Ethical thoughts about Sweyepe:
Project Task G) by Clara Hardes & Elisa Hagensieker

Sweyepe - interactive dreaming as an aid to communication with the real world? What ethical consequences are to be feared, and are there any scare scenarios at all?
Sweyepe is a dream technology used during lucid dreaming to communicate with the waking world. Rather than encoding Morse code, which was the provider technique, from the sleeper for yes/no questions or solving math tasks (1), it involves understanding more advanced responses (6), such as written words on a keyboard or objects you imagine drawing with your fingers. You can imagine an artificial keyboard and write a word by swiping across it. Try it while you are awake. You will see that you move your finger and follow that movement with your eyes. Before participants fall asleep, they are instructed to use finger and eye movements to respond to questions asked during lucid dreaming. Then, an electrooculography (EOG) measures this eye movement to reconstruct the answer. From the vertical EOG signal, one obtains information about the vertical position on the keyboard, while the horizontal position is derived from the horizontal EOG signal. In this way, one can obtain a unique pattern for different words or objects. This pattern can now be used to reconstruct words and images which are then fed into a neural network to classify these words or images.

Why would we want to record our thoughts during sleep and reconstruct these?
First, this technology allows sleep researchers to communicate with the sleeping world in real time. This is much more reliable than techniques such as questionnaires or dream diaries, which can only be answered after waking. Since one does not have a good sense of time during sleep, one can now give times when the dream occurred and how long it lasted, which was rather subjective without this technique. Not only the experience about time but also the thoughts and imaginations participants had, will become much more reliable.
One could also combine this technique with others where one measures brain signals to get more detailed information about the dream content. An example would be the measurement of brain signals together with eye movement during lucid dreaming. The participant might draw a human face that is easy to confuse with a flower. The measured brain signal shows an activation in the fusiform face area, leading to a less uncertain decision to have imagined a human face.
Overall, a very positive and promising development for sleep research.
Thinking about further development of the technology, there could be apps that evaluate sleep and interaction during lucid dreaming. When it notices that you are lucidly dreaming it can start measuring your eye movement while asking questions. An app that sets a timer to your preferred wake-up time or a to-do list of things that occurred to you during the night. Maybe you have also experienced yourself in a lucid dream, where you see yourself doing something you forgot to do the day before.Taking notes and looking at your recordings in the morning might help you remember about the dream. Creative ideas can also transfer, such as coloring in your dreams or saving a tune you heard during your dream. Perhaps an idea for a difficult problem occurred to you in your dream that is worth saving for implementation. "*Sleep on it. Things will look better in the morning*" (3) is something you might have heard often in your childhood or also when being stuck with some complex task and you do not want to take a pause yet. But you might also remember that you find yourself more confident in decision-making or with new ideas. Steve Calechman took up on this in his article about how sleep helps to solve tasks. The prefrontal cortex and also serotonin and norepinephrine

gets shut down. Without going into detail here, it helps with also taking into account looser connections, less frequent ideas and being less rational (3). Learning vocabulary or new concepts might be supported during lucid dreaming in a similar way as well.
In some cases, hypnosis is a helpful tool for trauma management, where psychologists gain new insights into people's emotional world (4). Moreover it is known that people with posttraumatic stress disorder have a fragmented REM sleep (2). Combining these two information, lucid dreaming, which occurs during REM-sleep together with concepts from hypnosis might help to cope with traumatic events.

Reading all these advantages, one might wonder what the disadvantages of this development could be. A few disadvantages come to mind, which we will discuss below.
Why might it be ethically incorrect to perform these measurements?
In EOG, electrodes are placed near the eyes to measure vertical and horizontal eye movements (5). When these electrodes are used during sleep, they may move away from their original position or feel uncomfortable during sleep. If used for a longer period of time, because one wants to record creative ideas regularly, this argument could be even more important.
Additionally, before this technique is used, it should be investigated whether it affects the efficiency of resting. Is a participant as recovered after communication during lucid dreaming as without? If not, it can be argued that the technique has a negative impact on the purpose of sleep, which is rest. However, other arguments might invalidate this. Having ideas and transferring them to the waking world could be one such statement.
Also, you might give answers that deviate from what you intended to say, which would lead to a bad consequence. Imagine a message where you send a random person a message to transfer money. You might not be as responsible as you are when you are awake. Therefore, it might be important to limit the scopes to those that do not have negative consequences. Answering a math problem with a different value might not be as harmful as sending money to a random person. Moreover, reality might deviate from what you are experiencing in your dream. Believing to have found a solution for a complex problem and implementing it in real time to your already existing work, might not be convertible in reality.
It could be similar, but even more drastic, with privacy. In the future, there could be apps that can be used with Alexa and communicate with you during lucid dreaming. These apps could disregard important privacy rules and therefore ask questions you don't want to answer, but you do because you are unaware that you are sharing information with others. Again, it should be well considered which apps and for what purpose this technology should be used in the future.

As with many developments that are not yet on the market, it is difficult to give a concrete answer to the question of whether its use is ethically right or wrong. However, considering the arguments above, we would tend to say that it can be used for many important areas, such as psychological treatments or sleep research. Therefore, we believe it is important to explore this technique further. Because of possible privacy issues and because one may have less rest during sleep, it is highly recommended to discuss its purpose and areas of application. Any negative consequences and side effects should be investigated and disclosed to the user. Especially if the technology is developed further and can be integrated into apps, interesting ideas might emerge where it is important to have specific regulations for safety.

References:

(1) Appel. K. 2021. “Real-time dialogue between experimenters and dreamers during REM sleep”, Available at: https://www.sciencedirect.com/science/article/pii/S0960982221000592 (Retrieved on: 23.12.2022)

(2) Bustamante, V., et al. 2002. “REM Sleep and the Early Development of Posttraumatic Stress Disorder”. Available at: https://ajp.psychiatryonline.org/doi/epdf/10.1176/appi.ajp.159.10.1696 , retrieved on: 20.12.2022

(3) Calechman, S. 2021. “Sleep to solve a problem”, Available at: https://www.health.harvard.edu/blog/sleep-to-solve-a-problem-202105242463, retrieved on: 27.12.2022

(4) Chan, N. 2021. “Update on hypnotherapy for psychiatrists”, Available at: https://www.cambridge.org/core/journals/bjpsych-advances/article/abs/update-on-hypnotherapy-for-psychiatrists/F8BCC7AABAEDCD28D625DBC48D51CBE1 (Retrieved on: 20.12.2022)

(5) Malhotra, R.K. et al. “Electrooculogram”. Available at: https://www.sciencedirect.com/topics/nursing-and-health-professions/electrooculogram (Retrieved on: 28.12.2022)

(6) Mallett, R. (2020). “A pilot investigation into brain-computer interface use during a lucid dream”. Available at: https://journals.ub.uni-heidelberg.de/index.php/IJoDR/article/view/68010 (Retrieved on: 28.12.2022)

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