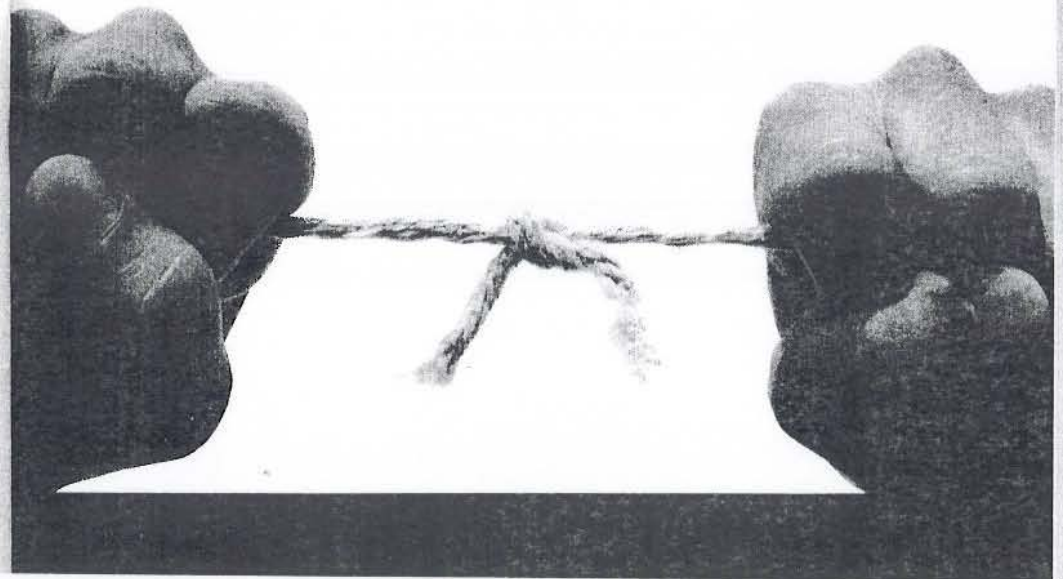


KNOTS

Carol Strohecker

The "bricoleur" [sic]... universe of instruments is closed and the rules of his game are always to make do with "whatever is at hand." ... Further, the "bricoleur" also, and indeed principally, derives his poetry from the fact that he does not confine himself to accomplishment and execution: he "speaks" not only *with* things, as we have already seen, but also through the medium of things: giving an account of his personality and life by the choices he makes between the limited possibilities. The "bricoleur" may not ever complete his purpose but he always puts something of himself into it.

—Claude Lévi-Strauss, *The Savage Mind*



I remember the day I taught my younger brother how to tie his shoes. I was nine years old and he was three, and since I often looked after him, I also frequently found myself tying his shoes. That day, we sat together on our staircase, our legs bent toward us. Looking down at our shoes, I remembered how a little mantra had helped me learn to write a figure 5: the pencil went “down, around, hat” and in three strokes reliably produced the numeral. So I made up a mantra about shoelaces having something to do with left, right, loops, and around, which I recited while moving the pieces of string accordingly—first on my foot and then on his.

My brother’s excitement grew as he observed me and then tried the technique for himself, repeating it until it worked and resulted in a triumphantly tied pair of shoes. His excitement reflected my own as I marveled not only at his diligence, but at the power of the simple mantra. Watching him carefully looping his laces, I saw myself mirrored in a younger child.

My own knot work developed through my teens as I generated macramé designs for belts, bracelets, potted plant hangers, shawls, room decorations, and the like. I adorned my siblings and friends, my walls and keepsakes with knots—in chains, braids and spirals, and with all manner of string weights, textures, and colors. I calculated lengths and costs; mastered arm bends, wrist flicks, hand spans, and fingertip maneuvers; and learned to see things dimensionally, imagining repetitions, alternations, interspersals, and entwinements. I didn’t know I was beginning to think like a mathematician. I was simply having fun. I enjoyed generating the creations and seeing how people received them.

“Knot Lady” was a name I first earned from the children I worked with at the MIT Media Lab. After en-

tering graduate school at MIT, I created a Knot Laboratory where I taught children, most of them around ten years old, to tie knots and talk to me about their experiences. Over a year, we transformed a bleak, urban classroom into a lively laboratory space devoted to learning with knots.¹

Each day at school, I was greeted with a large sign: “KNOT LAB.” Constructed by three students who mixed string knot formations with pictures of a chemist’s flask and party balloons for its design, the sign reminded me of the simultaneously playful and serious business that took place behind those doors.

Inside our “Knot Lab,” children played with string, tacked knots onto display boards, and worked together on stories about knots. The products of their experiments—large, colorful displays of knots in various stages of formation were drawn on paper, tacked to walls, and dangled from the ceiling.

Dozens of knot forms found their home in the Knot Lab. They included simple knots like the Overhand, Figure 8, and Stopper; square knots like the Stevedore and Granny and Thief; and movable knots like the Running Bowline, True Lovers’, and Trumpet. To construct them, the children considered unknots, tangles, mirror images, handedness, and knotty spatial relations—over, under, around, and between. They wrapped, rotated, flipped, twisted, and shifted scales as they tied. Their thinking spanned the deliberate and spontaneous, the rational and affective, the conscious and unconscious. And individual preferences were apparent: some children dealt with a knot as an integral entity produced by moving a single end of the string; others broke the process into steps, following and creating procedural instructions; and still others combined pieces—smaller knots as

modules—to build up more complicated knots. These approaches were each productive, but they were also very different. The knots demonstrate the diversity (rather than the standardization) of styles of learning. They are objects that enable us to explore the inner states of those who tie them.

One of the most avid knot-tyers was a girl named Jill. I remember that she tended to be serious in the lab, that she was neat and polite, and that she liked to sit close, touch, and talk at length about the knots she worked on. She liked being reassured about her work, which was careful and deliberate. What she didn't like was to leave something unfinished. She stayed with her projects until they were done and tried to convince others to do the same. She didn't like to skip steps; she wanted the sense of accuracy that only the careful progression from one detail to the next could provide.

I noticed early on that more than for any of the other lab participants, it was important to Jill to designate clear anchor points for the string as she tied new knots. On the way to producing a knot, she would often resort to stapling or taping down parts of the string. It was important to Jill to articulate and anchor intermediary configurations, in order both to understand a knot and create a record for later reference.

As the project progressed, Jill told me that her parents had recently divorced, and that she and her brother lived half of the week with their mother and half of the week with their father. She mentioned that there was tension in her parents' communication and that it troubled her. She told stories of situations in which any reasonable action on her part would have slighted one of her parents. She seemed to feel herself in a perpetual "double-bind," doomed to doing something wrong no matter what she chose, torn between decisions that her parents might see as representing the interests of one or the other of them.

Jill was absorbed with knots whose completed state involved motion. She once spent days creating an exhibit of such knots, where passers-by could pull the ends of a True Lovers' knot she had suspended from a pipe on the ceiling in order to play with the knot's back-and-forth movement. Jill made several iterations of the knot before the exhibit took its final form, modifying the string to facilitate pulling its ends. To hang her construction, she anchored a long string to a ceiling pipe with a Square knot. A Bowline at the end of this string held one of the two strings composing the True Lovers' knot, which supported the second string wrapped around it. Excited about her construction, she made a "museum label" highlighting the placement of the three knots:

At the very top [on the black pipe] notice the "Square knot" to hold it in place. The knot holding on to the Lovers' Knot [True Lovers' knot] is the "Bowline." Notice the way the strings are two colors. It is that way so it is easier for you to pull it.

To pull take the two strings with the black Lego pieces. Pull hard until the two pretzel knots meet. Then pull hard the two strings without anything on them. Repeat if you wish.

Please pull me.

To me, Jill's final phrase signaled her identification with the knot. And it seemed to echo another voice in her mind that wanted to say: Notice how I am suspended by two knots, one that anchors me and one that holds me. Notice how I am two knots, waiting to be pulled this way and that. I understand being pulled; it is something that I know. Allowing others to pull me is a purpose that I serve.

Through the course of the project, Jill expressed her emotions in knots and tried to initiate some emotional repairs as well: frustrated with being pulled by others led her to devise a step-by-step approach to knot

tying. Others might leave; Jill committed herself in advance to a plan.

Six years after the Knot Lab had closed, I was able to find Jill and another member of the original project. They were curious about reconnecting with each other and with me. Jill remembered me as the “Knot Lady” but claimed not to remember much about knots. I thought that in this she was expressing her anxiety about mathematics. Although Jill had been one of the most avid participants in the Knot Lab when she was younger, in the intervening years she had come to think of herself as a person who was “not good at math,” a self-image all too common among young women. Jill was open to discussing her lab experience and to participating in new projects involving colorful polyhedra but hesitated when our explorations involved some numeric quantification of an idea. The gap between what she could do and what she thought she could do was poignant.

It may be that I am the one for whom the Knot Lab had the most impact. Knot making showed me how commonplace objects can help people think purposefully about continuity and separation, combination and deviation. Through knots I learned that engaging objects can help people to build intuitions about mathematics. And witnessing one of the female participants succumb to stereotypical math phobia after such a strong start as a fifth grader spurred my determination to encourage the representation of different learning styles in all pedagogy.

For many, however, I will always be simply the Knot Lady. My growing collection of knot-oriented gifts serves as constant reminder of this: a ceramic vase with a Square knot decoration and braided handles, a clock with knots in places of numbers, two seared glass spindles entwined to form an elegant bracelet. And new objects and e-mails continue to come my way from people whenever they encounter news about knots—whether it's an article about the usefulness of knot theory in

DNA research, a publication from *The Shipping News*, or endearing knot jokes. In truth, I wouldn't want it any other way. Much as painters relish a blank canvas, writers a fresh page, or moviemakers a darkened screen, I suppose I will always have a penchant for bits of string and the potentials they suggest.

Recently, I asked my brother if he had any memories of learning to tie his shoes. He told me he recalled a moment when he had just completed tying his shoes and left the house to join his friends. I like to imagine that this moment occurred after he mastered the strings and mantra on the stairs, only steps from the front door of our house.

Carol Strohecker was Principal Investigator of the Everyday Learning Research Group at Media Lab Europe, and is now director of the Center of Design Innovation, an institutional partnership of the University of North Carolina.

