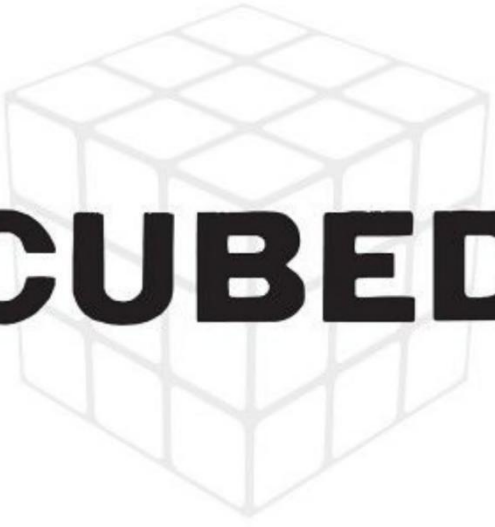
ERNŐ RUBIK



CUBED

THE PUZZLE OF US ALL

FLATIRON
BOOKS
NEW YORK

INTRODUCTION

My official name is the Rubik's Cube. "Cube Rubik" sounds more natural to me, but nobody has really asked me about my feelings. If I were of noble blood, you could call me the "Hungarian Magic Cube von Rubik," but I'm not. Personally, I prefer "Magic Cube" because it reminds me of my childhood, but my friends just call me "the Cube," and you may call me that as well. We probably have met already, since I've traveled all over the world and many millions have touched me and been touched by me over the decades. Even if you weren't one of them, please don't worry. (I never worry, by the way.)

You've probably seen me in the hands of people, or my image sometime, somewhere: on TV screens, T-shirts, magazine covers; in movies, YouTube videos, books; as part of tattoos, sculptures, album art; maybe in school ... and I could go on and on. They say that one in every seven people in the world today has played with me! That is more than a billion. Can you imagine?

Even though you certainly have seen me, it must be strange to actually hear from me, so let me explain. You are reading a book by Rubik, the person who gave me life in 1974. There is nothing conventional about this book—especially the man who wrote it (he believes the contrary)—and it became clear while this was going on that I needed to be included. I wanted to help him tell the story, because I'm its most authentic witness! (He hates to write and has a poor memory.) And since every puzzle has rules, here are mine: I can't think, but I can express myself. I can't read or write,

but I hear a lot and never forget. I am very simple/complex. I am colorful and happy. I met a young Hungarian fellow a long time ago (and now we are not so young...) and since then, we've been a team.

Teamwork has been my life. If you've ever picked me up and played with me, you and I formed a team. Now that you are reading, we are another team; you the Reader, and me with Rubik, the Writers. A group of three. As a 3x3x3, I think that the number three is magical. It has such perfect symmetries.

If all this seems bizarre to you, simply relax and open your mind. As Albert Einstein said, "The true sign of intelligence is not knowledge but imagination."

So let's play!

—The Cube

1

Who in the world am I? Ah, that's the great puzzle.

—LEWIS CARROLL

I GUESS MANY PARENTS have had the same experience I have had: Suddenly observing their own children with a moment of curious detachment and wonder, and not at all from the perspective of being a mother or a father. In these revealing and sometimes beautiful moments that I have had with my children, it is as if I were meeting them for the first time, and I see them being deeply involved in a world that has nothing to do with me. When that happens, and it is never planned and does not occur often, I am startled to see in them qualities that I have never appreciated before. A tone of voice, perhaps, or a way of thinking that is totally unpredictable, surprising, or maybe even the sudden revelation of a strange interest or a curious hobby I had never suspected they had.

It has been the same with my eldest child: the Cube. There are some languages that have genders, and in these languages the word "cube" is almost always masculine—*le cube* in French, or *der Würfel* in German, for example—so when I refer to the Cube, I will use that distinction. He is my boy, my son. If you take a ball in your hand, it is a totally different feeling: soft, supple—a cube is a boy with edges and muscles.

Even as much as he has defined my life for nearly half a

century, I can still be caught off guard by discovering some unexpected quality or character in him. Sometimes it is as simple as when I am playing with the rigid plastic pieces, but I am struck again and again by how they behave. The interplay of forces, the cohesive strength of all the elements, remind me of a drop of water floating weightlessly on a table, contained into a spherical shape by surface tension. I like the possibilities the Cube contains, and simply adore the visual pleasure of its shape. Often, the cubical shape is associated with an item that we have no control over, like dice. But there is nothing haphazard or out of control with the Cube. That is, as long as you are willing to give it some patience and some curiosity.

★ ★ ★

I HATE TO WRITE. Yet here I am, writing this book. There is no way back. Writing as an exercise is both technical and intellectual. Maybe being left-handed added some awkwardness to learning to write in a right-handed world. In retrospect, I was fortunate to have a teacher who did not force children to go against their natural proclivities. There was no pressure at all beyond the encouragement that I do the required work. My more pressing question with writing is abstract: How can we possibly capture in words all the dimensions of our lives?

That is not to say that I am not an avid reader. But when the writing involves a life—specifically *my* life—I find the medium almost paralyzing. This is not the first time I have confronted the challenge of writing about my experiences, my time with the Cube, and, inevitably, my life story. So far I have easily yielded to the temptation of not writing at all. But there is also the equally strong temptation of doing something well, of attempting to do something that feels authentic. Finally, I decided to approach the task of writing as if it were a puzzle, and I considered the model that I know best of all: the Cube, which I discovered in 1974. As an object, it shares many characteristics with the kind of writing I like

best. It is simple and complex; it has movement and stability. There is what we see, and then there is its hidden structure.

Simple and complex. Moving and stable. Hidden and exposed. I believe contradictions are not opposites to be resolved, but counterpoints to be embraced. Rather than becoming frustrated by what seems irreconcilable in a contradiction, the better option is to appreciate that a contradiction helps us make connections we may never have considered. One can never fully capture three dimensions on a page. And yet, framing the many themes in my work and in my life in terms of contradictions could add dimensions that may make it easier for me to write.

★ ★ ★

IT PROBABLY GOES without saying that the Cube has attracted more attention than I could have ever imagined. It is a curious fact—one that surprises me as much as anyone—that for so many decades, during a time of an unprecedented technological revolution, fascination with such a simple, "low-tech" object has survived. And, in fact, this fascination has evolved. The Cube has been a toy for children, an intensely competitive sport, and a vehicle for high-tech explorations and discoveries in artificial intelligence and bewildering mathematics. Blame has been cast on the Cube for divorces (and marriages), and for ailments known as "the cubist's thumb" and "Rubik's wrist."

With all this attention has come ... questions. Journalists, fans of the Cube, or casual acquaintances around the world, often ask me the same questions, as if I could easily provide answers that would reveal all the mysteries of my puzzle. They have hardly changed over the years, so let's dispense with them at the outset, shall we?

Q: How did you invent the Cube?

A: I sat down to think about a geometrical problem and how to illustrate it. I made something that became the Cube.

Q: How long did it take?

A: I began in the spring of 1974 and applied for a patent the following January.

Q: What is your record for solving it?

A: I have no idea. I have never measured my time.

Q: What are the tricks?

A: There are no tricks. At all.

Q: Why did you invent the Cube? [For me this is the most irritating question.]

A: I found a problem that captured my imagination and did not let me escape.

If these are the questions that a reader expects to be answered in this book, those are the responses, and one can stop reading right away. At the same time, I'm aware that asking a true question is more difficult than answering one. In the end, revealing or interesting answers can be given only in response to good questions.

What, then, are the questions that I would prefer to be asked? Well, one that may have already occurred to you is this: After all these years of "hating to write," why did I decide to write a book? I must admit, my motives were rather selfish. For all its shortcomings, writing does offer a chance to explore some questions in order to gain a deeper understanding. So even though I may hate to write, I am always eager to try to understand things better, especially those things that we take for granted. What makes us tick? What makes us create? And how are people inspired to make something that has never been made before?

This is also my attempt to try to more completely understand the remarkable popularity and endurance of the Cube. What does it say about the ways our mind works? Does it suggest there are certain universal qualities that bring us together?

One example of the Cube's ability to bridge seemingly unbridgeable differences occurred very early on. In 1978, one

year after it had appeared for the first time in toy shops in my home city of Budapest, I took my newborn baby daughter to a playground.

And there was my Cube! In fact, there were two Cubes in the park, and two very different people playing with them! The first was a little boy who was about eight years old. Quite content and extremely dirty, he sat on the ground, playing with the Cube—a small Oliver Twist, twisting it. The second Cube emerged from the elegant handbag of a youthful mother in her thirties who must just have come from the beauty salon. She was sitting on a bench and cast only an occasional glance at her baby in its stroller, so thoroughly was she immersed in tackling the Cube. It was astounding to see on the faces of these completely opposite people the very same expression.

Since then, I have seen that expression on faces all over the world. They are faces in repose but also intently engaged. Concentrating, turning inward, losing touch with their surroundings and the external world. They look as if they are in a state of meditation, except instead of being lost internally, they are engaged and active. They are suspended within a rare moment of peaceful coexistence between order and chaos.

★ ★ ★

I REALIZED I'VE TAKEN something for granted: Just like I hate to write but am still writing a book, you may not like to read but are reading one. If so, thank you for taking a look at my book anyway. You don't have to read it all in one sitting, or from the first page to the last. You are free to discover it as you want, and my hope is that you will permit yourself to get a little bit lost. In these pages, some of the puzzle pieces of my thoughts, insights, and observations may appear to be scrambled. Like the Cube, the internal structure is hidden, and what ultimately happens depends on you. Because every reader is different—bringing their own interests, talents, dreams, professions, passions, and contradictions to this or

any book—there is not a single "right" way to read. All the pieces contained here may not fall into obvious places, and they don't need to.

This book will touch upon many things: creativity, symmetry, education, architecture, questions, playfulness, contradictions, beauty. But at its core, this book is about puzzles. It is about the puzzle of myself. It is about the puzzle of this strange object I discovered almost fifty years ago. And it is about the puzzle of us all.

★ ★ ★

MY FATHER was not a playful man. Ernő Rubik Sr. was once a well-known name in the field of aviation—and not only in Hungary. He was obsessed with creating the perfect glider. He had several patents, and designed more than thirty airplane and glider models and also a mini car made of aluminum. But only when I was an adult did I realize that every time he figured out the structure and the materials and all the details of his designs, he was solving very practical and complicated puzzles. Perhaps I saw him working on his plans and was inspired, or maybe I was just a curious little boy, but from the time I was a small kid in Budapest, I sought out puzzles and would spend hours immersed in their challenges. One of my favorite things to do was to devise strategies for new and more efficient solutions.

I liked different puzzles for different reasons and their different capacities. I liked some because of their flexibility and capacity for change. I liked others because their ideas were expressed with such simplicity. I liked still others because they provided the framework for improvisation. I liked difficult puzzles more than easy ones. I remember the curiosity, focus, periods of disorientation and frustration, some excitement when crucial connections were made, and then the sense of accomplishment when arriving at the solution.

Interest in puzzles is nearly universal. They have been around for much of human history. Anthropologists digging

up pieces of the past and piecing them together discover puzzles all over the world. What I found in 1974 emerged from an entire lineage of puzzles that have inspired and baffled players since ancient times.

★ ★ ★

PLAYING WITH PUZZLES when I was a child trained my mind. I became familiar with the nature of their questions and answering them. I was not assigned these puzzles, was not graded on my performance, nor was anyone observing whether I solved them or not. If I failed or had trouble with one, I could start again on it the next day. This entertainment was solitary. Without an opponent, I was always the winner—not that I really thought that way. What most captured me was that I could use these puzzles as a starting point to discover something else.

Puzzles bring out important qualities in each of us: concentration, curiosity, a sense of play, the eagerness to discover a solution. These are the very same qualities that form the bedrock for all human creativity. Puzzles are not just entertainment or devices for killing time. For us, as for our ancestors, they help point the way to our creative potential. *If you are curious, you will find the puzzles around you. If you are determined, you will solve them.*

One that I played with very early on was the tangram, a deceptively simple geometric puzzle that is, in my view, not really a puzzle because it does not set a well-defined task. Originating in ancient China, a tangram is a square sliced up into seven pieces, or "tans": five triangles of varying sizes, a parallelogram, and a square. The challenge is to fashion from these simple elements a variety of unique figures. Sometimes, one can fit them all into a square. Other times, one may feel more whimsical and create figures from them. Usually it is an accidental composition of elements. You can't have a theory in a mathematical sense to solve a tangram, or to say why these contours look like a man, the other looks like a tiger, and the third looks like a flower. You cannot

imagine a simpler game, and yet from these pieces, an endless number of interesting figures can be constructed. The tangram appealed to me because it was very free. In a sense, it is close to art, since depending on how the pieces are assembled and the attitude one has when manipulating them, one can create very artistic results. I was one of those children who spent hours drawing and painting. Drawing something when I sat in class was a fine distraction when there were some subjects (or teachers) who bored me. With the tangram, sometimes I would draw on the pieces themselves so that when they were put together, they created something abstract and beautiful.

★ ★ ★

WHEN I WAS ABOUT FIVE OR SIX, I received a 15 puzzle as a present. I think that its original intent was to keep me occupied for the few hours on the train that it took to get from Budapest to Lake Balaton. Over the years, my father built us a cottage and we would spend the summer there. The original 15 puzzle was a flat box with fifteen squares that were numbered 1 to 15 and fitted into a four-by-four grid. There was always one empty space, which gave you the potential to move the pieces by sliding them.

In general, the challenge is to see how many possibilities, how many permutations or combinations of elements you can come up with. Another challenge was to see how many different ways, or in how many different permutations, the elements numbered from 1 to 15 could be arranged in the grids without taking them out and putting them back together. You have to follow the rule of sliding the pieces by filling the empty square. In that way it is a closed system. Today you can buy versions that are made from plastic with tongue-and-groove connections between pieces so you can't take them out of the frame. I prefer the old one that I had then. I could dump the pieces out from the box and put them back, scrambled. I especially liked the metallic sound when I played with it.

When the elements were inserted randomly, you needed to arrange the sequences by sliding the pieces. As a process, it was very simple. It was not a question of complexity but rather one of order and rules. If you have sequences of numbers in which each is valued as one, with no single one that is equal, they then can be arranged from the lowest to the highest. A simple law showed if something was possible and if something wasn't. You found the solution by discovering that not the individual pieces but the movements of the whole were important. If my parents hoped that this would keep me occupied for the few hours on the train, they must have been disappointed. I managed to solve it quickly.

There is no doubt that I learned from classics like the tangram and the 15 puzzle—but the pentomino was even more significant for me. "Pentomino," a term invented by American mathematician Solomon W. Golomb, means a shape consisting of five squares joined together by their sides. There are twelve different ways to arrange five squares. What is the task? The basic goal is to fill in rectangles; you can have different ones depending on the size. As one element consists of five squares, the area of the twelve different pentominoes is sixty squares (because 60 = 3 x 4 x 5, so you can fill the 3x20, the 4x15, the 5x12, or 6x10 rectangles with the set and you can have more than one solution of each). Or you can create other things. You can fill the big 8x8 square with four empty small squares in the middle or at the corners of the big one, or many different kinds of figures, and all of them are new tasks to solve.

Filling a surface with elements has so much potential and so many challenges. Mathematicians call it "tiling," which means covering the surface with elements that aren't overlapping. An enduring challenge that can feel unsolvable is to fill a rectangle with different sizes of squares. It becomes a very difficult task to create a "simple perfect squared square."

★ ★ ★

The fact that the seventh piece is made of three small cubes—rather than four, like the others—means, in my opinion, the game lacks homogeneity. As a puzzle, it is a three-dimensional form, filling a 3x3x3 space. It looks like a cube; you can make it for yourself. The Soma cube is not an open puzzle like the tangram or the pentomino. They both have sets, and you can create your own challenge. The Soma cube is a classical puzzle whose challenge is to figure out the task that was determined by the puzzle's creator. It is a three-dimensional challenge.

I created my own version of it long before I even imagined making the Cube by trying to put together a 3x3x3 cube by using only elements that contained three equally small cubes. I created nine elements in which the number of small cubes was identical but the way they were joined was different. I used all of the potential combinations to join the three cubies, touching each other on faces and/or on edges. There are two elements that are joined only by faces. There are five elements that are joined only by edges. And two have both types of connections. There are 880 different solutions for the puzzle. (This variation went to the market as Rubik's Bricks around 1990.)

The other important Cube predecessor for me is known as MacMahon's cube, which is also made up of cubes, much like a child's colored building blocks, in which all the faces are different colors and none are repeated. But the arrangement of the colors is different, and there are thirty different ways to make a cube with six colors. It is not as well-known as the others, but still it offers an interesting mathematical problem. There are thirty cubes whose faces have six colors, in all the possible permutations. The basic exercise is to choose one cube and then use eight others to make a 2x2x2 cube that has the same arrangement of colors as the first, with each face a single color and the interior faces matching. The biggest size that can be created by keeping the same rule is the 3x3x3 cube. From the perspective of the combinatorial question, there are thirty possible ways to arrange the colors on the six faces of the cube.

CONTENTS

www.flatironbooks.com

Cover design by Richard The

The Library of Congress has cataloged the print edition as follows:

Names: Rubik, Ernő, author.
Title: Cubed: the puzzle of us all / Ernő Rubik.
Description: First edition. | New York: Flatiron Books, 2020.
Identifiers: LCCN 2020019368 | ISBN 9781250217776 (hardcover) | ISBN 9781250217783 (ebook)
Subjects: LCSH: Rubik, Ernő. | Rubik's Cube. | Inventors—Hungary—Biography.
Classification: LCC QA491 .R83 2020 | DDC 793.74 [B]—dc23
LC record available at https://lccn.loc.gov/2020019368

eISBN 9781250217783

Our ebooks may be purchased in bulk for promotional, educational, or business use. Please contact the Macmillan Corporate and Premium Sales Department at 1-800-221-7945, extension 5442, or by email at MacmillanSpecialMarkets@macmillan.com.

First Edition: 2020