Save the Fabric to Save the Planet: A Mass-Producible Zero-Waste Childrenswear Ensemble

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Contextual review and concept statement

The goal of this design scholarship was to create a mass-producible zero-waste childrenswear garment ensemble. Fabric wasted during traditional garment manufacturing, which averages 15% (Carrico & Kim, 2014; McQuillan & Rissanen, 2011; Townsend & Mills, 2013), causes environmental damage. Zero waste patterns are designed such that the pieces interlock like a puzzle with no gaps between cutting lines (Townsend & Mills, 2013) leaving no unusable fabric pieces as waste (Rissanen & McQuillan, 2016).

A key component of mass-producibility is being able to grade the pattern into the full size range needed. The Carrico Zero Waste Banded Grading (CZWBG) technique (Carrico, 2019) uses inserted fabric strips to grade zero waste patterns into a range of larger sizes. This solution overcomes the obstacle of zero-waste patterns often being created in only one garment size (McKinney, Cho, Zhang, Eike, & Sanders, 2020), allowing zero-waste designs to be integrated into mainstream fashion (Carrico & Kim, 2014). Mass-producible patterns create garments that can be sewn efficiently in a factory. This means that the pieces are cut on grain, seam lines walk, and consistent seam allowances are used. (Joseph-Armstrong, 2010). An analysis of prior CZWBG technique creative scholarship revealed the viability of this method, but also potential issues with mass production, such as an increased number of seams as compared to similar non-CZWBG styles and differences in gathering ratios among sizes (Carrico, et al., 2022).

This scholarship aims to build on previous work while overcoming these issues to move the technique closer to mass-producibility, particularly for the childrenswear market. Childrenswear is an important apparel market with $9.8 billion in annual revenue (O'Connor, 2019). However, application of the CZWBG technique to childrenswear presents unique challenges, as there is proportionally greater length measurement growth between sizes than in women's wear (Joseph-Armstrong 2010), thus childrenswear-specific research is warranted.

Aesthetics

A nature-themed print was selected for the top to align with the ensemble's eco-friendly purpose and a coordinating olive green was selected for the pants. Matching bands were used in the pants due to the large pieces needed to grade the length. However, contrasting bands were selected for the top, for visual emphasis and to coordinate the top with the pants.

Process, technique, and execution

A problem-based design research approach (Bye, 2020) was used to address the research questions by producing two childrenswear ensembles as first samples. Quantitative and qualitative data were collected and analyzed throughout the process. Design research methods

included notes, photography, sketching, and spreadsheets collected in a digital process book (https://youtu.be/i-FD4FD96ls). For maximum application of the results, the author decided to focus on ubiquitous and gender-neutral garment types. A search of "essentials" on major children's retailer's (GAP, Old Navy, Osh Kosh, Children's Place) websites revealed the following styles for both girls and boys: zip up hoodie, quilted jacket, cardigan, windbreaker, puffer, sweater vest, polo shirts, tee shirts, button-down shirts, joggers, and chino pants/shorts. The designer elected to focus on joggers and tee shirts, due to their lower number of pattern pieces that would support manufacturing efficiencies. Next the designer researched extant approaches to zero-waste pants and tops. Each identified approach was evaluated for its ability to create the desired garment silhouette, to be graded with the CZWBG technique, and to be mass produced. Zero waste patterns were drafted using the selected approaches for the smallest size—size 3. Pattern and finished garment measurements were recorded. An Excel spreadsheet was used to calculate the garment dimensions for sizes 3 through 14, referencing a standard measurement chart (Joseph-Armstrong, 2010). Next, the researcher analyzed the patterns to identify where strips could be placed to provide needed growth between the sizes. Simultaneously, a mass-producible sewing order of operations was developed for each garment — with and without strips. Doing these steps in tandem allowed the researcher to develop a grading plan with the least visual interruption and fewest additional sewing steps. Next, strip dimensions needed for each grading location in each size were calculated, including consistent, manufacturing compatible seam allowances. This ensured that all pieces sewn together "walked" (were equal in length). The spreadsheet was also used to check length and circumference dimensions for each size finished garment by adding the relevant strip measurements and subtracting seam allowance. An interlock knit fabric (98% cotton/2% spandex) was selected for the top and a waffle knit fabric (64% polyester/33% rayon/3% spandex) was selected for the pants and top grading strips. Both were selected for their durability, comfort due to their breathability and slight stretch, and washability. For the joggers, 1" elastic was used at the waist and ½" elastic was used at the hem. Prototype garments were sewn in the original zero-waste pattern size (3) and in the second-to largest size (12).

Cohesion

The timeless tee shirt and jogger pants styles and washable, durable fabrics selected are aligned with the sustainability concept of long lifespan garment designs. A long lifespan reduces resource use and keeps garments out of the landfill (Cooper et al., 2013). The selected nature-themed print was also aligned with sustainability. Careful attention to the placement and design of the grading strips ensured that the pieces are cut on grain, seam lines walk, and consistent seam allowances were used for joining garment parts, contributing to the goal of mass-production.

Design Contribution

This scholarship builds on previous work while moving the CZWBG technique closer to mass-producibility for the childrenswear market. This work demonstrates the efficacy of the selected zero-waste patterns to be mass-produced into marketable childrenswear, grading with the

CZWBG technique. This research shows that simple patterns allow grading to be accomplished with only additions at the edge, making them good candidates for the CZWBG technique. By adding grading strips to the garment edge, the pattern pieces for the size 3 tee and jogger were successfully "grown" into a size 12. This is remarkable considering that childrenswear has a 1" circumference grade and a 2 ½" to 3" height grade between sizes. From size 3 to size 12 is a 7 ½" circumference increase (22" to 29 ½") and a 19 ½" height increase (36" to 55 ½"). For the selected patterns, the CZWBG technique increased the sewing steps for the top from 5 to 8 (60% increase) and for the pant from 13 to 20 (54% increase), as opposed to a 91% increase in prior childrenswear CZWBG work (McKinney, 2022). The selected zero-waste tee and pant patterns are aligned with currently popular childrenswear styles. These patterns and grading technique could be adopted by childrenswear retailers in place of existing methods for producing similar garments, reducing fabric waste and the related environmental damage. The selection of "essential" gender-neutral styles means that the impact could be broad-reaching both in terms of number of garments sold and number of seasons sold through changes in fabric. Future zero-waste scholars could use the developed design process to create manufacturable zero-waste garments for other categories.

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