

# emerald

**Creative practice**  
for a sustainable future

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Emergence is an initiative by Cynnal Cymru-Sustain Wales developed and presented in partnership with Volcano Theatre with the support of The Arts Council of Wales and British Council.

# Emergence - The Science

Today I am going to talk about worldviews. Where do they come from? How do they relate to science? What do they mean for the ways we engage with the world, ways to encourage sustainability and build resilience? And I want to think in particular about what all this means for artists.

Let's begin by thinking about science and the way it affects our thinking about the world. What is science anyway? You might say that the core of science, what most people think science is, is really based on the work of Isaac Newton in the seventeenth century. Isaac Newton is credited as being the scientist who finally got to grips with how the planets go round the sun. One of the things that people don't always realise is that Newton's physics, the mechanical science which underpins the dominant discourse about the way the world works, only actually applies to certain sorts of problems, such as the motion of things like billiard balls and planets. Furthermore his theory only works as a universal theory if you make some assertions about what is outside the universe. This most rational of sciences, when it's applied to everything, has to rely on peculiar axioms which sit outside the theory and cannot be proven, such as what God did before the beginning of time. Or how God periodically pats the solar system back into place to keep it flat. So, whilst it is a brilliant piece of physics for solving certain mechanical problems, we must be wary of applying it as a theory of everything.

It is interesting to ask why it is so popular as a worldview. Because, if we take Newton's theories as a universal truth, they tell us that the world is predictable, measurable, controllable and can be understood and managed by dividing it up into parts. So people like it; it gives a sense of control. But liking does not make it so.



**Dr Jean Bolton**  
Scientist,  
complexity  
theorist and  
change agent

Have we always thought about the world this way? I went back to look at the ancient cosmologies - the pre-Socratic philosophers in the West, and the Hindus and Daoists and Buddhists in the East. What do their ideas suggest? Here, we have an image of flow, of patterns that can emerge and reform, where new qualities can evolve. So this is very different from the mechanical world view.

I wondered what we could learn about the way the world worked from our personal experience. One of the ways I use to consider this is to ask people to

So what does our personal experience suggest about the way the world works? Sometimes the world changes fast. Small events can have large, unexpected and indeed unintended effects. Things are interconnected. We can't control what happens. We learn and change. Interestingly the Daoist and Buddhist views of the world as flow seems to fit with our personal experience and suggest that change can be - and often is - irreversible.

The next part of the story is to consider the theory of evolution. This was really important. Darwin's theory has very much in common with the emergent flowing view of ancient cosmologists, and in addition Charles Darwin was the first to recognise that messiness and variation are essential for change, are generative. We have to have variety and variation in order to have evolution. Nothing new emerges without diversity. This turned on its head a lot of scientific thinking and paved the way for new thinking which led to complexity theory.

A particular physicist working in the 1920s, Ilya Prigogine, said, "well we've got two images in physics; the image of a machine where everything stays the same and we've got an image of entropy from thermodynamics where everything decays. Why is neither of these theories consistent with evolution?" He got the Nobel Prize for recognising that the key, the answer, was in one word. This word is 'open': open systems. The physics up to that time had to focus on closed systems because otherwise the maths was intractable as nobody had computers, but when you actually start to look at open systems (and of course most things in our world are open - organisations, economies, ponds) they interact with their environment and there's a flow of information and energy and the potential for evolution and change. This led to the science of complexity.



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think back to when they were sixteen - "what did you imagine your life would be like; has it gone to plan". So of course when I do this people look at me as if I'm completely stupid and say "no of course it hasn't gone to plan," and I say "why not" and they say "well because I never had a plan," or "I've changed" or "things went to plan for a while and then something unexpected happened".

So what is the worldview that comes from the science of complexity? Firstly, everything is connected. You can't understand what goes on in terms of simple linear separable cause-and-effect chains. In general one action does not lead to one outcome; actually many things cause many things; it's a complex systemic process. Secondly, everything is unique. We are unique, our experiences are unique, our societies are unique. One size doesn't fit all; there's no right answer. Life is a path-dependent, historically based, emergent process.

The third point which is so terribly exciting and important is this point about messiness. Variation is generative and has a purpose; variation, diversity, messiness are essential for resilience and adaptation. The fourth point (that policy-makers and politicians do not like) is that the future is unknowable; unknowable but not random. In other words it has patterns. It isn't like everything is chaotic- the past does flow into the future but there are 'tipping points' when things can radically change. We're not always at a tipping point but there are times when the world can change rapidly and radically into something else. Runaway climate change is a really important example. If we were to be at the point of runaway climate change, there's really no going back. Upholding a mechanical worldview allows people to get complacent as it suggests things are reversible, we can always pull back. Civilisations never think they're going to collapse, but they do, as history shows.

So that's the kind of picture that the new science of complexity gives you.

So what I'm arguing is that complexity science, ancient cosmologies, our own experience and evolution all give similar views as to the way the world works. We have to really call into question our dominant Western methodologies which are based on

a mechanical worldview as to whether they're going to lead us to act in a way which gives us a sustainable and a resilient world.

So, what does all this mean then for resilience and sustainability and what does it suggest we should do? How could arts and culture in Wales make a difference? First we should build communities and relationships in the widest sense. Resilience comes from embracing connectedness and diversity; connected communities can share resources, pool skills, find new solutions as things change.

And because we cannot ever know what's going to happen, complexity theory emphasises the need to experiment. We can't know outcomes in advance, we have to build on what works and we don't know until we try. I find this very inspiring in the sense of it's about taking action – not asking if we have enough power or if it fits with a plan. You can never know the end point, so all you've got is the integrity of your action now.



And how can art help? I've got very, very interested in the issue of climate change denial. There's been an EU survey recently about the top ten things that people think are important, and only one in ten Europeans think that climate change is one of the top two challenges of our time. I speak as a scientist and I believe there is no question about it – there is absolutely no question about climate change. So what is going on? I was at a conference in Bristol recently where a very, very

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good articulate climate change scientist explained the issues simply and clearly - the best talk I've ever heard about climate change - yet people in the audience were still saying "well, I don't really know, is climate change really happening". You have to recognise that this reaction is nothing to do with reason and science but with emotions, with denial. I would say that the only people who can help combat this denial are artists. What art does, clearly, is engage with our emotions; it connects to the emotions and the spirit and can build images of the future that can both frighten and inspire.

I'd like to finish with the words of William James. His words, for me, capture the essence of the complexity message in a way which never ceases to move me.

"I am done with great things and big plans, great institutions and big success, and I am for those tiny, invisible, loving human forces that work from individual to individual, creeping through the crannies of the world like so many soft rootlets or like the capillary oozing of water - yet which, if given time, will render the hardest monument of pride".

A view of the world from our experience.