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The role of systems thinking and a complexity frame in the transition to a circular economy

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"Nothing grand has been achieved that did not come from an exaggerated ambition". Jules Verne

The Cradle to Cradle co-founder and architect, Bill McDonough, recently shared a story that illustrates this beautifully. When he started working with NASA, he heard this: "Kennedy call[ed] to be on the moon in 10 years. [The team in the USA made it] there in nine years. And when they looked at the average age of the team that put Neil Armstrong on the moon, it was like 28 years old. What does that mean? That means that engineers who heard Kennedy nine years earlier were just graduating [from] high school. They didn't know they couldn't go to the moon, so they did."[1]

'They didn't know it was impossible, so they did it.' That's what Mark Twain already told us.

It seems like a truism, but both Mark Twain and Bill McDonough make a point we often forget about. What they highlight is the creative power of inspiration, and the inhibitive potential of what we deem feasible or not.

Our beliefs or worldviews, our mental models, affect what we observe, analyse, understand and conclude, and most importantly – what we do as a result. Our mindset affects our behavior. When I was teaching in a secondary school, I would often say to my pupils: 'I can or I can't are both self-fulfilling prophecies.' What we believe is possible, will make it possible.

Is it possible to change the world, then, to move to a positive economic system? One that is restorative and regenerative by design.

Accelerating the transition to a circular economy is about shifting mindsets. Teachers are in the business of shifting mindset – that is why teachers and educators play a catalytic role in accelerating the transition to a circular economy.

When Ellen MacArthur graduated from high-school, she wanted to become a vet. Her teachers told her that she wasn't good enough, wasn't intelligent enough to do so. As she was revising for her exams, she stumbled upon a documentary that reignited her life-long dream... and she set her mind on pursuing a sailing career, with tremendous success. She was the first woman to circumnavigate the globe sailing single-handedly. More people have been to the moon than sailed around the world alone.

In a desirable way or not, it was her teachers who crucially influenced her view of herself and what she was capable of. Yet Ellen is an exceptionally strong character, and many other people would just have been left with a low self-esteem, if given the same treatment...

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[1] https://www.greenbiz.com/article/first-contact-team-future

Metaphors we live by

It is also in schools, that we get trained in the 'metaphors we live by', as the linguist George Lakoff titled one of his books. Let's take a simple example - we get trained to think of 'waste' as something useless that needs to be dealt with - preferably by someone else. What if we would learn to think of **waste as food** or as **'wasted resource'**? How would that change our attitude towards it and ultimately our behaviour?

Another interesting metaphor to muse about is how we think of the **'market' as a 'mechanism'**. The metaphor of a 'mechanism' assumes that it's easily fixable and simple. It implies that we just need to exchange the broken cog when something goes wrong. Talking about the market or the economy as a 'mechanism' also assumes that we are somewhat external to it, in a position of control. But all these implications are misleading. Might it be more helpful to think of the market or the economy as a 'metabolism' for example?

We also get trained to think that, when it comes to sustainability, we can only be less bad. That we can 'save the planet' by flying less, by eating less meat, by doing less and, really, by making ourselves as small as possible. That doesn't sound very inspiring or fun, but also, embeds metaphors in our mind that are frustratingly unhelpful when we actually want to rethink our systems.

For starters, we will never **'save the planet**' or 'hold it in our hands' - the planet doesn't need saving. The planetary system will rebalance after a tipping point induced by climate change. It might just happen that the conditions it rebalances in are not inhabitable for human beings anymore. What if we thought of the planet as the boundary to our habitat then and that we depend on certain conditions in order to continue living on it? Look for example at the definition of 'sustainability' that the student and teacher-led initiative 'compass education' came up with:

"Sustainability is a set of system conditions in which people can flourish indefinitely."[2]

They based their thinking on the sustainability compass by Alan Atkisson. Looking at the compass, it becomes clear that the image of 'saving the planet' is not very helpful – much rather, we need to learn metaphors that encapsulate the interconnectedness between the economy, society, well-being and nature.
We might need to learn to see them as concentric circles, with the economy being embedded in a society that is embedded in the natural environment. It's not a coincidence that that image inspired, for example, the logo of the Ellen MacArthur Foundation. ☺

But even more than just influencing the metaphors we live by, teachers can influence how we think about the relationship between different concepts or factors, and how comfortable we feel approaching complex issues, without defaulting to seeking simple solutions.

Getting comfortable with complexity

[2] http://www.compasseducation.org/benefits/

In school, however, we spend most of our time learning either about simple mechanistic systems with linear flows and simple connections or learning about completely unrelated chaos, when we study probability and statistics. Yet, in reality, we live in a world of complex systems, most of them complex *adaptive* systems. That is an important shift of mindset of what is important to understand during our time at school: complexity and how whole systems interact is key. Systems thinking can be defined as the "ability to understand how parts influence one another within a whole, and the relationship of the whole to the parts".
By the end of their time in school, students are often very well versed in reductionism... and already rather specialised, not to say 'silo-ed'. Students are educated for their working life using models that simplify reality into one-way relationships, with a strong focus on closed systems that are understood through the detailed study of their smallest parts. In other words, although the reality around us is characterised by a multitude of interconnections and compound causalities underpinning events, our students do not get trained in the habits of a systems thinker. Since we are speaking about the competencies that will equip students to play an active role in a circular economy, let me illustrate what good intentions without systems thinking can lead to. Let me tell you about Operation Cat drop.

"In the early 1950s, there was an outbreak of a serious disease called malaria amongst the Dayak people in Borneo. The World Health Organization tried to solve the problem. They sprayed large amounts of a chemical called DDT to kill the mosquitoes that carried the malaria. The mosquitoes died and there was less malaria. That was good. However, there were side effects. One of the first effects was that the roofs of people's houses began to fall down on their heads. It turned out that the DDT was also killing a parasitic wasp that ate thatch-eating caterpillars. Without the wasps to eat them, there were more and more thatch-eating caterpillars. Worse than that, the insects that died from being poisoned by DDT were eaten by gecko lizards, which were then eaten by cats. The cats started to die, the rats flourished, and the people were threatened by outbreaks of two new serious diseases carried by the rats, sylvatic plague and typhus. To cope with these problems, which it had itself created, the World Health Organization had to parachute live cats into Borneo."[3]

This did actually happen and these cat-drops happen all the time around us, because we are looking for quick fixes and don't consider the interconnectedness of the systems we intervene in. But complexity requires different habits of thought. One of the first habits in approaching complex issues might be to spend a little longer with a complex problem than feels comfortable. Especially once you think that you have found a solution spend a bit more time thinking about it.

The WatersFoundation has compiled a short list of 'Habits of a System Thinker' that are a good starting point for shifting a mindset. Once you start getting familiar and more comfortable with complexity, these habits of thought are helpful approaches to get 'un-stuck' when thinking about an issue.

Spending more time than seems comfortable with a challenge means taking time looking at the flows between the parts of a system, looking for flows of information, flows of materials, and flows of resources, and to observe how they change over time.

[3] http://www.catdrop.com

In natural systems, these flows are circular in the long-term and loops connect back in the end. Although talking about them as 'closed loops' might be misleading, because often there are leaks in loops that feed other flows. Take a tree for example. When it sheds its blossoms in the early summer, they fall to the ground and become part of the soil that does feed the growth of the tree again, but they also contribute nutrients to many other organisms in the tree's surrounding.

Humans used to be very comfortable with complexity, but with the Industrial Revolution, a different way of thinking about our environment and our resources evolved. Suddenly, we developed machines that drove unprecedented economic growth. This created a new worldview underpinned by the idea of control: we could predict what would come out of the man-made system, provided we guaranteed consistency of feedstock.[4] Thinking of processes and systems surrounding us as 'mechanisms' with cogs and wheels and simple causalities proved itself useful. So we developed the habit of thinking about the economy and its development in linear terms: taking resources – making stuff – disposing waste. Note how, if we exchange 'waste' for 'wasted resource' this doesn't sound like a very effective proposition anymore. Take resources – makes stuff – waste resources: It does make sense to turn this into a circle and underpin our future economic development with the framework of a circular economy.

Mathematics and science, maybe the industrial revolution, have made us believe that real systems around us are either simple and mechanistic or completely chaotic and disconnected. But in actual fact, most systems around us are complex and adaptive. They are influenced by deep interconnections and behave in ways that are unpredictable, but reveal patterns over time. The digital revolution enables us to understand ordered complexity better.

With the digital revolution in the late 20th century, our computing power has increased tremendously. This enables us to model complex systems now and observe their behavior over time. While we will not find exact solutions, this will enable us to spot patterns and define broad ranges within which events might occur. The weather is a good example of a complex system, although it's not very adaptive. But we have become quite comfortable with weather forecasts being approximately right, rather than precise, because they observe the big picture and generally evolving patterns.
The digital revolution allows us to become comfortable with unpredictability and uncertainty. It allows us to move away from concrete single answers to a range of possibility and a way of thinking that habitually answers 'It depends' to questions that might look for a simple answer.

Economic literacy

Coupled with this appreciation for and ability to deal with complexity, economic literacy is a crucial competence for a circular economy. Every single one of our students takes actively part in the production and consumption of goods and services, and seriously depends on the supply of money. Yet, economics often only gets taught at A-Level. In order to lead and shape the future, young people need to be able to understand and speak about the economic activities surrounding and involving them. Against the background of the digital revolution, the economy is

[4] Ellen MacArthur: https://agenda.weforum.org/2015/10/how-the-circular-economy-can-help-us-achieve-the-global-goals/

changing, fast. In order to lead fulfilled lives in spite of or thanks to this change, young people need to have the vocabulary, confidence and critical thinking skills to not only express their opinion about economic development, but also make critical choices in their own lives.

This way, teachers can exchange the mindset that the economy is a scary thing that happens to pupils for the idea of the economy as a complex system that arises out of individual interactions and in which we can have influence or 'agency',

In conclusion, education for a circular economy does not simply boil down to just more time spend on 'economic literacy' and systems literacy, - it's the mindset around why this is important and the vision that underpins this mindset. The vision for a future whose economy is regenerative and restorative by design will only become reality if we manage to shift our mindset to seeing the economy, society, the environment – in short the world – as complex interconnected systems with rich flows of resources, materials and information.

This shift in mindset in how to approach future challenges is key. Teachers are in a catalytic position in facilitating this shift in mindset that will lead to a different approach to resource and economic questions in the future.

In other words, this shift in mindset is the first important step in the transition to a circular economy – and you are in the best position to enable this first step.