

FACING THE FUTURE

Our Conversation with Professor Brian Arthur

Lawrence Burns and Paulina Sliwinska. First Quarter 2019



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International Concentrated Growth Fund Top Ten Holdings As at 31 December 2018

Holdings	Fund
Tencent	8.68%
ASML	8.00%
Alibaba	7.40%
Kering	6.88%
Illumina	5.20%
Amazon.com	4.64%
Ferrari	4.41%
MercadoLibre	4.27%
Inditex	4.24%
Spotify	3.72%

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FACING THE FUTURE

*International Concentrated Growth investment managers
Paulina Sliwinska and Lawrence Burns share thoughts on
future trends with Professor Brian Arthur, world-leading
economist and pioneer of the science of complexity.*

A well-established relationship between Professor Arthur and Baillie Gifford gave us the opportunity to spend time with one of the globe's most influential thinkers and economists.

As managers of Baillie Gifford's International Concentrated Growth (ICG) strategy, we were privileged to spend two days with Professor Arthur in July 2018. Our conversations took place at Xerox's R&D powerhouse the Palo Alto Research Centre (PARC), in the low hills fringing the suburbs around Stanford University.

Increasingly we believe the best way to minimise the risk of misunderstanding the future is to seek out those who have long-term, insightful and differentiated views. Whilst we do this as part of our company research we also decided two years ago to start doing this for the portfolio as a whole.

As with our interactions with the Copenhagen Institute for Future Studies last year, we were seeking a respected external party to provide an alternative perspective on our portfolio. We believe this critical process of tapping into the knowledge and experience of long-term thinkers generates new ideas, provides robust external challenge and acts as a potential risk control.

What follows is a summary of his responses to some of our portfolio holdings and questions from a general investment perspective.

ARTIFICIAL INTELLIGENCE

Professor Arthur told us that he attaches great importance to Artificial Intelligence (AI) and its potential effects on companies, economies and societies. He sees it as the most significant invention since the printing press in the mid-15th century.

That breakthrough made knowledge, often controlled by the church and kept in literal chains, available to share. By democratising knowledge and making it available for others to access and work with, it ultimately helped give rise to religious movements and new thinking contributing to the Renaissance, the Reformation and the Scientific Revolution.

For him, AI is the second great shift, but even more powerful because intelligence itself is being externalised, not just information. Predicting the impact of this is hard because there is no upper limit to intelligence or to the new structures it could engender. Johannes Gutenberg, inventor of the printing press, could not have predicted that it would lead to Newton's theory of planetary orbits, or the Industrial Revolution so we shouldn't expect to be able to accurately predict the changes AI will bring.

His views on what he calls 'combinatorial technological evolution' (successive breakthroughs achieved by combining existing technologies) are well-documented. Unsurprisingly, he believes radical change will follow as companies stick different pieces of externalised intelligence together.

For example? Chinese giant Tencent's ubiquitous social app WeChat can lend money using voice identification and algorithms scanning credit records and social media histories to instantly offer tailored interest rates and disperse cash whilst on the go.

Whether in retail banking, transport, healthcare or the military, industries are not only becoming automated, they are completely re-architecting the way they do business.

Professor Arthur believes that even technology economists miss the importance of this change because "they don't really know much about individual technologies themselves". If this is the case, then in our view this deficiency will especially apply in the field of AI, a hard-to-understand technology which attracts hyperbole, misunderstanding and dismissal in equal measure.





Johannes Gutenberg showing the first proof of the Bible printed on a moveable-type printing press he invented in 1439.

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His belief in the technological ignorance of economists led us to wonder whether they also disproportionately focus on outcomes with measurable outputs and clearer causality. For example, there are many studies about the economic impacts of the industrial revolution, which outsourced human and animal muscle to steam engines, but relatively little on the complicated chain of events following the invention of the printing press.

Similarly, he was sceptical about the usefulness of GDP as a measure in the digital and now AI age, as the economy moves ever more from the physical to the virtual world. For example, the shift from a postal system to email, which is more efficient but unlike stamps does not have a cost, so appears to depress GDP calculations.

Finally, building upon his comment that today's data was highly specialised and differentiated we suggested presenting the ICG portfolio according to the different types of data ownership. He thought this an excellent idea and we are now considering the practicalities.





FINANCE

Until fairly recently, Professor Arthur has been sceptical of Western incumbent banks' ability to adapt to AI and automation. However, a meeting with HSBC executives convinced him of their determination to take advantage of the opportunities these technologies are creating.

This change of heart is reflected in a shift in his own understanding of how businesses should approach AI. Rather than "crossing the Red Sea" which makes the task appear daunting, he now prefers talking about "Legos and small building blocks", allowing companies to implement simple, specific functionalities from the start.

In the case of retail banking technology, he sees China as far ahead of the pack, with tech companies driving the change. This is largely down to a more permissive regulatory atmosphere and there being fewer concerns around privacy,

factors which make it difficult for new entrants to gain banking licenses in the West. Also, the undeveloped state of China's banking industry and the lack of credit histories on most of the population incentivise innovation to address unmet needs.

By contrast, Western incumbents may be able to use small wins to leverage the vast amount of data they hold on their depositors. This should mean that retail banking in the US and Europe remains the province of the large banks. He believes that commercial banking is less suitable for AI implementation, because transactions are much more complex and don't lend themselves to off-the-shelf solutions. This could present an opportunity for new technologically-minded, nimble companies, perhaps making use of innovations in blockchain.

CHINA

Aware for three decades of the potentially transformative global role of China, Professor Arthur recalled asking a Chinese businessman in 1988 which Western products he was capable of reverse engineering and mass producing. He suggested cutlery designs. Professor Arthur pushed him on whether he could think of “anything more sophisticated?” An electric wok was the response. He pushed again. After consulting colleagues the businessman responded that, were he to supply him with an original, a nuclear submarine could be reverse engineered and mass produced.

Perhaps unsurprisingly, in his view the most interesting players in the Chinese economy are the internet titans. “Chinese internet companies could do anything so much better than the traditional economy, even running a cement company” he said. He also thinks we need to pay attention to Chinese biotech given the country’s combination of ambition and the absence of regulation.

Lack of regulation and concerns over data privacy were seen as an advantage for Chinese companies. Professor Arthur was convinced that a laissez faire attitude to privacy would not change given its long roots in Chinese history and culture. For several thousand years the social order has involved top-down rule, and its

citizens have never been granted much privacy, even before the arrival of Maoist Communism.

We touched on the topic of popular uprising in China and what this might mean. Brian thought the risk of this was very low. This view is partly based on his perception that greater trust in government prevails there than in the West. He also sees strong parallels with Japan in the 1980s, including a Confucian-based culture’s tendency to limit foreign access, which even a change of regime would be unlikely to change. Alibaba, Baidu and Tencent, he suggested, would probably carry on regardless.

He believes the US to have a two-year lead over China in AI. He thinks the gap could narrow, but was wary as to whether China could lead in invention and basic science anytime soon. He sees the US’ history of advanced technology as a key competitive

advantage rooted in culture with the process of invention being akin to a deep craft built over decades. His analogue was that science was like Cordon Bleu cooking. You can get it from a book but if you want to be really good you go to Paris.

Importantly though there is a difference between invention (basic science and research) and innovation (the application and adaption of invention for commercial use). We wondered whether China could still lead in the application of new technologies even if the US maintained an advantage in discovery. China could therefore still lead in innovation on the global stage. Indeed, we already have clear evidence that they are with Meituan in food delivery and Tencent and Alibaba having now effectively replaced credit cards as a means of payment.

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Beijing Skyline

BIOTECH

Professor Arthur believes that China's lack of emphasis on individual rights makes the country an easier place to innovate in biotech, especially in gene editing. He expects China to succeed in finding treatments for diseases linked to specific, missing or malfunctioning genes on the grounds that the discovery/testing feedback cycle will be much faster in China than elsewhere.

At the same time, while he was sceptical about the absolute advantage of large populations in a data-centric world, he conceded that China's demographics could be useful in terms of finding treatments for rare diseases. This makes sense – a sufficiently large population is needed to provide a statistically significant number of potential patients on which to test new treatments. There are around 6–8,000 rare diseases globally of which 80 per cent may have a genetic component, yet only 400 are currently treatable. While some, such as cystic fibrosis, appear much less common in Asia, the simple fact that China's population is four times that of the US should give it both more incentive and ability to treat in the future.



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POLITICS AND ESG ISSUES



We were interested to hear Professor Arthur's support for the idea that Europe leads the US on environmental, social and governance (ESG) issues. This is partly the result of a stricter regulatory framework, which is tough on issues such as monopolies. Europe could therefore act as a canary in a coalmine for global regulatory shifts that may impact our portfolio companies.

He would be particularly watching for increasing signs of social resentment, and believes that populism is clearly a growing issue which most economists dismiss. A large number of people are experiencing genuine

pain and suffering after being (mis) sold the dream of prosperity through globalisation and innovation.

Increasing automation means we will be able to continue producing more, for less, but it does nothing to solve the emerging problem of distribution. What we increasingly lack is an equitable and fair means of access to resources. This function is still performed by jobs and work, but as automation and AI continue, we will enter what he calls a new "distributive era" that will require a new solution.

As a result, he sees the likelihood of a basic income becoming necessary. He is not convinced by the argument that new jobs will be created to replace the old. We pushed him on this point, as excessive pessimism about jobs obsolescence is a mistake commonly made in the past, but he countered that even if replacement jobs are found, the process will take decades and involve much pain in the meantime.

CONCLUSION

Drawing a parallel between modern technology and the history of boom and bust in British railways, Professor Arthur described how hype about rail led to overinvestment, overcapacity, and finally successive corrections. Yet despite the intermittent pain and volatility, after each bust railways emerged even stronger and the total miles of track built continued to rise.

Similarly, while the dotcom boom was caused by overcapacity in fibre optics, 20 years later we have access to more varied digital services than we could have imagined at the height of the previous cycle. Perhaps a key difference in the technology boom of today is that it keeps changing and creating new possibilities from personal computers to the internet to the smartphone to AI. The boundaries of the possible keep getting pushed out.

Our five to ten-year time horizon provides a unique opportunity to put any fears over possible reversions in the context of the longer-term opportunity, giving us the freedom to envision a world well on the road to full automation, with AI-powered services giving us capabilities hitherto unimaginable. There will be risks and failures along the way – who could have predicted a nascent trade war and the possibility of self-imposed rationing in the UK 10 years ago? But the long-term trends are clear and gaining speed. Most of what adorns the front pages of the financial media will be historical footnotes compared to the technological transformations that await us.



PROFESSOR BRIAN ARTHUR

Based in the US since the 1970s, Belfast-born Professor W. Brian Arthur is a Visiting Researcher in the Intelligent Systems Lab at PARC in Palo Alto, California and an External Faculty Member at the Santa Fe Institute, IBM Faculty Fellow.

From 1983 to 1996 he was Morrison Professor of Economics and Population Studies at Stanford University and holds a PhD from Berkeley in Operations Research. He also has other degrees in Economics, Engineering and Mathematics.

Professor Arthur is credited as a pioneer in the science of complexity, and its relation to the high-tech economy. In the field of economics he has specialised in the ability of increasing returns to magnify the effects of small, random events on the comparative advantage achieved by some businesses. His 2009 book *The Nature of Technology: What It Is and How It Evolves* has been described as “an elegant and powerful theory of technology’s origins and evolution.”



ABOUT THE AUTHORS



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Investment Manager

Lawrence graduated BA in Geography from the University of Cambridge in 2009. He joined Baillie Gifford the same year and has spent time working in both the Emerging Markets and UK Equities Departments. Lawrence is co-manager of the International Concentrated Growth strategy as well as a member of the EAFE Alpha Portfolio Construction Group. He is involved in both listed and unlisted investing and travels extensively researching his particular interest in how pervasive technology and China are changing our world.



PAULINA SLIWINSKA

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Paulina graduated MA (Hons) Arabic & Politics from the University of Edinburgh in 2013 and joined Baillie Gifford the same year. She has worked with regional and global equity teams and is an analyst in the EAFE Alpha Team and co-manager of International Concentrated Growth. She is proficient or fluent in Arabic, French and Polish, and a CFA charterholder.

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