

‘Crossing the river by feeling the stones’

In this edition of *The Quarterly Interview: Provocations to Ponder*, eminent economist and tech historian W. Brian Arthur looks at how businesses can adapt to a world of continued uncertainty.

W. Brian Arthur is, among other things, one of the most influential economists in Silicon Valley. An external professor at the Santa Fe Institute and visiting researcher at PARC’s Intelligent Systems Laboratory in Palo Alto, Arthur introduced the concept that increasing returns could help tech companies lock in dominance. He has done extensive work on the science of complexity and is the author of several books, including *The Nature of Technology: What It Is and How It Evolves* (Free Press, January 2011).

Arthur believes that the current business climate alters a basic set of assumptions that we have come to take for granted and that business leaders must make significant changes to adjust to this new era. Different skills and different attitudes are required for this time of increased uncertainty. Resilience and adaptation are key. Tech companies and, yes, surfers can serve as role models. Arthur recently joined *McKinsey Quarterly* editorial director Rick Tetzeli for a wide-ranging discussion. An edited version of their conversation follows.

Rick Tetzeli: *Many people feel that we have entered a period of great uncertainty. Consider the title of the McKinsey Global Institute’s recent report The future of wealth and growth hangs in the balance. Do you think the mood of the economy has changed in some significant or fundamental way?*

W. Brian Arthur: I think we are living through a period of great uncertainty. There’s been COVID-19, disrupted supply chains, the war in Ukraine, a deterioration of relations with China, inflationary pressures. You could also add in the rise of generative AI and of hybrid and remote work. Most of these disruptions surprised us; they were largely unforeseen in advance.

Since about 2015 and 2016, we’ve been through a period of upheavals, one after the other. They are linked, to some degree. When COVID-19 came along, much Chinese

production ground to a halt and supply chains were disrupted. That meant that the flow of semiconductors to the US was disrupted, which meant the car industry was badly disrupted, cars became scarce, and inflation mounted. There was a chain of causality.

Now, in 2023, the economy is working again, and we feel we have things much more under control. And yet, things have not gone back to where they were before. The mood in the economy has changed. There's a feeling—a subtle one, I think—that something has been lost. What was lost, I believe, is trust: trust in the base arrangements of the economy, in trade agreements, financial arrangements, even democratic provisions, the reasonableness of judicial decisions, and the dependability of public health itself. Different countries have different versions of this, but wherever we are we don't feel we can quite rely on these things as before. And yet, these things are the ground level of how the economy operates. That slides us into a world of fundamental uncertainty.

Fundamental uncertainty is an expression economists use. John Maynard Keynes described this in 1937 before the war, when he wrote, "The prospect of a European war is uncertain, or the price of copper and the rate of interest 20 years hence. . . . About these matters, there is no scientific basis on which to form any calculable probability whatever. We simply do not know."

Not knowing might seem to be a sort of a nuisance affecting the kinds of decisions we have to make, but it's more than that. Not knowing has heavy implications. When you *really* do not know what's coming next, there's no logical calculus you can bring to bear, so the rational decision-making process gets ruled out. That means that the whole rational decision-making doctrine you're taught in business school no longer applies.

What's needed in this situation is not rational calculation but resilience. I define resilience as the capacity to respond, the ability to react appropriately, to deal with things, and even to do quite well. In a world where we don't trust the ground we stand on, what really counts is adaptation or resilience.

Rick Tetzeli: *How do you think the economy will respond to this uncertainty? Do you think there will be adjustments that can stabilize economies?*

W. Brian Arthur: One thing we can say is that an economy adjusts to some degree to fundamental uncertainty, and this happens automatically, almost in an instinctive way. Let me explain.

In a certain or well-grounded world, the one we are used to, you can rely on institutional structures and the social arrangements that go with these. You can rely on ground rules, partners, trading agreements, and legal structures. In such a world, it follows that you can put together alliances that work, you can build on what works, and you can set up arrangements to promote growth. You can reach out and create elaborate structures that are interconnected and complicated, with parts controlled by foreign partners, and these still work. In this world, you can dedicate your organization to growth and efficiency and reasonably expect to achieve these.

In an uncertain world, the one we are heading into, you are subject to surprises and upheavals, and you can't count on the grounding arrangements of foreign partners, outside alliances, and established compacts. You can still pursue growth and efficiency, but these count for less. Managing here is more about observing how the world is unfolding, making sense, exploring and adapting to uncertainty, and at an extreme the object here is staying in the game—survival. Here you need structures that are looser, lighter, and simpler. Elaborate structures are not appropriate—too many things have to go right, and too many outside agents need to perform as promised—so you create simple structures and bring things into your own control. You explore, investigate, find out what works. You can set up alliances or join ones, but these are often for mutual stability.

In an uncertain world, stability counts. It operates not so much under different rules but under different instincts. The instinct is, “What can I build up to rely upon? How can I get through this?”

Rick Tetzeli: *What happens to globalization as a result?*

W. Brian Arthur: In a world of certainty, globalization looks fine. The economic doctrine is pretty simple. The country you're offshoring to has cheaper wages. It can manufacture the same things more cheaply, and it can ship them to us more cheaply. We benefit, the manufacturing country benefits, and everybody's better off.

But in an uncertain world, offshoring may be inappropriate. Elaborate systems don't work, or the political structures may no longer align, and there may be a falloff in mutual trust, as with the US and China. Unforeseen upheavals may disrupt supply chains. All these impair offshore arrangements, and, if severe enough, it makes sense to bring production home and under domestic control.

I am sure there will still be much outsourcing in the near future, but it will cease to be regarded as the only option. For more complicated goods and ones that have to do with national security, there's an instinct—a sensible instinct—to bring items home and under domestic control.

Rick Tetzeli: *What choices do you see companies making that emphasize resilience and stability?*

W. Brian Arthur: In general, companies in the US and Europe are having second thoughts about having so much of their manufacturing operations abroad. It doesn't mean that they will bring everything home, but there's quite a lot of movement to bring some things back. For example, in 2022, the US decided that chip making was far too sensitive and important an endeavor to leave to China or even to Taiwan and passed the CHIPS Act [CHIPS and Science Act of 2022]. Similarly, the EU, and Germany in particular, had to bring home a lot of energy production that they had farmed out to Russia due to the war in Ukraine.

There is pushback against governments trying to bring things home. People say, “It's the government trying to choose the location of production. Don't we want to leave that up

to the free market?” I would answer with a guarded, “No, we don’t,” because of national security. I’m not against free markets, but I also do believe that if it’s risky, if you just don’t know what’s going to happen next, then you want to bring things much more under your own control.

Rick Tetzeli: *Is the focus on stability unprecedented, or does the global economy routinely go back and forth between an emphasis on stability and an emphasis on efficiency?*

W. Brian Arthur: I wouldn’t say the global economy routinely goes back and forth on this. But there have certainly been periods in which particular countries couldn’t trust the grounding arrangements of the economy. Overall, I’d say we have been lucky since the end of the Second World War. Out of the Bretton Woods Agreement and the reconstruction of Europe with the Marshall Plan came institutions like the International Monetary Fund, the World Bank, and other arrangements that fostered trade and economic growth. So until recently, we’ve had a largely unprecedented 70 years or so of stability and have come to take that as the norm. We’ve had a period in the sun, so all this instability is new to us.

Rick Tetzeli: *Will we get back to that period of being in the sun?*

W. Brian Arthur: I don’t think anybody knows, because the disruptions are coming thick and fast, and we don’t know what will show up next. There’s the climate and, as we’ve discussed, geopolitics. And, of course, technology is changing. We’re likely to get major disruptions from generative AI, which could lead to quite a rearrangement of the way national economies work.

Generative AI means that a lot of very deliberative questions about “white collar” work can be automated: “What would it mean for me to set up a new unit in Vancouver? What legalities and paperwork are required? Can you set up the paperwork for me?” Those are the kinds of questions that generative AI is likely to handle. That’s going to change how service and white-collar work will operate very deeply and in ways we don’t know yet.

This is where uncertainty comes in. We know that ChatGPT works reasonably well, but we don’t know what it will change. Will doctors be able to type in symptoms, and ChatGPT will give them the diagnosis? Probably. Will computer programmers be able to ask for code rather than having to write it in Python? Probably. But it is not just that an awful lot of human heavy lifting in white-collar work is going to change. Generative AI will alter how the economy itself works: it will alter existing industries and bring in new ones. But how that will happen is uncertain. We can’t say.

Rick Tetzeli: *Turning away from generative AI, what is the role of optimization in this more uncertain era?*

W. Brian Arthur: In a very stable world, where you know the probabilities and the risks, you can optimize. But even in that case, I would counsel against optimizing with a narrow criterion. I don’t think that is ever a good idea, because it brings brittleness to a system. This is because when a system is optimized, all its parts need to work properly, and some

are going to be working at their limit. For instance, you want a jet engine to operate very close to the limits of where the combustion chambers might melt down. If things go wrong, even minor disruptions can set off a cascade of failures.

In an uncertain world, optimization is even more iffy. You're just trying to get through this situation and be ready for the next thing coming up. Brittle optimization isn't appropriate for that.

Rick Tetzeli: *How should business leaders manage differently in this period, where stability is more important than optimization?*

W. Brian Arthur: One of the great lessons I learned in life happened in my 20s, when I used to do a lot of surfing in Hawaii. If you surf properly, you're in green water, not froth. The wave you're on keeps changing, but you can't predict how it's going to change, because of backwash from previous waves, so you're looking a little bit ahead and observing: "How is the wave going to break? Is it heading this way or that way?" You're adjusting your position on the board and your balance, you're watching, and you're not looking that far ahead. You're not looking at the shore.

The fun of it is trying to keep going in a situation that keeps changing. You're trying to stay upright on the wave. This is adapting to an uncertain world.

People talk about adapting all the time and being nimble and having flat hierarchies. I believe in all of that. But I want to point out something about adaptation. Adaptation doesn't really exist as a quality on its own. Adaptation lies in having at the ready a repertoire of available responses. In the face of being harmed from infections, human beings have an immune system. When the electricity to a South African hospital shuts off, the hospital needs to have backup generators. Adaptation means having a tool kit of backup preparedness: people, plans, responses, ideas, possibilities, attitudes, and equipment that allow you to construct solutions quickly.

Such tools might include having old hands around, people who can answer questions like, "How did we get through this before?" Adaption doesn't happen on its own; it happens by having a repertoire of available responses that lie in people's heads.

There's a lesson from biology that I like to keep in mind, Fisher's theorem, that goes back just under 100 years. It states that the pace at which adaptation can take place in a biological population is proportional to the genetic variation in the population. That sounds a bit obscure, but imagine you're in the Galápagos Islands. Imagine the climate has changed and finches now require longer beaks. You can't get to longer beaks unless there's enough variation in the population that some finches already have long beaks. They are the ones that will breed to get the population through the narrow tunnel of arriving at longer beaks. If none of the population has longer beaks, you're not going to get there.

The counterpart in business is to have a diversity of ideas, people, and designs to draw from as needed. Once again, you don't want to get too optimized, specialized, and efficient. It's good if you have some people around who know many other things.

Rick Tetzeli: *All this talk of adaptation makes me think of tech companies. Are there lessons from how tech companies have constantly navigated disruption that apply to today's companies trying to steer through uncertainty?*

W. Brian Arthur: Tech companies are always operating under uncertainty. They're always developing the next set of technologies, but they don't know how well those technologies are going to work. They don't know what their rivals are going to do or how well they're going to do it. They don't know what's coming on the market next or what the government regulations are going to be.

What they're looking for is survival until the next big thing. If this works sufficiently, they might be able to lock in the market and become the dominant technology. If they do it well, the prize can be enormous. If they do it badly, they just disappear. It's a very different mindset from, say, a beer-brewing business, which is more likely to be looking for incremental gains by doing such things as cutting costs or expanding into certain markets.

I think that most companies can learn a lot from high-tech companies, in terms of being resilient and adapting to change along the way. Working with the unknown is standard in tech. It means having shallower hierarchies, simply because people who lead these companies need to rely on the people who are getting them to the next technology. They want to know about that technology, so it can't be developed seven layers down the corporation.

Rick Tetzeli: *The adaptation mindset seems crucial to this time period. What else should leaders understand about it?*

W. Brian Arthur: Adaptation requires a mindset that deals with uncertainty. That's not a mindset so much of seeking ever-increasing profits and growth; it's a mindset, at least in the extreme, of survival. And it's a mindset of being prepared to let go of dearly held, constricting beliefs.

What you see again and again in survival stories is an attitude of, "OK, let's go from here and then make it to the next step. Then we'll see if we can make it to the next step." There's a Chinese expression about this that I like: "Crossing the river by feeling the stones." I believe [former People's Republic of China leader] Deng [Xiaoping] said this in 1984 when China was opening up to free markets. He meant proceeding gradually, step by step, and experimenting along the way.

You can see this attitude in the early days of the COVID-19 crisis, in March 2020. We didn't know how dangerous COVID-19 was, how the economy would react, or how lockdowns would work. We didn't know if we'd ever get vaccines or if they'd come fast or slow. We experimented with physical distancing, lockdowns, and working from home. Vaccines appeared earlier than expected: messenger-RNA vaccines were possible because much of the technology had been developed and was standing by. Different countries adapted in different ways, learning as they went, with varying success. But we all got through the crisis.

Rick Tetzeli: *In the early days of the COVID-19 pandemic, fear and confusion were present. Is this a normal part of adapting?*

W. Brian Arthur: Often it is. When things get badly out of kilter, fear can arise. That's inevitable, and it's always best to turn and face the fear. Confusion also arises, because uncertainty means that you're not quite sure what situation you're in.

That confusion is not necessarily a bad thing. It's actually a friend. I come from Northern Ireland. In the middle of the Troubles in Belfast, a BBC Television reporter asked a bystander, a middle-aged man, "What do you think is going on?" The man looked at him and said, "I don't know." The television reporter said, "It sounds as if you're confused." And the man said, "Mister, if you're not confused, you don't know anything." Confusion goes with this territory.

As I said, that's not a bad thing. Confusion forces you to think of a new version of your project or of your organization or even of yourself. Often, confusion remakes things or even remakes us. [Q](#)

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