Wakey, wakey! Wake up refreshed with a brain-monitoring alarm clock

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We all know the feeling, the short, sharp shock of waking to the sound of an alarm clock. Whether the traditional clattering metal bells, the incessant beeping of digital or the dulcet tones of today's radio news reader. Even the chance to slap the snooze button to grab a few extra moments between the sheets does not leave everyone feeling refreshed when they finally crawl out of bed. Now, researchers in India think they have the answer.

Writing in a forthcoming issue of the *International Journal of Biomedical Engineering and Technology*, the researchers describe an alarm clock that monitors your brain activity and triggers its alarm within a time window you set in advance but only when your brain is in a more easily roused state rather than deep sleep. "By using such an alarm clock, the user will wake feeling much more refreshed than if they were awakened by a conventional alarm clock that rings at a set time," explains Jemina Asnoth Sylvia of Jerusalem College of Engineering in Tamil Nadu.

Sleep is a behavioral state that is a natural part of every individual's life. We spend about one-third of our lives asleep. Although the precise functions of sleep remain a mystery, sleep is important for normal motor and cognitive functions as well as growth and rejuvenation of the immune, nervous, skeletal and muscular systems. After waking naturally, we recognize changes that have occurred, as we feel rested and more alert. However, many people use an alarm clock to wake them at a set time, which is when problems occur for some of us.

The researchers point out that sleep usually involves 90-minute cycles of brain activity during which there are periods when the brain is most arousable. If a person is woken, from a night's sleep, during such an arousable period in the cycle, they will feel more refreshed than if they are woken during a deeper part of the sleep cycle. To take advantage of this requires putting EEG scalp electrodes on the head to monitor brain activity and to hook the output to a modified alarm clock. Once out of the experimental stage, the team envisages a head-band worn while sleeping that uses wireless electrodes.

In tests, the alarm time is set and the monitoring process is set to begin 90 seconds before the alarm time. An onboard computer determines what stage of their brain activity cycle the sleeper is in during the 90-second monitoring time. If they are in the 3rd or 4th stage of sleep, the alarm is "snoozed" automatically. However, if they are in stage 1 or 2 of sleep, the more arousable stages, the alarm is sounded to wake the sleeper.

The team adds that it is feasible to record brain activity during the night to obtain a so-called "hypnogram" to determine how well you are sleeping overall. This would allow you to adjust your alarm time so that the monitoring window coincided more often with stage 1 or 2. That might mean an earlier alarm call, up to 45 minutes earlier, but it would be a gentler more refreshed awakening. Of course, the converse would also be possible - a "snooze" or 45 minutes and an even more rested and refreshed awakening. Just don't blame the researchers if you are late for work!

More information: "Alarm clock using sleep analysis" in *International Journal of Biomedical Engineering and Technology,* 2011, 7, 148-164

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