ACTIVITY

03

EXPLORING SYSTEMS DYNAMICS – A SIMULATION

HOW DO COMPLEX ADAPTIVE SYSTEMS BEHAVE WHEN 'RULES OF THE GAME' ARE CHANGED?

CONTEXT FOR THE ACTIVITY

The economy is a complex adaptive system, just as most systems that involve human beings. Complex adaptive systems often behave differently to what we might expect. Small changes can lead to the whole system reorganising as a result of the relationship between different parts (agents) of the system. When we talk about accelerating the transition to a circular economy, these small, but catalytic, changes are essential to shifting the system.

RESOURCES AVAILABLE

- 3:R1a Intro PPT slide
- Stickers with numbers written on them (1-20 or however many members the workshop group has. A minimum of 5 people is advisable). There is no upper limit.
- Flipchart paper on a stand or whiteboard, with pens
- An open space large enough for the group to form a circle with one metre between each individual

ORGANISATION

Whole group activity. If there are more than 20 participating, split the group into 'participants' and 'observers'. A small number of these observers can assist the facilitator by watching the progress of the activity and helping with the debriefing.

TASK(S) AND RUNNING ORDER

1) Arrange the group into a large circle. Each person secretly decides on two other individuals whom they will 'follow'. Everybody begins to move to form an equilateral triangle with the two people they 'follow'.

2) Remove one person from the whole group. Group moves around again. Debrief.

3) Change one of the 'rules of the game'. Group moves again. Second debrief.

4) Reflect on the interconnected nature of the group.

TIMINGS

Overall approximately 45-60 minutes.

AIM OF THE ACTIVITY

This activity provides an experience of how complex adaptive systems behave. This simulation will enable and enrich a discussion of their key characteristics such as interconnectedness, compound causality, tipping points and phase transitions, resilience and 'dynamic equilibrium'. This experience of the abstract model can then be applied to (the transition to) a circular economy, deepening consideration of stocks, flows, feedback and change in general.

GUIDANCE FOR FACILITATORS INCLUDING DEBRIEFING NOTES

TASK 1

Give each participant in the group a number (making it visible by use of a sticker on each person). Ask everyone to form one large circle, leaving roughly one metre space between each other. Then ask everyone in the group to silently choose two other individuals in the circle, without speaking or making other participants aware of their choice. Indicate to the group that shortly you will ask each person to follow the two individuals they have chosen.
Note that this activity works best in silence. Participants should move without talking.

INTRODUCE THE FIRST 'RULE OF THE GAME':
Introduce the first rule which is that each member of the group needs to ensure that they and the two individuals they are 'following' organise themselves in an equilateral triangle - without talking! Allow 1-2 minutes to observe whether the 'system' stabilises in a certain set-up.

TASK 2

Then the facilitator should select one participant at random and lead them away from the whole group. After that, again ask everyone to continue 'following' their two chosen individuals to try to organise themselves in an equilateral triangle.

Stop/'freeze' everybody for a quick debrief (ensure that the everybody stays where they are):

What did the participants observe/notice/experience?

How did the system react when one participant was removed from the group?

What does this adaptive system illustrate about complexity? e.g. 'dynamic equilibrium', complex interconnections, feedback and time delay.

TASK 3

INTRODUCE THE SECOND 'RULE OF THE GAME':
Ask participants to organise themselves into a large circle again, while still remembering the two individuals they are following. This time, ask each member of the group to aim to align themselves equidistant between the two participants they are following. Again, allow 1-2 minutes to observe how the system self-organises. Select a different participant at random and lead him/her away from the group.

Stop everybody for a quick debrief: What did the participants observe/notice/experience?

How did the structure of the second system compare to the first one?

Why might it be different?

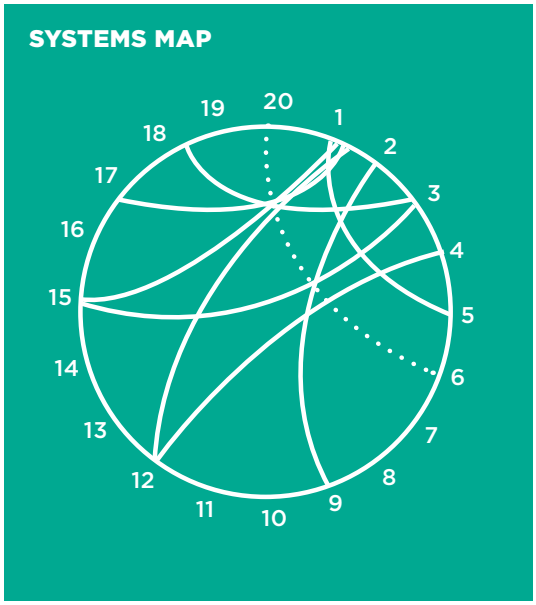
What can people deduce about the characteristics of complex adaptive systems? e.g. 'enabling condition', non-linear responses of systems, feedback and time delay.

TASK 4

On a flipchart, draw a systems map to reflect on the interconnected nature of the group; also introduce the idea of 'catalytic' points of intervention. Ask the participants to gather around the flipchart so that everybody can see it. On the flipchart, draw a big circle with the numbers 1-20 (number of participants) on the outside (see next page). Ask each participant to tell you the numbers of the two people they were following and draw a line from their number to the ones they were following. If you want to show the direction of influence, you can add arrows.

Once connections have been mapped, debrief with questions such as:

What do you notice? What can we infer about 'self-organisation' or 'relationships in the network'? Where might be the strategic points of influence, i.e. catalytic intervention points in the systems? In this final debrief try to draw attention to the



following points relating to complexity science and the circular economy:

There is no set equilibrium point but rather a range of possible states in which a given system can be stable;

Diversity is important for the resilience of systems;

Resilience is important in order for a system to recover from shocks or changes e.g. the planet's ecosystems can deal with increasing carbon dioxide emissions to a certain threshold beyond which conditions might drastically change, to the extent that the planet might no longer be inhabitable for human beings;

Systems develop based on their enabling conditions or 'rules of the game' e.g. an open plan office will create more interactions between people than individual offices for all employees;

There is an important difference between effectiveness (system optimisation) and efficiency (optimising parts) e.g. the production of cars might be most efficient when relying on a single supplier of parts. However, it will be more effective in the long run by having multiple suppliers - because it can continue producing cars regardless of the success of any individual supplier.

POSSIBLE EXTENSION ACTIVITY

To develop a conversation with participants about open and closed systems, ask them to read the short story *The Last Question* by Isaac Asimov: http://www.physics.princeton.edu/ph115/LQ.pdf

Ask them to reflect about boundaries of systems and the idea of 'leaky' or 'open' systems. How does the question of entropy relate to that? How does the question of entropy relate to the circular economy framework or the current linear economy?

As a starter or reflection on the importance of systems thinking, you might ask participants to read/research an event that has been come known as 'Operation Cat Drop'. Why is this story so well-known? Where else can participants see 'cat drops' happen? What can we learn from that? www.catdrop.com

SUPPLEMENTARY RESOURCES

A compilation of short videos and animations is available from the Complexity Academy. These may be useful for facilitators and workshop participants both before and after work on this activity.

https://www.youtube.com/channel/UCutCcajxhR33k9UR-DdLsAQ

REFERENCES AND FURTHER READING

Heinrich, S. & Jamsin, E. (2016) *What is Complexity? – A Primer for Educators* Ellen MacArthur Foundation

https://www.ellenmacarthurfoundation.org/assets/downloads/What-is-complexity_Ed-version.pdf

Booth Sweeney, L. & Meadows, D. (2010) *The Systems Thinking Playbook*: *Exercises to Stretch and Build Learning and Systems Thinking Capabilities*. White River Junction: Chelsea Green Publishing

Meadows, D. (Wright, D. ed). (2008) *Thinking in Systems – A Primer*. White River Junction: Chelsea Green Publishing

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This activity has been developed thanks to the inspiration from Linda Booth Sweeney's *System Playbook* and Mike Johnston's interpretation of the exercise. Thanks go to both individuals who are doing fantastic work making systems thinking accessible.

THUMBNAIL RESOURCES

CLICK TO DOWNLOAD HIGH RESOLUTION VERSIONS FROM BELOW

3:R1a INTRO PPT SLIDE