

from the qualitative to the quantitative would occur when the three groups used their knowledge of their respective domains to determine how best to formalise (for example, by assigning environmental and control variables to a model) a possible solution to the problem as a *system*—by setting up a market monitor agency, for example. A simulation of the proposed solution would then be run, and the result tested for its effectiveness both by quantitative measures and by qualitative judgment (which is to say, by human experts), initiating another *leap*, this time from the formal model back to human judgment.<sup>48</sup> In this way, neither quantitative judgement nor qualitative judgement would be subordinated to the logic of the other—rather, the two would be integrated in such a way that their specificities would be taken into account.

It could be said that Qian's metasynthetic engineering systems are the mature and implementable version of the social engineering systems of the previous decade—and, to risk ahistorical comparison for the sake of a concluding analogy, they are, in a sense, Cybersyn systems that survived and evolved to become a normalised and universalisable component of the late twentieth century and early twenty-first century computational paradigm.<sup>49</sup> Finally, it is fitting that Qian's career-long negotiation of the qualitatively different demands of theory and practice, human thinking and machine thinking, would find its final form in a method for synthesising the two—and not just on the 'micro' level of the individual (which constitutes a giant system in its own right) but on the 'macro' level of social organisation, whose human complexities (and potentialities) Qian refused to simply subject to quantitative analysis, just as he refused to let the incomputable elements of human thought function as anything other than a spur to the continued refinement of intelligent machines.

48. Qian Xuesen et al. 'A New Scientific Discipline', 5–6.

49. See E. Medina, *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile* (Cambridge, MA: MIT Press, 2011).

## You Mi

### A Different Endpoint: Qian Xuesen and Cosmotronics

How might we theorise computing beyond a Western perspective, and in particular through the lens of Chinese philosophy and history? This text takes the work of Qian Xuesen, a Chinese aerospace engineer with an interest in *qigong* (气功), as a critical starting point for approaching this question. Owing to his near canonisation in the Chinese history of technology, interpretations of Qian's ideas have often been superficial, and as a result his work on complex systems design has not been given enough attention. My exploration of his legacy began in 2020, when I commissioned a film by artist Shi Qing for the Shanghai Biennale.<sup>1</sup> Exploring how Qian's work could inform our ideas about computation, the film took the form of a theory-fiction that speculated on the implementation of the hypothetical 'Yangtze River Computer' as a model for artificial intelligence in which *qigong* and what Qian called *renti kexue* (人体科学), or 'somatic science', are 'written back' into computation, uniting 'nature' and 'artifice', human and machine. Qian's project, as reimagined and elaborated on by Shi, makes an important contribution to discussions about a possible Chinese 'cosmotronics', a framework for computation and technological development based in Chinese philosophy which has recently nourished animated debates around the prospect of alternative modernities.<sup>2</sup>

1. Shi Qing (石青), *Qian Xuesen and the Yangtze River Computer* (钱学森和长江计算机), single-channel video, 2021. The film was commissioned for the 13th Shanghai Biennale: *Bodies of Water*, 2021.

2. Coined by the philosopher Yuk Hui, 'cosmotronics' recognises the unification of cosmic and moral orders through technical activities as a means of overcoming the conceptual dualism of technics and nature. For Hui, technics or tools—*qi* (器)—are to be understood as belonging to the cosmic order—*Dao* (道)—not as something opposed to it. Hui also takes issue with the idea, which he sees as embedded in the very notion of technics, that there is a single, universal nature, whose telos can be progressively revealed via technology. Instead, he argues that such conceptions themselves belong to the specific political order of Western modernity. Consequently, he advocates

Qian Xuesen is a towering figure in the history of Chinese cybernetics. He spent the 1930s and '40s studying in the US, where he completed a doctorate at the California Institute of Technology under the supervision of mathematician, aerospace engineer, and physicist Theodore von Kármán, with whom he developed the Kármán-Tsien [Kármán-Qian] rule (for estimating compressibility effects of subsonic flow) in the field of fluid mechanics. In the mid-1950s, at the height of the Second Red Scare, Qian was forced to leave America and returned to China to oversee the development of the nuclear weapons, missile, and space programmes. In the decades that followed, he became the chief propagator of cybernetics in China. His work advanced a particular branch of cybernetics (which he called 'engineering cybernetics') that emphasised the importance of design principles in practical engineering and attempted to organise these principles into a holistic discipline united by fundamental concepts.

When Deng Xiaoping initiated the process of 'Reform and Opening-up' in 1978 he pulled the brake on heavy military industry and sought to decouple political mobilisation from technological development. As a result, revolutionary interests were no longer given priority. Instead, the aim was to kickstart China's economy by ramping up consumer industries and allowing decentralised development driven by self-motivated local agents to gain traction. '*Kexue shi di yi shengchanli*' (科学是第生产)—'Science is the Primary Productive Force'—became the motto of the era. At this juncture in state economic policy, Qian continued to promote cybernetics by reframing it as the science of efficient management, and suggested, like his contemporary Gregory Bateson, that it be applied to the study of agriculture and ecology.

What Qian would eventually become most drawn to, however, were the *renti teyi gongneng* (人体特异功能) or 'special capacities of the human body' that he saw being manifested in *qigong* practices, which were booming in China during the 1980s and 90s (so much so that the period has become synonymous with '*qigong* fever')<sup>3</sup> and which, alongside the idea that the human body is part of a vast communication system in which information can be transmitted via

for a great plurality of technics—or cosmotechnics—to reinvigorate cosmopolitics beyond this stale Western technological monoculture. See Hui, Yuk, *The Question Concerning Technology in China* (Falmouth: Urbanomic, 2016) and Hui, Yuk, 'Cosmotechnics as Cosmopolitics', *e-flux* 86 (2017).

3. D.A. Palmer, *Qigong Fever: Body, Science and Utopia in China* (New York: Columbia University Press, 2007).

the invisible medium of *qi*, would come to underwrite his development of the new field of 'somatic science'. In October 1982, at the third plenary session of the Preparatory Committee for Human Science, Qian wrote a report entitled 'Does this Breed a New Scientific Revolution?'.<sup>4</sup> In it, he declared that *qigong* and complementary investigations into supernatural somatic capabilities were a kind of human science worthy of in-depth study, and that they might lead to a new scientific revolution, the significance of which, he speculated, could be as profound for the twenty-first century as the scientific revolutions of quantum mechanics and relativity had been for the early twentieth century.

In the West, cyberneticians such as Warren McCulloch were interested in how to transpose mental processes into a kind of system that could be computed algorithmically. This reformulation of cognition in cybernetic terms as mere patterns that link thought to action marked the abandonment of ontological concerns with essences or the 'being of things', as expressed in questions such as 'What is x?'. In their place, an interest in function and the ability to predict future interactions, as expressed in questions like 'What does x do?', began to take precedence, displacing, in Qian's eyes, the fundamental role of the human body in computation and the specificity of human thought. This shift nevertheless inaugurated a new field of methodologies and practices that would render computation so powerful that the models developed in the West have come to define the global paradigm today.<sup>5</sup>

Qian embarked on a different path. Not long after the publication of 'Does this Breed a New Scientific Revolution?', he began to propose research into what he called *kaifang de fuza ju xitong* (开放的复杂巨系统) or 'open complex giant systems', in which human experts, databases, various AI systems, and giant computers capable of performing billions of computations per second would come together to form an enormous hybrid human-machine intelligence. Open complex giant systems, he argued, should become the object of a whole new field of study in systems engineering, one which, because it differed so greatly

4. Qian Xuesen (钱学森), 'Considering Science Popularisation as a Great Strategic Task' (把科普工作当作一项伟大的战略任务来抓), *Creating Popular Science* (科普创作) 3 (1980), in *Collected Works of Qian Xuesen* (钱学森文集), ed. Gu Jihuan (顾吉环), Li Ming (李明), and Tu Yuanji (涂元季) (Beijing: National Defence Industry Press, 6 vols., 2012), vol. 2, 349.

5. O. Halpern, *Beautiful Data: A History of Vision and Reason since 1945* (Durham, NC: Duke University Press, 2014), see especially Chapter 3.

from the cybernetics of the contemporary West, would open up an alternative route into computational research and development for China.<sup>6</sup> Far more broadly conceived than their Western counterparts, the systems Qian sought to create would be holistic: a 'unification of natural science and social science', synthesising technology with human thinking, collective organisational structures, and the 'special capacities of the human body'.<sup>7</sup> Qian's enduring wish was to integrate into computation something he called *linggan* (灵感) or 'inspiration'—the human ability to make qualitative leaps in thinking—along with *xingxiang siwei* (形象思维) or 'figural thinking'—the ability to solve complex problems very quickly without being aware of the logical steps one has taken to do so.<sup>8</sup> If a formal system based on logic alone fails to simulate human-level intelligence, he speculated, the pragmatic alternative was to create a symbiotic human-machine intelligence in which algorithmic logic and human creativity would combine without either one coming to dominate or instrumentalise the other.

Shi Qing's *Qian Xuesen and the Yangtze River Computer* is a one-hour-long retro-futuristic science fiction film. It draws on real figures and events in the history of cybernetics in China while also adding fictional details, thus conjuring a speculative past and future for computation alongside Qian's biography. The film is made up of archival footage, mostly in black and white or desaturated colour. The narration switches between a matter-of-fact socialist-TV-anchor-like narrator, the protagonist Qian Xuesen, and an unnamed commentator who operates as a mouthpiece for the artist. News-report-style titles, key words, and important phrases are shown on screen in a red font using a typeface that resembles propaganda posters from the Cultural Revolution era, and the film's collage of large text blocks and images is reminiscent of the socialist *heibanbao* (黑板报), or 'blackboard newspaper', a grassroots form of reporting on current affairs,

6. Qian Xuesen, Yu Jingyuan, and Dai Ruwei, 'A New Discipline of Science [A New Scientific Discipline]—The Study of Open Complex Giant Systems and Its Methodology', *Chinese Journal of Engineering & Electronics* 4:2 (1993), 2–12. With his open complex giant system, Qian foresaw the developments in big data, the internet of things, and smart-city related technologies that are familiar to us today, but for Qian they were infected with a more human-centred approach.

7. Ibid., 11; Dai Ruwei (戴汝为), 'From Engineering Cybernetics to Metasynthetic Engineering: Commemorating the 50th Anniversary of Qian Xuesen's Return to China' (从工程控制论到综合集成研讨厅体系——纪念钱学森归国50周年), *Complex Systems and Complexity Science* (复杂系统与复杂性科学) 3:2 (2006).

8. For a detailed discussion of the specific ways in which Qian understood and used these terms, see An, Bo, 'Between the Human and the Machine: Qian Xuesen and AI', in this volume.

arts, and culture that uses blackboards placed in public spaces to disseminate information, serving as a tool for mass engagement.<sup>9</sup>

Vintage footage of Qian speaking at congresses and filling blackboards with mathematical equations is intercut with footage of avid workers and factory scenes. The visual and narrative style conjures up the feeling of watching *kexue jiaoyu yingpian* (科学教育影片)—'scientific education films', a genre that occupied a prominent part of Chinese screen time from the founding of the People's Republic well into the 1970s. Encompassing topics including hygiene, modern machinery and production methods, pesticides in agriculture, and communal organisation, they were often technical and painstakingly detailed while conveying a sense of collective progress. Sometimes targeting specific audience groups such as peasants, factory workers, mine workers, or students, these films are inextricably bound up with scientific education in line with Maoist theories of development.<sup>10</sup> To an unsuspecting viewer, *Qian Xuesen and the Yangtze River Computer* may appear to be a factual, scientific documentary. Narrated by stoic, objective voices, the film follows Qian's journey from the US back to China and documents his development of the 'Yangtze River Computer'—a supercomputer that integrates the collective organisational power of the masses to achieve optimal computational results.

In the film, the idea for the Yangtze River Computer comes to Qian during a visit to the construction site of the Shisanling Reservoir in Beijing in 1958 where he is struck by the orderly organisation of four hundred thousand voluntary workers, and remarks:

This is like a computer only it is created out of the collaborative power of the physical masses! In contrast to the instrumental nature of Western computers,

9. The use of socialist aesthetics and a documentary style has been a hallmark of the artist's recent works, which critically revisit the legacy of socialism in China. In *Opposite the Zoo is the Planetarium* (2018), Shi traces parallels with Russian cosmism in China, and connects the cosmist project of resurrection with the making of a new socialist subject. *Fungus, Antimatter, and Fluid Urbanism* (2019) speculates on how the secret military industrial complex established during the socialist period left a lasting mark on the city of Chongqing. Such allusions to socialist aesthetics are also prevalent in the contemporary art scene in China and have reenergised interpretations of works by artists related to the Political Pop movement. See P. Wang, *The Future History of Contemporary Chinese Art* (Minneapolis: University of Minnesota Press, 2021).

10. See M.D. Johnson, 'The Science Education Film: Cinematizing Technocracy and Internationalizing Development', *Journal of Chinese Cinemas* 5:1 (2011): 31–53.

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it is the consciousness and discipline of these workers which makes real computation possible.<sup>11</sup>

Qian wastes no time in translating his vision into a blueprint for a supercomputer, the core principle of which would be the conversion of 'the organising energy of the natural world and human society into computational power'.<sup>12</sup> The government weighs in on this imaginative idea and the Central Military Commission sets up the 'Fifth Research Institute of the Ministry of Defence', a covert unit, with Qian as its director. It is decided that the supercomputer will be located near the Ma'anshan Iron and Steel Plant on the lower reaches of the Yangtze River where it can profit from both the organisational discipline of the steel workers and the hydraulic power of the Yangtze River, from which it inherits its name.

The ontological premise of the Yangtze River Computer as a 'computer of and for the masses' is an extrapolation from the mass movements in which the Chinese cybernetics program was rooted. Chinese cybernetics did not follow the path of Soviet cybernetics, which was largely controlled by a technocratic elite and thus presumed a high level of centralisation. The Soviet cybernetics programme ultimately failed as a result of self-interest and fierce competition among the numerous research institutes, technocrats, and specialists involved.<sup>13</sup> However, China did not have a technocratic class like the Soviet Union, and during the periods of the Great Leap Forward and Cultural Revolution especially, Chinese scientists worked on cybernetics, mathematics, and data science in person at local production sites such as villages and factories alongside peasants and workers, with the goal of effectuating mass political mobilisation through technology. Until the end of the 1970s, the Chinese approach to technological development was characterised by equal emphasis on high-level scientific projects and the grassroots technological politics of the 'mass line'.<sup>14</sup>

11. Shi, *Qian Xuesen and the Yangtze River Computer*. Translation modified.

12. *Ibid.*

13. See B. Peters, *How Not to Network a Nation: The Uneasy History of the Soviet Internet* (Cambridge, MA: MIT Press, 2016).

14. See Wang Hongzhe (王洪喆), 'The Political Turn in Chinese and Soviet Cybernetics and Socialist Information Technology: A Historical Comparison' (中苏控制论革命与社会主义信息传播技术政治的转型: 一项基于文献的历史比较), *Remapping* (区域) 1 (2016).

When the Yangtze River Computer faces a bottleneck in productivity owing to issues encountered, firstly with the diversity in levels of knowledge, training, and experience of the individuals (researchers, intellectuals, skilled workers, and students) comprising its computational substrate, and secondly with attempts to scale up its computational power, a Chinese delegate from the Fifth Research Institute is shown travelling to Salvador Allende's Chile to share information and, under instructions from Qian, to garner inspiration from Project Cybersyn. Designed by American cybernetician Stafford Beer, Cybersyn aimed to support the management of the national economy by processing production input and output data in real time whilst involving workers in management. It is noted that, like the Yangtze River Computer, Cybersyn 'places the human factor at the centre' and 'seeks to create a symbiotic system of diversity and autonomy between computers and organised networks of workers'. At the same time, the flow of information through the system no longer depends on a traditional hierarchical bureaucracy but instead on a structure in which 'the public and experts work together in a centrally negotiated way'.<sup>15</sup>

The film also identifies similarities between Cybersyn and the Angang Constitution (*Angang Xianfa* [鞍钢宪法]) of 1960—a set of management axioms derived from the practical experience of workers at the Anshan Iron and Steel Company.<sup>16</sup> Reflecting on the disparities present among the human components of Yangtze River Computer, Qian wonders:

Might the Angang Constitution be a solution to this difficulty? Should our researchers and leaders go down and participate in the computational work while more workers join the leadership group and participate in management?

15. Shi, *Qian Xuesen and the Yangtze River Computer*. Translation modified.

16. The Angang Constitution was designed to counter the outsized power of technocrats, which was seen to be affecting the operation of Soviet enterprises at the time, and to break the impasse in stimulating technological innovation in both China and the Soviet bloc. The larger context was the threat of capitalist restoration, which the constitution aimed to curb through mass political mobilisation. See Y.Y. Kueh, *China's New Industrialization Strategy: Was Chairman Mao Really Necessary?* (Cheltenham: Edward Elgar, 2008). In the Cybersyn system there are two ways to tame complexity. One is by way of rules, so as to make internal behaviour within the system more uniform, and the other is by granting autonomy and power to individual components so that they can re-engineer the underlying organisational structure in the face of emerging complexities. A comparative study of the Angang Constitution and Cybersyn certainly merits further treatment from the fields of media theory and economics. See S. Beer, *Designing Freedom* (Toronto: CBC Publications, 1974).

Should all rules and regulations found to be unreasonable be reformed? And should we implement an integration of workers, leading cadres, managers, and technicians? In the future, these will become the new organisational principles, the core algorithms of the project.<sup>17</sup>

As Shi's semi-fictional historical account reaches the era of Reform and Opening-up, Qian is forced to surrender the project to a wider scientific and industrial application in line with Deng's policy. However, he does not give up on the collectivist organisational principles inherited from the Angang Constitution. The result of this compromise is a parallel computing process involving both modern computer hardware and storage systems and the collective labour of the computing masses. Here Qian is depicted critiquing the American model of the personal computer:

I think the defect of the American computer is that, to put it bluntly, it is an object without a subject. If the Yangtze River Computer were to replicate it or to lose its original organisational structure, this would be equivalent to replacing the subject with an object and production with consumption. A total separation of the computational subject from the organisational mechanism would only transform the Yangtze River Computer into a sort of 'zombie computer'.<sup>18</sup>

In a final speculative leap, Shi traces Qian's deep interest in *qigong* and the 'special capacities of the human body' back to the work of his colleague at the California Institute of Technology, Jack Parsons, a rocket engineer under von Kármán who 'secretly participated in a communist discussion group with Qian' and practiced black magic, which he believed was 'theoretically intertwined' with quantum physics.<sup>19</sup> Amidst real reports from the provinces of children and workers able to 'read' Chinese characters without looking at them, see through barriers, or practice telekinesis, Shi's Qian Xuesen surmises that these 'special capacities' are the result of 'energy deviations produced by quantum leaps under unconventional conditions' occurring during secret government tests that took

17. Shi, *Qian Xuesen and the Yangtze River Computer*. Translation modified.

18. Ibid. Translation modified.

19. Ibid.

place during Mao's Third Front Campaign at sites close to the operational bases of the Yangtze River Computer.<sup>20</sup>

The film concludes by telling us that although Qian passed away in 2009, his theories, alongside China's real world-leading advances in quantum computing, have, by connecting somatic science, quantum computing, and the labour of the computing masses, led to the construction of a new supercomputer in which, following the original organisational principles of the Yangtze River Computer, the computing masses are not instrumentalised by a centralised control unit but incorporated into the computational process as its active components, evolving with and being emancipated by the technology rather than being alienated and enslaved by it:

The supercomputer is not a machine, but a symbiotic aggregate with computing as its organising technology. This 'cyborg', which includes all things in nature and all people, has another name: 'common cause!'<sup>21</sup>

\*

Through this mix of real and fictitious events staging an alternative history of computation, the narrative presented in *Qian Xuesen and the Yangtze River Computer* complicates the way in which futurism is often imagined in relation to China. It may be called a 'sinofuturist' film by some accounts, and yet it remains importantly distinct from Sinofuturism, an artistic genre that turbocharges technological imaginaries of China. With a touch of cyberpunk noir, Sinofuturism typically foregrounds the speed and velocity of technological innovation, ultra-efficiency as a mantra of statecraft, and bottomless obedient crowds as an abundantly available resource for technological development.<sup>22</sup> According to Gabriele de Seta, Sinofuturism operates with an aesthetic repertoire that

20. Ibid. In the film Qian proposes that, at the close of the period of *qigong fever*, state-backed claims of *qigong* being a delusion can only arise from viewing the practice through the lens of 'information individualism'—abstracting the human body out of the system it is embedded in and treating it as an 'independent computer'.

21. Ibid. Translation modified.

22. See L. Lek, *Sinofuturism* (中华未来主义) (1839–2046 AD), single-channel video, 2016, and V.L. Conn, 'Sinofuturism and Chinese Science Fiction: An Introduction to the Alternative Sinofuturisms (中华未来主义) Special Issue', *SFRA Review* 50, no. 2–3 (2020): 66–70.

is legible to an audience both inside and outside of China, evoking a sense of fascination, anxiety, and national or cultural pride. However, it reproduces techno-orientalist tropes and narratives premised on a 'denial of coevalness'.<sup>23</sup> The idea that China exists on a different timeline to the rest of the world, one marked by mechanical mass mobilisation, unites Sinofuturist imaginaries with the twentieth-century Western Left's fascination with communist states and their supposed anti-individualism.<sup>24</sup> It is also present in some local imaginaries, such as the infamous (arguably techno-orientalist) analogue computation scene in the blockbuster Chinese science-fiction trilogy *Remembrance of Earth's Past* by Liu Cixin. In a simulated world, Qin Shi Huang, the First Emperor of China in the third century BCE, orders his thirty-million-man army to enter a formation that allows it to function as a computer. Each soldier signals a binary value with a white flag for '0' and a black flag for '1', collectively forming the circuitry of an enormous motherboard.<sup>25</sup> In typical Qin Shi Huang fashion, the penalty for a soldier making a mistake and causing the computation to abort is execution.

These imaginaries of the human masses as a giant machine or robotic horde only replicate the assumptions behind the trope of the 'yellow peril', if not also fundamentally misunderstanding the paradoxical relation between living labour and dead labour.<sup>26</sup> The fiction of the Yangtze River Computer presents

23. G. de Seta, 'Sinofuturism as Inverse Orientalism: China's Future and the Denial of Coevalness', *SFRA Review* 50, no. 2–3 (2020): 86–94.

24. See for example B. Noys, *Malign Velocities: Accelerationism and Capitalism* (Winchester: Zero, 2014).

25. Liu Cixin, *The Three-Body Problem*, tr. K. Liu (London: Head of Zeus, 2016), 223–43. Importantly, the individual components do not themselves need to be intelligent:

'Instead of mathematicians, we'll use common laborers. But we need many of them, at least thirty million. We'll do mathematics using human wave tactics.'

'Common laborers? Thirty million?' Wang was amazed. 'But if I recall correctly, this is an age when ninety percent of the population is illiterate. Yet you want to find thirty million people who understand calculus?'

'Have you heard the joke about the Army of Sichuan?' Von Neumann took out a thick cigar, bit off the end, and lit it. 'Some soldiers were being drilled, but because they had no education, they couldn't even follow the drill instructor's simple orders to march LEFT-RIGHT-LEFT. So the instructor came up with a solution: He had every soldier wear a straw shoe on the left foot and a cloth shoe on the right. When they marched he shouted ... STRAW-CLOTH-STRAW-CLOTH... That's the kind of soldier we need. Except we need thirty million of them.' (225–6.)

26. 'Communist accelerationism', according to Benjamin Noys, tries to counteract the capitalist dynamic in which living labour (i.e. human workers) is squeezed out by 'dead labour' (i.e. machinery) leading to a lack of employment for human workers. It does so by reversing the dependence of living labour on dead labour and by fusing the human body of living labour with the machines of dead labour,

an alternative: it debunks both the universalist computer and the fetishistic, localist Sinofuturist supercomputer. In their place, it asks what other kinds of computation might be possible and desirable. Playing with truth and speculation, the film allows the intensities of the present to emerge rather than locking them into the models of a barbaric past or a fully automated machinic future. Qian Xuesen's work—especially his interest in collective *qigong* practices—suggests an alternative conceptualisation of the masses, of collectivity, and of computation. Rather than a throng of mindless workers at the disposal of an algorithmic regime, how might we think of a human mass that has *agency*? This is, in some ways, a philosophical problem. But Qian's speculations allow us to venture beyond the dominant Western cultural approach to computational paradigms, lending themselves instead to a 'cosmotechnical' approach. Shi Qing's vision of Qian Xuesen focuses on material constellations of technology, neither advocating for technological dominion over humanity nor for a scaling back of technology in the name of the human. The Yangtze River Computer is not a human-machine assemblage that leads to subsumption, servitude, and alienation, but it also resists the model of a grounded, 'local', cosmological episteme defined by practices that are small-scale, analogue, and communal. In the film, technology does not have to be voided of speculative dimensions to be viable. Qian's story shows how these practices can be lived and translated into concrete design.

In a conversation with philosopher (and ideologue of Eurasianism) Aleksandr Dugin, Yuk Hui suggests that if the Western model of technological singularity or 'AI takeover' marks the moment when human Dasein is destroyed, then instead of viewing 'the singularity' as the synchronised endpoint of history, we should diversify the notion of 'singularity' to take account of different endpoints.<sup>27</sup>

thereby forming living machines. (Noys, *Malign Velocities: Accelerationism and Capitalism*, Chapter 2, 'Leaps! Leaps! Leaps!: Communist Accelerationism'). Notwithstanding the continuities and ruptures therein, defining living labour as human workers and dead labour as machines simplifies the dynamism of capitalism. In a grander scheme that takes cycles of investment and the global market into consideration, dead labour can be analysed in Marxist terms as fixed capital, with investments in, for example, better machines and infrastructures realising their value over time and, along the way, enabling more production for a greater base of labour power. Hence, paradoxically, 'dead' labour leads to more 'living' labour, or the massification of labour and consumption at a global scale. See D. Harvey, 'Rate and Mass: Perspectives from the *Grundrisse*', *New Left Review* 130 (July/August 2021).

27. "'The singularity' has been commonly perceived as an endpoint. All civilisations and cultures—Russia, China—we are synchronised by this endpoint towards "the singularity". [...] [But] instead of converging and being synchronised to this singularity, is it possible that we will open it [up]—as a

Computational pluriverses can be conceived of by working backwards from the kind of endpoints desired by different communities. It would be possible, for example, look to traditional wisdom such as the Japanese *kami* (deities that are also forces of nature) to counteract the alienation caused by AI and enact a process of rehumanisation.<sup>28</sup> That said, a solipsistic retreat into a prepackaged cosmology threatens to be at best endearing but ineffectual, at worst a cold operationalisation of traditional knowledge. Benjamin Bratton warns of the pitfalls of this approach, for when divergence becomes a value in and of itself, we lose sight of technological viability. Importantly, the relation between convergent and divergent instrumentality and convergent and divergent epistemology (or cosmology) is not the same. As Bratton notes in 'The Stack at the Edge of Planetarity: Convergence, Divergence and War', '[w]e can imagine Stacks which are technologically diverse but cosmologically monocultural and we can imagine Stacks which are technologically isomorphic but animated by diverse cultural imaginaries (and presently, we have them)'.<sup>29</sup> For those of us with a specific interest in alternative paradigms of computation, the question that *Qian Xuesen and the Yangtze River Computer* brings to the fore is: Could we characterise Qian's design for a large complex system, in which human styles of thought and problem solving (such as *linggan* and *xingxiang siwei*) are reintroduced alongside somatic science, as cosmotechnical? If the Yangtze River Computer is the endpoint, where do we begin?

The work of Qian Xuesen diverges from today's dominant technological systems at both the instrumental and the epistemological level. However speculative Shi's image of the Yangtze River Computer, Qian clearly had an interest in viable reconfigurations of technological systems design. Given that Chinese computer scientists are still deeply influenced by his theories and are

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multiplicity, as multiple histories? [...] It seems to me that we need to diverge [from] this convergence—this to me is even more speculative than speculating on convergence on one point [...] and this is also the core of the argument of multiple cosmotechnics.' Hui, Yuk and A. Dugin, 'Technical Issues', *Sreda* (podcast), 2020, link no longer available.

28. J. Vallverdú, 'The Eastern Construction of the Artificial Mind', *Enrahonar, Quaderns de Filosofia* 47 (2011): 171–85; 177. Cosmotechnics, for Hui, is not necessarily related to computation but works as a sort of analogy for it, with Hui describing Chinese medical practice as cosmotechnical, expanding the definition of technology to encompass these 'minor' practices.

29. B. Bratton, 'The Stack at the Edge of Planetarity: Convergence, Divergence and War', in *Vertical Atlas*, ed. L. Dellanoce, A. Khalaf, K. Kuitenbrouwer, N. Nyabola, R. Roukens, A. Steiner, and M. You (Arnhem: ArtEZ Press, 2022), 276.

indeed working on contemporary implementations of Qian's legacy, this 'could have been' of computation is significant in more than just a symbolic way. There is a practical value to be discovered in rearranging the material assemblages of human-machine computational systems. For Qian, human *linggan* and the 'special capacities of the human body' are never presented as incomputable and therefore unoperationalisable. Instead, he was convinced that a time would come when research on their mechanisms would be complete and they could be fully incorporated into computation, completely transforming the contemporary, reductionist computational paradigm. In a similar movement of thought, can we not ask, what would the social use of a Yangtze River Computer look like in our time? And if the social(ist) reclamation of algorithmic organisation today involves mobilising the emergence of complexity against complexity,<sup>30</sup> can the speculative idea of the 'calculating masses' not be repurposed as a dynamic organisational structure to meet the demands of other kinds of complexities, specifically those that confront us in this current climate of geopolitical turmoil?

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30. See D. Saros, *Information Technology and Socialist Construction: The End of Capital and the Transition to Socialism* (Abingdon and New York: Routledge, 2014), and E. Morozov, 'Digital Socialism? The Calculation Debate in the Age of Big Data', *New Left Review* 116/117 (2019): 33–67.