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This Week's Citation Classic

Hebb D O. Drives and the CNS (conceptual nervous system).
Psychol. Rev. **62**:243-54, 1955.

Psychological evidence puts human motivation on a continuum of arousal, from deep sleep to strong emotion. Optimal levels for adaptive behavior are in the middle of the continuum. [The *Science Citation Index*® (*SCI*®) and the *Social Sciences Citation Index*™ (*SSCI*™) indicate that this paper has been cited over 380 times since 1964.]

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"This paper was mainly concerned with the behavioral meaning of the arousal system or ARAS (ascending reticular activating system) recently discovered by C. Moruzzi and H.W. Magoun.[1] This was one of an exciting series of physiological developments offering a new basis for understanding brain and mind. Earlier ones were incorporated in my book, *Organization of Behavior*, but not this one, for it was reported only in the year my book was published, 1949.[2]

"The title of the paper was a little joke. B.F. Skinner, who thinks that psychology should have nothing to do with the brain, had had his joke earlier. He said that for psychology CNS stands for 'conceptual' (instead of central) nervous system. Perhaps he was right; at the best, neurophysiology still has a long way to go; but if we have to conceptualize the nervous system, let's conceptualize it as well as we can. And perhaps Skinner's own views were more affected than he knew by an earlier nervous system. So what I proposed to do was to bring Skinner's CNS, and mine, up to date.

"Behavior at the time was mostly regarded as a matter of stimulus and response controlled by reward and punishment, and the new physiological information was changing all that. The brain was no longer inert unless stimulated from outside. The higher animal especially might then be intrinsically motivated, not solely by biological drives (hunger, pain, sex). But now Moruzzi and Magoun added a further point. Spontaneous activity of the cortex is unorganized and without behavioral effect, unless there is also arousal, a maintained excitation from ARAS. This in turn depends on a background of varied, nonspecific sensory stimulation. So motivation required sensory stimulation after all.

"We were then concluding our sensory deprivation' experiments, at McGill University which were really experiments on boredom. The subjects were only deprived of variety in their sensory input. The intense need that developed to escape the monotony was very enlightening. There is a continuum of arousal, from deep sleep to strong emotion. At low levels, any action moderately raising the level of arousal is supported by ARAS, and the subject acts as if seeking excitement. At high levels we may suppose that support is too great and makes conflicting reaction tendencies nullify one another. Now any act that lowers arousal will be supported, so the subject escapes from or avoids the situation that causes the high excitement.

"This theoretical scheme made sense of the anomalous fear-seeking behavior of mountain-climbing (and roller-coasters), and the attraction of puzzles and intellectual games like bridge and chess, as escapes from boredom On the other side of the coin, it made intelligible the impaired thought and action in crisis situations ('paralysis of terror'), and perhaps also fainting at watching a surgical operation Such phenomena were well-known but omitted from the textbooks, presumably for lack of the rationale that ARAS could now provide Unlike Skinner, I think neurologizing' can be a stimulant'

1. **Moruzzi G & Magoun H W.** Brain stem reticular formation and activation of the EEC *EEG Clin. Neurophysiol.* **1**:455-73, 1949.
2. **Hebb D O.** *Organization of behavior*. New York: Wiley, 1949. 335 p.