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Tie Your Shoes: A Process-Based Approach
to Sustainable Footwear Design

Textile Materials Technology Capstone

PROBLEM

Footwear is a global **need** for all humans. However, modern ways of producing athletic and lifestyle **footwear** are inherently **unsustainable**.

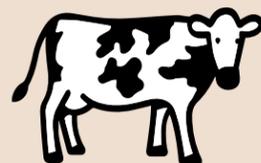
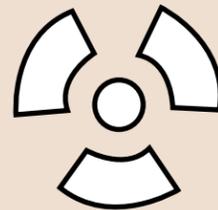
CONCERNS

The impact of athletic shoe production is largely due to end of life processes and materials used to make the shoe.



25 billion pairs of shoes are made each year, of which 8-10 billion pairs reach their end of life annually. *

Once in a landfill, **glues**, leather tanning chemicals, finishes, and **dyes** leach **toxic** and potentially **carcinogenic chemicals** into local waterways and soil.



These processes require animals to be **slaughtered**, waterways to be **polluted**, and often use materials that **cannot be separated** for later recycling.

* "Can Footwear Ever Give Waste the Boot?" Sourcing Journal Online, 13 Mar. 2018, pp. 1-5. Sourcing Journal Online.

INDUSTRY APPROACH



Adidas:

Partnered with Parley for the Oceans to produce a shoe made from plastic recovered from the oceans. Also produces a shoe made out of AMSilk Biosteel, a biodegradable, synthetic spider silk.



Nike Grind:

Take-back program where Nike shoes are ground up and used as paving material for athletic courts.

Although these developments are crucial to enhancing the sustainability of the industry, they are not holistic approaches because they do not challenge the conventional system of footwear production.

PROJECT BRIEF

Design a process-based approach to sustainable footwear by investigating alternative methods of material sourcing, designing and manufacturing.

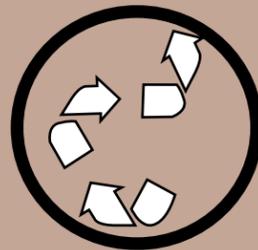
OUR APPROACH



WASTE REDUCTION

Waste is used as the material

- Actively prevents usable materials from ending up in landfills
- No pollution was associated with the creation of the new product
- Will always be a reliable input source



MATERIAL UPCYCLING

Dye sublimation and material composite processes

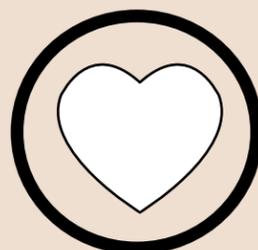
- Gives a product new life while reducing dependence on natural resources, energy, and material inputs
- Materials become structural and aesthetically functional enough for their end uses



LOCALIZED PRODUCTION

"Hyper - local"

- Smaller distances between plants and demand markets lessens carbon emissions
- Creates a sense of community and encourages sustainable development in the long run



PRODUCT LONGEVITY

Connection to consumer through customization

- Motivates consumers to prolong the product lifespan
- Lessens the amount of material waste in the landfill

PROJECT TIMELINE

JANUARY



- Research sustainability issues within the textile industry
- Present research topics to faculty and finalize our research topic of interest

FEBRUARY



- Gain design inspiration
- Experiment with various colors and prints that relate to the inspiration images
- Collect waste fabrics from facilities in the Philadelphia area

MARCH



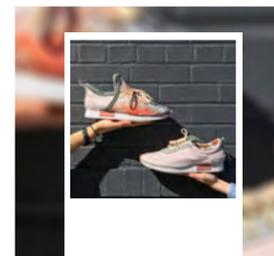
- Test print colors and prints onto fabrics using sublimation printing process
- Experiment with warp knit composites
- Partner with Community

APRIL



- Finalize material and color combinations
- Make shoes at Brooklyn Shoe Space

MAY



- Create booklet, presentation, poster and paper that reflects our process
- Install presentation at Jefferson Senior Design Expo



COMUNITY is a catalyst for change; inspiring action, participation, and empowerment in the community. They handcraft premium shoes in L.A. that give back locally to fuel their mission.

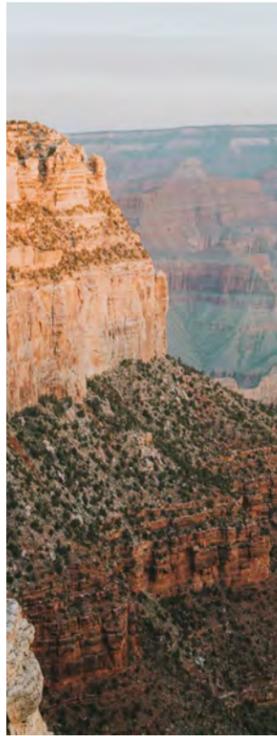
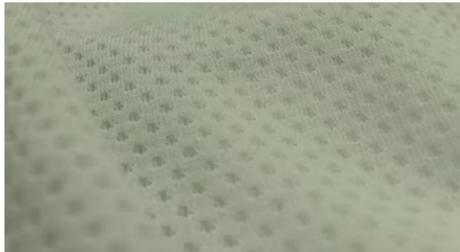
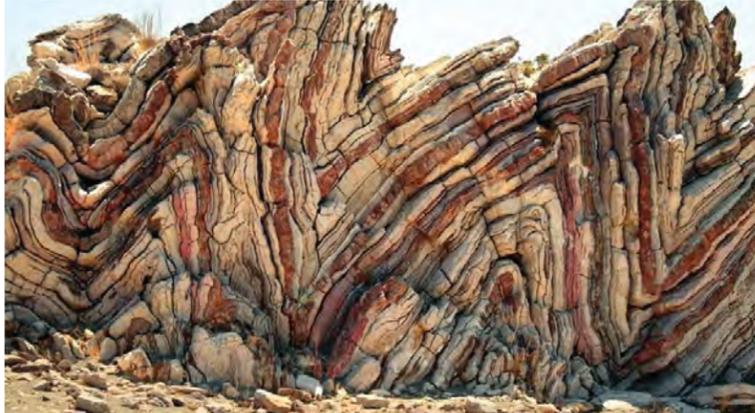


community

We were originally drawn to Comunity due to their business model. When a purchase is made, Comunity donates \$10 per pair to fund meaningful projects such as education, ending homelessness, and the arts in the Los Angeles area.

We reached out to Comunity to get their permission to customize their "Traction" and "Your Turn" shoe styles using our own materials and prints.

Comunity offered to provide us with patterns, soles and lasts for both styles, allowing us more time to focus on color and material development.



INSPIRATION

Rock stratification occurs over time as various types of rock melt and mix together to form eclectic layers. Forming holistic sustainable solutions requires creating in a similar way: by taking disparate elements and ideas and melding them into a cohesive solution. Our color story borrows colors from the type of earthy rock formations that coincide with our approach to sustainability.



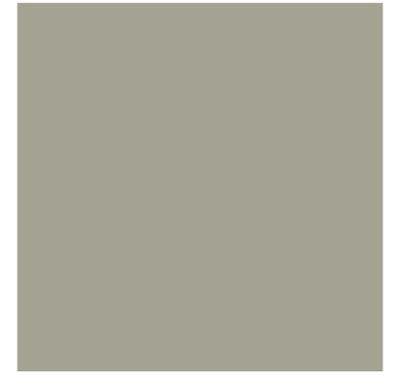
COLOR PALETTE



Deep Sea
Pantone P 179 -15 C



Lagoon
Pantone 176-7 C



Mist
Pantone 179-14 C



Clay
Pantone P 36-7 C



Canyon
Pantone 42-4 C



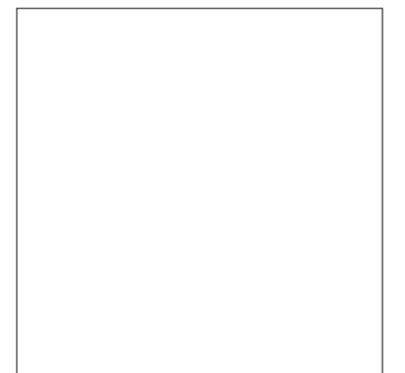
Sand
Pantone P 19-9 C



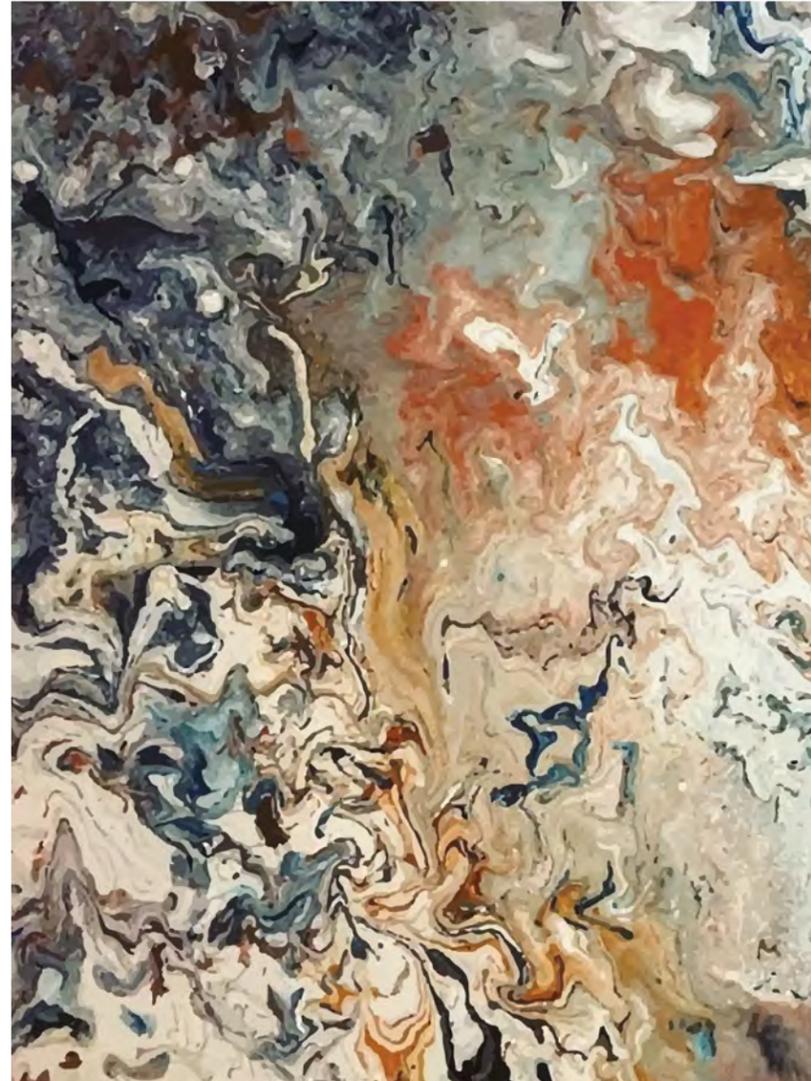
Strata
Original Print



Goldenrod
Pantone P 16-5 C



Limestone
Pantone P 1-1 C



Original print created by Erin Cartwright.

This print was created by applying multiple layers of mixed paint to an 5'x 4' substrate. The substrate was then tilted to create a marbled effect.



COLOR PROCESS

Color has been applied through the process of dye sublimation printing. The block of color and printed image were initially printed on coated heat-resistant transfer paper as a reverse image of the final design. The ink from the paper transfers onto polyester or nylon fabric using a heat press.

The images of our experimentation process are shown above. This process is important because there may be a variation in color quality when printing on a wide range of substrates.

MATERIAL SELECTION COMPOSITES



COMPOSITE PROCESS

Composites were created using a Stahls Hotronix heat press. The layers of each composite have been sandwiched with a nonwoven adhesive in between each layer. The temperature of the heat press melts the nonwoven due to its low melting temperature. This allows the layers of different materials to bond together to create a composite.



2 layers
Nylon weft knit
Polyester suede backing



2 layers
Polyester weft knit
Polyester suede backing



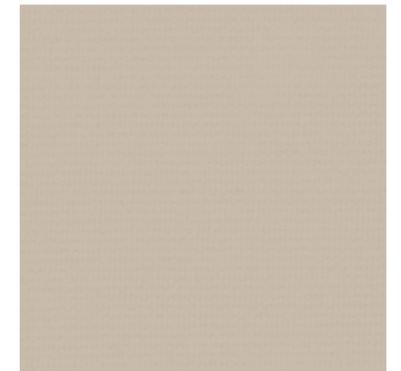
2 layers
Polyester weft knit
Polyester suede backing



1 layer
Polyester warp knit



2 layers
Polyester warp knit
Polyester warp knit



1 layer
Nylon weft knit



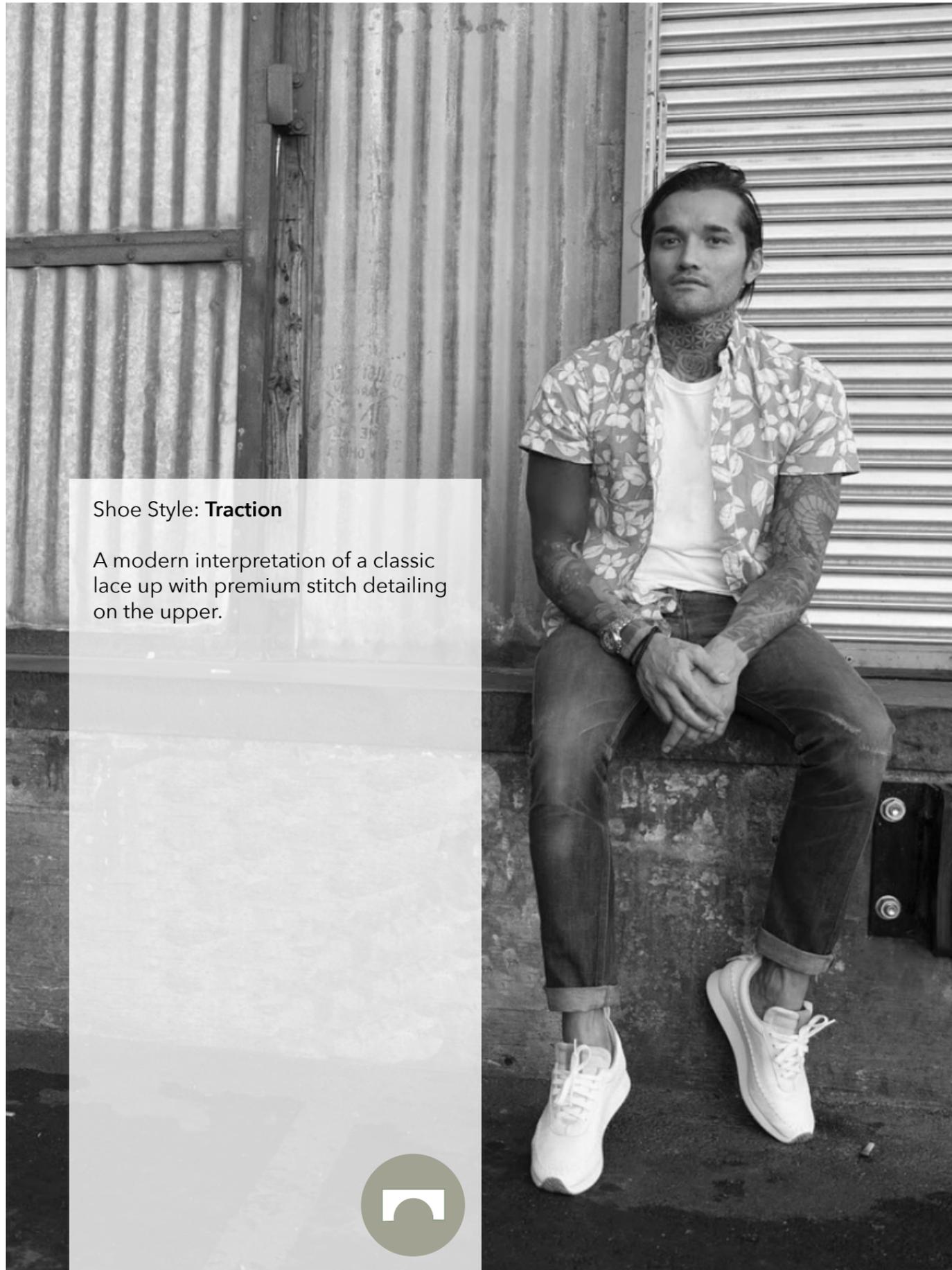
2 layers
Polyester weft knit
Polyester suede backing



1 layer
Nylon warp knit



1 layer
Nylon warp knit



Shoe Style: **Traction**

A modern interpretation of a classic lace up with premium stitch detailing on the upper.



STYLE 1
TRACTION



MATERIAL CALLOUTS

TRACTION



Lateral

- 1 Pull Tab: **Leather**
- 2 Lining: 2 layer composite
Polyester weft knit, Polyester suede
- 3 Tack Stitch: **Waxed Cording**
- 4 Midsole Detail: 2 layer composite
Nylon weft knit, Polyester suede backing
- 5 Outsole: **Rubber**
- 6 Tongue Tab: **Leather**
- 7 Tongue: 2 layer composite
Polyester warp knit, Polyester warp knit, foam
- 8 Laces: **Polyester woven**
- 9 Lace Stay: 1 layer
Nylon warp knit
- 10 Upper: 1 layer
Nylon weft knit, foam
- 11 Midsole: **EVA**
- 12 Merrow Blanket Stitch: **Waxed Cording**
- 13 Insole: **OrthoLite**

COLORWAY EXPLORATION

TRACTION



FINAL COLORWAY CALLOUTS
TRACTION



Lateral



- 1 **Lagoon**
Pantone 176-7 C
- 2 **Strata**
Original Print
- 3 **Mist**
Pantone 179-14 C
- 4 **Canyon**
Pantone 42-4 C
- 5 **Goldenrod**
Pantone P 16-5 C
- 6 **Lagoon**
Pantone 176-7 C
- 7 **Lagoon**
Pantone 176-7 C
- 8 **Sand**
Pantone P 19-9 C
- 9 **Mist**
Pantone 179-14 C
- 10 **Sand**
Pantone P 19-9 C
- 11 **Limestone**
Pantone P 1-1 C
- 12 **Sand**
Pantone P 19-9 C



Shoe Style: **Your Turn**

A clean, simple, and modern upper with premium stitch detailing.



STYLE 2
YOUR TURN



MATERIAL CALLOUTS

YOUR TURN

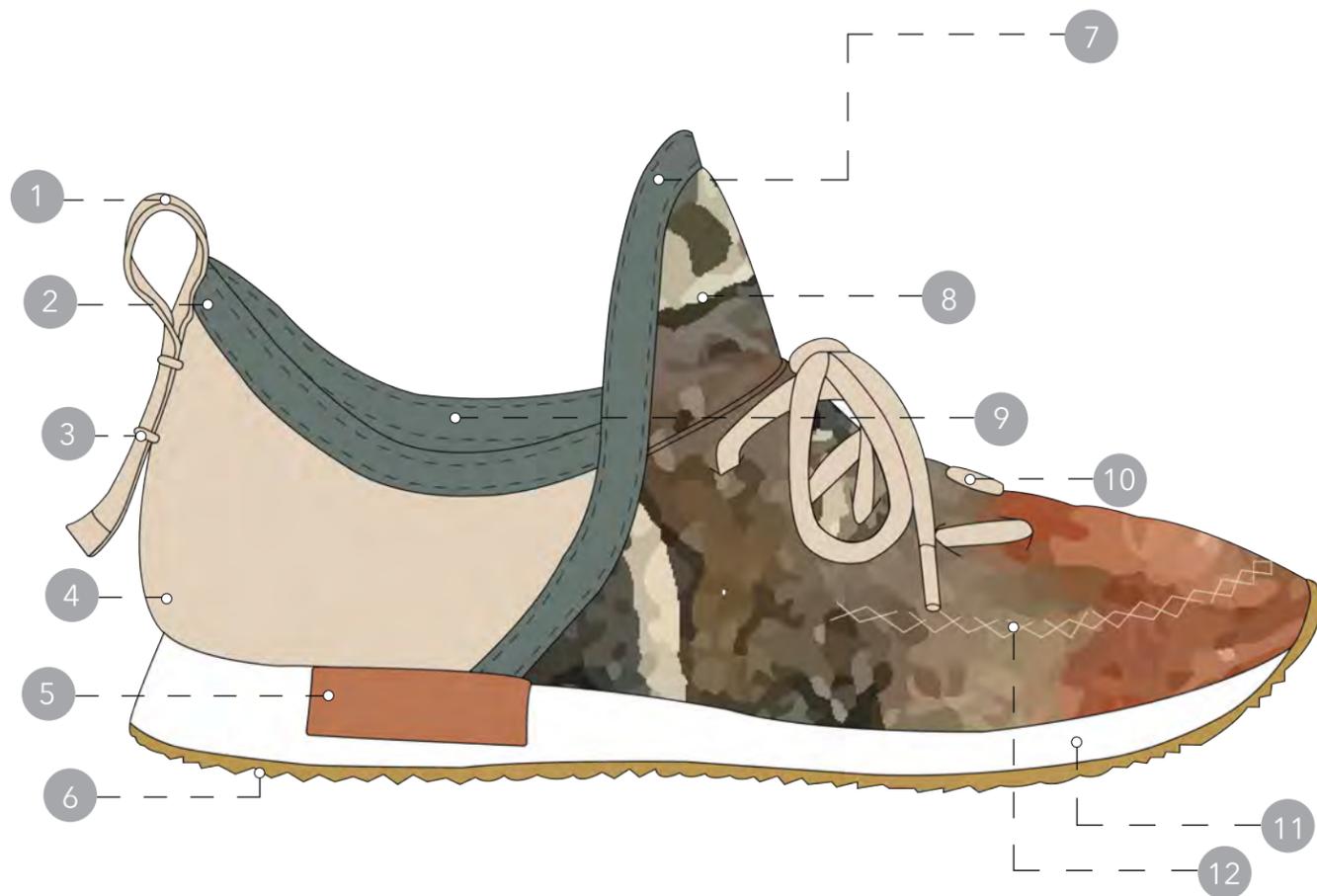


- 1 Pull Tab: 1 layer
Nylon weft knit
- 2 Side Collar: **Leather**
- 3 Tack Stitch: **Waxed cording**
- 4 Quarter: 1 layer
Polyester warp knit
- 5 Midsole Detail: 2 layer composite
Nylon weft knit, Polyester suede backing
- 6 Outsole: **Rubber**
- 7 Upper Collar: **Leather**
- 8 Upper: 1 layer
Nylon warp knit
- 9 Lining: 2 layer composite
Polyester weft knit, Polyester suede backing
- 10 Laces: **Polyester Woven**
- 11 Midsole: **EVA**
- 12 Cross Stitch: **Waxed Cording**
- 13 Insole: **OrthoLite**

COLORWAY EXPLORATION
YOUR TURN



FINAL COLORWAY CALLOUTS
YOUR TURN



Lateral



- 1 **Sand**
Pantone P 19-9 C
- 2 **Lagoon**
Pantone 176-7 C
- 3 **Sand**
Pantone P 19-9 C
- 4 **Sand**
Pantone P 19-9 C
- 5 **Canyon**
Pantone 42-4 C
- 6 **Goldenrod**
Pantone P 16-5 C
- 7 **Lagoon**
Pantone 176-7 C
- 8 **Strata**
Original Print
- 9 **Lagoon**
Pantone 176-7 C
- 10 **Sand**
Pantone P 19-9 C
- 11 **Limestone**
Pantone P 1-1 C
- 12 **Sand**
Pantone P 19-9 C



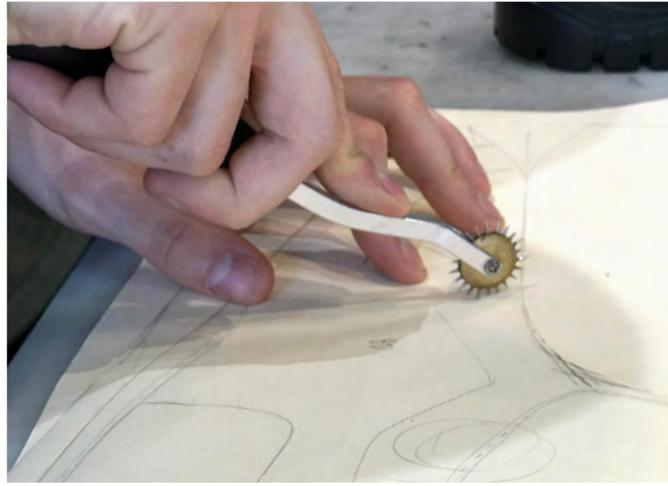
BROOKLYN SHOE SPACE is a fully equipped co-working studio space for shoemakers and leather workers. They strive to be a reliable resource for shoe designers, to encourage creativity in their community through fun, educational programming, and to make shoe making accessible to a wider audience.



BROOKLYN SHOE SPACE

We participated in an intensive three-day sneaker making course with the BKSS team in order to learn the proper construction methods for both the Traction and Your Turn shoe styles we received from Community.

The BKSS team was able to provide us with guidance and advice so that we could craft the sneakers on our own within the time frame allotted.



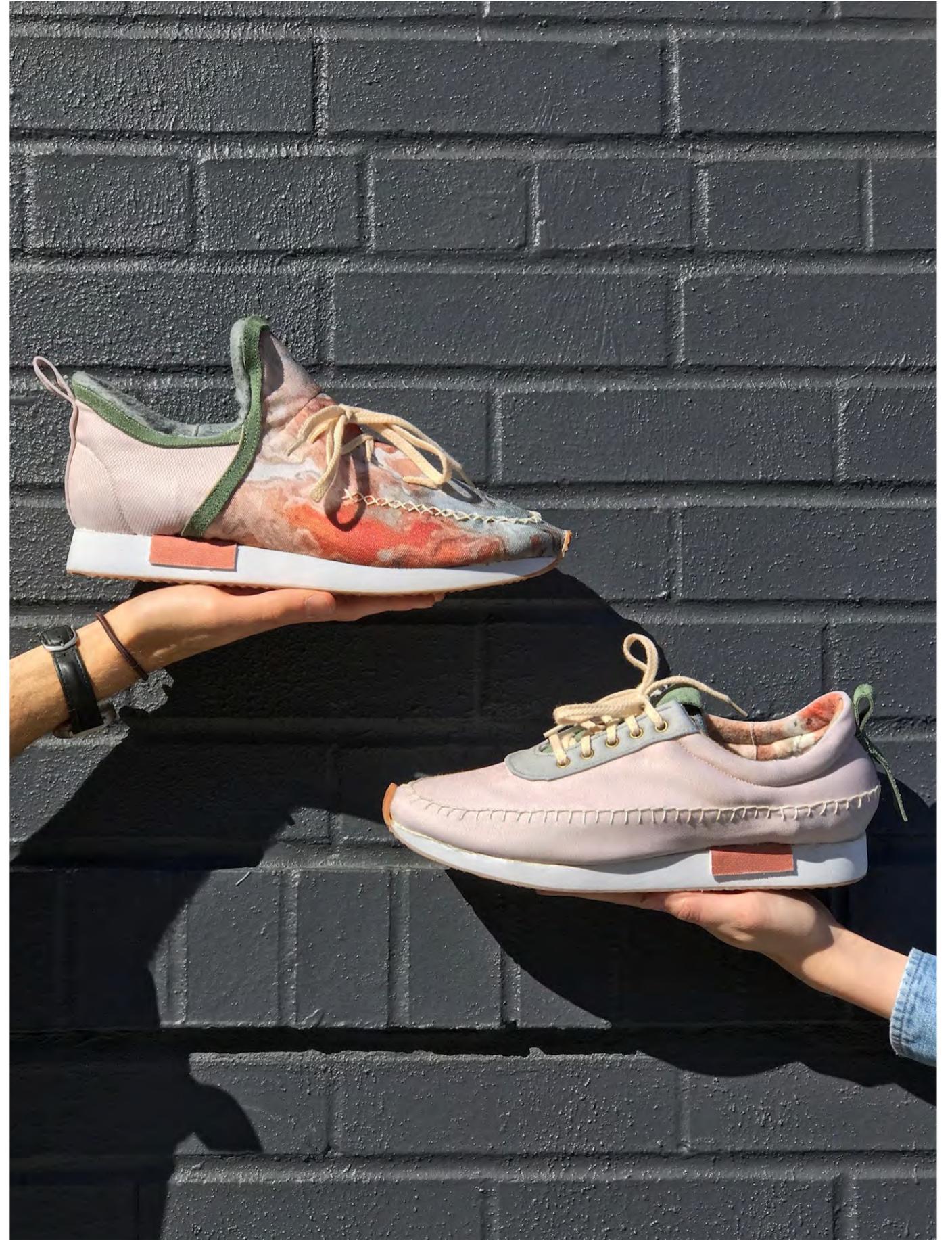
CREATION PROCESS

- Pattern Making
- Tracing
- Gluing
- Sewing
- Hand Stitching
- Lasting





FINAL PRODUCT
Traction - *Devon Willard*
Your Turn - *Peter Salera*





SPECIAL THANKS

Thank you to the following people and organizations for making this project possible. We couldn't have done it without you and are forever grateful for your continued support, patience and generosity.

Mark Sunderland
Janet Brady

... for mentoring us and keeping us sane over the past four years

Comunity Shoes

... for allowing us to customize your shoe styles and for providing us with patterns, soles, and shoe lasts

Brooklyn Shoe Space

... for guiding us through the shoe making process

Erin Cartwright

... for allowing us to use your print design

Boathouse Sports
Guilford Mills
Apex Mills

... for providing us with waste fabric

Angela Villanueva
Wendlyn Anderson

... for assisting with the printing process