The Third Teacher

Architecture as enabler of Active Learning

by

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Loris Malaguzzi, founder of the Reggio Emilia approach, once said there are three kinds of teachers of children in the education process: "Children develop through interactions, first with… parents and teachers, then with their peers, and ultimately with the environment around them."[1] The last of which is subsequently referred to as "**The Third Teacher**."

1. O'Donnell Wicklund Pigozzi and Peterson, and Bruce Mau. "The Third Teacher". New York: Abrams, 2010.

The Third Teacher

Architecture as enabler of Active Learning

A thesis by Carolyn Tam

Submitted to the Department of Architecture on January 16, 2022
in Partial Fulfillment of the Requirements for the Degree of Master of Architecture

Abstract

In the industrial age, schools were designed as tightly controlled environments to instill discipline and conformity to thrive in a machine era. Today, as architectural education evolves its mission away from manufacturing architects and towards producing creative contributors, the buildings that house education's mission have remained stagnant - our learning environment is still rendered passive, utilitarian designs of the factory model, reinforcing the unhelpful boundaries between space and active learning.

This thesis challenges the manner in which architectural education works in pedagogy through the built form. Rather than fixing a same batch of learners in a rigid container, this thesis proposes a series of deployable systems that can adapt to various urban conditions to form dispersed learning environments. Learning is not separated from daily life - it could occur in a park, a vacant lot, or in the most unexpected of spaces – fostering diverse modes of learning and greater creative possibilities.

A key concept in active learning, which can extend to architecture, is wilderness education, where students are taken outside the classroom and use full-scale tools to create, play and test boundaries within their environments. This thesis asks, what if learning opportunities found in these instruments could be expanded to architecture. Architecture can be structural and systematic - but at the same time playful and engaging - and cross many disciplines, from geometry and surveying to physics and structure. Instructors and books are no longer the only teachers: the hands, the ears, the eyes, in fact, the whole body and the architectural space itself, become sources of information. Viewing students as active constructors of knowledge, the proposed architecture encourages students to use full-scale instruments and their context to imagine and engage with haptic, real-world learning experiences.

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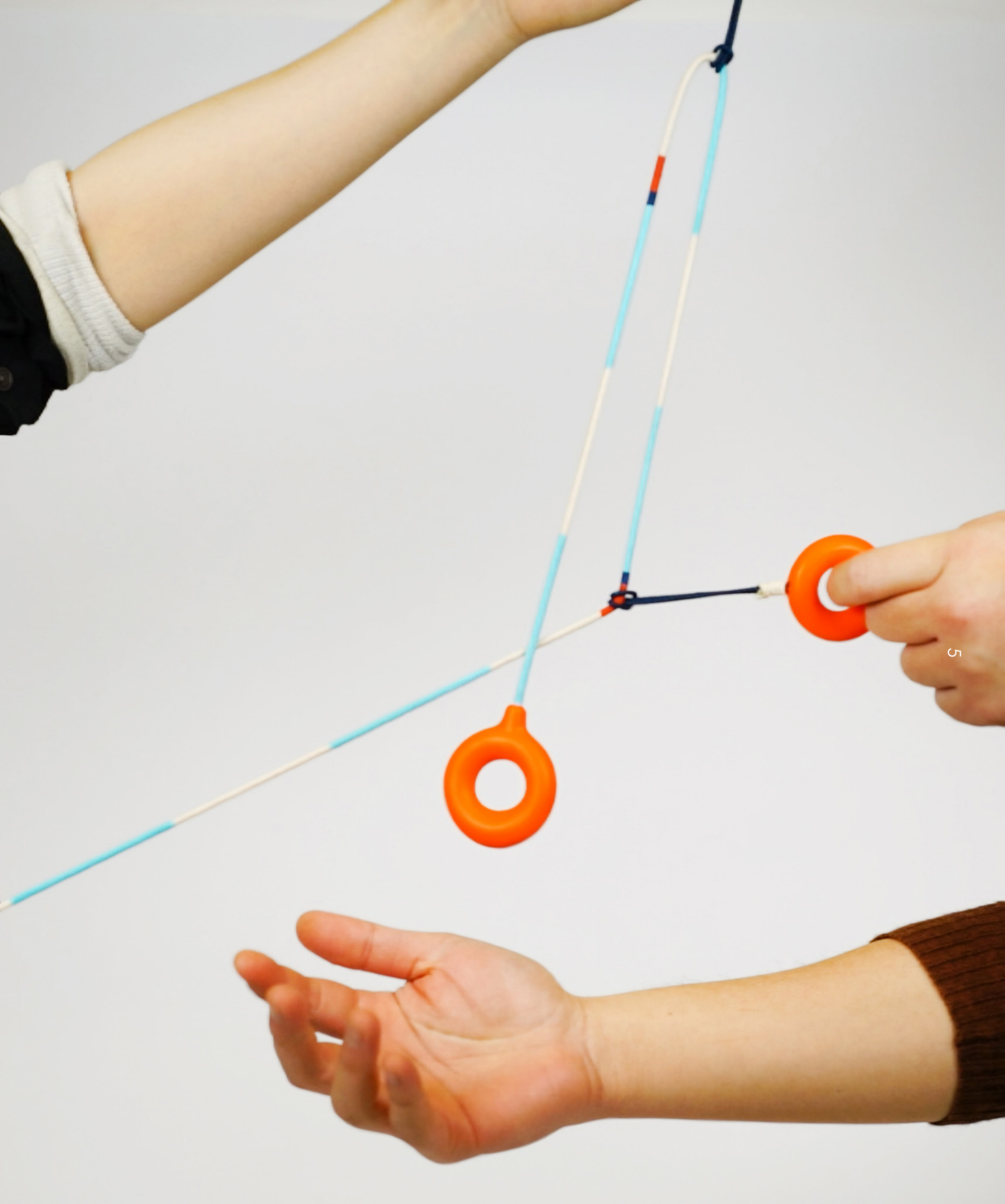

Fig. 1: String-based geometry.

Acknowledgments

First of all, thank you to **Brandon Clifford**, for your insight, encouragement and inspiration, and for nudging me out of my comfort zone but at the same time being my greatest supporter throughout all the challenges and obstacles. I am fortunate that I met you, a fellow mentor with research interests that align with mine. Without your patient guidance, this thesis would not have been possible.

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Finally, to my family, for your enduring support throughout my eight years of architectural and design education, and for sticking with me through thick and thin, wacky projects, my absence from the outside world and *sometimes* lack of contact with you.

Contents

Introduction

Schools are largely shaped by an antiquated design born out of the Industrial Era mindset of efficiency.

If we put before the mind's eye a contemporary classroom, it doesn't look drastically different from the industrial schools two centuries ago. In the past, these factory schools were designed as highly controlled spaces to instill discipline. They were intended to enforce students to conform to a linear process of learning in order to produce a constant supply of workers with a narrow set of capabilities.

To a large extent, the architecture school is a by-product of the Industrial Revolution. Walking into a studio, one is likely to see chairs and desks of almost the same sizes, with the same batch of students doing the same subject at the same time. Spaces like these, in John Dewey's view, treated people all the same.[2] They are made for lecturing, to produce uniform and batch-processed learners. The problem with this method is that people do not come in standard sizes and shapes like widgets on the production lines. We are all unique individuals with a wide range of talents, personalities, and interests.[3]

2. Lange, Alexandra. "In The Design of Childhood", 143. Bloomsbury Publishing, 2020.
3. Robinson, Ken, and Lou Aronica. "Creative Schools", Penguin Books, 2016.

Fig. 2: Women at work manufacturing gloves

Fig. 2. Women at work manufacturing gloves. 1932. Monochrome photograph.
https://collections.museumsvictoria.com.au/items/1764010

Education, however, is not exclusively tied to fixed containers, with knowledge transferred solely from teachers to learners.

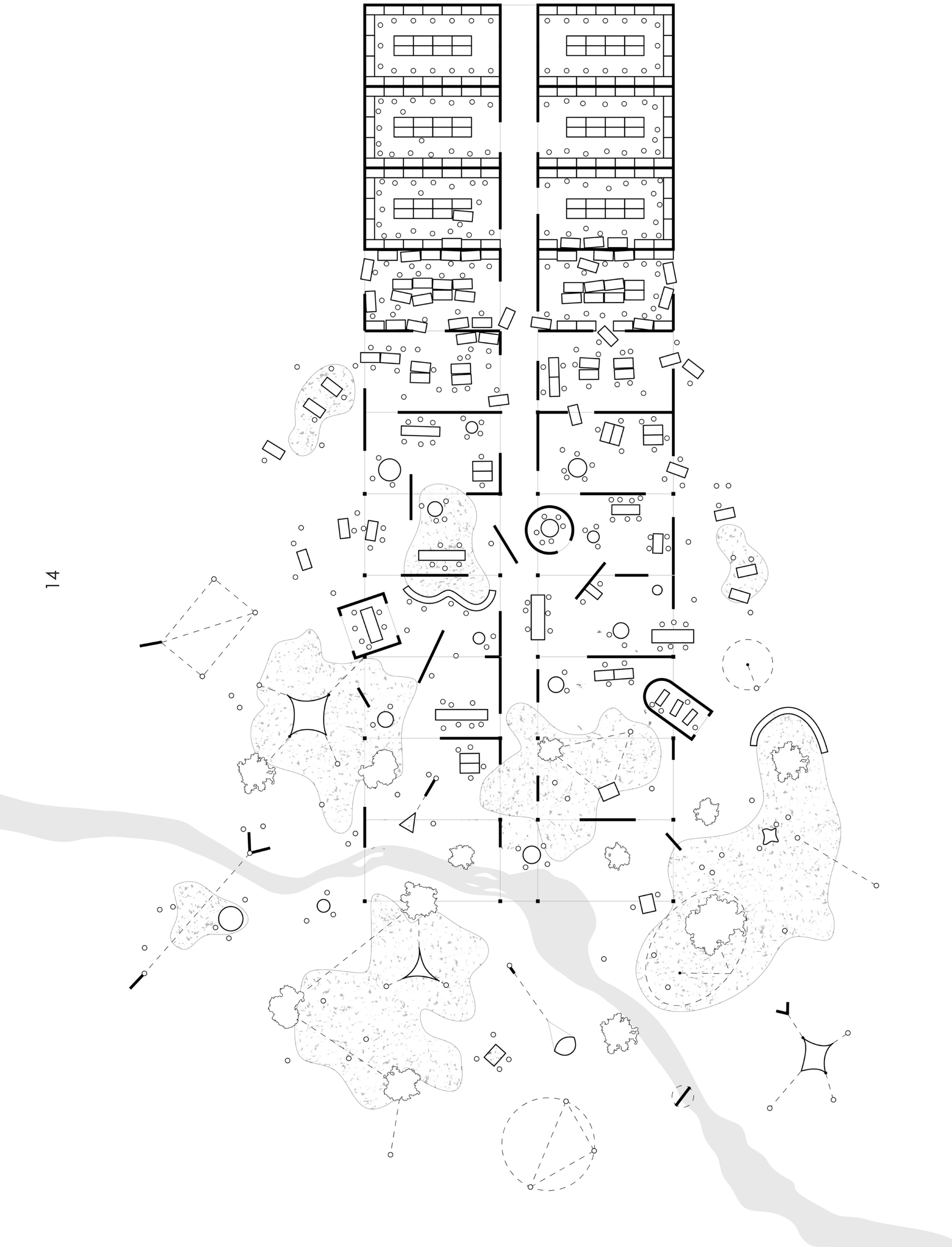
In the education field, there are examples such as wilderness education and forest schools, where students are taken outside the classroom and gain knowledge through direct experience from the physical environment. Research has shown that these types of multi-sensory approaches are highly effective as they connect the different ways in which we learn. Participants touch, hear, see, create - and this process enables a greater retention of information.

Fig. 3: Outdoor education program

Fig. 3. Sterling College. Outdoor education program. 2014
https://www.flickr.com/photos/sterlingcollege/

Fundamentally, this thesis asks what kind of architecture is necessary to de-couple the students from the fixed classroom and enter and interact with the world around them through real questions of space making, geometry, physics and construction.

To break the rigidity of the classroom layout, this thesis proposes a series of deployable systems that can plug into various urban conditions to form dispersed learning environments, with the goal of being flexible and engaging at individual, collective, and even architectural scales. Learning is not separated from our daily life; it could occur in a park, a vacant lot, or the most unexpected of spaces – to foster diverse modes of learning and greater creative possibilities.



Design Methods

This thesis defines four major design challenges in exploring an alternative learning environment, with the goal of interacting with the real environment and learning haptically, playfully, and for greater diversity.

1. Full Scale

At full scale, students can gain a deeper understanding of human bodies in relation to space as well as a hands-on understanding of forces, tolerance, material behavior, and environmental transition - concepts that we are familiar with, but are forced to scale down and abstract at our desks in our current studio learning environment. Scaling ideas out of the world is significantly challenging, as the field conditions are much more complex outdoors, and the instruments are exposed to external forces. Yet, this thesis sees using full scale as a valuable learning objective.

2. Deployability

The play instruments presented here are designed to be lightweight in order to be collapsed into a small package, carried to the site effortlessly, and deployed at a full architectural scale. Ripstop nylon, paracord strings and wood dowels are chosen as the main material palette for their light yet durable properties. In order to keep the number of tools to a minimum, artifacts are designed to be multi-functional. Certain configurations can be created with one kit, but if multiple students are present with their kits, they can then collaborate and create structures with higher complexity.

3. Ambiguity

Conventionally, classroom learning is a linear, deterministic process rather than one that invites creativity. A fundamental principle of this thesis is its embrace of ambiguity, which invites multiple meanings and encourages a diversity of creative approaches. Artifacts in the package are designed to be abstract and minimal in form to encourage students to learn through their own interpretations and experimentations.

4. Embedded Knowledge

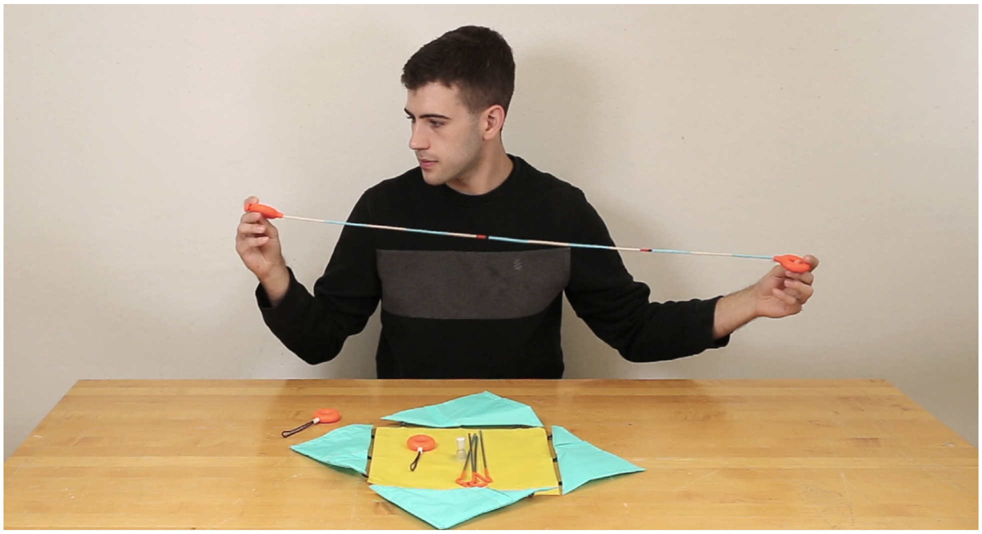
The design artifacts have the knowledge of construction embedded into them without verbal instructions. Through formal analysis and engaging with the objects, users unpack the secrets underlying these artifacts, and the path of discovery becomes play.

4. Boon, Yik Chung. "Space as the Third Teacher". 2015.
5. Resnick, Mitchel. "Lifelong Kindergarten". Cambridge: The MIT Press, 2018.

Learning Objectives

This thesis augments learning objectives that are central to the discipline of architecture. It proposes three sets of lightweight instruments to teach **geometry, surveying, and structure**. Students receive these artifacts by mail, like a package – this includes what's inside and the package itself, which can be unfolded and deployed at full scale.

These instruments are not limited to architecture students, but can also be for young adults who are interested in engaging with real world learning experiences.



Gift 1: Geometry & Proportions

Gift 2: Surveying

Gift 3: Physics & Structure

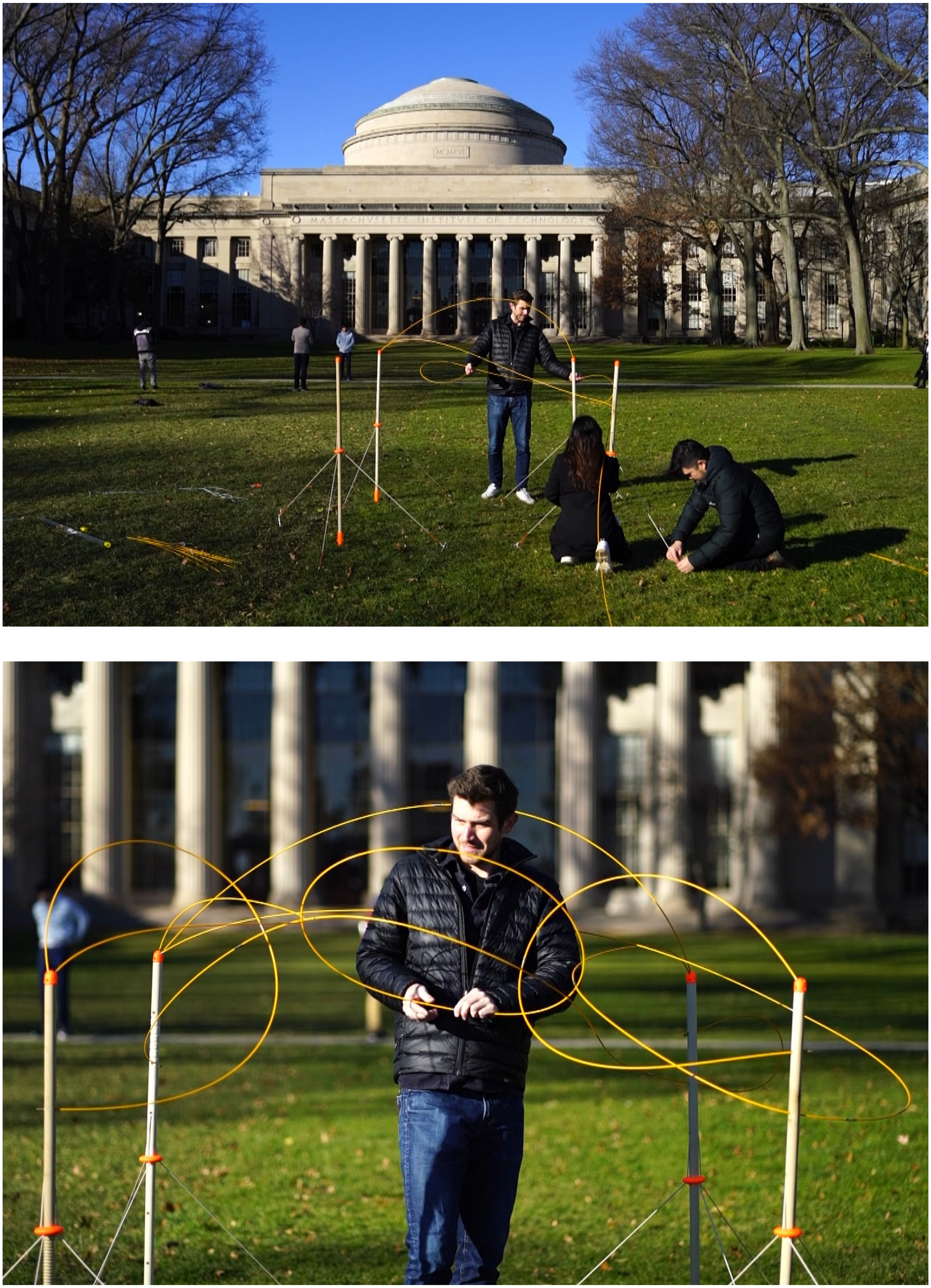


Fig. 4: Deployed Structure.

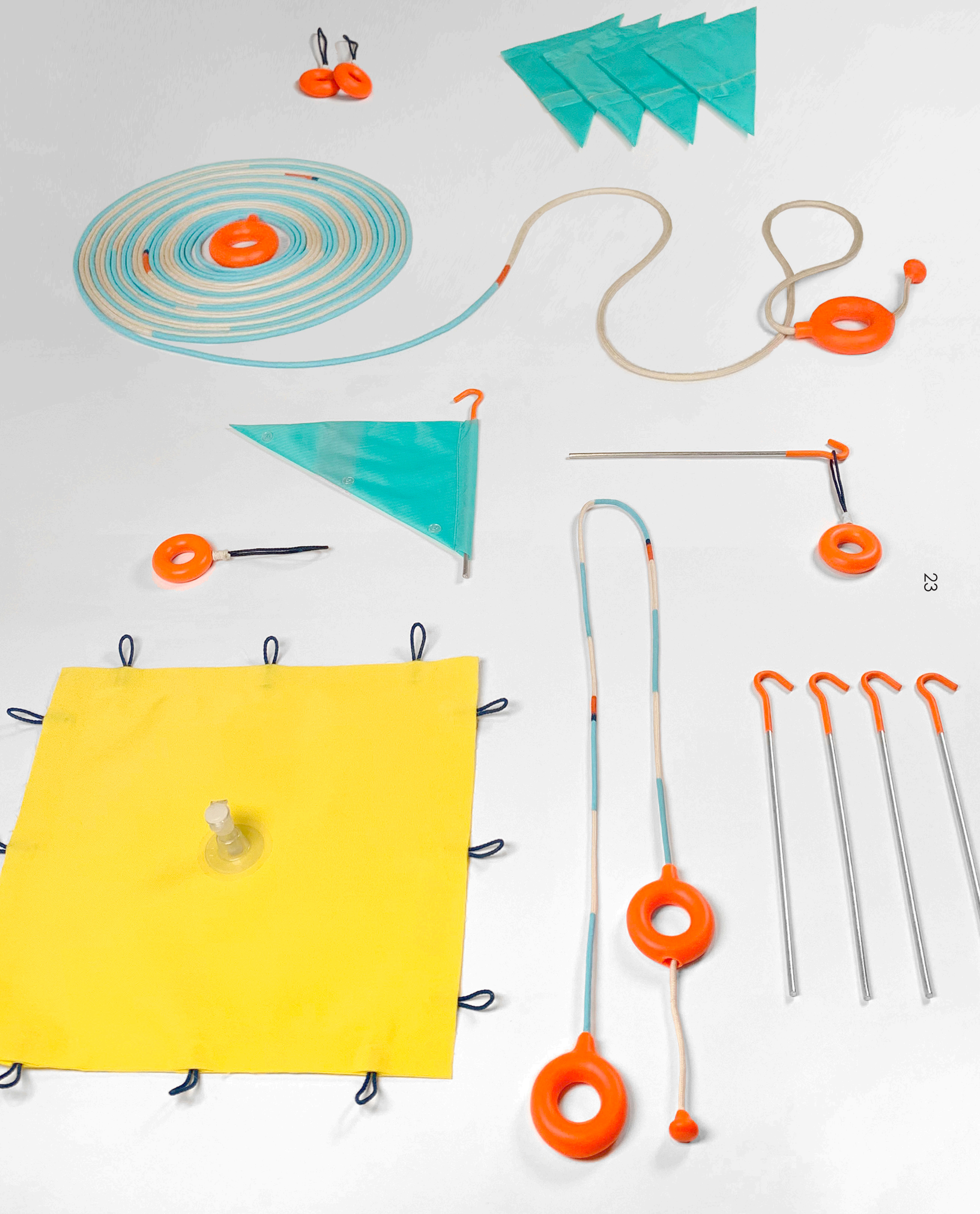
Fig. 5: Deployable Structure.

Gift 1 :
Geometry & Proportion

The learning journey begins with string-based exercises that demonstrate the relationship between proportions and geometry.

SCAN ME

PROMPT 1



Artifact 01

Artifact 02

Artifact 03

Artifact 04

Artifact 05

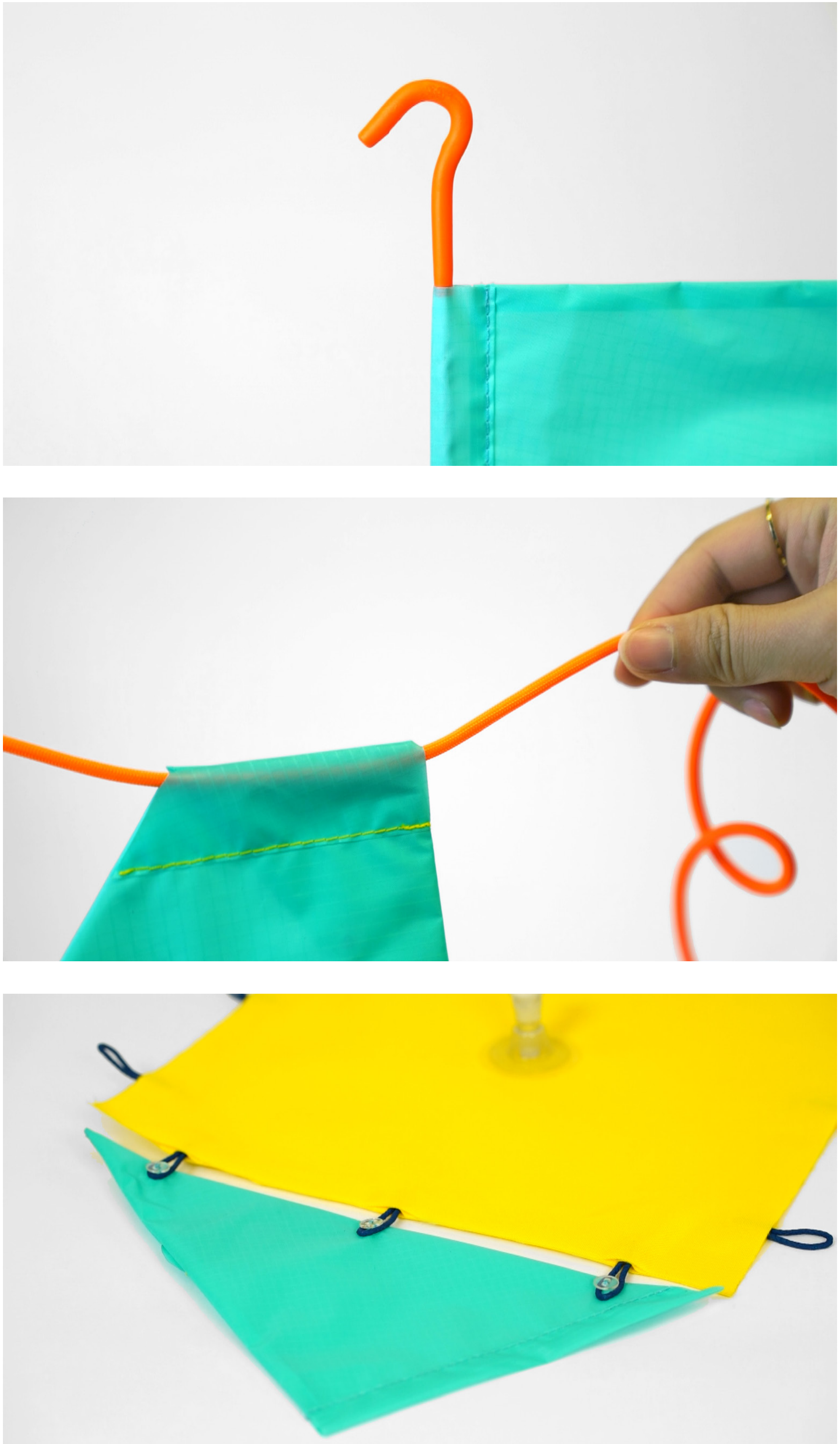


Fig. 6: The package itself can be taken apart for multiple purposes.

Fig. 7: Artefacts are designed to be abstract for multiple interpretations.

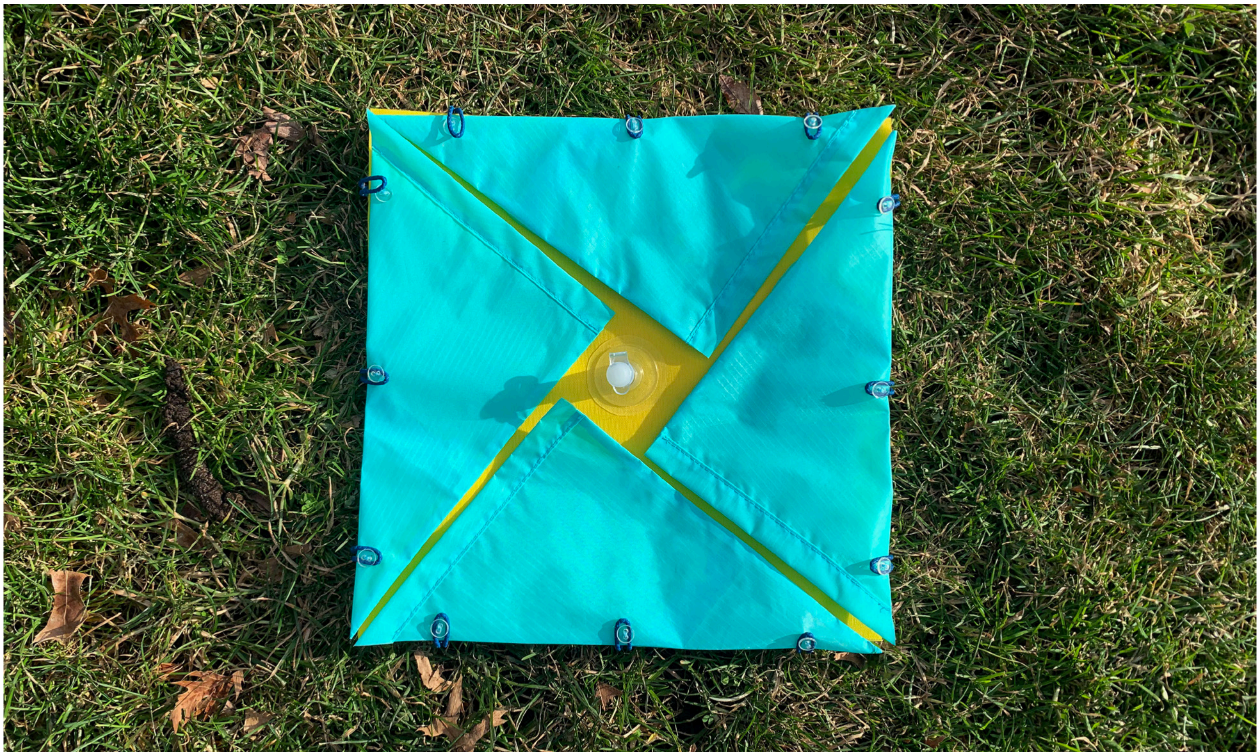



Fig. 8: Artifacts deployed on site.

This set of artifacts is embedded with knowledge about string-based geometries and proportions, which enable people to create spatial constructs without verbal instructions. Cryptic details on the artifacts help students to visualize and unpack the secrets behind these clues.

When users attach the small rings to the blue strip on the main rope, pull all the rings together, and stretch the rope out, they get a triangle with accurate 90 degrees. This method comes from the ancient technique of using a string line to find a perfect square corner based on the knowledge of the Pythagorean theory, as it is quite impossible to carry a giant corner ruler around. These types of techniques are still used on site to make spaces. While students can learn about this technique conceptually in school, this thesis contributes to haptic learning - having the physical interaction of feeling the 90 degrees in space.

Ultimately the artifacts aim to foster creative and imaginative exploration. In this early user testing, students come up with other creative possibilities or use their own bodies as anchor points to create spatial geometries.



Within the packaging of the design, fundamental knowledge is also embedded for the participants to unpack. The action of folding and unfolding suggests the relationship between the 3-4-5 triangles and a quadrilateral, which is essential for leveling the ground and creating a rectangular base, or creating parallel lines across a large distance.

USER TESTING

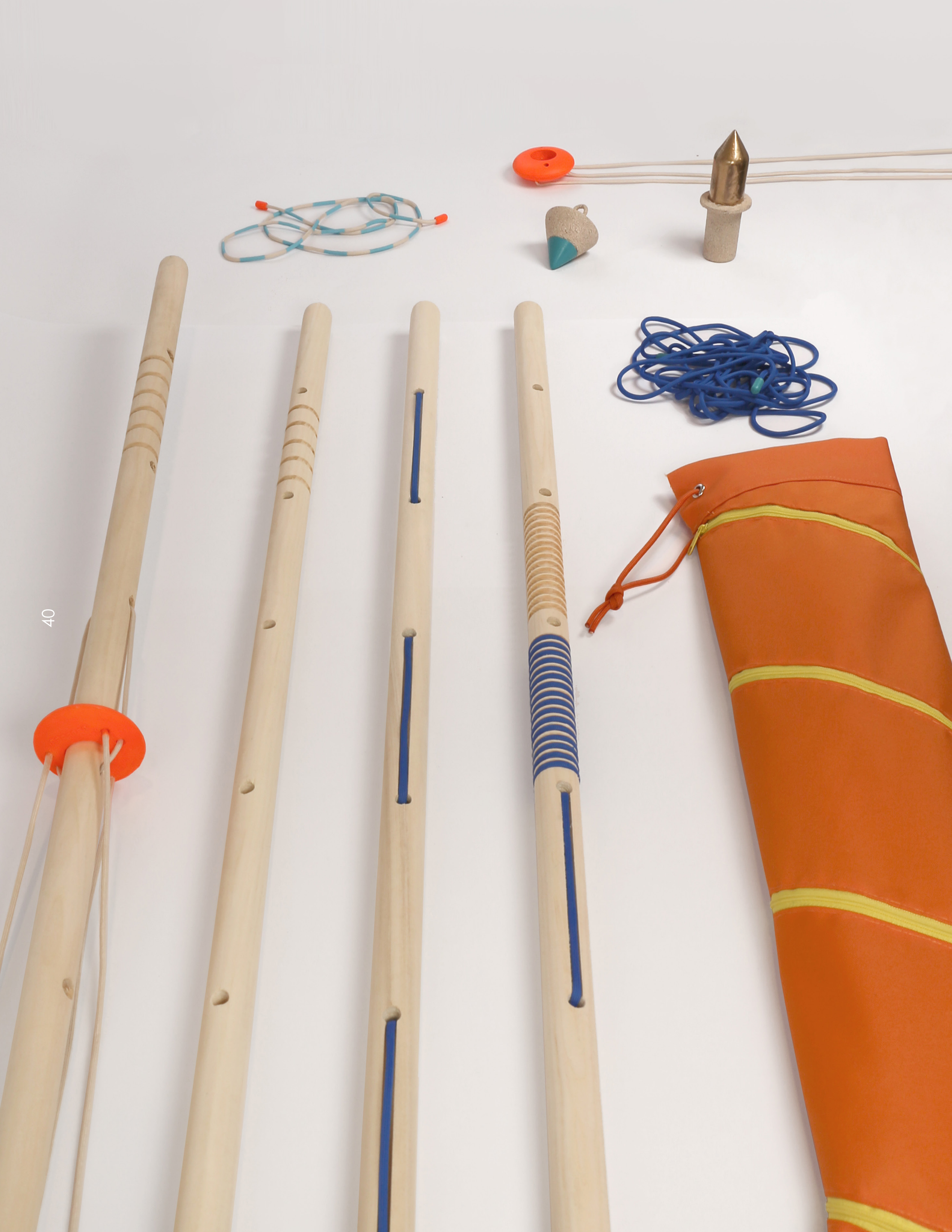
Fig. 9: Artifacts deployed on site.

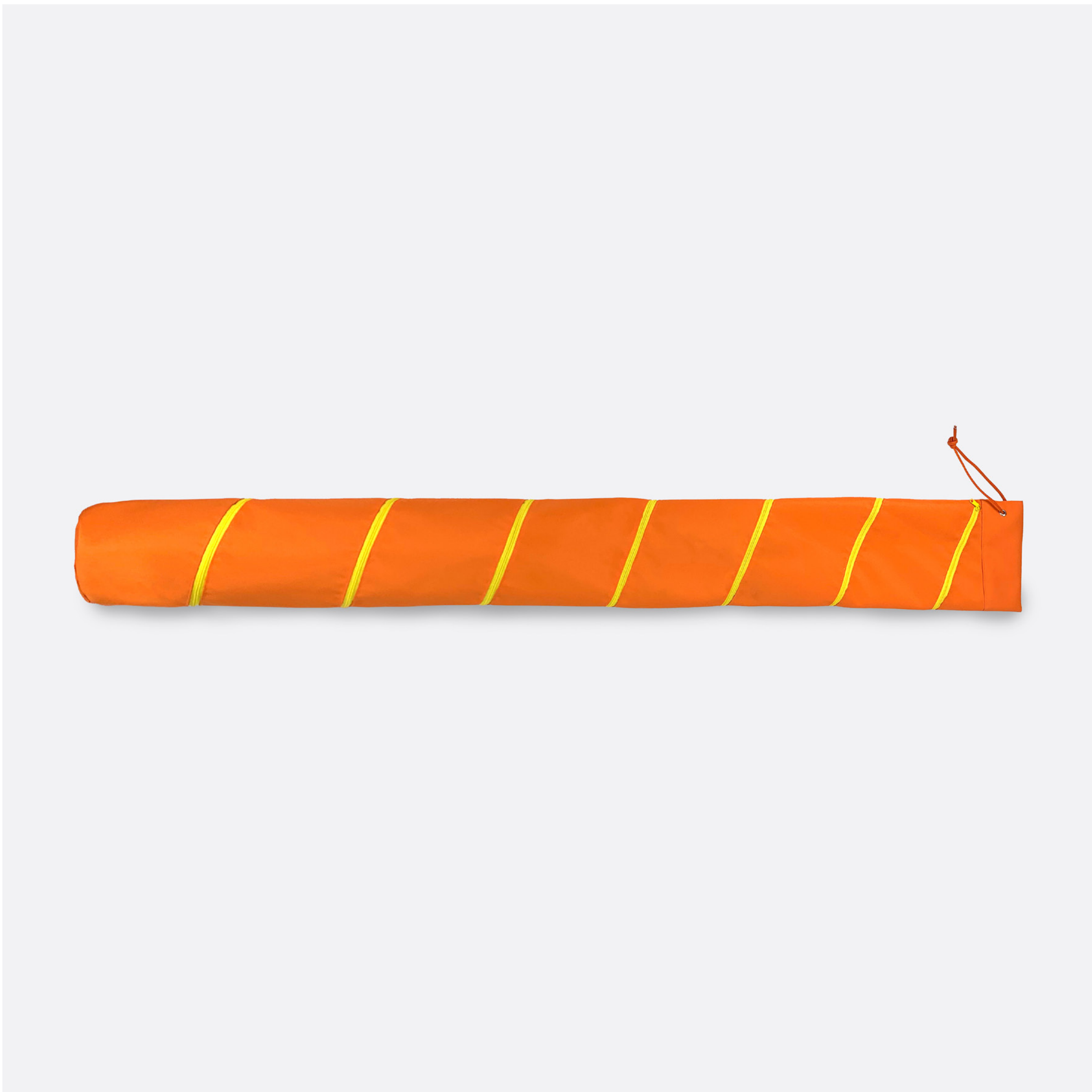
Gift 2 : Surveying

The second set of artifacts focuses on using strings and wooden dowels to make large-scale, accurate measurements of terrestrial points and the distances and angles between them. The prompt is built on the knowledge of the previous exercise and adds complexity.

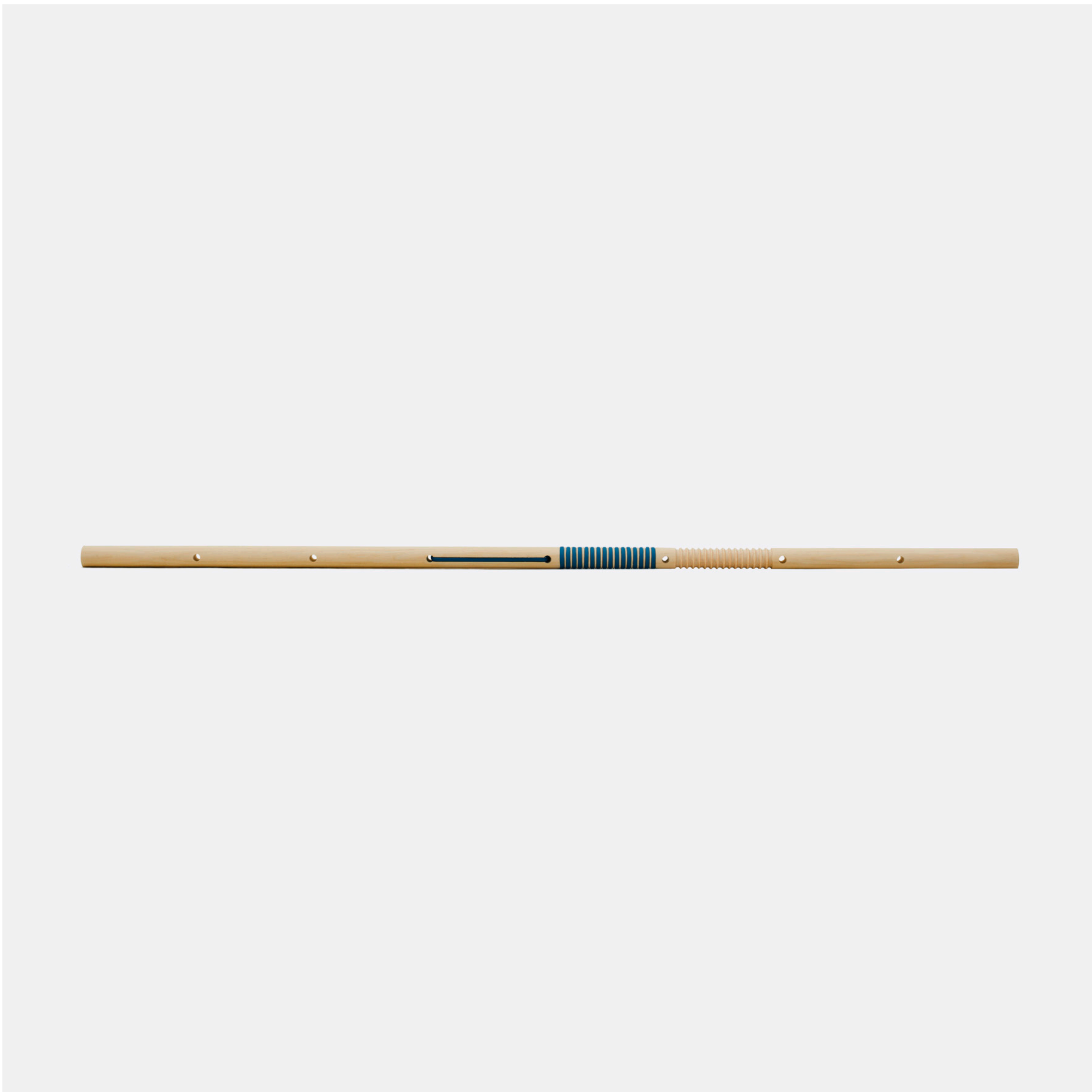
SCAN ME

PROMPT 2





Artifact 06



Artifact 07

Artifact 07 Detail

Artifact 07 Detail

Artifact 07 Detail

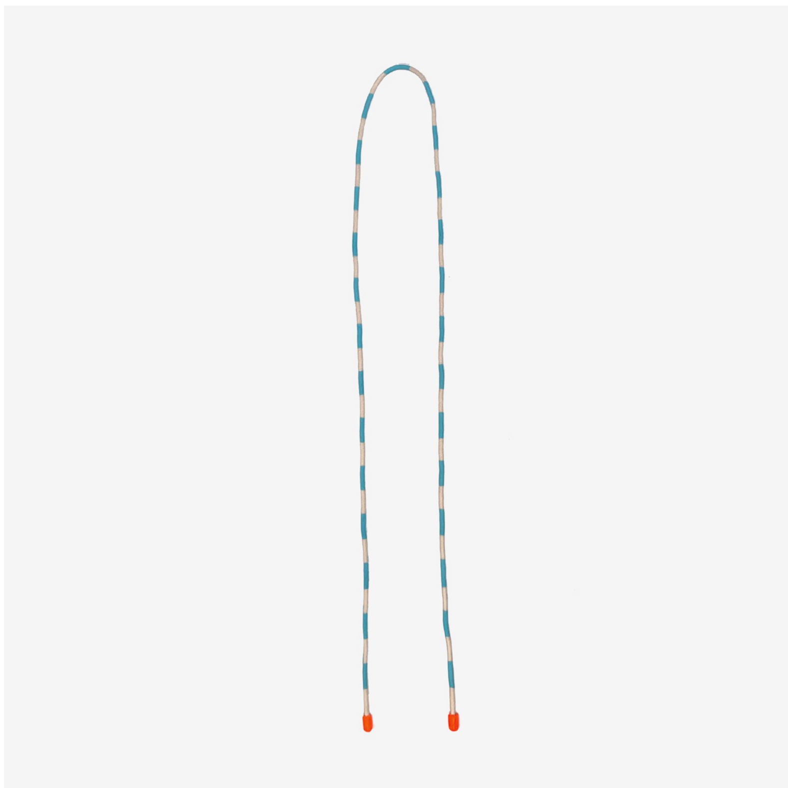
Artifact 07 Detail

Artifact 08

Artifact 09

Artifact 10

Artifact 11



Artifact 12

Fig. 10: The package itself can be unrolled for multiple purposes.

Fig. 11: Stablizing the wood dowel.

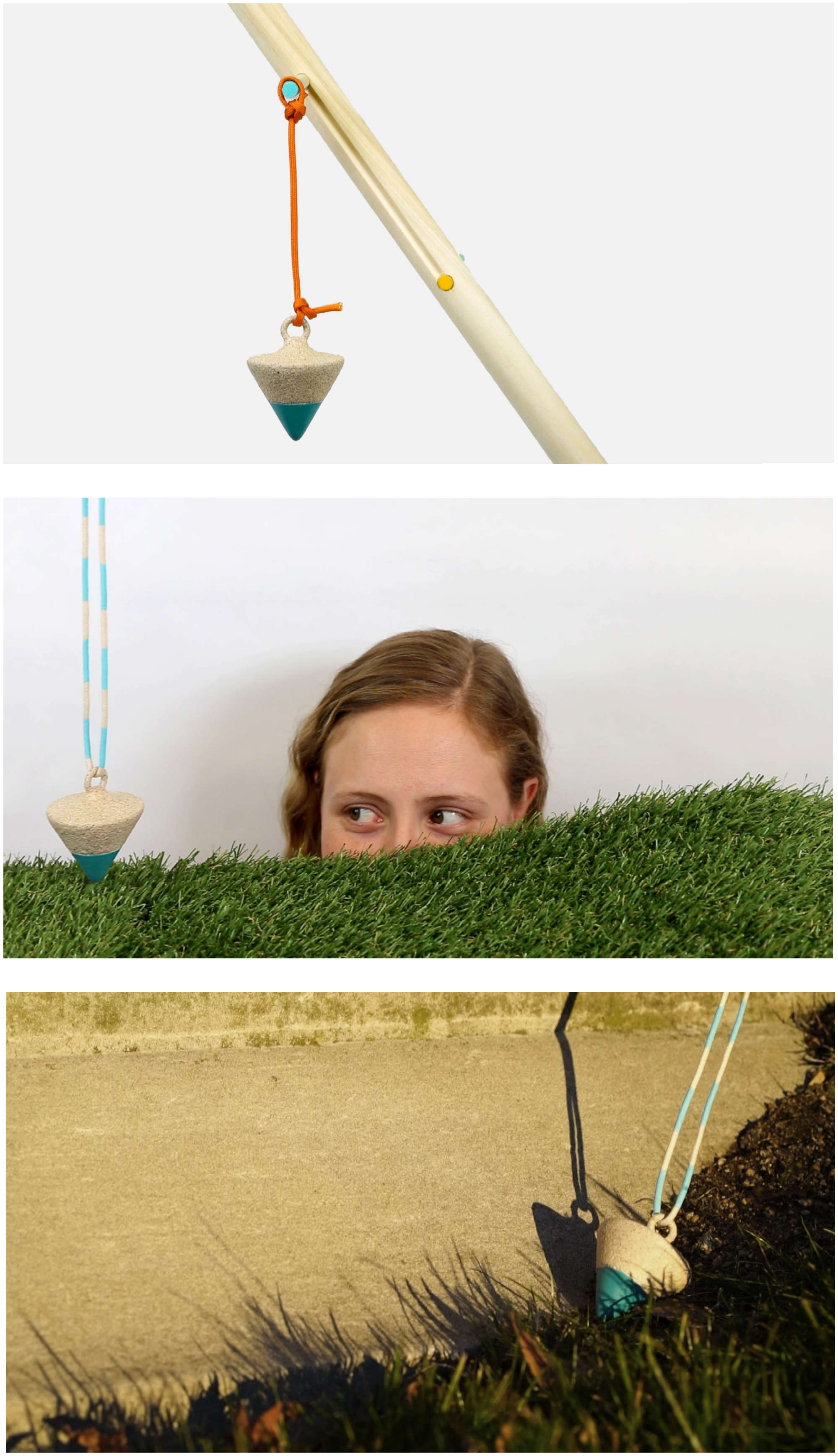
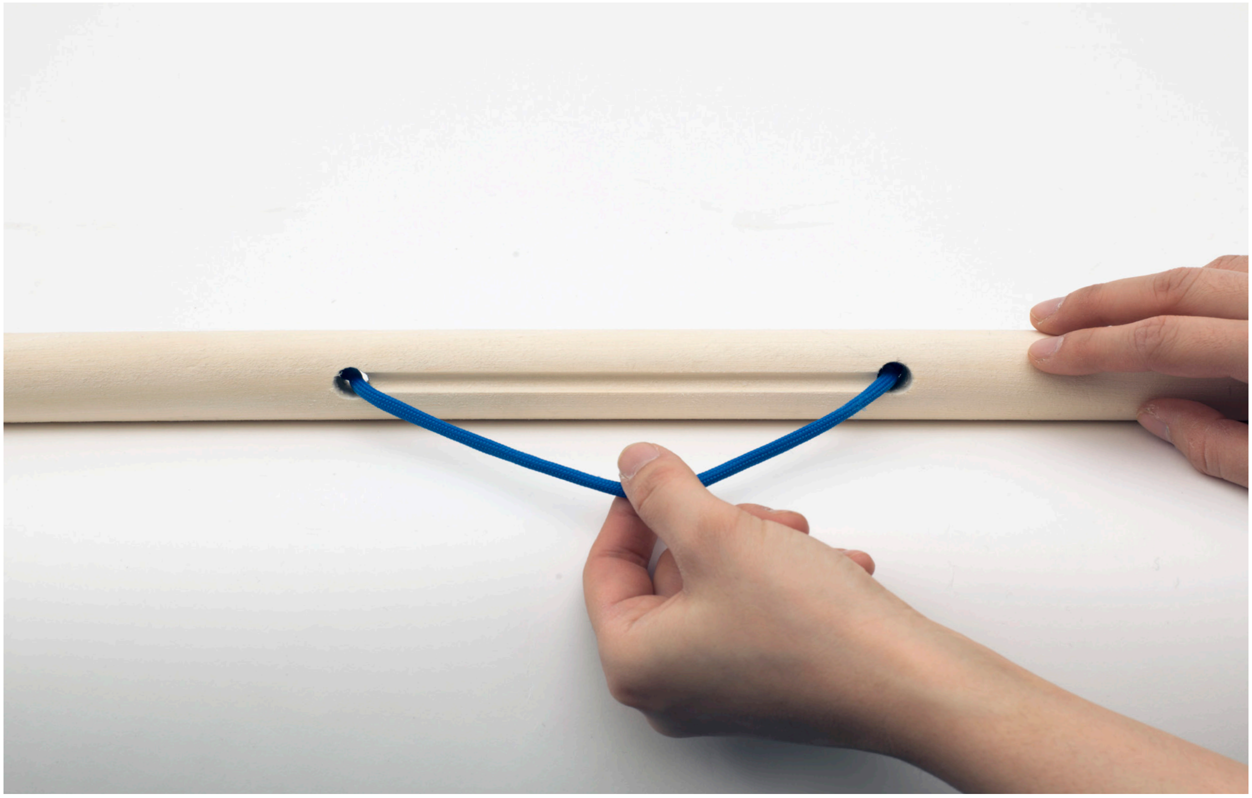
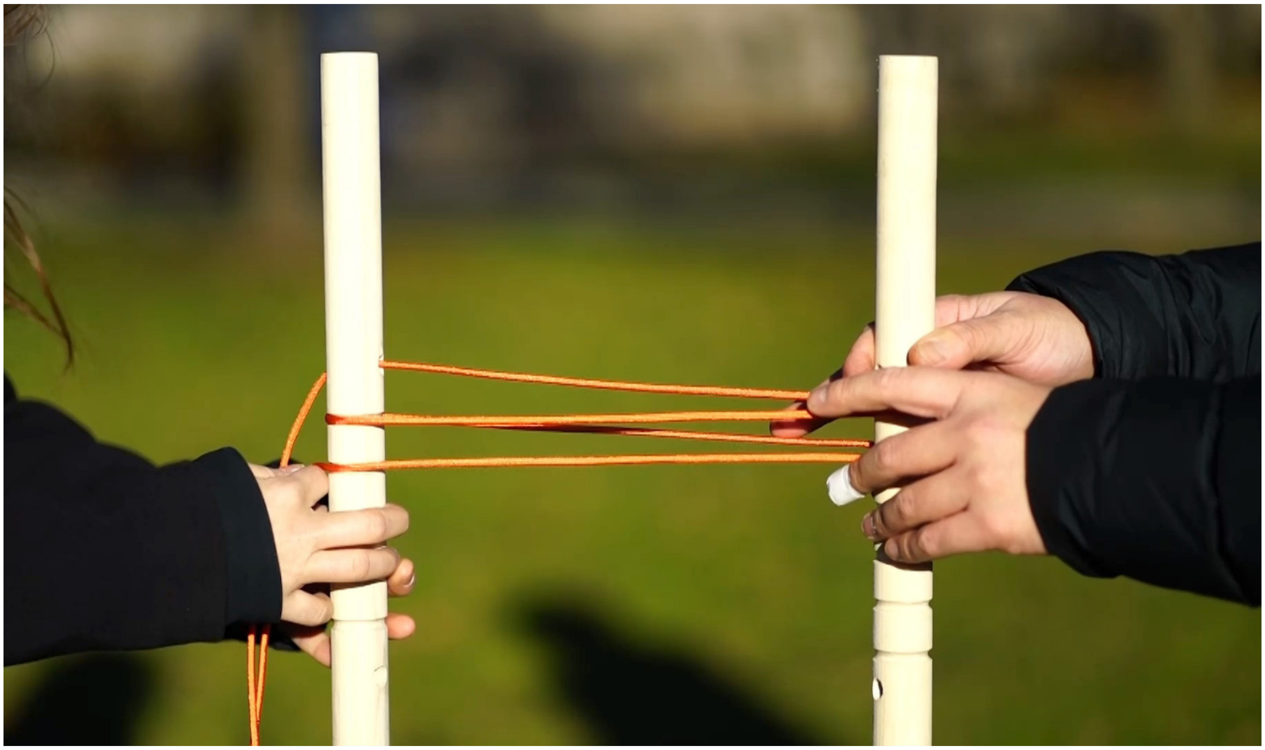


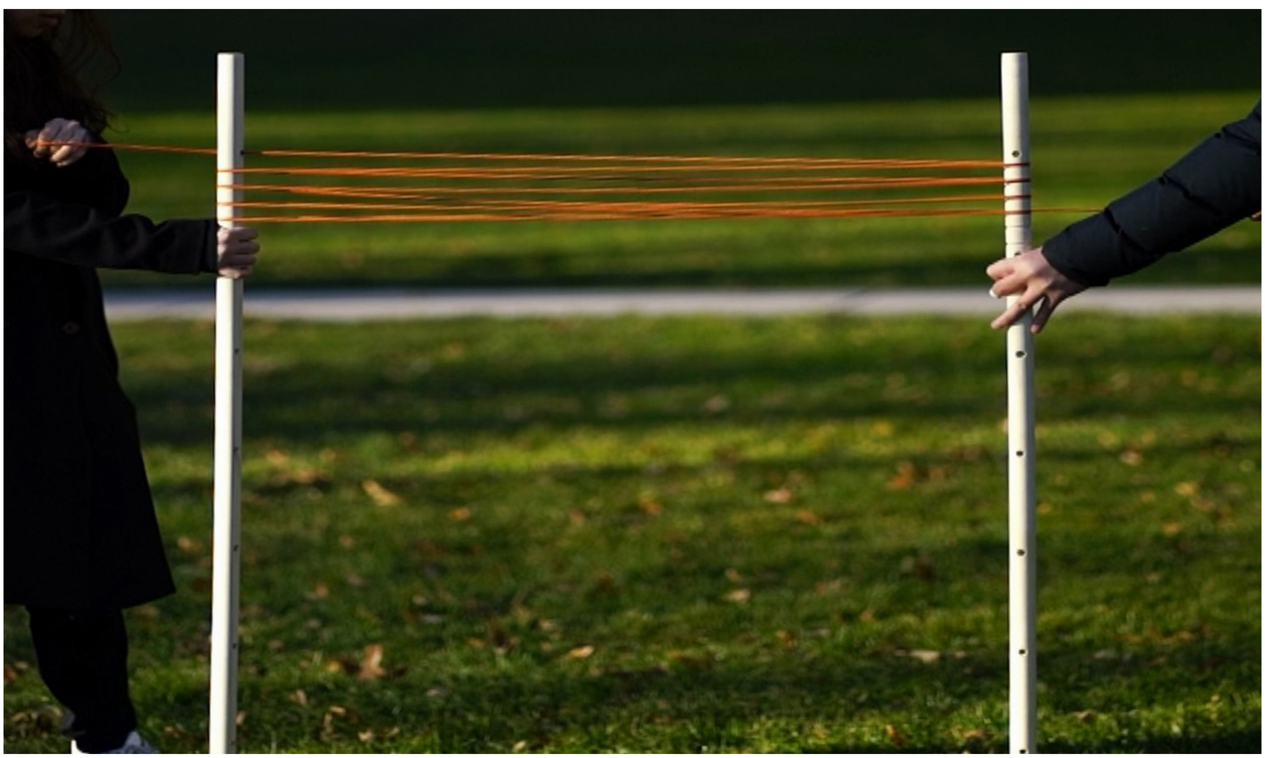
Fig. 12: Measuring the horizontal line.

The second package can be unzipped and transformed into a long strip of fabric, which can perform as a tree strap or can anchor to infrastructure. The fabric can be combined with strings, dowels and plumb bob to meausre distances, determine horizontal lines or for other surveying purposes.



The engraved details on the wood dowels suggest relationships between the string and rod. One potential use of the dowels is to measure the elevation change among a series of points on the ground surface and compare them.





Another set of dowels with different engraved patterns are intended to be used as a dividers. A piece of string can circle around the rods, and as the users pull them apart, the string can be divided into equal sections. Essentially, the patterns are abstract and minimalistic so that they do not impose a single function. The ambiguity opens up opportunities for interpretations, and stimulates the users' imagination for other creative expressions.

Fig. 13: Stablizing the wood dowel.

Fig. 14: Package transformed into a tree strap.

Fig. 15: User Testing.

Gift 3 :
Physics & Structures

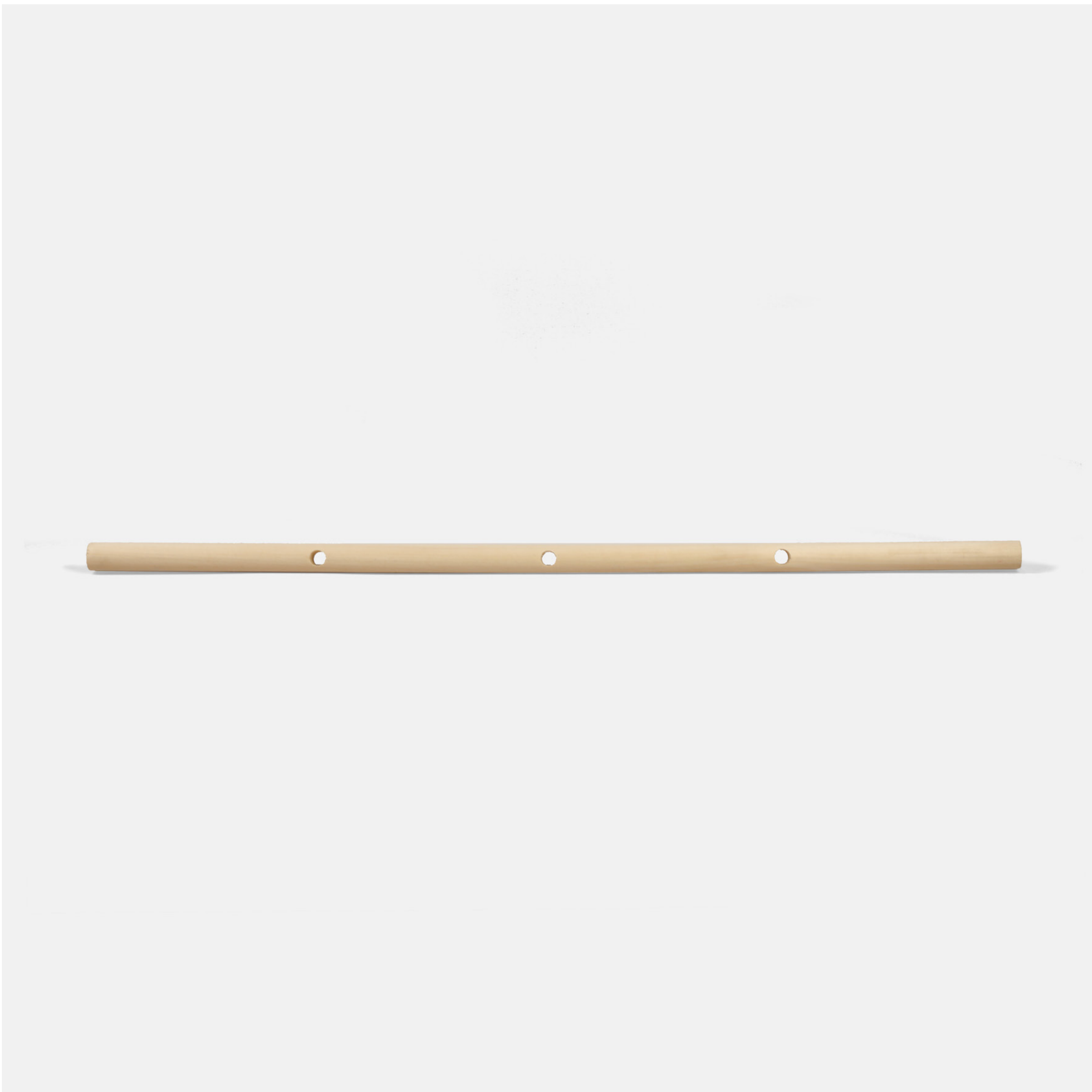
The third set of tools focuses on the relationship between loads and structural stability. At full scale, the artifacts can simulate real life structure behavior and enable users to learn about architectural structures in a haptic and intuitive way.

6. Mola, 'Mola structural kit', 2019.
www.designboom.com/design/mola-structural-kit-3-architecture

SCAN ME

PROMPT 3

Artifact 13

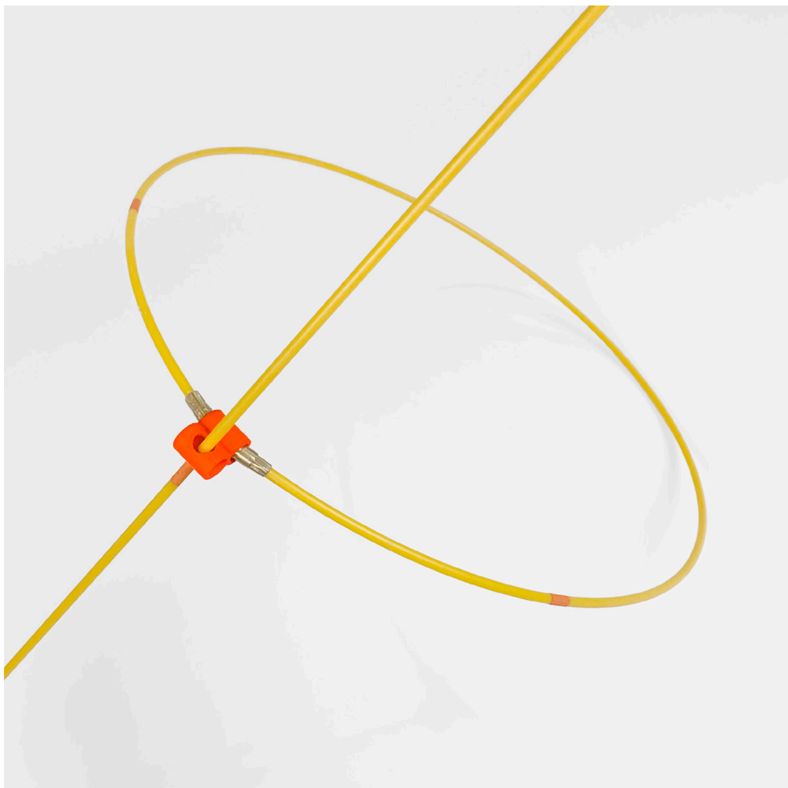


Artifact 14

Artifact 15

Artifact 16

Artifact 17



Artifact 18

Fig. 16: Design Combination

Fig. 17: Design Combination

Fig. 18: Design Combination

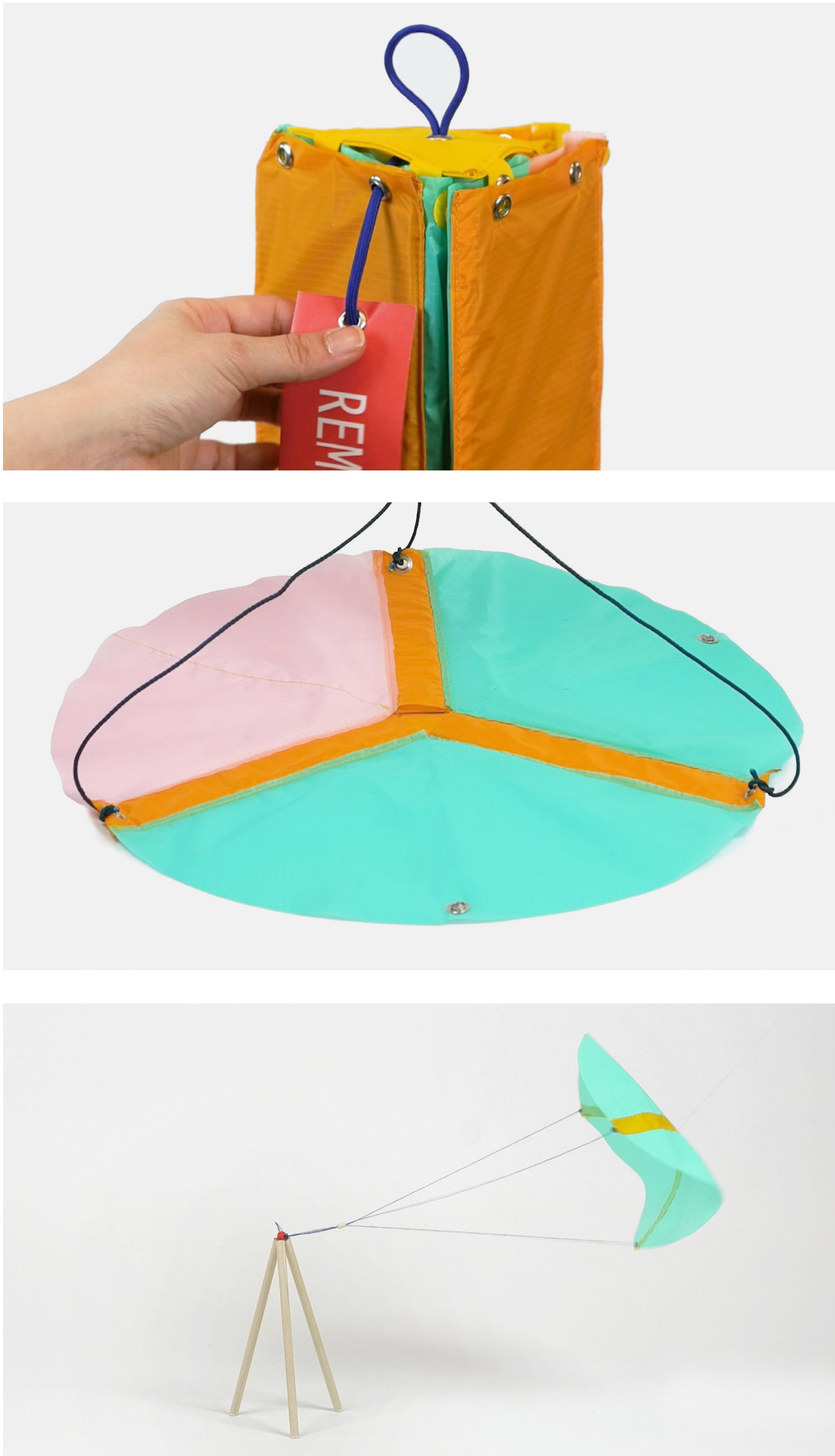


Fig. 19: The package itself can be taken apart for multiple purposes.

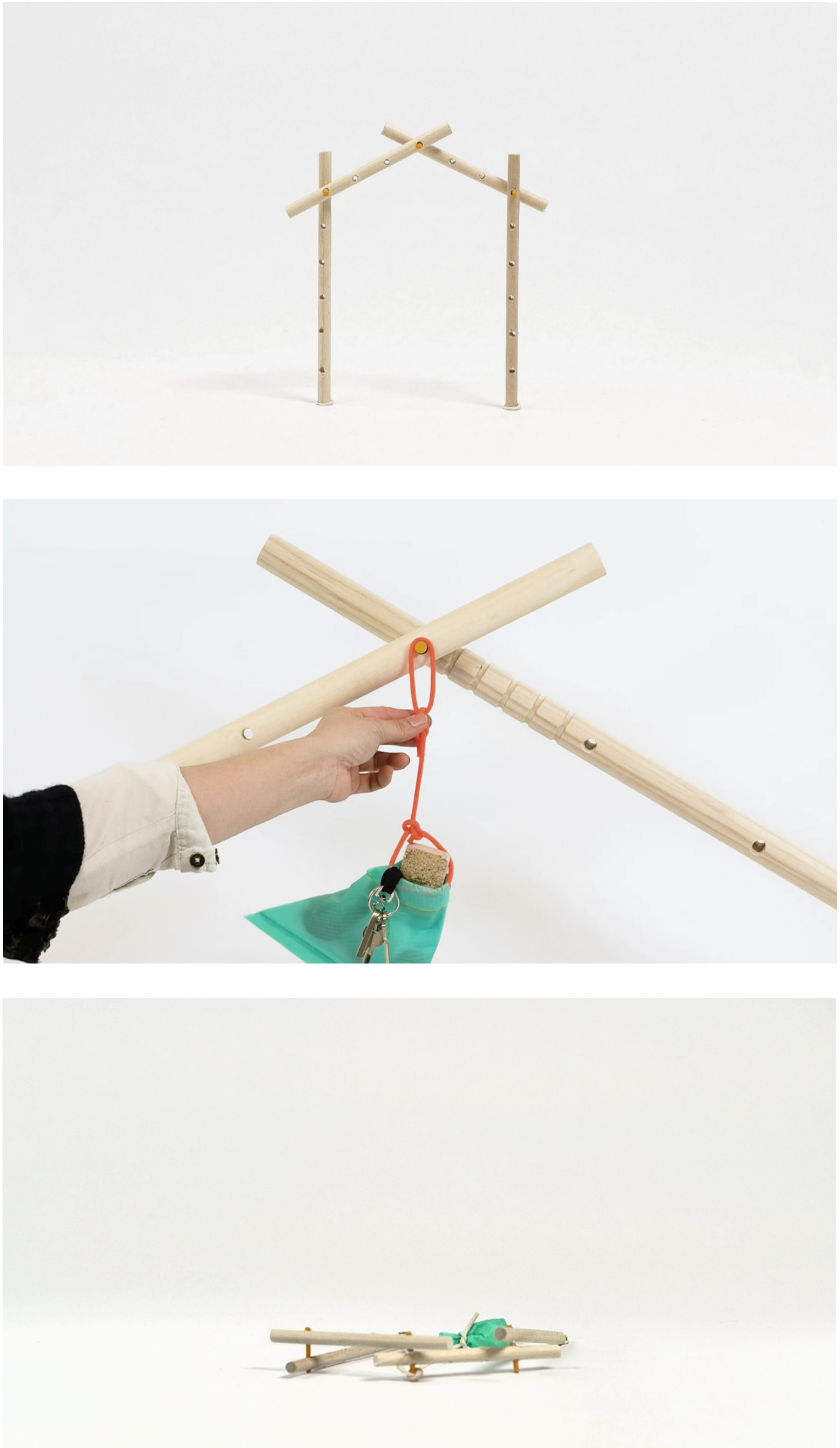


Fig. 20: Users can visualize and feel the forces exerted on the structure.

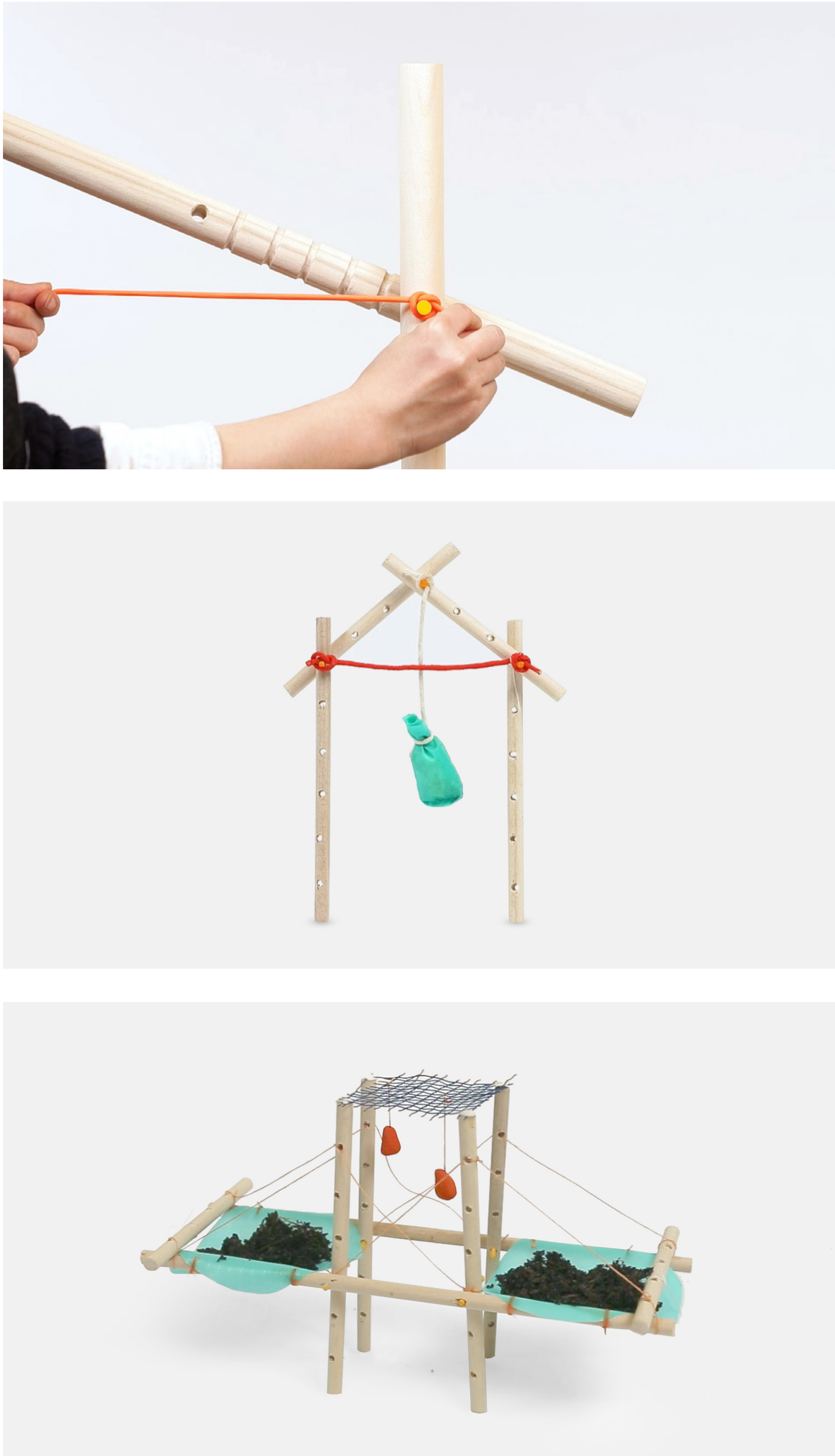


Fig. 21: Load tests.

7. Mola, ‘Mola structural kit’, 2019.

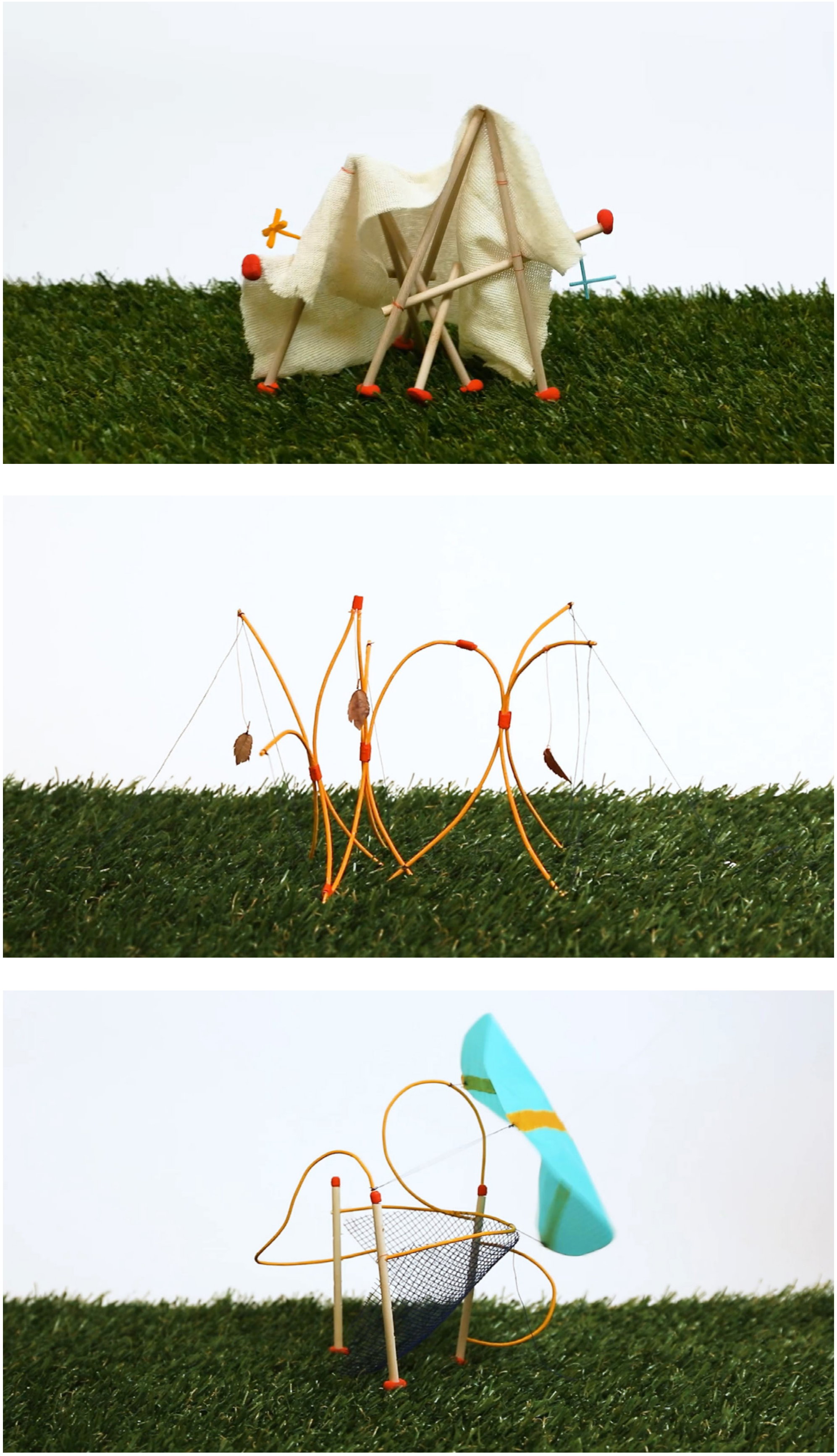
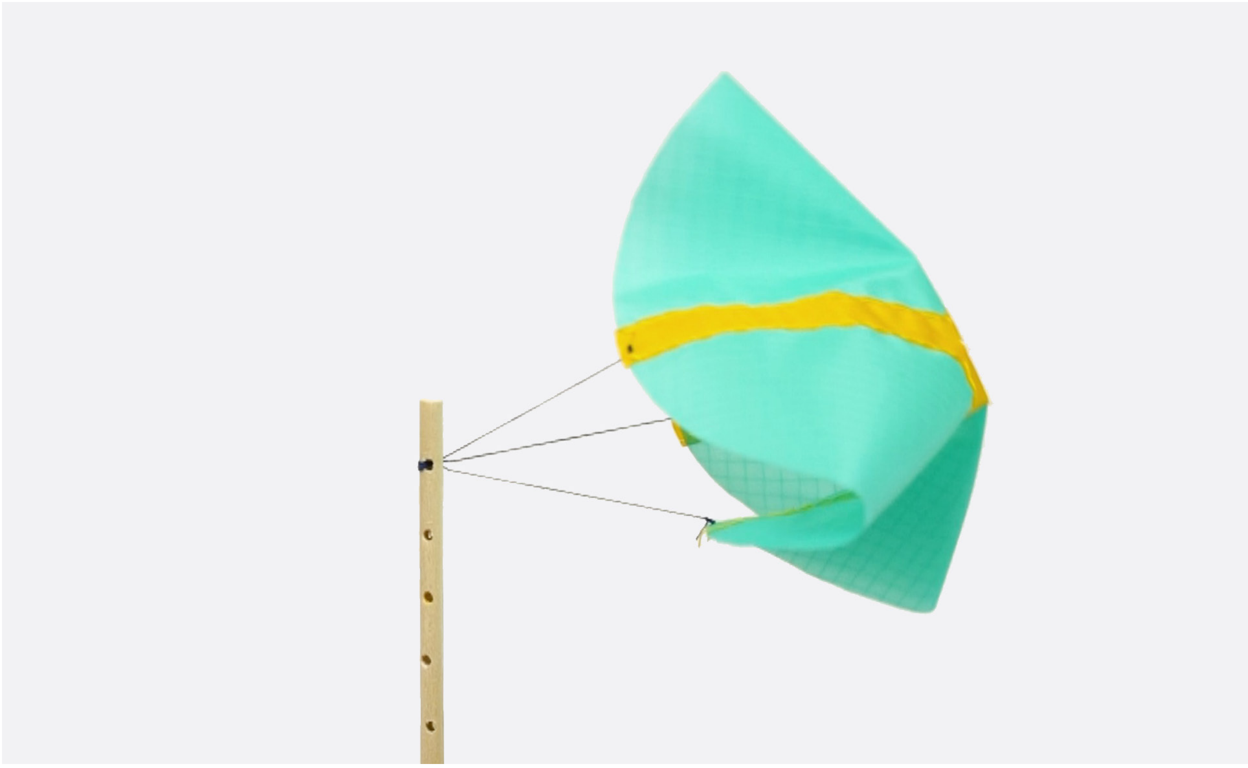


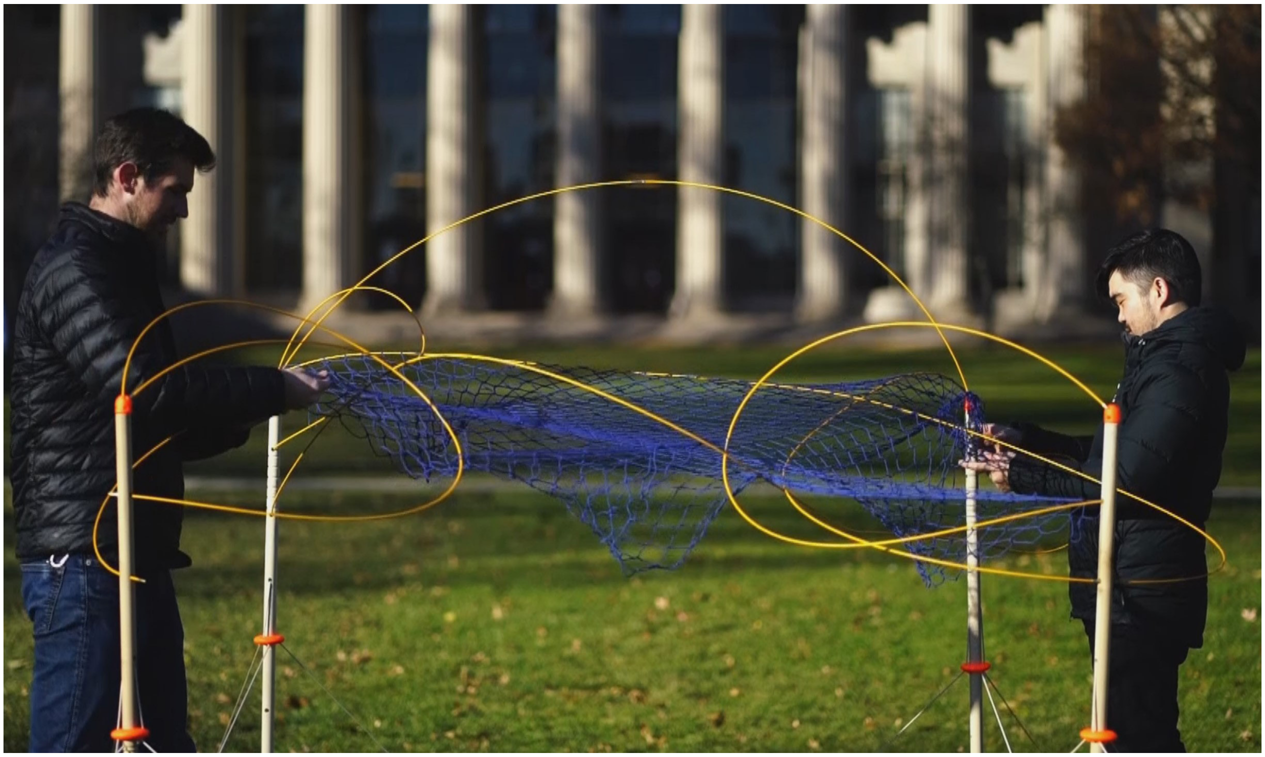
Fig. 22: Examples of creative expressions.

The third package builds upon the components of the first two. Students can feel and visualize the structure in a multi-sensory way to build a deep, physical sense of physics and forces that can complement or replace drawings. Ultimately, the full-scale artefacts enable users to explore spatial questions physically and learn by creating and constructing structures in the physical world.



The package itself can be unfolded as a parachute or to create enclosure for the structure. It is also designed in a way for different load tests and failure analyses. Seeing how structures break and deform under different circumstances helps designers to understand the failure modes of materials and structures, hence to improve their designs.

To keep the instruments lightweight, users can use materials they found on site as dead loads and see how much they can add before the structure breaks.



The artifacts allow users to imagine, create and explore countless design combinations. They can use the components to build structures, pavilions, and a wide variety of other creations. Through hands on real-world experiences, users develop the abilities to resolve problems, work collaboratively, and most importantly, develop as creative thinkers.

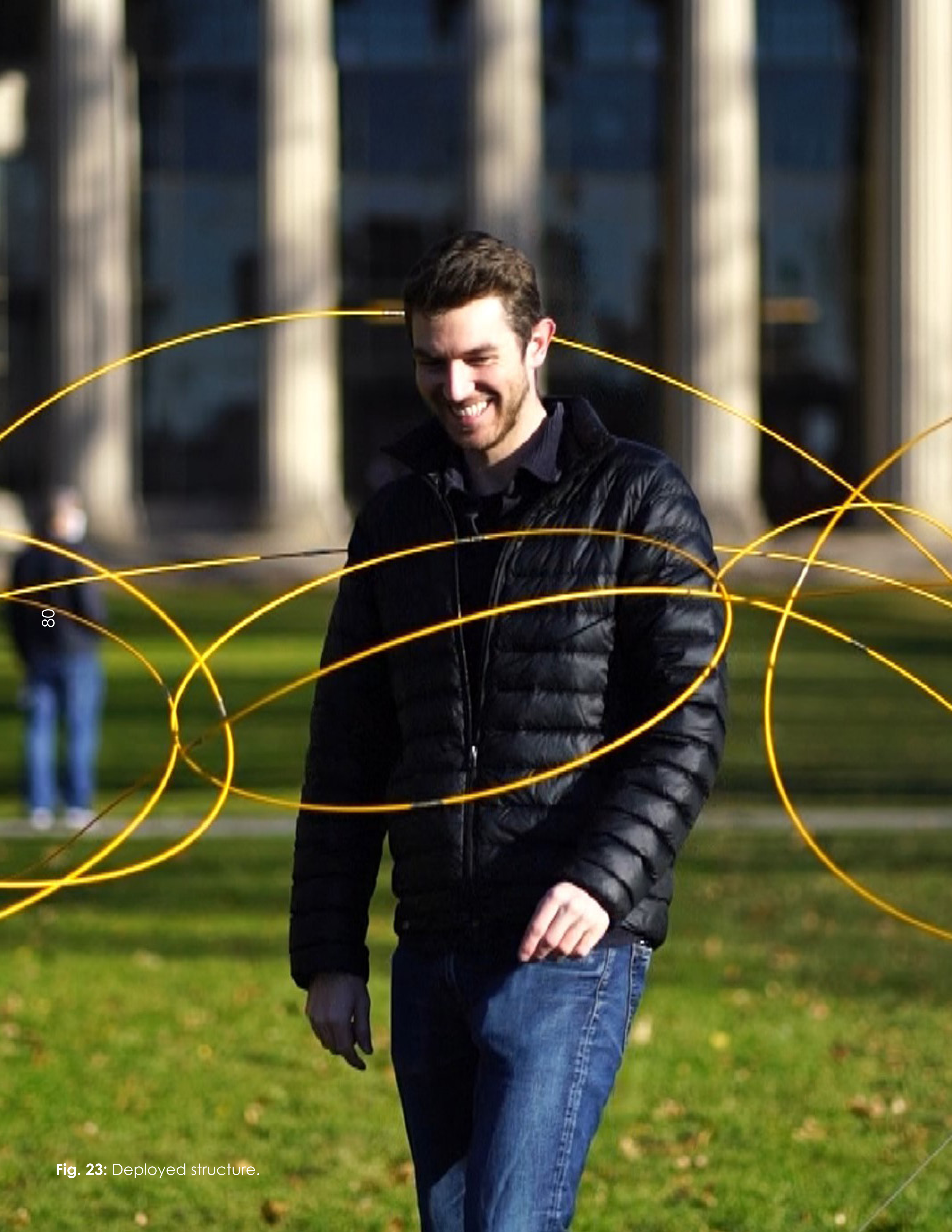


Fig. 23: Deployed structure.

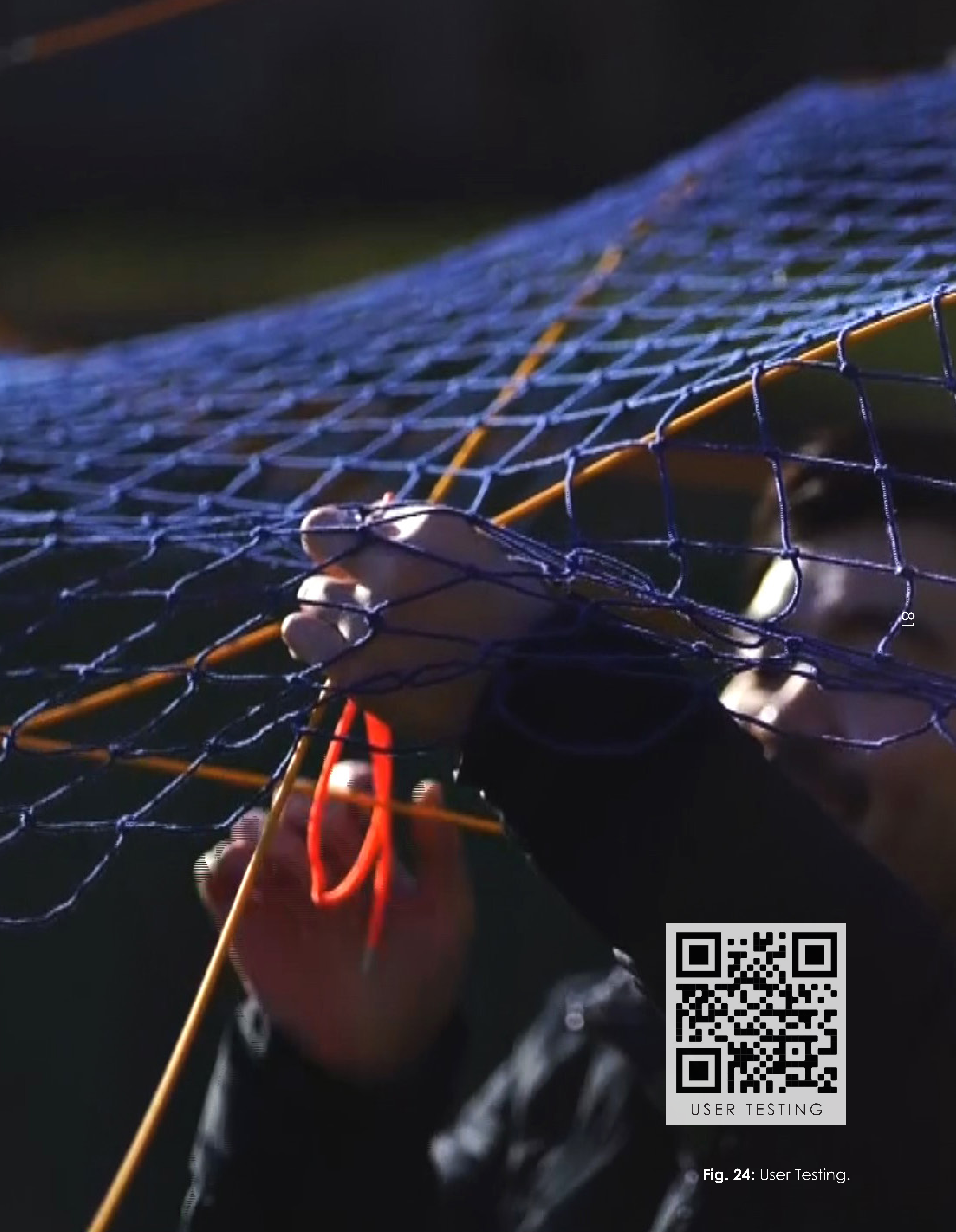


Fig. 24: User Testing.

This thesis focused on designing three sets of gifts to tackle learning objectives central to architectural education, and to understand how different artifacts can be combined and deployed at full scale, facilitating creative and playful learning opportunities.

The biggest design challenge was how to design artifacts and create prompts that are deliberately ambiguous, and allow room for imagination to discover the potential of these objects. The natural inclination would be to also enclose usage instructions, but this would prove problematic if students were to be funneled down a set of rules instead of coming up with creative interpretations.

Scaling ideas to the tactile world is also significantly challenging as field conditions are much more complex outdoors, and the instruments are exposed to external forces. When artifacts went full scale, every error was laid plain. Yet, this thesis views these challenges as positive learning opportunities, which would not be able to simulated at a desk or computer.

At the moment, this project is at the early stages of development. Post-thesis, the next phase of project development will be collaboration with an educator or education expert to develop the curriculum and lay out particular lesson plans, as well as doing more user testing to fine tune the artifacts and bring it into real world application.

Fig. 25: User Testing.

Conclusion

Beyond the design challenges and taking architectural learning outdoors, this thesis has challenged me on an entirely different level. Early beliefs that architecture could bring something to childhood education through engagement with a full-scale real-world environment were quickly displaced by the realization that architects are themselves deficient at working outdoors and at full scale. Through this thesis exploration, I realized that I have also missed this version of early childhood education at a higher level.

In a way, our current early education model has been largely shaped by Fredrich Frobel, who invented kindergarten and didactic wood blocks to be manipulated and reconfigured on a desk. Froebel's Gifts arguably has deeply influenced the world of architecture, including some of the world's most famous architects, like Le Corbusier, Frank Lloyd Wright, and Buckminster Fuller. If what Froebel taught us 150 years ago was a playful education model at our desks, how would this thesis serve as an alternative educational model by having students play with architectural-scale instruments? What kinds of architecture might emerge from the students who engage in haptic, imaginative play rooted in the real environment?

This thesis envisions the emergence of a new generation of creative thinkers from this new model of learning, by activating immense creative potential that would otherwise lie dormant and untapped. To be able to thrive in the fast changing and unpredictable world, people must learn to think and act creatively in real environments; these explorations present a way of doing so through integrating playful learning into real world experiences. Architecture can no longer be passive in cultivating our future. By integrating complementary models of imaginative play into architectural education, new learning opportunities can be fostered for a new generation of designers.

8. Huizinga, Johan, 'Homo Ludens: A Study of the Play Element in Culture', Beacon Press, 1971

Fig. 26: Users collect materials found on site for load test.

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Fig. 27: User Testing.

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Fig 3. Sterling College. Outdoor education program. 2014. https://www.flickr.com/photos/sterlingcollege/

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