Ever wonder how your Fitbit can tell that you're sleeping? Or how it knows which stage of sleep you're in?

Michael Grandner knows how it knows. He is the director of the UA Sleep and Health Research Program, and a consultant for Fitbit Inc.

In his work with Fitbit, he provides perspective and expertise as it relates to real-world sleep health, and helps ensure that this wearable technology provides people with an understanding of their total sleep hours and the quality of their sleep.

"My role is to be a check," he said. "My research team and Fitbit have similar goals. We try to improve health in the general population. They want to optimally meet that goal while also being responsible, scientifically accurate, accessible, usable and innovative."

**Fitbits as a Research Tool**

Fitbits are wearable technology that track daily step counts, heart rate, sleep and more. In some ways, the device is similar to a technology known as actigraphy, in which movement-based sleep sensors are placed on the wrist. Actigraphy is the gold standard in sleep research outside sleep labs.

Fitbits offer their own benefits, Grandner says, and he and other researchers are seizing the opportunity.

In recent years, Fitbit has incorporated heart rate readings with a movement sensor to improve sleep/wake detection capability, Grandner said. Now, the devices are even capable of estimating the different stages of sleep, which include light, REM and deep.

"But it's not perfect," Grandner said. "No device is. It would not make much sense to expect a wrist-worn device like Fitbits to be as accurate as a sleep lab, because sleep stages are brainwave-derived phenomena."

Even imperfect devices are useful to research if their strengths and weaknesses are known. All measurements of sleep are estimates in one way or another, Grandner said.

"The important part of validation studies are to show how imperfect it is, where it succeeds and where it fails, so that the information can be understood in context," he said.

For example, commercial sleep tracking devices are usually less accurate on a night-to-night basis and researchers usually don't get access to the raw data. But these devices, including the Fitbit, cost less than $200 and can be used over days and weeks.

"Compared to a device that can cost hundreds of dollars more and has fewer features, it's pretty amazing," Grandner said. "Even if one night with a Fitbit isn't as accurate as a sleep lab or even a research-grade actigraph, measuring sleep over a longer period of time is useful in its own way and much less expensive."

Fitbit also can be used with people participating in research studies. Unlike actigraphs, which keeps their data until the devices are handed over to a lab, Fitbits can deliver data daily.

Despite their convenience, Fitbits aren't optimal for studying people with sleep disorders, Grandner said.

"Fitbits weren't designed for people with artificially shallow sleep caused by chronic pain, sleep apnea, insomnia or other sleep disorders, especially those still untreated," he said. "It's important to understand the device's limitations. It has parameters within which it's relatively accurate. Any sensor will have limitations."

**Understanding What Your Fitbit Tells You**

New technology can provide a person with huge amounts of data – which has positives as well as negatives.

The data can be confusing, or even worrisome, for users who don't study sleep for a living, leading them to obsess over their data and what it means about the quality of their sleep.

"For example, if I see someone who says, 'My device says I'm waking up many times a night' – which is normal if you don't remember them and you don't wake up exhausted – or 'I'm getting much less deep sleep than I want to,' the first thing I ask them is, 'How do you know that these are actually a problem?'' Grandner said.

"Second of all, I say, 'So what?'"
If you give yourself enough time to sleep, practice generally good sleep habits, don't suffer from artificially shallow sleep or sleep disorders, and generally feel OK, then there's no evidence that there's anything wrong with that, Grandner says. Moreover, there's not much a person can do to change things like sleep stages anyway.

"You don't need to have perfect sleep to have good sleep," Grandner said. "We have millions of years of evolution on our side here."

There are some realities of life, however, that evolution couldn't have anticipated: shift work and artificial light, for example. But other than those disruptors, there are many kinds of healthy, normal sleep, he said.

If an individual is still worried about their sleep, Grandner encourages them to consult a sleep clinic, like the one here on campus [1], and ask any questions they have.

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