

BREAKING BARRIERS, BUILDING BRIDGES: FOSTERING TRANSDISCIPLINARY LEARNING BY USING FACILITATIVE INTERVENTIONS

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ABSTRACT

Society faces grand sustainability challenges such as climate change and energy scarcity. These wicked problems are intertwined between disciplines, making boundary-crossing collaboration essential. Packaging design is an area strongly linked to sustainability, yet current development processes often operate in silos, failing to address the intrinsic complexity of sustainable packaging. To stimulate cross-boundary collaboration in this field, the learning community ‘Packalicious’ was launched in 2020 by the University of Twente, in collaboration with the Netherlands Institute for Sustainable Packaging (KIDV) and four Dutch universities of applied sciences. Packalicious has since evolved into a symbiotic, transdisciplinary ecosystem of learning, connecting over 12 educational institutions, 27 industry partners, and governmental stakeholders to address intricate packaging challenges. Across four years of multidisciplinary Packalicious sessions, several recurring challenges emerged: communication issues caused by disciplinary jargon, varying impact horizons of stakeholders, and the intangibility of the subject, which can hinder concrete decision-making. While collaborative tools and group dynamics exercises have been widely applied, these often risk ‘beating around the bush’, emphasising sustainability concerns without progressing toward concrete actions. During the scale-up of the learning community the critical value of facilitative interventions became apparent as a means to enhance transdisciplinary learning. This paper highlights the potential of such tangible entities to supplement abstract collaborative tools and accelerate cross-boundary collaboration. Tangible objects, artifacts, and designerly learning approaches can anchor discussions, foster shared understanding, and support the development of intrinsically sustainable product-packaging combinations.

Keywords: Transdisciplinary collaboration, boundary objects, learning community, sustainability, packaging development

1 INTRODUCTION

In industrial development processes, legislative interventions, and the public opinion, the focus on sustainability-related issues and considerations is becoming increasingly critical. For the field of packaging development, this materialises in intensified views on the two-fold role of packaging as a facilitator of functions throughout supply chains [1-3], and as a motivator in discussions on material use and waste. Through this, packaging is the ultimate enabler of diverse purchase, use, and disposal scenarios. Often, packaging is being regarded as superfluous and wasteful immediately after the completion of its role in protecting and delivering products. Operationalising the diverse and complex aspects of sustainability in the development of product-packaging combinations in a well-founded manner is the domain of design and development teams, in which different stakeholders shape multidisciplinary collaborations [1]. To nurture and secure these collaborations for future development processes, connecting and educating ‘designers of the future’ (addressing research, industry, education, and society) is essential. They must be able to navigate the boundaries of the disciplines involved and must be able to frame the problem at a systemic level [4], allowing new strategies and solution directions to emerge. The complexity of such educational endeavours is the outset of this research, for which the University of Twente started a learning community on packaging sustainability, together with the Netherlands Institute for Sustainable Packaging (KIDV, now renamed to Verpact) and four Dutch universities of applied sciences, in October 2020. This learning community was named ‘Packalicious’, and aims to empower education, governmental bodies, research institutes, and the packaging industry

in accelerating developments towards intrinsically sustainable product-packaging combinations, and the definition thereof, by means of transdisciplinary ways of collaboration. This must result in a symbiotic, sustainable ecosystem in which stakeholders from different disciplines bring together knowledge and learn *with* each other, rather than 'just' learn *from* each other [5].

Drawing from three years of experimental experience, this paper aims to distil lessons learned in (1) transdisciplinary collaboration resulting from the development and scale-up of Packalicious, and (2) its function as a learning ecosystem bridging cross-disciplinary gaps. This paper highlights the value of facilitative interventions (e.g., boundary objects and dedicated connectors) to further accelerate cross-boundary collaboration with a shared objective of fostering intrinsically sustainable product-packaging combinations, through answering the research question 'How can facilitative interventions provide value and facilitate boundary-crossing collaboration in transdisciplinary learning ecosystems?'.

2 VALUATING FACILITATIVE INTERVENTIONS

The effectiveness of transdisciplinary approaches in tackling the world's most urgent problems remains complex [8]. Stakeholders do understand the complexity and interrelatedness of the themes and see the need to act on these issues – however, steering towards transitions appears to be quite a different endeavour. The Packalicious learning community demonstrates that for a successful understanding of the complexity of impactful societal challenges (such as the acceleration of intrinsic sustainability in packaging) it is critical for stakeholders to look beyond each other's expertise boundaries. Boundary-crossing activities require collaboration, learning, and co-creation across disciplinary, cultural, and professional practice [9, 10]. To build bridges between the activities and learnings of the development and scale-up of Packalicious, and the added value of facilitative interventions and boundary-crossing activities, this research centralises the four learning mechanisms as proposed by Akkerman and Bakker [9]: identification, coordination, reflection, and transformation, which serve to enhance collaboration and boundary-crossing efforts.

2.1 Boundary objects and dedicated connectors

Crossing boundaries can be simplified when using boundary objects [9] in the co-creation process by different disciplines. Boundary objects refer to “an object, artifact or concept that serves as a point of interaction and coordination between different social groups or communities, particularly in situations where those groups have distinct, often incompatible, understandings or ways of working” [11]. They facilitate (1) effective communication, (2) knowledge exchange, (3) common ground sharing, (4) collaboration promotion, and (5) innovation and creative problem solving [9, 12, 13]. Most importantly, they drive transitions by bridging conflicting logic without constraining their diversity [14]. Boundary objects' main goals are supporting the transfer, translation, and transformation of knowledge [15]. Transferring knowledge is simply processing information, while translation focuses more on creating a common ground, and transformation refers to the conversion of knowledge into action [16]. These three levels are crucial to address complex, interdisciplinary issues and to jointly develop new insights and solutions. Figure 1 visualises different types of boundary objects, categorised in a matrix inspired by the Packalicious learnings. These axes were derived from observations across the Packalicious sessions, where different boundary objects served distinct roles in bridging disciplinary gaps. The horizontal axis distinguishes between digital, two-dimensional representations and physical, three-dimensional objects, while the vertical axis separates conceptual, domain-reflecting models from process-based models embedded in active making. Together, the four quadrants reflect how boundary objects can range from collaborative physical prototypes - such as LEGO models that symbolically represent reality - to conceptual mapping approaches such as gigamapping, which create structure and overview within complex problems. Rather than implying a hierarchy, the matrix acknowledges that different interventions serve different collaborative needs, and that the most effective learning within Packalicious often emerged when boundary objects from multiple quadrants were combined.

3 SCALING UP A LEARNING COMMUNITY

Launching Packalicious as a learning ecosystem proved to be successful [5, 6]. However, as the community expanded, specific challenges arose. In this paragraph the development of Packalicious is discussed, zooming in on the different iterations in the community's development and scale-up, and the effect facilitative interventions had on this.

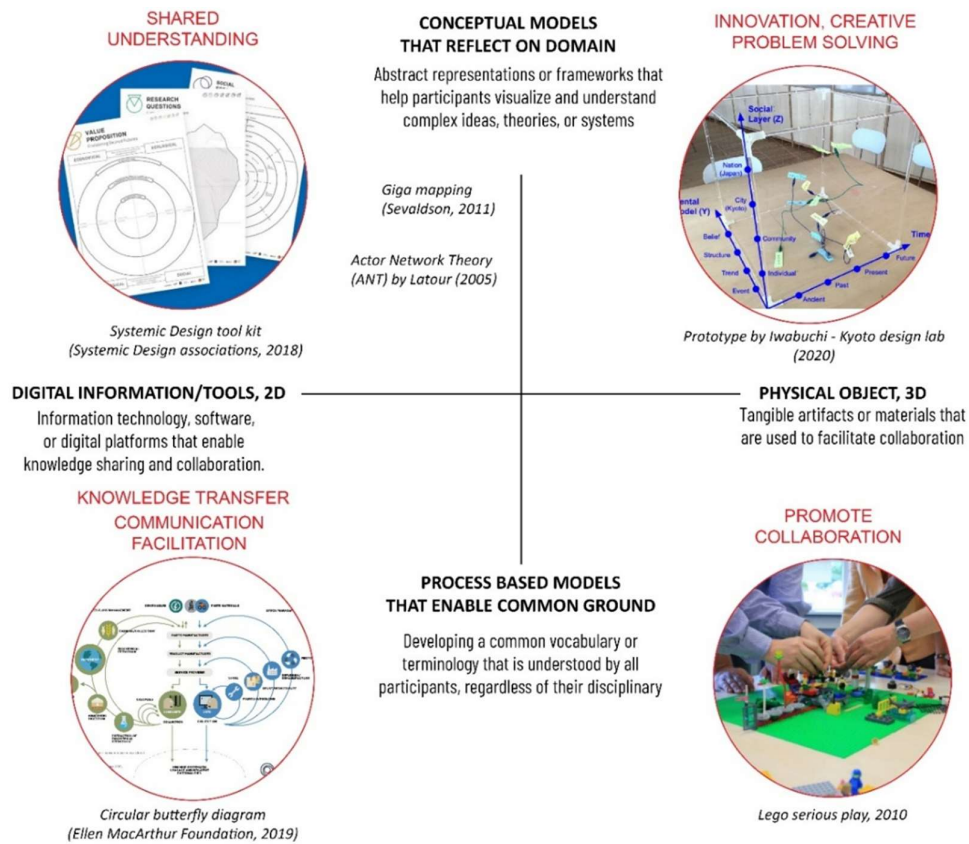


Figure 1. Overview of different types of boundary objects

3.1 Packalicious 1.0

The initial steps of the learning community development journey primarily focused on fundamental community building and the creation of a shared community vision by a core team consisting of students, lecturers, researchers, a packaging expert, and a packaging industry representative. Following, the learning community was launched during a live event. Two real-life industry cases were selected: ‘portion packaging’ and ‘reusable packaging’ (Figure 2), for which the challenges and solution space were explored in separate interactive sessions.

3.2 Packalicious 2.0

After the initial launch of Packalicious, its impact, value, and efficacy were evaluated through semi-structured interviews with packaging industry representatives, lecturers, and students [5]. The primary objective of this evaluation was probing the various stakeholders’ perception of the usefulness of the learning community.

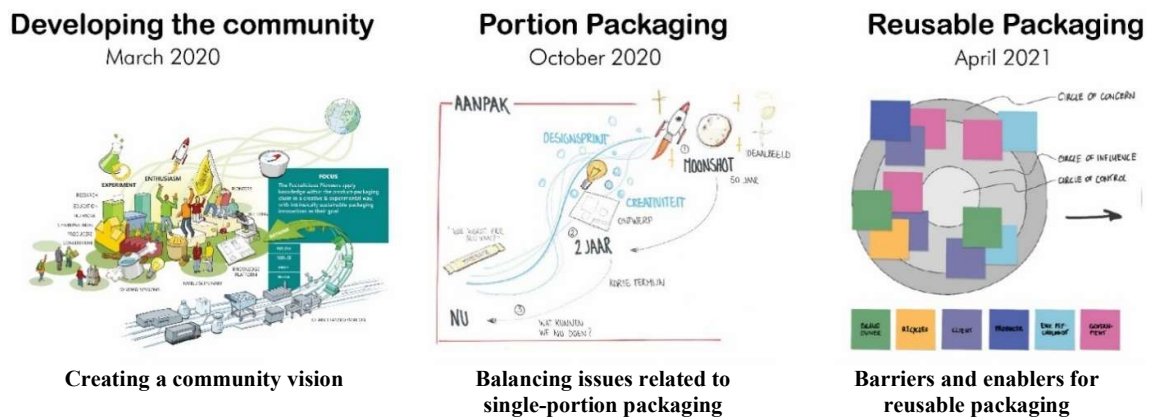


Figure 2. Chronological phases (interactive sessions) of Packalicious 1.0

After establishing that the results represent a successful and positive evaluation of Packalicious as a learning community, it was scaled up and further developed under the banner of Verpact. With this, the initial value of the learning ecosystem was extended to a more in-depth definition of intrinsic sustainability and a broader, more multidisciplinary stakeholder team. In combination, this fuelled the development of a strategy and research agenda on addressing the complexity of packaging sustainability, by means of various live interactive brainstorming and concept development sessions (Figure 3), with a broad and multidisciplinary representation of stakeholders.

Scaling up the learning community resulted in a substantial increase in the number of participants, which enriched discussions yet complicated collaboration. Boundary-crossing challenges such as communication issues (different disciplines speak different professional languages), stakeholders' varying impact horizons (short-term versus long-term solutions) and subject intangibility ('what are we working towards?') arose. These collaborative challenges complicate solving wicked societal problems [7], such as intrinsic sustainability - which Packalicious aimed to explore through shared case studies and interactive sessions. While developing the learning ecosystem as a platform, it was found that the strictly scoped case studies from the initial projects offered more guidance than the attempt to formulate overarching themes ('grand challenges') during Packalicious 2.0. Facilitating collaboration across disciplines in this endeavour proved to be a complex process, particularly when it came to aligning all expectations. During the scale-up of the learning ecosystem, the critical value of facilitative interventions (like boundary objects and dedicated connectors) as a potential medium to facilitate cross-boundary collaboration became apparent. In the next sections these facilitative interventions will be elaborated upon. The most recent iteration of Packalicious centred on the tension between standardisation and differentiation in sustainable packaging, bringing together stakeholders from supermarkets, brand owners, and knowledge institutes, alongside students from multiple backgrounds. Students acted as dedicated connectors, while industry and academic partners contributed practical examples - collectively mapping insights through shared boundary objects. This approach fostered shared ownership and engagement beyond individual curricula.

The Packalicious interactive sessions demonstrated the power of facilitative interventions which shed light on the connection between different disciplines, and which resulted in the definition of a shared vision. Examples such as in-process sketches by a visual notetaker and the Circles of Influence [17] functioned as boundary objects, framing the topic and aligning the participants' perspective variety. The scale-up of Packalicious indicated that (tangible) boundary objects provide a tangible perspective and a means to grasp the complexity of the design process. Figure 4 offers an overview of the boundary objects used in the Packalicious sessions. Two-dimensional visual sketches supported a shared understanding of how a complex problem could be approached in a practical way, the back-casting method bridged conceptual framing with collaborative action, and physical tools such as the Rethink Card Game fostered a deeper sense of connection with the subject matter, supporting both shared understanding and personal investment in the challenge. In-depth interviews with industry stakeholders and students showed that students started out uncertain in their facilitative role but became noticeably more engaged when working with boundary objects, picking up these tools more readily than professional participants did. The various Packalicious sessions demonstrated the central and directing roles the involved design students (the packaging designers of the future) adopted.

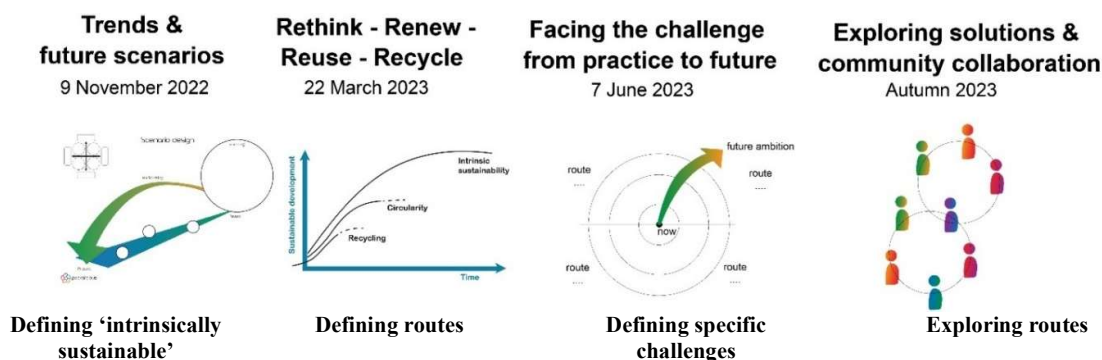


Figure 3. Chronological phases (interactive sessions) of Packalicious 2.0

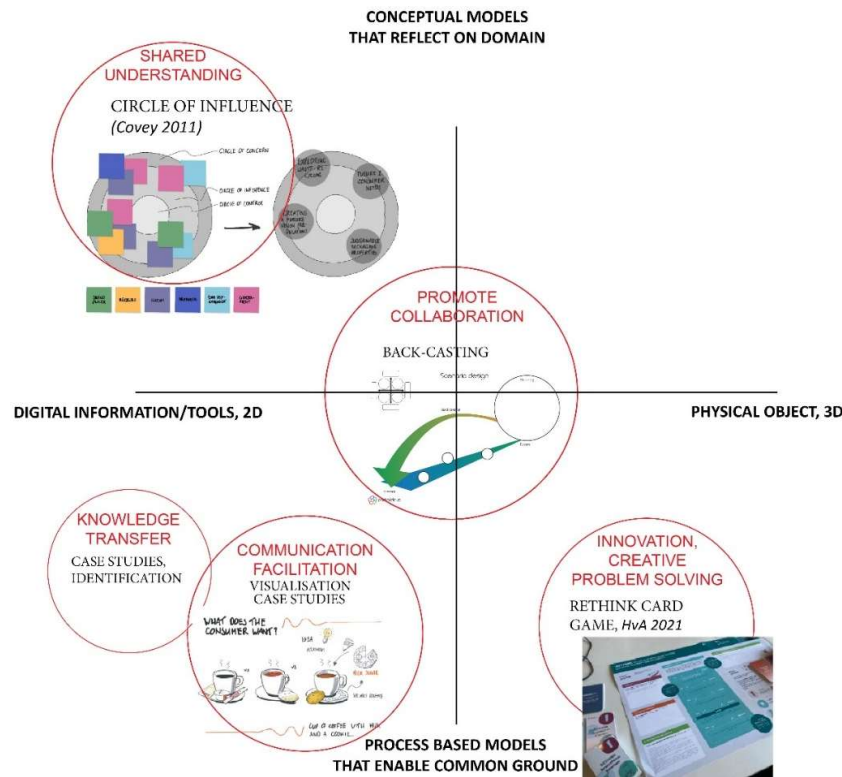


Figure 4. Overview of different types of boundary objects used in the Packalicious context

Often, they used boundary objects to steer discussions (echoing findings by Valk et al. [18]), and to ensure that the other stakeholders came to a shared vision and solution space. The students participating in the Packalicious sessions can be identified as dedicated facilitators, mediators, or connectors, in addition to their training as ‘traditional’ designers [19].

4 DISCUSSION AND CONCLUSIONS

With the description of the development and scale-up of Packalicious and the role of facilitative interventions in this, this research addresses the collaborative challenges that exist between disciplines. These stakeholders each have their own discipline, work methods, and specific professional language, constructing a diverse and therefore complex ecosystem. Aligning expectations among these diverse disciplines is not always straightforward, especially in the transformative phase [9], where the actual transition needs to be initiated. This paper argues that a solution can be found in effectively using facilitative interventions, such as boundary objects and dedicated connectors, as a learning means.

Designers (represented by design students in the context of Packalicious) can play a connecting role in this matter, by using these boundary objects to bridge cross-disciplinary gaps. They take on the roles of facilitators and mediators in transdisciplinary collaborations to ensure that the right connections are made. Their mode of problem-solving is more solution-focused by exploring several possibilities to find the optimal match. The development and scale-up of Packalicious demonstrate similarities to the initial two stages of the learning mechanisms. However, as was the case for the further acceleration of Packalicious, collaborations are often not successful in making steps in the transformative stage, to arrive at actions rather than just agreeing that something needs to be changed. For Packalicious, this hurdle which limits transformation can be identified as the result of the complexity of the challenge at hand, coupled with stakeholders' uncertainty about their role in the process. Stakeholders grasp the intricacy and interconnected nature of the themes and recognise the necessity to act on these matters, yet navigating the path toward transitions shows to be challenging.

This research argues that the combination of effectively using boundary objects and employing dedicated connectors adds significant value to cross-boundary collaboration and learning, answering the research question. It is the combination of the right balance of facilitative interventions (boundary objects, dedicated connectors, solid group dynamics) that leads to successful collaboration with the potential to look beyond boundaries and come up with innovative solutions. This paper aims to clarify

the designerly value of such interventions, for the application within the scope of Packalicious, and potentially beyond. This acts both as an answer to the research question, and as an invitation to the academic design research community at large to further discuss this and join in researching the transitional and educational value and application of facilitative interventions.

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