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Systemic Translation

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Translation has been highlighted as a feature of design practice that can be crucial in transdisciplinary research. The phrase 'from bench to bed' for example, describes how design can support the impact of science by translating fundamental research findings into products and services that benefit patients. This logic can be applied to any field where there is a gap between research and real-world application and use. Furthermore, the translational approaches practiced by designers, have been valuable in closing the gaps between disciplines in interdisciplinary research, through visualisation and materialisation However, when viewed through a systems lens, these horizontal and vertical framings for translation and boundary-spanning become problematic. Gaps exist between all actors where knowledge boundaries are experienced, not only between research and society, or between research disciplines. Translational practices within projects where systemic innovation, transformation or transition is the aim, need a different framing, that acknowledges and responds to, the complexity of knowledge and boundaries at play. This paper brings together the three theoretical constructs of boundary-spanning, systemic design and translational design to explore a new concept and practice: Systemic Translation. Four typical systemic frames are used to explore the concept of Systemic Translation in relation to a specific Systemic Materials Innovation project. The aim is to begin to understand how the systemic frame may benefit translational practices in complex transdisciplinary research and practice. The reflective discussion considers the role of a team in supporting

systemic translation, a pluralistic approach that acknowledges the dynamic and changing nature of system actors and their relationships, and the importance of boundary-object development and deployment in Systemic Translation that support knowledge flow across multiple levels and themes. The question of how to plan Systemic Translation methodologies when actors and boundaries are different with every new project is finally considered.

KEYWORDS: Systemic Translation, Boundary-spanning, Transdisciplinarity, Translational Design, Collaboration

RSD TOPIC(S): Cases & Practice, Methods & Methodology, Socioecological Design

Introduction

As research becomes increasing complex at the intersection of societal and environmental challenges, the imperative to enable knowledge flow between different actors has become the focus of work in many academic and non-academic communities. On the one hand, translation between scientific research and practice (or end-users) has been discussed at length in the emerging fields of Translation and Implementation Sciences with the aim of improving health outcomes (Drolet & Lorenzi 2011). On the other hand, knowledge flow is seen as essential if diverse disciplinary teams are to work together on collaborative outputs, which has been the focus of 'team science' and 'knowledge integration' research and described as 'interdisciplinary' (Vienni-Baptista, Fletcher, & Lyall 2023). Bringing these two schools of thought together about the necessary horizontal (across disciplines) and vertical (research to practice) knowledge flows in transformative research, has led to the notion of 'transdisciplinary' research.

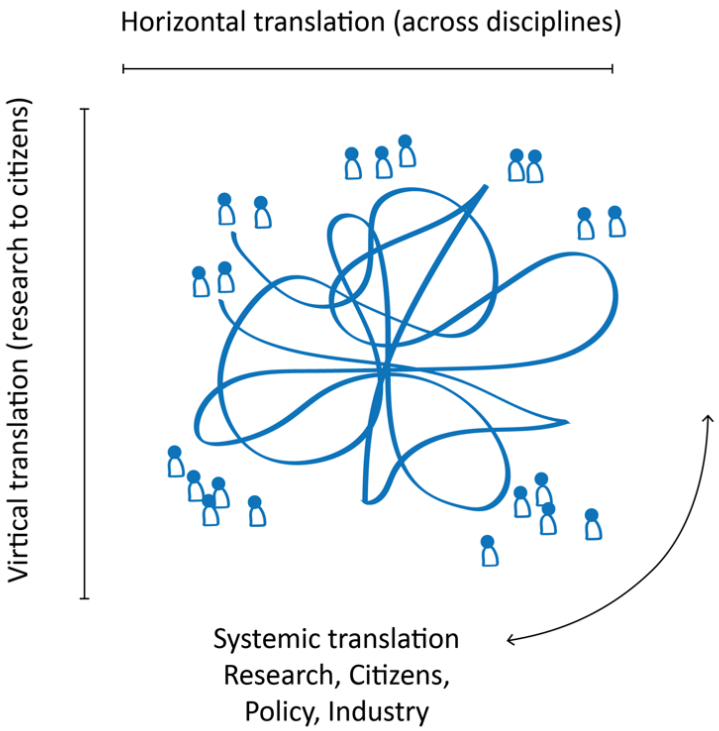


Figure 1: From Vertical and Horizontal translation to Systemic Translation (previously presented in Hornbuckle & Page 2024)

Within these two knowledge flows – vertical and horizontal – design research has demonstrated value as a facilitator of knowledge flow, illustrated in figure 1 (Nthubu et al 2022; Wizinsky 2019; Simeone 2019; Hornbuckle 2018). At the boundary with other disciplines, design methods subvert and renegotiate power, enabling knowledge mobilisation, collaborative learning and emergence. In turn, Rowan Page and I have previously argued that the boundary-spanning, bridge-building and knowledge integration roles that designers take on, can be explained by the intrinsic translational nature of design practice, an emerging sub-discipline that we have described as Translational Design (Hornbuckle & Page 2024).

Taking these discourses into the realm of systemic design, allows a further level of critique and theory-building. Thus far knowledge flow has been considered as linear and

compartmentalised – either vertical, horizontal, or a combination of the two, rather than multidimensional and complex, as is the nature of multi-actor systems.

This paper will consider the three discourses of boundary-spanning, translational design and systemic design together, to advance our understanding of what design does to enable knowledge flow in complex contexts of research. During the discussion I reflect on a specific project – Herewear – which piloted a Systemic Materials Innovation methodology incorporating translational design methods. The concept of 'Systemic Translation' is then presented and discussed.

Translational design

The study of Translational Design is relatively new and responds to a desire to align design capabilities to the challenges of impact-oriented research, which is a key priority of the wider scientific research ecosystem (Hornbuckle & Page 2024). Impact-oriented research necessarily involves collaborators from diverse academic disciplines and from other quadruple or quintuple helix organisations (society, policy, industry, environment). Operating in these projects which are commonly undertaken without provision for knowledge-integration (Hoffmann et al 2022), designers necessarily use their practices and approaches to bring knowledge together, 'building bridges' and lubricating the collaboration. This is essential for the task of 'designing' the artefact, whether medical device, garment, knowledge-based service - whatever it maybe. Without enabling the knowledge flow between collaborators, conventional design work cannot take place in a transdisciplinary way (Hornbuckle & Page 2024).

Within the projects I have been involved in, the act of translation has taken on different forms. For example, a prototyping workshop where the needs of the project are translated into a co-design process, or a design brief where inputs from different disciplines inform the frame within which the design activity will take place. Likewise,

I've observed designers visualise a cross-disciplinary discussion, create a map or a speculative prototype that brings different perspectives into a shared space. Designers have developed tool or guidelines that bring diverse expertise to a new audience, and commercial products that reconcile scientific, engineering, business, and manufacturing knowledge with service provision and patient dignity during treatment.

Designers perform translational processes intuitively during the design of 'a thing', but within complex multi-actor projects their translational role has necessarily expanded to build bridges and cross knowledge boundaries to activate the creation of collaborative outputs – it must be open and transparent so that collaborators can interrogate and 'trust' the inevitable reconciliation process, trade-offs and interpretations that have to be made during translation (Hornbuckle & Page 2024; Prendiville et al 2023).

Importantly, translational design takes place within a practice of care and trust. It requires a particular skillset and sensitivity as well as relational capabilities and qualities. Rowan & Page describe the translational designer as someone "who works with uncertainty and complexity, embraces iterative investigations, is a master of synthesis and interdisciplinary communication, disseminates research to wide and general audiences, asks naive questions, and encourages comfort with risk" (2019:702)

As a translational practitioner, I need to understand when to intervene and when to stand aside, what kind of translational process to perform and what interventions might be most effective. This role requires me to listen to the varying perspectives of different actors and be responsive to the often-conflicting priorities of the project aim, objectives, individual and organisational needs.

Boundary-spanning

Boundaries have been experienced, described, debated and acted upon extensively in diverse sectors and academic fields, for example organisational change (Rieple,

Haberberg & Gander 2005), education studies (Akkerman & Bakker 2011), and Sustainability studies (Goodrich et al 2020). Boundaries are understood to be socially constructed between different forms of knowledge, experience and values. Boundaries are intangible and difficult to identify, they follow the development of distinct communities and come into existence when someone from one community experiences differences in values, meaning, language, norms of practice in dialogue with someone from another community. Often this happens when seeking a partnership, or trying to access knowledge, and becomes particularly important in transdisciplinary research.

Boundary work has been highlighted by feminist sociologists as a form of structural inequality that systematically excludes, whether or not intentionally, some underrepresented people from participating in knowledge production and transfer. This happens by building a boundary between one community and another, through the use of exclusive language, forums and places where knowledge is shared (informally and formally) (Lamberg 2025). Conversely boundary-spanning takes place when one seeks to breach the boundary – a form of agency performed by people with a unique capability to be bilingual between different knowledge worlds, translating across boundaries (Rieple, Haberberg & Gander 2005). Boundary Spanners develop, adopt and adapt artefacts and language, often instinctively, as boundary '-objects' to create tangible anchors for exchange between different knowledge areas (Star 2010; Star & Griesemer 1989). The nature of boundaries - their operation, formation, and activation - is an area of debate between different epistemologies, particularly as they are socially constructed (Akkerman & Bakker 2011; Lamberg 2025; Star & Griesemer 1989).

In collaborative work, boundaries are experienced as differences in values, communication styles, cultures, norms of practice, language, and positionality, and can therefore feel like they make collaboration difficult and hinder progress (Hornbuckle 2022). However educational sociologists and philosophers have argued that learning

and innovation takes place at boundaries, and that it is only through dialogue at boundaries that 'change' can emerge (Akkerman & Bakker 2011).

Nevertheless, how these boundaries are 'transcended and transgressed' has become of increasing importance in transdisciplinary research (Hoffmann et al 2022; Vienni-Baptista, Fletcher & Lyall 2023). Moreover, designers have their own methods for enabling knowledge flow across boundaries that comes through their practice and tacit understanding of relating to and working with, others in the world (Hornbuckle & Page 2024; Hornbuckle 2022; Earley & Paine 2020; Haug 2019; Henchoz et al 2019).

Where boundary-spanning and translational design theories meet systemic design discourse

The first time I observed and documented designers using their translational capabilities to span boundaries was in the early 2000s, during an explosion of activity in novel materials development and application. At this time, I was studying for my PhD in London, UK, and immersing myself in the activities of several new materials libraries and their related knowledge exchange events. I saw that designers were adapting their intrinsic translational tactics to bridge the gap between materials science and design to help find new applications for novel materials, and help designers find materials to serve the needs of their design work (Hornbuckle 2010). My interest was in how alterative materials could contribute to improved sustainability and I was intrigued by how designers were repackaging material properties (which tended to be communicated in datasheets) into 'characteristics' and benefits for design, allowing designers to understand how they might be more effective for a 'more sustainable' product. Through their translational capabilities designers were re-packaging scientific information, using images, samples, language and narrative to mobilise the knowledge so that it was more accessible to designers and other creatives. Some notable people

operating in this way included Chris Lefteri (Lefteri 2014), Elvin Karana (Karana, Hekkert & Kandachar 2010), and Kara Johnson (Ashby & Johnson 2002) and many more.

This observed translational behaviour was typically occurring between one or two types of actors, in the space between materials science and design. As the research projects I was working on became more complex, involving more actors, I started observing the same boundary-spanning tendencies in my design practices and those of my design colleagues and collaborators, but this time we weren't only translating information between science and design, we were negotiating a web of knowledge boundaries experienced throughout the project ecosystem (Hornbuckle 2022).

As research projects have become systemic in nature in response to increasingly complex challenges, the boundaries between different forms of knowledge and experience are numerous, intersecting and entangled. Consequently, the boundary-spanning needs of the project have also taken on a systemic nature. When considering the translational needs and practices of a given systemic project or space, it can be helpful therefore to think about both the boundaries and the translational design approach as equally systemic in nature. That is, rather than assuming that boundaries exist between disciplines and organisations, as has been the dominant approach, taking the position of approaching a project as a system of actors with past, current and potential relationships, that might be explored and strengthened – in the spirit of Latour (1996) – through translational practice. This might include, for example, applying systems-thinking to the evolving project ecosystem; thinking about the boundaries as existing between multiple levels (after Geels 2002), or as having a shifting nature that is complex, dynamic, probabilistic and not visible as a 'whole' (in the spirit of Dubberley 2015). As typical of a systemic design practice, Systemic Translation might be at once a mindset, an approach to practice, and a set of tools and methods for approaching the challenge of boundary-spanning through a systemic lens.

These concepts provide a starting point for thinking about how translational approaches might benefit from a systemic framing. I will explore this in the next section while reflecting on my experiences of a specific systemic innovation project – HereWear.

The Herewear project

'Herewear' was a European Commission Horizon 2020 research project which aimed to 'empower bio-based, local and circular textiles'. The project brought together 15 partner organisations, including a stakeholder network – Textiles and Clothing Business Labs – and adopted a Systemic Materials Innovation methodology to activate the transdisciplinary collaboration.

Herewear subverted the science-led approach typical of material innovation research by integrating brands and designers into the development of the project ecosystem, both within the consortium and in the stakeholder community outside. The approach involved setting up and monitoring collaboration inside and outside the consortium through a 'methodology team'. I designed the Systemic Materials Innovation task and convened the Methodology Team to operationalise a translational approach, evolving methods from two previous consortium projects I had worked on – Trash-2-Cash (Tubito et al 2019) and Pharma Factory (Prendiville et al 2023).

The methodology team was situated inside the 'Communication, Dissemination and Exploitation' work package of the project, a mandatory part of Horizon 2020 projects, where all partners have allocated resource. The importance placed on this work package through the EC's policy, review process and resource provision reinforce its importance and leads to a good level of participation from all partners. This means that all partners share the responsibility for the Communication, Dissemination and Exploitation tasks, which in turn sets the stage for buy-in to the systemic and translational approaches which formed part of the work package.

The work package included partners from each broad area of knowledge within the project – industry, community, science, production, design –and this informed the membership of the Methodology Team. The team was tasked with supporting the collaboration inside and outside the project and identifying blockages to knowledge flow. When sticky patches emerged, such as disengagement, misalignments, or unresolvable disagreement, the team worked together to ideate, design and deliver interventions to build bridges and lubricate the collaboration.

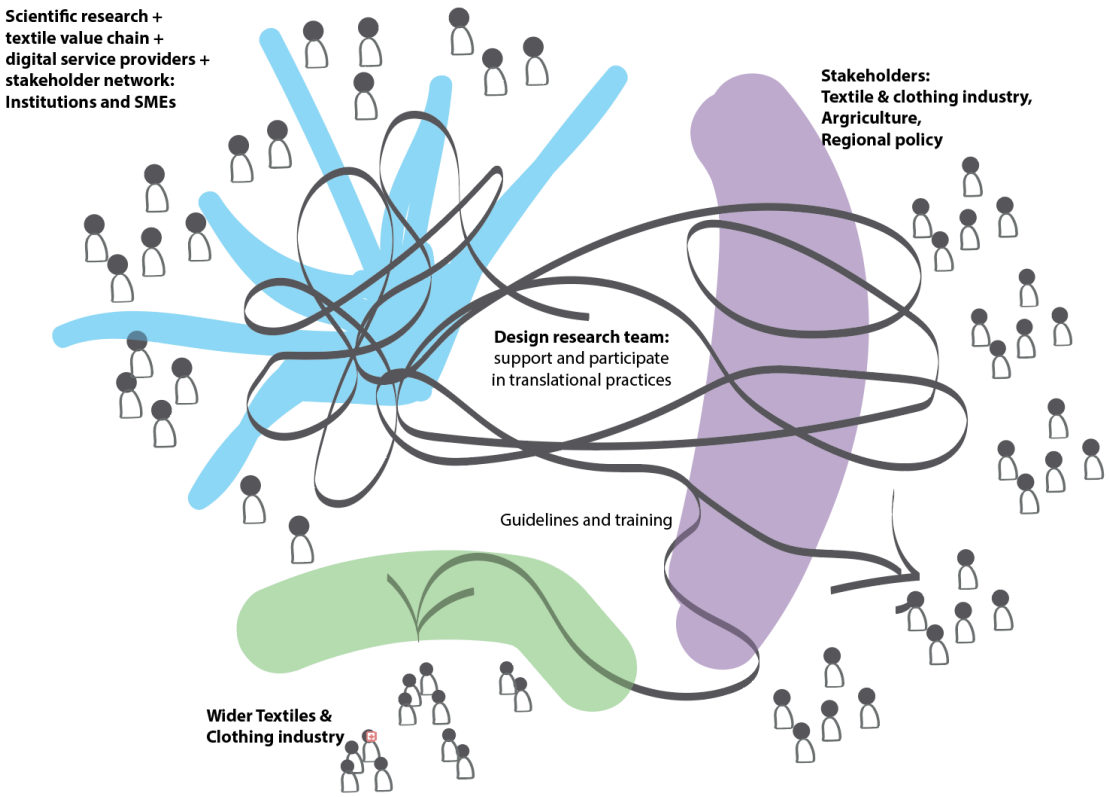


Figure 2: Author's conception of translational practice across three 'gaps', from Hornbuckle 2022, formed the basis for the translational design approach in HereWear.

The methodology design was based on my research, which at the time proposed three key boundary-spanning activities that translational design supports in complex innovation projects (figure 2):

- Between actors inside the research consortia
- Between actors inside and outside the research consortia
- Between the project and wider audiences

For example, in Herewear the translational approach involved:

- Working with the Project Coordinator and the wider creative team to design knowledge integration activities at anticipated moments where more intensive collaboration might help the project team move towards the next stage.
- Supporting community engagement professionals to enable knowledge flow from inside the project to the communities who are expected to 'take-up' the project outputs.
- Facilitating an iterative dialogue with the project partners and the stakeholder community, so that we might translate the guidelines created by each of the technical work packages into learning resources for the community.

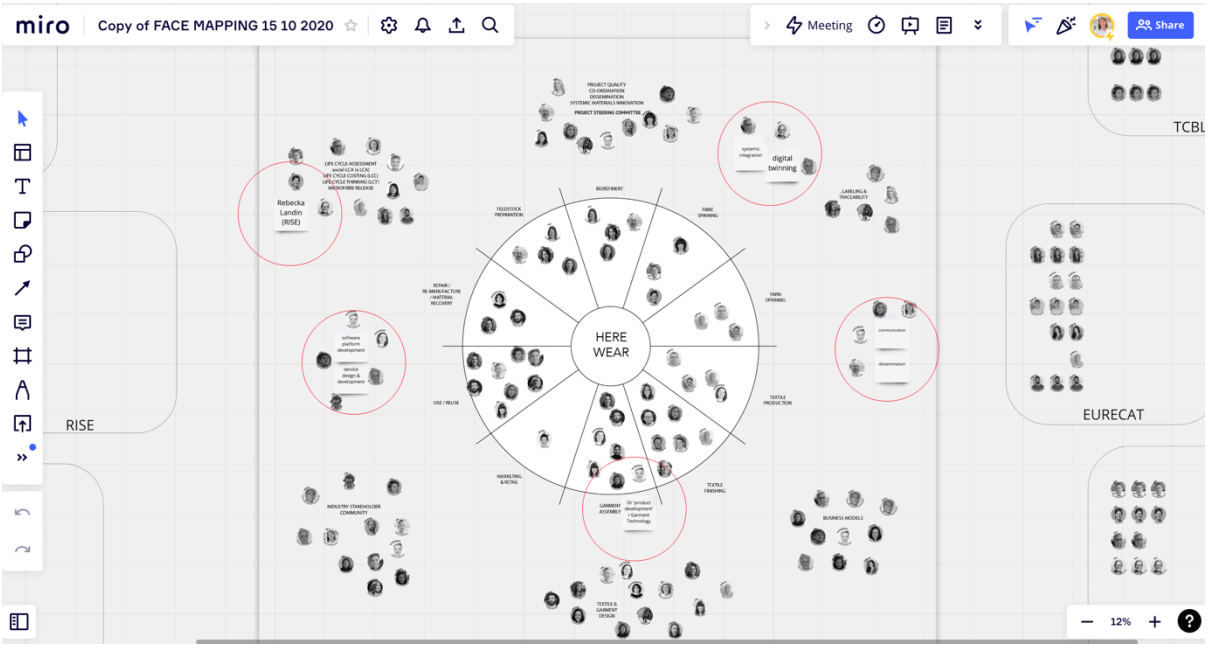
Although the Herewear project was planned and carried out in this way, the boundaries, the translational practice and the ecosystem itself was, perhaps unsurprisingly, more complex, messier and dynamic than anticipated. In the following discussion I explore how the boundaries and translational practice differed from what was anticipated and describe how the translational design process evolved in response to become systemic in nature.

It is also worth noting that the first 18months of the Herewear project was conducted remotely and online, with no in-person engagement because of COVID-19 lockdown restrictions, where travel and in-person gatherings were not permitted, and later not recommended.

Discussion

To frame the discussion, I draw on four system lenses or themes, introduced previously, as a starting point:

1. Conceptualising, visualising, materialising the project ecosystem
2. Translating to strengthen past, current and potential relationships
3. Translating across multiple levels
4. Translating across complexity



These frames are popular and familiar in systemic design discourse and are aligned to how the project unfolded. Although there are numerous systems characteristics and framings (complementary and competing) that could be applied here, these offer a useful starting point for thinking about how translational design might be altered by a systemic framing.

1. **Conceptualising, visualising, materialising the project ecosystem**

We kicked-off the first project meeting with a face-mapping exercise (figure 3). This is a method I developed for a previous project that allows partners to rapidly gain a first visual understanding of where they sit within the project ecosystem and in relation to one another; they begin to recognise one anothers' faces, building their 'know-who' understanding (Earley & Hornbuckle 2018; Jensen et al 2007). The online engagement unfolded as expected, until one partner queried the map frame – 'I would like to add something' – and asked to create a new area of the map. This person's act of system-forming and critique was replicated by others and accommodated within the map. The act of rebellion sought to undo and remake the 'project as written' which allowed collaborators to take ownership over the evolving project ecosystem and reshape it, challenging one anothers' perspective on how they view the project space, albeit in a

calm and mediated fashion. This activity revealed some important features of the partnership; that the participants as actors in this system were already demonstrating a willingness to engage in the process of subversion, change and emergence. However, the opportunity that was missed on this occasion was allowing the partners to develop the mapping further through the expansion beyond the consortium. Further mappings were conducted in other parts of the project and at different times, to describe the stakeholder community, as well as in collaboration with communities. However, these tended to be related to other tasks, conducted by different people, use different methods, styles and language, and therefore were not joined up to an evolving and expanding map of the project ecosystem. There is a plurality here that helped to create a rich picture of the HereWear ecosystem as it emerged and was imagined by different people in different contexts, however a 'meta' map that continued through the project would have provided a useful anchor for partners to understand the project (re)conceptualisation and activity as it evolved, and perhaps might have avoided some gaps being missed that opened up in the partnership towards the end of the project.

2. Translating to strengthen past, current and potential relationships

As discussed previously, translational design approaches have been used to enable interdisciplinary collaboration and knowledge integration. However, taking a systems-based actor network approach frees us from assumptions about where the disciplinary and cultural boundaries lie, perhaps paving the way for a different set of methods or approaches to translational design.

For example, to strengthen relationships in HereWear, the Methodology Team convened a series of 'Partner Talks', inviting partners to share their own passions and research which importantly was about transversal project themes and not related to specific tasks. With input from stakeholder engagement professionals, the Partner Talks combined the needs of the collaboration inside the project with the needs of building relationships with actors external to the consortium, to provide content for stakeholder engagement communication channels and meet-up events as well as an opportunity to build the collaboration.

While these were very successful for spanning boundaries early on in the partnership, the activity tailed-off, in part due to resource allocation and perhaps also some complacency crept in, leading to a belief that the task of partnership-building was complete, or that the subject matter of the talks had been exhausted.

Taking into consideration the idea of actor networks and "the careful plaiting of weak ties", as Latour (1996:370) describes, could have given more continuity, energy and purpose to this endeavour. By conceiving actors as more-than- human individuals, that connections are not all born equally, and that actor networks are never 'complete' but continue to evolve, "weave" and self-organise (Latour 1996:370). In a very practical way this manifested in the changing personnel on the project, as some people left their jobs and new tasks began. The nature of the stakeholder community also changed and understandings within the project about the emerging ecosystem, it's nature and

challenges, also remained rich and relevant. In hindsight, although the suggestion was made to look beyond the consortium for other 'actor' perspectives, this wasn't pursued, in part because of the anticipated need to develop a brave space of trust and open dialogue for the partnership inside the consortium first, and because resource had not been allocated for this.

Furthermore, we might have taken into consideration the influence of previous relationships that were evolving alongside new connections, and the interaction between them – how this disrupted some relationships and made some collaborations closer and more closed than others. The messiness and dynamism of relationships within actor networks is a useful systemic framing for translational practices that aim to integrate knowledge.

3. Translating across multiple levels

Multiple perspective levels were already represented within the project tasks, allowing partners to work at the 'niche' level (materials, garments), 'regime' level (industry, business and established production methods and processes), and 'landscape' level (EU industrial & agricultural strategy, incoming regulations, dominant and evolving production models). What we needed to do within the Systemic Material Innovation task, was to ensure that the knowledge flow was kept alive both within each level and between them. The Methodology Team pursued this through open discussion, by considering the wider landscape perspectives alongside possible interventions for developing materials literacy and collaborative language at the level of materials and garments, or through value chain or business model conceptualisation, and scenario-building. The systemic nature of the guiding vision – biobased, local and circular – guided and supported this narrative and the effort needed to enable the knowledge flow. The systems literacy of the Methodology Team members was another important factor for success, as well as having members who moved between different

work package forums, making connections through translational acts between them. Two people took on this boundary-spanning role – me and a fibre scientist – between us we attended most of the work package meetings as well as the Methodology Team meetings, and one was also part of the Coordination team. This allowed concepts, activities, and challenges to be translated and seeded throughout the project ecosystem. This meant that the different levels could 'mingle', influence and challenge one another through dialogue, giving the evolving project ecosystem the sense of a connected 'wholeness'.

Perhaps one of the most important areas where design practice can have a distinctive influence on boundary spanning is through the creation, adoption and adaptation of boundary objects. These might be worksheets, material samples, prototypes or maps, all of which were in play during the Herewear project. One example at the 'niche' level was the development of a material language and dialogue, we called 'material conversations'. Still operating within travel restrictions which meant we had to collaborate online, we hosted a touching and sensing experience based around material samples, where designers and materials engineers shared material samples (by post) and then discussed these samples in terms of their characteristics and affordances (online). Participants were located in several different countries which shows how translational acts can transcend challenges to proximity experienced in systemic innovation (Hornbuckle 2023). Developing a material sample system language was important to anchor discussion and avoid confusion, which could be considered a form of boundary object. Paying attention to developing this detailed conversation at the level of materials, supported the multi-level dialogue, although this happened in an adhoc way. Framing the translational tasks within multi-level perspectives could have enabled the Methodology Team to identify gaps in information flow that might have supported the emergence of systemic transformation opportunities.

4. Translating across complexity

A central challenge is that each new collaborative 'project' is unique– different partners, personalities, configurations, tasks, relationships, co-ordinator style, participation style and so on... This is even more the case with systemic innovation projects where the subject space is already complex, the approach designed to accept and explore complexity, and the actors (both inside and outside the consortium) are numerous - their past, present and (speculated) future connections are complex. Within HereWear, the Methodology Team worked to openly explore this complexity through discussion, proposing different frameworks and trying out different approaches. The atmosphere was generous, inquisitive, open and caring, which allowed the translational approach to be responsive and evolve with the needs of the project and the emerging understanding of the project ecosystem. For example, one of the main unknowns when a project is written, are the capabilities of the partner organisations and the individuals who eventually participate. Capabilities and affordances only become apparent through relational approaches such as the Partner Talks and co-design workshops. Although I had written a structured translational process into the bid, as discussed earlier, given the capabilities of the partners, their openness to engagement, their systemic literacy and so on, the translational process could have been much more fluid in practice to respond to the complexity of the project. In some ways the balance between the structured methodology and the experimentation and responsiveness of the Methodology Team was necessary, given the unknown qualities of the project and the level of methodological specification expected by the funder. However, a systemic approach to translation might involve accepting the inevitable risk in adopting a fluid and responsive approach, where a significant portion of the strategy for knowledge flow, both inside the consortium and with other actors and communities, is developed once capabilities are better understood. This might have led to closer and more meaningful collaboration between consortium members and members of the community from the outset, and a less sequential and mediated approach overall.

However, this will be different for each project, with some partnerships requiring a high level of mediation to achieve knowledge flow, while others – like Herewear – may enjoy a more organic and participatory style of collaboration. Both scenarios can benefit from translational practices, but while the set-up may be the same, the strategies, tools, and activities developed in response to the partnership would be quite different.

This is where a design-based translational practice becomes valuable; each Systemic Innovation project represents a different 'design brief' and requires a tailored creative response.

Conclusions

Translational design is proposed as set of practices that address the challenge of knowledge flow between different forms of knowledge needed for Transdisciplinary research and practice. Within a systemic innovation 'project', designers addressing knowledge integration, must take into consideration a set of competing and messy conditions that cannot be simplified or compartmentalised as 'across disciplines' or from 'bench to bed'. A systemic framing for translational work is needed. Within this paper some typical features of systems have been explored as ways of framing translational practice in reference to a specific Systemic Materials Innovation project – Herewear. The discussion aimed to tease out how a systemic frame might have benefited the translational work within the project and revealed some interesting starting points for further consideration.

The translational designer cannot perform the task of knowledge integration and translation within a systemic project on their own, they may orchestrate the process, convene and serve, but there are other necessary conditions for success. There needs to be 'buy-in' from within the management and coordination team as well as from the wider ecosystem of actors both inside and outside the project. There also needs to be a

small team of allies who are systems-literate and open to exploration, openness, care and methodological experimentation. Therefore, the practice of translation becomes infinitely more complex when practiced within a systemic innovation space.

The complexity of knowledge integration in systemic innovation projects could provide a rationale for why design practice approaches may be better placed to facilitate knowledge flow than some of the rigid frameworks that have been proposed in the sciences. I would argue that it isn't only the stand-alone 'replicable' methods and processes – whether it's a hackathon, a reflective practice session, or a citizen assembly – that aid knowledge flow, it's also the 'translational practice' itself which builds over time, an understanding and an attentiveness to specific signals, constellations of methods, and the narrative of the collaborative space. As with any practice, it also requires the 'nouse' to adopt and adapt tools and methods to fit the needs of specific knowledge integration contexts.

Although the project methodology was designed based on a previous model comprising three distinct areas of translational design activity – between partners inside, between the project and the outside community, between the project and wider audiences – systemic innovation projects are not so neatly compartmentalised in this way, and a sequential approach might not always be appropriate depending on the competencies of the partners. Rather we should be aiming for a Systemic model of Translational Design in impact-oriented research which recognises the diverse boundaries in complex transdisciplinary research, takes a truly responsive and practice-based approach, thereby accommodating a more dynamic knowledge flow between actors.

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