



雨树榕榕

英国最具影响力的青少年科普读物之一

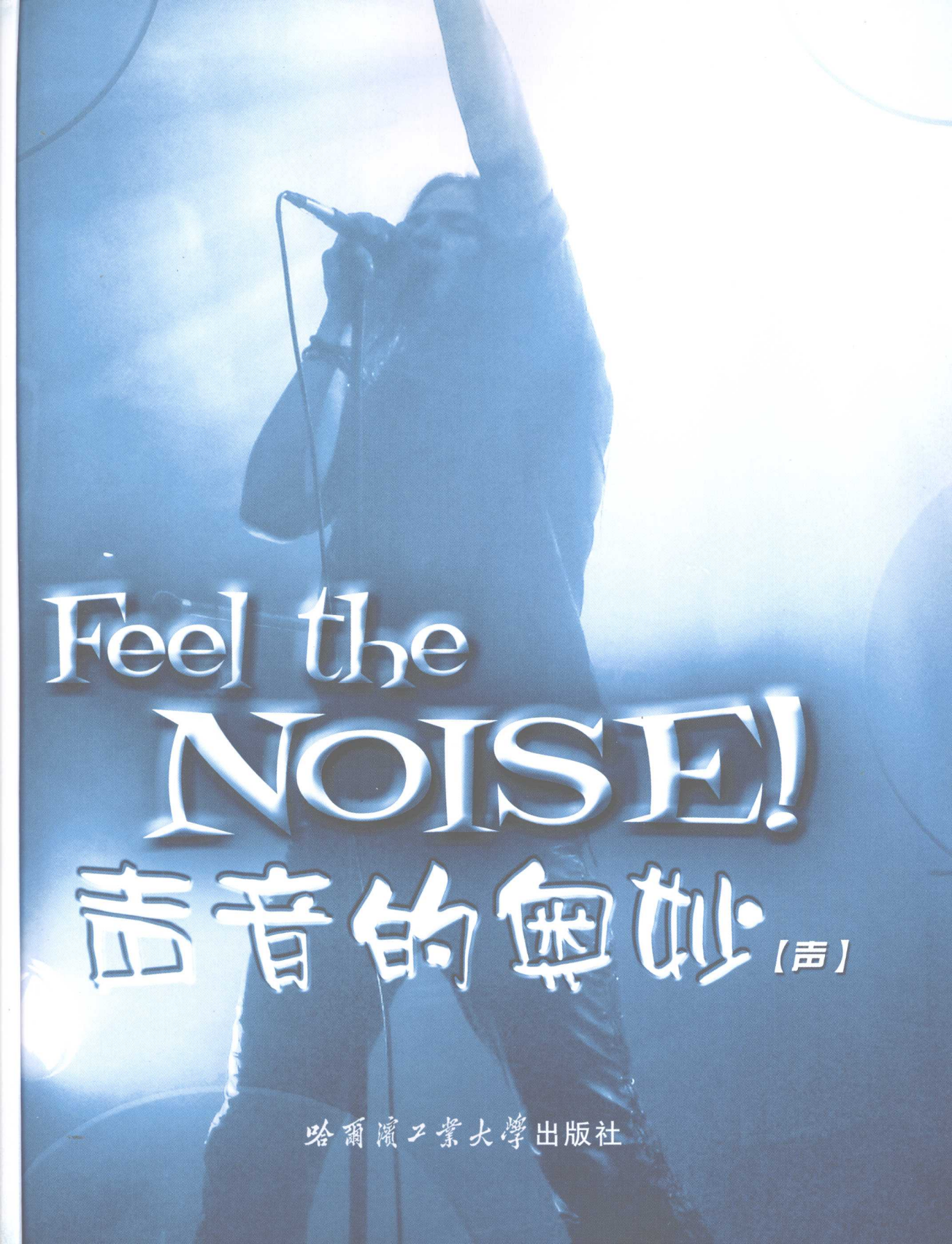
(英)克莱伯恩(Claybourne, A.) 著
李慧杰 译

Feel the NOISE!

声音的奥妙【声】



哈尔滨工业大学出版社
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有些单词被印刷成粗体，**就像这样**。你可以在第30页中找到它们的意思，还可以在单词第一次出现时，在相关书页下方的方框内发现它们的含义。

Meet the band

观看乐队演奏

A famous rock band is on tour. Millions of fans want to hear them. So the band needs to play in really big places like this sports stadium.

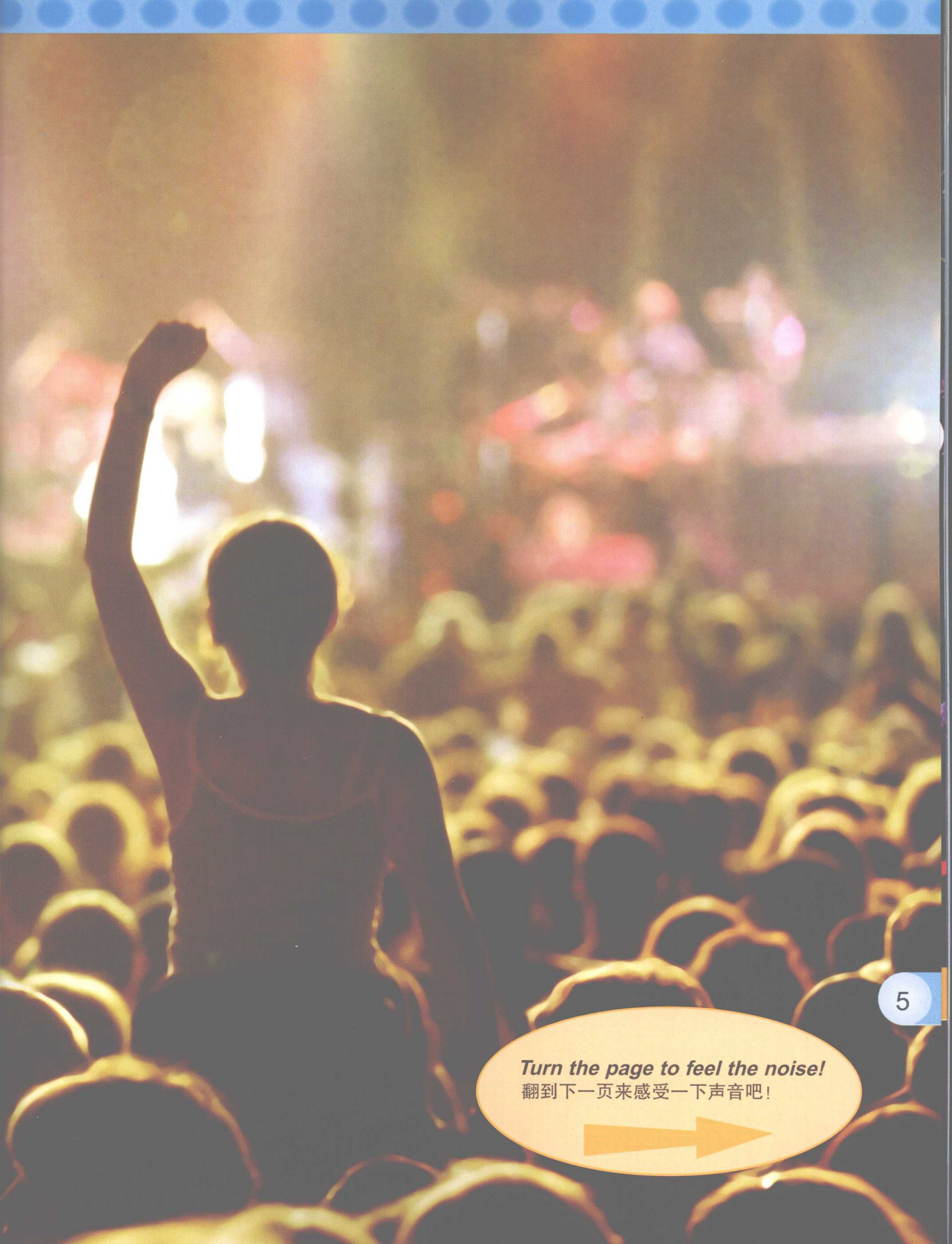
When they start playing, everyone around will hear them. It will be even more exciting for the fans in the stadium. The sound will be so loud that the fans will feel it shaking their whole bodies!

You know who your favourite band is and why you love their music. But how does music—or any sound—actually work? What are sounds made of?

一个著名的摇滚乐队正在举行巡回演出。由于数百万的歌迷都想要一饱耳福，所以乐队需要在像体育场那样大的场地里演奏。

当他们演奏时，周围每个人都能听到音乐声。体育场里的歌迷们变得越来越狂热。乐曲声震耳欲聋，歌迷们感觉到音乐正在摇晃他们整个的身体！

你知道你最喜欢的乐队是哪一个，也知道你为什么喜爱他们的音乐。可是你知道音乐，或者是其他的声音，究竟是怎样产生的吗？声音是由什么构成的呢？



Turn the page to feel the noise!
翻到下一页来感受一下声音吧！



Setting up

准备工作

Before a show can start, the band has to test their gear. The drummer starts by hitting a drum to check the sound. A drum is made of a tight skin, or plastic, stretched across the end of a hollow box. When the stick hits the skin, the skin **vibrates**. It moves backwards and forwards many times a second. This makes a sound.

Sound is a type of **energy**. Energy is the ability to do some kind of work. This could be making things move. Sound is made when objects move backwards and forwards, or vibrate. All sounds are caused by vibrating objects.

在开始演出之前，乐队需要检查他们的设备。鼓手先击打一下鼓，检测鼓的声音。鼓是由一张绷紧的皮革或者塑料，展开后固定在一个空盒子的表面做成的。当鼓槌敲击皮革的时候，皮革就产生**颤动**。它在一秒钟之内上下颤动多次，这就产生了声音。

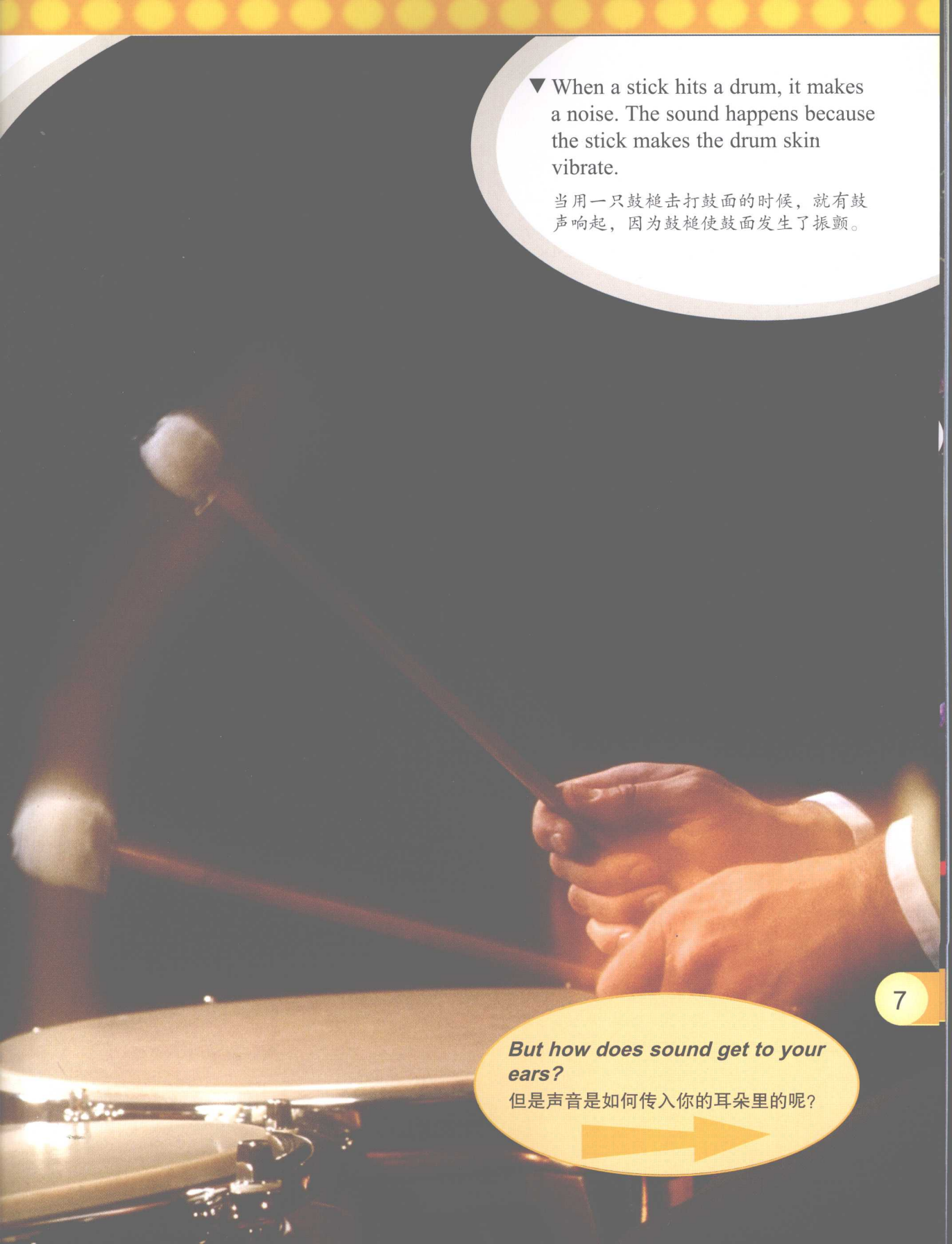
声音是一种**能量**。能量是指做功的能力。它可以使物体运动。一些物体前后运动或者振动，就能发出声音。所有的声音都是由物体振动产生的。

Sound fact!

声音小常识

A bass drum skin vibrates around 250 times per second.

一只低音鼓面每秒钟颤动250次。



▼ When a stick hits a drum, it makes a noise. The sound happens because the stick makes the drum skin vibrate.

当用一只鼓槌击打鼓面的时候，就有鼓声响起，因为鼓槌使鼓面发生了振颤。

But how does sound get to your ears?

但是声音是如何传入你的耳朵里的呢？



Sound check

检查声音

The band's **sound engineer** checks the instruments. He checks to hear if they are loud enough and if they sound good together. But how does the sound that the band makes get to the sound engineer's ears?

The answer is that sound travels through air. When an object like a drum **vibrates**, it pushes against the air around it. This starts **vibrations** in the air. These are called **sound waves**.

Sound waves spread out through the air and hit other objects. When they hit someone's ears, that person hears the sound.

乐队的**音响师**负责检查这些乐器。他要核查乐器发出的声音是否能达到他们想要的那样响亮悦耳。但是乐队发出的声音如何传到他的耳朵里呢？

答案是声音通过空气传播。当物体像鼓面一样**振动**的时候，它可以推动周围的空气，从而引起周围的空气以振动的方式运动。我们把它叫做**声波**。

声波通过空气四处传播直至碰撞到其他物体。当它们碰撞到人耳的时候，人就能听到声音。

The sound engineer checks the sound ► of the instruments. He checks to hear if they are loud enough, and if they sound good together.

音响师负责检查这些乐器。他来核查乐器发出的声音是否足够响亮悦耳。



Making sound

发出声音

1

The drumstick hits the drum.

用鼓槌击鼓。

2

The drum skin vibrates.

鼓面振动。

3

The vibrating drum skin makes the air vibrate.

颤动的鼓面使空气产生振动。

4

Sound waves spread through the air.

声波通过空气传播。

5

Vibrating air hits someone's ears.

振动的空气碰撞人的耳朵。

9

**Sound really does "hit" you.
Find out how.**

声音的确会“撞”你。现在来看看它是怎么“撞”你的。

Feeling the noise

感觉声音

The band has people called roadies to set up all their gear. While the band is getting ready, the roadies carry things on to the stage. A roadie walks in front of one of the giant speakers. Suddenly a wall of sound hits him.

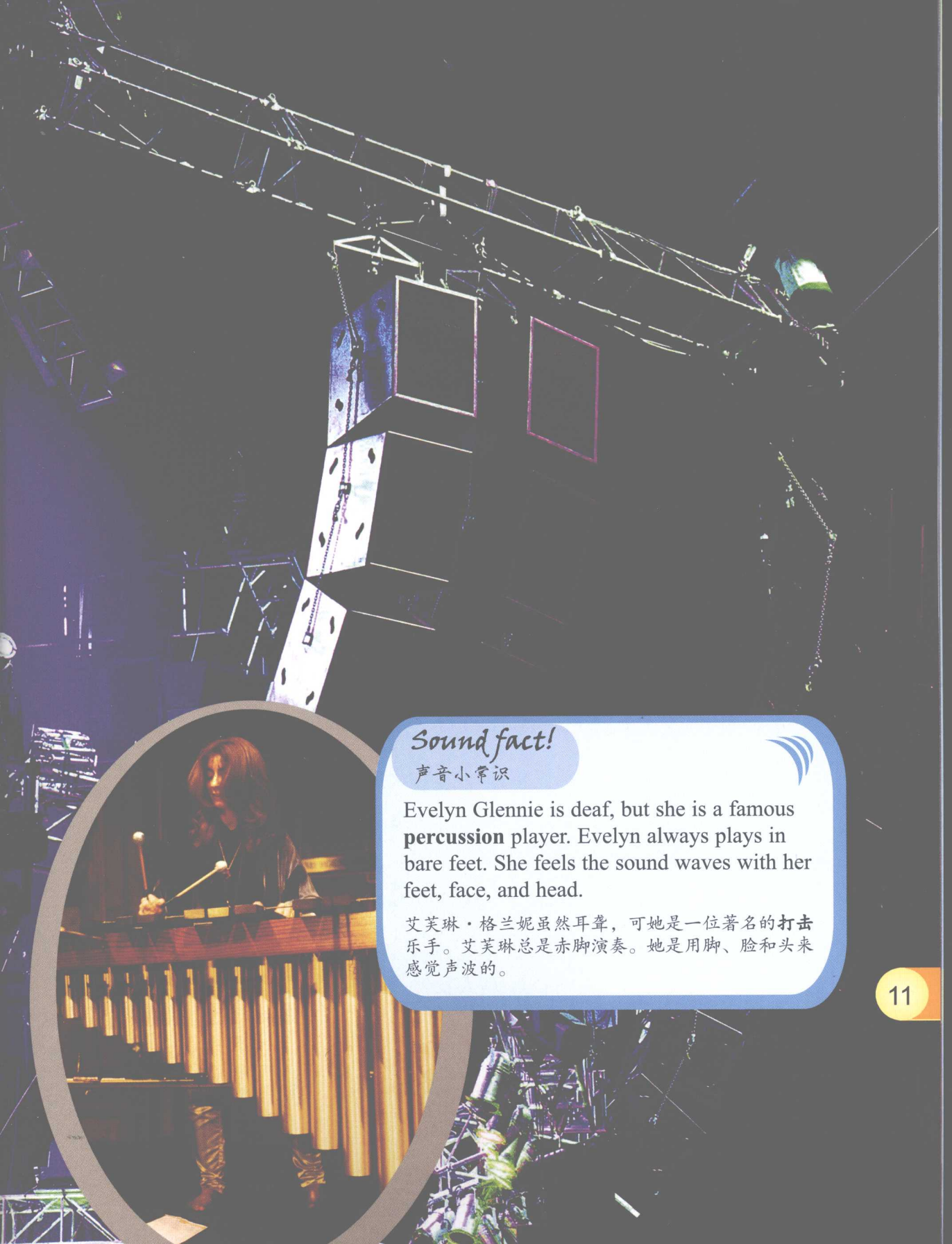
Have you ever been somewhere really loud? If so, you might have felt sound hitting you, too. In fact, **sound waves** actually do hit you. They make the air move backwards and forwards. If the sound is very loud, the air moves a lot, and you can feel it.

To test this, hold a blown-up balloon against a radio or hi-fi speaker. Your fingers will feel the sound waves making the balloon **vibrate**.

乐队中由演出管理员负责装卸所有的演出设备。在乐队做准备工作的時候，他们把这些设备抬到舞台上。一个管理员走到一只大音箱的前面。突然，一堵声墙撞击到他身上。

你是否也曾经身处震耳欲聋的地方。如果是这样，你一定会感受过被声音撞击的滋味。事实上，**声波**的确会撞击你。声音使得空气前后运动。如果声音足够响亮，空气就会运动得剧烈一些，这样你就能感觉到声音了。

要证实这一点，可以拿一个充满气的气球放在收音机或音响的喇叭上。你的手指会感觉到声波使气球产生的**振动**。



Sound fact!

声音小常识

Evelyn Glennie is deaf, but she is a famous **percussion** player. Evelyn always plays in bare feet. She feels the sound waves with her feet, face, and head.

艾芙琳·格兰妮虽然耳聋，可她是一位著名的**打击**乐手。艾芙琳总是赤脚演奏。她是用脚、脸和头来感觉声波的。

Ready to rock!

一起来摇滚吧!

The stadium doors open. The fans rush in to get the best places near the front. The stadium goes dark. Then the stage lights up and the band is on!

A huge cheer goes up as they start to play. The music is so loud that people living nearby can hear it too. Some open their windows so they can get a free concert.

体育场的大门打开了。歌迷们冲到前排最好的位置。体育场的灯光暗下来。然后，舞台的灯光亮了起来，乐队准备就绪了!

剧烈的欢呼声伴随着乐队的演奏响彻云霄。音乐声震耳欲聋，住在附近的居民也能听到。他们打开窗，享受着免费的音乐会。

The stage lights go on and the ►
concert starts at last. The band
rocks!

舞台的灯光亮起来，音乐会开始了。



Sounds range from very quiet to very loud. You can make sound louder or quieter by using the controls on your radio, TV, or CD player.

声音可以从弱到强。你可以用遥控器来调节收音机、电视或CD机的声音强弱，把它调得更响亮或更小声一些。

So how loud is really loud? Turn the page to find out!

那么，多大的声音才能算是大声呢？翻到下一页找答案吧！



How loud is that?

有多响?

The loudness of a sound depends on how strong the sound **vibrations** are.

If you hit a drum gently, the skin only moves backwards and forwards and **vibrates** slightly. It sends slight vibrations into the air. If you hit it hard, the vibrations get bigger. The air vibrates more too. The vibrations hit your ears harder, and you hear a louder sound. Loudness is measured in units called **decibels (dB)**.

声音的响度取决于声音**振动**的强度。

如果你轻轻击打鼓面，鼓面只是上下轻微**颤动**，轻微的振动被传送到空气中。如果你用力击打鼓面，振动就会加剧，空气的振动也会加剧。撞击你耳朵的振动越强烈，你听到的声音就越响。响度用**分贝 (dB)**这个单位来衡量。

Pin dropping

别针落地的声音

10 dB

20 dB

30 dB

40 dB

50 dB

60 dB

70 dB

80 dB

Whispering

耳语的声音

Talking

交谈的声音

Vacuum cleaner

吸尘器的声音

Traffic

交通运输的声音

Lawn mower

割草机的声音

Jet aircraft taking off

喷气式飞机起飞的声音

So loud it hurts

大到足以使人受伤的
声音

Front row of a rock
concert

摇滚音乐会现场前排
听到的声音

90 dB

100 dB

110 dB

120 dB

130 dB

140 dB

Sound fact!

声音小常识

Really loud sounds can lead to permanent loss of hearing. A loud bang can tear a hole in your **eardrum**. Going to a lot of loud concerts can give you **tinnitus**. This is ringing in your ears. It can also stop your ears from working properly.

极其响亮的声音可以使人永久失聪。震耳欲聋的乐曲可以穿透你的**耳膜**。多次听嘈杂的音乐会可能使你产生**耳鸣**现象，就是说你的耳朵中总是会嗡嗡作响。耳鸣也会造成你的耳朵不能正常工作。

Personal stereo, turned up
to loudest setting

个人音响调到最大时的声音

Hit single

演奏主打单曲

The band is half way through the show. They decide to play their latest hit single. The fans know the song. They go wild!

A tune or song is a sequence of different notes. The difference between notes is called **pitch**. Pitch means how high or low a sound is. The pitch depends on how fast a sound **vibrates**. The faster the vibration, the higher the pitch. The slower the vibration, the lower the pitch.

You use the keys or strings of an instrument to make different notes. When a guitarist presses a guitar string, it makes the string shorter. The note that comes out is higher.

乐队的演出进行到一半。他们要演奏最新的主打单曲了。歌迷们知道这首歌，他们疯狂了！

一首乐曲或歌曲是由一序列各不相同的音符组成的。音符之间的差别叫做**音高**，表明声音的高低。音高取决于声音**振动**的快慢。振动越快，音高越高。振动越慢，音高越低。

你用乐器的键盘或琴弦就能感觉到音符的差别。吉他手按下一根琴弦，使这根琴弦变短，发出的音符就是一个高音。

