16 Woven Circuits

An Interview with Taeyoon Choi

Shannon Mattern and Taeyoon Choi

The Jacquard loom, programmable by punched cards when it appeared in the early nineteenth century, weaves together the histories of textiles and computation. Entangled in those two histories are a number of shared concerns, including the tensions between craft and automation, between formula and experimentation, between technique and expression; the influence of new tools and industry demands; and the knotting together of manual and intellectual labor. These were also among the central preoccupations of the Bauhaus and its weaving workshop, where the institution's few women used a variety of contraptions, including Jacquard looms, to fashion rugs, wall hangings, and other textiles—as well as a new feminist theory of design, art historian T'ai Smith argues.[1]

The work of these weavers, and particularly that of Anni Albers, who went on to lead the weaving department at Black Mountain College from 1933 to 1949, has been threaded through the work in another present-day workshop: the acclaimed School for Poetic Computation (SFPC), where collaborators explore the intersections of code, design, hardware, and theory. Drawing intellectual and pedagogical inspiration from Albers, SFPC fashions itself as "a space where logic meets electricity, math meets language, and analytical thinking meets creative expression." In this interview with SFPC cofounder Taeyoon Choi—humbly self-described artist, educator, and activist—we study those seams linking SFPC to Albers's workshops. In the process, we examine how programming is (and isn't) like weaving, how an awareness of history enhances our engagement with new tools and demystifies technology, why "teaching and learning to code" should emphasize poetry as much as pattern, why poetic computation demands a sensitivity to machinic materiality, and how logical systems can facilitate poetic expression.

Shannon Mattern: As we trace the hundred-year-long thread that ties the Bauhaus to today's design and craft, I wonder what pedagogical value you see in infusing our

contemporary practice—particularly computational practices—with historical awareness. Historical and intercultural exploration were key to Anni Albers's work. In *On Weaving*, she wrote, "I find it intriguing to look at early attempts in history, not for the sake of historical interest, that is, of looking back, but for the sake of looking forward from a point way back in time in order to experience vicariously the exhilaration of accomplishment reached step by step."[2] And in a 1968 interview she discusses her own speculative historical pedagogy, one based on imagined fundamentals and first principles. She states: "I tried to put my students at the point of zero. I tried to have them imagine, let's say, that they are in a desert in Peru, no clothing, no nothing, no pottery. ... So what do you do? ... How do you gradually come to realize what a textile can be?" When we consider traditional technologies like the Peruvian backstrap loom, she says, we see that it "has embedded in it everything that a high power machine loom today has. And they understand it in a completely different sense than walking into a factory and seeing these things operate because they know what is necessary and what kind of inventions have occurred in the course of history."[3] How can such historical consciousness, and an understanding of basic principles (mechanical, electrical, communicative, etc.), help us to learn computation? And why is Albers's work one of the touchstones—one of those past places from which we can look forward—for your work at SFPC?

Taeyoon Choi: SFPC is an artist-run school based in New York City within the Westbeth Artist Community, which, from 1898 to 1966, was the headquarters of Bell Telephone Laboratories. Our main program is a ten-week immersive session for adult students to learn coding, electronics, critical theory, and poetry. We also offer a variety of public programs, such as our "Learning to Teach" conference for educators teaching computation in creative fields. Our motto is: more poetry, less demo. As an artist and educator, I've been teaching and working in administration at SFPC for six years from school's beginning.

The idea of computing long predates the development of transistors and, similarly, extends far beyond a strictly Western narrative. Approaching computing with a historical and global consciousness allows us to appreciate the generativity of other traditions. Various cultures, for example the medieval Islamic world, had mechanical forms of computers. Knowing the variety of past inspiration helps us understand how present technologies can inspire the future we want to see.

In her work at Black Mountain College, Albers also considered the dynamic between fundamental concepts and technique—how the evolution of form is driven in large part by the material properties of the medium. She writes: "Creating means ... reacting to material rather than the execution of a dream, as the layman conceives it. The first

vision of something to be done gives more the mood of the work than its final form. The form emerges as the work progresses."[4]

Thinking more about the evolution of forms: The words "text" and "texture" share a common lineage, stemming from the Latin *texere*, meaning to weave. At SFPC, we want our students to engage deeply in the materials and the fundamental logic of computation. We ask them to have a conversation with the material, iterate with it and progress the concepts through it. Similar to how Albers envisions weaving, it is our hope that thinking *materially* through computation will evolve into forms that might have initially been inconceivable.

SM: I'd like to talk a bit more about the threads connecting weaving and computation. T'ai Smith draws a distinction between weaving and painting. "Unlike painting, where the formal idea is laid on top of the canvas support," she says, "weaving's design is embedded in the material and process of its making." The weaver "develops the design in tandem with the fabrication of the surface."[5] Computation has its own distinctive materialities—its own ways of relating figure and ground, design and support surface. Could you describe how weaving is like computation, and how it's not?

TC: To begin on a granular level, weaving and coding share the logic and action of 0's and 1's, stitch and pass. Both activities depend upon information, instruction, and repetition; they share a logic that is transmitted through language, and that language can either be a line of code or a weaving design. They share a powerful transformative quality: turning information that is two-dimensional into an object or experience or interaction that is three-dimensional.

It gets a bit more interesting when we think about their differences. With coding, that dimensional transformation is usually not seen. Its execution occurs in the background, which means it happens invisibly for most users. Weaving makes that execution tangible and highly visible. The next difference is in regard to iteration. Software runs and changes; it transforms the data fluidly. But if you want to iterate on a woven piece, you have to either start a new one from scratch or unweave to where you want to change your pattern. In that way, code forgives more easily, as iterations and changes can be done quickly and without leaving any trace history. The act of undoing with physical materials leaves a mark: the yarn might feel looser than it was before, for example.

SM: Let's talk a bit more about how we can help our students appreciate the materiality of their tools—including code. How can we practice a materialist pedagogy? Albers proposed that "tangible material can teach that it has demands of its own and suggestions of its own for its forming."[6] Can we say the same for the material of code? It's

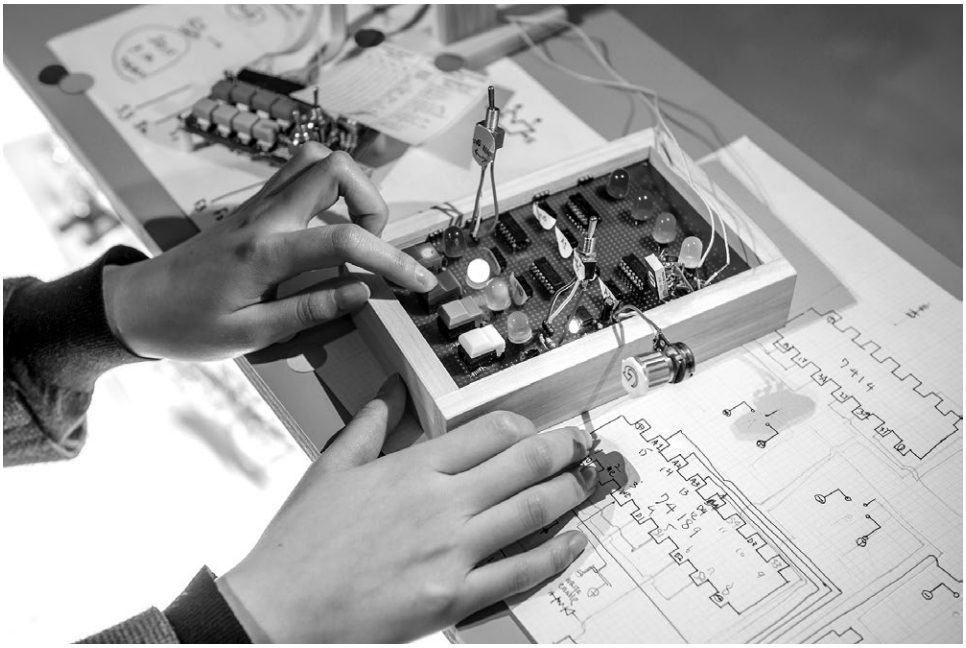

Figure 16.1
Taeyoon Choi, Handmade Computer, 2013–2017, custom electronics and drawings. Image credit (left image): National Museum of Modern and Contemporary Art, Korea. (Also plates 11–12.)

also worth noting that Albers's teacher, Gunta Stölzl, the only female master at the Bauhaus, thought that weaving's material affordances—"play with form and color, ... the ability to feel and adapt strongly, more rhythmic than logical thinking"—made it a distinctively feminine field.[7] I imagine you'd strongly disagree. How does SFPC frame materiality—epistemologically, ideologically, and so forth? How, through your pedagogy, do you reinforce the *integration* of logic and rhythm and poetry?

TC: Something that's great about being in the same room together at SFPC is that we can try things out in real life, with each other. There are a number of activities we do to help students appreciate that computing is a series of instructions, which can be performed materially. We play "becoming pixels," where each student functions within an array of pixels, transforming themselves into an embodiment of data. Another activity is enacting a sorting algorithm. When I explain binary logic, I ask a student to become a logic gate—AND, XOR, or other gates—by responding to a two-hand gesture that they take as input. More complex computing paradigms and systems can be explored by making illustrations, writing stories, or designing playful games. In enacting and

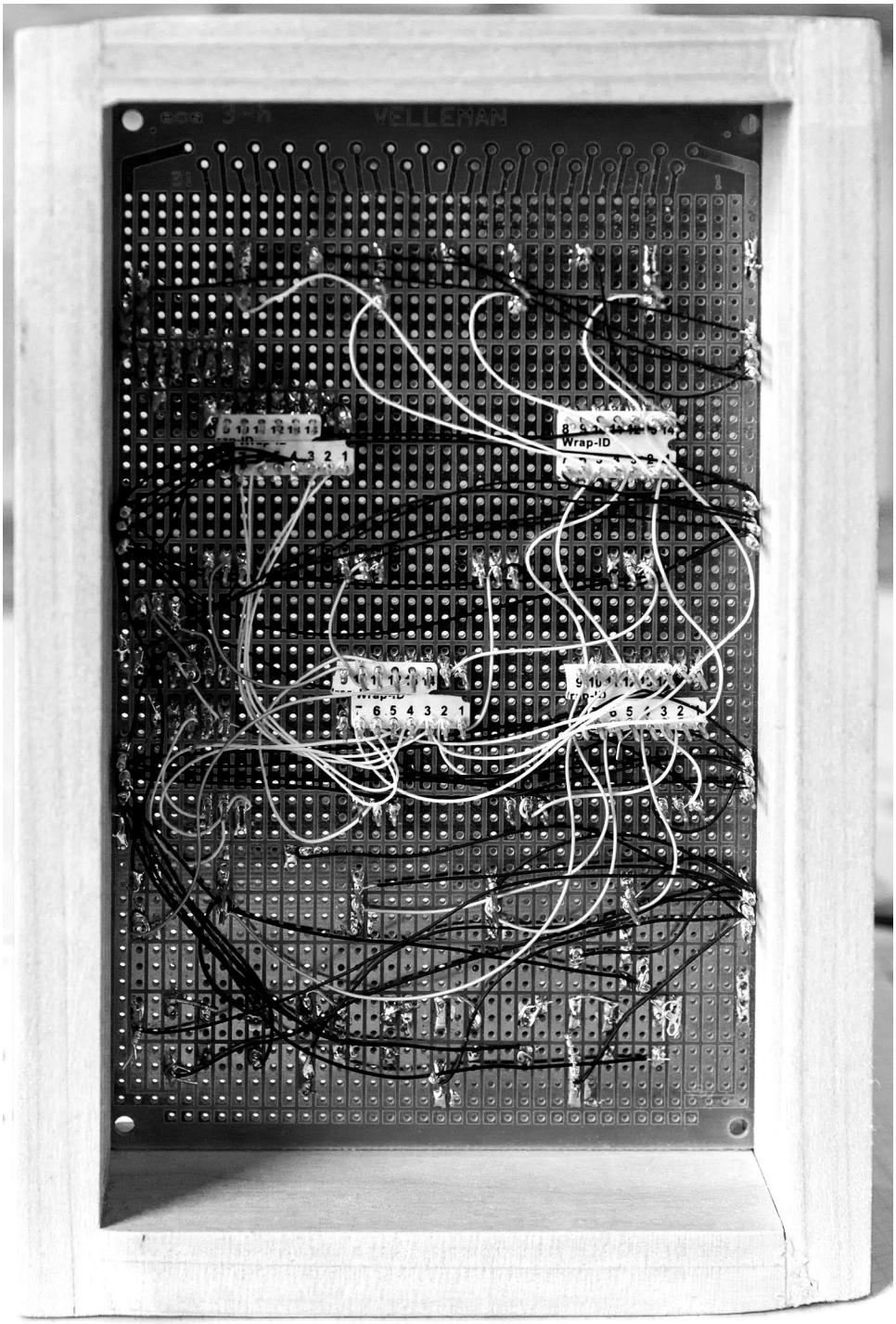

Figure 16.1 (continued)

performing instructions, by physically *feeling* computing, a poetics of computation emerges. This focus on mechanics often reveals the poetics and play inherent in code. This can mean finding poetics in the failures, glitches, and misinformation of computation as well. Embracing the intentional and accidental process of expression one can create with code leads to poetic computation.

Practitioners who experiment with the materiality of computing and weaving tend to employ two different approaches. Some people explore these connections by building tools, reinventing through crafting and new technologies. This approach prioritizes the tool as the poetic work, as in the work of Pam Liou, who created Doti: Desktop Jacquard Loom.[8] The other approach focuses on poetic outputs—for example, creating something, such as custom textiles, with ancient or contemporary tools. The emphasis here is more on the output than the enabling constructs. Although tools may not be their initial concern, their work often requires the creation or customization of tools to make something unique. Here I am thinking of the work of Mariko Kosaka, who creates computationally designed, handcrafted knitting projects, and who also talks about Knitting for Javascripters.[9] And of course some practitioners are interested in both, in storytelling through both the tool itself and its output. An example of this hybrid approach is the work of KOBAKANT, a collective that works on electronic textiles and wearable technology (http://www.kobakant.at/). All three names I've mentioned are artists I respect, who've taught at SFPC or continue to inspire how we think about poetic computation.

To your point on the gendered labor of weaving: weaving is certainly not limited to women; there is plenty of historical and contemporary cultural evidence that defies this stereotype. However, reclaiming the preconceived notion of feminine craft can offer something new, as my former student from NYU ITP, Francesca Rodriguez Sawaya, explained to me. She writes: "something I've seen [in] presenting my work about weaving stories is that women naturally feel attracted to it. And in societies where technology and engineering are really separated from arts and crafting, it's a good way to start connecting these two worlds and to involve more women in tech. [And] in the same way weaving has historically empowered female identity, it could also be a great tool to use today to empower females and get them more involved in the tech sector."

If weaving and coding can be equally appreciated in early education, I think we may cultivate a generation of creative individuals whose interests are as fluid as their identities. In other words, we should celebrate boys who are into weaving, as much as girls who are into coding.

SM: In "Handweaving Today," Albers argued that "teaching should be the development of structures, from the elementary weaves to more complicated derivations rather than the passing on of patterns for weaving."[10] In other words, teaching a craft is not merely a matter of instilling formulas and scripts. Instead, by "return[ing] to fundamentals" and general structures, the teacher can help to "clear the way for new forming." Yet in an age in which "code camps" are filled with both ambitious grade-schoolers and adults seeking a career change, in which the value of education is measured in terms of starting salaries, in which code and data seem to be ends in themselves, how has SFPC managed to balance practical application with experimentation, pattern with poetry? What have we learned from the Bauhaus, and what have you learned in your own work, about why poetry and code are best thought and practiced together?

TC: Returning to fundamentals is central to my practice. My Handmade Computer project began in order to change my relationship with the computer, fundamentally.[11] I wanted to become less of a consumer by demystifying the computer. Processes of technical demystification lead to "new ways of forming," as Albers says, but perhaps we can also say that demystification leads to new ways of giving form to an idea—whether that be through production, fabrication, or by some other means. Technology is a means of effecting power—that is, force or energy; but it's also a tool for manifesting power in a political sense. By demystifying these technologies we can feel less scared, less exploited, and more able to offer creative alternatives. There is so much potential once we see the CPU as a series of sequential and combinational logic systems. As we begin to understand the technologies around us, we change our perception and understanding of the world.

If we look at the trajectories of students at SFPC after graduating, we see some going into corporate industries and others working as artists, making work with computation. The fact that these students coexist, the spectrum of artists that we support, is our way of balancing practical applications with experimentation. This diversity is reflected not only in our students but also in our teachers and founders. We come from a variety of backgrounds, and for me, the most important thing is that we can sit in the same room and discuss the art, engineering, the industry, and the myriad facets of the field altogether. SFPC is not a demilitarized zone apart from the larger tech industry, nor are we an isolated utopia; rather, we act as a fair-trade zone of sorts. We offer alternative, safe places for people who are transitioning or exploring tech to find themselves.

At SFPC we prioritize students finding themselves rather than finding or innovating technologies. Learning through technical boot camps has its value, but boot camps as the sole narrative for computational education is problematic. It's important to

establish a critical and explanatory engagement with computers, and that happens by taking things apart, putting them back together, finding the poetics and the glitches in the code. These experiences become sources of empowerment. And this type of learning enables coding as expression, coding for joy. We're helping artists and technologists find their voice through the poetics and materiality of code. That is the outcome we hope for, and in some ways the formation of the school is a denial of this pervasive binary between experimentation and application. Coding and weaving can be a work of self-discovery, which I think is fundamental to human creativity.

Today, the teachers of critical coding—along with their affiliates in media and information literacy, critical algorithm studies, and related fields—are going through their own processes of self-discovery. In this new age of data leaks and privacy breaches and media manipulation, of inscrutable algorithms and deep fakes, the old pedagogical protocols are proving insufficient. Fundamental logics, like reason and mechanical functionalism, are unraveling. Will counting likes and links—one-time indices of credibility—help us explain the popularity of an extremist ideology? Can studying a backstrap loom help us understand a neural net? Will modeling a graphics processing unit help us discern how proprietary intelligence systems target immigrants for deportation? Perhaps to some degree, but what more must we know about the tangle of technologies, ideologies, and state and corporate interests that enmesh our new algorithmic everyday?

The Bauhaus sought to serve as a bridge between art and industry. Today, countless coders and engineers serve as bridges between governments and corporations, on the one hand, and some of our most vulnerable communities, on the other. In order to understand the tight weave of operational codes behind a Facebook newsfeed or a predictive policing algorithm—to appreciate their potential for both illumination and mystification, liberation and exploitation—we have a lot more ciphering and unraveling to do.

Notes

1. T'ai Smith, *Bauhaus Design Theory: From Feminine Craft to Mode of Design* (Minneapolis: University of Minnesota Press, 2014).

2. Anni Albers, *On Weaving* (1965; Princeton, NJ: Princeton University Press, 2017), 34.

3. Sevim Fesci, oral history interview with Anni Albers, July 5, 1968, Archives of American Art, Smithsonian Institution, https://www.aaa.si.edu/collections/interviews/oral-history-interview-anni-albers-12134.

4. Anni Albers, "Handweaving Today: Textile Work at Black Mountain College," Albers Foundation, http://www.albersfoundation.org/teaching/anni-albers/texts/.

5. T'ai Smith, "'Pictures Made of Wool': The Gender of Labor at the Bauhaus Weaving Workshop (1919–23)," *Invisible Culture* 4 (2002), https://ivc.lib.rochester.edu/pictures-made-of-wool-the-gender-of-labor-at-the-bauhaus-weaving-workshop-1919-23/.

6. Albers, "Handweaving Today."

7. Gunta Stölzl, "Weaving at the Bauhaus," in *Gunta Stölzl: Bauhaus Master* (New York: Museum of Modern Art, 2009), 87.

8. Pamela Liou, "Doti: The Desktop Jacquard Loom," accessed August 6, 2018, http://pamelaliou.com/doti.html.

9. Mariko Kosaka, "Knitting for Javascripters," JSConf US (2015), https://www.youtube.com/watch?v=X1Cc1vrvjdY.

10. Anni Albers, "Handweaving Today: Textile Work at Black Mountain College," *The Weaver* 6, no. 1 (January-February 1941), 4.

11. Taeyoon Choi, "Handmade Computer," *Avant.org* (n.d.), http://avant.org/thread/handmade-computer/.