻'), *Yangtze Daily* (长江日报), June 28, 2024, https://www.app.dawuhanapp.com/p/38687137.html.

[59] The forum was backed by a new entity called the "National Intelligent Social Governance Experimental Comprehensive Base" (国家智能社会治理实验综合基地). Han Yangmei, "The World's First Social-Level General Artificial Intelligence Simulator Platform;" Zhao Zhuqing (赵竹青), "General AI Large-Scale Social simulator Released" (通用人工智能大型社会模拟器发布), people.cn (人民网), October 25, 2024. http://finance.people.com.cn/n1/2024/1025/c1004-40347434.html.

[60] Liu Caiyu, "AI Social simulatorSimulator Released, Capable of Data Deduction in Areas of School Bullying Prevention, Public Safety," *Global Times*, October 26, 2024, https://www.globaltimes.cn/page/202410/1321892.shtml.

[61] Han Yangmei, "The World's First Social-Level General Artificial Intelligence Simulator Platform."

[62] "Holographic" here refers to different display levels; for example, 0.3–0.5 meter satellite imagery (L1), simplified 3-dimensional model (L2), and so on. https://flbook.com.cn/c/vXnzkqF3iW#page/30.

[63] Cited in "2025 General Artificial Intelligence Forum Was Successfully Held" (2025 通用人工智能论坛成功召开), Beijing Institute for General Artificial Intelligence (北京通用人工智能研究院), March 31, 2025, https://www.bigai.ai/blog/news/2025 通用人工智能论坛成功召开.

[64] National Natural Science Foundation of China (国家自然科学基金委员会), "Guide to the 2025 Annual Projects for the Major Research Program on Explainable and Generalizable Next-Generation Artificial Intelligence Methods" (可解释、可通用的下一代人工智能方法重大研究计划 2025 年度项目指南), January 24, 2025, https://www.nsfc.gov.cn/publish/portal0/tab442/info94367.htm. See full-text CSET English translation at https://cset.georgetown.edu/publication/china-2025-explainable-ai-project-guide/.

[65] Han Yangmei, "The World's First Social-Level General Artificial Intelligence Simulator Platform."

[66] Hannas, Chang, Riesenhuber, and Chou, "Chinese Critiques of Large Language Models."

[67] Hannas, Chang, Riesenhuber, and Chou, "Chinese Critiques of Large Language Models." Values in Zhu's system are digital guidelines that motivate an AI to seek and act on environmental inputs, based on a set of standards that include "social value" and "group value." Yujia Peng, Jiaheng Han, Zhenliang

Zhang, Lifeng Fan, et al., "The Tong Test: Evaluating Artificial General Intelligence Through Dynamic Embodied Physical and Social Interactions," *Engineering* 34,2024: 12–22.

[68] Hannas, Chang, Riesenhuber, and Chou, "Chinese Critiques of Large Language Models."

[69] Zhu Songchun clarified the difference between his approach and that of LLMs in an address at the March 29, 2025 Zhongguancun Forum, where he stated: "Our relationship with large models is not one of opposition, but of symbiosis (共生). Large models are like the human subconscious—they provide the foundation for perception and memory. What we aim to build on top of that is the cognitive and decision-making architecture for general-purpose intelligent agents." Li Hailun (李海伦), "Zhu Songchun at Beijing University's Institute of Artificial Intelligence: 'China's AI Narrative' Has Cognitive Bias'" (北大人工智能研究院朱松纯, "中国的 AI 叙事" 存在认知偏差), Tencent Network (腾讯网), March 29, 2025, https://www.163.com/dy/article/JRR3U7MT051193U6.html.; English translation by Tony Peng, "China's AI Looks Vibrant, But It's Fundamentally Chaotic, Scientist Warns," *Recode China AI*, March 30, 2025, https://recodechinaai.substack.com/p/chinas-ai-looks-vibrantbut-its-fundamentally.

[70] Cf. "人机混合智能" (human-machine hybrid intelligence). PRC State Council, "New Generation Artificial Intelligence Plan" (新一代人工智能发展规划), July 8, 2017. English translation by Graham Webster, Rogier Creemers, Paul Triolo, and Elsa Kania, New America DigiChina Project, August 1, 2017, https://www.newamerica.org/cybersecurity-initiative/digichina/blog/full-translation-chinas-new-generation-artificial-intelligence-development-plan-2017/.

[71] Wu Zhaohui, "From AI to CI—the Development of Brain-Machine Intelligence," (从 AI 到 CI—脑机智能的发展), Global Artificial Intelligence Technology Conference, Chinese Association for Artificial Intelligence (中国人工智能学会), Hangzhou, China June 5–6, 2021, https://dl.caai.cn/home/Literature/details.html?id=266; Hu Ge (胡舸), "Wu Zhaohui Appointed as Vice President of the Chinese Academy of Sciences" (吴朝晖任中国科学院副院长), Zhejiang University, http://www.cs.zju.edu.cn/csen/2024/0416/c38564a2902027/page.htm.

[72] Fudan University as a whole offered some 116 AI courses in 2024–2025. Yu Yan (喻琰), "Fudan University Has Established a New 'Institute of Trustworthy Embodied Artificial Intelligence' to Recruit Talents Worldwide, with Salaries Starting from 600,000 Yuan" (复旦新设 "可信具身智能研究院" 全球招聘人才, 薪资 60 万元起), *The Paper* (澎湃新闻), February 7, 2025, https://www.thepaper.cn/newsDetail_forward_30100161.

[73] A glossy 84-page (undated) pamphlet describing the Wuhan project, released by the PKU-Wuhan Institute of Artificial Intelligence and titled "General Artificial Intelligence" (通用人工智能), includes a graphic showing the project's application across three scales: "group and community" > "city and social" > "country and civilization"; https://flbook.com.cn/c/vXnzkqF3iW#page/23.

[74] Jinghua Piao, Yuwei Yan, Jun Zhang, Nian Li, et al., "AgentSociety: Large-Scale Simulation of LLM-Driven Generative Agents Advances Understanding of Human Behaviors and Society," arXiv preprint arXiv:2502.08691v1 (2025).

[75] Jinghua Piao, Yuwei Yan, Jun Zhang, Nian Li, et al., "AgentSociety: Large-Scale Simulation."

[76] "Tsinghua Team Builds Large-Scale Social simulatorSimulator AgentSociety to Promote Intelligent Social Governance and Research Paradigm Shift" (清华团队构建大型社会模拟器 AgentSociety, 推动智能社会治理与研究范式变革), Sina (新浪科技), February 19, 2025, https://finance.sina.com.cn/tech/roll/2025-02-19/doc-inekytkf6383509.shtml.

[77] "The large-scale social simulator built in Wuhan is neither a 'city brain' nor a 'city digital twin' as mentioned in the past, but a general-purpose intelligent agent on a social scale." Zhu Songchun (朱松纯), "Message from Chief Scientist Zhu Songchun."

[78] Valentin Weber, "Data-Centric Authoritarianism: How China's Development of Frontier Technologies Could Globalize Repression" (National Endowment for Democracy, February 11, 2025), https://www.ned.org/data-centric-authoritarianism-how-chinas-development-of-frontier-technologies-could-globalize-repression-2/.

[79] Zhu Songchun, "The Race to General Purpose Artificial Intelligence Is Not Merely About Technological Competition; Even More So, It Is a Struggle to Control the Narrative" (通用人工智能不仅是科技竞争, 更是叙事权争夺), *Economic View* (中新经纬), January 12, 2025, https://finance.sina.com.cn/roll/2025-01-12/doc-ineetfvt3694006.shtml. See CSET translation at: https://cset.georgetown.edu/publication/song-chun-zhu-ai-narrative-control/.

[80] China's nationwide deployment of "Innovation Service Centers for New and High Technology" (高新技术创业服务中心) began with a center in Wuhan in 1987. In December 2010, the Wuhan East Lake High-tech Development Zone, in which these AGI initiatives are now embedded, became China's second such "innovation demonstration zone" (创新示范区) after Beijing's Zhongguancun (中关村). See William Hannas, James Mulvenon, Anna Puglisi, *Chinese Industrial Espionage* (London and New York: Routledge, 2013), 176; "China's Second National Independent Innovation Demonstration Zone Will Carry Out Three Major Innovation Pilot Projects" (我国第 2 个国家自主创新示范区将开展 3 大创新试点), PRC Central Government (中华人民共和国中央人民政府), December 29, 2009, https://www.gov.cn/jrzg/2009-12/29/content_1499260.htm.

[81] Hannas and Chang, "China's STI Operations."

[82] Wm. C. Hannas, Huey-Meei Chang, Daniel H. Chou, Brian Fleeger, "China's Advanced AI Research," Center for Security and Emerging Technology, July 2022, https://cset.georgetown.edu/publication/chinas-advanced-ai-research/; Hannas, Chang, Riesenhuber, and Chou, "China's Cognitive AI Research;" William C. Hannas, Huey-Meei Chang, Rishika Chauhan, et al., "Bibliometric Analysis of China's Non-Therapeutic Brain-Computer Interface Research: Alternative Paths to Cognitive Augmentation and Control," Center for Security and Emerging Technology, March 2024, https://cset.georgetown.edu/publication/bibliometric-analysis-of-chinas-non-therapeutic-brain-computer-interface-research/.

[83] National Natural Science Foundation of China, "Guide to the 2025 Annual Projects." See in particular the section on "new-generation brain-inspired AI," with its detailed vision for neuroscience-inspired AI models. By contrast, two of the present paper's authors attended high-level U.S. and UK government-sponsored events on AGI in early 2025. The participants at both events focused exclusively on large

language models and used LLMs as a synonym for AI, seemingly oblivious to the possibility of alternatives—not to mention those China is actually pursuing.

[84] Joseph Needham, *The Grand Titration: Science and Society in East and West* (London: George Allen & Unwin, 1969); Kai-Fu Lee, *AI Superpowers* (New York: Harper Business, 2018).

[85] Dewey Murdick and William Hannas, "America's Next Chapter: Outpacing China Through Industrial Rebirth and Innovation," *The National Interest*, March 27, 2025, https://nationalinterest.org/blog/techland/artificial-intelligence-china-and-americas-next-industrial-revolution.

[86] PKU-Wuhan Institute for Artificial Intelligence, https://flbook.com.cn/c/vXnzkqF3iW#page/16.