

# When is sleep perceived as sleep and when as wakefulness?

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**INTRODUCTION** Electrophysiologically defined sleep is sometimes perceived as wakefulness when subjects are deliberately awakened and interviewed. The probability of this discrepancy between measured and perceived sleep depends on the current sleep state with more wake estimates after S2 than after REM sleep. One reason for this may be more dreamlike cognition during REM sleep and more thought like cognition during NREM sleep.

**METHODS** A total of 68 subjects (43 females and 25 males, mean age 24.1 years) without sleep complaints were polygraphically recorded for one night in the sleep lab. Deliberate awakenings were performed after at least 15 minutes of continuous S2 or 7.5 minutes of REM sleep by an acoustic signal (70 db). A standardised interview was performed with questions about state perception, different aspects of present orientation, and mental content. The interviews were tape recorded for later analysis. 39 subjects were awakened only once, randomly either out of S2 or REM sleep, while the remaining 29 subjects had two awakenings in a randomised order (once in S2, once in REM sleep). The first awakening was planned for the second sleep cycle. In case of two awakenings only the first one was selected for the present analysis.

**RESULTS** The state preceding the awakening was rated as wake instead of sleep by about one third of the subjects. The proportion of awake judgements tended to be higher in S2 than in REM sleep (38.2% vs. 20.6%, chi square = 2.55,  $p = .11$ , n.s.). Mental activity (Q: Was there something in your mind before you heard the tone signal?) was high in both states, with 85.3% for REM sleep and 64.7% for S2 (chi square = 3.8,  $p = .05$ ). Mental content showed state-dependent differences. It was clearer in REM sleep than in S2 (64.7% vs. 23.5%, chi square = 4.8,  $p = .03$ ), and it was more image like in REM sleep than in S2 (70.6% vs. 23.5%, chi square = 8.54,  $p = .003$ ). Subjects who perceived the state prior to the awakening as wake reported that they were oriented before the awakening (80%) in comparison to those who reported to be asleep (33.3%). There was no significant difference for this question between the two sleep states. In addition, there were state-specific differences in respect to image like cognitions and the degree of controllability of mental content in the sense that those subjects who reported sleep after awakenings from REM sleep had more image like and uncontrollable mental content than those subjects who reported to be awake.

**CONCLUSION** The results suggests that state perception can not be adequately (sufficiently) explained by electrophysiological features but depends additionally on mental content. Sleep perception was positively correlated with image like and uncontrollable mental content and low external orientation, while wake perception was correlated with reverse pattern. A higher degree of orientation before the awakening was associated with wake judgements in REM sleep and in S2. State judgements during sleep seem to depend on electrophysiological features as well as on experiential cues.