



WAFFLE FABRIC DESIGN WITH DIFFERENT WEAVE CONSTRUCTIONS

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ABSTRACT: *This study presents a design collection that reinterprets the traditional waffle weave texture, offering both a visual and tactile narrative. The raised structures on the fabric's surface form a silent language—conveying sensations of relaxation, refreshment, and memory through texture rather than words. In this approach, texture becomes not merely a structural element, but a communicative stance and an intentional design choice. The surface is crafted for those who express through touch rather than speech—leaving a lasting impression on everyone who interacts with it.*

Within this conceptual framework, seven original waffle weave patterns were developed. The technical settings and constructions for each pattern were defined, and samples were produced using both dobby and jacquard weaving machines. For the warp and ground yarns, Ne 20/2 ring combed cotton was used; Ne 10/1 open-end cotton yarns were employed for the weft. The woven fabrics were then transformed into finished bathrobe products, enabling the designs to be experienced functionally as well as aesthetically.

The different waffle weave patterns yielded fabrics with varied visual and tactile properties. These designs were comparatively evaluated, particularly in relation to moisture absorption, humidity response, and overall fabric behavior—factors that are crucial in bathrobe textiles.

Keywords: *Woven design, waffle weave, terry fabric, bathrobe, textile design.*

VAFLASTI DIZAJN TKANINE SA RAZLIČITIM KONSTRUKCIJAMA TKANJA

APSTRAKT: *Ova studija predstavlja dizajnersku kolekciju koja reinterpretira tradicionalnu teksturu vafle tkanja, nudeći i vizuelnu i taktičnu naraciju. Istaknute strukture na površini tkanine formiraju tih jezik – prenoseći osećaje opuštanja, osveženja i sećanja kroz teksturu, a ne rečima. U ovom pristupu, tekstura postaje ne samo strukturni element,*



već komunikativni stav i namerni dizajnerski izbor. Površina je izrađena za one koji se izražavaju dodirrom, a ne govorom – ostavljajući trajan utisak na svakoga ko sa njom interaguje.

U okviru ovog konceptualnog okvira, razvijeno je sedam originalnih uzoraka vafl tkanja. Definisane su tehničke postavke i konstrukcije za svaki uzorak, a uzorci su proizvedeni korišćenjem mašina za tkanje dobi i žakard mašina. Za osnovu i donju pređu korišćen je prstenasto češljani pamuk Ne 20/2; za potku su korišćene pamučne pređe otvorenih krajeva Ne 10/1. Tkanje tkanine su zatim transformisane u gotove proizvode za kupaće ogrtače, omogućavajući da se dizajni dožive i funkcionalno i estetski.

Različiti uzorci vafl tkanja dali su tkanine sa različitim vizuelnim i taktilnim svojstvima. Ovi dizajni su uporedno procenjeni, posebno u odnosu na apsorpciju vlage, reakciju na vlagu i ukupno ponašanje tkanine – faktore koji su ključni kod tekstila za ogrtače.

Ključne reči: Tkanje dizajn, vaflasto tkanje, frotir, ogrtač, dizajn tekstila.

1. INTRODUCTION

Woven fabrics are among the most widely used textile structures, offering versatility in texture, durability, and design [1]. As the interplay of yarn type, weave pattern, and finishing techniques determines both functional and aesthetic properties, the field of textile design continues to evolve through experimental and sensory-focused approaches. In particular, terry and waffle weaves hold significant importance in personal care textiles due to their tactile richness and moisture absorption capacity.

Terry fabrics are characterized by their looped pile, which enhances water absorbency and softness—making them ideal for towels and bathrobes [2]. Meanwhile, waffle weaves, also referred to as honeycomb or cellular structures, are distinguished by their three-dimensional grid-like texture, providing a unique combination of absorbency, breathability, and lightweight feel [3]. This structure not only enhances functionality but also offers a distinct visual and tactile identity, often sought after in luxury bath textiles.

Bathrobes, as end-use products, integrate comfort, functionality, and emotional appeal, and are often associated with relaxation and daily rituals of self-care. The tactile features of bathrobe fabrics contribute not only to physical comfort but also to sensory experience, a concept increasingly emphasized in contemporary textile design [4]. The evolution of textile design has moved beyond functionality, incorporating emotional and psychological dimensions, where texture becomes a language in itself [5].

In recent years, textile designers have explored waffle weaves not just for their absorbency, but also as a medium for expressive surface design. The structural variability in waffle weave construction allows for the creation of visually and texturally diverse surfaces, suitable for creative reinterpretation [6]. Within this context, the present study aims to reimagine traditional waffle fabric design by developing new weave patterns intended for bathrobe production. Through the integration of design thinking, weaving technology, and material experimentation, this research proposes a tactile design language that extends beyond conventional textile functionality.



2. MATERIALS AND METHODS

In this study, seven distinct waffle weave structures were designed with the aim of exploring new tactile and visual qualities in bathrobe textiles. The design process began with the development of unique weave patterns using textile CAD software. Each design was conceptualized to produce a different three-dimensional surface expression while preserving the absorbency and functionality characteristic of waffle fabrics.

For the production of samples, two different weaving technologies were employed: dobby and jacquard weaving machines. Dobby fabrics were woven on a Staubli-brand dobby loom, and jacquard fabrics were woven using a Staubli-brand electronic jacquard loom. These platforms were selected to accommodate both simple and complex weave patterns. The following materials were used in the production process:

- Ground warp yarns: Ne 20/2 100% cotton ring combed yarns
- Ground weft yarns: Ne 10/1 100% cotton open-end yarns
- Pile yarns Ne 20/2 100% cotton ring combed yarns

The yarns were selected for their softness, moisture absorption capacity, and compatibility with terry and waffle weave structures. The ground and binding yarns for all patterns consisted of Ne 20/2 combed cotton, ensuring uniformity and structural integrity across different samples. The weft yarn, Ne 10/1 open-end cotton, contributed to the bulky texture and enhanced tactile performance of the fabric.

The weaving parameters were as follows:

- Warp density: 25 ends/cm
- Weft density: 26 picks/cm
- Weightiness: 1st Design-430 g/m²; 2nd Design 425 g/m²; 3rd Design 380 g/m²; 4th Design 395 g/m²; 5th Design 405 g/m²; 6th Design 425 g/m²; 7th Design 415 g/m²

Each weave structure was woven under controlled settings to ensure consistency in tension, density, and weave fidelity. After weaving, the fabrics were subjected to standard wet finishing processes, including washing and drying, to simulate real-life use and to stabilize the fabric geometry.

Subsequently, the woven fabrics were cut and sewn into bathrobe prototypes. This allowed the evaluation of design performance not only on flat fabric samples but also in finished product form, emphasizing the transformation of woven design into functional and emotional user experiences.

The produced fabrics were evaluated comparatively based on their visual aesthetics, surface texture, and potential tactile appeal. Although quantitative testing (e.g., absorption rate or air permeability) was not the focus of this phase, qualitative observation and user interaction feedback guided the analysis of design effectiveness.

3. RESULTS AND DISCUSSION

This study resulted in the development of seven original waffle weave designs, each created with the intention of offering distinct tactile and visual experiences within the context of bathrobe textiles. The constructional details, woven fabric appearances, and final bathrobe

forms of each design are presented in the figures below [Figures 1–7]. These visuals illustrate the transformation of design concepts from theoretical weave structures into functional textile products.

Each weave pattern was carefully developed to alter the depth, repetition, and geometric flow of the waffle texture. While maintaining the fundamental three-dimensional grid structure characteristic of waffle weaves, variations were introduced through different interlacing sequences and binding points. These differences are clearly visible in the weave construction diagrams, where systematic changes in yarn path and float length contribute to the distinct surface characteristics of each design.

The woven fabric samples exhibited a wide range of surface behaviors, from subtle, shallow reliefs to deep, cellular textures. These structural nuances not only influenced the fabric's aesthetic appeal but also its tactile response. For example, designs with larger waffle cells and longer floats resulted in softer and more cushion-like surfaces, while tighter and more compact patterns offered a firmer and more resilient hand feel.



Figure 1: 1st waffle design



Figure 2: 2nd waffle design



Figure 3: 3rd waffle design



Figure 4: 4th waffle design



Figure 5: 5th waffle design



Figure 6: 6th waffle design



Figure 7: 7th waffle design



When transformed into bathrobe prototypes, the impact of each design became even more pronounced. The final product views highlight how structural design decisions affect the drape, volume, and perceived comfort of the garments. Some designs contributed to a more luxurious and enveloping silhouette, while others supported a lightweight and breathable user experience—an increasingly important factor in modern loungewear preferences.

The variety of structures offered by the seven weave patterns demonstrates the creative and functional potential of waffle weaves beyond their traditional use. In recent years, consumer interest in waffle-textured fabrics has grown due to their moisture management, thermal comfort, and minimalistic aesthetic. This research contributes to that trend by proposing innovative surface designs that can cater to both performance expectations and sensory engagement.

In addition, the study reinforces the idea that textile design is not merely a technical process, but also an emotional and experiential one. The possibility to communicate comfort, softness, and personal ritual through texture aligns with contemporary approaches in sensorial and user-centered design. Thus, the newly developed patterns are not only structurally distinct but also emotionally resonant for users seeking tactile connection in everyday garments.

4. CONCLUSION

This study explored the expressive and functional potential of waffle weave structures in the context of bathrobe design, resulting in the development of seven original woven patterns. By reinterpreting the conventional waffle texture through creative design and thoughtful construction, the research demonstrated how surface structure can serve not only as a functional textile feature but also as a medium of tactile and emotional communication. Each pattern introduced a unique interaction between visual geometry and fabric behavior, contributing to a broader spectrum of user experiences—from comfort and absorbency to softness and aesthetic appeal. The transformation of these fabrics into finished bathrobes further illustrated the real-world application and impact of surface-level design decisions on garment performance and user satisfaction.

As waffle fabrics continue to gain popularity in modern textile markets due to their minimal design language, breathability, and sensory qualities, this study contributes valuable design alternatives that respond to evolving user preferences. By integrating weaving technology with user-centered design thinking, the developed patterns offer both innovative aesthetics and enhanced functional performance.

In conclusion, this research affirms the role of textile designers not only as technical problem-solvers but also as creators of meaningful, multisensory experiences. The outcomes of this study provide a foundation for further explorations into sensorial textile design, and open new directions for design-driven innovations in the field of personal comfort textiles.



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