

# Study finds children better at converting implicit into explicit knowledge after sleep

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Credit: Maurajbo/Wikipedia.

(Medical Xpress)—Researchers from Germany and Switzerland have found that children are able to do a better job of converting implicit knowledge into explicit knowledge after getting a night's sleep, than are adults. The team describes their study and results in their paper they've had published in the journal *Nature Neuroscience*.

Explicit knowledge, the team explains, is where information is stored in the brain and can be retrieved for use later—implicit knowledge, on the other hand, is the ability to do something without necessarily thinking

about how to do it—driving a car for example. They note that explicit knowledge can be converted in the mind into implicit knowledge, such as taking a driving course to gain the explicit knowledge required for driving a car—once it's mastered it can be converted to implicit knowledge. More importantly, they note, the reverse can also be true. People can gain some implicit knowledge and then convert it to explicit knowledge to help them accomplish a task. How it all works of course, is still much of a mystery, which is why this new effort was undertaken.

To learn more about the different ways implicit and explicit memory work, the research team tested the differences in [children](#) and adults. They enlisted volunteers from both [age groups](#) and asked them to perform tasks that required implicit learning—pressing buttons on a panel in a random order in a trial and error fashion to achieve a desired goal. The next day, after all were allowed a good night's sleep all of the [volunteers](#) were asked to run the same test again, using knowledge they'd gained the day before. They found that the children did much better at converting what they'd learned the prior day (implicit knowledge) into [explicit knowledge](#).

As a possible explanation for why children might be better at converting implicit knowledge to explicit, the researchers theorize that it's likely due to slower wave activity that occurs during sleep—as noted in prior research. When people sleep, they experience a period known as slow wave activity, where electrical signals slowly wash across the [brain](#), over and over again, like waves on a beach. Prior research by other groups has shown that slow wave activity is involved in learning and possibly memory retention. This new research may indicate that children, because they experience slower wave activity during [sleep](#) than adults, tend to be better at converting one type of knowledge to the other.

**More information:** The sleeping child outplays the adult's capacity to convert implicit into explicit knowledge, *Nature Neuroscience* (2013)

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## Abstract

When sleep followed implicit training on a motor sequence, children showed greater gains in explicit sequence knowledge after sleep than adults. This greater explicit knowledge in children was linked to their higher sleep slow-wave activity and to stronger hippocampal activation at explicit knowledge retrieval. Our data indicate the superiority of children in extracting invariant features from complex environments, possibly as a result of enhanced reprocessing of hippocampal memory representations during slow-wave sleep.

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