

Traditional Japanese Material Practices as a Model for Sustainability in Clothing Design

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ABSTRACT

Traditional Japanese Material Practices as a Model for Sustainability in Clothing Design

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This research-creation explores how traditional Japanese materials and methods can inform the production of a garment that contributes to understanding alternative clothing design and consumption practices. The thesis is a response to the unsustainability of a fast-paced industry driven by low-cost production, toxic dyes, material waste, disposability, and overconsumption at the expense of the environment. Moving towards a sustainable future requires rethinking the entire garment lifecycle from sourcing to production and consumption.

Japan's rich traditional textile history of using diverse bast fibers¹, natural dyes, and small run and no waste productions may offer designers a way forward. In this thesis, the principles of *mottainai* and *shinto* are intertwined with *slow fashion* and *design-with-care*. The research methodology was conducted in three phases: (i) an experiential field study in Japan; (ii) a contextual analysis of formal literature and experiential learning; and (iii) material and performative experimentation through sourcing of biodegradable materials and food waste for colouring; carrying out dye experiments; zero-waste patterning, to uncover viable solutions. The result of my investigations is a *hanten*, a traditional Japanese jacket, which I adapted for use in the Quebec winter climate.

Further emphasizing the Quebec context, I worked in collaboration with local professionals for the jacket's quilted milkweed insulation and patternmaking and sewing techniques. My aim has been to design a one-off garment prototype to represent some of my ideas and processes. In future research-creation, I hope to address the potential of this thesis paper and *hanten* jacket as a model for multi-garment production in Quebec.

Keywords - Sustainability; Research-creation; Japanese Traditional Textiles; Mottainai; Shinto; Slow Fashion; Natural Dyeing; Shibori

¹ Bast fibers refer to plant fibers derived from the inner stems of certain plants, including flax, hemp, jute, ramie, hibiscus, abaca, stinging nettle, wild orchid, and milkweed. Japan has a wide variety of bast fibers such as *Basho-fu* (banana fiber-based textile), *Fuji-Fu*, *Miyako-jofu* (ramie textile from Miyako Island), *Kudzu-fu* (textile from Japanese arrowroot), and *Shifu* (textile made from *Kaji* mulberry paper).

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Unless otherwise stated, all images and illustrations are by Larissa Zemke.

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INTRODUCTION

SITUATING THE RESEARCHER AND HER PRACTICE

As a person with German and Iraqi heritage, a European upbringing, and a North American education, I have long been interested in learning from other cultures. I was raised by parents who were both trained in agriculture and a mother who practiced slow living and conscious consumption of food and clothing since the 1980s. Consequently, values of care and sustainable living were instilled in me from an early age. My fascination for quality textiles stems from my mother's family history of textile trade in the Middle East.

During my educational and professional experience in the fashion industries of New York, Paris, Vienna, and Montreal, I was directly exposed to unsustainable design and production practices. I witnessed the darker sides of the industry as I worked in different departments, including design, production, merchandising, and retail. It became clear to me that the industry focused more on turnover and profit rather than addressing the user or wearer, labor exploitation, garment life cycle and environmental sustainability. I also had multiple opportunities to travel to countries in the Global North and South including Japan, India, Italy, and Austria where I learned about local textile and production practices. These experiences shed light on the complexity of the entire value chain of the garment industry and the importance of understanding interconnectivity between agricultural/resources, labor/human relations, and fashion/material systems.

*Through my research on fashion design and textiles, I ascertained that many Japanese traditional and some contemporary practices could be considered precursors to sustainability. These discoveries and my appreciation and curiosity for Japanese craftsmanship and culture motivated me to travel to Japan (2019–2020) to source novel ideas for design solutions. The trip included field studies, experiential learning and living with artisans, which became the impetus for my Master of Design research/creation. I was able to associate experiential learning with the traditions of responsible living present in my own upbringing. My journey culminated with the production of a bookwork titled, *A Year in Japan – Exploring the Japanese Way of Being, Creating and Consuming* (2021) that serves as Volume 1 of the thesis.*

Hence, I hereby recognize that the one-year travel and field study was conducted from the perspective of an outsider, a guest in Japanese culture. My research-creation thesis is highly influenced by Japanese traditional textile practices, without trying to appropriate or own them.²

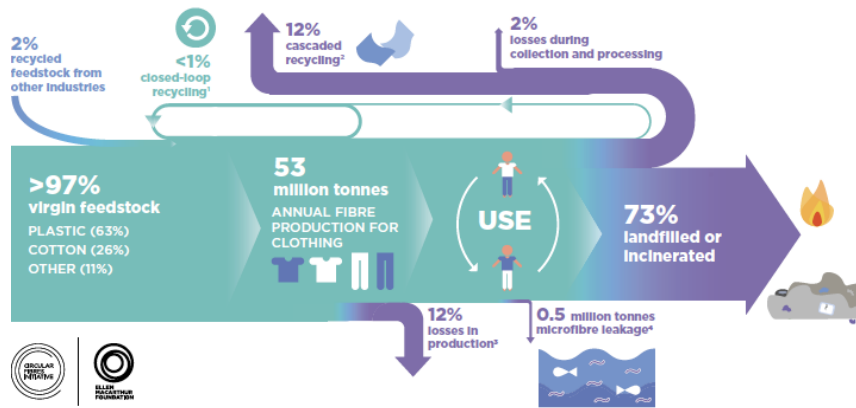
² Please note: This thesis project is informed by the principles of the Simon Fraser University guide, Think Before You Appropriate, to ensure respectful creative collaboration. The guide defines 'cultural heritage' as elements that are shared by a given group since they are culturally significant and linked to collective memory or identity. 'Appropriate' signifies "to take something that belongs to someone else for one's own use." With regards to heritage, appropriation occurs when a cultural element is removed from its original cultural context and applied in another context (Simon Fraser University 2015, 2). On the contrary, cultural appreciation acknowledges cultural heritage and its significance.

UNSUSTAINABILITY IN THE GARMENT INDUSTRY

As a creative who has worked in the garment industry, my thesis illustrates the challenges of dealing with unsustainability, specifically the devastating environmental and health impacts of global mass-produced clothing consumption and disposal.

Environmental degradation and over-consumption are entrenched in global fashion manufacturing. Therefore, rethinking the cycle of design, production and consumption is an enormous but necessary challenge in the transition toward sustainable futures. The 2017 Ellen MacArthur Foundation report explains that the textile industry follows a linear “take-make-waste” model in which non-renewable resources are extracted to manufacture garments for planned obsolescence as they are only consumed for short periods of time before being disposed (See Figure 1). The average number of wears per garment has dropped by 36% compared to 15 years ago. It is estimated that some \$100 billion USD is wasted annually due to clothing underconsumption and lack of recycling (Ellen MacArthur 2017, 36). The waste produced by the garment industry is alarming as “87% of the total fiber input use for garment production ends up in landfills or is burned.” Moreover, 10% of fiber input is wasted during garment assembly and 2% is wasted from samples (Ellen MacArthur 2017, 36-37). Consequentially, I was driven to explore clothing design practices that reduce fabric waste during garment production and reframe the perspective and habits of consumers.

From an environmental perspective, textile production releases 1.2 billion tonnes of CO₂ greenhouse gas emissions annually, which is more than all international flights and maritime shipping joined (Ellen MacArthur 2017, 36). The fashion and textile industries have become major environmental polluters at all stages of the garment lifecycle. Notably, heavy toxic petrochemical dyes and synthetic fibers enter water streams and other natural ecosystems. As a result, 70% of China’s waterways are polluted with toxic waste including residual dyes. These impacts on the environment have led to 1.4 billion people lacking access to uncontaminated, safe water (McIlvride and Mazzotta 2020). Additionally, during the consumption stage, synthetic fiber-based garments release plastic microfibers into water systems when washed. These microfibers contribute approximately sixteen times more to ocean pollution annually than microbeads from cosmetics. The harmful substances negatively affect not only the people working in the industry, but also the end consumers of the clothing and ultimately the environment.



- 1 Recycling of clothing into the same or similar quality applications
- 2 Recycling of clothing into other, lower-value applications such as insulation material, wiping cloths, or mattress stuffing
- 3 Includes factory offcuts and overstock liquidation
- 4 Plastic microfibres shed through the washing of all textiles released into the oceans

Source: Circular Fibres Initiative analysis - for details see Appendix B

FIGURE 1. GLOBAL MATERIAL FLOWS FOR CLOTHING IN 2015, CIRCULAR FIBRES INITIATIVE ANALYSIS (ELLEN MACARTHUR 2017)

It should also be noted that the toxic dyes and chemical treatments such as flame retardants, stain- and wrinkle-resistant) also impact human health as we are in direct contact with clothing most of our lives. Hence, we are constantly exposed to chemicals and particles via breathing, ingestion, and skin absorption (Licina et al. 2019). External factors during garment use such as washing, drying, storage, and usage routines also impact human exposure (Licina et al. 2019, 2-3). This information represents a partial review of the literature that informs my practice.

Research and Strategies Towards Change

The term ‘sustainability’ has been used increasingly in the garment industry as companies are being pressured by shareholders, non-profit and inter-governmental organizations (i.e., the *United Nations Sustainable Apparel Initiative [SAC] Ethical Trading Initiative, Fair Wear Foundation and Clean Clothes Campaign*), and consumers’ brand perceptions to address growing ecological and fair labor concerns while ensuring long-term business success. Generally, ‘sustainable fashion’ refers to clothing, shoes, and accessories that are produced, marketed, and consumed by prioritizing environmental and socio-economic factors. Researchers and design schools have acknowledged that defining sustainability as a complex multi-faceted issue is essential to driving sustainable change. Holmberg and Sandbrook (1992) and Pearce et al. (1989) state that over 70 different definitions of sustainability exist (as cited in Gwilt and Rissanen 2011, 20). The garment product lifecycle encompasses stages from fiber growth and harvest to textile manufacturing, dyeing, printing, garment assembly, transportation, consumption, and the reuse or disposal of garments and fabrics. Consequently, it is important to adopt a holistic perspective that considers the entire lifecycle of garments (Coste-Manière et al. 2018, 12). Sustainability can be viewed as a triple-bottom-line concept that involves social, environmental, and economic facets (Baier, Rausch, and Wagner 2020, 1). From an environmental standpoint, Coste-Manière et al. 2018 propose initiatives reduce the ecological damages of the product’s lifecycle by addressing the following three components (Coste-Manière et al. 2018, 11): ensuring efficient and careful use of natural resources; selecting renewable energy sources; and maximizing efforts to repair, reuse or

recycle (Green Strategy 2021). I would add that effective and conscientious use of resources is key to ensuring long-term resilience and regenerative systems.

In response to these environmental, economic, and socio-cultural challenges, a growing number of actors including companies, non-profit organizations, academic institutions, and governments have launched initiatives in recent years. The industry players continue to explore and adopt novel approaches for more responsible design, production, consumption, and disposal practices. For example, companies have launched recycling and repair programs and have published sustainability guides on key principles that support positive environmental impacts. With growing pressure to adopt sustainability initiatives, many brands have adopted expensive marketing campaigns to jump on the bandwagon to improve their 'green' image to appear as to 'be doing the right thing' (Gwilt and Rissanen 2011, 20). Despite these attempts, the implementation of comprehensive close-looped design strategies (see Glossary in Appendix A) that drive impactful change is still lacking (Gwilt 2014, 24).

Patagonia, a successful frontrunner in sustainability since inception, launched the *Worn Wear* program (<https://wornwear.patagonia.com>). At the 2022 North Carolina State University Conference: "Evolving Textiles Conference: Materializing the Future," Patagonia's Lead Materials Developer, Ciara Cates, affirmed the company's goal to keep textiles in circulation so that they never reach the landfill. Their process has focused on reverse designing to determine how a garment gets made to fit into existing systems. It was uncovered that recyclers need clean, consistent streams of inputs and outputs. Thus, Patagonia proposes a strategy that involves designing for simplicity and repair by avoiding blended fibers and coatings, and by focusing on easily removable and repairable garment constructions. Moreover, they encourage customer education by using recycling bins and providing detailed information on garment labels. However, it is arguable whether recycling bins may encourage overconsumption because consumers could be led to feel like their garments continue on a positive trajectory after disposal.

Nike has responded to pressures to be more transparent and sustainable by publishing a *Circularity Guide* (www.nikecirculardesign.com). According to Nike Senior Director of Materials Design, Golnaz Armin, materials tend to have the most significant environmental impact. When considering chemistry, energy, and water, 60% of Nike's impact comes from materials. Armin calls for better material choices and acknowledges: "Nobody has the golden answer. But our questions about our own processes and learning from others moves us forward" (Nike Circularity Workbook 2020, 9). Armin's perspective highlights the importance of choosing better materials as a way for lower-impact consumption.

Additionally, new innovative biodegradable textiles made from cellulose fibers from agricultural waste i.e., okra stalks, papaya prunings, pineapple leaves, coffee grounds (Adhia et al. 2021, 50-51), and recycled synthetic fibers are being researched. According to Reddy and Yang 2015, there has been a decrease in cotton and other natural fibers due to the challenges of cultivation, resource intensiveness and increasing costs of agriculture. This has driven investigation on agricultural waste by-products from corn, wheat and rice as renewable biodegradable fiber alternatives (Reddy and Yang 2015, 3). Furthermore, the Laudes Foundation's study explores the potential of agro-residue-based sources as textile fiber feedstock in eight countries (Adhia et al. 2021, 50-51). There are also an increasing number of initiatives that collaborate with nature by using biodegradable ingredients and avoiding all petroleum-based fibers and dyes. *The California Cloth Foundry* proposes a naturally made "Healthy Wardrobe" that is comparable to the food we can consume safely (California Cloth

Foundry 2022). The founder, Lydia Wendt's research, emphasized that the current cost-driven fashion system does not support clean agriculture and that higher prices directly represent the healing of the system" (Moore 2020).

Sustainable Initiatives in Quebec Production

Important to my thesis work was to move the literature review from a global to a local perspective, which would have more impact. On a local level, companies such as *Ciele Athletics*, *Atelier b* and *Lasclay* have also taken steps towards improving environmental sustainability by using recycled and biodegradable materials, as well as local and zero-waste garment production methods. Ciele launched products using recycled yarns with their reprieve program in 2020. The company is shifting towards sourcing materials that are at least 50% and up to 100% of Global Recycle Standard (GRS), recycled yarns (recycled polyester and recycled nylon) as well as organic blends (Ciele Athletics n.d.). Montreal-based Atelier b produces minimalist clothing locally using natural fibers along with slow design and zero-waste manufacturing processes. Moreover, they have implemented an end-of-life collection program to offer repair services to prolong the life cycle of each garment (Atelier b 2022). With the rise in Quebec-grown plant fiber, milkweed has become an alternative insulation material for outdoor clothing. For instance, Lasclay produces outdoor accessories that are harvested, designed, and made in Canada. Milkweed provides the endangered monarch butterfly population with breeding grounds before they migrate south, which supports local regenerative agriculture. These Quebec brands among others, inspired my own personal production.

RESEARCH-CREATION PROJECT

My research-creation offers a compelling example from which to examine a prototype and bring attention to new ways of thing and making. In this context and from my field study in Japan, I chose to explore textile and garment design techniques through a material and performative process. The creative one-off hanten jacket is informed by a traditional Japanese garment with a zero-waste pattern (see Figure 2), which I also adapted for use in the Quebec winter climate. The garment was produced in collaboration with Quebec industry professionals and Concordia community. The research-creation process involved fabric sourcing, shibori stitching, zero-waste patternmaking, natural dyeing, quilting and garment assembly. Inspired by Japanese principles of shinto and mottainai, I used local food waste and biodegradable materials including milkweed insulation. My exploration was driven by the motivation to lower the negative environmental and health impacts of clothing. The hanten presents the possibilities for rethinking the design of garments through slow fashion and design-with-care. Research findings were disseminated to the public, Concordia community and New York-based design schools through an exhibition, workshops and presentations.



FIGURE 2. LEFT: HANTEN ORIGINAL GARMENT, RIGHT: HANTEN PROTOTYPE

Through Japanese culture and materiality, I examine the relationship between humans, textiles, and the environment. Slow fashion and design-with-care principles (see Chapter 2) are applied to draw attention to the human and non-human sources that contribute to garment-making. In the spirit of slow fashion, the thesis adopts a cultural sense of time that values traditions to understand how garment production can shift away from a linear “take-make-dispose” model (see Glossary in Appendix A) towards more closed-looped models that embrace more conscientious ways of designing and consuming.

The scope of the project is limited to sourcing, design and assembly phases to produce a one-off hanten prototype. Rather than offer definite solutions for lower-environmental impact garment-making practices, this thesis is a material exploration to inspire more responsible garment design. In the future, I hope to further explore a model for multi-garment production in the Quebec context.

Research Question

In response to these provocations, the research-creation project addresses the following primary research questions:

- A) *Concerned by the unsustainability of mass-garment production, is there a research-creation prototype that could represent and provoke change?*
- B) *Could my year of training in Japanese traditional material practices be applied to the research-creation investigation?*

METHODS AND MATERIALITY

The research-creation project's methodology consisted of three phases for which I provide an overview below.

Phase 1: Experiential Field Study (May 2019 - March 2020)

During Phase One, I conducted field studies on textile practices in Japan from May 2019 to March 2020. Participatory and observation methods focused on apprenticeships and workshops, journaling, sketching, and photographing. My experiential learning of traditional and contemporary textile production practices drew from ethnography, specifically participatory observation research methods. I observed Japanese practices of care through mottainai and shinto. Whenever possible I worked in the fields alongside, ate and socialized with the artisans and their families.

Phase 2: Contextual Review & Analysis (May 2021- August 2021)

In Phase Two, I completed a contextual review of sustainable ways of being and textile practices, specifically bast fibers and shibori, which resulted in a bookwork (Zemke 2021). This was followed by a literature review on sustainable efforts by North American companies. Next, I conducted initial experimentation to test possibilities for the final research-creation.

Phase 3: Research-Creation Experimentation and Final Production (November 2021 – May 2022)

In Phase Three, I began by comparing sustainable design ideas and traditional Japanese methods and then proceeded with material and performative iterations. The following stages led to the production of the one-off hanten adapted for Quebec weather and wearer. The insulated biodegradable hanten jacket was designed and constructed in collaboration with local industry professionals. I did a photoshoot in collaboration with Concordia students and Montreal friends and created a lookbook. The final production was presented at 4th Space in May 2022. During the exhibition week, I gave workshops as part of my strategy to knowledge share. External to Concordia, I was invited to present at Pratt, Parsons, and FIT design schools.

CHAPTER 1: GROUNDWORK

In this chapter, I present the context in which the project was developed. Research for my thesis project began prior to the commencement of the Master of Design program at Concordia, with an experiential field study consisting of over ten months of living, researching, working, and volunteering in Japan (2019-2020) to learn about traditional textile techniques and worldviews. The groundwork involved daily interactions in proximity with Japanese hosts, mentors, and experts. During the master's program, this dialogue was continued through conversations and creating in collaboration with a Japanese friend who had just moved to Canada, a Canadian Japanese textile artist, Concordia's faculty and students, and Quebec industry professionals.

I applied a participant observation research method in the field study to draw lessons from Japanese design practices. The qualitative research focused on textile methods including bast fiber-making, plant dyeing, and *shibori* tie-dyeing in Okinawa, Shizuoka, Wakayama, Osaka and Kyoto. I chose the participant observation (PO) research method drawn from ethnography to gain a deeper understanding of these practices through experiential learning. Ethnography stems from anthropology and sociology, and focuses on studying patterns of behavior, language, and actions of a cultural group in a natural setting over an extended period of time (Creswell 2014, 42-43). In the PO method, the researcher is immersed in the everyday activities of participants (University of Toronto 2019). By living and working with locals, I was able to investigate the role of materiality in various aspects of Japanese life.

I aimed to divulge textile practices that have a lower impact on the environment and human health. The research consisted of a five-month apprenticeship as well as numerous textile and fiber-making workshops, lectures, exhibition visits, and interviews with experts and companies. As a result, I was able to base my research-creation thesis on a more profound experience of Japanese culture.

A couple of interactions were particularly impactful for me and paved the path for this thesis. Notably, during a lecture at Shizuoka University on July 17th, 2019, Tatsuhiko Murai-san explained that *kudzu*, Japanese Arrowroot, served as a food source during the Edo period (1603–1868) and how different parts of the plant were used for a variety of purposes (Murai 2019). I spent a day with the Murai family learning about the kudzu-fu making process, from harvesting to fiber extraction, drying and spinning. I was able to observe in wonderment and witness firsthand the overarching commitment of these extraordinary makers who continue to keep traditional techniques alive. The interconnectivity between food and fashion systems became apparent when fried kudzu was served for lunch. Murai-san emphasized that “the wisdom of the new age is in the tradition” (Murai 2019). His statement resonated with my intent to draw from traditional textile production practices to explore new approaches to sustainability. Furthermore, Ryoko Murai, Murai-san's business partner and wife, explained that the word “loom” in Japanese is composed of two Kanji characters: thread, hito (person), and ki (tree), the loom's material. She said that “this shows how language can teach us what something is made of” (Murai 2019). This led me to reflect on the current context of mass-produced fashion, in which consumers have minimal knowledge about clothing composition and production. As a result, I was driven to explore how designers can better educate consumers about the processes involved in garment production. Murai-san stated, “Textiles made by hand with love can protect the family” (Murai 2019). This inspired me to ponder how it would be possible to build more emotional and spiritual connections that honor our relationships with clothing.

1.1 TRADITIONAL JAPANESE TEXTILES

Japan has a rich textile history consisting of diverse plant-based fibers and dyes. Due to its tropical climate, Japan and Southeast Asia are home to various bast fibers. The need to adapt textiles to weather and seasons has prompted innovative approaches to using biodegradable fibers. It is presumed that the first Japanese textiles dating back to the *Jōmon* period (c. 13th–10th BC) were composed of netted and braided fibers from tree bark and tall grass. Before cotton was introduced to Japan in the 17th century, people relied primarily on bast fibers to create their garments as they were affordable and locally available (Karuno 2016, 252). I examined the following cellulose-based textiles: *bashōfu* (banana fiber), *kudzu* (Japanese arrowroot), *miyako jofu* (ramie), and *shifu* (*kaji* mulberry paper). The various techniques I researched in Japan provided a basis for my material explorations.

Exploring Dyeing Techniques

While I studied various local bast fiber-making practices, my fieldwork focused on natural dyeing techniques, including *aizome*, indigo, and shibori, to address the concern of environmentally harmful chemicals used in garment production.

Over five months, from August to December 2019, I learned about regenerative agriculture at a weaving atelier, Ohara Koubou, on the outskirts of Kyoto. Dyeing with plants known as *kusakisome* involved the use of indigo and marigold grown on the farm's plot of land. Indigo processes included techniques with dry leaf, fresh leaf, and fermentation (see Figures AD.7, AD.8, AD.9, AD.10 in Appendix D). As a culmination of the apprenticeship, I created a yarn-dyed bouclé wool scarf (see Left Image in Figure 4). The yarns were dipped with red root and marigold (see Figure AD.11 in Appendix D). I gave a new life to garments in my travel wardrobe through plant dyeing (See Figure AD.12 in Appendix D). During the apprenticeship, I expected to focus solely on color methods. However, I also performed a significant amount of farm work. The plot of land supported the family's food supply and the daughter's restaurant, as dyestuffs were grown alongside vegetables (see in Figure 3). The atelier's operations of coloring and weaving shawls, performing workshops and hosting rental space served as another source of income. Through this participatory-observational experience, I learned about the complementarity of farming and textile production, and I gained an appreciation for rural Japanese ways of eco-conscious living. It became clear to me that food and clothing should be considered synergistically as part of the same regenerative agriculture system.



FIGURE 3. OHARA KOUBOU FARM, KYOTO PREFECTURE



FIGURE 4. LEFT: WOVEN WOOL SCARF DYED WITH INDIGO AND MARIGOLD, RIGHT: ORINUI SHIBORI EXPERIMENT, WAKAYAMA PREFECTURE

I also attended other workshops to learn about different shibori techniques using indigo in Wakayama and Kyoto. The techniques involved tie-dyeing with different tools, mainly everyday objects such as rubber bands, chopsticks, marbles, and clips. The techniques learned included: orinui -, murakumo-, itajime-, and kanoko- shibori. Orinui utilizes stitching to create resist patterns (see above Right Image in Figure 4), which I later used in the research-creation process (See Figure 17).

1.2 JAPANESE PRACTICES

For consistency in this paper, I refer to traditional Japanese concepts, philosophies, and cultural and religious beliefs as ‘practices.’ The limitations of this terminology include the fact that while these practices are traditional they have still survived to a certain extent in modern cities that have adopted mass-consumption and production practices. For example, global brands like *Levis and Uniqlo* offer garments silhouettes inspired by traditional garments.

I observed mottainai and shinto practices to be pervasive in everyday Japanese life specifically among textile artisans and in rural areas as well as the more traditional city of Kyoto. Through my exchanges with locals, I learned that these worldviews are still being transmitted to youth through education and family. Yet, the extent to which they are applied in daily contemporary life is debatable.

Shinto (神道) is a traditional animism religion that originated during the *Jōmon* period in Japan and highlights the veneration of nature, including the spirits of plants and animals (Sato 2017, 149). With the start of rice agriculture 2,500 years ago, came respect for nature’s resources, which became the basis of shinto. There are various present-day rituals that carry the vestiges of this appreciation. For instance, the custom of saying ‘itadakimasu’ (頂) which in the literal sense translates to “I humbly receive.” It is an expression of gratitude and appreciation for all beings that contributed to the meal, including stakeholders such as the cook, agricultural workers, animals, and plants. It brings a mindful aspect to consumption that the globalized world could benefit from. With a similar respect for inanimate beings, world-renowned Japanese decluttering guru, Marie Kondo, asks people to thank their garments for the care they provided before disposal. Consequently, I was prompted to wonder: “What if we took a moment to show gratitude daily towards our garments before dressing just like the Japanese do by saying itadakimasu before eating a meal?”

Yuriko Saito describes Japanese aesthetic tradition as morally based since it encourages respect, care, and consideration for others, including humans and non-humans. Aesthetic design principles, include: 1) respecting the innate characteristics of objects and 2) honoring and responding to human needs (Saito 2013, 159). I experienced this moral aesthetic dimension while observing everyday activities from the wrapping of purchased items by salespeople to the careful disposal of waste. Moreover, I witnessed kimonos and clothing being folded with the utmost caution for protection and preservation for storage or transportation.

In another experience, a local Okinawan insisted on guiding me to a location he referred to as “the power spot,” where tectonic plates seemed to move (Zemke 2021, 26). This exemplifies the Japanese veneration and respect for nature, which may also be tied to the country’s climate and geographic location, making it susceptible to unpredictable natural disasters, including tsunamis and typhoons. Yuriko Sato (2017) urges us to move away from a human-centric approach that has been exacerbated by technological advancement and that causes suffering due to a loss of purpose. Sato argues that connecting with non-human worlds could help expand our limited perspective (Sato 2017, 150).

Mottainai (勿体無い)

Mottainai (勿体無い) originates from Buddhism that is used in daily life to convey a sense of regret over waste due to the inherent value not being adequately utilized. The term is commonly used as an expression that translates to “What a waste!” or “Don’t be wasteful!” (Sato 2017, 147-148). As Sato explains that the word consists of ‘mottai,’ which refers to the form of something (勿体) and ‘nai’ (ない), a negation which indicates the absence of something. Hence, it relates to the core Buddhist belief that nothing exists on its own and so that “something—one thing—can only exist in relation to many others, and if one of these others changes, another constellation emerges.” This is referred to as dependent or (inter)dependant origination (Sato 2017, 148).

Part of Japanese tradition is to teach children at a young age not to waste even the last grain of rice in their bowls. Teaching this mindset to younger generations is not considered to be religious education. However, it does play a crucial role in developing a religious understanding. During periods of poverty, it served a practical purpose to consume frugally (Sato 2017, 148). The practice is noticeable in various aspects of Japanese life and aesthetics. For example, *kintsugi* is used to piece back together broken pottery and *furoshiki* traditional wrapping uses square-shaped textile scraps.

From my personal observations as an outsider, mottainai seems to be the underlying thread guiding everyday societal life and actions in both rural and urban areas. These activities include the manner in which food and clothing are consumed, cared for, and disposed. This was particularly apparent in rural areas, for example, on the farm where I worked on the outskirts of Kyoto. Mottainai practices also remain in more prevalent use by artisans. It should be noted that with industrialization, the *furoshiki* wrapping was replaced by plastic disposable bags. I find it important to bring to light these traditions from historical contexts to inspire slower and more conscious design and consumption practices. This worldview witnessed in Japan, guided my research-creation journey.

CHAPTER 2: COMPARATIVE SUSTAINABLE DESIGN

My research-creation process was also informed by literature on existing sustainable design practices that I encountered during my graduate studies. To clarify, these practices encompass attempts at addressing sustainability in the global mass-market garment industries. It should be noted that Professor Kate Fletcher's work provided strong influences in my literature review.

The increasing negative impacts of garment industry practices have led to the development of a number of initiatives such as the LCA (Life-cycle Assessment), Cradle to Cradle, the Higgs Index Material Sustainability Index (HIMSI,) and Considered Take and Return (CT&R) (Kozlowski, Bardecki, and Searcy 2019, 2). The GOTS (Global Organic Textile Standard) has become a standard environmental and social responsibility requirement when companies source textiles. While well-established approaches exist, they have yet to be implemented effectively to create impactful systemic change in the industry.

In recent years, *slow fashion*, *design-with-care*, *localism*, and the *garment lifecycle* have emerged out of a need for change in our fast-paced production and consumption practices. Concepts of slow design began with a food movement in 1986 in Italy, followed by the slow cities and slow fashion movements, which aimed to encourage greater awareness and responsibility leading to improved quality of life (Fletcher 2014, 172-173). Slow fashion and localism had a significant influence on my research-creation process and provided principles that complement the Japanese practices thereby allowing me to dig deeper into the complexities of unsustainability.

2.1 DESIGN-WITH-CARE

Post-pandemic, 'care' has become a buzzword that companies in all different industries have started using in their marketing. Hence, it is important to define "care" in this paper. Care is referred to as a mindset and way of life inspired by principles of *mottainai* and *shinto*, and the ontology of *design-with-care*, which aim to minimize waste while honoring both the animate and inanimate (See Glossary in Appendix A). It encourages us to question how we care for each other, all beings, and the planet. *Design-with-care* was the common thread enabling me to interlace sustainable design and traditional Japanese practices in the context of materiality in my research-creation path.

The Lancaster Care Charter was developed through an international multi-disciplinary workshop on "Does Design Care?" held at Lancaster University in 2017. It aims to tackle the complex and pressing challenges of care as both the future and the responsibility of design (Rodgers et al. 2017, 73). The charter stipulates that design has disregarded its responsibility to care and hence calls for a design approach that is more "attentive to context, difference and time; to be relational, ecological, modest and reflexive and therefore caring." It adopts a more humble stance that approaches all situations and beings both animate and inanimate as they exist by notably caring for and celebrating diversity while functioning inclusively and allowing for the transparency of processes and products of design (Rodgers et al. 2017, 73). The charter emphasizes that the cultivation of the sources and flows of energy involved in implementing caring labor practices is essential to the care-of-design. This relational ontology diverges from a human-centric approach to include both the human and non-human. Moreover, it can

encourage us to expand our values beyond what is newest and most novel “to truly acknowledge what exists already and steward these resources” (Rodgers et al. 2017, 74). Therefore, my research was motivated by a desire to cultivate respect for sources and flows of energy from all animate and inanimate beings.

2.2 SLOW FASHION AND LOCALISM

Slow fashion practices have existed all over the world for centuries as hand-made locally produced textiles and garments. The industrialization of garment production brought on a fast pace that feeds overproduction and overconsumption at the expense of the environment and human health. In response to this state of unsustainability, numerous books and articles have emerged to propose an alternative approach that favors a slower pace. For example, John Thackara’s *In the Bubble: Designing in a Complex World* suggests a culture built around a more diverse range of speeds and ‘selective slowness’ (as cited in Fletcher 2014, 172). In her book *Sustainable Fashion and Textiles – Design Journeys* British designer, professor, and researcher, Kate Fletcher, coined the term ‘slow fashion’ to encompass the concepts of designing, producing, consuming, and living better. She proposes merging the notions of natural time, which involves regenerating cycles and evolution, with the cultural sense of time, which values traditions and wisdom along with timeframes of fashion and commerce (Fletcher 2014, 173). The slow fashion movement goes against the ‘planned obsolescence’ of the fashion industry (Gwilt and Rissanen 2011, 153). It advocates for a shift towards ‘planned preservation or reuse’ of textiles and garments. The model emphasizes quality, durability, and long-term investment, and values the relationship between the consumer and the environment (Preuit and Yan 2017, 1141). It rejects the large-scale, expedited models that dominate the current garment industry. Gwilt and Rissanen describe slow fashion as aiming to reduce excess consumption by promoting local and authentic options, high-quality garments, and style education. There are several ways this can be achieved, for example, by encouraging personal style combined with the strategies of repairing, upcycling, alteration, renting, alongside artisanal and DIY methods. The slow fashion diagram by Pookulangara and Shephard 2013 brought me to consider the following criteria during the creation process of the hanten (See below Figure 5).

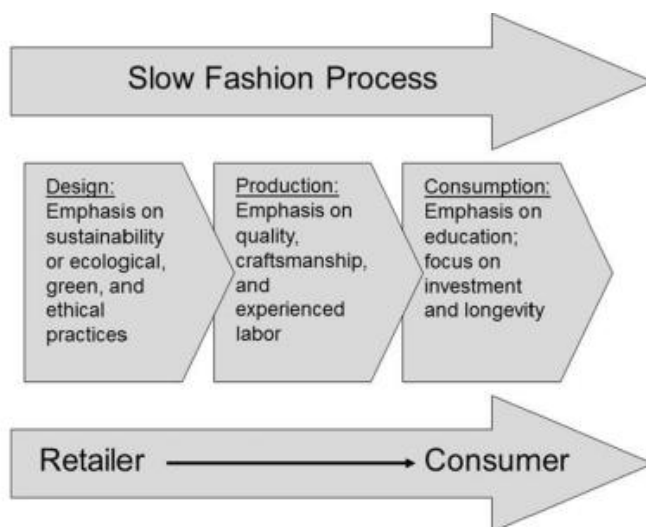


FIGURE 5. THE SLOW FASHION PROCESS (POOKULANGARA AND SHEPARD 2013)

In parallel, Kate Fletcher's *Fashion Ecologies* project proposes localism as a key principle for change that will “solve at root many of society’s theoretical and practical problems” (*Fashion Ecologies* 2018). This practice relies on communities and nature for economic decisions. Activities are determined by regional natural factors to secure longer-term prosperity. Localism is a centripetal movement (See below Figure 6) characterized by small-scale production, self-reliance, and practices based on local traditions, necessity, and environmental conditions, aiming to keep economic and political power inside communities (*Fashion Ecologies* 2018).

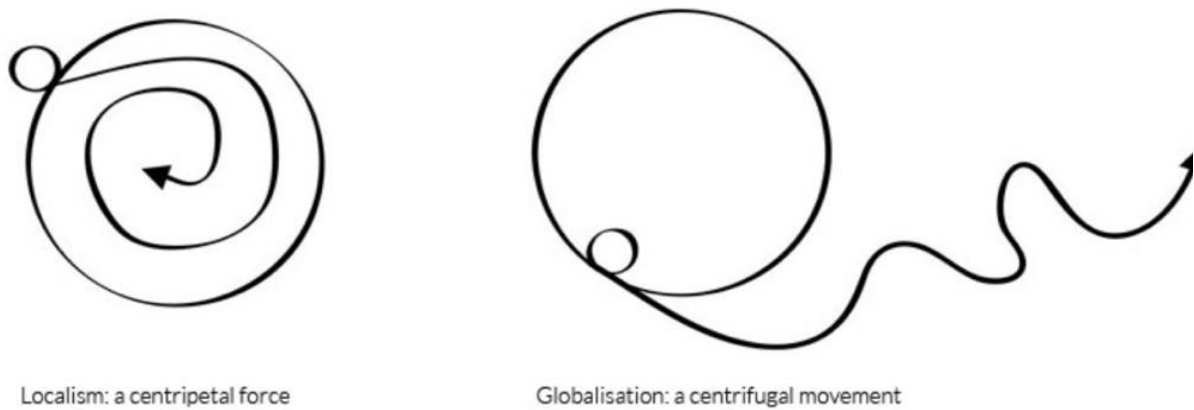


FIGURE 6. LOCALISM VS THE GLOBALIZATION MOVEMENT (FASHION ECOLOGIES 2018)

Fletcher and Vittersø’s 2018 explores how the experiences and initiatives from the local food movement can facilitate more small-scale and diverse garment practices. Food and fashion systems are compared to enable knowledge transfer for local clothing consumption. It is characterized by small-scale regional producers, seasonal availability, farmers’ markets, foraging and hunting skills, distinctive gastronomy, celebrity chefs, and other aspects that are unique to a given community. The movement’s mantra “fibre follows food” (Fletcher and Vittersø 2018, 161–163) led me to compare our fibre and food consumption habits (See below Figure 7).

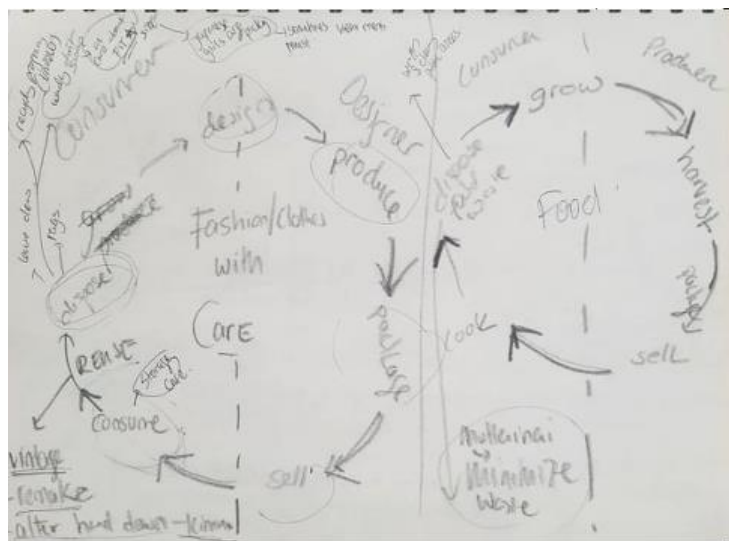


FIGURE 7. REFLECTIONS ON PARALLELS IN LIFECYCLES OF FOOD AND CLOTHING

Additionally, both food and clothing rely on agricultural systems, physical exertion, demanding and repetitive labor, weather conditions, and factories. According to Simpson (2016), “they have origins in agricultural systems, food in an almost total way; and for clothing, natural fibers make up 27% of the global fiber supply” (cited in Fletcher and Vittersø 2018, 161). From a historical-cultural perspective, they also share histories of knowledge transmission through generations. For example, just as recipes are handed down in families, so are garment maintenance skills i.e., mending, sewing, and knitting habits (Fletcher and Vittersø 2018, 161). Unfortunately, with our current fast-paced lives and garment overproduction that promotes disposability, these skills have become rarer. The kitchen was traditionally a place for serving food, cutting, and sewing clothes, dyeing, and home remedy preparation. The role has become diminished in modern times as mass-production and ready-made food and clothing have become common. While the burden of women’s responsibilities has been reduced, so have individuals’ skills and power over production and consumption of these everyday essentials of garments and food (Fletcher and Vittersø 2018, 161). Shared histories between food and clothing became apparent while I was experimenting with dyes in my kitchen during the pandemic.

Fletcher and Vittersø (2018) point out some key differences uncovered between food and clothing systems. For example, high-status food consumption is marked by moderate consumption of the “right sort” of food. Whereas attitudes about the type of clothing that is considered fashionable, sophisticated, and on-trend are constantly changing. This effect is enhanced by social media and the fashion seasons, thereby encouraging over-consumption at faster rates (Fletcher and Vittersø 2018, 163). The critical differences between food and fashion lie in durability and consumption, which lead to the following issues. Eating demands ongoing replenishment of goods, while dressing involves an inventory of garments and accessories that need less frequent restocking. Yet, I would argue that with the rise of fast fashion and the rollouts of new collections every few weeks, consumers are restocking more frequently within each season. Best practices for food consumption include awareness of when to stop eating, yet this is much less clear regarding clothing consumption. Local food is valued by the industry’s producers, diners, and media, while local fashion is not prevalent nor straightforward (Fletcher and Vittersø 2018, 163).

The localism approach encourages people to gain a deeper understanding of connections with nature’s resources, food origins, seasonality, healthy eating, and appreciation for the resource intensiveness of food and clothing production (for further information see Table AB.2 in Appendix B). Ultimately, these practices may promote a higher investment value by providing the consumer with knowledge of the source of their garment, making their fashion choices a statement of personal style and values. Moreover, time that has been invested in repair or upcycling builds a deeper attachment between the consumer and the garment, which contributes to prolonging the usage. This mindset inspired me to search for locally available materials for the iterative final production process of this research-creation study.

2.3 GARMENT LIFECYCLE

The sustainable design strategies (See Table 1) also proposed by Professor Kate Fletcher (Fletcher 2017) address the different lifecycle phases including materials selection, production, distribution, consumption and end of life. For example, the goal of material selection is to avoid those that harm human and ecological health and use minimal resources including recycled materials and waste by-products. In the production phase, the number of materials and production methods are minimized to optimize manufacturing. In the consumption phase, lower impact-use and an optimized product lifetime may be achieved through i.e., reducing energy

inefficiencies and building a desire for consumers to care for products long term. For an enhanced end-of-life phase, designing for biodegradability, disassembly and safe disposal can be considered. I used these guiding concepts in my research-creation process to adopt a circular design approach that intends to reduce waste and environmental impact (for more information see Table AB.1 in Appendix B and Figures AC.1 and AC.2 in Appendix C).

lifecycle phase	goal	strategy
materials selection	choose low-impact materials	<ul style="list-style-type: none"> — avoid materials that damage human health, ecological health or deplete resources — use minimal resources — use renewable resources — use waste by-products — use recycled or reused materials
production	optimize manufacturing	<ul style="list-style-type: none"> — minimize manufacturing waste — minimize energy in production — minimize number of production methods and operations — minimize number of components/materials
distribution	efficient distribution	<ul style="list-style-type: none"> — reduce product and packaging weight — use reusable or recyclable packaging — use an efficient transport system — use local production and assembly
use	low-impact use	<ul style="list-style-type: none"> — reduce energy inefficiencies — reduce water use inefficiencies — reduce material use inefficiencies
	optimize product lifetime	<ul style="list-style-type: none"> — build in user's desire to care for product long term — design for take-back programmes — build in durability — design for maintenance and easy repair — design for upgrades — design for second life with a different function
end of life	optimize end of life	<ul style="list-style-type: none"> — integrate methods for product collection — provide for ease of disassembly — provide for recycling or downcycling — design reuse or 'next life of product' — provide for reuse of components — provide ability to biodegrade — provide for safe disposal

TABLE 1. SUMMARY OF SUSTAINABLE DESIGN STRATEGIES (FLETCHER 2017)

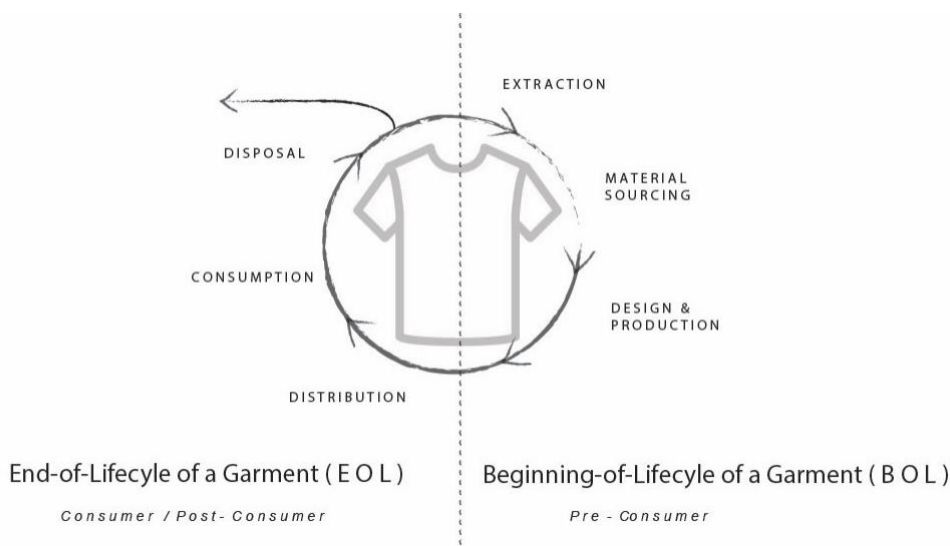


FIGURE 8. BOL AND EOL GARMENT APPROACH ADAPTED FROM LIFE CYCLE ASSESSMENT AS INTRODUCED IN VEZZOLI AND MANZINI (2008)

My approach was also influenced by the garment lifecycle concept adapted from the Life Cycle Analysis framework as introduced in Vezzoli and Manzini 2008 to consider the environmental effects of clothing production and consumption. This approach looks at pre-consumer (designer and producer) stages, which I refer to beginning-of-lifecycle of a garment (BOL) and consumer and post-consumer stages, end-of-lifecycle of a garment (EOL) (See Figure 8). In summary, each of the concepts and strategies in the literature review has been integrated into my research-creation project.

CHAPTER 3: RESEARCH-CREATION

My research-creation thesis resulted in the production of a one-off hanten garment prototype, a public exhibition and workshops, and presentations at design schools.

3.1 HANTEN GARMENT

To begin, I will provide context on how the hanten garment was selected for the final research-creation. While in Japan, I received a traditional Japanese hanten 袴天 jacket from a Canadian friend (see Left Image in Figure 2). A hanten is a traditional Japanese winter jacket typically made of cotton. This garment became crucial to my fall 2019 outerwear wardrobe in Kyoto. Upon returning to Canada, it became part of my everyday wear while studying at home during the COVID19 pandemic. It provided a unique combination of physical warmth and mental comfort. The care and coziness felt when wrapped up in the insulated garment are reminiscent of a Japanese home product, the *kotatsu* (a low table covered by an electric blanket, traditionally designed over a charcoal furnace). As a result, the hanten's embodiment of care in my daily life during the pandemic became the intention behind the research-creation. The hanten is interesting because it is a no-waste pattern and very easy to size to many different body types because the sleeves are wide and the body loose fitting – the belt draws the garment close to the body as each wearer desires – it can be easily layered underneath and in warmer weather it can be worn open. We see the kimono and the hanten copied over and over due to their simplicity and ease of wear even for some sports. Furthermore, it is suitable for all genders and ages. On the practical side, it suited my limited sewing skills and for attaching the quilted layer.

Locally Sourcing Biodegradable Materials

During the material selection phase of the design process, I focused on sourcing lower-impact materials to mitigate damage to environmental and human health. The following aspects were considered: using minimal resources, waste by-products and biodegradable materials.

Due to mass-production, the hanten I received was composed of synthetic materials instead of traditionally being made of cotton. While my hanten offered warmth and comfort, I tended to feel suffocated. I would become uncomfortably hot resulting in the need to take it off regularly. While wearing it outdoors in Kyoto, I noticed the lack of breathability afforded by the synthetic fabric causing an excessive amount of sweat to accumulate against my skin. My dissatisfaction with the product's fabric quality led me to question how I could locally produce a more environmentally responsible and breathable version of this insulated garment. Hence, I sought to redesign a hanten made of biodegradable materials and dyes adapted to the Quebec climate that embodies the main principles of *mottainai*, *shinto*, and slow fashion. Below is the research-creation that I produced (See Figure 9).



FIGURE 9. FINAL RESEARCH-CREATION PROTOTYPE: HANTEN GARMENT

Throughout the design and production process, I focused on balancing aesthetics, function, and sustainability (See below Figure 10). I was continuously confronted with numerous questions about how to minimize environmental impact without compromising that balance. This exercise provided insight on how material explorations can offer a way to engage with sustainability challenges in a deep way. Similar to the slow living and localism movements that promote consuming food locally and consciously, I prioritized ingredients that were available locally for producing the garment. This was inspired by my contextual analysis of the groundwork in Japan that revealed the regenerative systems of food and clothing production that embrace nature's cycles.

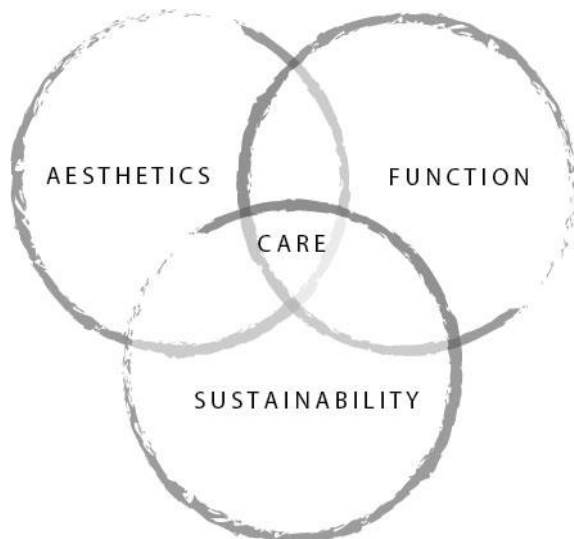


FIGURE 10. BALANCING AESTHETICS, FUNCTION AND SUSTAINABILITY TO DESIGN WITH AND THROUGH CARE

Regarding material sourcing, natural fiber-based fabrics are needed for optimal absorption of biodegradable dyes. Therefore, I decided to work with locally stocked cellulosic and protein-based textiles (100% cotton and 100% silk). It should be noted that cotton is not the most sustainable fiber, requiring pesticides during growth and large quantities for production. I did not account for the resource intensiveness of the fiber growth and fabric production processes. Rather, I sourced available deadstock fabrics or what is called pre-consumer waste. Two fabrics were chosen to create a reversible hanten. I decided to add a luxurious aesthetic component by using Dupioni silk for the lining. For the outer shell, I used cotton scraps from Professor Langshaw's previous project. Moreover, instead of importing indigo leaves from Japan, food waste (onion peels) was sourced from Concordia People's Potato and from my home kitchen.

Furthermore, I attempted to minimize the number of different material components by avoiding extra materials (e.g., plastic or metal) for closures or attachments, and choosing to utilize the self-fabrics (silk and cotton) instead. This circular design strategy focused on reducing the number of materials. I was inspired by Patagonia's Lead Materials Developer, Ciara Cates', talk that proposed designing for simplicity and deconstruction by minimizing the different materials and utilizing easily removable and repairable garment constructions. Hence, this design intervention aimed to address the end-of-life phase by designing for disposal optimization. This was done by designing for the disassembly and applying zero-waste patternmaking inspired by the kimono. Drawing from lessons learned from Cates, I designed the hanten jacket with a detachable hood using loop attachments, straps for altering the sleeves and a belt for adjusting the waistline (see Figure 11 and 14 and AD.1 and AD.3 in Appendix D). Straps are typically found in traditional Japanese clothes to change the size of waistlines and for closures. By reusing fabric scraps for fit adjustments and closures, this strategy is also reminiscent of furoshiki, a traditional method of wrapping objects in square fabric pieces for storage or transportation. A hood was added as a personal preference to adapt the design to Montreal's cold weather. Additionally, the armhole opening found in kimonos was integrated to allow for extra ventilation thereby improving functionality (see additional hanten photos AD.1-AD.6 in Appendix D). As a result, all the colored silk scraps were used to produce the hanten, leaving practically zero silk waste from the design and production process.



FIGURE 11. DETACHABLE HOOD WITH TIES AND BELT MADE OF SELF-FABRIC LEFTOVERS

Food Waste as Dyestuff

As part of the material selection process, onion peels were selected as the most sustainable option for the dye source for several reasons. Firstly, it is an excellent locally available dyestuff since it has tannins, thereby the color is fixed to fabric without mordant (see Glossary in Appendix A). Food waste is increasingly a global issue as it is a source of methane in landfills, contributing to greenhouse gas emissions. The US alone accumulated over 34 million tons of food waste annually in 2009. Yet less than 3% of this waste is recycled. According to a study by Gustavsson et al. 2011, food waste at the consumer level in industrialized countries amounts to 220 million tons, which is equal to Sub-Saharan Africa's total net food production (Kosseva and Webb 2013, xvii). Secondly, the onion is a kitchen staple, ranking among North America's top three most consumed vegetables (USDA 2020; Louis Bonduelle 2018). It is worth noting that alternative dyestuffs that have recently gained popularity, such as avocados, were not selected. The reason is that rising world demand in recent years has been shown to contribute to the adverse environmental impacts of deforestation. From 2000-2021, the US per capita avocado consumption tripled (USDA AMS 2022). Cho et al. 2021's study on the expansion of avocado plantations in Mexico's Michoac'an region which supplies 80% of US avocado imports reveals that it has caused circa 20% of total deforestation in the region from 2001-2017 (Cho et al. 2021). Moreover, it offered the opportunity to collaborate with Concordia's community and highlight the link between clothing and food production and consumption.

Milkweed as a Local Alternative Biodegradable Insulation

As an alternative to the polyester fill, I used VEGETO made from milkweed for insulation of the hanten. The material developed by Quebec-based Eko-Terre's founder and professor, Ghyslain Bouchard, provided an excellent option that was biodegradable and eco-friendly. A question that arose during the research-creation process was: How could we support regenerative systems and build a stronger connection with the animate and inanimate beings that feed us and keep us warm? Milkweed in this case is a food source for the endangered Monarch butterfly population thereby supporting local ecosystems (Martin et al. 2021). This example highlights the interdependencies between the agricultural systems of clothing and food production for different beings.

From a historical perspective, milkweed was used as a substitute filling for life vests by the United States during WWII since the Japanese controlled the Indonesian *kapok* supply. The plant was previously viewed as an invasive species that grew in ditches, farm fields, and forests. Yet, it eventually became a local alternative for filling. About one pound of milkweed could keep a 150-pound person afloat for over 40 hours (Jones 2016). Similarly, the kudzu plant that I had spent a day harvesting, fiber extracting, and spinning in Shizuoka, Japan, is also an invasive species. Kudzu fiber was used to make fabric, and therefore, the idea of using milkweed as an alternative Quebec-grown insulation resonated with me.

Milkweed offers numerous benefits, including being 100% plant-based, biodegradable, thermal insulating, compressible, lightweight, and moisture-wicking (Vegeto Textiles, n.d.). It provides a cruelty-free alternative to animal-based and petroleum-based materials. The downside is that milkweed is a slow-growing plant that may be detrimental to mass production but quite relevant to the slow design principles. VEGETO provided an environmentally friendly insulation material that does not compromise performance, while remaining designed and produced locally (Innovation in Textiles Canada 2022). Even so, various aspects of the plant-based alternative must be acknowledged. The VEGETO is comprised of 25% milkweed, 25%

kapok, and 50% biopolymer polylactic acid (PLA) from cornstarch. The milkweed must be combined with other components due to its feathery property (Vegeto Textiles n.d.). Corn is likely genetically modified and chemically treated, and so has its own set of complexities regarding sustainability. Additionally, since the kapok is imported from Indonesia, it may be argued that it is not local; thus, the material is not 100% locally produced. Therefore, I'm recognizing that this was an attempt at lowering the environmental impact of a one-off hanten garment. I selected VEGETO with a weight of 150 g for temperature conditions of -10 °C to -15 °C. Eko-Terre generously donated yardage for the prototype to support my research. Traditionally, the hanten is used as an indoor garment in Japan. I propose to use the jacket during long Canadian winters as both an outdoor and indoor garment for warmth and to encourage the reduction of energy consumption for heating homes. My European upbringing may also influence this decision, as Germans tend to layer their indoor clothes during cold months. As a result, I intended for the hanten to communicate care for both the wearer by offering warmth and comfort and the environment by allowing for lower heating consumption. Regarding garment functionality, VEGETO was combined with cotton (outer shell) and silk (lining) textiles for reversibility. This combination offers a higher level of breathability than the outerwear industry standard of using a nylon shell and VEGETO fill. Bouchard explained that silk and milkweed fibers are hydrophobic; thus, the fabric does not absorb humidity and wicks from the surface. As a result, my prototype offers higher comfort level.

Locally Quilting a Garment

Bouchard recommended his business partner, Sylvain Lepine, to produce the quilting of the dyed cotton fabric and VEGETO fill for the hanten. Since Lepine had never worked with natural materials, selecting the optimal stitch length was a challenge. To ensure the highest degree of thermal insulation, I requested that the quilting be kept to a minimum in terms of the quantity and spacing of the stitching. I decided to use a tubular instead of diamond stitch pattern to maintain a minimal aesthetic that complements the hanten's design (See Figure 12). As I was producing only one jacket prototype that consisted of four meters of fabric, the cost of production per garment was significantly increased.



FIGURE 12. QUILTED INSULATION AND NATURALLY DYED FABRICS, SILK INTERIOR SIDE OF THE PROTOTYPE

Hiring a Designer with Care

In the context of this project, sustainability involved considering the well-being of both the environment and collaborators. My collaboration with Quebec industry professionals was central to supporting localism principles.

Throughout the iterative design and production processes I was brought to question the concept of shinto. These entanglements penetrated all aspects, from the tangible materials to the relationships with collaborators. The phase of selecting a fashion designer to finalize the pattern and sew the garment was tough as I had a tight budget. This was especially difficult since I felt torn due to the principles of showing respect for all those embedded in this project while having to negotiate on cost. I interviewed three local fashion designers, and finally chose Philippe Goana, who radiated the most appreciation for the project's purpose. He also has a personal connection with Japanese designers as his parents used to work for renown Japanese designers including Rei Kawakubo and Yohji Yamamoto. Consequentially, it felt like it was the right match, and I accepted the collaborator's compensation demands that helped cover overhead as an independent designer.

Garment Design

Our collaboration successfully incorporated the designer in the decision-making process during the hanten's design and production phases. I offered a certain degree of liberty for Philippe to propose and make critical decisions on patternmaking and sewing techniques. Rather than engaging the designer as the sole executor of technical tasks, he was involved in the design iteration process that focused on minimizing fabric waste (See Figure 13). The main challenge we faced during the process was maintaining a balance between function and aesthetics while prioritizing sustainability.

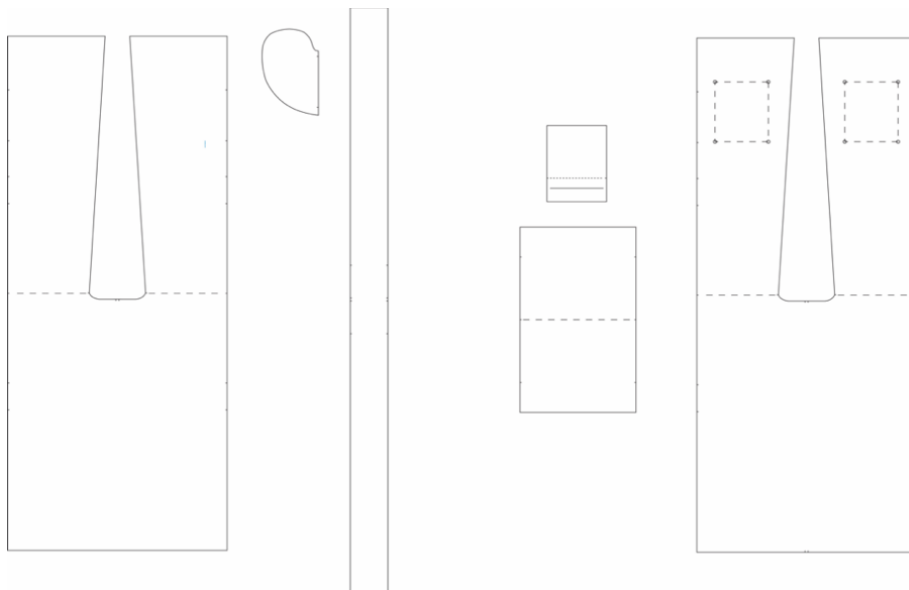


FIGURE 13. HANTEN JACKET PATTERN COMPUTER-AIDED DESIGN



FIGURE 14. HANTEN GARMENT ASSEMBLY

To sum up the garment's design and production process, I began with biodegradable material and dyestuff sourcing, patternmaking and hiring of a designer. This was followed by coloring the cotton fabric with onion peels and a hint of iron to create a more muted Burberry-esque beige hue (See Right Image in Figure 15 and AD.1, AD.2 and AD.4 in Appendix D). I then travelled to Cowansville, Quebec to visit the milkweed factory and pick up the VEGETO fill. Next, the 4 meters of dyed cotton fabric and 3 meters of milkweed insulation were delivered to Sylvain Lepine for quilting. Meanwhile, the designer assembled the silk side of the garment. This silk garment was then worn, and the hands of a hug were traced. Next, I performed the shibori stitching along the tracing of the hands (See result in Left Image in Figure 15 and AD.4 in Appendix D). This piece was then submerged in an onion peel dye bath with a bit of alum for a more brilliant color. Finally, the quilted side was assembled with the silk side by Philippe. I printed the care label on the remaining scraps of cotton fabric that were used for the lining of the pockets. For the final touches, I helped hand hem the band for the neckline of the hanten, which ended up being a slow and meditative task.

Shibori



FIGURE 15. LEFT: SHIBORI TIE-DYE PATTERN TRACING THE HUG, RIGHT: VARYING ONION-DYED SILK FABRIC RESULTS

We used silk leftover fabric pieces that had lighter tones for parts of the hood and waistband (See Right Image in Figure 15). The inconsistency of the colors opposes consumer expectations of consistency. It provides a visual reminder that resources shouldn't be discarded despite their aesthetic imperfections.

Shibori was a performative cyclical process that involved: simmering an onion-peel infused bath, wrapping jars in fabric for transportation (See below Figure 16), tracing body movements through stitching (See Ornu tests in Figure 17), pulling threads to gather fabric, and dipping and stirring fabrics and garments into the bath, and finally rinsing the garments and untying the stitches. This process embodied the care that I as the researcher and designer embedded within the research-creation process. Slow and caring practices were also rooted in my practice in the form of rituals such as the weekly collection of onion peels from the People's Potato. I drew inspiration from the intrinsic vitality of clothing, which is ingrained in the universal everyday performative activity of wearing clothing that protects our bodies. I ran numerous other experiments with participants to upcycle second-hand garments (See Appendix E). The silk side of the hanten garment featured an Ornu resist tracing the hand gesture of a hug (See Left Image in Figure 15). Therefore, my research-creation process intended to honor the cycle of care in our daily lives.



FIGURE 16. DYES IN JARS WRAPPED IN REUSED FABRIC SCRAPS AND ELASTIC BANDS FOR TRANSPORT



FIGURE 17. TEST SAMPLES OF ORNUI SHIBORI USING NATURAL DYE FROM ONION FOOD WASTE

Embedding Slow Fashion, Shinto and Localism Principles in a Care Label



FIGURE 18. HANTEN PHOTOSHOOT

In the spirit of slow fashion, shinto, and localism, all human collaborators, including the designer, quilter and milkweed producer, were credited for their contributions on the care label that was built into the hanten's pocket (see Figures 19 and 20). I was inspired by the transparency of food origin and content advocated by localism. I included the composition of the VEGETO and the origin of materials whenever possible. The non-human beings, i.e., fabrics, insulation materials, and onion food waste, were also mentioned (see Figure 20). Moreover, another label was patched on the exterior side of the hood to reveal the garment's story and embodiment of shinto and mottainai waste-reduction values (See Right Image in Figure 20).

To design for lower impact consumption, a care label was built into the pocket using cotton fabric scraps to refrain from using extra materials (See Figure 19). The label is used as a communication tool for the eco-friendlier care instructions that require mild soap and washing and drying at lower temperatures (See Figures 19 and 20). The choice of milkweed promotes lower energy usage during the cleaning process. Washing the hanten requires a cold temperature and mild pH-neutral soap that is eco-friendly followed by merely machine drying at low heat for only 20 minutes then air-drying flat in the shade. While outerwear is typically dry cleaned, chemical cleaning process treatment should be avoided for milkweed insulated garments. Therefore, the jacket was designed for a less resource-intensive consumption process.



FIGURE 19. BUILT-IN POCKET CARE LABEL

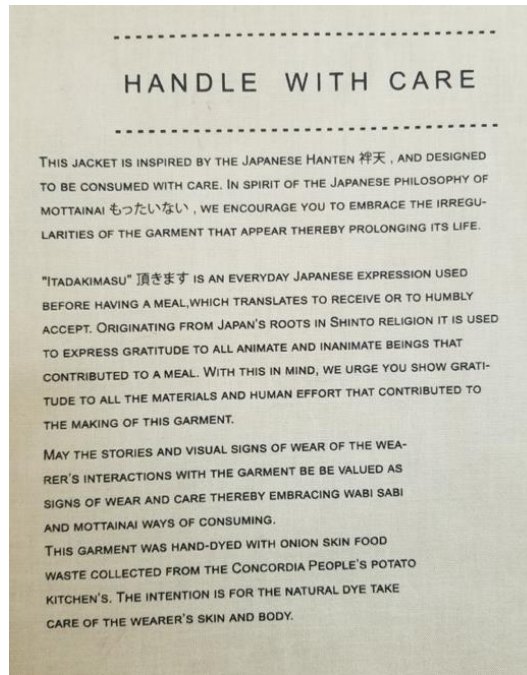
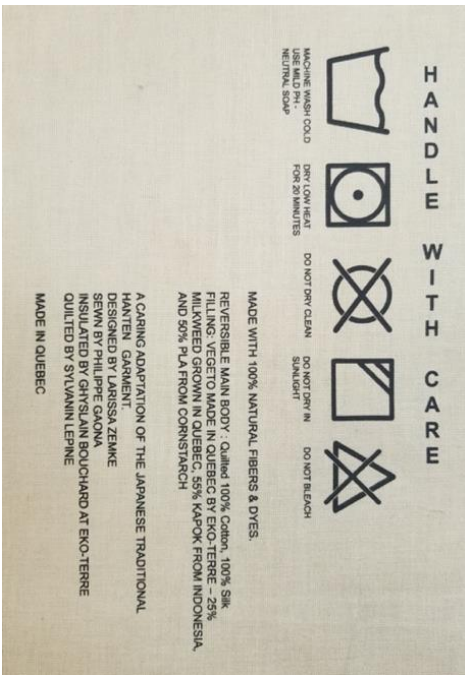


FIGURE 20. LEFT: CARE LABEL PRINTED IN THE POCKET LINING, RIGHT: GARMENT STORY PRINTED ON THE HOOD

To print the care label I tried different methods, including stamping and engraving linoleum with a laser machine at Concordia's Digital Fabrication Lab. The hand stamping results were not satisfactory. Due to time constraints, I went to a local shop to print on the fabric with an Epson printer that uses the Direct-to-Garment (DTG) method technology. While chemical inks are used in this process, quality was sharp with a higher resolution than the hand stamping and

laser methods. Furthermore, the DTG method allows for printing on demand thereby lowering expenses and resources relative to other options (e.g., linoleum stamping or screen printing). As a result, DTG was a relatively lower-impact option for the purpose of producing one hanten prototype.

Research-Creation Results

Through the research-creation process, I investigated sustainable practices that designers might apply in the clothing lifecycle phases of material sourcing, design, and production (see Table AB.1 in Appendix B). These were adapted from Fletcher's Summary of Sustainable Design Strategies (see Table AB.2 in Appendix B). I decided to explore this by reimagining the traditional Japanese hanten. The aim was to create a more sustainable version that exemplifies mottainai and shinto principles to propose garment production and consumption methods with a lower environmental impact. This was attempted by applying textile and garment techniques of shibori, zero-waste patternmaking and design for disassembly. I hoped to design for safer consumption and disposal of clothing. My overarching goal was to explore less materially intensive (Fletcher 2017) ways of designing garments.

As a result, this study proposes sustainable design research through a creative process that applies a combination of traditional textile and clothing methods, in this case, Japanese along with locally available materials. A localism approach encouraged direct in-person collaboration with Quebec makers to foster a deeper connection with the garment-making processes. It is hoped that a stronger connection between the designer and the animate and inanimate resources is created. This may contribute to practices that embrace slow fashion principles by advocating for garment designs that offer a statement for both style and values.

3.3 EXHIBITION

The exhibition of my research-creation work involved a multi-layered communication strategy that included a display, workshops, a performance, and lectures to disseminate the research. The MDES'22 cohort's group exhibition was held at Concordia University's 4th Space from May 2–13, 2022 (<https://www.concordia.ca/next-gen/4th-space.html>). The space was chosen as it is within the University environment yet also has a presence within the greater Montreal area as a venue for residencies, lectures, and events. Architecturally speaking, the space provided greater visibility for thesis projects as it has street-level windows in downtown Montreal.

My exhibit display strategy focused on creating an interactive concept store environment to invite visitors to engage with textile samples, dyestuffs, prototypes, photos, and books through tactile interactions. In contrast to a concept store that displays finished garments ready for purchase, I aimed for transparency through honest communication of the research and production processes to the public and local consumers. This was accomplished by displaying samples of textile techniques, shibori and dye tests, and the different iterations of the hanten (see Figures 21, 22, 23). The garment flat pattern was printed at full scale and hung as a backdrop in the exhibit to provide the context of the 2D process of patternmaking in clothing design. I sought to showcase the collaborative aspect of this research-creation project. The bookwork of the field study (Zemke 2021) was displayed on an iPad station to provide contextual information. Experiments were displayed on racks and shelves. The goal was to showcase the backstory of field research and experimentation to prompt people to wonder

about the making of the hanten and reflect on their own garment consumption practices. A question that arose during the exhibition process was: With a focus on transparency, how can we, designers, build more awareness around the process of creation and production of products?



FIGURE 21. EXHIBIT DISPLAY

The floor plan of my exhibition design that was developed in collaboration with our cohort's 3D spatial design team (See Left Image in Figure 22). It was used to plan out the display of the textile and garment experiments in the allocated space. The bars show the mid-air hanging racks and the flat surfaces including four cubes. The large square represents the lightbox platform placed next to the window above which the hanten was suspended. Moreover, photos were hung on the exhibit walls to provide a store-like ambience and a visual narrative of the underlining sustainable design practices (See Figure 25). I also imagined a brand concept. A physical and digital look book was created to communicate the cycle of care, including values of shinto and mottainai. that led to the prototyping phases of the hanten. Additionally, a film featuring models ceremoniously wrapping objects in furoshiki style was projected.

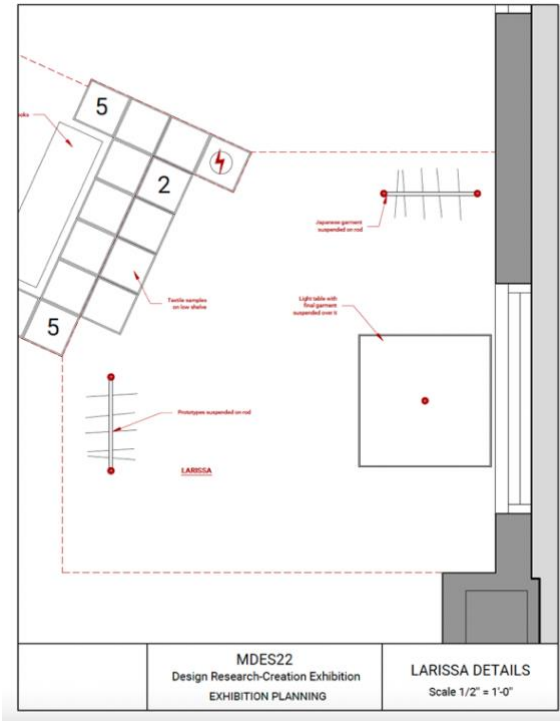


FIGURE 22. RIGHT: FLOOR PLAN FOR EXHIBIT, LEFT: HANTEN PROTOTYPE SUSPENDED IN EXHIBIT SPACE



FIGURE 23. EXHIBIT DISPLAY CLOTHING RACK



FIGURE 24. ISSEY MIYAKE, MAKING THINGS EXHIBITION, FONDATION CARTIER POUR L'ART CONTEMPORAIN, PARIS (MIYAKE 1998)

The mid-air suspension of the hanten, was inspired by Issey Miyake's exhibition at the Fondation de L'Art Contemporain in Paris 1998 (see below Figure 24), as it emulates the presence of a body in space. This display strategy intended to provide 3-D view of the garment as if it worn on a body and prompt curiosity among viewers (See Right Image in Figure 22). Since the hanten was suspended high above a lightbox, it wasn't reachable to the public. Hence, visitors were not able to try on the prototype, which did not match my intention. The hanten iterations were shown hanging mid-air on racks to showcase the garment design and shibori processes (see Right Image in Figure 22). Textile swatches, dyestuffs, and tools were laid on flat surfaces like the curation of artifacts in museums (see Figure 21 and Right Image in Figure 22). I hoped this would stimulate viewers to engage through tactile interactions.

In terms of the materials used to construct the exhibit space, I tried to primarily work with resources available at 4th Space and on campus. Metal poles provided by the exhibit space were used as aesthetically minimal bases for the clothing racks. Jute rope was sourced from a local hardware store for midair suspension. Moreover, a roll of canvas cotton fabric found in the cohort room was used as a backdrop (See Figure 21). This fabric was donated to the CUCCR center after the exhibit to promote its reuse on campus. A light box was used to draw attention to the hanten prototype. The prompt that led the process of sourcing exhibition equipment was: How can designers use and reuse more locally available tools and materials for exhibitions?

Looking back at the outcome, the exhibit received overall positive feedback on its effectiveness in creating a little universe, which was my intention. The main drawback was that the hanten was suspended too high, which didn't encourage visitors to interact with it in my absence. Moreover, I was given feedback that the space was too tightly packed with materials and samples. While I was motivated to communicate a complete picture of the research-creation journey, the display would have benefited from a more minimalist curatorial approach.

3.4 WORKSHOPS AND PRESENTATIONS

Workshops at 4th Space

The main incentive for the collaboration with 4th Space was to disseminate the cohort's research to a broader audience both locally and internationally. Their social media platforms, including Zoom, YouTube, Instagram, and Facebook, provided a marketing platform for the exhibition. We set up an online presence with a website (<https://mdes22.com>) as well as Instagram (https://www.instagram.com/mdes22_research_creation/) and Facebook (<https://www.facebook.com/MDES22researchcreation>) pages to promote the events. I acted as the liaison between the cohort members and 4th Space managers. Moreover, as host of the Designer-Walk-Through on the exhibition's opening day, I interviewed all designers to provide explanations adapted towards a diverse non-academic audience (see the recording here <https://www.youtube.com/watch?v=jJIQq-HJWXw>).

My dissemination strategy involved the exhibition along with workshops, lectures, and discussions. I hosted workshops and lectures to share my research-creation practice with a broader audience. Digital streaming via Zoom allowed participants from abroad, i.e., the US, Japan, and Europe, to join the events live. Recordings were published on YouTube for future reference and shared with the public online. I hosted the following events:

1. *Japanese Ways of Designing and Consuming with Care*—consisting of two parts, namely a designer talk and natural dyeing workshop
<https://www.concordia.ca/cuevents/offices/provost/fourth-space/programming/2022/05/10/japanese-ways-of-designing-and-consuming-fashion-with-care.html?c=/events>
2. *Sustainable Fashion Roundtable*—aimed to discuss challenges of sustainability in the fashion industry. <https://www.concordia.ca/cuevents/offices/provost/fourth-space/programming/2022/05/12/collective-care-through-mending.html?c=/events>.
3. *Collective Care Through Mending*—in collaboration with Selina Latour (Concordia Fine Arts, MA fibers student), participants were taught how to darn holes in their garments as a form of care. <https://www.concordia.ca/cuevents/offices/provost/fourth-space/programming/2022/05/12/collective-care-through-mending.html?c=/events>

The workshops aimed to investigate the possibilities for strengthening consumers' bonds with clothing items and raising awareness of DIY methods for prolonging the consumption of garments. The intention was to explore how personal investment in a piece of clothing leads to a higher perceived value by the consumer. The effects of the workshop were not recorded. However, this could provide a possible avenue for further research in responsible consumption practices.

Presentations at Design Schools

Another key component of my research-creation dissemination strategy was educating design students about Japanese practices. In April 2022, I was invited to conduct presentations at fashion schools in New York City, including the Fashion Institute of Technology (FIT), Parsons School of Design, and the Pratt Institute, to share my field study findings. I aimed to build awareness among future generations of designers on the possibilities of drawing

inspiration from traditional conceptual principles and techniques to lower the environmental impact of clothing production. I sought to encourage embracing slower practices. My presentations sparked conversations between faculty and students about the unsustainability of the industry and the designers' role in tackling these issues. I consulted with students on ways of incorporating sustainable design strategies in their projects.

At FIT, I held guest lectures at business and technology and art and design schools. The business students in the Corporate Social Responsibility class of the International Trade and Marketing program were introduced to sustainability from a research-creation perspective. The presentation at the Textile Design Department focused on exposing design students to Japanese textile techniques. At Parsons, I conducted a lecture for the textile's graduate student cohort. This was followed by a visit to the students' individual studio spaces, during which we discussed eco-responsibility in the context of their work. The presentation at Pratt encouraged a debate between faculty and students about slower eco-conscious practices in the industry. During the collection review, I assisted the professor by consulting on more circular design methods to incorporate into their collections—reoccurring challenges revolved around fabric choices. One student decided to adopt the suggestion of making a garment more modular. I observed that most fashion design students were primarily concerned with aesthetics and innovation, with little consideration for sustainability in the design process.

Overall, the presentations were well-received by the students and faculty at the design schools, and I received interest in future shibori workshops. My lecturing and consulting experiences have shown that there is room for improvement regarding incorporating more close-looped approaches in design programs and encouraging interdisciplinary collaborations between departments and different universities.

Reflections

Overall, the workshops provided an opportunity for me to share my research with a public audience. I hoped that consumers of all ages would be inspired to reconsider their relationships with clothing. The participants were introduced to a shibori technique that could offer possibilities for upcycling garments. I aimed to educate the public on DIY techniques for reviving second-hand clothing and extend its life. In collaboration with MFA Fiber's graduate student, Selina Latour, we hosted a mending workshop to teach consumers how to darn their clothing. This dissemination strategy was successful in allowing me to communicate my practice to a broader audience, including both locals such as Concordia students, Lower Canada College students, and participants abroad. The experience of teaching resonated with my intentions to expose consumers of different ages to practices of care. I sought to introduce them to new environmentally conscious design and consumption methods. Even if only one or two people take something forward from the workshops, it is a starting point for the propagation of ideas. And this can prompt slow change and open a dialogue of different ideas to address sustainability. In the future, I hope to be able to further distribute the research findings by hosting workshops for children at Montreal schools as well as offering private sessions for adults or through organizations such as museums. Artist residencies could be considered as an option to share what I have learned with audiences abroad.

CHAPTER 4: CONCLUDING THOUGHTS & FUTURE WORK

My research revealed that one of the critical questions that ought to be continuously asked by designers is: “What does care mean?” This is followed by “How can we care more for all beings, people, and the planet?” What we wear and how we behave penetrates every aspect of our interactions with clothing throughout our daily lives. These multi-layered interactions span from how we shop to how we wear, wash, mend, and dispose of clothing.

My iterative design process revealed the importance of considering the environmental impact of the different garment lifecycle phases (See Table AB.1 in Appendix B and Figures AC.1 and AC.2 in Appendix C). It highlights the need for holistic sustainable design models that rely on the active involvement of multiple stakeholders. Designers are responsible for considering the lifecycle stages of the garments they create from sourcing, design, and production all the way through to consumption and disposal. This involves advocating for transparency by tracing and communicating the origins of fibers, color treatment, and garment assembly because these details influence how a garment will be consumed and eventually disposed of in the future. While labelling standards weren’t researched for the purpose of this thesis, care labels offer an opportunity for designers to educate the public on the origin of raw materials, assembly process and maintenance. In other words, designers should consider what products they are releasing into the world and their short and long-term effects on the environment and human health. This remains an idealistic consideration when faced with the demands for speed and low cost from business executives.

Through the production of the *hanten*, I was able to explore alternative methods for designing more sustainable clothing. Even though this thesis is based on the production of merely one prototype garment, my interactions with Quebec-based collaborators provided a sense of optimism for possible change toward more responsible futures in garment production and consumption. The *hanten* is aspirational, not an endpoint to implement as is. It demonstrates principles to begin the conversation between the stakeholders involved, including designers, producers, and consumers, on how these ideas can be appropriated. However, it does have a crucial value in developing implementable sustainable approaches toward reducing the negative environmental impacts of our clothing consumption.

In the context of the pandemic, during which a significant portion of the research-creation study took place in my own home, I engaged in deep brainstorming about the design and consumption cycle of clothing. The intertwining of the workplace and personal life exposed the cycles of care in our daily lives and our relationships with both humans and non-humans. The material and performative experiments that I ran spurred reflections on our interactions with clothing as designers and consumers. The upcycled experiments propose that we view garments as mementos that carry the stories of our lives. Each clothing item carries traces of interactions between the garment and wearer, much like denim and leather. I highlighted the interactions using shibori techniques to record body movements that represented care in participants’ daily lives (for further information see Appendix E). While the color consistency on second-hand garments was not mastered, it visually portrayed this relationship between humans and clothing. Consumers’ expectations of consistently vibrant hues have become a convention that should be challenged moving forward. To conclude, designing and consuming more responsibly is a slow path that requires more time and energy from all parties. It involves questioning our everyday actions and finding creative solutions amidst the tendencies of overconsumption and planned obsolescence in our current society.

4.1 RESEARCH LIMITATIONS

While the research-creation shows potential for applying Japanese techniques to garments, this case study remains a work in progress. In other words, the hanten is an initial prototype that is not ready to be produced except possibly on a small scale. The onion dye's lightfastness, color consistency, and washability would need to be tested for end use. Moreover, due to time constraints, the garment fit was only tested on me. To scale it up for local production, tests with professional models and grading would need to be performed. My research does not investigate the opportunity for coloring garments for small-scale production in Quebec. This offers potential for further chemical engineering and scalability analysis research to evaluate the method as a viable lower-impact alternative for industry applications. However, the hanten is successful as an experiment that expresses sustainable design principles. The jacket is a material manifestation of my experiential learnings and opens the discussion for more environmentally conscious design practices and for rethinking society's mentality on consumption.

Despite the intentions of creating an environmentally responsible garment, it should be recognized that challenges remain in striking a balance between keeping production costs low and exclusively using ideal low-impact materials and processes (i.e., pesticide-free fibers and less-chemically intensive dyes). As part of the literature review, I analyzed the sustainable garment lifecycle and how its principles (See Table 2 in Appendix B) are pertinent to clothing design. If the hanten were to be produced, these practices would come to the forefront rather than remain a research endeavor.

4.2 FURTHER RESEARCH

I was hugely influenced by the fieldwork experiences and the context of working and studying at home during the pandemic. As a result, my work and ways of thinking about eco-conscious design are embedded in the hanten. At this point, I only created one prototype which I plan to wear to see how it may be used and to explore its end-of-life phase. It is hoped that by wearing the hanten at events and showcasing it at exhibits, the dialogue can be pushed further to cultivate new approaches. In this way, garment visibility may inspire a pool of people to work towards slow change toward models that prioritize sustainability during garment design and consumption. In the future, I would ideally produce 10 samples in collaboration with a local garment manufacturer and collect wearers' feedback to assess how successfully the EOL and BOL strategies (See Table AB.1 in Appendix B) were applied.

Further ethnographic research on traditional practices and historical forms of responsible living could reveal additional implementable approaches aimed at reducing the impact of garments throughout their lifecycle. Experiential research based on the PO method is recommended for further exploration of traditional cultural practices that could be combined with sustainability concepts to enhance design methods. On another note, an experiential field study provides a methodology to uncover models that have greater respect for the environment and humans. For example, it would be interesting to research design with care and sustainable approaches closer to home during the depression/war or through the lens of traditional practices by settlers and first nations people in Quebec and Canada.

In closing, my present contribution is to encourage designers to consider the human and non-human sources and flows of energy involved in garment production as well as to adopt a cultural and slower sense of time that values traditions and nature's cycles. I encourage the development of designs that feature minimal materials and design for disassembly to promote less resource-intensive products and facilitate disposal practices including upcycling and recycling. Additionally, producing locally can create an emotional connection between designers and consumers and clothing thereby promoting fashion with a higher investment value.

The workshops provided testing grounds for educating the greater public on my research. Even if my research-creation inspires only a few participants, this provides breeding grounds for more ideas and initiatives to drive slow change toward more sustainable practices. Furthermore, it is crucial to incorporate educational initiatives. Education is also needed in the context of schools and universities and for a greater public audience. Promising avenues for such education include workshops, documentaries and transparent product labelling. The goal should be to build awareness of the story behind products involving resource usage, and the environmental impact of the different garment lifecycle phases. Consumers should also be informed on how to properly care for their garments, including cleaning and mending, repurposing, and disposal practices.

After uploading this paper to Spectrum, I intend to publish an article, exhibit the hanten, host workshops, and give talks at conferences and educational institutions to disseminate findings to the greater academic community and the public. I hope to encourage further research on textile practices in different cultures to develop more sustainable models for garment design and consumption.

APPENDIX A - GLOSSARY

Alum – (potassium aluminum sulphate) A mineral used as a mordant to fix natural dyes on cellulose fabrics. It improves light and wash-fastness and tends to brighten the resulting dye color. It is also used as a food preservative (Maiwa 2022).

Bast Fibers – Plant fibers derived from the inner stems of certain plants, including flax, hemp, jute, ramie, hibiscus, abaca, stinging nettle, wild orchid, and milkweed. Japan has a wide variety of bast fibers such as *Basho-fu* (banana fiber-based textile), *Fuji-Fu*, *Miyako-jofu* (ramie textile from Miyako Island), *Kudzu-fu* (textile from Japanese arrowroot), and *Shifu* (textile made from *Kaji* mulberry paper).

Beginning-of-lifecycle garment approach (BOL) – A sustainability approach proposed for designers to develop garments with a lower environmental impact by being biodegradable, circular, and zero-waste. This approach is geared toward the pre-consumer phases of the garment's lifecycle, i.e., textile sourcing, garment design, and production phases. It aims for a balance of function, aesthetics, and sustainability throughout the entire design, product development, and production phases of the lifecycle (see Figure AC.1 in Appendix C).

Biodegradability – The ability of an item or material to decompose into its essential natural elements using biological processes within a relatively short period (around one year). Generally, this term does not address the level of toxicity, which may result from using agricultural pesticides, fabric dyes, and bleach in different stages of textile production. To ensure biodegradation, the complete composition of the item or material must be non-toxic.

Care – A mindset and way of life inspired by the Japanese practices of *mottainai* and shintoism combined with the sustainable design framework of slow fashion and design-with-care that aims to minimize waste while honoring both the animate and inanimate beings that contributed to the design and production of a garment. It encourages questioning how we care for each other, all beings, and the planet in our daily lives.

Centrifugal Movement – The outward force of globalization and large-scale garment production and consumption that moves economic and political power outside communities or ecosystems.

Centripetal Movement – A localism force that keeps economic and political power within communities. In the context of the fashion industry, it refers to a highly decentralized garment production system that focuses on environmental conditions, community engagement, economic priorities, local narratives, and, as a result, fewer products.

Circular Design – The creation of products with the intent to design out waste, avoid negative environmental impact, and use material components that extend the product's life and can be returned to the garment production system as valuable feedstock.

Closed-Looped Design – Developing closed-loop products is a key step towards turning the global economy into a circular one, in which waste and pollution are eliminated while natural systems are restored. So, you make something, and someone uses it and brings it back somehow. Moreover, that is turned into a new product: a new shoe or something else.

Design-with-Care – A non-human-centred design approach concerned with care as a commitment to human and nonhuman coexistence. This sustainable design framework adopts a humble stance of approaching all situations and beings, both animate and inanimate, as they exist, by notably caring for and celebrating diversity while functioning inclusively and allowing for the transparency of processes and products of design.

End-of-lifecycle garment approach (EOL) – A sustainability approach in which consumers give new life to second-hand clothing through upcycling and natural dyeing with food waste and plants to reduce the environmental impact of overconsumption. This approach is geared toward the consumer and post-consumer phases of the garment lifecycle, i.e., consumption and disposal. The aim is to prolong the lifecycle of garments by promoting mottainai and wabi-sabi principles that embrace the imperfect and worn. The shinto values of respecting all animate and inanimate beings are also reflected in this approach. Consumers are encouraged to value their interactions with garments and embrace the wear and tear of clothing (see Figure AC.2 in Appendix C).

Food waste – Waste derived from food such as plate waste; this includes food that was served but not consumed, spoiled food, and peels or rinds that are then used as animal feed, composted, sent to landfills, or combusted for bioenergy (EPA 2022). Decomposing food waste produces methane, a potent greenhouse gas, resulting in higher carbon footprints and global warming.

Garment Lifecycle – The journey of a garment from raw material extraction and textile production, garment design and production, transportation, distribution, and consumption to disposal.

Indigo – (Indigofera) A green-leafed bush plant that grows around the globe in countries with hot, sunny, humid climates such as Japan, India, Mexico, and Nigeria. It is most valued for its dye fastness that does not require a mordant. Through fermentation and oxidation processes, the green dye turns into a rich blue. The range of hues varies from pale sky blue to deep navy. Indigofera is also used as a medicinal healing plant around the world.

Iron – (Ferrous Sulfate or Lactate) A mordant that creates deeper and duller shades of the dye and increases the lightfastness, which prolongs the life and stability of dyed natural fabrics. This is also the iron found in our supplements.

Localism – The practice of focusing on communities and nature for economic decisions. Regional natural factors determine activities to secure longer-term prosperity. It is a centripetal movement characterized by small-scale production, self-reliance, and practices based on local traditions, necessity and environmental conditions, and an economic and political power kept inside communities.

Mordant – A chemical that facilitates dye absorption by a fiber. Mordants are used to ensure the light- and color-fastness of natural dyes. Certain mordants, such as alum, prepare fabric for dye absorption without impacting the color. Mordants like tannin and iron add color to fabric, thereby altering dye colors. Mixing dyes and mordants allow for a wider variety of colors.

Mottainai (勿体無い) – A Japanese term used in daily life to convey a sense of regret over waste. The Japanese teach their children from a young age not to waste even the last grain of rice in their bowls.

Natural Dye – Dyes that are biodegradable and have been derived from plant dyestuffs (including food waste) for thousands of years by indigenous cultures around the world. They can be derived from different parts of plants, including leaves, roots, flowers, barks, nuts, seeds, and berries.

Regenerative Agriculture – An agricultural system that involves farming practices that remove carbon, reduce artificial fertilizers, promote biodiversity, and assist in reversing the effects of climate change through soil health.

Shinto (神道) – A Japanese worldview originating in the *Jōmon* period (14,000–300 BC) that values everything in nature as it is endowed with a spirit. It suggests an awareness of all beings, both animate and inanimate.

Slow fashion – The slow fashion model emphasizes quality, durability, and long-term investment, and values the relationship between the consumer and the environment. It rejects the large-scale, expedited models that dominate the current textile and apparel industry. This study applies the slow fashion concept as a process across the design, production, and consumption phases.

Sustainability – While numerous definitions of sustainability exist within the context of the fashion industry, this study refers to a process that reduces the negative environmental impacts of garment and textile production and consumption during the garment lifecycle.

Sustainable Fashion – Generally, ‘sustainable fashion’ refers to clothing, shoes, and accessories produced, marketed, and consumed in the most sustainable way possible by prioritizing environmental and socio-economic factors. The entire product lifecycle of a garment encompasses stages from fiber growth and harvest to textile manufacturing, dyeing, printing, assembly, transportation, consumption, and finally to the disposal of the garment. Hence, when looking at the complex issue of sustainability in the fashion industry, it is essential to adopt a holistic perspective that considers the entire product lifecycle of a garment.

Take-Make-Dispose Model – A linear model of resource production and consumption that refers to the extraction of raw materials to manufacture products that are finally disposed of as waste after consumption.

Upcycling – An intervention that aims to give a new life to second-hand products and materials that are post-consumer use and destined for the landfill. In the context of this study, upcycling transforms waste materials into products that are perceived to have a higher aesthetic value.

Wabi-sabi (侘寂) – A Japanese worldview that embraces the aesthetic qualities of natural wear and tear of materials as they age.

Waste – Resources or energy remaining from the production process of a product deemed as useless excess or a byproduct.

APPENDIX B – ADDITIONAL TABLE

LIFECYCLE PHASE	GOAL	STRATEGY	EXECUTION
Material Selection	Source lower impact materials	Use waste by-products	Locally source onion peel food waste from Montreal kitchens (campus and homes)
		Use biodegradable materials	Sourced natural woven fabrics (100% silk and cotton) and milkweed
		Avoid damage to environment and human health	Using natural dyes and fibers
		Use minimal resources	Use second-hand tools and fabrics; minimize number of materials
Design & Production	Low-impact production	Minimize waste	Japanese zero-waste patternmaking; reuse of fabric scraps for detachable elements
		Minimize material components	Minimize number of different materials
Consumption	Low-impact consumption	Lower resource usage of garment care	Reduce machine drying time and temperatures
		Lower environmental impact of garment care	Mild pH neutral soap
		Lower impact on human health	Soothing human body by fabric dyeing with natural dyes instead of toxic chemicals; using mild soap for garment washing
		Build in user's desire to care for a garment long-term	Shibori tie dye stitching; care labeling of local production and story of garment
Disposal	Disposal optimization	Design for ease of disassembly and reuse/recycling	Minimize number of different materials; Zero-waste

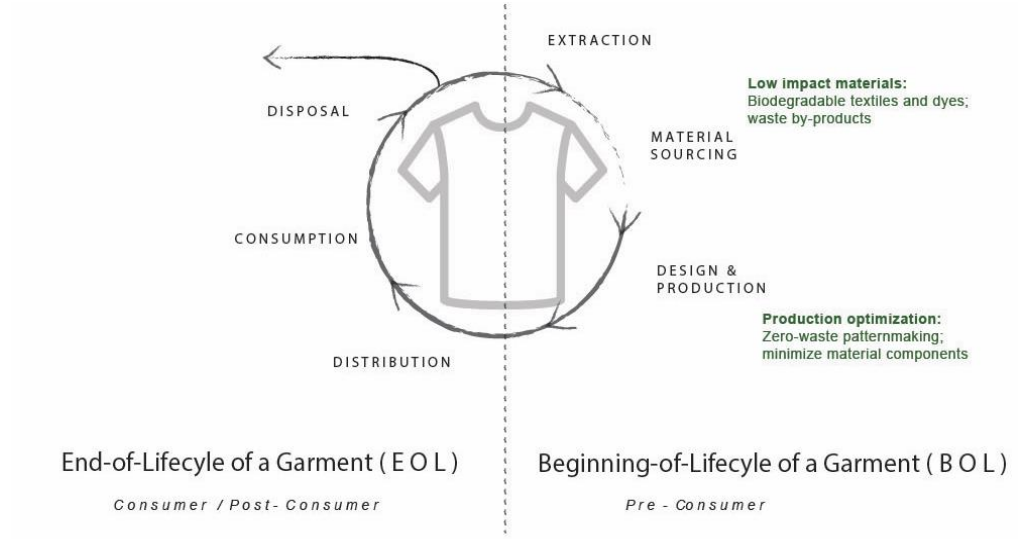
			patternmaking; detachable parts
		Design for biodegradability	Biodegradable materials use (natural dyes and fabrics)

AB.1 Sustainable Garment Lifecycle Approach Adapted from a Summary of Sustainable Design Strategies Table in Fletcher 2017

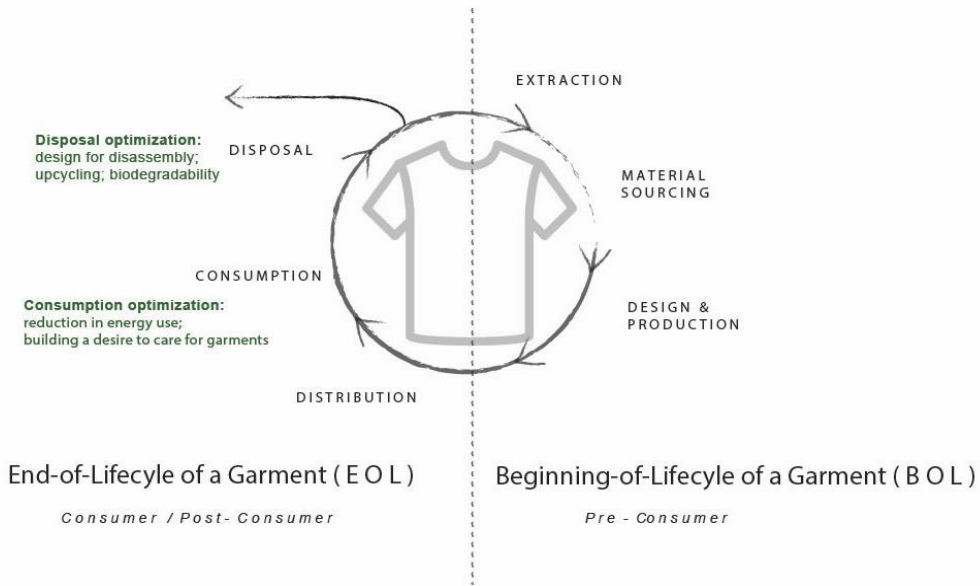
LOCALISM	STRATEGIES
	<ul style="list-style-type: none"> • Transferring local food industry experiences to the garment industry
	<ul style="list-style-type: none"> • Reframing slow fashion as a process that supports local ecosystems by regenerating the skills and practices of small-scale and diverse fashion producers
	<ul style="list-style-type: none"> • Understanding what is produced and consumed by shifting towards more diverse practices and small-scale producers with regional supply networks
	<ul style="list-style-type: none"> • Promoting production and consumption practices that support local ecosystems
	<ul style="list-style-type: none"> • Community-supported agriculture that encourages personal investment of time or money to grow, forage, or hunt food that is consumed locally
	<ul style="list-style-type: none"> • Providing transparency on the origin of clothing products similar to what exists in the food system (i.e., Terroir in France for Geographic Origins)

AB.2 Localism Principles as Introduced in Fletcher and Vittersø 2018

APPENDIX C – ADDITIONAL FIGURES



AC.1 BOL Approach Adapted from Life Cycle Assessment as Introduced in Vezzoli and Manzini 2008



AC.2 EOL Approach Adapted from Life Cycle Assessment as Introduced in Vezzoli and Manzini 2008

APPENDIX D – ADDITIONAL IMAGES



AD.1 HANTEN WORN WITH OPEN HOOD



AD.2 HANTEN REVERSIDE SHOWING SILK SIDE



AD.3 HANTEN REMOVABLE SILK STRAPS



AD.4 REVERSED HANTEN SHOWING HUG



AD.5 HANTEN PHOTOSHOOT FT. EXPERIMENTS



AD.6 LEFT: SUMAC AND ONION NATURALLY DYED SHIRT, RIGHT: FINAL RESEARCH-CREATION, THE HANTEN



Indigo leaves sun-drying, Ohara Koubou, Kyoto



Dried Indigo leaves, Ohara Koubou, Kyoto

AD.7 INDIGO DRY-LEAF DYEING



AD.8 INDIGO FRESH-LEAF DYEING



AD.9 INDIGO FRESH-LEAF DYEING



AD.10 INDIGO FERMENTED DYEING



AD.11 YARN-DYEING WITH MARIGOLD AND RED ROOT



AD.12 INDIGO-DYED SECOND-HAND CLOTHING CAPSULE

APPENDIX E – ADDITIONAL EXPERIMENTS

Upcycling with Biodegradable Materials

The upcycling process enabled me to explore wearer-garment interactions while testing materials for dyeing. This was carried out through collaboration with local participants. This iterative phase served to uncover ways in which garments' product lifetime might be extended. The experiments aided in the discovery of the best material/dye outcomes in preparation for the production process of the hanten jacket.

I attempted to follow the mottainai principles of minimal waste by reviving locally-sourced second-hand clothing from *Renaissance* and dyeing using local food waste, onion peels, from Concordia's Peoples Potato campus kitchen and reused tools from CUCCR (Concordia's Center for Creative Reuse). Moreover, I decided to use food waste and plants from the Montreal area as dyestuff to adopt a localism approach.

I chose to work with 100% plant-fiber-based garments, including mostly cotton and some silk along with natural dyes from local food waste (onion peels) and plants (sumac buds). Cotton was chosen as the primary fiber because it is the most widely consumed, accounting for 80% of natural plant-based fibers in garments (Muthu and Ángel 2020, 63).

To do the upcycling I used the shibori nui technique. As part of the iterative experimentation process, I performed tests by stitching with my used dental floss. According to readings on shibori, nylon threads or waxed threads work well for this type of stitching. To adhere to the mottainai principle that promotes minimizing waste through reuse, I avoided using new materials by primarily sourcing second-hand materials and tools (thrifed cotton men's shirts, nylon thread, and used dental floss).

Experimentation through Slow Fashion Principles

The upcycling experiments incorporated slow fashion principles to investigate how a deeper connection might be built between the consumer and the garment. This was done by engaging a group of local participants, including family, friends, and Concordia contemporary dance students. The concept of care was explored in the context of the Montreal community during the pandemic. I hoped that these interactions with participants might lead them to question their consumption practices and relationships with clothing. It should be noted that other circular design methods, such as mending, and maintenance also provide ways of prolonging garments' lifetime. The experiments were intended as a material exploration of close-looped approaches, rather than a plan to definitively secure garment longevity.

The participants were given the prompt: *How do you care for yourselves or others in your daily life?* Based on the responses, they were instructed to perform a body movement that expressed 'care.' The body-garment interactions were recorded using a water-soluble fabric marker. The subtle folds in the fabric that emerged during these movements served as traces to map the interactions. As part of the performative cycle of care, I proceeded to stitch along the markings using the shibori nui technique and nylon thread. During the process, I aimed to visually honor and 'care' for the interactions between wearers and garments.

The first two experiments were conducted with my mother, who cares for our family by cooking. I sought to embed the act of service by tracing the interactions between her and garment. This was done through shibori stitching (See Figure 17). Onion peels from the cooking process were used to color a thrifted silk dress. The dyes were placed in jars and then wrapped for transportation to and from the university to my home (See Figure 16), which became a visual representation of the performative cycle of care embedded within my research-creation process.

Through this practice-led research process, I discovered that the shibori nui stitching of hand outlines was a fitting manifestation of the mottainai and shinto principles. The white traces from the tie-dye resist subtly evoked the quintessential hug as an everyday performance of the cycle of care through the following prompts, highlighted in Figure 15.

These prompts distilled my interactions with fabrics in spirit of slow design. The key verbs performed were stitch-unstitch-re stitch, wrap-unwrap-rewrap, and tying-untieing-retying. As a result, the experiments turned into mementos that were intended to visually embody the relationships between consumers and their clothing. The caring actions performed by participants reflected the values of shintoism. Through designing with reused materials, I aimed to offer respect to all beings, human and non-human. The upcycling of the garments became a performative material exploration of slower ways of consuming garments.

The experimentation process was documented at a local photo studio. The resulting photos and film provided content for visually communicating slow fashion, mottainai and shinto principles to a broader audience at the final exhibit (See Figure 18 and AD.1 - AD.6 in Appendix D). Ten friends participated as models, stylists, and photographers in the experiments and final photoshoot. As a token of appreciation and in the spirit of the cycle of care (nourishing the body with food and protecting it with clothing), I baked two onion quiches for lunch with the participants. With respect in mind, I tried to ensure that my collaborators remained fueled during the photo session. The photo documentation successfully illustrated the underlying concept of shinto between wearers and their clothes and the performative material explorations of the project.

Through the collaborations with participants, I imagined a way of engaging consumers in the process of giving the shirts a new life. After the exhibit, the shirts were gifted to the participants leaving the shibori threads for them to shape the garment as they wished. I left the threads in place instead of undoing them (as done traditionally) to encourage consumers' investment in the upcycling process. However, I did not do follow-ups with the participants. The results were shared with Concordia's community and the public at the 4th Space exhibit and through a natural dyeing workshop. Even though these experiments are not the final outcome of the thesis study, the conceptual and technical knowledge gained was applied to produce the hanten.

REFERENCES

- Aakko Maarit, and Ritva Koskennurmi-Sivonen. 2013. "Designing Sustainable Fashion: Possibilities and Challenges." *Research Journal of Textile and Apparel* 17 (1): 13–22. <https://doi.org/10.1108/RJTA-17-01-2013-B002>.
- Atelier b. 2022. "Our Vision." Accessed October 20, 2022. <https://atelier-b.ca/en/pages/notre-vision>.
- Bendix, Aria. 2019. "7 toxic chemicals are hiding in your waterproof, stain-resistant, and wrinkle-free clothes." *Business Insider*. July 11, 2019. <https://www.businessinsider.com/toxic-chemicals-in-clothes-cancer-2019-7>.
- Baier, Daniel, Theresa Maria Rausch, and Timm F. Wagner. 2020. "The Drivers of Sustainable Apparel and Sportswear Consumption: A Segmented Kano Perspective." *Sustainability* 12 (7): 2788. <https://doi.org/10.3390/su12072788>.
- Bielefeldt Bruun, Mette, and Michael A. Langkjær. 2016. "Sportswear: Between Fashion, Innovation and Sustainability." *Fashion Practice* 8 (2): 181–88. <https://doi.org/10.1080/17569370.2016.1221931>.
- Britannica. n.d. "Mordant dye." Accessed September 5, 2022. <https://www.britannica.com/science/mordant-dye#ref290597>.
- Brito, Karren K. 2002. *Shibori: Creating Color and Texture on Silk*. New York: Watson-Guptill Publications.
- Burrows, Sara. 2017. "Yoga Pants are destroying the Planet." *Return to Now*. October 15, 2017. <https://returntonow.net/2017/10/15/yoga-pants-destroying-planet/>.
- California Cloth Foundry. 2022. "California Cloth Foundry." Accessed April 3, 2022. <https://clothfoundry.com/>.
- Cavanaugh, Erin Lynn. 2017. "Fiber Arts and SAORI as Art Therapy Media." Master's Thesis. Drexel University.
- Ciara Cates. "Evolving Textiles Conference: Materializing the Future." Lecture, North Carolina State University Conference, March 16–17, 2022.
- Ciele Athletics. n.d. "Sustainability." Accessed October 20th, 2022. <https://cieleathletics.com/sustainability/>.
- Costanza-Chock, Sasha. 2020. "Directions for Future Work: From #TechWontBuildIt to #DesignJustice." In *Design Justice: Community-Led Practices to Build the Worlds We Need*. Information Policy Series. Cambridge, Massachusetts: MIT Press. <https://direct.mit.edu/books/book/4605/chapter/211376/Directions-for-Future-Work-From-TechWontBuildIt-to>
- Coste-Manière, Ivan, Paul Charpentier, Gérard Boyer, Karine Croizet, Julia Van Holt, and Sudeep Chhabra. 2018. "Innovation and Sustainability in the Luxury Fashion and Fabrics

Industry.” In *Models for Sustainable Framework in Luxury Fashion: Luxury and Models*, edited by Subramanian Senthilkannan Muthu, 11–34. Textile Science and Clothing Technology. Singapore: Springer. https://doi.org/10.1007/978-981-10-8285-6_2.

Earley, Rebecca, and Kay Goldsworthy. “Designing for Fast and Slow Circular Fashion Systems: Exploring Strategies for Multiple and Extended Product Cycles.” Paper presented at the PLATE Conference, Nottingham Trent University, June 17–19, 2015.

Ellen MacArthur Foundation. 2017. “A New Textiles Economy: Redesigning Fashion’s Future.” Accessed October 19, 2022. <https://ellenmacarthurfoundation.org/a-new-textiles-economy>.

EPA United States Environmental Protection Agency. 2022. “Sustainable Management of Food Basics.” Last updated July 14, 2022. <https://www.epa.gov/sustainable-management-food/sustainable-management-food-basics>.

Fairs, Marcus. 2019. “Adopting Circular Design is ‘Good for Business’ says Adidas Eco-Innovation Leader Dharan Kirupanantham.” *Dezeen*. Accessed July 27, 2022. <https://www.dezeen.com/2019/07/17/adidas-circular-economy-closed-loop-design/>.

Fashion Ecologies. 2018. “Localism.” Accessed April 13, 2022. <http://fashionecologies.org/localism/>.

Fletcher, Kate. 2017. “Exploring Demand Reduction through Design, Durability and ‘Usership’ of Fashion Clothes.” *Philosophical Transactions: Mathematical, Physical and Engineering Sciences* 375 (2017): 1–13.

Fletcher, Kate, and Gunnar Vittersø. 2018. “Local Food Initiatives and Fashion Change: Comparing Food and Clothes to Better Understand Fashion Localism.” *Fashion Practice* 10 (2): 160–70. <https://doi.org/10.1080/17569370.2018.1458496>.

Fletcher, Kate. n.d. “Local Wisdom.” 2021. Accessed April 13, 2022. <http://localwisdom.info/use-practices/view/358/citizen-of-planet-earth>.

Fletcher, Kate. 2014. *Sustainable Fashion and Textiles: Design Journeys*, 2nd ed. London: Earthscan from Routledge/Taylor & Francis Group.

Fletcher, Kate. 2018. “Towards a future framework for fashion.” Accessed April 3, 2022. <https://katefletcher.com/towards-a-future-framework-for-fashion/>.

Fondation Louis Bonduelle. 2018. “Vegetable Consumption in Quebec and Information for Consumers.” Fondation Louis Bonduelle. May 29, 2018. <https://www.fondation-louisbonduelle.org/en/2018/05/29/consumption/>.

García, Héctor and Francesc Miralles. 2016. *Ikigai: The Japanese Secret to a Long and Happy Life*. Penguin Books.

Gordon, Beverly. 2011. *Textiles: The Whole Story*. New York: Thames & Hudson Inc.

GOTS. 2021. “Global Organic Textile Standard: Ecological and Social Responsibility.” GOTS. Accessed August 15, 2022. <https://global-standard.org>.

- Green Strategy. n.d. "What is Sustainable Fashion?" Accessed March 6, 2021. <https://www.greenstrategy.se/sustainable-fashion/what-is-sustainable-fashion/>.
- Gwilt, Alison. 2014. *A Practical Guide to Sustainable Fashion*. London: Bloomsbury Publishing Plc.
- Gwilt, Alison and Timo Rissanen. 2011. *Shaping Sustainable Fashion: Changing the Way We Make and Use Clothes*. London: Earthscan.
- Hargrave, Marshall. 2022. "Kaizen: Understanding the Japanese Business Philosophy." *Investopedia*. July 9, 2022. <https://www.investopedia.com/terms/k/kaizen.asp>.
- Harris, Jennifer, British Museum, Whitworth Art Gallery, and Victoria and Albert Museum. 1993. *5000 Years of Textiles*. London: British Museum Press in association with the Whitworth Art Gallery and the Victoria and Albert Museum.
- Harvard University, T.H. Chan School of Public Health. n.d. "Food Waste: The Big Picture." The Nutritional Source. Accessed August 15, 2022. <https://www.hsph.harvard.edu/nutritionsource/sustainability/food-waste/>.
- Innovation in Textiles Canada. 2022. "Nonwovens/Converting: Exploiting the Benefits of Milkweed." *Innovation in Textiles*. January 19, 2022. <https://www.innovationintextiles.com/exploiting-the-benefits-of-milkweed/>.
- Intellectual Property Issues in Cultural Heritage Project. 2015. *Think Before You appropriate: Things to know and questions to ask in order to avoid misappropriating Indigenous cultural heritage*. Simon Fraser University: Vancouver. <https://www.sfu.ca/ipinch/resources/teaching-resources/think-before-you-appropriate/>.
- Merriam-Webster. 2023. "Eco-conscious." Accessed May 18, 2023. <https://www.merriam-webster.com/dictionary/eco-conscious#:~:text=eco%2Dcon·%E2%80%8Bscious%20'e,showing%20concern%20for%20the%20environment>
- Miyake, Issey. 1998. *Jumping*, view of the exhibition *Issey Miyake Making Things*, Fondation Cartier Pour L'Art Contemporain, Paris. <https://www.fondationcartier.com/en/exhibitions/issey-miyake-making-things>.
- Jones, Meg. 2016. "Milkweed Heroes, WWII sailors Reunite." *Milwaukee Journal Sentinel*. August 17, 2016. <https://www.jsonline.com/story/news/2016/08/17/milkweed-heroes-wwii-sailors-reunite/88865522/>.
- Juniper, Andrew. 2003. *Wabi Sabi: The Japanese Art of Impermanence*. 1st ed. Boston: Tuttle Publishing.
- Karuno, Hiroko. 2016. "Shifu: A Traditional Paper Textile of Japan." *Crosscurrents: Land, Labor, and the Port*. Textile Society of America's 15th Biennial Symposium, Savannah, GA, October 19–23. 2016. <https://digitalcommons.unl.edu/tsaconf/977/>.

Kay, Jennifer. 2017. "The Trendy Athleisure Clothing Everyone Is Wearing Is Harming the Environment." *Business Insider*, March 15, 2017. <https://www.businessinsider.com/athleisure-clothing-could-be-damaging-the-environment-2017-3>.

Kosseva, Maria R, and Colin Webb, eds. 2013. "Introduction: Causes and Challenges of Food Wastage" In *Food Industry Wastes: Assessment and Recuperation of Commodities*, 1st ed., XV–XXIV. Food Science and Technology International Series. Amsterdam: Elsevier. <https://doi.org/10.1016/C2011-0-00035-2>.

Kozlowski, Anika. Michael Bardecki, and Cory Searcy. 2019. "Tools for Sustainable Fashion Design: An Analysis of Their Fitness for Purpose." *Sustainability* 11 (13): 3581. <https://doi.org/10.3390/su11133581>.

Licina, Dusan, Glenn C. Morrison, Gabriel Beko, Charles J. Weschler, and William W. Nazaroff. 2019. "Clothing-mediated exposure to chemicals and particles." *Journal of Environmental Science & Technology*, 53 (10). UC Berkley. May 1, 2019. <https://escholarship.org/content/qt1qx0b360/qt1qx0b360.pdf>.

Loop of the Loom. n.d. "Saori—Zen Weaving from Japan." Accessed April 21, 2021. <https://loopoftheloom.com/weaving>.

Low Tech Lab. n.d. "What are Low Techs?" Low Tech Lab. Accessed Sept 15, 2022. <https://lowtechlab.org/en/low-techs>.

Lululemon. 2020 "Annual Report 2019." Accessed March 3, 2021. <https://investor.lululemon.com/static-files/8df91f4d-25a1-4e69-8b94-606f9c370440>.

Maiwa. 2022. "Maiwa" Accessed February 13, 2022. <https://maiwa.com/>.

Martin, Amanda E, Greg W Mitchell, Judith M Girard, and Lenore Fahrig. 2021. "More Milkweed in Farmlands Containing Small, Annual Crop Fields and Many Hedgerows." *Agriculture, Ecosystems and Environment*. 319. <https://doi.org/10.1016/j.agee.2021.107567>.

McIlvride, David, writer and director. 2020. *Riverblue*. Paddle Productions. Distributed by Global Environmental Justice Documentaries Project. <https://riverbluethemovie.eco/the-film/>.

Moore, Lachaun. 2020. "Episode 130: Regenerative Fashion with Lydia Wendt of California Cloth Foundry." *Gist Yarn*. December 7th, 2020. <https://www.gistyarn.com/blogs/podcast/episode-130-regenerative-fashion-with-lydia-wendt-of-california-cloth-foundry>.

Murai, Toshiko and Ryoko Murai. 2014. "Changing of Kudzu Textiles in Japanese Culture." *Textile Society of America Symposium Proceedings*, 901. University of Nebraska - Lincoln. <https://digitalcommons.unl.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1916&context=tsaconf>.

Murai, Tatsuhiko and Ryoko Murai. 2019. "Learn from the Cloth of Nature." Lecture presented at Shizuoka University, Ooya Campus, July 17, 2019.

- Nam, Changhyun, Huanjiao Dong, and Young-A Lee. 2017. "Factors Influencing Consumers' Purchase Intention of Green Sportswear." *Fashion and Textiles* 4 (1): 2–2. <https://doi.org/10.1186/s40691-017-0091-3>.
- Nike Circularity Workbook. n.d. "Circularity Workbook: Guiding the Future of Design." Accessed April 20, 2021. <https://www.nikecirculardesign.com>.
- Okumura, Shigesaburo, and Akane Okutsu. "The man who clothes Asia: Uniqlo chief Tadashi Yanai." *Nikkei*. October 14, 2020. <https://asia.nikkei.com/Spotlight/The-Big-Story/The-man-who-clothes-Asia-Uniqlo-chief-Tadashi-Yanai>.
- Patagonia. n.d. "Wornwear." Accessed March 8, 2021. <https://wornwear.patagonia.com>.
- Payne, Alice. 2011. "The Life-cycle of the Fashion Garment and the Role of Australian Mass Market Designers." *The International Journal of Environmental, Cultural, Economic and Social Sustainability* 7 (3): 237–246. https://www.researchgate.net/figure/Garment-Life-cycle-Assessment_fig1_267205505.
- Peters, Greg, Gustav Sandin, Bjoern Spak and Sandra Roos. 2018. "LCA on fast and slow garment types." *Mistra Future Fashion*, no. 6. <http://mistrafuturefashion.com/wp-content/uploads/2018/11/G.-Peters-LCA-on-Prototypes-D1.1.4.1-D1.2.4.1-2page.pdf>.
- Pookulangara, Sanjukta, and Arlesa Shephard. 2013. "Slow Fashion Movement: Understanding Consumer Perceptions—an Exploratory Study." *Journal of Retailing and Consumer Services* 20 (2): 200–206. <https://doi.org/10.1016/j.jretconser.2012.12.002>.
- Preuit, Rachel and Yan, Ruoh-Nan (Terry). 2017. "Fashion and Sustainability: Increasing Knowledge About Slow Fashion Through an Educational Module." *International Journal of Environmental and Science Education* 12 (5): 1139–1154. <https://files.eric.ed.gov/fulltext/EJ1278171.pdf>.
- Puig de la Bellacasa, María. 2017. "Matters of Care: Speculative Ethics in More Than Human Worlds." *Posthumanities* 41. Minneapolis: University of Minnesota Press. <https://muse-jhu-edu.lib-ezproxy.concordia.ca/book/50528>.
- Ranson, Beth. 2019. "The True Cost of Colour: The Impact of Textile Dyes on Water Systems." *Fashion Revolution*. <https://www.fashionrevolution.org/the-true-cost-of-colour-the-impact-of-textile-dyes-on-water-systems/>.
- Redress. 2018. "Sustainable Fashion Educator Pack." Accessed October 28, 2022. https://static1.squarespace.com/static/582d0d16440243165eb756db/t/60bda6dbb33637072f938b51/1623041781234/EducatorPack_Topic1_EN_20180614_1443_Final.pdf.
- Rodgers, Paul, Giovanni Innella, Craig Bremner, Ian Coxon, Cara Broadley, Alessia Cadamuro, Stephanie Carleklev, Kwan Chan, Clive Dilnot, James Fathers, Jac Fennell, Chris Fremantle, Tara French, Diogo Henriques, Peter Lloyd Jones, Richard Kettley, Sarah Kettley, Mashal Khan, Karl Logge, Jen Archer-Martin, Lynn-Sayers McHattie, Robert Pulley, Dina Shahar, Gemma Teal, Saurabh Tewari, Cathy Treadaway, Emmanuel Tseklevs, Hamed Moradi Valadkeshyaei, Jonathan Ventura, Trudy A. Watt, Heather Wiltse, and Euan Winton. 2019. "The Lancaster Care Charter." *Design Issues* 35, no. 1: 73–77. https://doi.org/10.1162/desi_a_00522.

- Sanders, Elizabeth B.-N. 2006. "Scaffolds for building everyday creativity." In *Design for Effective Communications: Creating Contexts for Clarity and Meaning*, edited by Jorge Frascara. New York: Allworth Press.
- Sato, Yuriko. 2017. "Mottainai: A Japanese Sense of Anima Mundi." *Journal of Analytical Psychology* 62 (1): 147–54. <https://doi.org/10.1111/1468-5922.12282>.
- Saito, Yuriko. 2013. "The Moral Dimension of Japanese Aesthetics." In *Rethinking Aesthetics: The Role of Body in Design*, edited by Ritu Bhatt, 159–180. New York: Routledge.
- Schultz, Mette Fersløv. 2011. *Living Lightly-Sustainable Fashion. Laboratory for Design, Innovation and Sustainability*. Kolding School of Design. <https://www.designskolenkolding.dk/en/publications/living-lightly>https://doi.org/10.1007/978-1-84800-163-3_14.
- Strauss, Carolyn F., and Alastair Fuad-Luke. 2008. "The Slow Design Principles: A new interrogative and reflexive tool for design research and practice." *Proceedings of Changing the Change: Design, Visions, Proposals, and Tools*, Turin, Italy.
- ThredUP. 2016. "10 Super Compelling Reasons Why You Need to Choose Used." August 24, 2016. https://www.thredup.com/bg/p/10-reasons-why-you-need-to-shop-secondhand-first?tswc_redir=true.
- Ted Research. n.d. "TED's Ten Aims." Accessed March 26, 2021. <http://www.tedresearch.net/teds-ten-aims/>.
- Tohoku Standard Project. 2013. "Nanbu Sakiori." *Tohoku Standard*. Accessed April 21, 2021. <http://tohoku-standard.jp/en/standard/aomori/sakiori/>.
- University of Toronto. 2019. "Participant Observation." Accessed November 1, 2022. <https://research.utoronto.ca/participant-observation>.
- USDA. 2020. "Potatoes and Tomatoes are the most commonly consumed vegetables." Economic Research Service. U.S. Department of Agriculture. December 16, 2020. <https://www.ers.usda.gov/data-products/chart-gallery/gallery/chart-detail/?chartId=58340>.
- Vegeto Textiles, n.d. "Milkweed." Accessed Sept 17, 2022. <https://www.vegetotextiles.com/en/milkweed/>.
- Vezzoli, Carlo and Ezio Manzini. 2008. "Chapter 14: Evolution of Sustainability in Design Research and Practice." In *Design for Environmental Sustainability*. London: Springer. https://doi.org/10.1007/978-1-84800-163-3_14.
- Wada, Yoshiko Iwamoto. 2004. "Boro no Bi: Beauty in Humility—Repaired Cotton Rags of Old Japan." *Textile Society of America Symposium Proceedings*. 278–284. <https://digitalcommons.unl.edu/tsaconf/458>.
- Yu, Yuanyuan, Qiang Wang, and Ping Wang. 2019. "Bioprocessing of Bast Fibers." In *Advances in Textile Biotechnology*, 2nd ed., edited by Artur Cavaco-Paulo, Vincent Nierstrasz, and Qiang Wang, 1–19. Woodhead Publishing. <https://www.sciencedirect.com/science/article/pii/B9780081026328000013>.

Zemke, Larissa. 2021. "A Year in Japan: Exploring the Japanese Ways of Being, Creating and Consuming." Unpublished manuscript, last modified July 6, 2021. PDF file. https://liveconcordia-my.sharepoint.com/:b:/g/personal/l_zemk_live_concordia_ca/EVfnApUh-nNEp4xeX-ZacYBuVR76L34BYN-ZZ-JxSXebA?e=3oOTYb