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Lee Krasnow: A Puzzling Designer

by Corina Yen

When we think of puzzles, crosswords and jigsaws may be some of the first that come to mind. The fact that some of their pieces are missing or jumbled is what makes them puzzles, but what about a puzzle that has no immediate clues and already looks complete? Lee Krasnow designs and manufactures geometric wooden puzzles out of his workshop and home in Oakland. Beautiful objects made up of interlocking pieces, his puzzles are grounded in the underlying systems of logic that constrain their pieces together. The puzzles blend the artistry of a master woodworker, the spatial conception of a mathematician, and the understanding of how people handle objects that comes from years of experience and observation.

Krasnow studied math and computers in college before dropping out to pursue puzzle making full time, and many of his designs reflect that background. The Barcode Burr is a cube with a striped zigzag pattern made up of six identical pieces with pins that restrain their movements. Each piece can slide between two positions, and the key to unlocking them is that the sequence they move in must follow a binary progression (it takes 64 moves to remove the first piece, 32 for the next, and so on). Watching Krasnow solve it is mesmerizing. His fingers manipulate the pieces with the deftness and ease of a musician playing an instrument.

A good puzzle balances working with and against the user. One puzzle

Krasnow discusses uses the fact that people intuitively grasp opposite faces of an object when trying to pull it apart. The Pennyhedron has two mirror-image pieces in the shape of a rhombic dodecahedron. The puzzle's secret is that you must hold adjoining faces to unlock it, which I managed to do with some awkward grasping and clawing. In this respect, while it may be impossible for Krasnow to plan on every person's solving process, his experience with what shapes, grasps, and steps people struggle with allows him to design with some level of control over the interaction. When talking about the design of one of his puzzles, Krasnow says, "I wanted to micro-manage how people had to hold it and think about it... I can do little



psychological things to make people do what I want.”

His process for designing puzzles begins with ideas in his head that become sketches on paper and then often CAD drawings. Sometimes he starts with an overall shape or an underlying logic in mind and then thinks about how to design the pieces to come apart to fit that. “I try to think about how I want the puzzle to feel, how I want the parts to move,” he explains. His ideas often require developing manufacturing techniques and setups to achieve the desired shapes or movements. He combines the latest technology (CNC saws, CAD software to visualize designs, and 3D printed jigs) with traditional woodworking tools to develop production techniques that achieve the precision necessary to make his puzzle pieces fit perfectly together.

Krasnow’s puzzles have a high level of craftsmanship and are impressive works in wood even apart from being puzzles. One of his most prized tools is a table saw outfitted with a custom


jig on a cross-cutting sled. The jig helps him achieve precise angles and lengths as well as perfectly smooth and level surfaces. “It’s my ace up the sleeve. It sets me apart,” says Krasnow. He is so confident in his abilities as a manufacturer, he openly shares his designs and his construction techniques online. “I don’t patent anything I design. I’m not so much worried about people stepping into my market,” he says. Because of the high quality craftsmanship (and as a result, price) of his works and the heavy-hitting spatial

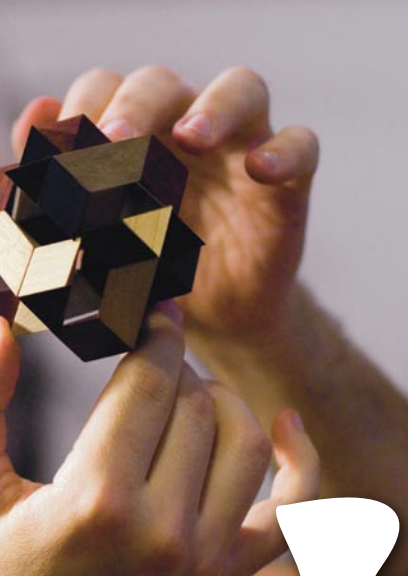
is to entertain and delight the solver, a puzzle maker cannot simply do whatever he wants. A good puzzle cannot be too complex or obtuse or else the user will just walk away, and Krasnow admits that it’s very easy to make a puzzle far too hard. Likewise, a well-made puzzle requires some amount of precision in manufacturing so that pieces fit together and move correctly, but if a puzzle’s craftsmanship is what dominates it, it may be less inviting to handle and explore its form. Krasnow’s Merkaba puzzle, made of

“I can do little psychological things when I’m designing a puzzle to make people do what I want.”

thinking required to solve them, the owners of Krasnow’s puzzles are mostly serious puzzle collectors.

As a puzzle designer, Krasnow crafts experiences—by creating pieces of certain shapes and restricting how they move, he manipulates users’ interactions with a puzzle. Given that the underlying purpose of a puzzle

is to entertain and delight the solver, a puzzle maker cannot simply do whatever he wants. A good puzzle cannot be too complex or obtuse or else the user will just walk away, and Krasnow admits that it’s very easy to make a puzzle far too hard. Likewise, a well-made puzzle requires some amount of precision in manufacturing so that pieces fit together and move correctly, but if a puzzle’s craftsmanship is what dominates it, it may be less inviting to handle and explore its form. Krasnow’s Merkaba puzzle, made of five interwoven tetrahedral frames, is beautiful to admire, but its many-pointed surface makes solving it a physical challenge as well as a logical one. Thus, puzzle designers must balance the elements of working with and against the user and the medium to achieve an object that by challenging also delights. 



Puzzle Design Tips

by Jan Chong & Ian Tullis

The following principles will help budding puzzle designers avoid the most common pitfalls. To whet your puzzling appetite, try our free-form puzzle on the back cover, a modified version of one originally by John Owens.

1. A good clue is a twist on what solvers are already expected to know.

Steps to solving a puzzle should be reasonable to infer based on common or readily accessible knowledge. Expecting American solvers to recognize that Illinois, Indiana, and Kentucky are all properties in Monopoly is reasonable, especially within a board-game themed puzzle; expecting them to then take the next-to-last letter of each of those words to spell out INK is less so.

2. An impossible puzzle makes for good cryptography, but poor puzzling.

Puzzle difficulty does not indicate puzzle quality. Good puzzles guide the solver along a logical path from start to finish, rather than leaving him stumped and guessing. That means requiring solvers to hop randomly from encoding (say, music notes) to encoding (that are Morse) to encoding (that are also Caesar shifted) makes for bad design. Similarly, suppress the urge to introduce superfluous puzzle elements—"red herrings"—to disguise the ultimate logic of the clues. Your puzzle is never as easy as you think, so don't waste solvers' time.

3. All the steps of the puzzle solving process should be fun.

Before getting carried away with your clue's cleverness, seriously assess what you're asking solvers to do. It's easy to lose track of this as you begin to wrestle with your own puzzle rules and constraints. No matter how clever the puzzle, there are limits to a solver's time and patience. Looking up ten pieces of obscure 70s television trivia may be quite interesting. Looking up thirty pieces of obscure 70s television trivia may be tolerable. Looking up three hundred pieces of obscure 70s television trivia is arduous, even for the most ardent 70s television lover.

4. Puzzle designers have complete information, but solvers do not.

Solvers make mistakes. They write down the wrong word when copying a clue. They copy the dots as dashes. They transpose ones and zeroes. Unlike the puzzle designer, puzzle solvers do not have the luxury of knowing exactly which parts of their data are correct and which are not. Building in mechanisms that allow solvers to double check partial information can ease frustration down the line. You might, for example, order word clues alphabetically by answer word so solvers can figure out when their answers are wrong. Or you might have a recognizable theme, such as Harry Potter characters, to which intermediate answers relate. And, of course, testing your puzzle on a range of solvers can help tease out what's frustrating and what's fun.