The world is getting exponentially more complex. Here's how we navigate it

August 23 2022, by Ragnar van der Merwe and Alex Broadbent

Credit: AI-generated image (disclaimer)

Living organisms, our planet and even the entire universe are getting ever more complex with time. "Complex" doesn't just mean "complicated": it means that the parts of a system interact in ways that give rise to properties that can sometimes be quite surprising.

Whenever a certain threshold is crossed, a transition seems to occur in which some complex systems, such as ants or stars, develop the ability to construct further complex systems, such as ant colonies or certain chemical elements.

On Earth, organisms across kingdoms of animals, plants and microbes can also come together to form complex ecosystems. And we humans construct extremely complex social, institutional and technological systems. So complexity can generate more complexity.

Complexity can also develop the ability to manage, control and navigate the complexity it has constructed. We, for example, manage, control and navigate the complex economic systems and traffic systems we have constructed. In a sense, complexity can thus "turn back on itself."

This is a reason why complexity continues to grow. The process is iterative, generating exponentially more complexity over time.

Complexity theorists have thoroughly described how we act *on*—that is, manage or control—complex systems. However, it's less clear how we act *in*—that is, navigate—complex systems. That's because it involves making decisions without necessarily controlling the system to achieve a desired outcome.

For example, we regularly buy groceries in the complex economic system or cross the road in the complex traffic system. We do our best to manage our personal finances with short- and long-term goals in view, and we plan our daily commute to minimize traffic time. Regardless of how unpredictable complex systems can be, we mostly enjoy good levels of success when undertaking such actions.

Yet, we seldom stop to think about how this is possible.

Rules for navigating complexity

There are several ways to answer the question of how successful navigation of complex systems is possible. The "analytic approach" views complex systems as reducible to some simple deterministic law or set of laws that enable us to accurately predict how it behaves. Presumably, we can then act successfully in complex systems by learning and following these laws.

But most of us have no idea about the laws governing the economy, for example. In fact, if there are such fundamental laws, they are incredibly difficult to discover.

And, there is no guarantee that all relevant complex systems can be reduced to simple laws anyway. Some argue that a system that is reducible was never complex in the first place, but instead merely complicated.

Another approach, dubbed "postmodern," argues that there are no discernible laws for acting in complex systems. The postmodern approach considers complex systems to be unpredictable and chaotic, meaning that navigating them involves a kind of existential leap into the unknown—something like an act of faith. Presumably, successful actions in complex systems are then largely the product of lucky guesses.

The postmodern approach does seem to describe some decisions we make in the face of complexity. These include those for which there is little evidence and high uncertainty, such as whether marrying a certain person is a good route to a happy life.

However, the postmodern approach fails to account for most of the actions we perform in complex systems, including buying groceries or crossing the road. The decisions involved in such actions do not ostensibly involve leaping into the unknown. The regularity and reliability with which we perform them suggests that something less arbitrary—something more methodical—is going on.

Both the analytic approach and the postmodern approach have problems, but each nonetheless captures something important. Is there a way to get the best of both?

Rules of thumb

We believe that "reasoning heuristics"—more familiarly known as rules of thumb—are at work. In the context of complex systems, rules of thumb track "emergent" regularities rather than underlying, deterministic laws.

An emergent property is one that isn't fundamental, but arises from a large number of underlying interactions. For example, individual water molecules cannot ripple, but ripples on a pond can nevertheless emerge from their interactions.

In the same way, complex systems can sometimes be stable and law-like, seen at a certain scale, rather than chaotic, enabling us to make predictions. When circumstances are right, we can predict what a complex system will do from its past behavior, and this can inform our proceeding decisions and actions.

This process is, of course, not infallible. Sometimes, people go to the shop for milk and there is none; sometimes, people crossing the road are hit by cars. So, there is a sense in which we take a leap of faith, as the postmodern approach suggests. We trust that conditions are right for our rule of thumb to work.

Yet, there is also a sense in which rules of thumb are law-like, as the analytic approach suggests: they are, in a sense, methodical and also reliable enough to engender regular success.

Imagine, for example, that you are waiting to cross a road. You see a green pedestrian light, a truck moving towards the pedestrian crossing and various other details. The truck appears to be slowing down, so you infer that the truck driver is seeing a red light and will halt.

This is how you have generally experienced truck drivers behaving in the past (non-psychopathic and sober truck drivers with good brakes). The same goes for the behavior of traffic lights, fellow pedestrians and the like. So, you step into the road.

On the one hand, you are obeying a rule, even if it is tracking stabilities in complex systems rather than underlying, deterministic laws. On the other hand, you enjoy a degree of freedom to choose one course of action over another.

This happens when a threshold is crossed where complexity develops the ability to apply rules of thumb. The ability to apply rules of thumb might, in turn, equate to the ability to become an agent, something that has intention and therefore cognition. Perhaps, cognition emerges in the universe when complex systems like living organisms develop the ability to apply rules of thumb to successfully navigate the further complexity they create.

Provided by The Conversation

Citation: The world is getting exponentially more complex. Here's how we navigate it (2022, August 23) retrieved 24 April 2024 from https://phys.org/news/2022-08-world-exponentially-complex.html