

MIT Open Access Articles

Hybrid Basketry: Interweaving Digital Practice within Contemporary Craft

The MIT Faculty has made this article openly available. **Please share** how this access benefits you. Your story matters.

Citation: Zoran, Amit. "Hybrid Basketry: Interweaving Digital Practice within Contemporary Craft." *Leonardo* 46, no. 4 (August 2013): 324-331.

As Published: http://dx.doi.org/10.1162/LEON_a_00603

Publisher: MIT Press

Persistent URL: <http://hdl.handle.net/1721.1/80357>

Version: Final published version: final published article, as it appeared in a journal, conference proceedings, or other formally published context

Terms of Use: Article is made available in accordance with the publisher's policy and may be subject to US copyright law. Please refer to the publisher's site for terms of use.



Hybrid Basketry: Interweaving Digital Practice within Contemporary Craft

Amit Zoran
MIT Media Lab
75 Amherst, E14-548
Cambridge, MA 2142
USA
amitz@mit.edu

Amit Zoran

ABSTRACT

Contemporary 3D printing and traditional craft rarely meet in the same creation. They tend to live in different worlds. In this paper, the author argues for merging these two distinct traditions. To that end, he developed hybrid basketry, a medium where 3D-printed structures are shaped to allow the growth and development of hand-woven patterns. While the 3D-printed plastic elements contribute the aesthetics of the digital curvatures and manifolds, the hand-woven reed, jute, and canvas fibers infuse the baskets with a unique organic appeal. The author discusses his motivation, describes the making process, and presents four hybrid baskets, integrating a deeper discussion on the place of craft and tradition within our contemporary approach to design and fabrication.

Introduction

Design language is constantly changing. Digital fabrication is on the rise, and parametric tools are transforming the design landscape. Three-dimensional printing is the hot topic of the day, enabling digital practitioners to rapidly implement their ideas [1]. The intrinsic nature of this programmable mode of creation has a major impact on the physical value of the produced artifact. In particular, digitally designed artifacts are intrinsically reproducible: one can always make another identical copy of a 3D-printed object. This style of production stands in stark contrast to traditional craft, where artifacts are individually produced, and repetition of the exact same design is almost impossible.

While craft and art are dynamic practices that respond to new technology trends, 3D printing is still a sterile domain, limited to digital media. In my work, I seek a dialog between digital practice and traditional craft, merging qualities to create a hybrid territory. I demonstrate that tradition can be merged into a hybrid, contemporary “making” practice that respects its double origins. While computational digital design enables an exploration of forms and structures free from traditional fabrication limitations, craft contributes an intimate engagement between the maker, the material, and the product.

In an early project, I merged digital fabrication with ceramic craft in a process that requires an actual restoration of traditional handcrafted objects [2]. I used innovative 3D fabrication techniques to articulate the absent form of the broken originals, thus creating something new while also commemorating what was lost. For example, by holding shards of pottery together with a 3D-printed lattice that follows its naturally implied form, a new object is created from pieces of a shattered one. In this way, technology is used not simply in the service of the revolutionary possibilities of digital production, but also in the service of other one-of-a-kind artifacts.

In the projects presented in this paper, 3D-printed structures are designed to accept the development of hand-woven fiber, intertwining the two different practices into a single artifact. In contrast to a fully digitized design process, hybrid basketry is a search for agreement and



collaboration between practices. A unity among subjective investment, the use of organic materials, and uniqueness of the final artifact is sought. Here, I explore a synergy between digital practice and craft, based on equality rather than breakage and trauma as in my early work. Following this motivation, I present four hybrid basket projects that span a creative space of parametric design as well as manual artistry. But before delving into the artifacts, I will start by providing some context on the art of basketry.

Context: Basket Makers and Cultural Expression

Looking at my work, people have to see many different pieces. Often my work is from dreaming—when I sleep, I dream the patterns and then I draw them, they become clear to me in time and then I put colors together. Each one, for me, is special. None are the same.

-Thitaku Kushonya, workshop brochure

Thitaku Kushonya is a traditional basket maker from Maun, Botswana (Figure 1). Learning basketry from her mom, who used to make functional containers for domestic use, Kushonya gave it a modern interpretation by adopting a Western view on originality, uniqueness, and the individual. She doesn't want her work to be used, but rather to be presented and treated as artwork. Each of her coiled palm-fiber works has a different graphical pattern. Basket-making time can vary from a week or two up to several months, depending on the complexity of the work. Designs and patterns are not arbitrary; they are influenced by traditional Kavango style and dreams. Thitak emphasizes the uniqueness of the work and the originality of the graphic. She has her personal intention and technique, so she is the only person producing her baskets.



Figure 1. Thitaku Kushonya (right) in her basketry shop in Maun, Botswana. Photo © 2013 Amit Zoran.

I first met Kushonya in July 2011 while collecting materials on traditional African craft. I was mostly influenced by the level of engagement Thitaku, similar to other local makers, has with her practice—an intimacy that stood in stark contrast to the digital realm of my work. Collecting palm leaves in the Kavango delta, preparing the fibers and their pigments, designing

and making the baskets: each of the making stages has potential for creative experimentation. For example, in addition to the variety of patterns and forms, Thitaku investigates alternative materials, such as fibers made from a green nylon bag mixed with palm fibers, and demonstrates the flexibility of a tradition that is often considered highly conservative.

Thitaku Kushonya is more than just a gifted maker. She is also the voice of the Botswana basketry tradition, traveling abroad, promoting the traditional craft, visiting local villages to collect baskets and train makers as producers of collected artwork rather than functional objects. Working with over 450 traditional weavers, Thitaku's organization, Botswana Quality Baskets, empowers makers to use their craft to become self-sufficient, assisting the producers with quality training, design, marketing, and logistics. In an age where mass-produced plastic and nylon containers are cheaper and more accessible, basket makers are looking for identity. Contemporary basketry in Africa, like other traditional crafts around the world, is losing its place as a practical tradition. While knowledge is still preserved by older generations, the search for modern identity is moving forward.

At the heart of basketry lies the practice of intertwining different material elements to reinforce an artificial structure. Unlike woodworking, blacksmithing, and pottery, basketry is not tied to a specific raw material or tool. Basketry practice grows from the inside out—like trees growing over time—in an organic and emergent process. This is the art of pattern repetition and structural growth, as discussed by Tim Ingold in his essay “On Weaving a Basket” [3]. But similar to cloth making, most baskets are based on organic materials, which makes it difficult to study their origins [4]. Recently, archeologists have demonstrated the possibility of an early use of bamboo basketry in Southeast Asia, even with the absence of stone tools [5], by reconstructing early craft conditions of a pre-agricultural period. Based on evidence from bird weavings, it is safe to assume that basketry is one of the oldest practices of humanity.

Ancient as it may be, basketry is a flexible craft that was independently developed by many cultures. It appears in a huge variety of forms, designs, and sizes. Raw material varies from bamboo and cane [6] to pine and leaves [7], and today even metal and plastic wires. Many basket traditions borrow elements from other crafts, such as wooden handles and legs. These qualities of basketry (adaptability, changeability, and usage of a variety of technologies and raw materials) make it a perfect domain for experimentation. Many contemporary makers have visualized this quality, and beautiful examples are illustrated by Billie Ruth Sudduth's *Baskets: A Book for Makers and Collectors* [8].

Exploration

As an accommodating, forgiving craft, basketry invites collaboration with digital practices. Technically, the construction of one-dimensional elements that use woven (or other) patterns, and the discrete nature of the basket's graphics, are relatively easy to model. Indeed, over the last few years several projects have articulated the use of computational technology to explore digital weaving. An example is the work of Rizal Muslimin [9], who demonstrates how computational design of woven structures can be implemented in architecture. While algorithms for digital weaving have been explored in an early work by Matilda McQuaid [10], Zubin Khabazi enabled designers to study and implement computational weaving using Grasshopper, a parametric plug-in to Rhino3D [11]. He divided a 3D surface into a woven pattern of warps (the longitudinal thread), and wefts (the transverse thread) creating networks of woven curvatures. This last work served as a starting point for my investigation.

Basket I

Due to its woven structure, I call this first work a basket, but it may resonate more with the traditional shape of a vase. Modifying Khabazi's weaving algorithm, this artifact demonstrates digital possibilities that cannot be implemented in traditional practice (Figure 2). Using an Objet Connex 3D printer, which allows a linear combination of two different printed materials, a smooth surface was deformed to a woven pattern by several linear steps (from the bottom up). *Basket I* demonstrates surface deforming, starting with a smooth texture and a single white color and developing to a woven pattern with black warps (Objet's flexible material) and white wefts (Objet's rigid material). In the bottom of the basket, I manually wove natural reed into the pre-designed 3D-printed wefts, to achieve a simple demonstration of hybrid structure.

Basket I demonstrates the potential in revising 3D printing and digital design to achieve traditional craft aesthetics, such as the woven pattern. Starting by designing a sleeve with freehand deformation of a cylindrical surface, I then decomposed the surface to warps and wefts. Based on Khabazi's work, my modification of his algorithm enabled a non-uniform woven development, allowing control of the relative distance of the warps from the base surface. This virtually designed structure was then printed in one piece, before weaving the wet, flexible reed inside it.

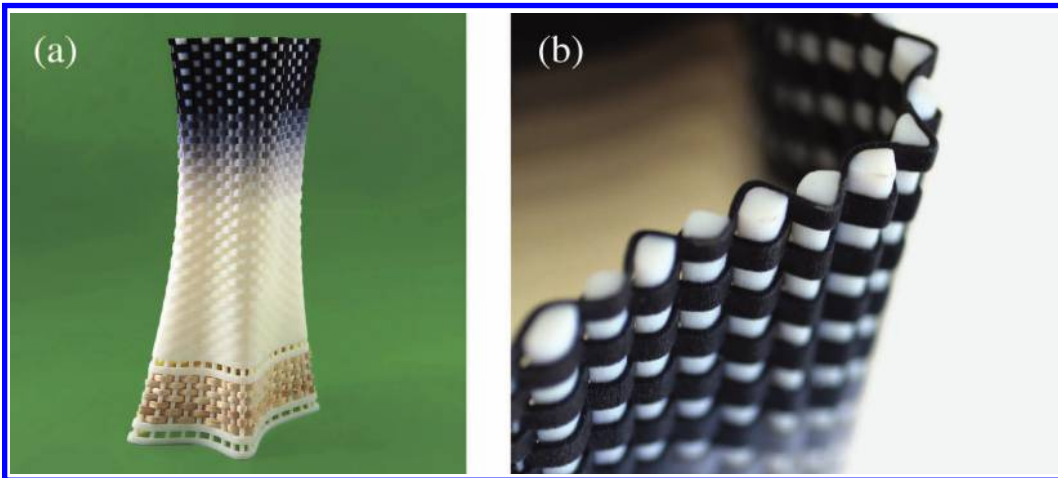


Figure 2. *Basket I*, made by an Objet Connex 3D printer and reed. © 2013 Amit Zoran.

Basket II

Basket I is an aesthetic illustration of the potential of parametric design and multi-material 3D printers. However, the manual part of that work is limited and doesn't show a balanced exchange between the practices. As a digital practitioner, it was my first attempt to design for manual weaving. While *Basket II* still mainly relies on digital process, it presents a higher degree of investment and skill development for the maker (Figure 3).

In *Basket II*, I used a new implementation to join reed and 3D-printed structures, rather than the weaving technique. I used a structure of layers, where 3D-printed miniature arms (Nylon 12 material printed by a selective laser-sintering process) are the bases of the basket, and two separate horizontal and vertical reed layers cover it from the outside. Due to its size (60cm long), this basket when printed was divided into four separate parts that were glued together manually. Several virtual renders were made beforehand, to test dyes and different reed arrangements, prior to manually completing the design and gluing the reeds to the structure.

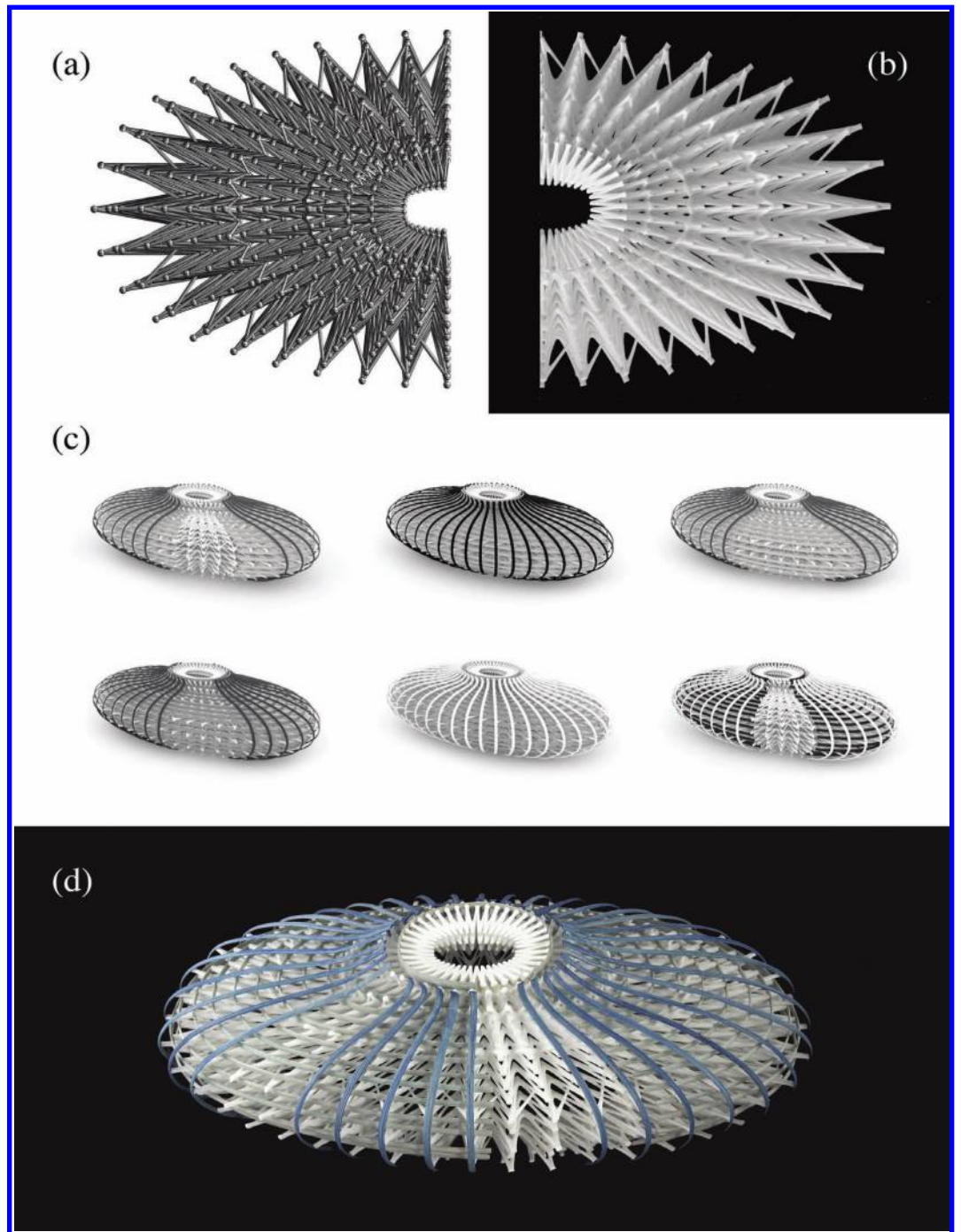


Figure 3. The making process of *Basket II*. (a) CAD design of the 3D-printed arms structure. (b) The 3D-printed Nylon 12 structure. (c) Six renderings of reed colors and arrangements. (d) The final basket (3D-printed nylon, reed, pigments, and glue). © 2013 Amit Zoran.

Basket III

Basket III demonstrates a weaving technique, wherein in a 3D-printed lattice guides the woven reed in pre-defined paths (Figure 4). Similar to the previous work, dyed reed was manually woven into the brittle 3D-printed nylon object, reinforcing it to a solid artifact. The design of the basket is based on 2D weaving guides (Figure 5) that were rotated to achieve a closed oval shape. The printed nylon acts as the basket's wefts, while the reeds are the warps.

This basket owes its shape to the marriage between the two materials. The 3D-printed structure alone doesn't resemble the final form, and the two elements are essential in order to achieve physical stability. In many aspects, the result was a surprise, since the final hybrid shape was not simulated during the design, and the aesthetic qualities of the basket first appeared while manually weaving the reed (which took approximately six hours). For me, this work was the first real “workmanship of risk” within the hybrid basketry project—a quality so essential to real craft [12], where the shape of the crafted object is never predetermined.

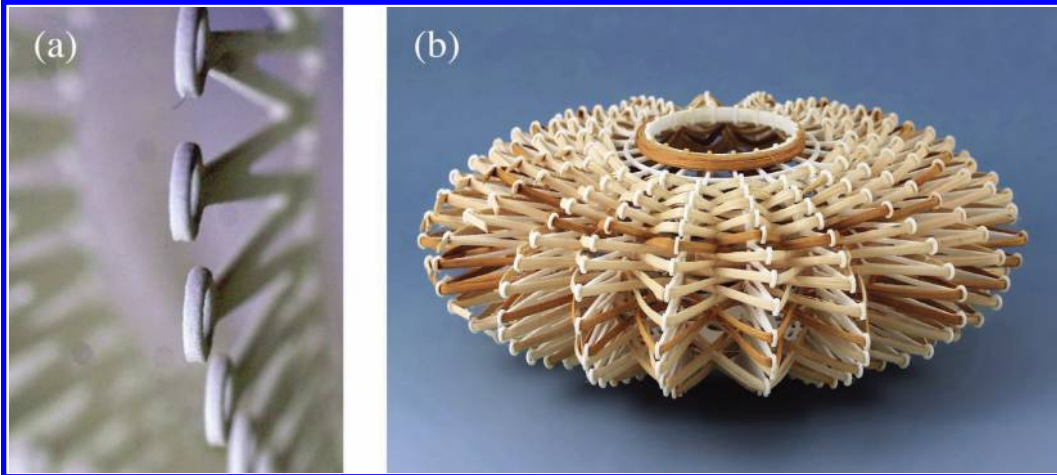


Figure 4. *Basket III*. (a) 3D-printed nylon structure, and (b) the complete basket with the dyed reed. © 2013 Amit Zoran.

Basket IV

The last project is, in a sense, the most accurate manifestation of my intention within hybrid basketry (Figure 6). Here, unlike the previous projects, the manual investment was greater than the digital one, as it took me almost a week of work (2-3 hours a day) to complete the weaving of canvas and jute ropes inside the 3D-printed construction. While the overall shape of the basket depends on the computational process (and may be difficult to achieve within traditional practice), the woven pattern was only partially pre-defined in the computer, and a lot of freedom was available for the weaving stage itself.

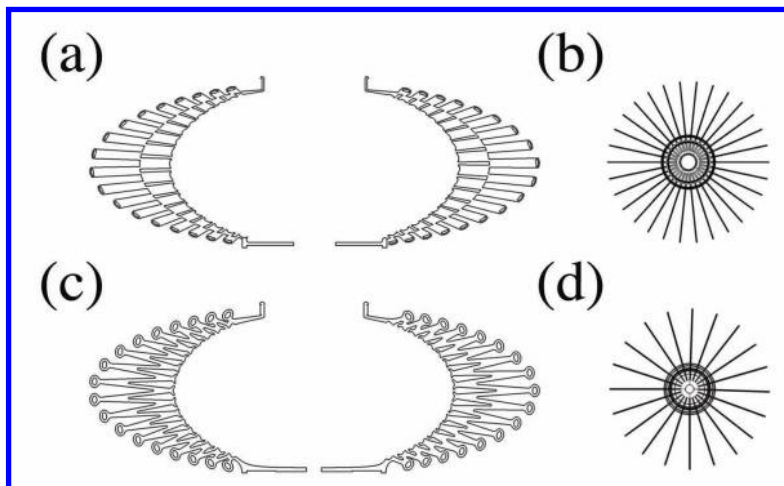


Figure 5. The design process of *Basket III*. (a) An early 2D support structure, and (b) its rotation plane. (c-d) The final basket's 2D support structure with its rotation plane. © 2013 Amit Zoran.

The 3D-printed sleeve was designed in a process similar to *Basket I*: starting with a sleeve and using freehand deformation of a surface, I sliced the surface to horizontal bands and used these slices to make deformed cylinders (Figure 7). This cylindrical weft structure constrains the weaving's vertical pattern. In addition, the horizontal density of the weaving process, the weaving pattern itself (such as how many wefts should be included in one loop), and the type of rope and its color (canvas or jute) allow for a vast design exploration during the making process. The result is a unique artifact, with a singular surface pattern. The 3D-printed structure offers



Figure 6. *Basket IV*: Nylon 12, jute and canvas ropes, pigments, and a rosewood plate. © 2013 Amit Zoran.

digital freedom, but it requires the woven rope for reinforcement and stability.

Summary

In this paper, I explore what have conventionally been treated as two divergent realms: emerging digital technologies and timeless hand-hewn craft. This work allowed me as a digital practitioner to be engaged in the making process and invest many hours practicing my new unique basketry skills. It is, in a sense, a physical manifestation of an intensifying desire to develop a new way of thinking about these polarities: the machine, as generator of control and innovation, and human manual skill, as preserver of artistic production and culture. This is an investigation of our

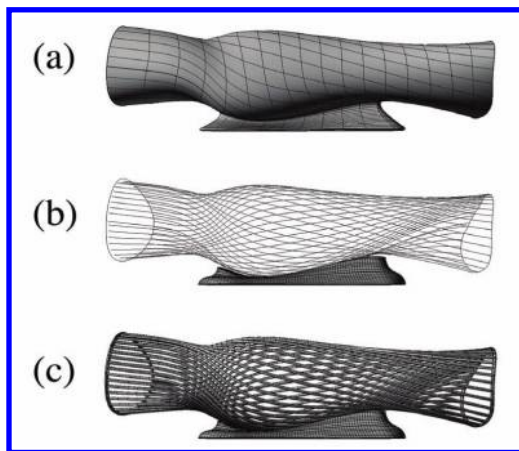


Figure 7. Three design stages of *Basket IV*: (a) lofting and twisting a sleeve surface to create the overall shape, (b) slicing the sleeve to horizontal stretches, and (c) creating a solid structure that can be 3D printed. © 2013 Amit Zoran.

digital culture and our potential to reclaim a lost material identity in the cyberspace of design and fabrication. Here, two distinguished practices, hand-woven organic fiber patterns and computationally driven 3D-printed structures, are assembled to become a hybrid material territory. My hope is to substantiate a this new hybrid territory for investigation and discovery, in which the value of artifacts produced by both machine and man can infuse our excitement about technological progress with a need to remember the very soil from which it came.

While the motivation of this work was to encourage dialog between material practices, this essay demonstrates a work by one individual. While mastering the digital-design arena, I took only a few steps toward the craft of weaving. As such, the scope is limited to my subjective interpretation and perspective, and thus more work is needed, with more participation by creative makers to claim a cultural practice. Hopefully this project will inspire other makers to preserve and integrate, while still innovating and progressing.

Acknowledgements

I would like to acknowledge Marilyn Levine, Roy Shilkrot, Susanne Seitinger, Tamar Rucham, Azra Aksamija, Leah Buechley, Dena Molnar, and Ifaat Shoshan for their guidance and support. This work was funded (in part) by the Council for the Arts at the Massachusetts Institute of Technology and Objet Geometries Inc., and could not have happened without them. Special thanks to Thitaku Kushonya, who shared her knowledge and opened a door to the world of basketry.

Work described in this paper will also be presented in this year's Art Gallery, XYZN: Scale.

References

1. Gershenfeld, Neil, *FAB: The Coming Revolution on Your Desktop—From Personal Computers to Personal Fabrication* (New York: Basic Books, 2007) 3–27.
2. Zoran, Amit and Leah Buechley, “Hybrid reAssemblage: An Exploration of Craft, Digital Fabrication and Artifact Uniqueness,” *Leonardo*, Vol. 46, No. 1, 4–10 (2013).
3. Ingold, Tim, “On Weaving a Basket,” *The Perception of the Environment: Essays on Livelihood, Dwelling and Skill* (London: Routledge, 2011) 339–348.
4. Koenig, Hazel, Spencer Moseley and Pauline Johnson, *Crafts Design* (Belmont, CA: Wadsworth, 1965) 124–209.
5. Bar-Yosef, Ofer, et al., “Were Bamboo Tools Made in Prehistoric Southeast Asia? An Experimental View from South China,” *Quaternary International*, doi:10.1016/j.quaint.2011.03.026 (2011).
6. Ranjan, M.P., Nilam Iyer, and Ghanshyam Pandya, *Bamboo and Cane Crafts of Northeast India* (India: DC Handicrafts, 1986).
7. Mallow, Judy, *Pine Needle Basketry: From Forest Floor to Finished Project* (Asheville, NC: Lark Crafts, 2010).
8. Sudduth, Billie Ruth, *Baskets: A Book for Makers and Collectors* (Gloucester, MA: Hand Books Press, 1999).
9. Muslimin, Rizal, “Learning from Weaving for Digital Fabrication in Architecture,” *Leonardo*, Vol. 43, No. 4, 340–349 (2010).
10. McQuaid, Matilda, *Extreme Textiles: Designing for High Performance* (New York: Princeton Architectural Press, 2005).
11. Khabazi, Zubin, “Generative Algorithms—Concepts and Experiments: Weaving” (2010), <www.morphogenesisism.com>, accessed 22 November, 2012.
12. Pye, David, “The Nature and Art of Workmanship,” *The Craft Reader*, ed. Glenn Adamson (New York: Berg, 2010) 341–353.