



Building bridges & creating pathways

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LIFECYCLE THINKING

KNOWLEDGE EXCHANGE

DESIGN RESEARCH

DESIGN EDUCATION

1

Introduction

Nobody is an island. As Reverend John Donne said, we are all a piece or a part of the main. Therefore, in order to avoid isolation, we need to connect to those around us. Design is a rather young discipline that, while small, is flourishing with variety. Our little design land is shared by communication, graphic, industrial, accessory, fashion, and textile design to name only a few. Island life is thriving and therefore, it is easy to forget that there are other islands of knowledge just a short distance away that have developed their own cultures; so different from our own. To build bridges and exchange knowledge, we need to find ways to communicate and combine different perspectives. This is especially vital when we endeavour to find solutions to complex problems that no-one discipline alone can solve.

As the world strives towards sustainable transitions, it requires multi/inter/trans-disciplinary teams to combine knowledge and develop solutions. However, these islands of knowledge can be difficult to bridge. In the context of the ReSuit project (Recycling Technologies and Sustainable Textile Product Design), this chapter will explore what role design research can play in building bridges between a

variety of stakeholders, including the social sciences (anthropology), and STEM (process engineering). This form of terrain, one with multi-stakeholders, can be tricky to navigate. This is particularly true, based on my - the authors - own experience (Hall, 2021), with industry partners that often work at a different pace and have different perspectives to their academic counterparts.

This chapter will explore specific examples of how Design School Kolding (DSKD) and other funded research projects have constructed bridges for easier communication and collaborative working methods that could be applied to the ReSuit project. However, it is ultimately the pathways these bridges create that form the core of this chapter. To continue the metaphor, a bridge provides access, enabling you to get where you want to be, but you need to know where you are going first. For sustainable transitions, we need a clear route forward, not just for the industry and academic stakeholders but for the next generation. So, the questions I am asking are:

**How has design research built bridges between stakeholders?
How can we use this knowledge to map pathways for knowledge exchange with the design school?**

2

Background

As it becomes more and more urgent that we address the world fast approaching environmental crisis, a greater emphasis is placed on coming together towards a sustainable transition (Messerli et al., 2019). According to the European Environment Agency (2019), the fashion and textile industry is the fourth highest-pressure category for the use of primary raw materials and water, after food, housing and transport. To address this problem, the circular economy model is proposed, in which resources are kept at their highest value during use, re-enter the economy at recovery and never end up as waste (EMF, 2017). It is often hailed, across the design field more generally, that 80% of the environmental impacts are determined at the design stage (Graedel, Comrie and Sekutowski, 1995; European Commission, 2012). This places a lot of the responsibility on the individual designer. Yet, as Hornbuckle (2016) explains, the designer is often constrained by the existing systems, supply chains and methods of production, and in reality, this change can only take place with the support of a large number of actors.

2.1 ReSuit Project

Funded by Innovation Fund Denmark, the ReSuit project focuses on developing textile recycling technologies together with textile user behaviour data and strategies for circular design. The three-year research (2021-2024) brings together process engineering specialists and chemists developing polyester recycling technologies (Fraunhofer Institute, Aarhus University, Danish Technology Institute); anthropologists, investigating consumption, use, and disposal of clothing (NaboSkab); and design researchers exploring design strategies for the improved circulation of our textiles in a circular economy (Design School Kolding). These experts are joined by central danish industry stakeholders in fashion (Bestseller), textile hospitality (Elis) and fuel (Crossbridge Energy).

Together the research explores key elements of the textile lifecycle. First, the use phase, exploring how textiles are currently used, and how this could be done differently towards more sustainable goals. Second, the recovery stage, where technologies are being tested to enable recycling of textile back into clothing or, if this is not possible, be used in other industries. Finally, using these insights, circular design guidelines for industry will be created to ensure product longevity (extending the use) and materials longevity (recycling textiles).

2.2 Why am I writing this chapter?

As the postdoctoral researcher on the ReSuit project and a fairly new member of DSKD's Lab for Sustainability and Design, I am writing this chapter both for my myself and for others that would like to work in a similar way. Imagine, if you will, that I have walked to the topmost point of our little design island. From here I can clearly see the other lands of knowledge surrounding us. Bridges have already started to be built, but as soon as I descend to the ground the way forward will not be so clear. I need a map, so I know which way to go.

Reviewing the landscape, design schools are buzzing with activity but the pathways from larger research projects appear narrow and

under-used. If the future generation of circular design students will become the industry that we seek to transform these pathways are vital for the sustainable transition. This chapter is my way of exploring the bridge building activities that have already started in this space and use them to map a path between the ReSuit research and the design students at DSKD.

2.3

Methods

As the project remains in the early stage, I was unable to base the chapter on the experiences of the ReSuit project itself, therefore I have investigated this using a range of relevant case studies. Each section is structured by describing a case study from within DSKD itself drawing on publications, student work and a short email-based interviews about past and future practice. Second, a range of European fashion/textile-based case studies are drawn upon. These have been sourced from information provided in published papers and reports.

3

Role of Design

Design as a field has been largely ignored by other disciplines. We see evidence of this in large multi/inter-disciplinary research projects that exclude design researchers, such as REACT (2019), addressing the problematic waste acrylic textiles produced from outdoor awnings and furniture to be transformed safely into new products. While this research brings together a wide range of technical expertise and collaborates with industry partners, it does not involve design research. This is not necessarily a problem, but it does miss out on the variety of approaches that design offers in this space.

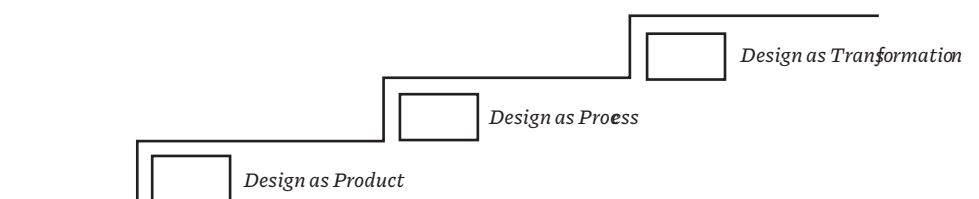


Figure 1. Three levels of Design
(Friis, 2006, p. 143)

These approaches are described by Friis (2006) across three levels (Figure 1). First, Design as Product, this she explains, is design as form giving. Second, Design as Process, where the process of designing is explored towards an end result but also learning from the process. Thirdly, Design as Transformation is where design can help others to transform.

3.1 Role of Sustainable Textile Designer

In the context of sustainable transitions, the designer more generally is called to address all three of Friis' design levels. Designing with more sustainable materials for products. Design more sustainable process for manufacture and recovery. And finally, design used to transform the behaviour of consumers in the use stage but also transforming the mindsets of stakeholders involved across all stages.

The ReSuit project is centred within the fashion and textile field and it is textiles, Lerpiniere (2020, p. 93) argues, that has an important role to play. This is because the textile designer is naturally positioned to engage with micro (materials) to macro (supply chains) and are able to bring together "disparate approaches, competencies and skills" to problem solve and consider the entire lifecycle of a product. Therefore, in the context of the ReSuit project my position as a textile designer to sit between the different stakeholders situated at different points of the lifecycle is a useful place to establish how bridges have been built and the pathways they create.

Bridge Building

4

For a sustainable transition, it is not enough for individual bridges to be forged, intersecting networks of pathways are required and the spaces in-between should enable trans-disciplinary ideas to form (McGregor, 2004). For the fashion and textiles sector bridges are required with experts at all stages of the garments lifecycle. The lifecycle, in the context of the ReSuit project, can be broken down into three core stages: **production**, the creation of the yarn, fabrics, and garments from raw materials (recycled or virgin); **use**, how the customer perceives and

uses the garment and **recovery**, the process of returning the textile to raw materials ready to enter the production stage again (removing the need for a raw material stage). These three stages are interlinked and in the creation of a circular product, the designer can aid this process by sitting in the middle interacting with stakeholders from each stage. The following subsections will explore case studies that demonstrate how design is able to build bridges between these lifecycle stages.

4.1 Building bridges for the production stage

The production phase is at the crossroads between recovery (into new materials) and use. It is here that a garment materialises. Design is critical at this point as it provides the specification for the garments manufacture, including its material. As a note, the designer being discussed here refers to an industry-designer team, including the buyers and product developers.

For a sustainable future, the challenge for the industry-designer is shifting from a linear design to one that is circular. Very recently, a wide range of circular design guides from industry has been produced (ASOS and CSF, 2021; H&M, 2021; Nike, 2021; Bestseller, 2022). However, designing in this way is not without its challenges. For example, when Adidas (2019) designed a recyclable running shoe coined 'futurecraft.loop' the team had to rethink the manufacturing process completely. To ensure the shoe was completely recoverable, the glue between the sole and upper had to be replaced with a new 'clean-fuse' process. Therefore, while designing for circularity Adidas shifted its production methods due to this requirement. This method is called lifecycle thinking and forces all stages of a product's life to be considered from the very beginning. The lifecycle thinking method first emerged in the 1960s but exploded in the 1990s (Mazzi, 2020) and is now often used by design researchers to engage industry in circular design (Goldsworthy and Ellams, 2019).

While the fashion industry is only just starting to navigate circular design, the academic discipline is further ahead. This is due to the different time frames and perspectives they each bring (Niinimäki, 2018;

Hall, 2021). While the academic designer might slowly spend time building up insights for the imagined future, comparatively, the industry-designer speeds through the design process for garments to be produced in systems that exist in the here and now or explore ideas that are possible in the near future (Hall, 2021). However, for sustainable transitions, it is vital to bring both perspectives together so that industry and academia are not completely disconnected.

DSKD CASE STUDY: International Solid Waste Association (ISWA)

In 2017 researchers in the LAB for Sustainability and Design at DSKD held two workshops with International Solid Waste Association (ISWA) to explore their two focus areas: plastic packaging and cotton jeans. Participants represented a variety of actors in the value chain to explore, identify and address the barriers to circular material flows.



Using a lifecycle thinking and a product development tool, the workshops brought together actors from the waste sector, design, and manufacture to explore these two product groups. This required clear communication, and so the workshop was designed to enable dialogue in identifying and understanding the various perspectives and challenges of the specific products. This way of working produced a set of recommendations which explain the need to design the product for re-use and recycling, rethink the way we only use virgin resources and suggest actively seeking innovative technologies. It also highlighted the need to cooperate throughout the value chain and suggests partnering up with a waste management sector during the development process (ISWA, 2017). It was only through creating an open dialogue with all actors about the products that change in design could occur.

Engaging with the lifecycle, industry has started to recognise “that each choice sets the stage for not only how the product will look and function, but also for how it will impact the environment” (Mazzi, 2020:2). Here, the academic designers were able to create dialogue about the specification and connect different actors in the lifecycle of the product.

Figure 2. International Solid Waste Organization (ISWA) June 2016 - September 2017, Photograph Credit: Design School Kolding

CASE STUDY: Mistra Future Fashion: Circular Design Researchers in Residence

Circular Design Researchers in residence formed part of the design theme on the Mistra Future Fashion consortium (Earley and Goldsworthy, 2019). They explored circular design speeds, specifically ‘speeds of use’ to maximise material value retention in fashion garments. The research took place between researchers at Centre for Circular Design, University of the Arts London and Filipa K, a sustainable Swedish women’s wear brand. Four workshops were conducted at Filipa K’s head office, meaning that the design researchers were embedded within industry, exploring the research ideas in a specific company context.

Working in this way meant the academics had to “think like industry and industry to think beyond the design of product – use and recovery” (Earley and Goldsworthy, 2019:14). For this collaboration to work, once again, workshops centred around the lifecycle with the whole team present representing as many of the different employees from the brand’s departments. In addition, this project had to balance two parallel journeys, the researchers were focused on creating more extreme ideas of ‘circular speeds’ whereas the industry versions were constrained by production scales and times. This parallel method enabled problems and insights to be shared in a form of knowledge exchange throughout the experience. The result of this work allowed researchers to “apply and contextualise their knowledge...[and] contribute their ideas in an impactful and meaningful way” (Earley and Goldsworthy, 2019, p. 4).

These two case studies explore similar dynamics when design researchers work with industry partners. Both examples demonstrate the benefits of bringing a variety of actors around the lifecycle to create dialogue about a specific product. In addition, the Mistra Future Fashion case study also explores how researcher and industry prototyping can be used in parallel as a method to share insights from different perspectives.

For ReSuit, prototyping by industry partners has already been built

into the project. Still, the addition of prototyping by researchers opens the door for DSKD to explore ideas and bridge the research and industry sides. Combined, these two methods seek to demonstrate ways in which a large project, such as ReSuit, can successfully work within Friis' (2006) first level, design as product.

4.2

Building bridges for the use stage

Beyond the design of the product, the designer is also required to understand the customer/user; how they will view and use the product over time. This is less established in the fashion and textile industry, which often places its attention on trend-led decision-making. However, notably H&M (2021) has recently promoted a more user focused circular design strategy. In general, there has been more momentum within sustainable design research and education investigating design methods that encourage the user to keep the garment longer (Fletcher and Klepp, 2017). Here design methods that stem from ethnology and anthropology are used to inform and enrich the design process.

Typically, anthropological studies in fashion “explore the use and materiality of dress objects, often in a non-Western context” (Skjold, 2014, p. 16). Less common, until recently, was the study of western use and disposal practices that are required to transform for the sustainable transition. This was first investigated by Fletcher and Tham (2004) in their book chapter ‘Clothing Rhythms’, which conceived of the different relationships between people and their clothes. Since then, looking into the wardrobe as a method for design has been expanded by Skjold (2014) and Fletcher (2016) as well as formalised into a book of formal methods (Fletcher and Klepp, 2017).

This approach is only expanding, in an attempt to understand the complex relationship between how often and long we use our clothes and how they move between people (Laitala and Klepp, 2021) we can glimpse at “what is really going on in people’s wardrobes” (Skjold, 2014:248).

CASE STUDY: Take-Back of Textiles - Resale and Rental of Fashion Deadstock

Most recently, the complex relationship between people and their clothing has been explored in 'Take-Back of Textiles' research (Skjold, 2021). One of the project's activities focused on resale and rental of the Danish Fashion brand GANNI. The research was conducted in two phases, first mapping the resale market of GANNI in Denmark and abroad and second wardrobe studies with "experienced GANNI resellers who are operating on consumer-to-consumer platforms" (Skjold, 2021, p. 24). The initial mapping exposed the large resale market share that GANNI products hold, however, rather than solely analysing the types of products available on these websites, the wardrobe study investigated the movement of GANNI garments in and out of resellers wardrobes.

These studies found some previously unknown behaviours, such as both 'buy-to-sell and sell-to-buy' attitudes, that enabled participants to earn money and make room in their closets. Specifically, the resellers had an in-depth knowledge of the parameters of resale "such as changes in the weather, condition (new or used), availability (rare or widespread), hype and exposure, but also to new GANNI collections" (Skjold, 2021, p. 27). It was found that the resellers appeared to 'rent' clothing for short periods before reselling.

For example, a dress was bought, tried on and did not work out, and was sold again four hours after for a little more than what had been paid. Others would have and wear a garment for much longer periods and resell with a potentially rather small loss, thus having 'rented' this garment for a year for a few hundred DKK. (Skjold, 2021, p. 28)

This research created dialogue to explore re-use in the fashion system where the insights could be used to inform garment design for extended use. However, to go beyond this and create shifts in mindsets, designers have sought methods of creating dialogues with a range of stakeholders using co-design methods. This has been explored at DSKD, in one of the Master level courses, in which design is used as a method to change behaviour in the sustainable transition by asking:

How can design engage people in changing behaviours towards sustainable living? What does it take to bring a network together, and why are design dialogues so powerful in evoking different relationships between stakeholders? (DSKD, 2021)

Design for Behaviour Change is an eight-week course undertaken by second-year Master's level students at DSKD. The brief requires the students to "set up and conduct a co-design laboratory together with real-life partners in order to rehearse sustainable everyday practices" (DSKD, 2021). This way of working draws on Binder and Brandt's (2008) Design: Lab concept, which, unlike a workshop, studio or atelier, is space to prototype and explore a sustainable practice. However, the most important aspect of the lab is the 'lab partners'; the stakeholders that are brought together to envision new possibilities, rehearsing them in ways "that can turn these possibilities into reality" (Ibid, 2008, p. 128).

An example of a student project completed in Autumn 2021 is Re:Generation by Elisabeth Christiansen, Marina Almanstotter and Runa Rossau. They explore how to shift behaviour from overconsumption to a more conscious lifestyle. For their lab, they brought together the older generation brought up in a post-war frugal mindset and the current young generations that have only known convivence and abundance. Working with Kolding's Sustainability House (Bæredygtighedshuset) they responded to the challenge, 'how might we inspire visitors...to make more sustainable choices?' (Almanstotter, Christiansen and Rossau, 2022).

The students approached this across a variety of different activities. First, they conducted mapping and explorative tasks. For example, they undertook bathroom surveys with students asking “which sustainable habits the young generation can learn from the older generation, and the other way around” (Almanstotter, Christiansen and Rossau, 2022). This was combined with interviews of two women from activity centres for seniors in Kolding (Floraklubben and OK Klubben). Here they gained insights about their lifestyle and habits that they learned to do out of necessity. The students found that there was a large overlap between these two groups, but whereas the older generation habits stemmed from need, these behaviours were now performed voluntarily by sustainable communities.

At the end of their project, the students explored ways of engaging and learning. First, they actively asked people outside the sustainability house to create a poster for a fictional sustainability event they would like to attend. This was combined with students passively attending a knitting workshop led by a member of Floraklubben. As participants, they learned ways to create a “successful learning experience and an enjoyable social gathering” from the older generation that hold what is now considered sustainable knowledge (Almanstotter, Christiansen and Rossau, 2022).



Figure 3. Design for behaviour Change Project images from knitting workshop with Floraklubben members (Almanstotter, Christiansen and Rossau, 2022).

Both these case studies demonstrate the need to understand more about behaviours of use. In particular, the ‘Take-Back of Textiles’ report explains, “it is necessary for brands to investigate who their customers really are, and how their products are being valued in use” (Skjold, 2021, p. 54). In the ReSuit project, this is being addressed by anthropologist partners NaboSkab for both Bestseller’s traditional fashion consumers and Elis hospitality service model. However, it is what this information tells us for the design of circular products that is vital. We need to transform this knowledge for designers to ensure the extended use of our clothing from the outset.

However, beyond exploring the consumer’s current behaviour, ReSuit also provides the opportunity for DSKD to build bridges with the anthropologists using the co-design lab method. This could bring together the design lessons gleaned from current use practices and explore in more depth how mindsets can be shifted towards more sustainable purchase, use and disposal. This combined approach addresses Friis’ (2006) third level, design as transformation.

4.3 Building bridges for the recovery stage

Finally, a designer must ensure that all elements of the garment do not prohibit its eventual flow into recovery processes. Although mechanical recycling technology has existed for hundreds of years (Shell, 2014), the complexity of our current textile waste has required new chemical processes to be developed. However, the gap between design and science is wide. Unlike the Design:Lab concept (Binder and Brandt, 2008), design research can also be conducted with and in the very real scientific laboratory. This ‘Science laboratory’ described here includes within its scope Science, Technology, Engineering and Mathematics (STEM) subjects, although the examples discussed here will focus on science and engineering.

In the field of fashion and textiles, the combination of STEM and design has only more recently been explored. For example, Amy Congdon’s (2020) PhD thesis explores how (textile) designers can engage with living materials. Her research sought to explore how craft textile

embroidery techniques could be re-appropriated in the field of tissue engineering. Similarly, Miriam Ribul PhD methodological model for material-driven circular fabrication and finishing processes in the materials science laboratory makes a “compelling argument for designers to be active” in these spaces (Ribul, Goldsworthy and Collet, 2021, p. 14). While a range of new knowledge can emerge from these design-science collaborations, it also requires adaptation and new forms of communication between the two different types of research. However, as Hornbuckle (2018, p. 6) explains, designers have the ability to “ask the right questions and to challenge the scientists,” which can lead to unexpected insights.

DSKD CASE STUDY: Monica Hartvigsen PhD

In a new generation of design PhD practitioners, Monica Hartvigsen has just begun her study at DSKD, exploring how designers can use microorganisms within their process to design in a more conscious way. The research, she explains, spans different laboratories, starting with a DIY lab at DSKD and expanding into a natural sciences lab (Hartvigsen, 2021).

Working in this way, Monica will explore how the role of laboratories differ. Her DIY lab at the design school provides her space to explore how design students navigate laboratory-style design work, whereas the more formal lab provides Monica with the “possibility to control the experiments a bit better, with...advanced facilities” (Hartvigsen, 2021). In addition, the formal natural science lab would enable her work to be scaled up, which is more difficult in the DIY setting.

Monica’s research has found great benefits in working collaboratively. She explains that there is great value in being able to discuss the research with a biologist or microbiologist and ask questions, “they have also taught me different methods and how to ‘hack’ them for DIY testing” (Hartvigsen, 2021). In addition, design is also positioned to bring value, as Monica explains, while biologists focus on explaining nature, there is no application required. This does not mean that scientists are not creative:

The natural scientist also work[s] creatively, but in a different way than designers. Designers are often working with a concept – a bigger picture, while natural scientist are more detailed oriented (Hartvigsen, 2021)



Here design can build on the knowledge produced by biologists and apply these learnings in the context of the human world. Of course, Monica's work is situated within the field of biology, but the principle of working within any STEM field is very similar. The scientist or engineer takes an extremely focused look at a specific area to explore/test and only afterwards seeks an application. This is also demonstrated in the next case study.

Figure 4. DIY Lab at DSKD,
(Hartvigsen, 2021)

CASE STUDY: Design-Driven Value Chains in the World of Cellulose

Designers should be involved in materials research and technology development in the early stages (Kataja and Kääriäinen, 2018, p. 16).

This multidisciplinary research project: Design-Driven Value Chains in the World of Cellulose (DWoC) brought together designers, engineers and business researchers to investigate the potential of cellulose as a material for a sustainable future (Kataja and Kääriäinen, 2018). Here designers and engineers came together to investigate materials for distinct product applications. While the material engineers provided technical expertise, the designers provided new approaches, such as prototyping for technical development, possible applications, and communication tools.

One of the material investigations during the project was the creation of acoustic materials using foam-forming technology (Härkäsalmi et al., 2017). Usually, engineers would develop flat white materials, but using the design-driven approach, 3D, coloured and textured samples were explored. Härkäsalmi et al. (2017) explain that with the design-driven approach, they found that early dyeing before the physical foam-forming produced improved uniformity of colour when compared to post-foaming methods. This highlights the value that design can bring when involved from the beginning.

Both case studies demonstrate designers working with STEM disciplines but taking two different approaches. Firstly, Monica balances visiting a physical lab and drawing on the technical expertise before returning to the design space to experiment in her DIY lab. In contrast, the DwoC project saw designers working together with engineers towards joint aims.

For the ReSuit project, elements of both approaches could be used simultaneously. As both case studies explain, the designer has a broader view of the system, including the application for the materials developed and considering the input before the process starts. For the recycling technologies, this means the designer is able to bring the

design perspective of the material, how it is collected and sorted as well as possible applications, into the engineering conversation from the beginning of the process as in DWoC. However, working side-by-side on the ReSuit project is difficult due to technical partners located in locations across Denmark and Germany. Therefore, exploring ideas with technical partners and returning to the DIY design lab might be a more practical way of working. Combined, these methods provide DSKD with a way to build bridges with the engineering and chemists to address Friis' (2006) second-level, design as a process.

5

Knowledge exchange with the design school

Young people are not only the most affected by future sustainability challenges, but also the decision-makers of today and tomorrow (Kubisch et al., 2021, p. 2)

While the previous section has explored how design research in the ReSuit project can build bridges across product, process and transformation levels (Friis, 2006), the benefit of these bridges has the potential to reach beyond the project itself. As with many large consortiums, the outcomes of such projects are set to benefit the industry and produce academic papers. However, pathways for knowledge exchange with education (design students) can be more challenging (Forst and Hall, 2021).

The role of universities has been traditionally split between academic research and higher education, however at the beginning of the millennium, discussion, specifically in Finland, expanded this to include creating practical knowledge for the use of society (Hyvönen, Saarela and Marttila, 2014). This was first described by Nieminen (2004) and translates as 'the universities third role'. This has been translated in the first instance with industry and education collaborations. For example, the 'Space Between' project at Massey University, New Zealand which Whitty (2016, p. 43) explains, "offers a method of aligning education, industry and enterprise to create positive change from the spaces between, inside and outside of the dominant system".

However, knowledge production towards more sustainable practices is increasingly more complex, in which inter- or trans-disciplinary meth-

ods are required. This, Marttila and Kohtala (2014) argue, should be reflected in education where design students can learn collaboratively with inter-professional teamwork that will prepare them for working life that involves real-life projects and problems. Design, as they ascertain, is fully, “capable of translating stakeholders’ values and disciplinary concepts and data into practical application” (ibid, 2014, p. 459) or building bridges as this chapter describes, but they argue there should be stronger connections between research and education. The challenge, therefore, is how academic research with industry partners, such as ReSuit, can be more strongly connected with higher education.

One way to create this connection is through knowledge exchange which is described by Cruickshank, Whitham and Morris (2012, p. 451) as “an approach in which everyone with an interest has something productive and creative to offer”. However, this is far than simple to carry out. Traditionally, students have been actively involved in research as a method to test ideas or tools, such as in DSKD’s development of the Sustainability Cards (Hasling and Ræbild, 2018). In larger research consortiums, such as during the Mistra Future Fashion - Circular Speeds Project, working with students in workshops was used to explore design concepts, yet (as in this case) these methods involving students are not always discussed (Goldsworthy, Earley and Politowicz, 2019).

In another example, the Finnish project Telaketju which was made up of a vast mix of academic and industry partners and explored improving textile recycling, also worked with design students (Heikkilä et al., 2019). Conducted at the Institute of Design at Lahti University of Applied Sciences, the aim of this collaboration was to “familiarise design students...with the principles of sustainable design towards a circular economy” (Heikkilä et al., 2019, p. 50). The students explored Design for Recyclability approaches, including mono-materiality and disassembly. This project impacted the students by making them consider their material choices outside of the project, and from now on, they will only use mono-materials or ‘justified’ blends. This student project is listed as one of many demonstrations within the research. Still, It is not specified what the benefit was for the project for the project, was it knowledge exchange or solely a knowledge transfer activity?

The difference between these two (knowledge exchange and knowledge transfer) is contended. It is argued by Polkinghorne et al. (2011) that it is impossible to undertake an activity without gaining something in return, therefore suggesting that knowledge transfer can also be a form of knowledge exchange. However, rather than get bogged down in the semantics, this chapter is concerned with exploring multi-directional sharing of knowledge between research and design education. How can students become part of the research itself, where the research learns from the students and the students learn from the research?

5.1

ReSuit

Throughout this chapter, different examples of how design research can build bridges across the ReSuit project has been investigated. It is through this that pathways for working with design students start to emerge across product, process and transformation levels (Friis, 2006). Like a 'hive mind' students provide a rich platform for design investigation within curricular or extra-curricular projects. Activities in research like ReSuit, therefore, could be set up to mimic the way design researchers plan to work.

Product

It is easy to see how this might be actioned when investigating the production stage and designing at product level because design students are very accustomed to making prototypes, and in particular, DSKD students are introduced to lifecycle thinking during their education. As with the activities in the ReSuit project with industry stakeholders, student projects could also be conducted in collaboration with these same industry partners. For DSKD industry collaboration is also embedded within the current education. In creating research-specific industry collaborations, students could actively participate in the research, creating parallel prototypes (Earley and Goldsworthy, 2019) to be analysed by the design researchers and shared with industry partners, providing inspiration and playing a role in the new knowledge creation.

Transformation

Specifically, at DSKD, Design as Transformation has been integrated into the design education within the master's course 'Design for Behaviour Change'. Therefore, in this setting, there are easy links to be made by using the ReSuit project as an example brief for interested students to work with. How the students explore the issues would not only inform the research but inspire further design for transformation methods to be used by researchers and project partners. Once again, the students would not only gain insight into a real-world problem but contribute to the knowledge created on the project.

Process

In the ReSuit project, Design for Process has been described as the recovery of waste and requires collaboration with academic partners in STEM. While the ReSuit project is focused on the reclaiming process, for the designer, it is the requirements for these systems that is most interesting. This includes collecting and sorting waste in addition to physical/chemical recovery. Research investigation into the collecting (Watson et al., 2020) and sorting (Heikkilä et al., 2019; Fibersort, 2020) has more recently been prioritised, but how this relates to our design decisions is only recently starting to be addressed (Ninimäki and Karell, 2020; Hall, Goldsworthy and Earley, 2022)).

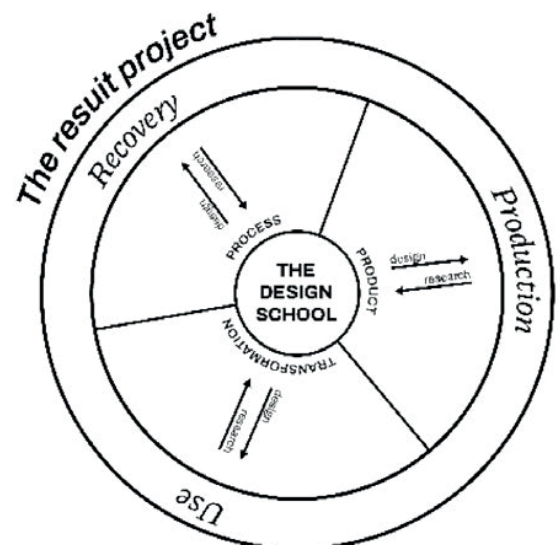


Figure 5. Design research building bridges between the ReSuit project and the design school.

It is clear from the two case studies presented in the recovery section (DSKD Monica Hartvigsen PhD and Design-Driven Value Chains in the World of Cellulose) that there are in this section mutual benefits for designers working with STEM experts. However, within research, this can be challenging (Niinimäki, 2018) and, therefore, even more, difficult to replicate within design education. Other ways to connect different disciplines have been used by Aalto University, where three different educational institutions (business, technology and art and design) came together to create a combined university (Hyvönen, Saarela and Marttila, 2014). However, for design-specific schools (such as DSKD) this is not possible on a permanent basis. Therefore, methods such as Monica Monica Hartvigsen's DIY lab adapted for the ReSuit project's aims could be useful. Here, field trips, conversations with STEM experts and DIY testing at the design school could provide ways of engaging students in the recovery research exploring design for process.

6

Conclusion

Now as we reach the end of this chapter, the way forward becomes a little clearer. Perhaps the designer can imagine our little design land is not so isolated after all. This chapter has explored Friis' (2006) three design levels (product, process and transformation) that have been employed to build various bridges between design and other disciplines across six case studies. In the context of the ReSuit project, this is organised around three stages of the lifecycle (production, use and recovery) with three different stakeholders: industry partners, anthropologists and STEM disciplines. The bridge between design and these different stakeholders correlates to the different design levels and therefore provides a variety of methods for the designer to employ.

However, it is how these methods can be used with design students at DSKD for the ReSuit project that this chapter was really investigating. I have discovered that through design for products, students can prototype to generate research ideas to inspire the research. Design for transformation is where students can generate co-design methods to explore real-life issues that can widen the research scope.

Finally, design for process is where students can explore DIY methods of sorting and recovery to provide a wider systems perspective for the research.

This is, of course, just one research project in which only a handful of relevant ideas have been used to open up a dialogue. The broader view of this topic is purposefully left open, not only to discuss how bridges can be built and pathways forged but how we fill the spaces in between (McGregor, 2004) for and with the designers of the future because no one is an island.

7

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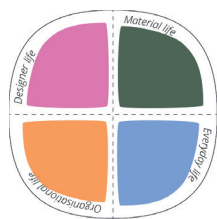
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