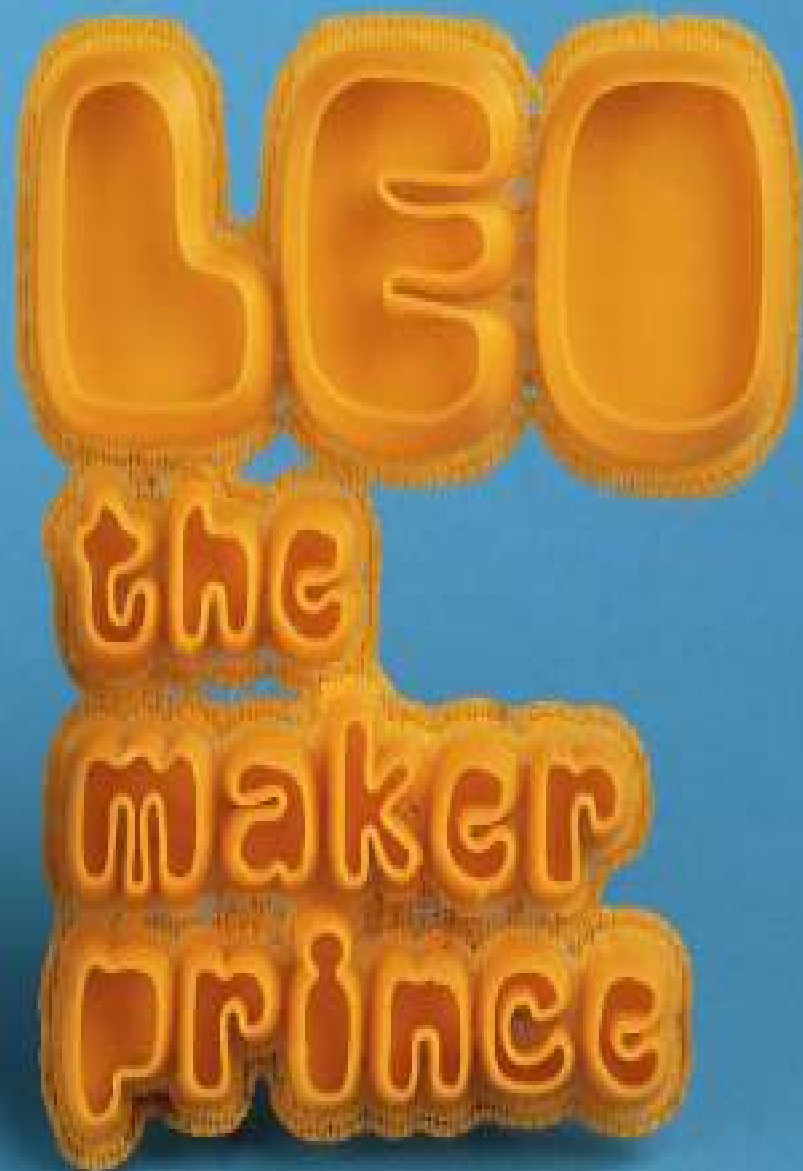


LEGO
the
maker
prince



JOURNEYS IN 3D PRINTING

by Carla Diana



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**This book is dedicated to my father, Joseph C
who taught me to find wonder in everyth**

LEO the Maker Prince: Journeys in 3D Printing
by Carla Diana

Visit LeoTheMakerPrince.com to learn more, or go to Thingiverse.com/LeoTheMakerPrince to download the objects in this book.

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Editor: Brian Jepson
Story, illustration, and object design: Carla Diana
Book design: Nicholas Lim
Story editor: Cindy D. Hanson
Photography: Claudia Christen
Design and production assistance: Alexa Forney

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FOREWORD

2013 has often been called “the year of the 3D printer.” While the technology for automatically fabricating solid, 3Dimensional objects based on stereolithography has been around for decades, it was so expensive that it could only be used in industrial and commercial applications. Only very sophisticated manufacturing facilities and design firms could afford one, and the parts themselves were expensive to produce, compared to the price of a similar, mass-produced part. They were also delicate and highly limited in terms of material qualities.

What led up to this change in 2013 was the fact that the DIY movement encouraged people tinkering with making their own kinds of electronic, customized devices. Built from off-the-shelf components, housed in laser-cut panels, and assembled by hand, these devices formed the foundation for visions of new products. One such device was the MakerBot, launched in 2009 by MakerBot founders Bre Pettis, Adam Mayer, and Zach “Hoeken” Smith, who created the first affordable 3D printer at a hacker space in Brooklyn, N.Y., NYC Resistor. With their vision of creating “3D printing for the masses,” the MakerBot marked what might be called a “Macintosh moment,” referring to the turning point when a vision of turning an expensive piece of equipment made for business use only (the computer) into a central and ubiquitous part of everyday life became reality.

In 2009 the first MakerBots were sold at a price of \$1300, over one tenth the price of the Dimension uPrint, one of the leading professional 3D printers at the time. By mid-2013, 30,000 MakerBots were out in the world, and more than a dozen other companies creating different types of inexpensive 3D printers had formed.

While the vision of 3D printing is becoming a reality, there are still many questions about how it will be used or what impact they will have. Theories say people will download a digital file of a single object from a digital marketplace and buying a mass-produced version of the printer will be used to experiment with the printer will be used to experiment with allowing people to customize their products to their tastes and needs. And other theories say it will spawn new types of “micro-entrepreneurs with new ideas” who will distribute new products through their own channels and startup cost.

This book is a celebration of the visions of the future. Some of the visions may be a little blurry, but the excitement of current machines and materials gives us exciting glimpses into how they will be used in the hands of regular people like you.

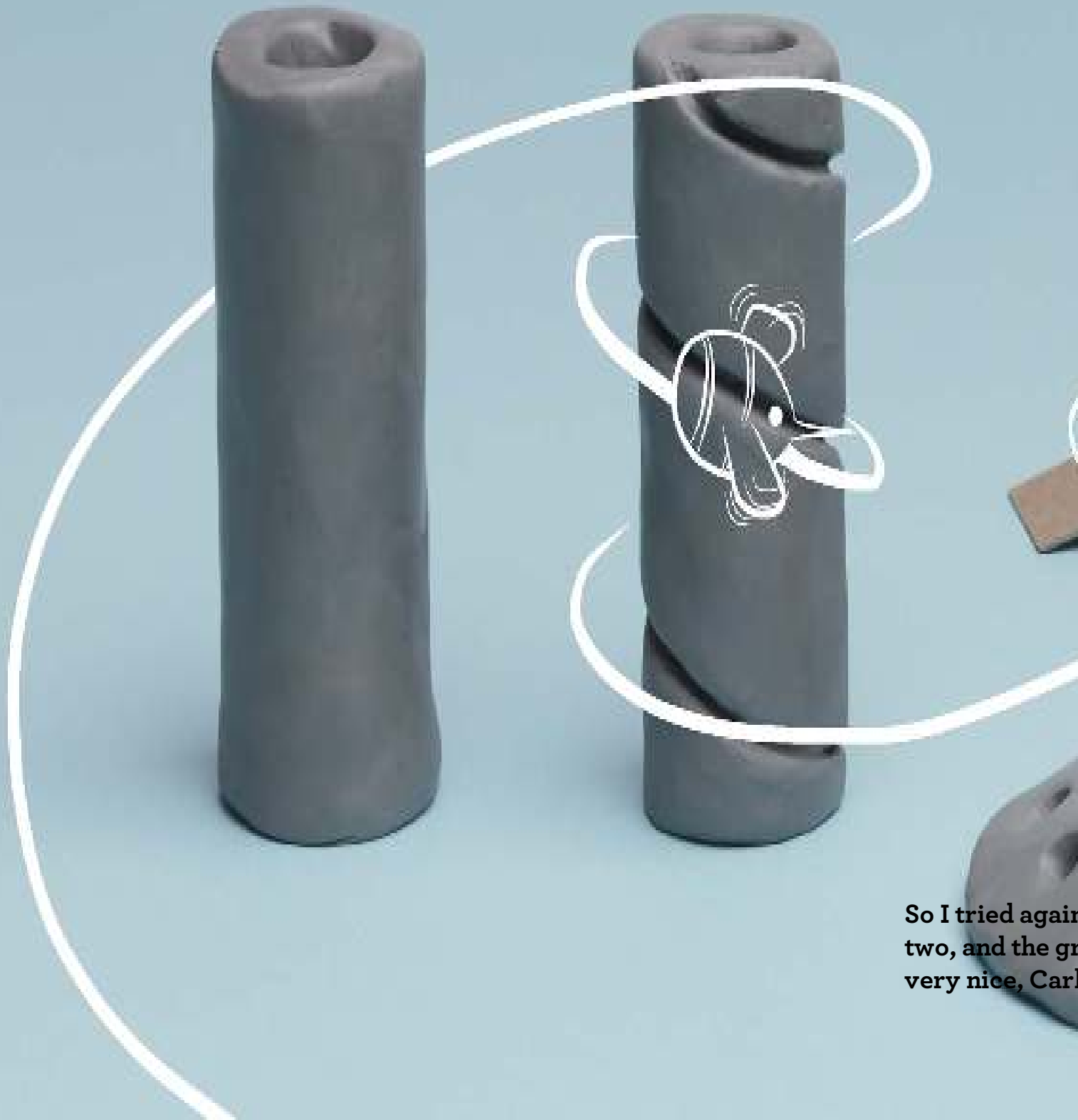
In sharing these visions through this book, we hope to help you see this moment in time, but to also see the potential for decades to come. By putting these visions into the hands of our children, we can jumpstart the future.

With excitement and a loving hope for the future, we invite you to enjoy LEO t

**When I was small,
I used clay to create..**

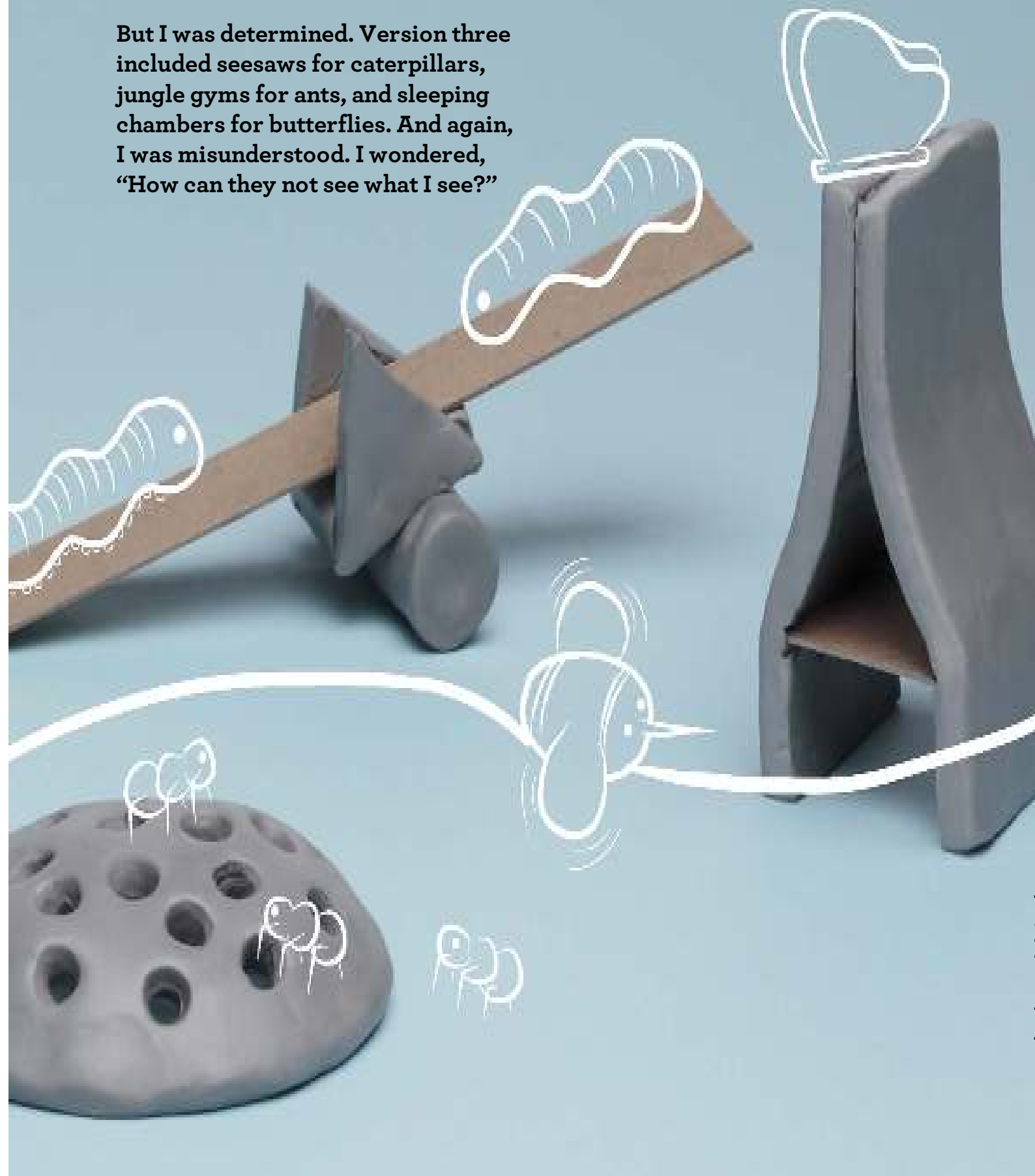


I made a spiral slide for a bee. The grownups said, "That's very nice, Carla. You made a pipe."



So I tried again two, and the grownups said, "That's very nice, Carla."

But I was determined. Version three included seesaws for caterpillars, jungle gyms for ants, and sleeping chambers for butterflies. And again, I was misunderstood. I wondered, “How can they not see what I see?”









That day of the big storm,

● HOME

HURRICANE SANDY

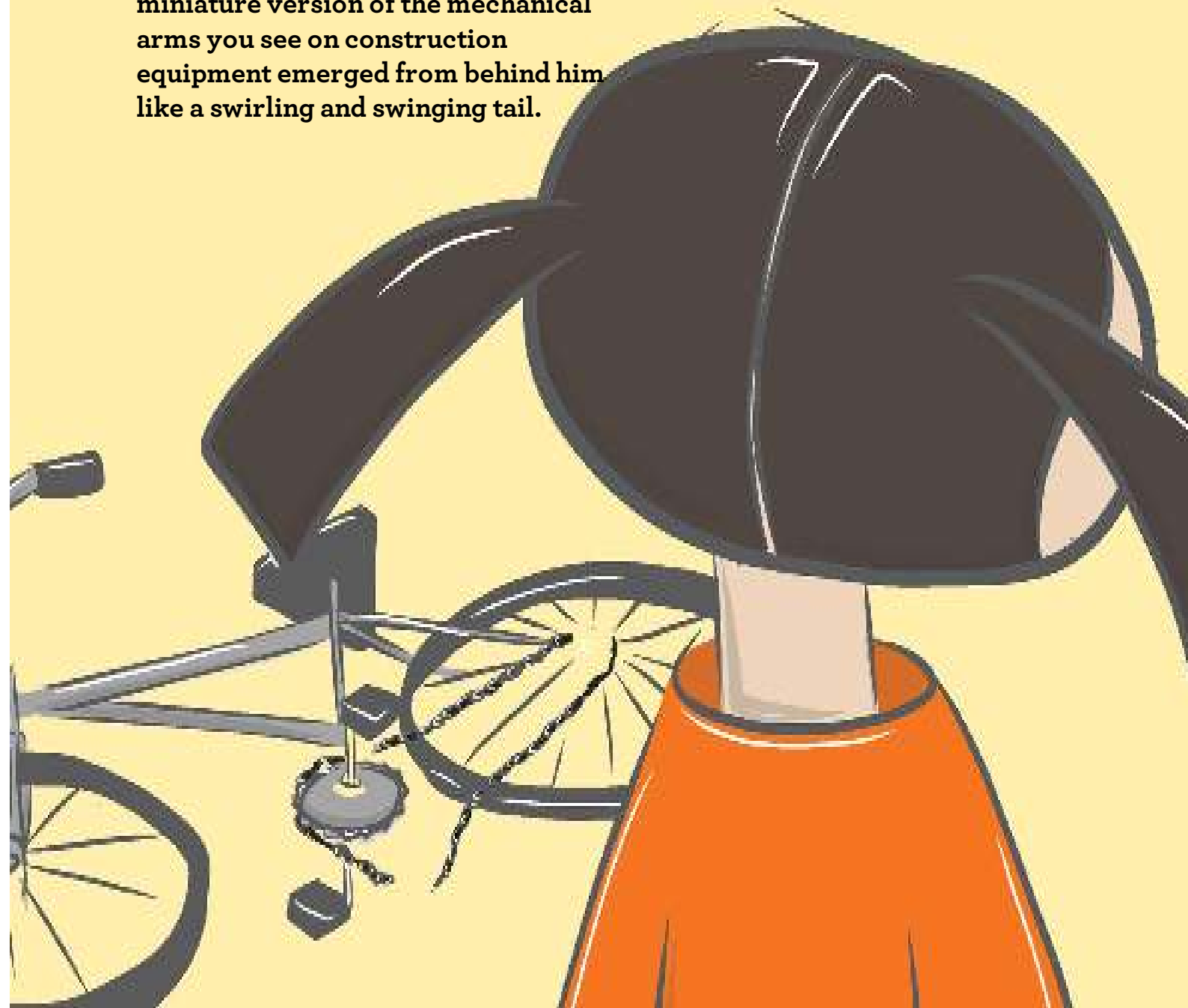
You see, I am an accountant who loves to ride my bike everywhere, even if it isn't the most practical means of transportation. Biking allows me time to turn off all the numbers and ponder, ever so slightly and lightly, the worlds of butterflies and bees. That is how I found myself biking back from a client meeting that had taken me

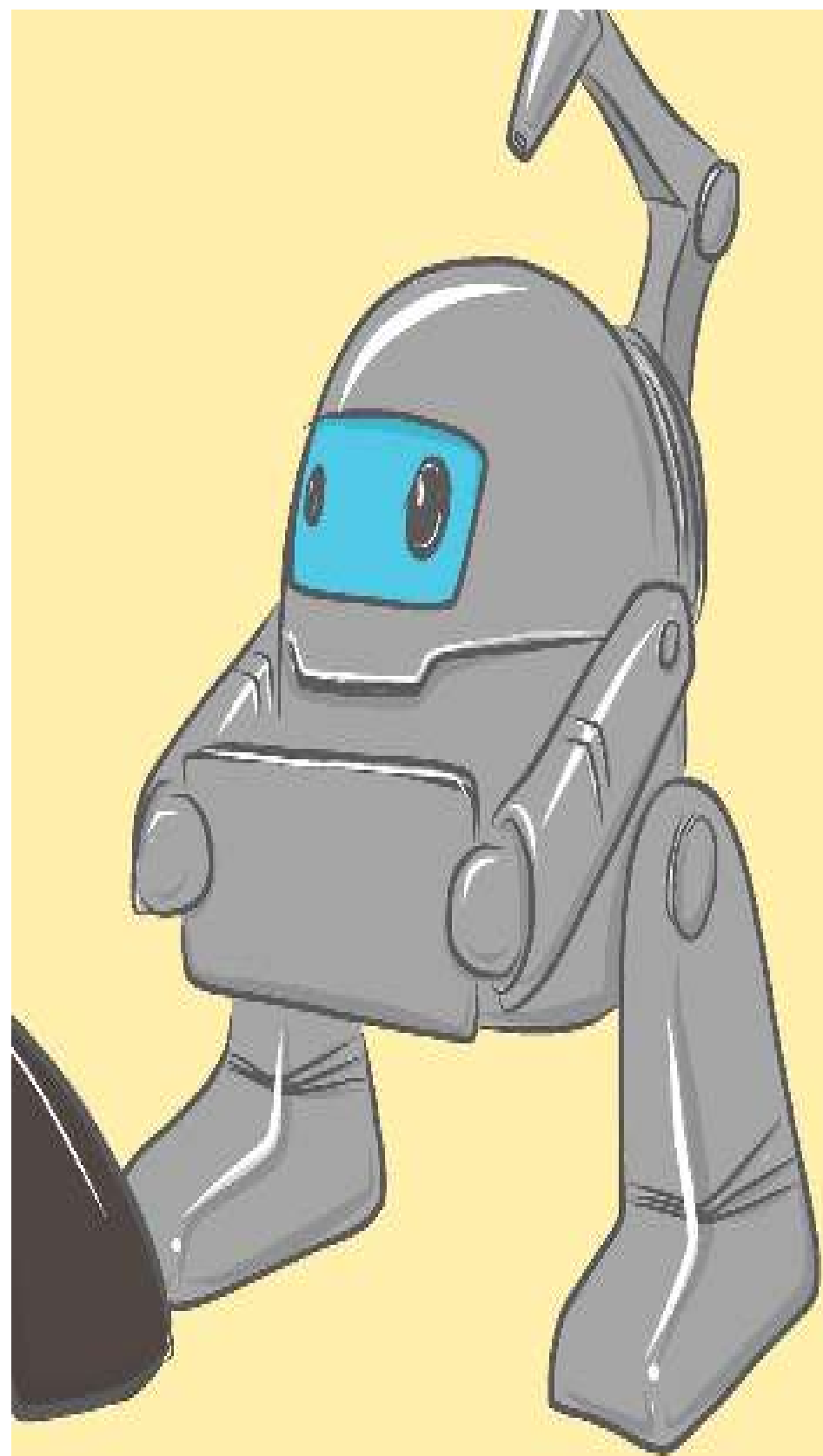
from Manhattan across the Brooklyn Bridge and into the heart of New York City's second largest borough, Brooklyn, or, the other Manhattan. By the time the meeting was over, Hurricane Sandy was percolating and proving punctual, and I was pedaling as fast as possible to get back home safely.

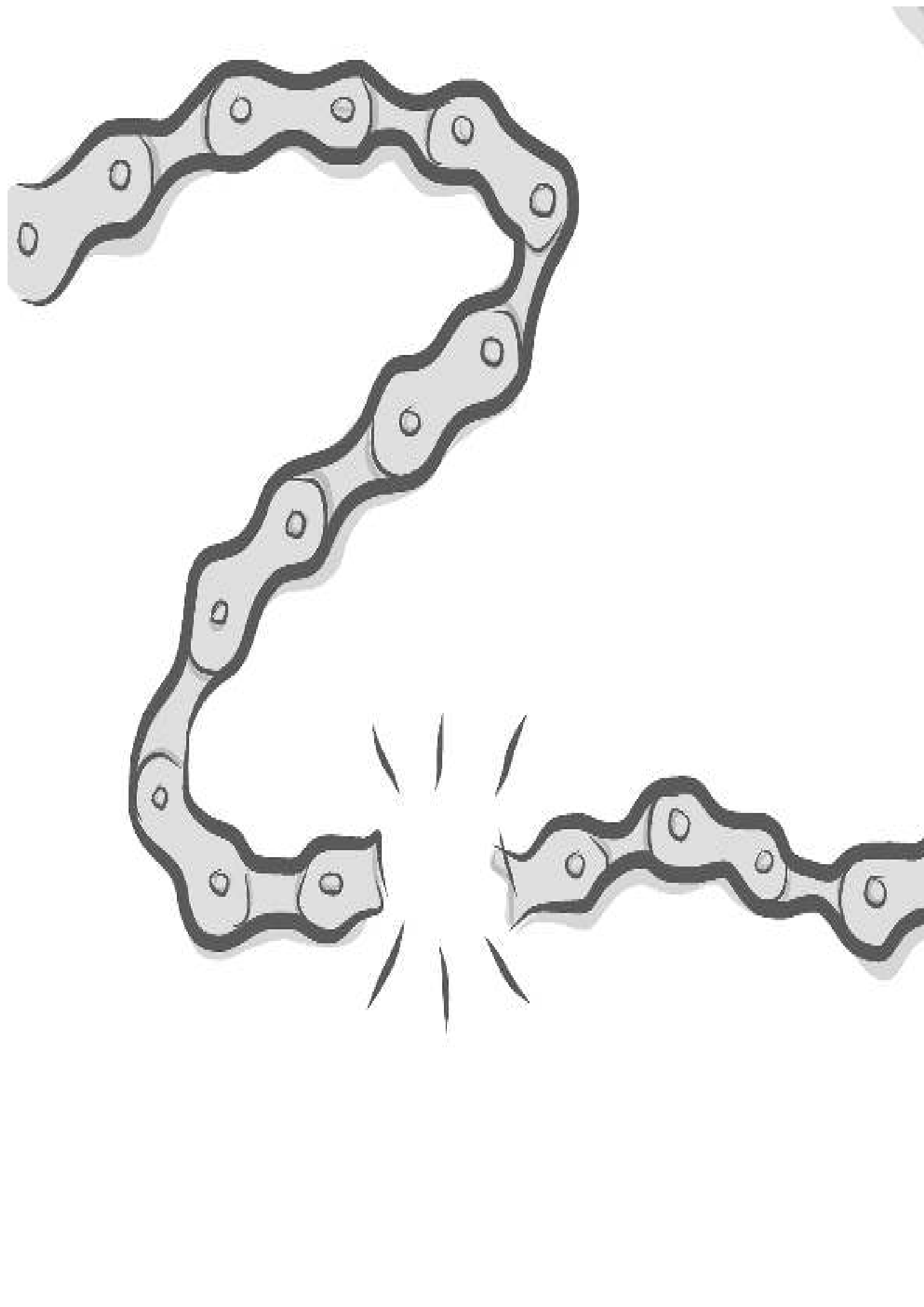
When all of a sudden, a gust of wind took me, and the next thing I knew, I was splat on the pavement. The world was spinning, and blurry. I believe I blacked out.

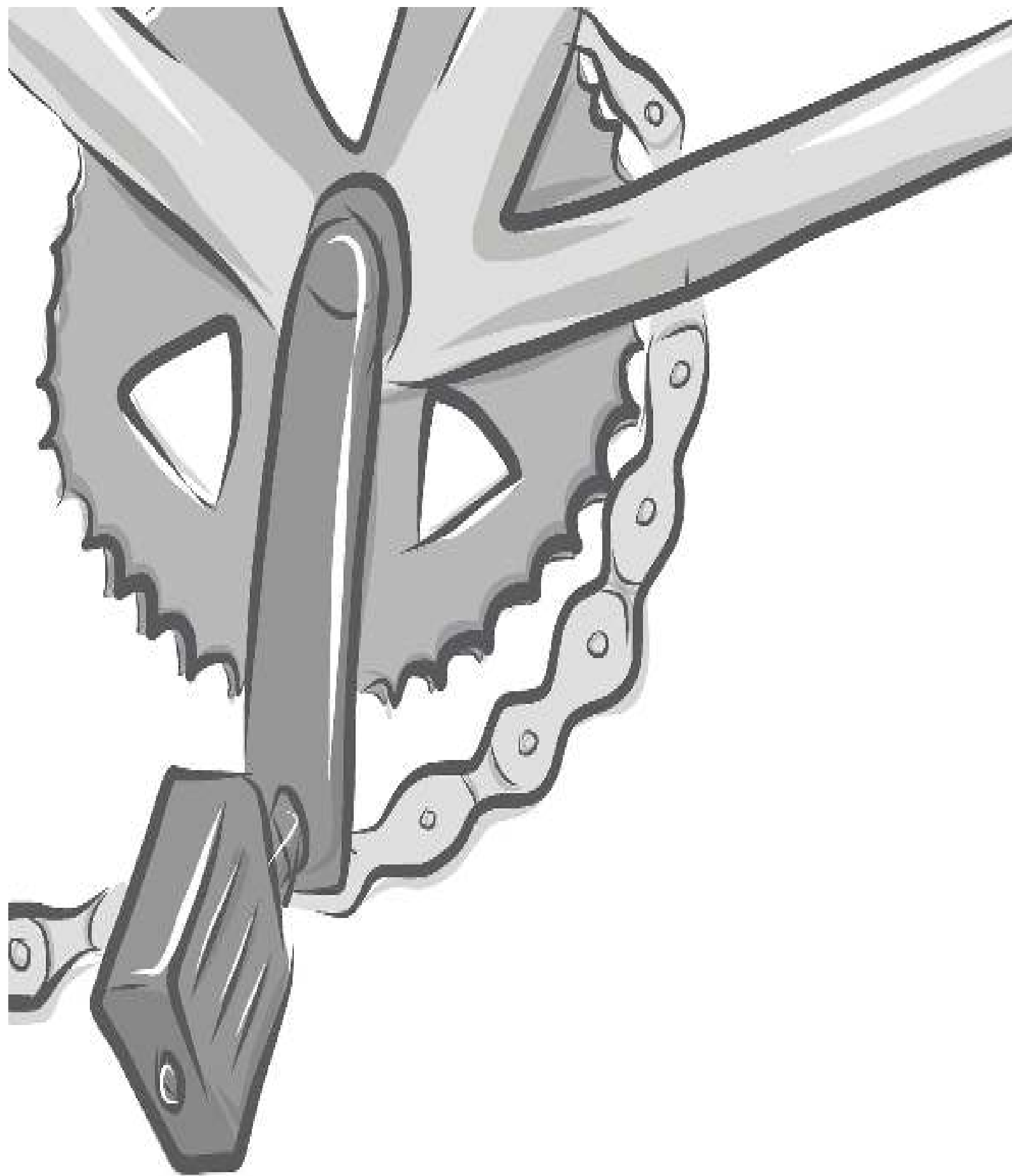


But it was a robot! I admit to being a tiny bit frightened, but there was something very intriguing about this little mechanical character. He had chunky legs, and straight arms that gripped a small tray in front of him. Behind him was a special kind of backpack that held spools of what looked like black and white wire. A miniature version of the mechanical arms you see on construction equipment emerged from behind him like a swirling and swinging tail.









“Okay, LEO. Fine. You drive a hard bargain”, I said, “I’ll draw you a sheep. Here goes.” I quickly pulled some paper and a ball point pen out of my knapsack and began drawing the best sheep I could muster, given my accounting education. It felt so foreign at first, but then something from my sculpting days began to take hold. My imagination took over. Lines poured out through the pen and onto the paper, and lo and behold, I had drawn a sheep!

“Here?” I asked. “Precisely!” he said. So I put my drawing on top of the tray, wondering what this little robot could be up to. He tilted it back towards him just slightly as projected light ran back and forth across the page. It was kind of spectacular.

“PERFECTO!”

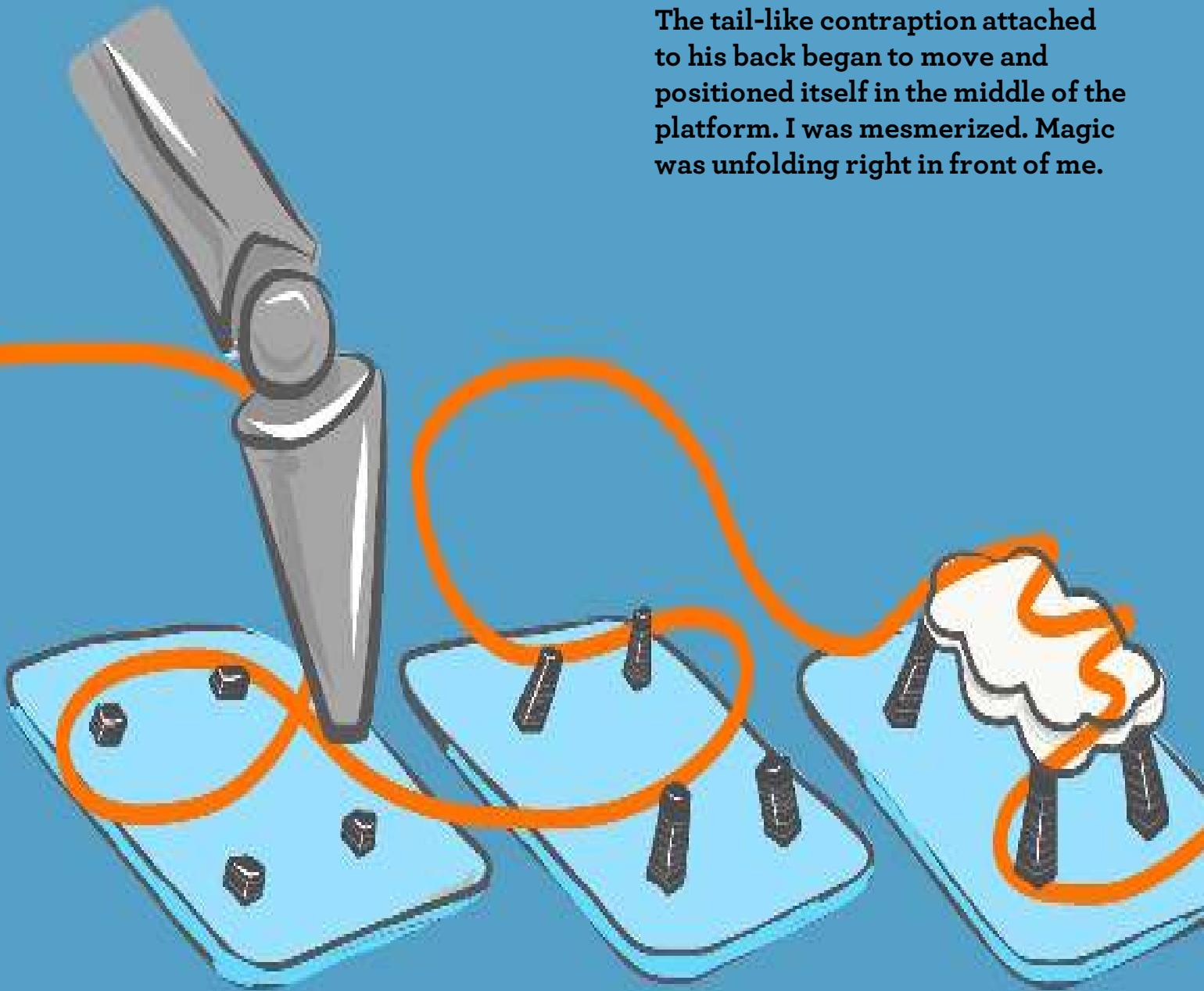
LEO exclaimed, and extended the tray he was holding so that it lay flat in front of me. It seemed to be an invitation of some sort.





“Scanning complete!” he said with authority, and tilted the drawing so I could take it back.

LEO then lifted his arms and the tray he was holding became a horizontal platform above his head. The tail-like contraption attached to his back began to move and positioned itself in the middle of the platform. I was mesmerized. Magic was unfolding right in front of me.



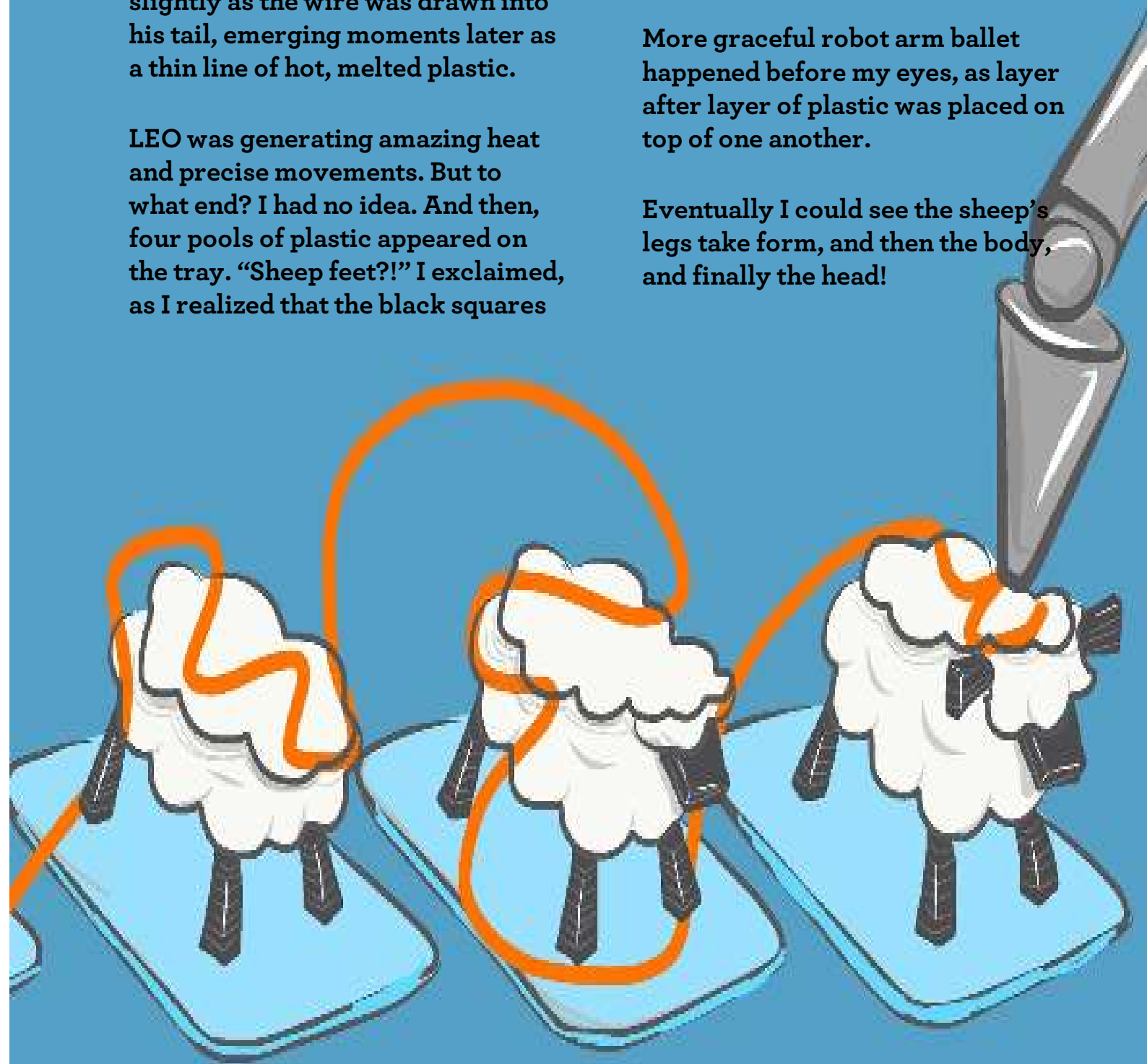
it and landed on the platform. The spool on his back turned ever so slightly as the wire was drawn into his tail, emerging moments later as a thin line of hot, melted plastic.

LEO was generating amazing heat and precise movements. But to what end? I had no idea. And then, four pools of plastic appeared on the tray. "Sheep feet?!" I exclaimed, as I realized that the black squares

matched the bottom view of the sheep I had drawn.

More graceful robot arm ballet happened before my eyes, as layer after layer of plastic was placed on top of one another.

Eventually I could see the sheep's legs take form, and then the body, and finally the head!



“AND
VOILÀ”

LEO exclaimed, as he presented me with a fully formed sheep.

“That was amazing!” I had almost forgotten my aches and scrapes and the fact that I was stranded. And even though I could still see the broken chain on my bicycle out of the corner of my eye, it was the last thing on my mind.

I needed to know more. “How did you do that? Where did you come from?”

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