Evolution of an Automaton

by Chris Chomick and Peter Meder

How a simple stick figure became four monkeys in motion

"We make automata."

That answer to the question of our employment usually leaves the inquirer with a puzzled look on his or her face as they mentally try to decipher the meaning of our statement. "Automata, what's automata?" Our response of "We make moving figures" turns a light on. "Oh, like those dancing Santas; I have one of those." Technically correct, but not really.

An interest in animation has been a driving force in both our lives. As children we were fascinated with animated window displays, puppets, stop-motion films, mechanical toys—anything that came alive through movement.

We met in Chicago 27 years ago and began experimenting with stop-motion animation. Our first commission was to make a stop-motion puppet for Dutch Boy Paints. That job began a career creating special effects for television commercials. Twelve years ago, we became full-time artists making figurative art and automata; we have never had so much fun.

When designing an automaton, we decide what kind of character will fit the movement; a frenzied motion suits an intense-looking character, while a slow and graceful motion is appropriate for an elegant figure.

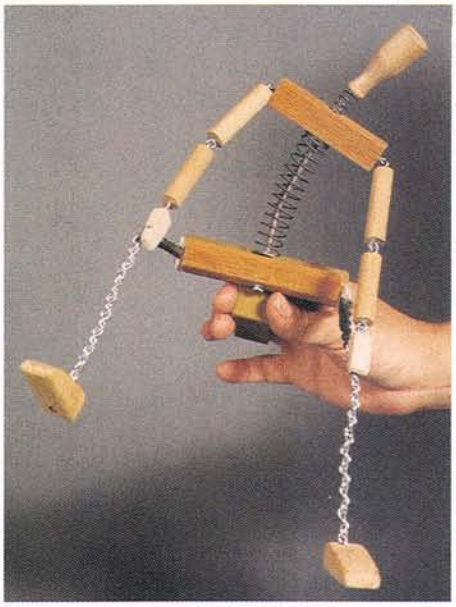
In this case, the prototype design produced a rhythmic side-to-side motion with alternating leg kicks—a happy and playful movement. A monkey was the perfect character choice. Using this mechanism, we created four monkey automata: *Bonzo, Lulu, Marco* and *JoJo*. (*JoJo*, a resin and mixed media autmaton, was produced in a special edition of 50. The others are one-of-a-kinds made of Cernit and mixed media.)

Our initial experiment was to get the most motion out of the simplest puppet. Automata design begins as a stringless marionette controlled from below using internal cables, levers or wires.

The inner workings of antique automata can be extremely

Bonzo

LuLu



This stick-figure armature incorporates springs in the neck and torso. The arms are loosely jointed; the hands are attached to the legs to follow the up-and-down motion of the legs.

complicated. The idea was to make a simple, balanced armature that was robust, trouble-free and – most important–moved naturally.

A basic stick-figure armature was made with springs in the neck and torso. The arms were loosely jointed with the hands attached to the legs so they followed the up-and-down motion of the legs. The balance and movement of the springs seemed relatively natural as it eased in and eased out of the motion on its own.

There are two kinds of automata motion: controlled and passive. In our monkeys, cables attached to each side of the neck control the head movement by pulling the cables alternately and shifting the head from side to side. The legs also have controlled motion; the cables attached to the levers at the pivot point of the hip cause the legs to move up and down when pulled by the control mechanism.

Passive movements in the monkey are added through springs in the ankles that allow the feet to move. The arms have passive motion because the legs control their movement. The passive motion creates the illusion of more movement without having to add to the mechanism.

Passive motion creates the illusion of more movement without having to add to the mechanism.

Many things affect automata construction. In particular, weight affects balance and fabric restricts motion, so it is best to start with an armature that moves almost on its own.

The weight of the head, hands and feet can cause the armature to droop and be hard to move. Counterbalancing springs are required to bring the armature back into balance. A figure will operate automatically and require the least amount of control if the armature is properly balanced, but it is also important to let the figure do what it can do, instead of trying to make it do what it cannot.

It is important to make the pieces sturdy, solid and flexible. But "flexible" does not mean loose; there has to be some restraint. If the piece is too loose, it will not produce a natural movement. Conversely, if there is too much resistance, the cables are hard to pull and can break.

Once the balance of the monkey puppet was established,

Marco

JoJo

Interior view of *JoJo*. The batting fleshes out the body so the costume fabric hangs naturally.

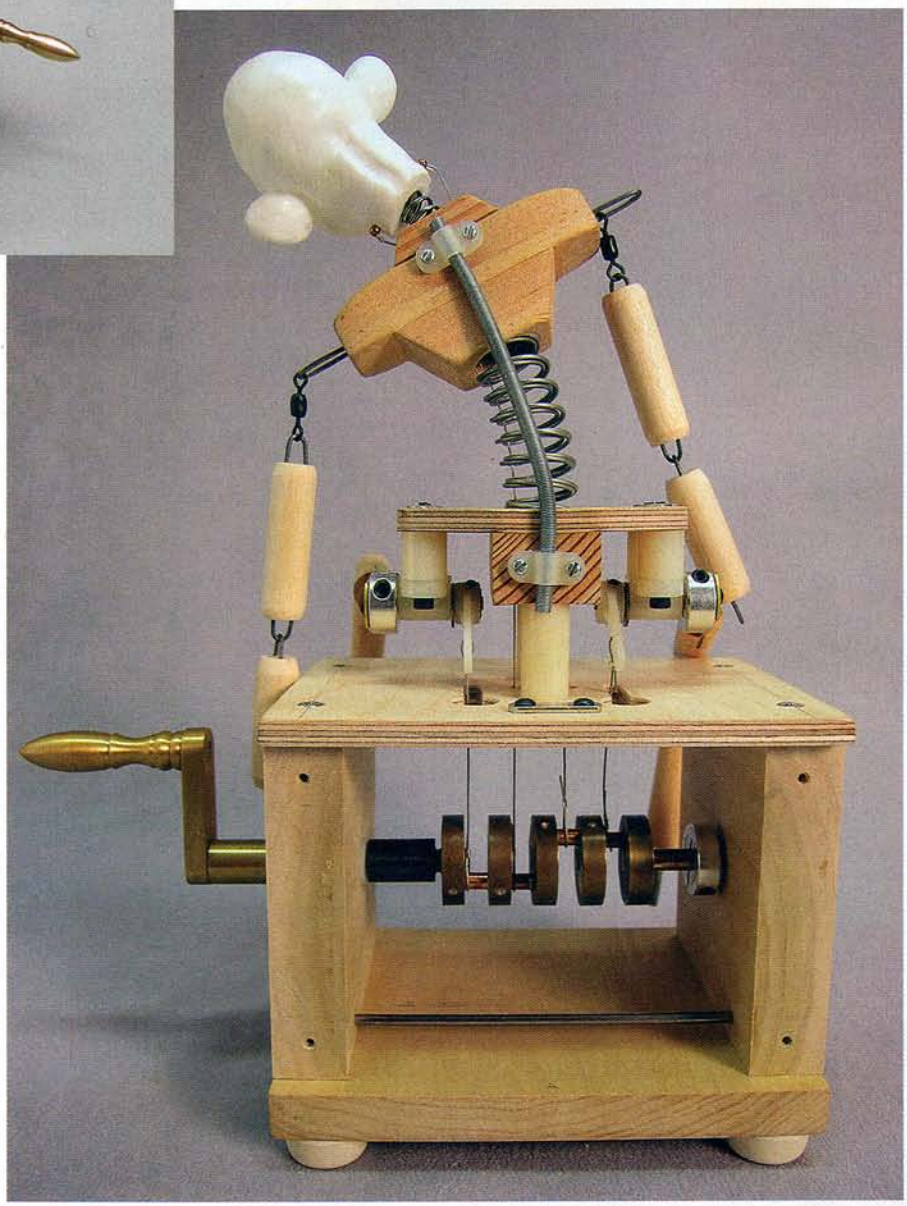
Exposed front view of the automaton armature. The large spring acts as the spine, supporting the upper body.

the next step was to design a mechanism to control the movement. A crankshaft controller was chosen because of its mechanical flexibility. It allows the automaton to be cranked in either forward or reverse and at varying speed.

We first tried to make a simple controller mechanism using a single piece of bent rod for the crankshaft, but this created a stiff and robotic two-dimensional movement, so the crankshaft was redesigned using five stacked discs. A natural motion was created by altering and positioning the crank pins on the discs–as the crankshaft rotates, each pin caught up with the next producing a cyclic wave motion.

This simple design produced a relatively complex action; using one crankshaft and one control mechanism, it takes only one revolution to create quite a bit of motion.

To make the crankshaft strong and accurate, the discs were center drilled using a miniature lathe; this center point becomes the reference for the other measurements.



Cables attached to each side of the neck control the side-to-side head movement. They run down the center of the large spring and attach to the crankshaft. Cables attached to the hip levers cause the legs to pivot up and down when pulled by the crankshaft control mechanism.

With a hand crank, stopping and pausing the automaton is as dramatic as moving it.

We originally thought the crankshaft would not require this degree of accuracy, but the holes that link the parts required techniques used in gear cutting. The discs are then silver-soldered to create a concentric crankshaft that will not wobble and wear out the bearings.

Designing a costume for an automaton is different from designing for a traditional doll because the clothing should contribute to the motion. Costumes must be designed with plenty of room around the cables so the fabric or seams do not upset the balance or interfere with the movement of the automaton. For a full-body costume, the fabric should be light and drape easily because heavy costuming can hide the movement. For this figure, the primary movement of the monkey happens at the waist so a stiff fabric such as mohair fur will work if the shirt top can move independently from the pants bottom.

The box the monkey sits on contains the control mechanism. Inspired by the automata from the Victorian era, the box was draped in velvet and finished with a heavy fringe.

What we like best about this hand-crank mechanism is the interactivity. The automaton operator is the puppeteer, the showman. With a wind-up mechanism, the operator is an observer, but a hand-crank automaton requires the person to control the speed and direction. Stopping and pausing the automaton is as dramatic as moving it.

The hand-crank mechanism is the same for all four monkeys, but their movements appear different because they have distinct personalities. The crazed looks of *Bonzo* and *JoJo* evoke high energy, but *LuLu,* with her pretty pink tutu, and the elder monkey, *Marco,* appear to be more subdued. The monkeys can be seen in motion online at *www.chomickmeder.com.*

Our lives changed drastically 12 years ago when we quit our day jobs to become full-time artists and automaton makers. It has been a rewarding experience, even if our chosen profession draws a blank stare. Can you think of a better way to make a living than making a dancing monkey in a tutu?

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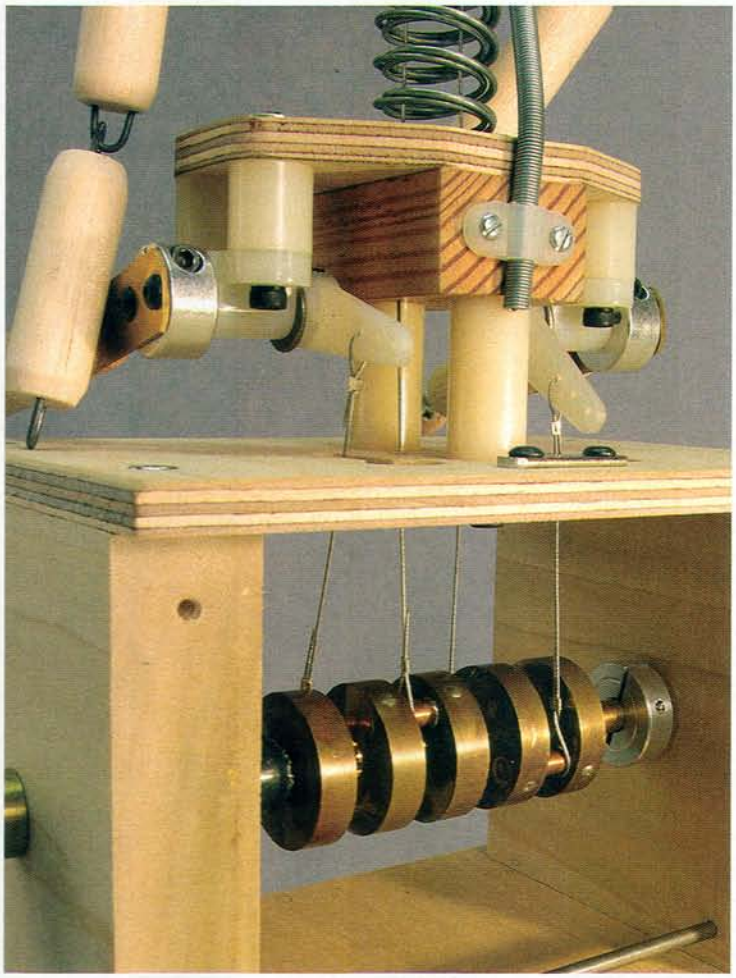
NIADA is a worldwide organization of doll artists, supportive patrons and friends whose purpose is to promote the art of the original handmade doll. For more information about NIADA, write to Antonette Cely at 3592 Cherokee Road, Atlanta, GA 30340; e-mail noni@cely.com*; or visit* www.niada.org.

A five-disc crankshaft controller allows the automaton to move in either forward or reverse and at varying speed.



Close-up of the crankshaft control mechanism. The head and leg cables are secured to the crank pins with silver crimps. As the crankshaft rotates, each pin catches up with the next, producing a cyclic wave motion.