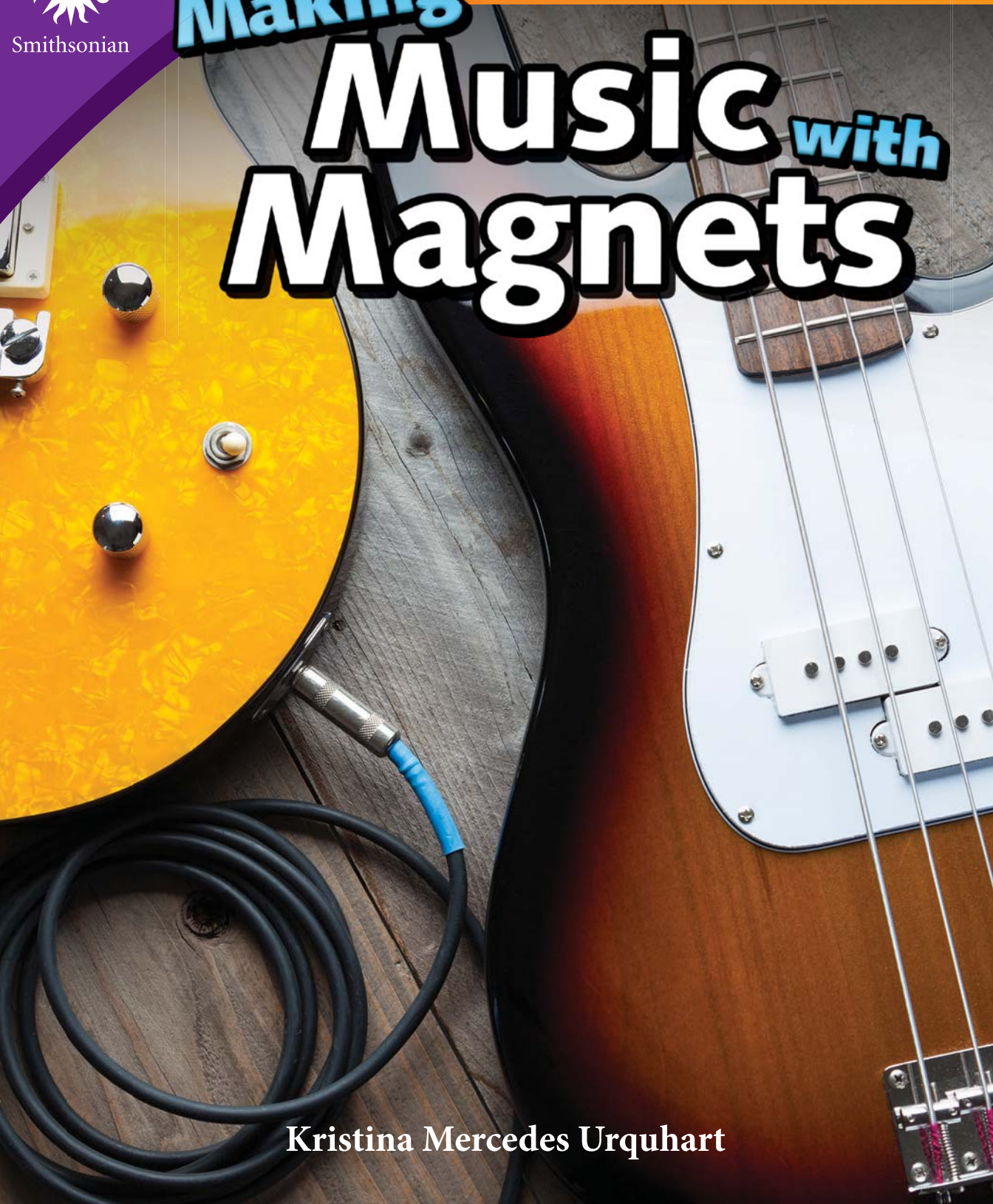
Smithsonian

Making Music with Magnets



Kristina Mercedes Urquhart

Table of Contents

Origin Story 4

Turn Up the Volume 6

The Birth of the Electric Guitar 12

Electric Guitars Take Over 16

It's Electric 22

A New Sound 26

STEAM Challenge 28

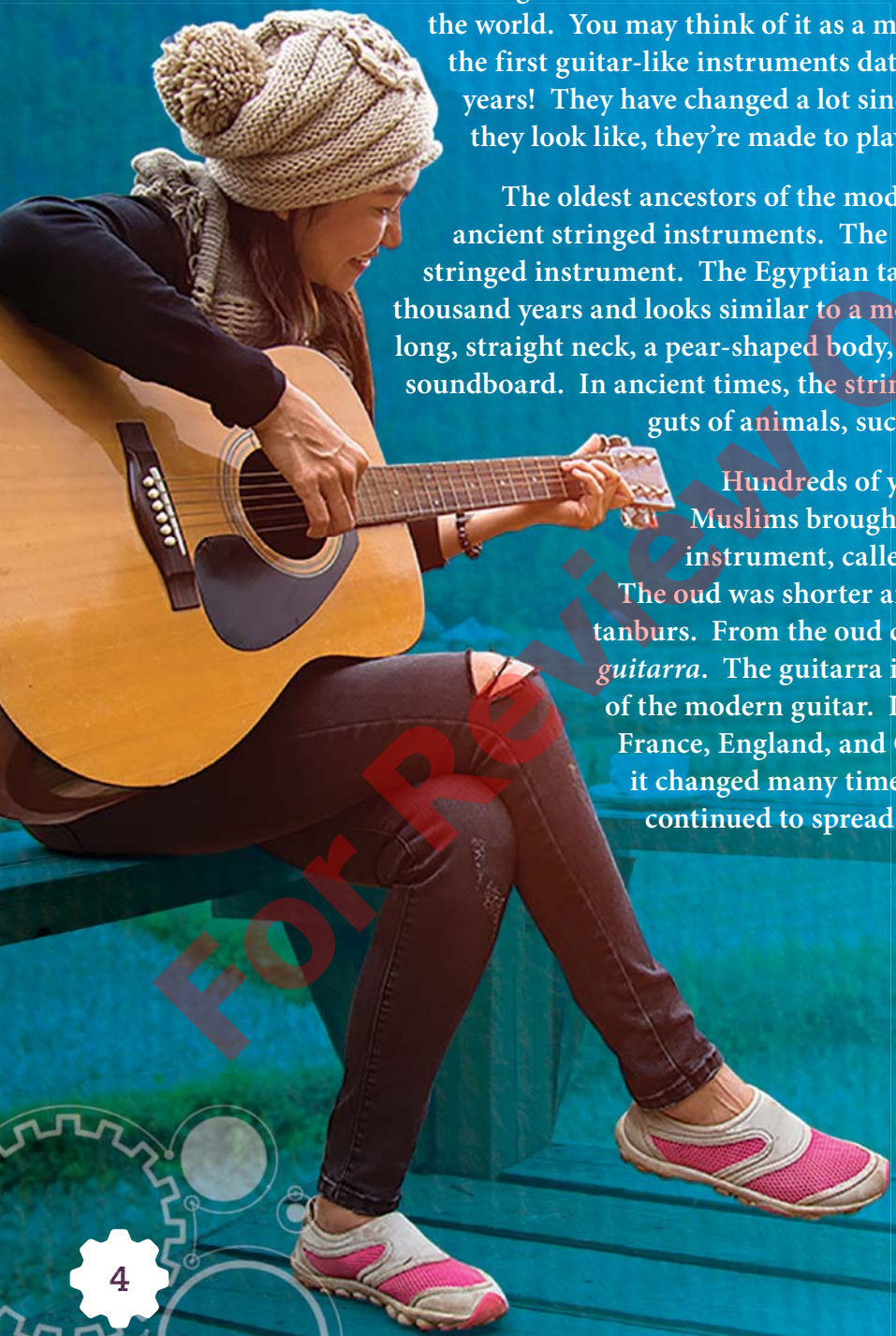
Glossary 30

Index 31

Career Advice 32

For Review Only

Origin Story



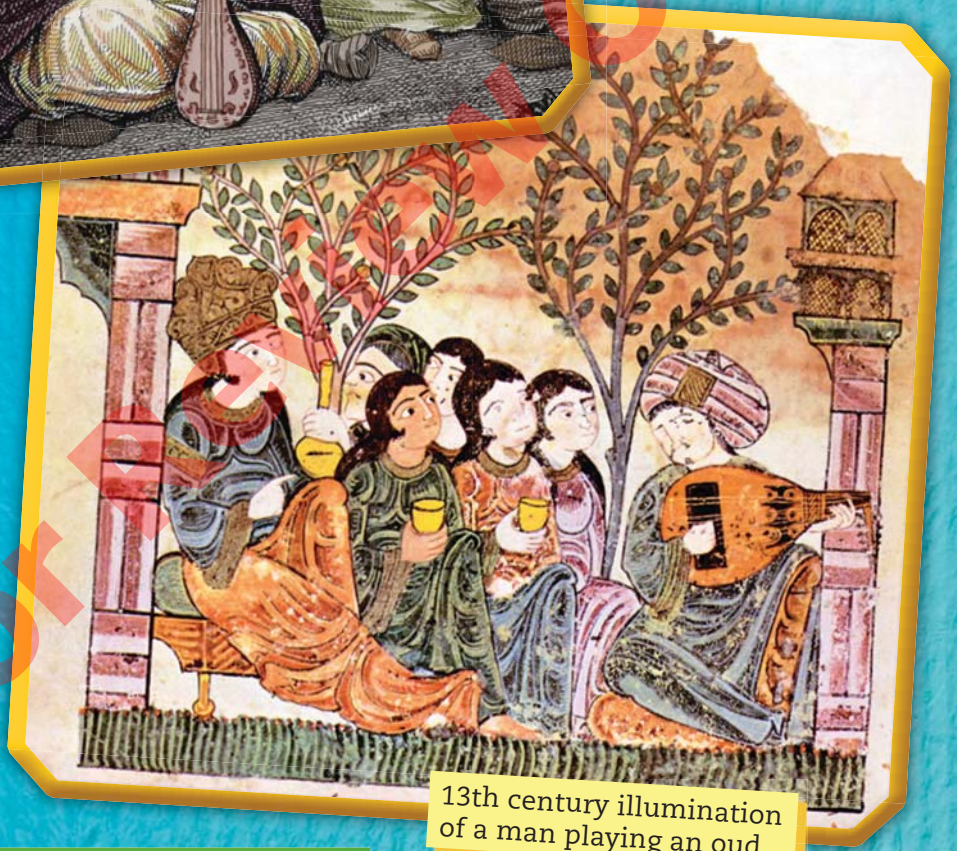
The guitar is one of the most widely used instruments in the world. You may think of it as a modern invention, but the first guitar-like instruments date back thousands of years! They have changed a lot since then, but whatever they look like, they're made to play music.

The oldest ancestors of the modern guitar were ancient stringed instruments. The *tanbur* was one such stringed instrument. The Egyptian tanbur dates back four thousand years and looks similar to a modern guitar. It has a long, straight neck, a pear-shaped body, and strings across a soundboard. In ancient times, the strings were made from the guts of animals, such as cows and cats.

Hundreds of years later, a group of Muslims brought their own stringed instrument, called an *oud*, to Spain. The oud was shorter and rounder than most tanburs. From the oud came the Spanish *guitarra*. The guitarra is the earliest ancestor of the modern guitar. It soon spread to France, England, and Germany. From there, it changed many times over the years and continued to spread around the world.

For Review Only

18th century engraving of a man playing a stringed instrument



13th century illumination of a man playing an oud

Ancient Egyptian wall paintings show people playing tanburs together in groups. These paintings are more than 3,500 years old!

For review only

Turn Up the Volume

For a long time, people were happy with guitar music just as it was. However, some musicians thought guitars were too quiet. They couldn't be heard over trumpets, drums, and pianos. They needed to be louder!

Making Music

Today, the two most common types of guitar are **acoustic** and electric. They look similar from the outside. The top of both guitars is called the head. The head holds the strings and has tuning pegs, which loosen or tighten the strings. Connected to the head is the fingerboard of the guitar. The fingerboard is where the strings are located. On the fingerboard are different frets, which are metal strips. Artists can use a finger to hold the string down on one of the frets, which will change the **pitch** of the note. This allows the guitarist to play many musical notes.

Acoustic and electric guitars may look similar. However, the way they make music is very different. Acoustic guitars have hollow bodies with holes in the middle, appropriately called sound holes. First, a musician plucks the strings. Then, the vibrations from those strings travel down to the sound hole. The vibrating hollow hole makes the air inside vibrate, which makes sounds.

inside an acoustic guitar

For Review Only

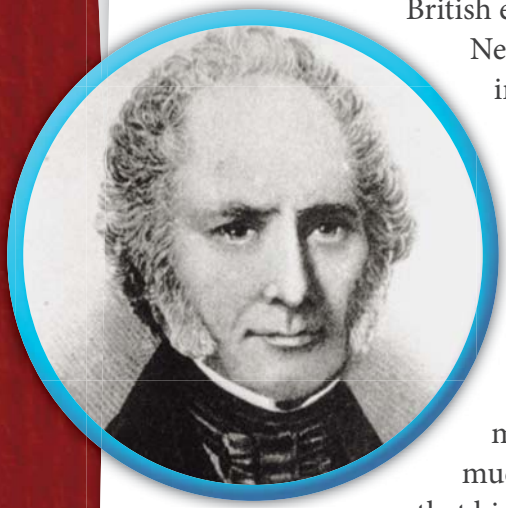
For Review Only

TECHNOLOGY

Catgut Your Tongue?

Today's acoustic guitars use plastic nylon for their strings, but ancient guitarists used natural materials to create their strings. The earliest cords were made from animal intestines and were called catgut. Sometimes called "gut" for short, these strings made a rich, warm sound.

Electric guitars are different. They use **electromagnets** to make sound. Electromagnets are made from **conductive** wire and metal. First, a piece of metal wire is wrapped around a piece of metal. Then, electricity is added. This creates the electromagnet. Electromagnets are different from normal magnets. Magnets do not need a power source; electromagnets do. When the power is on, the electromagnet is on. When it is off, so is the electromagnet.



William Sturgeon made the first electromagnet. He was a British engineer. While he was in the army, he went to Newfoundland. While there, he watched thunder in the sky. These storms made him want to learn more about electricity. How did it work? What could he learn from it?

When Sturgeon got home, he started working with magnets and electricity. At first, he just passed electricity through coils of wire to create a **magnetic field**. In 1825, Sturgeon had an idea. He wrapped wire around a piece of metal. Then, he added electricity. His magnet was much stronger than it was before. He did not know that his work would impact the world of music!

a reconstruction of Sturgeon's first electromagnet

For Review Only

Electromagnets can be found in telephones, electric motors, MRI machines, and earphones.

A doctor prepares a patient for an MRI.

For review only

STEAM CHALLENGE

Define the Problem

Imagine you are a music teacher planning to teach your class about pitch. Your idea is to demonstrate the concept with simple materials. For the lesson, you must design and build an instrument that plays four different pitches.

Constraints: You may only use four types of materials to build the instrument.

Criteria: Your instrument must play four distinct pitches.

For Review Only

Research and Brainstorm

What are pitches? How can electric guitarists change pitches? How did the creation of the electric guitar change the future of music?

Design and Build

Sketch your instrument design. What purpose will each part serve? What materials will work best? Build the model.

Test and Improve

Have a friend listen as you play your instrument. Did they hear four different pitches? How can you improve it? Modify your design and try again.

Reflect and Share

How do different materials affect pitch? How can you produce a louder sound? Can you modify your instrument to add more pitches? Why don't you need a power source to hear your instrument's sounds?

For Review Only