Recommendations for a Circular Design Practice

Reflections on Designing for a Circular Textile and Fashion System
for Students and Emerging Designers

Design Guideline 2.0
Going Circular Going Cellulose

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PREFACE

The *Recommendations for a Circular Design Practice: Reflections on Designing for a Circular Textile and Fashion System (Design Guideline 2.0)* is part of the project 'Going Circular Going Cellulose' (GC)2[1] and serves as an extension of the *Design Guideline for Recycling*[2]. Based on the collection of empirical data on the designers' practices, this guideline demonstrates how fashion and textile designers are able to tap into circular practices to arrive at a circular product. During the (GC)2 project, six design teams were given the opportunity to work together with various industry partners in order to develop circular methods and strategies, in which an interdisciplinary design research took place. Departing from a co-creation perspective, the six design research projects faced circular challenges and adopted circular habits that were translatable to circular design principles by engaging with materials, technology, new business models and user needs. Moreover, the investigation of the role of the designer played a pivotal part in identifying what skills and competencies are needed to design for the Circle Economy (CE), as well as the tools and methods that can contribute to embedded systemic change. The results of this study demonstrate the ingenious possibilities designers can thrive on within circular design, and how essential these practices can be in the transition towards creating circular systems, which is complex and challenging in its nature.

Keywords: circular economy; circular design principles; co-creation; sustainability; fashion and textiles

[1] Going Circular Going Cellulose is the followup research of Going Eco Going Dutch in which ArtEZ Future Makers worked together with Saxion University and various project partners in the textile and clothing chain, see: https://futuremakers.artez.nl/project/going-circular-going-cellulose-gc2/.

[2] I developed a Pilot Design Guideline for Recycling: Closing the Loop as part of the project 'Going Eco Going Dutch' (2016), see: https://futuremakers.artez.nl/publication/closing-the-loop-design-guideline-for-recycling/.

The Reflections on Designing for a Circular Textile and Fashion System for Students and Emerging Designers is aimed at starting designers who are invested in designing for the CE and in turn wish to incorporate and adhere to key circular design principles in their design practices. Herein, transformative design behaviours are encouraged that optimise circular business models to function, in which products, services and wider systems are reframed and redesigned. The guideline advocates the transition from a throw-away system to a regenerative one from within. It acknowledges the importance of interdisciplinary collaborations to pave the way for designers, manufacturers, producers and consumers to adopt circular design methods throughout the entire supply chain of a product. It is also based on the belief that the sharing of information and data is imperative in advocating for a holistic fashion system in which a functional circular design and economy is key.

Contents

INTRODUCTION

This document was written with the intent to offer a set of recommendations for emerging designers who want to position themselves within the field of circular design, in which the economic, environmental and social aspects of designing for the CE are taken into account. Herein, designers can profit from a framework based on case studies and guiding principles that advocate the transition to designing for the CE. By approaching design as an evolving discipline, this paper focuses on designing for evolution; suggesting a constant act of redesigning and system innovation. Due to its dynamic and complex nature, designing for the CE brings forth intricate and layering challenges, extending beyond recycling waste and adopting resource efficiency. Understanding the primary mechanisms of designing for a CE is vital in order to benefit from new business opportunities, models and strategies. Not only is the role of the designer considered in this document, the design behaviour is also put into light. Starting from an expanded view on designing for the CE (Part I) and the five pillars that serve as a basis to induce behaviour change, the publication also focuses on the circular design principles (Part II) with a pragmatic approach, drawing relevancy from the case studies of the project (GC)2. During the monitoring process of these case studies, I was able to witness how these principles are translated into strategies and actions, serving as a compass for designers to navigate in. This brings us to the designer's toolbox (Part III) which dives deeper into pinpointing the skillsets that are relevant when adhering to circular design principles. The three sections contribute to the transition towards circular design thinking and acting, as a response to the challenges often encountered in designing for the CE and in turn, encourage desired circular behaviours. This is directed to "a more sustainable relationship and ethical engagement with fashion and a more humanised value chain" (Bruggeman, 2018). This transformative nature requires a wider system-based design approach, in which interdisciplinary and collaborative forms of working facilitate the designer's ability to solve circularity challenges. In various stages of the product development, the active engagement between designers and other stakeholders such as producers, suppliers, material experts and end users strengthen the transition into redesigning an entire system, in which the exchange in knowledge and data between all these stakeholders spark innovation and evolution. Thus, designing for the CE is to be seen as a core strategy embedded in a designer's ethos.

METHODOLOGY

The six design teams who participated in the (GC)2 project and their design research projects were approached as case studies to initially test the design principles defined in the *Design Guideline for Recycling*. The designers were asked to read the guideline before commencing the project, and this served as a starting framework of their design research as well as the starting point of this guideline. Based on the collection of empirical (observational) data of the designers' design-through-research, a monitoring team supported the designers in reflecting on their process whilst taking into account the interaction between multiple stakeholders. Alongside periodical monitoring sessions, I conducted expert interviews with the designers that were semi-structured to confirm, modify and validate the findings, which in turn informed the circular design principles that were brought forth out of the research. During five 'check-in' meetings (over the course of six months) with the monitoring team and the designers, design exercises[3] were conducted in an attempt to delve deeper into these principles and the role of the designer. Some of these exercises served as a basis to build a framework and process for the design research and to encourage circular behaviour. This put the toolkit section of the guideline into direct practice. By adopting a qualitative research design, an attempt to refine these outcomes of the monitoring sessions, check-in meetings and semi-structured interviews were repeatedly iterated between data, literature and cross-case analysis. Unpublished empirical data was also taken into account, in specific the project documentation (notes, minutes, reports, interviews conducted by the monitoring team as well as supportive visual material). During a work session in March 2020, the designers were able to offer proof-of-concept and through storytelling, revealed the outcomes of their research. By collecting qualitative research design, I attempted to analyse these outcomes together with the data and literature in order to refine the identification between the designers' research and results.

[3] See appendix of this guideline for examples of the exercises.

DESIGNING FOR A CIRCULAR TEXTILE AND FASHION SYSTEM

I.I The Pillars of Circular Design

"At the core of climate action is beauty, a notion of beauty that has nothing to do with an industry, but a fundamental motivation and human need."
— Renate Stauss (2019)

The current fashion system is reliant on a linear and throw-away model, favouring financial capital over human and natural capital (Stauss, 2019), which in turn creates deep economic dependency based on a constant influx of new materials. According to Bruggeman (2018) "the logic of take, make and dispose is part of the Ego of the capitalist fashion system, which thrives on the continuous production of new fashion objects". In Bruggeman's book, *Dissolving the Ego of Fashion*, the focus is on dismantling the *ego* of fashion based on human-centred and holistic beliefs that can encourage a way of designing and consuming based on restoration. Designing for the CE is driven by this regenerative nature in which waste is designed out of the system and does not depend on new virgin materials to drive economic growth. Herein, it builds on natural, social/human and economic capital, based on two cycles: a biological and a technical cycle. In order to participate in this transition, circular design principles play a pivotal role in ensuring designers and other stakeholders of the product chain are on a regenerative and restorative design path, which I will further elaborate on in the following chapter. But first, it is important to acknowledge the foundation of these principles, which I have named the *pillars of circular design*.

In the previous guideline, three pillars of circular design were indicated: *philosophy, practice* and *product* in order to ease the obstacles when implementing aesthetic and technical decisions in a designer's practice for a sustainable outcome. I have elongated this to five pillars that are at the foundation of a circular ecosystem design: *philosophy, practice, product, process(es)* and *services*. In order to carry out sustainable practices, these five pillars serve as an integral backbone when approaching a wider ecosystem as well as incorporating new business models.

Figure 1. The pillars of Circular Design.

In the first guideline for recycling, I described *philosophy* as an ideology of use, which often becomes the biggest driver for sustainable practices, consumption and usage. The ideology of use as defined by Fletcher (2012), extends beyond the materiality of the object and outweighs the physical aspects of a product that encourages durability. This also ties in with the human dimensions of fashion, in which the psycho-social nature of fashion plays an integral role in how a product is used. The mindset of the designer directly determines how the tools and methods can enhance design behaviours (see chapter I.II) and subsequently improve decision making. With this mindset, comes the pioneering nature that will induce innovation in a systemic way, thus influencing consumer behaviour (Earley 2017). Ultimately, philosophy can be seen as an approach to design well-being enhancing circular transitions. The pillar *practice* soon follows as a way to deepen into how the philosophy is carried out in human action and as Fletcher (2012) eloquently describes as "emerging from an individual and collective practice with dynamic implications for [the] use of materials". The *product*, naturally, is the material outcome of the philosophy and practice, yet also serves as an important driver to stimulate radical interventions and new ways of usage that promote circular goals. The product can promote the human values that withhold the restorative and regenerative nature of the CE, and take on the material form of the user-object relationship. When it comes to *processes*, the focus is taken away from the outcome or solution, and the process is what drives knowledge and impact. An example of this is looking at how as a designer, one can move from capital to natural profit as seen in Bruchter's design case study in which she developed a tool to analyse both profit conditions when designing for the CE. Or how within the design processes, one can address commercial viability as a start-up by focussing on processes as an outcome as opposed to a product. Herein, there is the opportunity to re-think business models in order to fit in these outcomes. I have witnessed the challenge of the designers in the (GC)2 project move from technical issues to a more business-oriented process, because of the financial viability. Notably, design as a process starts to precede design as an outcome. Design as a process refers to a creative yet rational process, in which the nature of the process often is what shapes the solution (Kimbell, 2011). Herein, rationality is about solving a specific design problem by dissecting it and come to these new solutions. This iterative nature of designing processes has the goal to bring a wealth of knowledge that can be translated into new business models, without having to rely on a product as a result, and tackles the complex nature of designing for the CE (Buchanan, 1992). In UNSEAM's research project for (GC)2, the design duo uncovered the notion of becoming designer consultants, in which the entrepreneurial skills of the designer were highlighted. Their technical development proved to be valuable enough to look at patented solutions in order to have more freedom and to be taken seriously when it came to investing opportunities (Froon, 2020). This B2b approach uncovers the potential processes can hold for designers. Services play a large role, especially when taken into account the product passport which I elaborate on in Part III as part of the designer's toolbox. The life-cycle thinking forms a basis of designing services as opposed to products, adding on to forming

new business models in which the product encompasses a dynamic function and fulfils the user's needs. In addition, the act of maintenance, repair and reliability through services is paramount to designing for the CE, extending the end of life as well as replacing damaged parts. This particular pillar challenges how ownership is viewed, transitioning a standardised selling model to leasing or serviced-based user-ship, moving the focus from the material nature of the product to impalpable services. As described by Baldassarret (2019), this potentially leads the "dematerialisation of the economy, which is associated with material flows in production and consumption". Pinpointed as 'function-orientated' business models (Tukker, 2004), services can play a vital role in looking at new ways of ownership, new forms of economic profit (business opportunities) and satisfying the user's needs beyond the usage of a product. Van Rees (2020) centres her interaction with the user around the services she provides in her design practice, and adds on to the personalisation factor which connects the process with the product. She also indicates that the services inform her with new knowledge on the product and the process (feedback), which helps strengthen her business model. The wider ecosystem approach tackles the design of services, processes as well as (new) business models, and therefore play a fundamental role in supporting circular design principles, triggering the evolutional aspect of the CE.

I.II Design for Behaviour Change

Designing for behaviour change encourages designers to think about how products and systems can enable the user behaviour for CE. As opposed to the passive consumerism which we have been witnessing in the economic capital-driven fashion industry, there is a need for active makers in order to turn to circular solutions (Fletcher, 2008). The emphasis is on participating in a heterarchy (focused on mass innovation as opposed to mass production), in which the product and product value chain is not centred around the designer as the creative director, but sees the designer at eye-level the consumer who becomes an active maker. In Hellen van Rees' design practice, she integrates her clients in the aesthetic and functional facets of her products by receiving them at her studio, and taking them along the bespoke design choices she offers. This suggests a change of behaviour – which can both be approached from a designer perspective, as well as the user. Although design for behaviour change may not necessarily tackle system wide change directly, it challenges the role and status of the designer which is further elaborated in Part III of this guideline. Herein, the human context plays a role in which the social and experiential dimension sustain circular habits. It is worthwhile noting that behaviour on its own cannot be the foundation of change, as it is not possible to design behaviour although designers certainly are able to shape user behaviour (Selverfors et al.). Yet there is an immense opportunity for designers to design the preconditions that will encourage behaviour change. It also becomes worthwhile noting how this change in behaviour can extend itself throughout the entire product chain, enriching collaborations between designers and manufacturers, or designers and consumers, for instance. In Wastling's Design for Circular Behaviour: Considering Users in a Circular Economy (2018), the focus lies on change of behaviour of the consumer in order to adhere to slowing and closing loops. However, it is interesting to tackle the behaviour from the designer's perspective, as well as the interactions designers have with other stakeholders in the various stages of the product value chain, that can inspire circular behaviour change. As seen in (GC)2, the designers were placed in a co-creation led environment, which led them to consider the other stakeholders in their design process. This created a conscious effort to think in systems, in which the inclusion of suppliers, producers, manufacturers and consumers leads to more informed design decisions that ultimately are of benefit to all those involved. This was reflected in the case of Bureau Baggerman, which bridged knowledge gaps in order to arrive to more sustainable material choices and processes in her quest for the most sustainable tea towel. Thinking in system-levels, can also enable to act of co-dreaming, which was how Bruchter sought to find commonalities between the financial side and the natural capital side of circular design. The act of experimentation, which can be seen as co-playing, also has the potential to be enhanced in a collaborative environment which was the case of design team Suzanne Oude Hengel and Milou Voorwinden, as well as Buro Belén. They co-created with technicians in their design experimentation, which resulted in new forms of material manipulation, pushing the

boundaries of what is possible to this collaborative nature. On a business level, this can also prove to be beneficial for designers as research project UNSEAM proved. Herein, co-visioning gives space for designers to adopt an entrepreneurial outlook towards their practice, exploring new business opportunities with other stakeholders as they seek to solve their circular challenges. When design behaviour is put into focus, it is worthwhile noting how designers can thrive when co-creating with others in the various phases of a value chain. Niinimaki (2017) emphasises this in stating that "shared learning challenges everyone. Everyone has to step outside their 'comfort zone', their own disciplinary knowledge and professional practices". Stepping out of the bubble of a designer's design practice was an integral aspect to arriving to new solutions during (GC)2, in which designers demonstrated the importance of co-creation. This paper focuses on this very behaviour of the designers, often seen through a transformative lens, which effectively commits to circular design futures.

CIRCULAR DESIGN PRINCIPLES

II.I The 12 Circular Design Principles based on (GC)2

Taking the six design case studies of the (GC)2 project as a starting point, the circular design principles are to be seen as guiding principles when designing for the CE. The principles I will elaborate on are based on my analyses of the design research projects of (GC)2, in which the designers were challenged to reflect on these principles during the check-in meetings and interviews the monitoring team conducted. Designing for the CE has designers adopt a systems-thinking method, in which regenerative and restorative goals of designing are crucial. This leads to thinking in circular design principles, which suggests a fundament for circular thinking and behaviour. These principles can become quite thought-provoking once you dive into them, as it can lead to a radical redesign and alternative approach in how to adopt circular design methods at various stages of the product value chain, exploring new relationships and experiences with products (Bakker, Hollander, van Hinte and Ziljstra, 2014). Added to this, designers do well to consider how their business model(s) can also be led by the principles by re-framing their profit model. In the case of Van Rees (2020), the product and the business model shape one another, in which her process informs her business by adjusting it continuously and addressing different parts of the value chain to it. I will go on to define twelve circular design principles that were highlighted during the (GC)2 project, and formulate the approaches of each principle and where possible, identify the methods for incorporating them into a design practice. Each principle adheres to differing circularity challenges, stemming from worksheet of the Circular Design Guideline by the Ellen MacArthur Foundation[4], in which the impact of the design outcome and aligning goals becomes crucial in order to define what it is you would like to solve (taking into account the inherently systemic nature of circular design). It also suggests an interdisciplinary approach to solving the circularity questions that come up throughout your process. In reality, it's not seen as a conscious concept but brews in the back of the designer's mind, linked to the designer's ethos whilst coming from a place of urgency. The authentic nature of the designers furthermore is enhanced by these principles, as they can be adopted and hybrid forms can be created according to the designer's circular goals. In my case study analysis during (GC)2, I was able to witness how designers solve circular challenges through their research questions whilst adhering to the principles.

I have divided the circular design principles in designing thoughts and emotions with the aim for designing conditions for behaviour change, slowing resource loops with the intention of creating life-long products through an emotional attachment and/or physical durability, slowing resource loops with the intention of extending the life of a product, closing resource loops and narrowing

[4] The Circular Design Guideline is a collaborative outcome of the Ellen MacArthur Foundation and IDEO focussing on an iterative and inclusive design thinking approach, see: https://www.circulardesignguide.com/

resource loops. *Designing Thoughts and Emotions* are built on the philosophical pillar I mention in Part I, in which the action of interception is pivotal in which the mindset of circular design is being adopted in every facet of a designer's practice. Slowing resource loops promotes products that are being used over a long period of time, by creating long-life products, as well as the extension of the usage of the product, in which reusing, maintenance and repairing extend and intensify the product. It counters the notion of planned obsolescence, as normally products are 'meant' to fail after a period of time, and promotes alternative usage for products that can no longer adhere to their original function. Closing resource loops (between post-use and production) relates to adopting a biological cycle, as referred to in the cradle-to-cradle approach by eliminating waste entirely compatible with biological systems (McDonough and Braungart 2002) and relates to a technological cycle, in which materials are completely recycled. This results in a circular and continuous flow of resources. Narrowing or shortening resource loops aims at lessening the resources of the product, by making it more efficient (resource efficiency[5]). This particular strategy is sometimes criticised, as it only considers narrowing the loop and doesn't take into the account the regenerative nature of circular design (by not addressing the cycling of products). For the purpose of this guideline, I have decided to include it as a principle that was utilised by UNSEAM (Design for Reshoring) that can potentially bring relevant insights into optimising the production process.

Principles 1, 2, 11 were (newly) identified by the designers and put into practice in their design research projects during (GC)2. The principles numbered 3 - 9 are derived from the article 'Product Design and Business Model Strategies for a Circular Economy', written by Bocken, Nancy, M. P. Et al (2016) and further analysed using the empirical data of the case studies of (GC)2 as well as the theoretical research that was done during the project[6]. This source was used throughout the entire (GC)2 project as a reference, and formed the basis of the pyramid exercise explained in Part II.I. Through the expert interviews I conducted with the designers, I've attempted to dissect the principles and assess what circularity challenges are prominent and what opportunities there are for designers to follow circular choices in developing a sustainable product and production. Thus, the explanation of the principles elaborated on below are all based on the design research projects of G2(2), with the theoretical backbone that accompanies this report.

[5] See: von Weizsäcker, E., A. B. Lovins and L. H. Lovins, Factor Four; Doubling Wealth – Halving Resource Use. The New Report to the Club of Rome, Earthscan Publications, London. (1998)

[6] The monitoring team of GC(2) conducted a theoretical research throughout the entire project, which formed the basis of the bibliography section of this paper.

Designing Thoughts

1. Design for Understanding

This principle motivates the designer to assess the life-cycle of the product, by visualising the bottle-necks in the design process which stimulates a deeper dive into the technical facets of the product. Falling under *designing thoughts*, it triggers critical thinking in every step of the process of designing a circular product by identifying its challenges creating a deeper understanding of the circular design process itself. Design for Understanding encourages the complexities of designing a sustainable product to be fully transparent in order to make it understood by technical and manufacturing partners as well as the user. These complexities, tackled during the design-through-research, takes the product as a central axis to unravel the intricacies of the product development resulting in informed choices. According to Earley (2017), there is an opportunity for "designers to bridge understanding of scientific tools such as Life Cycle Assessment" (see database). Storytelling plays an important role — as the information needs to be understood by various stakeholders in the product development chain as well as the consumer. Materialising the insights serves as a tool to make the information better understood. Herein, design is used as a way to create understanding to answer technical questions that are relevant to others who also seek to design a sustainable product, in order to make it easier to understand by sharing the decisions made in each step of the development. By adopting this principle, the designer is able to challenge the current industry by reinforcing that trust and transparency is needed in order to improve circularity. When adhering to these values, it is easier to identify where things are going wrong and where certain choices can lead to things dropping out of the circle. In Bruchter's design research for (GC)2 she looks at designing a networked model in which the circular industry (economic capital) is merged with the human and intellectual capital, with the aim to evoke mutual trust through the principle design for understanding. Herein, she sees the benefits of creating knowledge together (co-creation) in which designers are attuned to the financial capital (and vice versa) to find shared goals. There is an opportunity to evaluate all aspects of production when incorporating this principle, allowing to go more in detail in the environmental impact. Also, the awareness is able to impact user behaviour as it leads to consumer to not only back track how the product is made, but also closely follow the choices that were made. This is evident in Baggerman's process, in which transparency plays an important factor to enhance the emotional attachment, by communicating the complexity of the production and design choices, in order to foster trustworthiness with all stakeholders involved in the supply chain. This complex nature of the technical aspects may need certification in order to support the evidence of why particular choices were made[7]. The challenge in following this principle is it can only be regarded as a circular strategy if the link to emotional attachment is

[7] "A trustworthy or transparent product does not necessarily equal a product with a long lifespan and a deceleration of resource loops", as stated by Michelle Braggeman who identified Design for Understanding as a pivotal principle in her research for (GC)2, February 2020, Z. de Brouwer interviewer.

ensured, in which long usage plays an integral aspect[8]. It should also be delivered in a way that can be easily understood by various stakeholders in the product chain, and pinpoint the economic, aesthetic and sustainable perspective. Ultimately, it serves as a triggering principle to ensure designers, producers and consumers are fully aware and confident on the choices that are made in every step of the design process which is often complex.

Designing Emotions

2. Design for Aesthetic Usability

The aesthetic sustainable experience plays an important part in designing for Aesthetic Usability, in which the product should include aesthetically sustainable value in order to trigger the user[9] to hold on to the product for a long period of time. Relating to aesthetic nourishment which Harper (2017) describes as a way to keep consumers emotionally involved with the product in which repairing and reusing extend the lifecycle. This principle is oriented at the product itself, and not so much the process, in which it emphasises whether the product meets or challenges the user's assumptions and expectations. By enchanting the wearer (herein emotional attachment plays a role — see principle nr. 4), the aesthetic choices made by the designer serve as a catalyst for positive change in the way users interact with the product. Resulting in provoking new thinking and habits, aesthetics drive the consumer to make better and more informed choices. Buro Belén[10] regarded this principle as a guiding reference throughout their project during (GC)2, and adopted aesthetic usability from a user's perspective, in which colour codes are offered as choices for the user in order to determine what UPF factor they needed. In this design duo's case, they looked at how their circular products empowered usability and simultaneously increased the user's willingness to learn and adapt. The merging of the technical ease and aesthetics is seen as a way, in their eyes, to convince other stakeholders of the importance of their work. To test this principle, it does require extended user analysis in order to test the product usage, as one cannot assume emotional responses will prolong product usage. Also, there will be limitations in production and choices when aesthetics drive the product. In addition, a lot of input will be needed from the manufacturing side of the product because the technical aspect is not in focus when adhering to this principle. Designers need to allow the manufacturers to make certain choices, and work within the aesthetic limitations of these

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[8] As mentioned in Zaplata's (2019) paper, "the key to Baggerman's approach is the causal connection of design for understanding to emotional attachment: trust/transparency comes in tandem with emotional attachment. The extent to which these strategies correlate and potentially slow down loops needs to be tested in further project phases. A trustworthy or rather transparent product does not necessarily equal a product with a long lifespan. The design strategy design for understanding can thus only be considered a circular strategy if a correlation to emotional attachment is ensured".

[9] See the *Aesthetic Strategy Model* as defined by Kristine Harper in Aesthetic Sustainability, 2017.

[10] Belén is one of the design teams that participated in (GC)2 and developed a range of UV protection materials based on hemp, see: www.burobelen.com/projects/sunplus

technical choices. In Van Rees' work, she decided to embrace the production 'flaws' of her materials by giving them a function in her designs, and looking at the happy accidents encountered during production. Initially, this is not based on consumer demand, and manufacturers often discard these flawed textiles. This particular case shows positive design solutions, in which new ways collaborating can be adopted to work towards the ideal scenario intended by the designer.

Slowing resource loops with the intention of creating long-life products

3. Design for Physical Durability

A direct way to slow resource loops is by creating products that can take wear and tear without breaking down. This principle centres on the material selection and development, strengthening the reliability factor between user and product. This, in turn, influences pro-environmental behaviour. By encouraging this sufficiency, the product is designed to increase the chances it will not deteriorate. This requires continuous product testing to ensure its reliability. The selection of materials is crucial when following this principle. Product ageing and discolouration can be critically viewed when incorporating this principle, such as in Buro Belén's[11] case who work with enhancing this quality as opposed to dismissing it. The studio embraces discolouration and sees it as an added aesthetic value to the product, promoting the very act of physical durability. Being a technically-driven principle, the challenge lies in maintaining product integrity, and avoiding it becoming obsolete, much like the principle design for emotional durability also strives for (see principle 4).

4. Design for Emotional Durability/Design for Attachment and Trust

In these two particular principles, the ideology of use is highlighted which I reflected on in Part I.I, which supposedly strengthens the bond between user and object, focused on a long-lasting relationship (Chapman 2012). Because both principles are strikingly similar, the monitoring team of GC(2) decided to combine them as they are both are aimed at responding to an emotional obsolescence. Both principles foster the trust and attachment with the product, and centre around human-driven values such as love, trust and empathy. It is all about flourishing the relationship between user and object based on empathic partnerships (Chapman, 2012). The emotional value triggers the user to hold on to the product as long as possible, by postponing discarding it, and repairing it to avoid replacement. Taking the user as central in this, designers can guide themselves by this principle in ensuring the product has unique identity, as well personalising the buying process for instance by offering made-to-measure enhancing the product attachment. The act of transparency in the product process can also facilitate this emotional attachment. Again, in Baggerman's research, the transparency factor enables a product that is most aligned with a

[11] See: www.burobelen.com/projects/livingcolours

sustainable circular goal, due to the choices that are being informed on how it is made and how the choices are weighed against one another measuring their sustainability factor. Baggerman (2020) defines this as having a product one can feel confident on, and reflects the best possible circular choices. In this way, she shows the responsibility it should have on the industry, and not merely in the consumers' hands. The user, in this way, can feel at ease with the choices being made and thus pave the way in strengthening the attachment to the product due to the trust factor. This suggests going beyond the certifications that are currently existing (see database), which bring risk factors related to greenwashing if not taken critically into account. Both principles can get tricky when incorporating them into business models, because the question of ownership then comes to light and may be in contrast with other circular business models as it does not extend beyond life-long ownership. Therefore, when incorporating these principles designers would do well to consider hybrid forms by choosing other principles to strengthen their circular practice. Van Rees, for instance, does this through incorporating design for emotional durability in the essence of her business by including the user through her personal design service in which the client gets to choose certain design elements according to their own personal preference. She is able to generate customer loyalty through this method, by strengthening the trust between designer and user. In this way the user is not only attached to the product but also the process, involving them on a deeper level. Van Rees pinpoints this trust as a reliability factor, and touches on cultural circularity by incorporating behavioural aspects that are required when interacting with the user to foster these principles.

Slowing resource loops with the intention of extending the life of a product

5. Design for Upgradeability and Adaptability

Upgradeability and adaptability focuses on extending the period of utilisation, which is service-oriented (see designing services in part I.I). These services comprise out of maintenance, repair and upgrading (or a combination) in order to extend the lifecycle of the product, by retaining its primary functions, but also to expand its capabilities. Herein, upgrading as a service becomes interesting to tackle, in which the value of the object is enhanced, as well as its effectiveness and performance (Linton and Jayaraman, 2005). The entire product can be approached in this manner, or the components that form the product. According to Bruchter (2020), it speaks to designing as a moving discipline, constantly evolving. Locality plays a large role herein, as ideally the manufacturers will be in close proximity to the designers and the users (herein also lies a collaboration opportunity between the three sectors). Resulting in stronger relationships with consumers, the interactiveness that takes place to ensure upgradeability not only strengthens the product experience, but also creates the opportunity to better understand the needs of the user when it comes to performance requirements of the product. Also, designing for maintenance ideally should not be seen as a

separate principle, but part of the service design that encompasses upgradeability and adaptability. In addition, the supply and demand should be aligned in order to realise these product-life extension strategies. This principle holds greater potential of circular processes (as well as more complexities), when compared to recycling as product integrity and the increased adoption align with repair processes. This results in more economic value in the field of end-of-use strategies corresponding to inner, shorter cycles (Circularity Indicators, 2019), and facilitating the recovery of the products. Because of the longer serviceable life of a product, the fortified circularity results in getting the products and materials back so that they can be improved in quality. The B2C (business to consumer) models are integral, and designers can add real value by including their customers and subsequently, customer behaviour, as part of the process. As stated by Wastling (2018), "the user of a product and their behaviour can have a significant influence on the overall flow of products, components and materials". It is worthwhile noting that designers do well to increase adaptability to unforeseen changes.

6. Design for Standardisation and Compatibility

Another technical-driven principle, designing for the purposes of standardisation and compatibility encompasses designing components or interfaces that fit other products. By establishing a uniform process in the material development, the designers can reap benefits from lower production and procurement costs and ensure repair and replacement services that are easier to perform, and less expensive (Circular Economy Practitioner Guide, 2018). It also increases the efficiency and speeds up the services subsequently. Material qualities and characteristics (such as colour and composition) are important to consider, as well as the production techniques (such as equipment and tools). The zero-based approach, as defined by the Circular Economy Practitioner Guide (2018) inspires designers to start their circular challenge within this principle by asking themselves how they can design a product using as few material and/or processes as possible, and by minimising these throughout the design process. Although the design teams of (GC)2 didn't actively speak on this principle during the project, the inherent qualities of their work all touched on this principle when it came to the efficiency of their design process.

7. Design for Dis- and Reassembly

Reducing time and costs, the parts of a product have the function to be separated and reassembled relatively easily and quickly. The agileness of the product is an important aspect of this design principle, and ensures the lifecycle of a product can become dramatically extended as well as increase the amount of ways materials and components can be reused. During Van Rees' (2020) design research for (GC)2, she looked into turning her garments modular – existing from the same pattern pieces – which meant they were able to be interchanged, from different materials, making it easier to replace damaged parts or parts that no longer fit in her designs. She also looked into

utilising a specific type of thread used for seams that can be melted to ease the modularity subsequently enabling dis- and reassembly efficiently. This principle also takes into account the different cycles that materials will fall under – technological and biological (see principle nr. 8 and nr. 9) – when it comes to the deconstruction of the materials. This ensures the materials can be (completely) recycled. It is worthwhile mentioning it is always better to make something last as long as possible than it is to recycle it (Luiken, 2020). Van Rees learned through (GC)2 that not every aspect of the final product needs to be recycled. When easing the dis- and reassembly for certain parts (if not all are possible), the rest can be recycled fortifying the diversity of modular garments that are made out of differing materials. The benefits of adhering to this principle is that repairs and upgrading becomes much easier, prolonging the utility of a product. How easily a product can be disassembled often is a determining factor to how the lifecycle of a product will end. It is advisable for designers who wish to follow this principle to think about using a minimum amount of components to facilitate the deconstruction, and utilise as few binders (such as glue) as possible. Part of the service design is to focus on the instructions that come along with the product, in order to help users understand it better. This principle requires a level of flexibility to be integrated into the product, in which flexibility can be defined to be the "incremental time and cost of modifying a design as a response to changes exogenous (e.g. shifting customer needs) or endogenous (e.g. the discovery of a better solution approach) to the design process" (Bischof and Blessing, 2008).

Closing resource loops by reusing materials

8. Design for Technological Cycle

This principle ensures all materials and components are completely recycled, and can be implemented in service design as well as product design. The materials, also coined as "technical nutrients" (Bocken et al. 2016) when it comes to designing for a technological cycle should be safely recycled into new materials and products when adhering to this principle. The Guideline for Recycling (1.0) I developed touches on this principle more in depth. Van Rees indicated that this principle can often be very abstract for designers, especially when they are at the starting phase of their practice. Due to the varying methods of recycling, it becomes difficult to look at the entire cycle of every material choice a designer makes especially in Van Rees' case where she is working with the waste material of a manufacturer. New business models can also be developed under this guiding principle, in which access and performance plays a crucial role in order to have materials reclaimed and recycled. Furthermore, designers should incorporate the principle design for dis- and reassembly if they are to facilitate the separation of materials that will enter into this cycle (as well as into the biological cycle). The purpose of this principle is to mimic the properties of the original material when recycling, in which closed-loop or chemical recycling are performed. Closed-loop

recycling is the reprocessing of mechanical properties, in which up-cycling focuses on maintaining (or improving) the material properties (Hopewell, Dvorak and Kosior, 2009). Chemical recycling enables the separation or dissolving of certain qualities of material properties (the sustainable aspect of this can be questioned).

9. Design for Biological Cycle

The products that adhere to this principle are focused on products of consumption which result into incorporating dissipative losses that are compatible with biological systems. Bocken et al. (2016) link this principle to designing "biological nutrients" in which biodegradability ensures biological activity enhances chemical recycling. Other methods include utilising composting resources (in which material decays without leaving harming residues), bio-based or renewable resources. Through a regenerative force, the product's life-cycle will completely dissolve waste out of the equation (McDonough and Braungart, 2002). In my paper, *Design Guideline for Recycling* (de Brouwer, 2017), this principle is challenged due to most existing textiles not being designated to be compostable due to their properties (chemicals, dyes and other components). Seen as a tertiary definition of recycling, design for a biological cycle "looks at the breakdown of materials into their original raw core components" (Bocken et al., 2016). It is worthwhile to look at the end-of-life stage of the product and assess whether the materials can end up in an environment that can sustain biodegradability. The concept of biomimicry becomes interesting to adopt in new business models, by looking at how nature comes to solutions and using this to address human-driven challenges. By finding inspiration from biological strategies, design challenges can be solved by looking at how nature solves its problems[12] (for instance, how to shift from economic profit to natural profit which is seen in Bruchter' design process).

10. Design for New Production Process Techniques

Coined by Milou Voorwinden[13], one of the designers as part of (GC)2, this principle looks at the unique qualities of production and design process techniques. It promotes working directly with the machinery manufacturers conventionally work with, and sees the designer as a disruptor in which new techniques are manipulated that may seem unconventional for manufacturers. This iterative design process focuses on working on sampling, and refining the process in every step of realisation. This principle encourages designers to look at the material in-depth (for instance, considering the fibres of the material and how its properties can be applied in a new way), in order to utilise materials in a different way than initially intended. It also forces the designer to question sourcing methods, challenge production methods and apply multi-disciplinary thinking in which the

[12] See: asknature.org

[13] In Voorwinden's case, she worked with on the CCI loom provided by Saxion University which resulted in new production techniques utilising folding methods to change the properties of the material.

role of the designer is challenged (see part III.I). This principle contests the conventional ways of developing material, and pushes the boundaries of what is possible and adopts the philosophy "spending more time on the design – less in the making" (Voorwinden, 2020). Often, this requires a lot of research to be done before being able to grasp the full potential of the final product. This could entail acquiring in-depth information of yarn suppliers for instance, as in Voorwinden's case, to get a better insight into sustainable solutions. It can be a challenge to get producers and manufacturers on board, and it requires a lot of effort from the designer to visually explain what the possibilities are of the material (in which the prototype phase is the most time intensive). Also, mistakes are welcome when following this circular principle, because it asks for connection to the material through material exercises. Voorwinden looked at ways to simplify production processes, in order to focus on pushing the boundaries of the material itself. By playing with the machinery and having the time to do so, she was able to work with the characteristics of the connections of the yarns allowing her to "find the possible in the impossible", a mind-set that designers incorporate to explore the constraints of the production methods revealing new and exciting insights into design solutions.

Narrowing resource loops

11. Design for Reshoring

This principle is led by reducing resource flows, in which the optimisation in the production process takes a primary role that impacts costs and environmental aspects. It does not necessarily incorporate the cyclic use of products and materials, but focuses on designing the process or product in order to proximate to the consumer by being mindful of locality and working on-demand; thus resulting in working in smaller loops (Bakker, Hollander, van Hinte and Zijlstra, 2014). The sourcing of material is also key and prefers a closer locality, in order to shorten the loops between designer, manufacturer, consumer and shops. Also, more machines and less labour involve this principle. By incorporating this principle in their practice, designers have the ability to control their production (producing less) and only what is needed (or asked for). In the (GC)2 project, design team UNSEAM explored this principle by pinpointing what choices they could make in their process to adhere to design for reshoring. In their design research they looked at minimising the number of stakeholders involved in the production, in order to better the optimisation as information can be lost more easily if a lot of steps within the production method is divided amongst many stakeholders. If time is not addressed, the efficiency in resources can lead to speeding up the linear resource flows, for instance by selling more (which questions the sustainable motive). This bodes the question on what is being saved in the process. Design for reshoring can

address new business models, by looking at systemic change within the industry re-framing the production methods based on on-demand strategies. UNSEAM (Froon, 2020) explored this by highlighting their entrepreneurial skills in their process in order to become more commercially driven anticipating that the market needs that will inevitably happen. They pinpoint this as paramount in order to attract the right funders – one that is driven by user impact – to ease design for reshoring in their design practice. Furthermore, the design duo indicated that once there is a shared commercial goal, co-creation starts to occur which is an important factor to getting circular goals met. By sharing common values, they were able to create what they mention a "cradle-to-wholesale" approach in which on-demand strategy (manufacturing) becomes an integral part of design for reshoring, claiming there is "no sustainability without business" (Froon, 2020).

II.II Circular Design Principles Pyramid Exercise

During the (GC)2 project, I developed a stand-alone tool for designers in order to pin point what circular design principles were predominant in their design research. I drew a pyramid exercise in which the intention was to capture patterns of creative behaviour and instill them into a circular design method. The designers utilised this tool throughout the project, appropriating the principles to fit their intended purposes. By highlighting their key principles in a pyramid and prioritising them, enabled the designers to define their circularity challenges - even if it wasn't at a conscious level, in practice it started to inform the choices they were making. As an extension of this guideline, the tool is can be used to identify, structure and incorporate the circular principles in one's design ethos. By utilising the pyramid as a top to bottom structure, the top signifies the highlight of a particular design practice, and the bottom forms its basis. It is advisable to prioritise the principles, in order to asses throughout the design process if the principles still remain in the same position or an in need of shuffling around (or perhaps new principles can be added at a later stage). It is notable that during the (GC)2 project, the pyramids defined by the designers at the start of the project remained in the same position within the pyramid until the end, reflecting a clear set of direction and intention the designers had. It is also worthwhile noting that the circular principles do not have to stand on their own to take effect, and can be seen as hybrid-forms as well as mutually reinforce one another depending on the circularity challenges at hand.

Figure 2. These twelve Circular Design Principles based were identified by the designers of the GC(2) project as the main circular principles they adhered to as seen in the pyramid exercise (see Appendix I).[14]

[14] The cards on twelve circular design principles were partially based on the literature study done by the monitoring team during the GC(2) project.

A DESIGNER'S TOOLBOX

III.I The Role(s) of the Designer

"A good designer is comfortable in chaos" — Bruchter (2002).

When re-thinking systems, there is a natural progression to re-thinking the role of the designer in this very system. In the (GC)2 project, the role of the designer was placed into light, in which the alignment with their strategic goals reflected the business potential of what it is they wanted to achieve. By now we can acknowledge that designers play an essential role when it comes to innovation and sustainable solutions, and it is worthwhile to pinpoint what this role exactly is and can be. Every designer carries with him/her a set of skills, a wealth of knowledge and experience that enriches their design process to ultimately arrive at a product. The role of a designer is continuous dynamic and fluid embodiment, which ask for specific competencies depending on what the context is the designer finds him- or herself in (Lawson and Dorst, 2009). This embodiment extends into a visionary strategist that speaks various languages, and has the ability to adhere to different perspectives. Although this paper takes the designer perspective, and whilst addressing the role of the designer, the individualistic nature of designer may often seem as a precedent. However, the strength in designing for the CE lies in a collective form of thinking and acting, and it the very nature of collaboration and co-creation plays an integral role in this. For the purposes of this guideline, I will delve in deeper into a designer's toolbox, in which the role of the designer plays an essential component, with the idea that no man is an island and that the very nature of designing for the CE requires collective perspective and action. Stompff and Smulders (2013) mention the natural skill of a designer that is called "mirroring", in which designers are able to collect all different information to develop their product, and are able to integrate all the needed aspects and knowledge in a way that is easily understood by everyone within the chain. This asks for designers to take on multiple, layered roles that are often hybrid, in which they can be seen as 'carriers of knowledge': transporting knowledge throughout the product value chain. Through "mirroring", designers take on the responsibility to fill in the knowledge gaps often experienced in the multidisciplinary settings. Through the expansion and crossing of boundaries, designers have the ability to communicate through their prototype phase (in which ideas and innovations take shape) and turn it into something that is easily understood turning them into knowledge intermediators (Niinimaki, Tanttu and Kohtala, 2017). This bears a weighty responsibility from the designer, and although during GC(2) the designers naturally embodied the role of a knowledge intermediator when dealing producers and manufacturers, they are not able to carry this responsibility solely on their shoulders. It poses the question to what extent can designers be the mediators who can visit different disciplines to create a link between them. As pointed out by Buro Belén (2020), new roles are needed for circular solutions to be met such as someone who is able to follow the design process closely and pinpoint

the opportunities that designers might have missed due to lack of circular knowledge. In addition, measuring an integrated LCA (life-cycle assessment, see database) for instance, requires someone with the technical know-how to do this to relieve the designer of this enormous task. In UNSEAMS's project enunciated that a quick scan methodology on performing a LCA may not be sufficient and needs an integrated approach in order to move to an industrial scale. Through a designer role exercise[15] during (GC)2, new roles came to light that were relevant for circularity purposes, namely the role of the aesthetic nourisher (which aligns with the principle design for aesthetic usability). Herein, the designer provides the user with aesthetic nourishment which promotes durability and a deeper relationship between user and object. Buro Belén (2020) seek to do this in their design practice, in which they allow the user to be led by aesthetics to make ethical choices, looking at the variable aesthetic manifestations of the material itself to strengthen the social aspect of designing. The role of negotiator also become apparent, in which the visualisation of knowledge and ideas brings together actors from the product value chain and simultaneously bridges the gap between stakeholders. The role of data designer can be seen as a relatively new role, tying with circular design principle: design for understanding, in which data that needs to be interpreted and presented in a way that can easily be understood (especially when communicating environmental impacts in the design process). This is directly seen in Baggerman's work, in which she seeks to understand and offer understanding of different aspects of sustainability (social, economic and material), in particular to strengthen the relation between user and product. As witnessed in the case of Bruchter, who developed a framework on the circular industry during her design research for GC(2) in which the economic side and the environmental side inform one another in order to create new knowledge and understanding. In addition, the social skills of a designer also became crucial in strengthening the potential to work in a multidisciplinary setting.

It is evident that different design temperaments, types and purposes contribute to the varying actors in the design process. Borrowing William's (2014) categorisation of a designer, I was able to pinpoint the six designer case studies of (GC)2 into three roles: designer as a determiner, designer as a co-creator and designer as condition creator. Designer as a determiner takes on a more traditional role, in which "designers are privileged makers whose work is centrally concerned with materiality" (Kimbell, 2011) yet paves the way for innovation and disruptions. Herein, the role of the designer does not shy away from what we have come to know as the traditional designer to be, but their work methods and forms changes, for instance in influencing pro-environmental behaviour. During her design research project, designer Van Rees pinpointed the importance of having to transition from having the design be informed by aesthetics to a more technically-centred approach in order to adhere to circular solutions. Designers in this role hold the potential to

[15] The design role exercise intended to explore the changing role of designers in circular value chains, and was carried out by the monitoring team during GC(2).

"produce 'provotypes' to provoke new thinking" (Williams 2014) and behaviour. Language usage is crucial when adopting this role (see part III.III). Designer as co-creator places emphasis on co-design methods that are incorporated in the designer's set of aptitudes and actions. It holds the potential to create a direct dialogue between wearer and creator. This role is also often seen as the facilitator in the product value chain, and places co-creation high in the agenda and allows for active involvement throughout the entire product chain. This results in a better serviced design process and product, with more transparency towards the user. As seen in GC(2), designers become the translator of information to manufacturers and host technically enriched environments based on experiments with technical partners as seen in the case of Voorwinden (2020). Designer as a condition creator looks at the designer as an instigator by challenging "existing ways of 'doing design', and challenging the status of the designer" (Williams 2014). This brings up the question if designers can be the chain director of the product chain, and should they even be asked to perform such a role. As Buro Belén (2020) puts it, "designers are a small part [of the chain] and they deliver a big function", questioning the role of the designer in the entire chain and if the innovation perhaps starts somewhere else as opposed the designer making it. Embracing the human dimension, it asks for an activist type of role from the designer opening creative opportunities for others. It is largely dependent on the designer's background and experience, what competencies can contribute to the varying roles a designer can embody. When tackling circular design strategies it is becoming increasingly important to adopt a systems-thinking approach in which the roles almost become strategic in order to carry out the circular design principles. This asks for a level of consciousness and decision-making from designers, to invest in becoming the knowledge intermediators that can link the various disciplines within the product value chain.

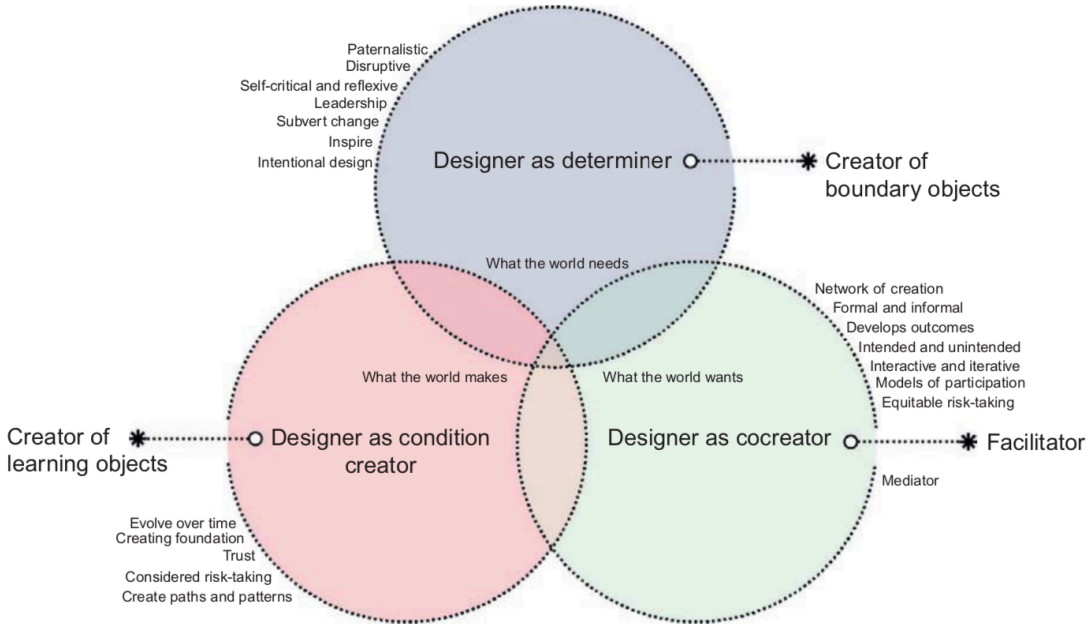

Figure 3. The roles of a designer according to Williams (2014).

III.II Product Passport

A valuable tool to include in a design process is developing a product passport, delivering insights in the circularity of materials and a direct way to put the circular design principles into practice. Much like a regular passport provides details of someone's identity, the product passport reflects the identity of a product, enunciating Rau's vision 'waste is material without an identity'[16]. According to Luscuere (n.d.) 'the scope of [a passport] is on the level of materials, products and systems and would refer to these'[17]. By keeping up with a product process, designers are able to record all the steps and choices of material and processes, and how it is made. In a conventional, linear way of producing, the documentation of the product is done at the end of the process. When designing for the CE, this is done at the start of the process, and throughout the product value chain. This could bring a large incentive for the designer to already make the sustainable choices. However, it isn't just about sustainability and measuring the Life Cycle Analysis (LCA) and Environmental Product Declarations (EPD) is a fraction of what a product passport entails. On a material level, such a passport can define its value for recovery for instance. "Existing tools only partially meet those needs because they focus more on measuring and reducing negative environmental impacts rather than increasing positive value creation" (Luscuere n.d.). When taking products and systems into account, general attributes that indicate value for recovery can be defined, an example would be design for disassembly (Luscuere n.d.). Maintaining a product passport can strengthen the circularly claims made by a designer, and also facilitate the collaboration with industry partners. By means of transparency, the product gains more credibility and shows its circular potential. In contrast to certification methods, the passport itself does not represent this potential, the information *in* the passport supports this. Material passports can also contribute to new business models, where leasing a product could play an integral role when it comes to ownership. In this scenario, the passport would reveal how many times it was utilised and what effect this has on the product itself. A relatively new concept, the product passport reflects the user-ship of the product, the care, maintenance, repair, etc. and can offer valuable and reliable information for diverse users[18]. Cradle to Cradle calls it a circularity passport[19], and highlights the engagement with suppliers as a result about material composition of products, use and location, design for disassembly and ownership value.

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[16] Architect and visionaire Thomas Rau is often quoted for this famous one-liner, see: https://materialdistrict.com/article/material-passport-next-step-circular-economy/

[17] See: https://www.bamb2020.eu/wp-content/uploads/2017/03/MaterialsPassportsPaper.pdf

[18] During my expert interview with Anton Luikens, he introduced me to the concept of product passports and their potential, March 2020.

[19] See: http://www.c2c-centre.com/news/circularity-passports-powered-cradle-cradle

III.III A Shared Circular Language

The integration of language as part of a designer's toolbox sets an example how language can play a beneficial and facilitating role in the interdisciplinary process of designing for the CE. According to the UCRF[20], the act of preciseness and consistency in language and important circular terms avoids concepts being lost and dampened, which in turn enhances their value and actions becoming highlighted and understood across a range of stakeholders involved in the product value chain. We already see this happening with the word sustainability, which has been appropriated in various contexts, becoming muddled in definition and losing the power of its importance. When approaching circular design strategies, the key terms that fall under them should be considered and explicitly defined in order to mirror its true progress and impact. The terminology around the CE can often be diverging, rather than converging. A paradigm of a circular economy requires new concepts and tools to describe and support it. A more coherent terminology is necessary to facilitate all of this, and this can be revealed in all levels of the process, on a strategic level and when looking at new business models. This brings me to the usage of a circular vernacular. The term vernacular refers to a group of people belonging to a specific group, or engaging in a specialised or specific type of activity (Oxford English dictionary, 2007). Therefore, it is quite fitting to look at how the common language within the circularity desires and goals can inform the design process and vice versa. Designers are often forced to take in all perspectives into account when working in an interdisciplinary environment, and due to the complex nature of their circularity challenges they are required to speak different languages in order to communicate more effectively with different stakeholders in order to have their ideas adopted and understood. The usage of engineering language, to communicate in R&D, in commercial aspects and strategic language are all examples of how language can take varying directions and meaning. Designers hold the potential to unite the stakeholders involved across the entire product chain through language and usage of correct terminology. The importance of policy language for instance, to tackle the ecosystem level in circular design and to be able to communicate with decision makers such as in funding, could potentially hold an important function in for example the development of a product passport (see part III.III). During (GC)2, my analysis has been that the usage of technical terminology comes quite naturally at a stage where designers already have a level of expertise and experience. It does pose the question for emerging designers on how to navigate with all these different terminologies. Furthermore, I found that circular terminology not always to be as consistent, for instance notions linked to emotional durability weren't always used according to the definition of the principle and confused with other principles. At the risk of certain terms losing their value, the act of a vernacular `language forces experts to be precise and consistent. This also relates to staying true to its

[20] Union of Concerned Researchers, see:http://concernedresearchers.org/ucrf-addendum-to-the-report-pulse-of-the-fashion-industry-2019-update/

meaning, and what the actions and consequences are of importance when adopting specific terms in the design process, especially communicating them to an audience or public. As the circular economy is a dynamic and developing concept, circular design reflects this evolution by continuous redesigning and system innovation. For that, a constructive debate amongst relevant stakeholders and information sharing must be facilitated. Also, the circular economy drivers, reasons, benefits, and challenges need to be communicated, in order to raise the awareness and importance of this topic. Only then, mental shift and an attitude change can take place.

CONCLUSION

It is vital to note how the circular design principles impact wider consequences of adopting strategies that come with them, not only from an environmental and economic perspective, but also from a social perspective. The focus on designing for new business models suggests thinking beyond products and services - adopting the five pillars of designing for the CE. When innovating with a broader focus, designers are urged to understand what becomes most relevant for financial viability, and how sustainable issues are taken into regard. This financial viability becomes crucial, due to the radical nature of coming up with solutions when working directly with(in) the industry. Circular models allow designers and companies to manage risks when it comes to the supply of materials. In fact, according to the Ellen MacArthur Foundation, applying circular design principles could unlock value to business and society worth EUR 900 billion greater than in a business as usual scenario in the EU alone.[21] Besides economic impact, the purpose of this guideline is to adopt design as a transformative tool that contributes to building resilient practices and business models, to sustain the CE in a human-driven manner. Invigorating the designer's role into one that contributes to a systemic change within the industry, the circular design principles motivate the designer by engaging into various levels in the industry, from product, to process to ultimately new business models and user needs, desires and patterns of behaviour (Wastling 2018) that will contribute to systemic change. As stated by Stella McCartney, "the transition to a circular economy will require exceptional levels of collaboration across the value chain and the implementation of new sustainable business models"[22]. This means that a recommendation such as this one does not only benefit (starting) designers, but also draws on the inclusion of all actors involved in the product value chain. The circular design principles are not only beneficial from an environmental and economic perspective, but also strengthen the social perspective on designing for the CE, which in turn positively contribute to major global challenges the fashion and textile industry is facing. Whether or not all of the circular design principles should be taken into account depends on the circularity challenge of the designer. By looking at it from a social perspective, it would be worthwhile to investigate the wider consequences of adopting the strategies of these principles. By taking not only the physical longevity into account, but also the emotional and cultural longevity, the hybrid forms of these principles could potentially lead to even more insights. Furthermore, as we have witnessed during the (GC)2 project the collaborative and multidisciplinary nature of designing for the CE plays an important aspect to realising the circular design principles. In a systems-thinking environment, the link between designers, manufacturers, producers and users holds the key to intrinsically transitioning towards a circular and human-driven economy and serving our well-being wholeheartedly.

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[21] See: https://www.ellenmacarthurfoundation.org/assets/downloads/Circularity-Indicators-Methodology.pdf

[22] See: https://www.stellamccartney.com/experience/en/sustainability/circularity-2/.

DATABASE

This database offers a collection of circularity initiatives and tools that play a supportive and/or significant role in contributing to the systemic change towards designing for the CE.

Circular Design Guide
A comprehensive guide and toolkit brought to fruition through a collaboration between the Ellen MacArthur Foundation and IDEO, which provides methods and mind-sets to help designers apply design thinking and circular design.

Circular Economy Practitioner Guide
A guide intended for sustainability professionals in various sectors of the chain, offering insight into over 70 strategies which include numerous resources, strategies and tools that designers and companies can use to implement the circular economy.

Common Objective
A sustainably led community for fashion professionals focused on fostering a global B2B network, connecting buyers and suppliers whilst offering circular-led content and tools to support sustainable fashion and textile businesses.

The Fashion Transparency Index 2020
A tool to incentivise and push major brands to be more transparent, and encourage them to disclose more information about their policies, practices and supply chain.

Fashion Revolution
A non-profit global movement intended to radically change the way clothes are sourced, produced and purchased, in which campaigns are held to increase transparency in the fashion supply chain.

Principles of Behaviour Change Tool
Based on behavioural psychology, the tool aims to inform designing for behaviour change, by indicating which design interventions are likely to be most effective, based on user's behaviour, intentions and habits.

Trash2Cash
Funded by the EU, this is a research project into textile recycling project involves 17 partners across 10 countries, aiming to provide new material solutions by extending life to zero-value waste and turning it into materials that can be used in fashion, interiors, etc.

Slow Factory
A design innovation lab focused on improving sustainable literacy in fashion, in order to develop products, resources and certifications that commit to the UN Global Compact and its principles in the areas of human rights, labour, the environment and anti-corruption.

Methods:

Life Cycle Analysis (LCA)
An environmental-oriented tool to gain insight in the full life cycle of a product, quantifying all inputs and outputs across the industry value chain of a product, process and/or service.

Made By Environmental Benchmark
A transparent fibre benchmark that is published and generally accepted, comparing the environmental impact of the most commonly used fibres in the garment industry.

Environmental Product Declarations (EPD)
An independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products.

Environmental certifications:

Global Organic Textile Standard (GOTS)
A certification helping to verify that a given textile was made using organic materials and/or that a mill, dyehouse, farmer or other producer used organic practices to create its textiles, in addition to upholding the labour standards set forth by the International Labor Organisation.

Global Recycling Standard (GRS)
This certification covers processing, manufacturing, packaging, labelling, trading and distribution of all products that are made with a minimum of 20% recycled material. The GRS is intended to meet the need of companies looking to verify the recycled content of their products and to verify responsible social, environmental and chemical practices in the production of these products

ECO PASSPORT by OEKO-TEX®
An independent testing and certification system for chemicals, colourants and auxiliaries, which are used for the production of textiles and leathers

Bluesign ®

A standard for environmental health and safety manufacturing of textiles. Each garment component is assessed based on its eotoxicological impact, suggesting ways of reducing consumption while recommending alternatives to harmful chemicals or processes.

Climate Beneficial

A verification award to farmers by Fibershed, as a way of ensuring that the process of creating ht material in question is contributing to a net positive impact on the climate.

Cradle to Cradle

A certificating fronted to specific products that are composed solely of either natural materials that can safely return to the earth to decompose, or synthetic materials that can be used again in perpetuity without downgrading in quality.

MODINT Eco-tool

A transparent guideline that makes it easier to calculate different products and materials on their environmental impact based on (parts of) their life-cycle.

HIGG Index

The HIGG Index empowers brands, retailers and facilities of all sizes, at every stage in their sustainability journey, to measure their environmental and social and labour impacts and identify areas for improvement.

Reformation RefScale

The Life-Cycle Assessment Tool calculates the CO2, water and waste footprints of Reformation products, as well as comparable products, including assessments of select fabrics and processes.

Regenerative Organic Certification

Created by the Regenerative Organic Alliance, this certification is still in pilot phase and is aimed at certifying that agricultural products such as wool and hemp are produced on farms that promote soil health, animal welfare and social fairness, based on the values of regenerative farming.

Standard 100 by OEKO-TEX®

This is most commonly encountered by consumers and certifies that textiles are free of substances that can be harmful to humans: a certification system for the complete processing levels of raw, semi-finished and finished textile products, including haberdashery.

Social certifications:

The Business Social Compliance Initiative (BSCI)
A social auditing methodology and report by providing a network of external accredited, experienced and independent auditing companies, helping companies to gradually improve working conditions in their supply chain.

The UN Global Compact
A call to companies to align their strategies and operations with ten universal principles related to human rights, labour, environment and anti-corruption, and take actions that advance societal goals and the implementation of the Sustainable Development Goals (SDGs).

Whilst these tools and certifications can uphold many standards that are needed in circular processes, it is important that they are critically evaluated at all times.

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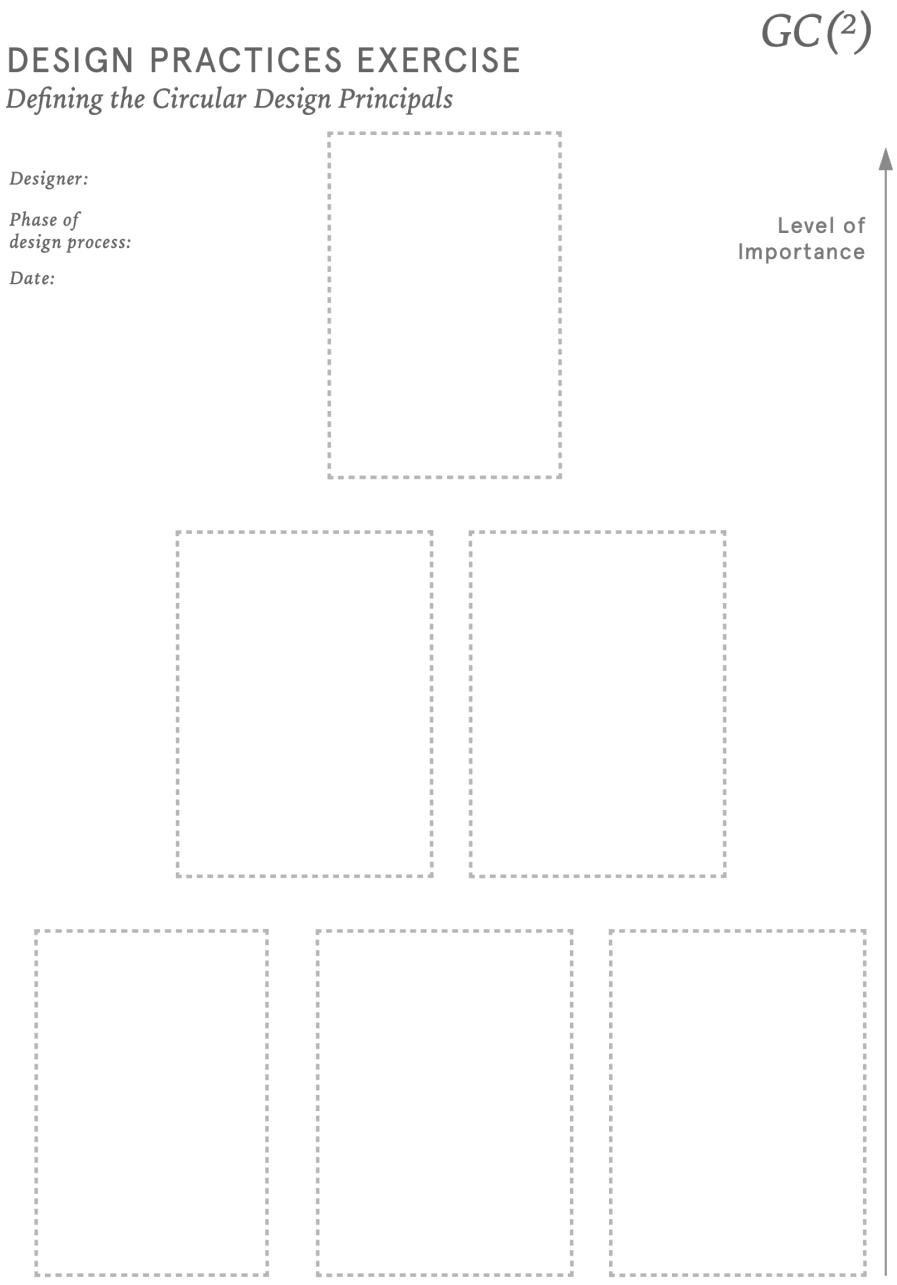
APPENDIX

Appendix I. Circular Design Principles Pyramid Exercise



Appendix II. Circular Design Principles Cards

Appendix III. GC(2) Design Role Exercise

Design Roles Exercise: Answer Sheet

Part I

- Which role/roles do or did you take on in this project?
  We have pre-defined a number of possible roles (see designer role cards on the next pages), but you can also define your own.
- Illustrate your roles with at least one concrete example/practice from your GC²project.

1. Role & Example

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2. Role & Example

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3. Role & Example

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4. Role & Example

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5. Role & Example