

# Human circadian clocks couple to local sun time

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By assessing the daily activity patterns of thousands of individuals living in different geographical locations, researchers have found evidence that the human circadian clock becomes coupled to so-called local sun time despite the fact that people live and work according to a common "social time" that is determined by time zones. The work also indicated that city dwellers appear to experience a relatively decreased influence of local sun time relative to those living in more sparsely populated areas.

The findings appear in the January 23rd issue of *Current Biology* and are reported by Till Roenneberg of Ludwig-Maximilians-Universität, Germany; C. Jairaj Kumar, of Kasturba Medical College, India; and Martha Merrow, of the University of Groningen, in The Netherlands.

Because our watches and clocks are set according to time zones, which are constant over multiple longitudes, rather than according to local sun time, which continuously changes across longitudes, there is often a discrepancy between the natural-light cues one receives as a result of local sun time and the "social" cues one receives as a result of clock time. The extent of such discrepancies depends on the time of year and one's location within a time zone, but can be substantial: In some cities, midnight (according to clock time) can fall well beyond an hour away from "mid-dark." The relative influences of these two types of cues on circadian rhythms are not fully understood by scientists, and in the new work, researchers sought to address this issue by comparing the circadian behaviors of people experiencing these influences to different extents in their daily lives.

The measure used to assess patterns of daily activity is the so-called chronotype, which is determined by answers to questionnaires that assess patterns of habitual activity and rest during work days and free time.

In the present study, the authors compared the chronotypes of over 21,000 individuals living in different geographical locations across Germany. Individuals were compared according to the town size in which they lived: The first group included those in areas with a population size of 300,000 or less, while other groups corresponded to individuals living in towns and cities of larger sizes.

The researchers found that within the first group--individuals in more lightly populated regions--chronotypes were tightly coupled to sun time, while within groups corresponding to more densely populated towns and cities, chronotypes showed a progressively weaker coupling to sun time.

City dwelling potentially impacts the influence of sunlight as a zeitgeber because urban dwellers are typically exposed to less natural light than individuals inhabiting less densely populated areas. The authors propose that the gradual uncoupling of the circadian clock of city dwellers from local sun time may reflect the relative strength of natural-light and social cues in influencing activity patterns. When natural-light cues are more abundant--as seems to be the case in more sparsely populated areas--human circadian rhythm entrains to local sun time.

Past work has indicated that as influences on the circadian clock--known as "zeitgebers"--become weaker, chronotypes tend to become later--that is, daily activity is shifted later in the day. And indeed, the present study found that chronotypes became later with increasing population size.

Source: Cell Press

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