

**SOCIAL JETLAG- AN EXHAUSTING CONDITION IN 21ST CENTURY –
A CONCEPTUAL FRAMEWORK**

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ABSTRACT

Our lives are regulated by three types of clocks: the social clock, which schedules our interactions with others (local time); the biological clock, which manages our body's functions (circadian time); and the solar clock, which dictates natural light and darkness. When these clocks are out of sync, our risk of developing certain diseases increases. The term 'social jetlag' measures the disparity between local time and circadian time.

KEYWORDS: *Social Jetlag, Exhausting, disparity, anticipation.*

INTRODUCTION

Clocks everywhere, but what time is it?

Time carries a lot of power in itself...it has been rightly said that it is the most powerful warrior. We must value the time given to us on this earth and try to avoid the non-significant that surrounds us...Power of time has been felt by everyone in one way or the other...

The rotation of the earth on its axis and around the sun determines regular changes in the environment, namely the alternation of day and night and of seasons. Many organisms have developed an internal time keeping mechanism in order to synchronize to external time signals (zeitgebers) . “Zeitgebers” refer to environmental and social cues that provide input to the circadian system and help to synchronize biological rhythms (Aschoff, Hoffmann et al., 1975). Light is considered the most important zeitgeber for human entrainment (Duffy & Wright, 2005), (Pittendrigh, 1964), nonphotic stimuli, such as food intake and physical activity, can also influence circadian rhythms (Mistlberger & Skene, 2004; 2005).

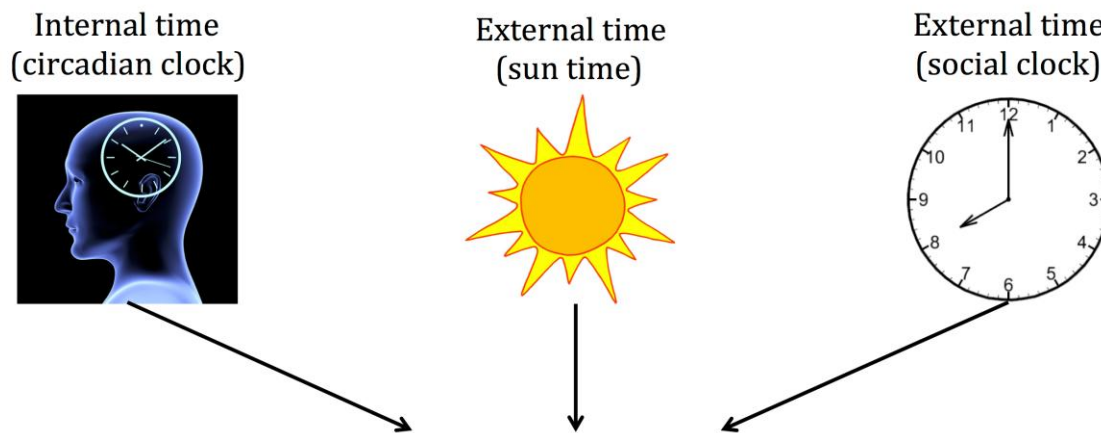
The process that maintains a stable phase relationship between two oscillators is called entrainment (Aschoff, Klotter, & Wever, 1964). Having an internal clock able to entrain is thought to be adaptive since it allows, for example, anticipation of the regular changes in the environment (Moore-Ede, 1986).

The internal clock has a period of about 24 hours (similar to the period of its zeitgeber) and is hence also called circadian clock (from Latin: circa diem = about a day).

Inconsistency in Internal Time

On top of the inconsistency between different external time signals, internal time can vary substantially between individuals. Like many biological traits, also circadian clocks vary

with individual characteristics such as sex, age, and genetic background (Hamet & Tremblay, 2006; Roenneberg, Kuehne, Juda, Kantermann, et al., 2007a; Roenneberg et al., 2004). The additional exposure to different light landscapes results into a wide distribution of phases of entrainment, which determines, for instance, differences in sleep timing (Roenneberg & Merrow, 2007). These individual differences have been described as a distribution of chronotypes (Roenneberg, Kuehne, Juda, Kantermann, et al., 2007a).



Conflicting clocks (some examples):

- Time zones: same social time but different sun times
- Daylight saving time: abrupt change in social time not in accordance to sun time
- Shift work: conflict between internal and social time

Figure 1. Internal time, sun time, and social time.

Source: Zerbini, G. (2017)

The image shows that Internal time, sun time, and social time. Internal and external time signals are not always perfectly synchronized in modern society, giving rise to several conflicts. Some examples of these conflicts are listed.

Chronotype and how to measure it

Chronotype is a feature of the circadian clock that can be easily measured via questionnaires such as the Munich Chronotype Questionnaire (MCTQ; Roenneberg, Wirz-Justice, & Merrow, 2003) and the Morningness-Eveningness Questionnaire (MEQ; Horne & Ostberg, 1976). Chronotype assessed via the MCTQ refers to sleep timing on work-free days, while the MEQ expresses chronotype as a diurnal preference towards morningness or eveningness. The majority of the working population (80%) needs alarm clocks to wake up on workdays (Roenneberg, Kantermann, Juda, Vetter, & Allebrandt, 2013); hence most people are chronically sleep deprived, showing sleep rebounds on work-free days to compensate for the lost sleep. Because of this tendency to oversleep on work-free days, midpoint of sleep on work-free days (MSF) has to be corrected for the confounding influence of sleep debt accumulated on workdays, resulting in MSF sleep corrected (MSFsc). This difference in sleep duration between workdays and work-free days is particularly evident in late chronotypes (if they have to attend early school/working

schedules). Generally, the later the chronotype, the shorter the sleep duration on workdays and the longer the sleep duration

on work-free days will be (Roenneberg, Kuehnle, Juda, Kantermann, et al., 2007a).

Characteristics of Chronotype

Chronotype varies with age and sex. The prevalence of morning types is higher in the toddler age, but a progressive delay in chronotype is clear already during the first years of age (Randler, Faßl, & Kalb, 2017). Males on average are later than females, and this becomes particularly evident during adolescence (Randler et al., 2017; Roenneberg et al., 2004; Roenneberg, Kuehnle, Juda, Kantermann, et al., 2007a). Based on the MCTQ database, males reach their maximum in lateness at the age of 21, whereas females, who mature earlier, reach their maximum in lateness at the age of 19.5. After that age, both gradually become earlier chronotypes. When using another questionnaire to assess chronotype as diurnal

preference (Composite Score of Morningness; Smith, Reilly, & Midkiff, 1989), these peaks in lateness are observed earlier (at the age of 18 for males and at the age of 15 for females; Randler et al., 2017).

Chronotype varies also with light exposure as shown by the correlation between chronotype and time of dawn described in a German population (Roenneberg, Kumar, & Mellow, 2007b). Moving from east to west, dawn was shown to progress continuously and the same was true for chronotype that was found to delay from east to west, although local clock time was the same within the given time zone. The correlation was stronger for smaller towns (less than 300,000 inhabitants), where people hypothetically experience a stronger zeitgeber since they spend more time outdoors and are exposed to more natural light than people living in bigger cities. This finding suggests the importance of considering sun time as well as total

outside light exposure since the circadian clock seems to entrain to natural light rather than social schedules.

Genetic influences on chronotype have been also described in relation to extreme sleep behaviors, such as advanced and delayed sleep phase syndromes (Archer et al., 2003; Hamet & Tremblay, 2006).

Chronotype and Other Tools to Assess Phase of Entrainment and Sleep Timing

In addition to forcing social jet lag, the modern lifestyle also contributes to an extreme expression of the so-called chronotypes – the classification of individuals according to the preferences of their body regarding the time they perform daily activities such as sleeping, waking up, working out and exercising the mind.

There are two main chronotypes: the “morning people,” who sleep and rise early, and reserve the night period to sleep; and the “evening people,” who prefer to sleep and wake up late, even if that means dedicating part of the day to sleep.

In terms of their circadian behavior, these two chronotypes are growing farther and farther apart because of how the patterns of exposure to natural light are changing in the modern age. According to him, throughout the course of evolution, our biological clock was synchronized with a light/dark cycle regulated by exposure to sunlight: “The environment in which we were synchronized during the last thousands of years was one of much light during the day and no

light at all at night. The morning and evening chronotypes existed, but the distance between them was not significant.”

However, the dissemination of electric lighting and the habits of modern life have imposed different levels of exposure to solar and artificial light. Indeed, the luminous signals that help synchronize internal body rhythms and external environment rhythms are being minimized. In daytime, when people should normally be exposed to the Sun, participants were confined indoors, with little natural light; at night, on the other hand, when the body should be in the dark, they were exposed to a prolonged period of artificial light. “We are darkening the day and illuminating the night. And this light is increasingly turning us into evening people,” Roenneberg

According to him, exposure to artificial light at night would hardly make a farmer become an evening person, because, when working outdoors, under the Sun, he would signal to the biological clock that sunlight, stronger and natural, was the real light. “It is the *contrast* between light and dark that synchronizes our biological clock, making us sleep from 10 pm to 6 am,” he said.

In Roenneberg’s view, unlike what is commonly thought, being an evening person does not imply any type of pathology. “There is no innate timing of the circadian clock,” he explained, pondering that sleeping and waking up later is “a natural reaction to the environment where one lives, a normal way for the circadian clock to synchronize a body that is not being sufficiently exposed to light.”

Chronotype can be used to estimate an individual’s phase of entrainment. Although

chronotype is assessed with questionnaires (subjective measurement), the MCTQ asks about sleep timing that is usually reported quite objectively. The greatest advantage of using chronotype to assess phase of entrainment is the possibility to collect data in large populations in a quick and cost-effective way; the MCTQ online database has in fact reached over 200,000 entries so far. Alternatively, biological (objective) phase markers can be used in human research to determine phase of entrainment, especially in relatively small-sample-size studies. Dim-light melatonin onset (DLMO) is often the first choice because melatonin has a robust and stable

rhythm under the direct control of the circadian clock (Arendt, 2006; Klerman, Gershengorn, Duffy, & Kronauer, 2002). Melatonin is suppressed by light and therefore needs to be assessed in dim-light conditions. Other markers of the melatonin rhythm can be used, such as the peak in expression, but the advantage of DLMO is that it is accepted as a proxy for a full, overnight melatonin curve in most experiments (less expensive and time consuming). Another biological phase marker mainly used in laboratory studies is core body temperature. Core body temperature also shows a strong circadian rhythm with a peak in the evening and a trough at night, but is more variable and influenced by external factors such as physical activity more than is melatonin (Klerman et al., 2002). Sleep timing can be assessed both with daily sleep diaries (subjective measurement) and with actiwatches (objective measurement) that usually record activity together with light exposure. Actigraphy data can give also insights about sleep quality based, for instance, on awakenings and the time spent asleep in relation to time spent in bed (sleep efficiency). Actigraphy can also be used to assess other phase markers such as center of gravity (the time point when the amount of activity before and after is the same).

Natural Rhythms/ Daily Rhythms

Daily rhythms in fundamental aspects of physiology and behavior are controlled by an endogenous biological clock. They persist in temporal isolation experiments with a period of approximately 24 h (hence circadian, about 1 day) and have been shown for many biological functions, ranging from the sleep/wake cycle and physiology, e.g., temperature, melatonin, and cortisol (Bailey and Heitkemper, 1991, 2001; Duffy et al., 2001; Waterhouse et al., 2001) to gene expression (Clayton et al., 2001; Young and Kay, 2001).

Poor scheduling, combined with unhealthy attitudes about the need for sleep, can cause major problems for who do not take proper sleep during weekend. That's because working at night runs counter to the body's natural circadian rhythm, says Charmane Eastman, PhD, a physiological psychologist at Rush University in Chicago. The circadian clock is essentially a timer that lets various glands know when to release hormones and also controls mood, alertness, body temperature and other aspects of the body's daily cycle. Our bodies and brains evolved to relax and cool down after dark and to spring back into action come morning. People who work the night shift must combat their bodies' natural rest period while trying to remain alert and high functioning. It doesn't matter whether they get enough sleep during the daytime, she says. All the sleep in the world won't make up for circadian misalignment.

What is Social Jet Lag?

Social jet lag, a term coined by German researcher Till Roenneberg in 2006, is the discrepancy in a person's sleep pattern between the weekday and the weekend, which can cause a person to feel "jet lagged" or tired and fatigued. Researchers in Europe have coined the term "social jet lag" to describe the all-too common practice of following a different sleep schedule on weekdays versus the weekend. Our circadian rhythms are out of sync with our hectic work schedules, the theory goes, so each weekend we're effectively flying back and forth between time zones without ever leaving the ground.

An Important difference in between Travel Jet lag and Social Jet lag is that travel jet lag is lighter in intensity. When we arrive in a different place, the sun is coming up and setting at different time and your body can reset its own clock to match. With Social jet lag, the schedule disruption is chronic a person staying in the same place.

According to recent researches, in last few decades people are facing problem of social jet lag because of constant work pressure, going late to bed for sleep, getting up early or normal to complete the tasks (personal and professional) and losing out 1-2 hrs. of sleep. A disrupted sleep schedule can increase your risk of Diabetes and heart diseases, a new study revealed.

How Social Jet Lag Impacts Health

Social jetlag has been found to be associated with several health issues. Social jetlag significantly increases the probability of overweight and is positively associated with weight gain within this specific sub population (Roenneberg, Allebrandt, Merrow, & Vetter, 2012). Furthermore, stimulant consumption is related to social jetlag and, in particular, the greater the social jetlag, the more likely someone is a smoker (Wittmann et al., 2006). A positive correlation between social jetlag and depressive symptoms has also been found in a rural population in Brazil (Levandovski et al., 2011). Social jetlag is particularly high in shift workers and is positively correlated with heart rate, considered as a marker for cardiovascular diseases (Kantermann et al., 2013). Since social jetlag arises from a discrepancy between two clocks, there are two possibilities to decrease it: delay the social clock or advance the

circadian clock. Several schools and working places have introduced delayed or flexible schedules, but still there are many situations in which late chronotypes need to perform at an early (non-optimal) time of day. Therefore, more studies investigating interventions to decrease social jetlag by modifying (advancing) phase of entrainment are needed. Basically, there are two forces that determine when we are awake or asleep at any point in time. The first is how long we've been awake, and the longer we're awake the more tired we feel and it's easier to fall asleep. But, there's this other force that keeps us awake during the day, which opposes that sleepy force or sleep debt that is building up. This is called our internal body clock or circadian rhythm. Intensely adjusting the circadian rhythm confuses the body and brain - no longer knowing what time to go to sleep and what time to get up, which makes us feel horrible. This is exactly what happens to teens that sleep in for multiple hours on the weekends. In fact, teens who go to bed two or more hours later on the weekends (compared to teens who went to bed within two hours of their weekday bedtime) reported having difficulty falling and staying asleep, falling asleep in school and/or while studying, feeling cranky/irritable and sleepy during the day and more difficulty getting along with family members. These kids also drank more caffeine, had worse grades and reported more depressive mood symptoms.

Other potential side effects of social jet lag include:

- Disturbed sleep (insomnia, early waking or excessive sleepiness)
- Daytime fatigue
- Difficulty concentrating or functioning at your usual level
- Stomach problems (constipation or diarrhea)
- A general feeling of not being well
- Behavioral problems
- Metabolic risk

Research Context and Relevance

Social jet lag is “the discrepancy between what our body clock wants us to do and what our social clock wants us to do,” says Till Roenneberg, Ph.D., a professor at the University of Munich’s Institute of Medical Psychology, in Germany. “It almost looks as if people on a Friday evening fly from Paris to New York, and on Monday morning they fly back again.”

Even though light is considered the main signal that entrains inner biological rhythms according to circadian environmental rhythms, social organizations have the capacity to take the body “out of sync”. An emergent field of research on the topic refers to what has been described as social jetlag, the biological misalignment that arises from alternated work and free days. However, to the present moment, there is still controversial evidence on the effects of such a phenomenon to human health.

There are 400 new Facebook notifications, 548 unread emails, 20 missed calls and you’ve just discovered that the white shirt you had planned to wear to the conference tomorrow has a terrible coffee stain down the front of it.

In our modern day world, where everything is all go-go-go and no slow, we ignore our body’s whispers for rest – often forgetting that in order to help others, we must first help ourselves.

According to Dr Patricia Wong of the University of Pittsburgh, : ‘Social jet lag is a habitual form of circadian misalignment, when individuals have to essentially sleep and wake at times that are out of sync from their internal, biological clock and shift back and forth in their sleep schedules due to social obligations.’

"Sleep plays an important role both in the physiological and psychological development of an individual's body," says sleep expert Dr Preeti Devnani. "Our body has a preferred time for sleep and activity, which when hampered, causes various changes in your body," she adds.

Further understanding entrainment: The Role of Season and Weekly Schedule

Light is the primary zeitgeber for human behavioral entrainment, and therefore many studies have investigated the (isolated) effects of light on the circadian clock, often in highly controlled laboratory conditions. However, entrainment is a complex phenomenon resulting from the integration of many different internal and external time signals. Therefore, more field studies investigating entrainment in real life conditions may be useful to understand the problems and possibilities of giving sound advice to people who are not institutionalized.

The social clock also influences human behavior, in particular the sleep-wake cycle. Sleep is usually later and longer on work-free days compared to workdays (social jetlag), and this difference is greater in later chronotypes (Wittmann et al., 2006).

CONCLUSION

In the current scenario, due to modernization and development in technology people are forced to work late at night, working in shifts, late-night use of electronic gadgets, eating late at night, and mismatch timings of various other activities. This misalignment of various daily activity timings with the natural day/night environmental cycle tends to misalign the circadian rhythm. As a result, people suffer from several circadian disruptions such as social jetlag, eating jetlag, obesity, depression, etc.

The Centers for Disease Control and Prevention (CDC) in the United States has declared insufficient sleep a ‘public health problem’, with more than one-third of American adults not getting enough sleep on a regular basis. However, insufficient sleep is not exclusively a US problem; it equally concerns other countries.

There are studies which shows that Social Jetlag is also hat adults with higher levels of social jetlag were more likely to be overweight or obese and have metabolic syndrome (which is associated with the development of type 2 diabetes) compared with those with more regular sleep patterns – even after controlling for how much sleep they got.

While reading various studies it was found that most of the studies are done on students, teen agers who spent lot of time on screens, shift workers who works in night shifts. Also, studies done on to find out the corelation between social jet lag and health aspects such as diabetes 2, Cardiovascular disease . Some studies explored and got corelation between social jetlag and behavioural aspects such as smoking, depression and mood swings etc.

Although, there are various studies on social jetlag, still there are need to explore the awareness level of a common person about the social jetlag and it’s impact?

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