Textile & Design Proceedings

Peer-Reviewed Design Scholarship Showcase

SAAFECS–IFHE International Conference 2026

Mount Amanzi, South Africa

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Iowa State University, United States

Sixteen works were submitted and evaluated through a double-blind peer-review process, with eight selected for exhibition (50% acceptance rate). Submissions were assessed on scholarly context, material and process exploration, aesthetic resolve, and overall contribution. The selected works reflect strong engagement with historic, functional, circularity, and the conference theme, *Science as Collaboration*.

SAAFECS
SCIENCE as COLLABORATION
17th International Conference
IFHE

Re-Piece: Sustainable, Adaptive Children's Apparel Integrating Digital Prototyping and Repurposed Textiles

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Iowa State University
Dr. Rachel J. Eike – Mentor
Category of Scholarship: Graduate Student
Key Words: Adaptive Apparel, Digital Prototyping, FEA Model, Repurposed Garment, Visual Texture

Contextual Review: According to a systematic literature review by Rana et al. (2024), adaptive apparel remains an incredibly niche design area that is in demand. Only 51 scholarly publications were deemed usable in the study, highlighting the limited scope of the area. In 2016, Tommy Hilfiger launched Tommy Adaptive, their collection designed with and for people with disabilities (Tommy Hilfiger Licensing, n.d.). Since then, only a small number of large brands have launched their own adaptive collections. However, in an unpublished interview, participants discussed how items designed for adaptive use will not work for everyone (C. Blackwell, personal communication, July 9, 2025). For example, a magnetic zipper may still be challenging for someone who has limited hand strength, even though it is commonly used in adaptive designs. This suggests that adaptive apparel remains difficult to mass-produce and must be tailored to individual user needs.

Concept: Grounded in the functional, expressive, and aesthetic (FEA) model by Lamb and Kallal (1992), Re-Piece is a garment that responds to the comfort needs of children who use a wheelchair and a g-tube, while also being simple enough to produce. This garment was designed to address long-term sitting comfort, use with medical devices, ease of donning and doffing for caregivers, and individual expression. Re-Piece embodies Science as Collaboration by integrating insights from design and medical experts to inform the design process, enhancing user comfort and caregiver ease, and repurposing existing garments into something new.

Aesthetic properties and visual impact: The concept for Re-Piece was to create a garment that was colorful and expressive while meeting the wearer's functional needs. The ensemble utilizes multiple repurposed, woven fabrics and a custom knit to create a variety of visual textures. Fabrics were chosen based on their patterns and shared blues, greens, and pinks to create rhythm of color and unity among the varying visual textures. The knit was then developed with colors and a pattern to complement the woven fabrics. Strategic consideration of patterns, visual textures, and colors resulted in a unique, colorful garment.

Re-Piece's silhouette was developed with functionality in mind. The wrap-style top provides additional fullness to accommodate medical devices, such as a g-tube, while preserving a traditional, smooth appearance. The low-high gathered skirt offers extra coverage when seated in a wheelchair while maintaining modesty. The gathers provide additional fullness, allowing greater freedom of movement and easier adjustments.

Process, technique, execution, cohesion: When developing Re-Piece, color and functionality were at the forefront. McKinney and Eike's *Adaptive Apparel Design* (2023) was used throughout the design process to guide the translation of my ideas into functional, adaptive apparel. Concept sketches were developed after reviewing caregiver and industry expert interviews and researching adaptive apparel, leading to iterations that would be easy for caregivers to don and doff. Browzwear VStitcher was then used to prototype the design and make digital modifications as needed. VStitcher enabled the creation of a custom avatar that matched the user's measurements and allowed testing of the fit in a seated position (see Figure 1). The digital fit test was an essential part of the pattern-making process, as the tension and shape of the pattern pieces had to be adjusted to meet the user's functional needs. This prototyping allowed for proper pattern development and fabric mapping before physical construction began. After model fitting and peer feedback, a bottom ruffle and a jacquard-knit underskirt were added for improved modesty.

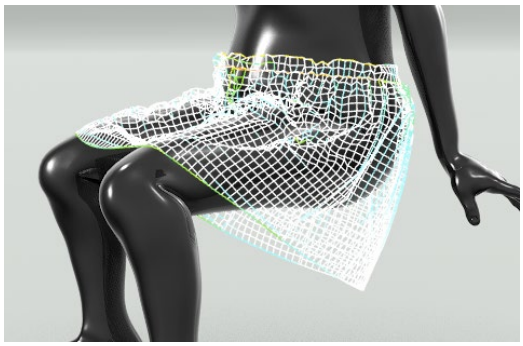

Figure 1. Digital fitting in seated position.

Materials were selected based on color, visual texture, and fabric weight. Four woven garments were selected and deconstructed for use with the associated pattern pieces. A custom jacquard knit was developed using a Stoll 830 knitting machine and M1 software. This knit was strategically developed and placed in the upper rear yokes of the top and skirt for comfort and stretch. Functional notions were then added for ease of wear and comfort based on research by Mindy Scheier, who identified magnetic snaps, adjustable hems, and flexible entry points for adaptive children's wear as ideal (McBee-Black & Ha-Brookshire, 2022). Magnetic snaps were added to the top to facilitate easier donning and doffing by the user or caregiver. A partial elastic waistband around the front and sides improves fit, while the smooth knit waistband in the back and yoke enhances comfort while seated. This combination of adaptive techniques, materials, and technology produced a garment that is both visually engaging and functional.

Design contribution, originality, and innovation: Re-Piece demonstrates a cohesive integration of concept, process, and aesthetics by employing the FEA framework to balance function and expression. Collaboration with experts and peers, along with sustainable practices, digital prototyping, and repurposed fabrics, served both creative and functional intentions. This ensemble contributes to adaptive apparel scholarship by presenting a sustainable method for creating visually expressive garments for users with mobility and medical impairments. In an interview, Z. Schumm (personal communication, July 22, 2025) explained how sustainability and repurposed design must take into account premade shapes and construction, such as seams within a pattern piece. The garment's simple silhouette and pattern shapes allow for viable mass production or at-home sewing while being adaptive to different needs and emphasizing uniqueness and expression.

Mentor Statement: This creative work was developed within a course-based project, supported through structured faculty mentorship. Guidance emphasized the integration of research into the design process, the development of a functional and user-focused solution, and the strategic repurposing of garments. I additionally provided feedback on early drafts of the abstract. This mentorship aligns with my scholarly focus on sustainable, functional, and user-centered apparel design.

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Reimagining Healthcare Protection: A User-Oriented Surgical Gown Design

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Category of Scholarship: Graduate Student
Key Words: Surgical gown, User-oriented design, Reusable PPE, Self-contamination reduction, Healthcare worker safety

Context and Concept: Personal protective equipment, particularly surgical gowns, serves as a critical barrier protecting healthcare workers from infectious agents and bodily fluids. However, current commercial gowns present significant challenges, including inadequate fit, compromised mobility, and elevated self-contamination risk during donning and doffing (Kilinc Balci, 2016; Šterman et al., 2022). Critically, many existing gown designs require assistance for proper donning and doffing, increasing contamination exposure and workflow inefficiency. The healthcare PPE market, projected to reach $30.28 billion by 2029 (Insights, 2022), reflects urgent demand for innovative protective solutions addressing user experience alongside protection standards. Research highlights that healthcare workers desire gowns that balance protection, comfort, and functionality, yet few designs adequately integrate these factors through systematic user input (Lee et al., 2021). This design addresses: How can surgical gown design enhance healthcare worker safety, comfort, and efficiency through user-oriented innovation while enabling independent donning and doffing. The objective was to develop a reusable surgical gown prototype that reduces self-contamination through independent use, facilitates intuitive single-person donning and doffing, and improves fit and mobility. This work embodies the conference theme, Science as Collaboration, through an interdisciplinary partnership between textile design and healthcare practice. The design process was informed by qualitative interviews with healthcare professionals, operating room nurses, oncologists, and NICU staff, whose lived experiences revealed critical pain points, including the need for assistance during gown removal. This collaborative inquiry bridged design research and clinical expertise, demonstrating how co-creation with end-users yields evidence-based innovations. Employing Rosenblad-Wallin's (1985) user-oriented product development framework, this design integrates functional values protection, fit, ease of use, with symbolic values reflecting professionalism. The gown's reusability addresses sustainability concerns; facilities transitioning to reusable gowns documented waste reductions exceeding 300 tons annually (UCLA Health, 2015). For the IFHE audience, this project contributes methodological insights into applying user-centered design principles to protective apparel, demonstrating how collaborative research processes generate innovations with cross-cultural applicability.

Visual Impact and Aesthetics: The design employs clean, functional aesthetics rooted in professional medical contexts while incorporating innovative structural elements. The silhouette features a knee-length tunic with raglan sleeves providing unrestricted shoulder movement critical for healthcare workers performing precise procedures. Raglan construction eliminates traditional shoulder seams, creating smooth diagonal lines from the neckline to the underarm that enhance visual flow and mobility, reflecting unity where form follows function. Visual emphasis is achieved through the strategic placement of adjustable elements. Horizontal and vertical hook-and-loop strips at shoulders and sides introduce

rhythmic accents while serving closure functions. The overlapping front and side closures create asymmetrical visual interest and reinforce protection. Proportion is balanced between bodice length, sleeve length, and overall silhouette to accommodate diverse body types. The design intentionally minimizes decorative elements, maintaining professional simplicity appropriate for clinical environments.

Process, Technique, and Materials*:* Design development followed a systematic user-oriented methodology integrating market research, patent analysis, qualitative inquiry, and iterative prototyping. Initial research analyzed approximately 30 commercially available gowns and existing patents to identify prevalent design features, construction methods, and innovative closure mechanisms. This revealed common limitations, including inadequate size adjustability, restrictive armscye construction, and closure systems requiring assistance or prone to failure. Subsequently, semi-structured interviews and focus groups with healthcare workers (n=20+) explored experiential dimensions of gown usage, emphasizing protection concerns, mobility restrictions, comfort deficiencies, and contamination vulnerabilities, particularly during unassisted doffing. Three conceptual designs explored variations in closure placement, sleeve construction, and adjustability mechanisms. The selected prototype was chosen for enabling independent single-person donning and doffing through accessible side and shoulder closures. It integrates multiple innovations: raglan sleeves enhancing mobility and reducing armscye stress; thumbhole knitted cuffs providing secure wrist coverage while maintaining dexterity; hook-and-loop (Velcro) closures positioned horizontally at shoulders and vertically at sides enabling single-person adjustment and removal; and an overlapping front panel with bias tape finishing ensuring comprehensive coverage and minimizing exposure risk. The pattern incorporated ergonomic ease allowances specific to healthcare worker movements. Material selection prioritized 100% cotton broadcloth fabric for breathability, comfort during extended wear, and compatibility with industrial laundering protocols. While synthetic materials facilitate sanitization, steam autoclave sterilization through certified medical laundry services effectively eliminates bacterial contamination from tightly woven cotton, maintaining structural integrity through repeated cycles.
Complementary materials include bias tape for clean edge finishing, knitted cuffs with thumbholes for secure wrist closure, and durable hook-and-loop (Velcro) fasteners for adjustable, self-manageable closures. Construction employed flat-felled seams to eliminate raw edges and reduce contamination-harboring sites. Future iterations will explore performance textiles incorporating antimicrobial finishes or fluid-repellent treatments. Video demonstration of donning and doffing process: https://tinyurl.com/4j2xya58

Cohesion and Contribution: This surgical gown demonstrates cohesive integration of concept, process, materials, and aesthetics through its user-oriented development foundation. Each design decision from raglan sleeve construction to self-manageable closure systems directly responds to healthcare worker needs articulated during collaborative inquiry. The prototype embodies *Science as Collaboration* by bridging disciplinary knowledge systems: textile science informs material selection and construction techniques; healthcare expertise identifies clinical requirements, including the critical need for independent donning and doffing; and design methodology synthesizes these perspectives into tangible

innovation. The design's scholarly contribution lies in the systematic application of user-oriented design frameworks to healthcare PPE while addressing self-contamination reduction through independent use capability. By documenting healthcare worker perspectives and translating experiential data into design specifications, this work advances understanding of functional apparel development. The gown's novelty resides in its integrated self-donning/doffing system, eliminating assistance requirements, adjustability addressing fit heterogeneity, mobility-optimized construction reducing occupational strain, and reusability supporting environmental sustainability. These innovations offer practical implications for PPE manufacturers, healthcare facilities seeking improved worker safety, and design researchers exploring collaborative methodologies. Future directions include wear-testing to validate independent use efficacy, comfort and protection performance, and exploration of advanced breathable textiles.

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New Materialism Explored Through a Speculative Design Inquiry for Futuristic Zulu Traditional Attire

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Category of Scholarship: Graduate Student
Key Words: New materialism, speculative design, beadwork, Zulu attire, 3D printing

Contextual Review: The relationship that Zulu women have with their traditional attire has an interesting history and development through time. The relationship between wearer and attire was deeply symbolic and personal; the garment had agency within Zulu communities. For example, a married Zulu woman's *isidwaba* [1]was buried with her, signifying its agency beyond mere utility (Klopper, 1987, p. 20). In addition, their clothing connected them to several assemblages, such as her affinal, agnatic, future children and ancestors. This relationship between wearer and garment aligns with new materialism, a theory emphasising material agency and the interconnectedness of human and non-human entities (Fox & Alldred, 2018, p. 1). However, over time, the relationship between Zulu women and their attire has changed through colonialism and urbanisation. In new materialism, assemblages are in constant irregular movements or changes, where assemblages form and decouple at unpredictable intervals, and matter is not stationary but in flux (Coole & Frost, 2010, p. 9).

Figure 1. Christian Msimang (Photographer), Ingodosi wearing her isidwaba

Concept: The purpose of this study was to explore and understand the history of pre-colonial Zulu female traditional dress in northern Kwa-Zulu-Natal and its connection to the concept of new materialism. The aims of this research were posed as what-if questions to align with the speculative design inquiry that was used as the theoretical framework. The main what-if question was: based on pre-colonial understandings of Zulu tradition and materialism, how can the exploration of Zulu female traditional attire be reimagined for the future, using modern advanced technology to foster cultural preservation?

This project falls under interdisciplinary collaboration, knowledge exchange, and impact. Through new materialism, the garment breaks the dualisms of time using speculative design to re-imagine how the Zulu female traditional attire might look in the future. Through interdisciplinary collaboration, the author worked with their university's industrial department to render and print their own 3D-printed chainmail textile based on existing Zulu motifs, prominent in Zulu beadwork. This was used for the speculative futuristic attempt at possible future methods of Zulu attire construction. This project was a qualitative research study that used a combination of the transformative paradigm and speculative design as the

[1] A leather kilt worn by married Zulu women

theoretical frameworks. Through these paradigms, Zulu women's experiences and responses informed the speculative design inquiry and framed the speculative scenarios in which the garment exists. Further, within the transformative paradigm, Zulu women's relationship with their attire was included in the new materialist discourse, as was the application of speculative design to African traditional attire. Based on participants' responses, a summarised historical information guide was developed for Zulu women to learn about the history of their traditional attire via an easy-to-read website. This was done to make speculative discourse easier for Zulu women to participate in and to share and preserve cultural knowledge with others in English.

Aesthetic properties and visual impact: The garment blends time, using past methods of constructing Zulu attire alongside possible futuristic methods, while utilising present, trendy colour palettes. It is inspired by existing Zulu attire; it can be worn as an apron over *isidwaba*, *ixhama*[2], and as a top inspired by *isibhodiya*[3]. The top portion of the garment is made with glass beads, while the bottom portion is made with 3D-printed chainmail mesh. The beaded piece is the focal point with the bright colours and Zulu motifs. The 3D mesh pulls on the colours of the beadwork through the embroidery thread at the centre front of the piece. This also emphasises the use of symmetry, which blends all the elements together. Movement is exemplified by the dynamic 3D mesh and the garment's beaded fringe. This was done to emphasise the garment's agency through new materialism.

The originality of the visual composition lies in merging existing Zulu motifs with patterns in 3D-printed chainmail textiles, which, to date, have not included these geometric shapes from a cultural perspective. Further, the beadwork utilised colours that are less common in Zulu beadwork.

Process, technique, execution, cohesion: This project used the generative tool for the creative process. The needs, goals and preferences, as well as the design criteria and constraints, are considered before the ideation process. During the ideation process, the author determined that the garment should be inspired by existing Zulu female attire and that they would use 3D printing to create textiles. The author designed four garments and, based on participants' responses, selected the best design and colour palette. The author created a necklace-sized prototype of the beadwork and tested multiple designs and chainmail techniques to join the 3D-printed component. The author used size 8/0 Czech glass beads for their consistent size and white nylon thread for their strength to create the beaded textile using a technique they learned from the women in their family. The 3D-printed component was made from white PLA using FDM printing. The designs were rendered in SolidWorks and printed in sections on a 3D printer. The sections were joined with silver necklace hooks and decorated with embroidery thread.

The 3D-printed component used FDM printing because it was one of the most accessible options, especially in the fashion industry (Jeong et al., 2021, p. 2). PLA filament was chosen for its printing quality and strength. The construction process aligned the work's purpose statement with new materialism and existing Zulu female traditional attire, and analysed the dualism of time. The beading process took 2

[2] Girdle or belt constructed from braided grass

[3] An apron made from a specific impala's hide, worn by pregnant women

months to complete, and the progression of the author's improvement is imprinted on the beaded piece, while the 3D printed piece took over 4 hours to print.

Design contribution, originality, and innovation: This concept was executed by establishing a link between new materialism and the Zulu female traditional attire, using examples of pre-colonial garments. The design and construction process of the garment were based on these pre-colonial garments. New materialism was further applied by breaking the dualisms of time, blending pre-colonial garment construction practices with possible futuristic methods. While grounding it in the present, using trendy colours and accessible materials. Further, the agency of the garment and the assemblage of the wearer and the garment were displayed through the garment's fluid movement. Through speculative design, the attire was re-imagined, while through the transformative paradigm, the research participants' experiences were centred in framing the speculative design scenario in which the garment exists.

The project involves an African epistemology in new materialism, which has been critiqued by authors for excluding indigenous epistemologies (Alaimo, 2020, p. 177; Truman, 2020, p. 9; Taylor, 2024, p. 147). Further, it positions Zulu epistemologies that parallel new materialism through fashion, a field that authors such as Smelik state has been less explored (Smelik, 2018, p. 34). Additionally, female African voices are included in the speculative design discourse; through the 3D-printed chainmail process, Zulu geometric motifs are now incorporated. Further, within the theoretical frameworks used, Zulu women's traditional attire can be viewed as a fashion to be explored through speculative design. In fashion history, which has remained biased towards Western fashion history (Craik, 1994, p. 18).

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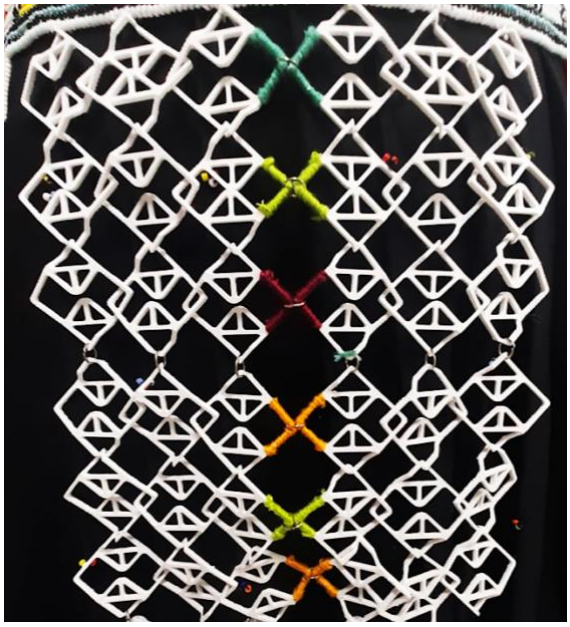

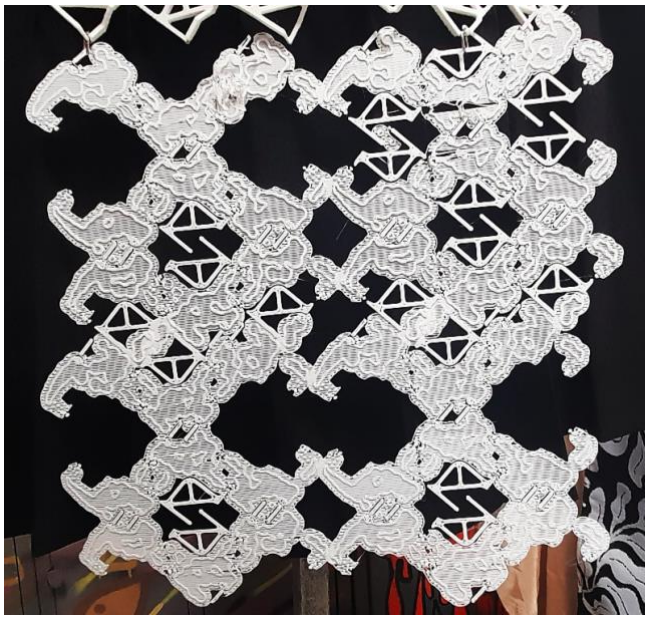

BloomStep: A Regenerative Footwear Prototype Using Reclaimed Textiles and Papermaking Processes

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Accessory Artifact (Footwear): Graduate Student
Key Words: Circular design; Textile waste valorization; Papermaking science; Biodegradable footwear; Design for regeneration

Contextual Review: Cotton constitutes a major share of global textile waste, much of which is still landfilled or incinerated despite its biodegradability and cellulosic potential (Abtew et al., 2025). Reclaimed cotton fibers retain favorable absorbency, bonding capacity, and mechanical behavior in nonwoven and sheet structures, and maintain adequate strength even when mechanically shortened (Kamble & Behera, 2021; Ütebay et al., 2019). Papermaking has similarly been shown to transform textile waste into nonwoven sheet materials for new products, such as upcycled paperboard–denim prototypes (Ciarla, 2023). Within circular design frameworks, including the C2CAD sustainable apparel model (Jin Gam et al., 2009) and broader circular economy concepts (Geisendorf & Pietrulla, 2018), transforming waste textiles into renewed material streams is a central goal. BloomStep advances this agenda by using papermaking as a low-impact method to convert cotton textile waste into biodegradable, single-use footwear for spa, pedicure, and travel contexts. In place of foam or synthetic sandals that contribute to microplastic pollution and long-term waste (Niinimäki et al., 2020), BloomStep proposes a fully cellulose-based, seed-embedded slipper designed to biodegrade safely and support plant growth after disposal.

Concept: BloomStep reflects Science as Collaboration through its integration of textile waste science, fiber behavior, papermaking technology, and pattern engineering. It draws on research showing how recycled cotton fibers respond to fibrillation, bonding, and structural formation in nonwoven and sheet matrices (Kamble & Behera, 2021), and aligns with interdisciplinary work that reformulates textile waste into panels, molded forms, and composite laminates (Cao et al., 2022). By grounding a wearable accessory in these material-science foundations, BloomStep bridges design practice with empirical research and advances sustainable, science-driven approaches to innovative product development.

Aesthetic properties and visual impact: The finished slippers show visual and material honesty typical of natural cellulose. Their matte, softly textured surfaces reveal a fine fiber network, clearly tracing back to reclaimed cotton. The slipper silhouette pairs a gently contoured footbed with a curved upper band assembled through interlocking folds and slots. This origami-like construction builds volume from flat sheets without hardware or adhesives, creating a sculptural, minimal form aligned with sustainable aesthetics. The raw, undyed color reinforces the biobased story, while seeds, secured in place using konnyaku paste, adds a subtle texture and symbolize renewal and circularity.

Process, technique, execution, cohesion: Discarded cotton garments and muslin offcuts were processed into pulp using traditional papermaking preparation methods. The reclaimed cotton materials were shredded and run through a Hollander beater to fibrillate fibers and enhance bonding (Takahashi, 2019). Despite shorter fibers, the recycled pulp formed strong, uniform sheets (Ütebay et al., 2019). Sheets were formed using a mould-and-deckle, then couched, pressed, and air-dried, using a pressing weight and drying orientation adjusted to improve sheet strength (Kamble &featuring an).
In this prototype phase, scale, fit, and structural behavior were developed through a slipper pattern featuring an alternative strap and contoured footbed. Pattern pieces were drafted in Adobe Illustrator and laser cut from reclaimed cotton–pulp sheets to achieve clean edges, consistent slot geometry, and efficient nesting for assembly. Assembly relies on interlocking slits and folds which eliminates the need for adhesives or other closures materials (e.g. hook and loop take) while aligning with zero-waste design principles. To support a regenerative end-of-life strategy, chia and mung seeds were embedded into the slipper surface and secured using konnyaku paste as a plant-based binder, enabling the slippers to be planted after use. The material system, composed of reclaimed cotton cellulose, seeds, recirculated water, and a bio-based konnyaku binder without dyes or synthetic adhesives, supports compostability and aligns with cradle-to-cradle principles (McDonough & Braungart, 2002). Offcuts generated during fabrication are reintroduced into the pulp stream, reinforcing a zero-waste approach and enabling renewal into future footwear forms.

Design contribution, originality, and innovation: BloomStep demonstrates strong alignment between concept, material strategy, construction logic, and regenerative intent. The project expands textile waste valorization by transforming reclaimed cotton pulp into a wearable, visually resolved prototype with functional potential and an intentional regenerative end-of-life. As a prototype-stage concept, BloomStep presents a design-driven model combining papermaking, origami-inspired construction, konnyaku-assisted seed application, and minimal-material engineering, with laser cutting used to refine slot geometry and support scalability. Within current cotton-waste recycling research, the project shows how low-impact, craft-adaptable methods can support circular material systems, sustainable spa and hospitality products, and community or classroom innovations in textile waste recovery. Moving beyond “less harmful disposables,” BloomStep advances a pathway toward truly biopositive product design.

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Full Circle Hobo: Reclaimed and Recrafted Cellulose

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Category of Scholarship: Professional
Key Words: Circular design, Papermaking science, Design for disassembly

Contextual Review & Concept: Fashion remains a resource-intensive global industry, generating significant waste across pre- and post-consumer stages. Pre-consumer textile offcuts, such as cotton muslin waste discarded in design studios, offer a clean cellulose feedstock for material recovery yet are seldom reintegrated into product development (Tonjes & Greene, 2012). This project addresses that opportunity by exploring how reclaimed cellulose fibers can be transformed into functional fashion artifacts using papermaking science aligned with circular design and Cradle-to-Cradle Apparel Design (C2CAD) principles (Jin Gam et al., 2009; McDonough & Braungart, 2002).

Purpose: This scholarly design project, Full Circle Hobo, investigated the use of discarded cotton offcuts to create a fashion accessory grounded in circular design principles. By repurposing shredded cotton muslin and flax/linen waste through traditional Japanese papermaking techniques, the project proposes a leather alternative taking shape of a large hobo bag. In transforming textile byproducts into a functional accessory, Full Circle Hobo presents a regenerative material model aligned with zero-waste goals and cradle-to-cradle design. This design-led research engages sustainability frameworks that emphasize renewable inputs, material recirculation, and regenerative end-of-life pathways (EMF, 2024). By merging traditional Japanese papermaking techniques (nagashizuki, konnyaku application, momigami manipulation) with contemporary accessory design, the project contributes to sustainable material development and advances the discourse on material diversity for fashion (Blum, 2021; Ciarla, 2023).

Connection to the Conference Theme: Science as Collaboration: This project exemplifies Science as Collaboration through the integration of material science (fiber processing, natural dye chemistry, nonwoven formation) and fashion design practice (pattern drafting, digital fabrication, construction). Circular design frameworks further demonstrate how scientific processes and creative methodologies collectively enable regenerative product innovation. This intersection provides a replicable model for educators and designers seeking low-impact alternatives to conventional textiles and aligns strongly with IFHE's global mission to advance sustainability through interdisciplinary practice.

Aesthetic properties and visual impact: The accessory features handmade nonwoven sheets of recycled cellulose pulp that created a leather-like surface. Repeating laser-cut, leaf-like motifs generate rhythm and depth, producing a sculptural, scale-like pattern that reinforces themes of renewal and fiber transformation. A symmetrical silhouette grounds the visual complexity, while earth-tone natural dyes support material authenticity. Principles including rhythm, unity, contrast, and proportion were

intentionally applied to achieve visual impact and showcase the expressive potential of reclaimed cellulose materials.

Process, technique, execution, cohesion: Cotton muslin and flax offcuts were sourced from a fashion studio and processed in an 80/20 cellulose blend. Approximately one pound of discarded textiles was shredded and beaten for 14 hours in a Hollander beater. Natural dyes (Himalayan Rhubarb, Cutch, Pomegranate) were incorporated using tannin mordants and soda ash for retention. Nonwoven sheets were formed on an 18"x18" mould and deckle using nagashi-zuki sheet formation, then couched and air-dried. To strengthen and waterproof the material, konnyaku paste was applied to each sheet, followed by momigami, a kneading process that increases flexibility and fiber entanglement (Takahashi, 2019). The accessory pattern was drafted in Adobe Illustrator and laser-cut for precision. Components were assembled with 100% cotton thread using long stitch lengths to reduce puncture and facilitate disassembly (Jin Gam et al., 2011). Metal hardware was attached with screw rivets to allow removal and full recyclability of the textile components. The photo series below visually documents the material development process, from raw pulp (a), to sheet formation (b) and couching (c), through konnyaku paste application (d), and finally, a side-by-side comparison of the textile before and after momigami treatment (e).

(a) (b) (c) (d) (e)

Design contribution, originality, and innovation: Full Circle Hobo demonstrates cohesion across concept, materials, aesthetics, and process by centering circularity from fiber sourcing through end-of-life disassembly. The integration of papermaking science with accessory design offers a novel pathway for creating leather alternatives from reclaimed cellulose waste. This work advances sustainable design scholarship by illustrating how interdisciplinary methods, grounded in craft, material science, and sustainability frameworks, can produce regenerative fashion artifacts. Future directions include material performance testing, refinement of sheet-forming methods, expanded fiber-blend trials, and user-testing.

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The Future of Fashion Lies in the Past: Pieces of Tradition

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Category of Scholarship: Professional
Key Words: Repurposing, Collaborative design, traditional textile craft

Contextual Review: This project is intended to contribute to existing research on sustainability in the apparel and textile industry, specifically incorporating the concept of slow fashion into an existing apparel repurposing model and providing visual examples of these concepts via traditional textile craft techniques. This design is one of six created collaboratively, each paying homage to a different traditional textile craft.

The apparel and textile industry ranks as the fourth highest in environmental impact behind the energy, agriculture and transportation industries (Omondi, 2022). Problems caused by the production of apparel and textile products include large amounts of greenhouse gas emissions, water usage, pollution and pre-consumer and post-consumer textile waste. While the production of other consumer goods may face similar issues, the underlying issue that makes the production of fashion products particularly problematic is the frenetic pace of change that it undergoes and encourages. This phenomenon is called fast fashion; characterized by large volume, low cost, low quality, rapidly produced clothing and often utilizing exploitative labor practices (Fletcher, 2015). Fast fashion satisfies the consumers need for instant gratification, enticing them to constantly want more while simultaneously encouraging disposal of still functional, yet "out of style" clothing.

Irick (2013) interviewed designers of repurposed apparel and textile products to understand their design processes, resulting in the development of a model for the creation of repurposed apparel and textile products. This model identified three levels of repurposing (restyling, subtractive, and additive) based on the labor intensiveness of the process. This model was amended by Irick and Eike (2020) to include a fourth level of repurposing, intentional pattern making. Irick, Eike and Kumphai (2019) tested the fourth level, intentional pattern making by each creating a repurposed design utilizing three different pattern making techniques: draping, flat patterning by hand and digital patterning. The purpose of these research studies has been to understand the design process for repurposing apparel and textiles in order to efficiently use the copious amounts of second-hand clothing available, preventing it from becoming waste. Hawley (2006) established the greatest opportunity for growth in reclaimed textiles is to transform used apparel into new products and Lapolla and Sanders (2015) suggested that combining co-creation and repurposing may be one way to add longevity to fashion products.

Concept: The foundational concept for this project, in opposition to fast fashion, is the concept of slow fashion. Paralleling the slow food movement, the term slow fashion was first coined by Fletcher (2007). Slow fashion is a movement that focuses on quality materials, sustainable production, small-scale production, local markets, taking pleasure in the process of making, cultural diversity and traditional, artisanal craft techniques. The latter was selected as proof of concept for this project. Understanding the historical importance of such techniques and how they inform the construct of slow fashion will

allow us to connect with generations past and promote a more sustainable future. Additionally, the time intensiveness of repurposing lends itself well to the slow fashion movement, so it is conceivable that concepts of slow fashion and repurposing could be melded, and it is important to understand how they overlap and how they complement each other in sustainable apparel design processes. This design contributes to the conference of "Science through Collaboration" by researching design methodology as a science, specifically how the use of technology for fast fashion has impacted our world. Collaborative design methods combined with repurposing were used to display this point.

Therefore, the purpose of this project is to understand how the concepts of slow fashion inform and overlap with apparel and textile repurposing. Traditional textile crafts will be used as proof of concept of slow fashion. Secondarily, this project will provide visual examples that tell the stories of the participants, hopefully leading to promoting and educating consumers about repurposing and slow fashion, and reviving interest in traditional textile craft techniques. The research question for the design component of this research project was as follows:

> *How can the identified categories of textile techniques be combined best with repurposing techniques to visually tell the stories of the participants?*

Aesthetic properties and visual impact: The designer successfully utilized symmetrical balance and a complementary color scheme to achieve a visually impactful design. The maroon under dress ties in with the maroon quilted pieces near the front waistline creating a focal point. The pattern repeat on the back quilted panel creates visual rhythm and the bright orange near the hem draws the eye downward.

Process, technique, execution, cohesion: This design is part of a six-piece collection contributing to existing research on textile sustainability, specifically slow fashion and repurposing. Six categories of traditional textile techniques were identified resulting in three phases of research; 1) researching the six traditional textile crafts to understand their historical usage and associated meanings, 2) identifying and individually interviewing collaborators with expertise in each of the techniques regarding their experiences with the technique, 3) collaborating with the participants to design and construct six garments paying homage to each of the techniques while also incorporating repurposing. The technique that this specific design focused on was quilting. After the interview with the collaborator, the main designer created a series of sketches inspired by the interests and preferences of the collaborator as well as the history of the quilting technique. The sketches were narrowed down, discussed, and edited further to arrive at the final design. The collaborator discussed an interest in the history of the American plains and a connection to her indigenous ancestry. She also identified an interest in bold colors. Both the color/print choices as well as the quilt block pattern selected were inspired by her story. The silhouette of the outer dress including the panel concept was inspired by research on the history of quilting, specifically quilting in Medieval Europe and women's dresses during that time period.

Both garments were draped on a dress form to create the patterns. General dimensions of the back outer dress were given to the collaborator, and the back piece of the outer dress was quilted by the collaborator using virgin quilting cotton fabric. The main designer used the pre-consumer waste scraps from the quilting process to create a quilted design on the front panels of the outer dress (level three of the repurposing model, additive repurposing). Additionally, the front and back quilted pieces were bound with purchased bias binding to complete the quilted look and finish the edges. The side

front and back sections of the underdress were also created from the pre-consumer waste scraps from the quilting process and the center front and center back panels of the underdress were created from a repurposed tablecloth (level two of the repurposing model, subtractive repurposing).

Design contribution, originality, and innovation: Rooted in research and collaborative design, the design is one of six created that satisfy the purpose of this research. Using traditional textile crafts as proof of concept, in this case, quilting, this design successfully combines slow fashion with multiple levels of repurposing from the previously stated model. This design successfully tells the story of the collaborator, combined with research on the history of quilting, while also delivering a visually impactful design.

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Interdisciplinary, speculative, and materialist narration of Hazel Futa: Miss South Africa 1955

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Key Words: Bio-art, Fashion, Hazel Futa, Micro-biology, Miss South Africa 1955

Context and Concept: The creative work installation titled, *Interdisciplinary, speculative, and materialist narration of Hazel Futa: Miss South Africa 1955*, uses biographical and archival material to ask, how do we use interdisciplinarity, speculation, and materiality to narrate events and individuals who are largely ignored in present-day South Africa? What happens when individuals who participated in these events are dead? How do we glean answers to questions we may have? To answer these questions, we tell the story of the first black Miss South Africa, Hazel Futa, as a case study to pluralize and democratize history. This presentation is Part One of a larger interdisciplinary and creative research project and focuses on material experimentation. As a brand, *Miss South Africa*, the organisation contemporarily known in South Africa, had its inaugural pageant in 1956, with Norma Vorster as the title winner (Glenn 2022). This formerly white-only Miss South Africa is distinct from the Miss South Africa in which Futa participated and eventually won. Futa entered a pageant open to the black race and headed by Dale Quaker. This pageant was largely publicised in the South African magazines such as *Drum, Zonk!,* and *Hi-Note!*.

Figure 1. Image of Hazel Futa being crowned Miss South Africa in 1955. Zonk Magazine July 1955

Futa was born on 20 August 1931 in South Africa and died in 1989, years after she'd relocated to Kensington, UK. She was also known for her acting, mostly in supporting roles, including the South African film *Come Back, Africa* (1959), the theatrical production *King Kong: All African Jazz Opera*, which toured London for six months in 1961, and in the UK series *The Saint* (1962-1969). While Futa was known for her acting and singing, she first came to wide public visibility as Miss South Africa in 1955, at the height of *apartheid* (Figure 1).

Studying Futa's life through archives from 1950s South Africa contributes to the discourse of pageantry and the meaning it held for society at a particular period. While they were prohibited from entering the white-only Miss South Africa due to the racist *apartheid* laws, pageants enabled the black South African community to celebrate beauty on their terms.

To engage in the concept of death that lies within the project, Robert Lanza's (2009) thoughts on death are informative. Pulled from quantum physics and biocentrism, Lanza (2009) writes about many worlds

> There are an infinite number of universes, and everything that could possibly happen occurs in some universe. Death does not exist in any real sense in these scenarios. All possible universes exist simultaneously, regardless of what happens in any of them. Although individual bodies are destined to self-destruct, the alive feeling – the 'Who am I?'- is just a 20-watt fountain of energy operating in the brain. But this energy doesn't go away at death. One of the surest axioms of science is that energy never dies; it can neither be created nor destroyed.

This thought provides the theoretical foundation of this interdisciplinary project, where Fashion, Microbiology, and Jewellery collaborate to narrate Futa's life story. Here, we play with the science axiom of an ever-existing, and never-dying energy capable of telling and retelling a narrative. In addition to this concept, Karen Barad (2007) is also helpful. The Baradian agential realism theory of intra-action comes into play in this project. Favouring intra-action over interaction, Barad (2007, 33) proposes this materialist neologism to signify that "agencies are only distinct in relation to their mutual entanglement; they don't exist as individual elements."

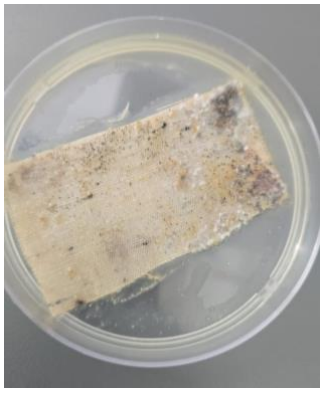
Aesthetic properties and visual impact: While the larger project infuses jewellery design pieces, the first part focuses solely on the Fashion Design and Microbiology aspects. During her crowning, Hazel Futa wore a strapless, light-coloured, printed dress with a ribbon detail in the sweetheart neckline style (See Zonk February, 1955, p. 29; Zonk July, 1955, pp. 9-10; Hi-Note August 1955, p. 5). Accompanied by a belt in the waist area composed of a darker hue. The skirt area of this classic 1950s silhouette is layered and has what appears to be a lace trim in the hem area. Futa wears pearl earrings and a necklace. In order to achieve visual impact and the desired aesthetics that are consistent with the theories that inform this study, that is, Lanza's concept of death and Barad's intra-action, the dress she wore for the pageant is remade and finished off with a pageant sash (Figure 2). The concept of death that is embedded in the project features in how we imagine and speculate an instance where Futa tells her Miss South Africa 1955 victory from her grave. Through Microbiology, microbes are grown on the dress to express the idea that we, as knowledge seekers, ancestrally

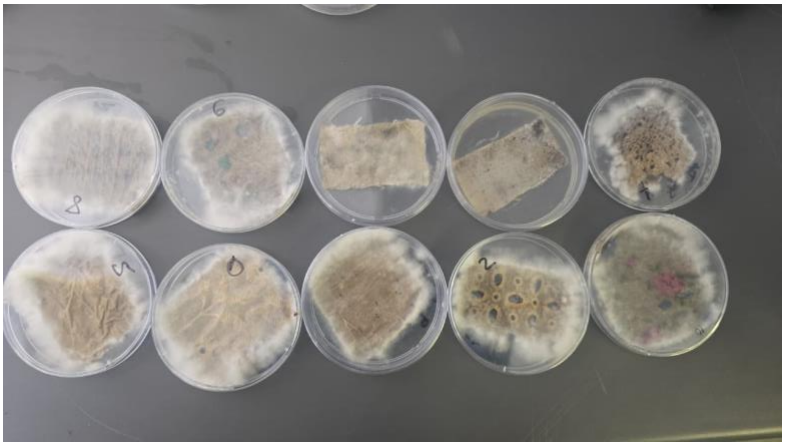
Figure 2. The re-made dress worn by Futa in 1955.

communicate with Futa years after her passing and burial. In the spirit of speculatively travelling Futa's journey before her Miss South Africa victory, the victory itself, and the events that followed the win, the exhibition features maps of eMonti (formerly East London), Futa's birth town, Gqeberha (formerly Port Elizabeth) where her crowning took place, Triomf (formerly Sophiatown) where she had an entertainment career, and London. Additionally, the project uses the idea of communicating with an ancestor and uses *udengezi/isitsha se-impepho* (clay dishes used to communicate with an ancestor and invoke guidance) and places the soil and sand from these different locations in them.

Process, technique, execution, cohesion: The microbial, mycelial, and burial in the process, technique, and material decisions of this project draw upon the works of fashion designers who exercised similar processes. For example, we are informed by Hussein Chalayan's (1993) *The Tangent Flows*, a fashion collection whose technique entailed a process where he designed an entire collection that was then buried for three months in a garden and excavated before the show. The infusion of iron fillings in the clothing burial process resulted in fashion pieces that adopted a radical method of textile dyeing, garment finishing, and unconventional recycling methods (Abramovich, n.d.). Years later, Maison Martin Margiela collaborated with Ad van Egeraat, a microbiologist from Wageningen University. Margiela conducted textile experimentation by placing them onto a solid agar plate made with a defined medium containing a combination of salts, nutrients, and building blocks, solidified with agar in petri dishes, referred to as agar growth plates, that enabled microbial growth (van Wijngaarden, 2024). The experiment resulted in a fashion collection where the separates were covered in mold. Like Chalayan, Margiela too, proposed a new design sensibility of textile colouration and finishing.

Standing on the shoulders of these two examples, our project infuses microbial techniques that parallel the decolonial and counter-historical theme that circulate in the concept of this interdisciplinary and speculative project. Soil and sand from the four locations (eMonti, Gqeberha, Triomf, and London) are used to grow microbes on the material used to make the dress. The microbial growth is first encouraged on the material placed onto a selection of agar plates (with different nutrient and salt concentrations) to allow the growth of different microbes, covered by soil, and incubated until growth is seen. This not only allowed the microbial growth but also added to the textile dyeing as done by Hussein Chalayan's (1993), adding to the colour of the fabrics. Fabrics that show microbial growth were removed, and liquid media (media without agar) was added to encourage the bacteria and fungi growing to continue growing, eventually using the material as a food source (Figures 3-6).





Figures 3-6. Dress mock-up, and fabric swatches before and after microbial treatment

Design contribution, originality, and innovation: Through its involvement of multiple disciplines towards one creative output, this project embodies collaborative processes and interdisciplinarity. Studying Hazel Futa through the lens of the afterlife of materials, as we do in this project, also contributes to knowledge exchange and sharing, and its impact lies in the potential of public learning about a local, South African history that does not receive wide recognition. It also contributes to the field of textile experimentation and storytelling through textiles and fashion.

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Zonk February 1955

Zonk July 1955


The Beginning: Hazel Futa


The Beginning: Hazel Futa
The 1955 Miss South Africa
Futa's London Years
Sophiatown, Johannesburg

RawrWear: Adaptive, Sustainable Youth Clothing developed through User-Centered and Collaborative Design Science

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Category of Scholarship: Professional
Key Words: Adaptive Apparel Design, User-Centered Design (UCD), Caregiver-designer collaboration, Sustainable garment modification, Youth medical needs

Contextual Review & Concept:
Children with complex medical needs remain critically underserved within the adaptive apparel marketplace (Cho, S., Karpova, E., & Chung, 2024). Although more than one billion people globally experience disability (Gaffney, 2019; World Health Organization, 2020) adaptive innovations in children's wear remain limited, focusing mainly on sensory-friendly features rather than true functional adaptations (Mallon, 2019). Caregivers frequently report barriers such as inaccessible retail environments, limited options for medical accommodation, and the inability to try garments on in-store, resulting in frustration and disengagement from traditional apparel shopping (Kabel et al., 2017). As a result, families are often left to modify clothing themselves or rely on costly custom solutions.

Purpose: The purpose of *RawrWear* was to collaboratively design an adaptive youth clothing ensemble that meets the functional, emotional, and caregiving needs of a medically complex child, using caregiver insights and sustainable garment modification practices. Designed for a 5–6-year-old child ('Dino') who is non-ambulatory, non-verbal, and requires G-tube feeding, and frequent diapering, *RawrWear* addresses challenges not met by mainstream apparel. By transforming second-hand garments into functional adaptive wear, this project also advances circularity and material stewardship.

Connection to the Conference Theme: Science as Collaboration: *RawrWear* exemplifies Science as Collaboration by integrating apparel design, human factors, user-centered research, and caregiver knowledge into a unified design process. Through semi-structured interviews, needs assessment, and prototyping, the project demonstrates how scientific inquiry can work alongside creative garment modification to produce responsive, compassionate adaptive clothing. This interdisciplinary collaboration aligns closely with IFHE's commitment to advancing global well-being through science-driven solutions.

Aesthetic properties and visual impact: *RawrWear* balances joyful, child-centered aesthetics with discrete yet powerful adaptive functions. Din's love of dinosaurs, bright colors, and tactile elements informed a playful visual direction that supports self-expression and identity. Dinosaur appliqués, embroidered details, and spiked hood embellishments create rhythm and emphasis, while a cohesive palette of blues, greens, and oranges preserves unity across the ensemble.

Adaptive features, such as magnets concealed beneath faux buttons, in-seam snap placements, and jacket-access zippers, were integrated into existing seamlines to maintain visual familiarity. Thoughtful application of design principles including balance, contrast, and proportion ensures that *RawrWear* appears age-appropriate and expressive, not medicalized. Visual documentation highlights the integration of function and aesthetics throughout the construction process.

Process, technique, execution, cohesion: Grounded in User-Centered Design (Morris et al., 2017), development began with a caregiver interview identifying five priorities: (1) ease of diapering, (2) head and torso support during dressing, (3) accessible limb entry for limited mobility, (4) long-term seated comfort in a wheelchair, and (5) thermal regulation. These insights guided all adaptations. Second-hand cotton knits and wovens were selected for softness, breathability, and sustainability, aligning with research emphasizing lived-experience collaboration as essential in reducing burden and improving daily quality of life (McBee-Black, 2022). Key modification strategies included: a) Diapering Access: inseam snap tape and a magnetic fly opening to enable diaper changes without undressing; b) Upper Limb Access: magnetic tape replacing shoulder seams and the center-front opening for easier dressing; c) Seated Comfort: removal of back pockets and reduction of pressure points; d) Climate Adaptation: a detachable padded hood for warmth and comfort; and e) Visual & Sensory Engagement: dinosaur-themed patches, embroidery, and puffy-paint details. Initial wear-testing with the designers' child assessed mobility, closure performance, and comfort; future testing with Dino's caregiver will further refine usability and application potential for a larger market.

Design contribution, originality, and innovation: *RawrWear* demonstrates strong cohesion across concept, aesthetics, materials, and technique by centering the lived experiences of the caregiver–child dyad. By merging sustainable garment modification (Eike, 2020), adaptive clothing science, and playful aesthetic direction, *RawrWear* delivers a holistic solution that is functional, expressive, and accessible. This design directly responds to research calls for adaptive clothing solutions that integrate comfort, function, and user participation throughout the development process (Rana et al., 2024) and contributes to design scholarship by presenting a model for low-cost adaptive clothing development using second-hand garments. Additionally, this work validates caregiver collaboration as an essential input to scientific and creative decision-making while expanding circular fashion practices within the adaptive apparel context. Together, these aspects illustrate how interdisciplinary design processes advance equity, creativity, and well-being for medically complex youth. Future research will explore scalable alteration templates, long-term wear testing to analyze user interactions with adaptive features and further refine design solutions.

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