

# **The dynamics of transdisciplinarity: How does a group modelling workshop generate joint understanding and cognition**

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## **Abstract**

System dynamicists pride themselves in generating cross-disciplinary understanding and whole-systems perspectives through the use of a specific workshop structure, facilitation and visual boundary objects in group model building workshops. While there exist best practices in the form of scripts for how to structure a group model building workshop, it is not known in detail how the respective workshop activities generate cross-disciplinary understanding and a whole-systems perspective among participants. In this paper, we therefore offer a novel analysis of the dynamics across disciplines during a facilitated system dynamics workshop and profoundly examine these disciplinary transitions as well as the role of the facilitator. We also discuss how the workshop structure and its focus on causal boundary objects generate insights and thus provide an innovative dynamic view of what happens within a workshop and workshop session.

## **Key words**

Transdisciplinary research, group model building, heritage science

## Introduction and background

Technological and scientific development creates many knock-on effects and may change how people live and what they like. Such changes trigger novel questions for research, e.g. with regards to innovative practices or materials. These new questions may include how to deal with plastic waste, but equally also how to preserve plastics, e.g. if used to create very valuable objects. These novel questions are rarely addressed in one discipline but they require transdisciplinary collaboration. Yet, despite its importance, transdisciplinary collaboration remains rare (Cairns et al., 2020).

Systems research by definition allows for the integration of diverse knowledge. In particular participatory system dynamics, e.g. in the form of group model building has been used to understand complex interconnections (Vennix, 1996). Thus, the generation of transdisciplinary understanding and a whole-systems perspective are probably the core benefits of system dynamics and are at the core of what system dynamicists identify themselves with and are proud about.

Existing literature has found that participatory system dynamics increases communication among participants, their insights, consensus and commitment to action (Rouwette et al., 2002; Rouwette et al., 2011; Scott et al., 2016) and critical learning incidents (Thompson et al., 2016). There exists scripts to guide the underlying activities of the facilitator (Ackermann et al., 2011; Andersen & Richardson, 1997; Hovmand et al., 2013). Yet, with few exceptions (Dwyer & Stave, 2008; McCardle-Keurentjes & Rouwette, 2018; Yearworth & White, 2019), there is little insight into the micro-processes of workshops and corresponding micro-analysis of participatory system dynamics workshops.

Our study provides a dynamic view of a participatory system dynamics workshop. It addresses transdisciplinary interconnections, facilitation, communication and participants' impressions of the workshop. We carried out an in-depth qualitative communication analysis in a transdisciplinary heritage science workshop. We also analyzed additional interviews with participants. Hence, we provide an innovative dynamic analysis of a system dynamics workshop.

## Method

The workshop took place early in the project "COMPLEX: The Degradation of Complex Modern Polymeric Objects in Heritage Collections: A System Dynamics Approach". It tries to better preserve precious plastic objects, e.g. if they are part of museum collections and may deteriorate within short amounts of time.

In November 2017, we ran a group model building workshop with 13 participants and the facilitator to better understand the interactions between the chemical decay processes of plastic objects and the handling of these objects in museums. Participants were academic staff, researchers, PhD students and museum professionals. One of the participants was online.

The workshop helped to kick off the COMPLEX project and supported the development of a systems perspective and better project management. The authors were the facilitator (NZ) and gatekeeper and project lead (KC). The workshop lasted approximately five hours (including breaks). It included a *graphs over time* session, to sketch the past, most likely, feared and desired future behaviour of the variables they regarded most important for understanding the decay of plastic objects in museums. After prioritisation of the key variables, and a short discussion on the starting variable based on the ranking, the *group initiated and elaborated a causal loop diagram*, including graphs over time graphs from the wall as well as further variables when needed.

In order to capture the long-term effects of the workshop and the retrospective thinking of participants, KC conducted follow-up interviews with 11 of the 12 other participants in June to September 2019. They related to the interviewee's professional identities, their reaction to the workshop and its usefulness, insights, the CLD, language used at the workshop and transdisciplinary work.

The workshop and interviews were audio-recorded and transcribed. We conducted a micro-level workshop analysis of micro processes. In the analysis of these transcripts, we followed best qualitative practice (Kvale & Brinkmann, 2018; Strauss & Corbin, 1998) and innovated on existing practice where necessary.

## Results

Our analysis showed that the focus of the conversations shifts throughout the workshop. It 'oscillates' between more science and museum focused topics. It also transitioned between discussions at the level of the visual object scale most prominent to museum professionals, the material scale as well as the molecular scale most prominent to chemists. This also relates to higher vs. lower levels of abstraction.

Facilitation had an effect here. She asked questions, made suggestions, explained, reproduced what the group or individuals had said and directed the discussion by closing topics, opening new ones and by commenting on the direction of the discussion. However, we also observed that at times different participants took initiative to direct the discussion and thus temporarily adopted facilitator practices.

Concerning the workshop impression, participants highlighted the usefulness of the causal loop diagram created at the workshop. They also liked the transdisciplinary aspect of learning beyond their own discipline and learning how their work connects to the world of others. It helped not being siloed and created light bulb moments for some. Yet, not all had such lasting impressions that they still remembered 1.5 years after the original workshop.

## Discussion and conclusion

Our analysis addressed the lack of research into the micro-processes of workshops in the area of participatory system dynamics. It provided a dynamic account of how the conversation can go back and forth between disciplines during a workshop, and discussed these transitions and the impact of facilitation.

Our workshop was a special case and the beginning of the use of participatory system dynamics to improve interdisciplinarity as it mainly focused on the development of a systems perspective and the better research project management. Another example of such work was recently completed (Zimmerman & Pluchinotta, 2020). It seems to be a successful direction for future research.

We believe that our diverse disciplinary background hugely benefited the analysis. It allowed digging deep into molecular, material and object scales while at the same time analysing system dynamics processes and participatory facilitation. Practical suggestions for future work based on this include to use the interdisciplinary diversity better during follow-up interviews and to conduct them by an interdisciplinary team in order to ensure that follow-up questions can be asked related to all disciplinary perspectives from which the interviews are supposed to be analysed. Suggestions from workshops on participatory systems dynamics include using video instead of audio recording to link the text to the developing diagram.

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