3D ZERO WASTE: NISHIJIN weaving meets HAORI

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Abstract: With this project, we have been investigating material technologies and pattern creation. Investigating traditional kimono fabric creation and new materials such as high-twist silk yarn with contemporary techniques, such as Processing and Clo3D, enabled us to use future facing production methods and exploring how digital and physical material making processes can feed into the design process to create body-fit materials and patterns. This project explores the body in the digital age developing new patterns, textiles and garments using digital and bespoke material manufacturing. This research stretches the boundaries of smart textiles and deploys the state-of-the-art technologies and processes we would like to share. To explore this further in the workshop, our focus is on transformation and material supporting the design process for the re-creation of the existing and the yet-to-exist. We aim to bring the digital and physical (re)creation of the developed sensory materials which have been enhanced through the application of technology to investigate further experiential effects of materials. difficulties in designing materiality for a 3D environment. The digital developed material suppors the design process for the re-creation of the existing and the yet-to-exist woven structures.

CCS CONCEPTS • Human-centered computing à Interaction design; • Human-centered computing à Human computer interaction (HCI); Interaction techniques; Interaction paradigms

Additional Keywords and Phrases: Materiality, Multisensory interaction, Embodied interaction, Embodied experience, Body perception

ACM Reference Format:
Bine Roth, Kaori Ueda, 2023, 3D ZERO WASTE NISHIJIN weaving meets HAORI, For CHI 2023 Workshop: Call for Participation for Body x Materials: A workshop exploring the role of material-enabled body-based multisensory experiences 2023, In CHI '23: ACM Symposium on Neural Gaze Detection, June 03–05, 2018, Woodstock, NY. ACM, New York, NY, USA, 10 pages.

1 CONCEPT

We have studied in our work the interaction with materials and the body in a physical and digital context, developing garments that transform our relationships to woven structures. The woven structures created are inspired by digitally coded materials and define the woven process on the jacquard loom. The idea in future would be to develop patterns using digital programmes such as Processing and Grasshopper to define woven jacquard structures, feeding directly from a digital programme into the loom programme to develop 3D woven structure.

2 DESIGN PROCESS

One can approach the design process from different directions, either with an idea already in mind or by been given the resources of material and structure. There are various possibilities and effects created and the choice will impact not only visually but also conceptually. For this concept we have decided to explore and combine two directions:

1.) Designing for material qualities – based on material experiments and observational studies determining the weave structure and output to determine fabric and pattern construction
2.) Computing materials for digital design process: Using digital programmes (Processing, Rhino, Illustrator & Clo3D) to visualise and demonstrate the influence on textile and garment pattern making

This paper focusses on two possible starting points for design, firstly the resources of material and weave structure and secondly, the desired fabric qualities to dress a body based on the practical requirements of the garment pattern using digital programmes.

These two approaches work hand in hand. Material and weave structures suggest certain ways however, digital programmes might interpret materials and structures differently. Whichever process is the starting point, the process required us to be reflective and willing to move back and forth between ideas and resources and not to rely on one or the other completely as the design evolves.

Materials hold a special position in the design process. Being at the heart of every output, materials are the core of storytelling and finally connecting people with the design. For this proposal digital and physical created materials are the formal element to this work and give meaning to the experience. The designing and sharing process as we are situated in different countries happened via Miro. We have developed four strands to allow for the material development to define the final design. Please note this is still work in progress.

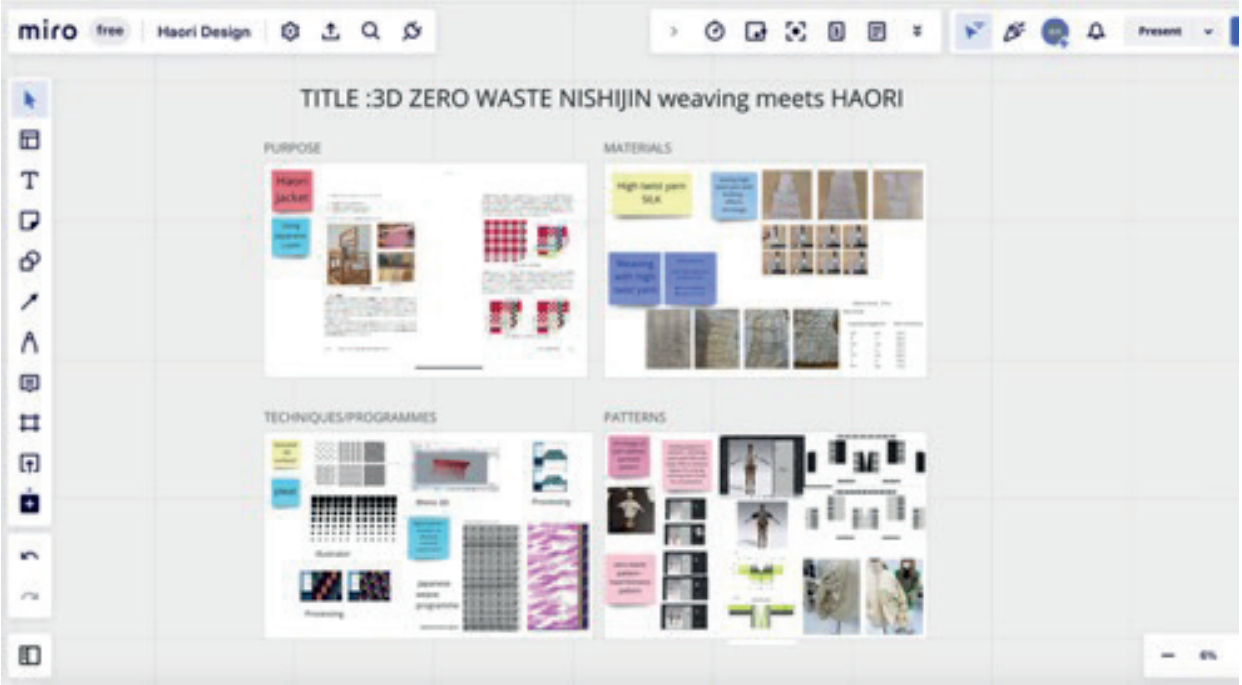


Figura 1: Digital collaboration process, documenting material development and sharing ideas – defining areas of research into purpose/material/pattern/techniques, screenshot taken by Bine Roth,[https://miro.com/app/board/uXjVP1dLnYc=/], via Miro website

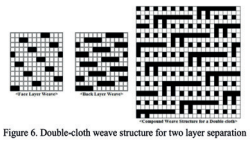
3 MATERIAL EXPERIMENTATION AND DEVELOPMENT

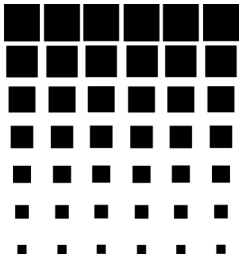
This part deals with the process of embedding technology into the practical process of designing. In this process we stayed open minded and flexible to respond to unplanned results that arise from the digital interplay of pattern and assigned materials. Some qualities of the fabric only became obvious once a physical piece has been produced. Developing the purpose of the sample to fit a body, experience the properties of the material and respond to them accordingly.

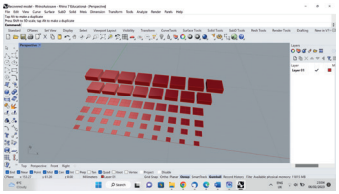
3.1 Digital material development

The practicalities of designing through making gives the designer the possibility to react to the behaviour of the materials and structures and make adjustments, accordingly, allowing the design to evolve gradually. Responding to the digital prototype feedback can be in contrast to the idea formed physically – responsive approach to design is needed.

The ease of computer drafting has encouraged us to become absorbed in more complex manipulations of structure, using programmes such as Clo3D, Processing and Rhino to generate patterns. The images demonstrate the development of the designs from 2D-3D. The question whether these programmes can be interlaced within the making process arose and if these can be tested as success even if not real textiles. Seeing designs on paper or on screen can be inherently successful but ultimate success or failure can be rated when seen when created and seeing the interplay with the material. The quality varies with the texture and stiffness of the fibre, the character of the yarn and the pattern.







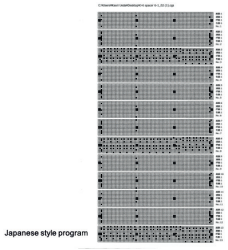
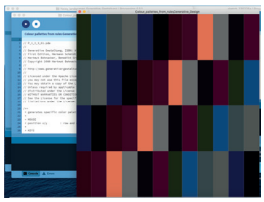
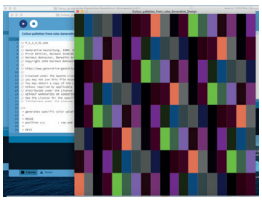


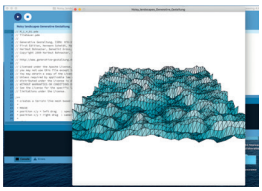
Figura 2 [1] Figura 3 Figura 4 Figura 5

Figura 2: Kim, Ken Ri (2018): Weave structure and image pattern exploration for modern double-cloth design development by deploying digital technology. Loughborough University. Journal contribution. https://hdl.handle.net/2134/35217. Retrieved February 23, 2023 from https://repository.lboro.ac.uk/articles/journal_contribution/Weave_structure_and_image_pattern_exploration_for_modern_double-cloth_design_development_by_deploying_digital_technology/9335882
Traditional woven structure and pattern creation
Figura 3: Pattern creation by Kaori Ueda, Illustrator file created January 2023
Figura 4: Digital design development by Bine Roth, Using Rhino to develop 3D patterns for jacquard loom, Screenshot taken by Bine Roth January 2023

Figura 5: Digital design development by Kaori Ueda, Japanese Jacquard programme, Screenshot taken by Kaori Ueda Februarym2023







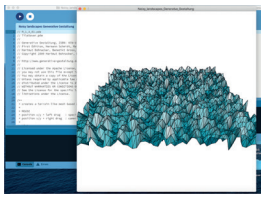


Figura 6 Figura 7 Figura 8 Figura 9

Figura 6 - 9: Using coding (Processing) to explore material developments and mechanisms for woven structures, screenshots taken by Bine Roth via personal computer [3]

3.2 Interplay of material and structure

The interplay with digital programmes with the weave structure is complex and provided a useful starting point for the designs. An awareness of the characteristics of various materials and structures and how they interplay gave us a sense of their potential for the patterns The images show a selection of weaves and show how they change shape depending on material, scale, and pattern.

The fibres have an impact on the final properties of the yarn, as well as their spinning – their thickness and the amount and direction of twist applied to them. For this project, we have been using high-twist yarn. The stress imposed on the yarn by twisting makes it unbalanced – it has surplus energy that can be released through dipping it in hot water [4]. This extreme instability in the yarn can be put to good use in creating textured effects and forming around the body. Silk is the main fibre which swells and increases the stress on the yarn, so triggering the creping reaction. Through this method contrasts of texture and fit are possible if high-twist wefts are used, since only openly set areas will allow enough space for such yarns to create the crepe effect, shrinkage around the body.

We have created squares – floats on the fabric to create a more textured fabric. The threads in between the floats are crammed areas which may tend to not shrink or fall into the spaces. The density of the weave allows the yarn to stay in place. The shrinking effect allows for a garment pattern fitting a body shape.

The results are not completely predictable simply from the known characteristics and measurements, which is why sampling has been very important. The measurements gave us a suggestion on roughly what to expect for the final outcome. Designing for a double cloth, the fabric itself became quite firm and therefore the calculation of shrinkage was more predictable for the garment pattern.

3.4 Table 1: Shrinkage of yarn and evaluation

Table 1: Shrinkage of yarn

square(cm)		gap(cm)	After wet treatment (cm) Definition
3.5	0.5	27.0	Big squares allow for less shrinkage
3	1	25.0	
2.5	1.5	23.5	Gradually shrinking
2	2	21.5	
1.5	2.5	20.0	
1	3	18.5	
0.5	3.5	17.5	Small squares should be places around waste for body fit pattern

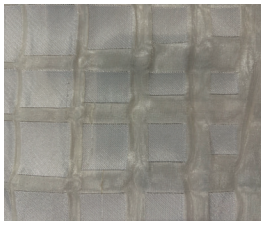


Figura 10

Figura 11

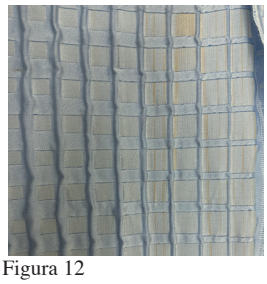


Figura 12

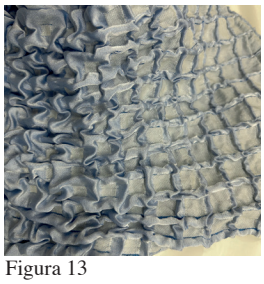


Figura 13

Figura 10 - 13: Using evaluation of digital material developments to create 3D woven structures, designs made by Kaori Ueda & Bine Roth, woven structures created by Morisan, Images taken by Kaori Ueda February 2023

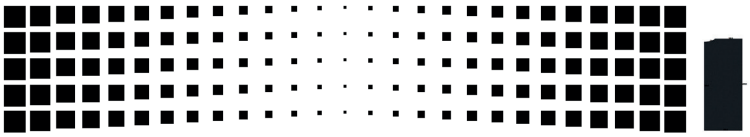


Figura 14

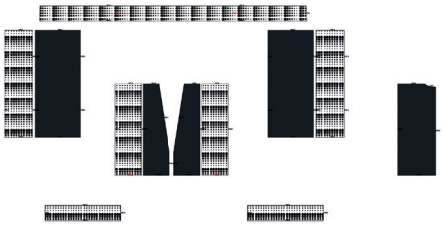


Figura 15

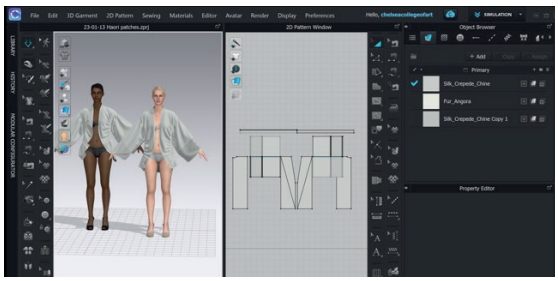


Figura 16

Figura 17

Figura 14: Using evaluation of digital material developments to create 3D woven structures that shrinks to fit the body shape, Illustrator file made by Kaori Ueda, Screenshot taken by Kaori Ueda February 2023

Figura 15 - 17: Using Clo3D to develop zero-waste pattern and evaluating stretch and shrinkage through fabric simulation, Clo3D file made by Bine Roth, Screenshot taken by Bine Roth January 2023

4 GARMENT PATTERN DEVELOPMENT: LOOM-TO-BODY PATTERN

The kimono and haori jacket patterns are ‘loom-to-body’ clothing which rely simply on the draping of rectangular pieces of cloth. This is an experiment in shaping woven clothing on the loom by using high-twist yarn and the calculation of shrinkage. Using the yarn structure to shape the fabric is essentially applying the pattern on the loom rather than cutting. This is to pursue the idea of loom-to-body garments, to concentrate on the techniques to shape the garment. Woven rectangles shape shift through the interplay of yarns and weave structure.

The idea behind this is to manipulate the coordinates using tools like Clo3D, Processing and Grasshopper to visualise the possible ways of shaping from woven rectangles through contrasts of materials, yarn twist in combination with the weave structure. Due to the stress created on the yarn during wet finishing the properties of the yarn causes the rectangular pieces of cloth to change shape. Usually, these structures can be more easily achieved in a knitted process were increasing and decreasing stitches cause different characteristics. These can be highly effective methods to create 3D-shape and allow another interaction between material and structure.

Figura 18

Figura 18- 21: Pattern development: Using evaluation of digital material developments to create 3D woven structures that shrink to fit the body shape and create 3D woven structures, through wet finishing and dyeing the yarn shrinks and develops 3D structures, Images taken by Kaori Ueda February 2023

5 DISCUSSION POINTS

How can digital material making processes enhance the physical design process?

Can generated 3D patterns directly feed into the textile manufacturing process such as Jacquard looms?

ACKNOWLEDGMENTS

We acknowledge the support of Morisan: Hideaki Mori and Yoshi Yamada (https://www.mori-san.com/) for weaving support of patterns and Textile Summer School 2022, Kyoto Saga University, (https://fabcafe.com/events/kyoto/tss2022_lecture/)

REFERENCES

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A.1 IMAGES REFERENCES

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25th February 2023

To whom this may concern,

My apologies for handing in the project a second time. However, the format in word did not allow me to insert the images in the right order.
Attached the file with the exact same data but images are in the right place. Hope this does not disqualify our project.

Thanks for your understanding.

Sincerely ,

Bine Roth