

## **Chronotype, gender, and time for sex**

Konrad S. Jankowski<sup>1\*</sup>, Juan Francisco Díaz-Morales<sup>2</sup>, Christoph Randler<sup>3</sup>

Faculty of Psychology, University of Warsaw<sup>1</sup>; Complutense University of Madrid<sup>2</sup>; University of Education Heidelberg<sup>3</sup>

\*Corresponding author. Address: Faculty of Psychology, University of Warsaw, Stawki 5/7, 00-183 Warsaw, Poland. Tel.: +48 225549721, Fax: +48 226357991,  
Email: [konrad.jankowski@psych.uw.edu.pl](mailto:konrad.jankowski@psych.uw.edu.pl)

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### Abstract

The study aimed at testing chronotype and gender differences in the time of day when humans feel the greatest need for sex and the time of day they actually undertake sexual activity. A Polish sample of 565 participants aged between 18 and 57 was tested. In females, regardless of chronotype, the greatest need for sex occurred between 18:00 and 24:00, but a secondary peak appeared in morning types at 6:00-9:00. In males, the greatest need for sex occurred either in the morning or evening: in evening types at 9:00-12:00 and 18:00-3:00; in neither types at 6:00-9:00 and 18:00-24:00; in morning types at 6:00-12:00 and 18:00-24:00. Considering time of day when subjects were undertaking sexual activity most frequently, this appeared between 18:00-24:00 for all the participants, and prolonged until 3:00 at night in evening type males. Morningness preference was more strongly related to the timing of need for sex than to the timing of actual sexual activity ( $r = -.275$  vs.  $r = -.174$ ), while the timing of desire and the timing of sexual activity were positively, but moderately related ( $r = .320$ ).

*Keywords:* morningness; eveningness; time of day; sexuality; sexual activity; desire

## INTRODUCTION

A number of physiological, psychological, and behavioral variables are subject to circadian regularity in humans (Monk et al., 1997). Considering the most endogenous circadian rhythms, the peak of core body temperature, melatonin and cortisol occurs around 19:00, 2:00, and 7:00, respectively (Monk et al., 1997). As for affect, during the waking state subjective energy decreases from 9:00 to 21:00 (Adan & Guardia, 1993), while pleasantness and relaxation are lowest at 8:00 within the 8:00 – 20:30 time frame (Jankowski & Ciarkowska, 2008).

A few studies examined circadian variation in sexual activity. In a study on 15 university students (Refinetti, 2005), the majority of sexual encounters took place between 23:00 and 01:00 at night, while a secondary, smaller peak occurred in the morning at 6:00 – 8:00. Participants explained that the main reason they choose that time for sexual activity was partner availability (around bedtime). A similar pattern has been also revealed in five males (Reinberg & Lagoguey, 1978) and seventy-eight young married couples (Palmer et al., 1982) – a major peak in the evening and a minor peak in the morning. However, the latter study showed that the morning peak in the frequency of sexual intercourse occurred mostly during weekends, as work obligations restricted such activities during weekdays (Palmer et al., 1982). Interestingly, pairs with a male suffering from erectile dysfunction also reported predominantly a night/evening pattern of sexual activity, while a morning pattern was established by fewer pairs (Fisher et al., 2005). Such evening pattern of sexual activity was even more pronounced in subjects beginning sexual life – 85% of 135 female university students reported the loss of their virginity in the evening or at night (Barak et al., 1997).

Circadian rhythms are subject to robust individual differences, named chronotype or morningness preference. Although the most striking differences appear between subjects positioned at extremes of morningness-eveningness dimension (morning types – M-types vs. evening types – E-types), the majority of the population is actually situated in-between extreme circadian preferences – these are neither types (N-types) (Adan et al., 2012). More evening-oriented people prefer later times of day for various activities, such as physical or intellectual ones, and this preference is accompanied by a time shift in the rhythms of physiological or psychological variables. For example, M-types compared to E-types had an earlier peak in the rhythm of core body temperature by 68 minutes or in cortisol secretion by 55 minutes (Bailey &

Heitkemper, 2001) and also in melatonin onset (Burgess & Fogg, 2008). As regards affect, the highest levels of subjective energy occurred between 9:30 and 12.30 in M-types, but at 20:00 or later in E-types, although the time of the peak in pleasantness or relaxation did not differ between chronotypes (Jankowski & Ciarkowska, 2008).

As noted above, circadian variation in sexual activity has been reported, but it is not known whether the timing of sexual behavior differs between chronotypes, like many other variables do. Moreover, it is not known whether there are differences between the chronotypes in the timing of need for sexual activity. The timing of need for sexual activity and actual undertaking of sexual activity might be different considering that, in a previous study, subjects explained their choice of time for sexual activity by partner availability than by actual desire (Refinetti, 2005). We also aimed to explore gender differences in preferred time of day for sexual activity, as no such direct comparison has been reported so far – previous studies have considered mostly pairs with no distinction on gender. Previous studies have shown that sleep patterns may both influence and be influenced by interpersonal interactions in couples (Hasler & Troxel, 2010; Troxel et al., 2007), thus the stated questions seem important when considering sexual and relationship satisfaction for partners with different chronotypes.

## **MATERIALS AND METHODS**

### **Measures**

Morningness-eveningness preference was assessed with the Polish version of the shortened Morningness-Eveningness Questionnaire (Jankowski, 2013). The scale has four Likert-type items scored with four or five response options. Higher scores indicate greater morningness (lower eveningness), whereas lower scores indicate lower morningness (greater eveningness). Internal consistency for the scale as indicated by Cronbach's  $\alpha$  was 0.73 in the previous study and 0.80 in the present study.

Further, two questions referring to the optimal time of day for sex ("What time of day do you usually want to have sex most" and "What time of day do you usually undertake sexual activity") were asked. The response format for these two questions consisted of a single choice of one out of eight equal time intervals between 0:00 – 3:00, 3:00 – 6:00, 6:00 – 9:00, 9:00 – 12:00, 12:00 – 15:00, 15:00 – 18:00, 18:00 – 21:00, and 21:00 – 24:00.

Demographic variables included gender, age, sexual orientation, place of residence (village, city of under 500,000 inhabitants, city of 500,000 or more inhabitants), education (primary, vocational, secondary, higher), occupation (student, employee, unemployed, retired), marital status (single, in relationship and living apart, in relationship and living together, married) and number of children (and whether they lived together in the same household).

### **Participants and procedure**

Participants were 565 (77.7% females) Polish internet users aged between 18 and 57 years ( $M = 24.3$ ,  $SD = 5.1$ ; 97.3% of participants below 36 years). Most of the participants were presumably psychology students, as an external link to the questionnaires was sent via email for psychology students, but it was also distributed through social websites. Participants were mostly residents of cities of 500,000 and more inhabitants (74.7%), students (66.0%) and people with accomplished secondary education (56.8%). Regarding marital status, most of the participants were in a relationship and living apart (38.2%) or single (32.6%). Most of the participants had no children (91.2%) and were heterosexual (89.9%). According to the Polish version of the shortened Morningness-Eveningness Questionnaire cut-off points, based on its distribution in a large sample (Jankowski, 2013), 31.2% were E-types, 51.5% N-types and 17.3% M-types. As the same cut-off points were applied to males and females, the two genders should not differ in morningness scores within each chronotype group, and this was additionally confirmed with t-Student tests (E-types:  $t = .10$ ,  $p = .919$ ; N-types:  $t = .52$ ,  $p = .601$ ; M-types:  $t = .45$ ,  $p = .66$ ). Participation in the study was anonymous, unpaid and voluntary. After collecting the data, a visual screening was conducted in order to exclude double entries (one case) or absurd responses (two cases). The study was conducted in accordance with the ethical standards of the journal (Portaluppi et al., 2010).

### **RESULTS**

At first, Pearson correlations were computed between morningness scores and time of day when individuals desired sexual activity most and undertook it most frequently. For this purpose, time intervals were recoded to constitute a continuum with values ranging from one to eight, corresponding to a continuum from earliest (3:00 – 6:00) to latest (0:00 – 3:00) hours. It should be noted here that the time interval 3:00 – 6:00 could be regarded either as the earliest or the

latest one, as it was the least frequently chosen and indicated by the same number of M-types and E-types (Figure 1 and 2). Regardless of whether it was assumed as the earliest or the latest one the results were similar, thus reported are these for 3:00 – 6:00 time interval defined as the earliest one. Thus, Pearson correlations revealed that more evening oriented individuals indicated that they desired sex most at a later time of day ( $r = -.275, p < .001$ ), and more evening oriented subjects undertook sexual activity at later times of the day ( $r = -.174, p < .001$ ). The two above correlations differed in magnitude ( $z = 2.16, p < .05$ ) indicating that morningness-eveningness is more strongly associated with timing of the greatest need for sex than with the actual timing of sexual activity. The time of day when individuals desired sexual activity most and the time when they undertook it most frequently were positively, but not fully, related ( $r = .320, p < .001$ ).

Splitting the sample according to gender and three chronotype groups (morning, neither, evening) revealed patterns for time of day when individuals of different genders/chronotypes desired sex most, and when they usually undertook sexual activity. Considering need for sex (Figure 1), all females declared the greatest need for sex between 18:00 and 24:00, but female M-types also exhibited the second peak occurring between 6:00 and 9:00 (E-types:  $\chi^2_{(7)} = 235.2, p < .001$ ; N-types:  $\chi^2_{(7)} = 226.3, p < .001$ ; M-types:  $\chi^2_{(7)} = 52.8, p < .001$ ). In all males, there were two peaks in the greatest need for sex: the morning and the evening/night one (Figure 1). In male E-types they occurred at 9:00-12:00 and between 18:00 and 3:00 at night ( $\chi^2_{(7)} = 16.9, p < .05$ ), in N-types at 6:00-9:00 and at 18:00-24:00 ( $\chi^2_{(7)} = 43.8, p < .001$ ) and in M-types at 6:00-12:00 and 18:00-24:00 ( $\chi^2_{(7)} = 29.0, p < .001$ ).

Regarding the time of day when sexual activity usually occurred (Figure 2), all females declared the most common time interval between 18:00 and 24:00 (E-types:  $\chi^2_{(7)} = 394.8, p < .001$ ; N-types:  $\chi^2_{(7)} = 516.4, p < .001$ ; M-types:  $\chi^2_{(7)} = 109.8, p < .001$ ). In all males, there was the same, most common time interval for sexual activity, occurring between 18:00 and 24:00, but in the E-types, this period was prolonged till 3:00 at night (E-types:  $\chi^2_{(7)} = 43.1, p < .001$ ; N-types:  $\chi^2_{(7)} = 128.9, p < .001$ ; M-types:  $\chi^2_{(7)} = 65.8, p < .001$ ).

## DISCUSSION

The presented study was the first one examining the role of chronotype in a time of day when males and females desired sex most and undertook sexual activity. Generally, there was a major evening peak of sexual activity and desire, but additionally, some chronotype and gender related

differences appeared regarding timing of desire for sex. Namely, in males, a secondary peak in desire appeared in the morning hours, and the same was true for morning oriented females. Moreover, these peaks were slightly shifted toward later hours in more evening oriented subjects, but this shift was not robust.

The observed patterns could be related, for example, to day schedules such as starting work activities, caring for the children, and primarily to the presence of a sexual partner as suggested previously (Refinetti, 2005). The latter issue might be of special importance for occurrence of evening peak in sexual activity, particularly in subjects not living with their sexual partners, as in the case of most participants in this study. A role of external factors could be further tested in samples with atypical time schedules (e.g. shift workers) or these varying in time restrictions, often related to age (e.g. students, full time employees, retirees).

Interestingly, testosterone levels are highest in the morning hours both in males (Gupta et al., 2000) and females (Al-Dujaili & Sharp, 2012), though, in females, testosterone levels are still very low. Therefore, this morning testosterone peak may lead to morning desire peak in males, while in females, testosterone is less related to sexual functions. The observed patterns, if they translate into individual level, suggest that males, compared to females, desire sex for more hours per day, in line with theories explaining gender differences in sexual behavior (Pettersen & Hyde, 2010). Nevertheless, a morning peak in desire does not seem to lead to sexual activities, as such was most profound in the evening hours. This is interesting from an evolutionary perspective, because the early morning peak in desire might have been related to sexual activity in our ancestors, and could diminish, in favor of the evening peak, more recently within human evolution as a result of the developing social schedules. Some light could be shed on this issue by analyzing in future studies preferred and actual time for sex separately in workdays and weekends. However, in hunter-gatherer societies in Africa, which are presumably closer to human ancestors (Hewlett & Hewlett, 2010), sexual activity also takes place mostly during the night, which does not support the hypothesis that the morning peak is a relic of our ancestors.

The observed evening peak in sexual activity might also be related to an endogenous evening increase in melatonin production. Namely, exogenous melatonin in rats enhanced sexual behavior (Brotto & Gorzalka, 2000) and attenuated the effects of chronic stress on sexual behavior (Brotto et al., 2001). However, in the above cited studies, prolonged effects of exogenous melatonin were tested, but not the acute effects. Moreover, exogenous melatonin

might have different effects on sexual function than the endogenous phasic elevation of melatonin levels during evening/night hours.

Although there is a general pattern with a major peak of sexual activity/desire in the evening, there is still a synchrony effect with evening types reporting higher desire/activity in the later hours compared to the morning types. However, it seems that this could be related to a shift in bed times in different chronotypes. Such a synchrony effect has been found in many variables with better performance at times of day that match individuals' preference (morning vs. evening types), in the morning versus in the afternoon time-of-day (Adan et al., 2012; Goldstein et al., 2007). From the perspective of circadian mismatch (i.e., performance at one's non-preferred time-of-day) reflected in concepts such as social jetlag (Wittmann et al., 2006), asynchronization (Kohyama, 2009) and synchrony effect (May, 1999), chronotypes would tend to exhibit greater sexual activity in synch with their circadian arousal. However, when pursuing this idea of the synchrony further, evening types in our society might be more advantageous in having sex, as this study shows it happens at their optimal time of day – late evening or night. This is in line with studies showing that evening types have a higher number of sexual partners (Gunawardane et al., 2011; Jankowski et al., 2014; Randler et al., 2012).

One of the limitations of the present research is that it was not conducted in dyads, thus chronotypes of participants' partners are unknown. This could be an interesting aspect pursued in further studies, e.g., when individuals perform sexual activity if their partners are of the same or different chronotype. One study (Larson et al., 1991) found that morning-type married couples undertook sexual activity more frequently in the morning than evening, while for night-type married couples, evening hours were mostly chosen. The question arises whether match/mismatch in chronotype in couples has an impact on timing of desire as well – the present results show, however, that the timing of need for sexual activity and the timing of undertaking sexual activity do not overlap entirely. Moreover, it has been found that couples that are mismatched in chronotype experience poorer marital adjustment and more conflicts than couples that are matched in chronotype (Larson et al., 1991). But, on the other hand, Randler and Kretz (2011) assessed relationship satisfaction and they found no correlation with chronotype mismatch. Nevertheless, assortative mating in chronotype exists (Randler & Kretz, 2011), and females tend to prefer partners closer to their own circadian preferences (Randler et al., 2014), particularly that females' sleep timing is earlier than the males' one (Jankowski, 2014).



Generally, it appears that people tend to mate with those rather similar to themselves than with those that complement them (Escorial & Martín-Buro, 2011). The presented results indicate that mismatch in chronotype between partners may lead to asynchrony in sexual activity in some pairs, but in most couples it does not have to be of a great importance for sexual satisfaction, as most people feel the greatest need for sexual activity in the evening, regardless of their chronotype.

## DECLARATION OF INTEREST

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Figure 1. Percentage of subjects in each chronotype group declaring a given time interval when they desired sex the most. Females (top) and males (bottom) are presented separately. Expected percentage assuming no circadian variation is 12.5 for each time interval.

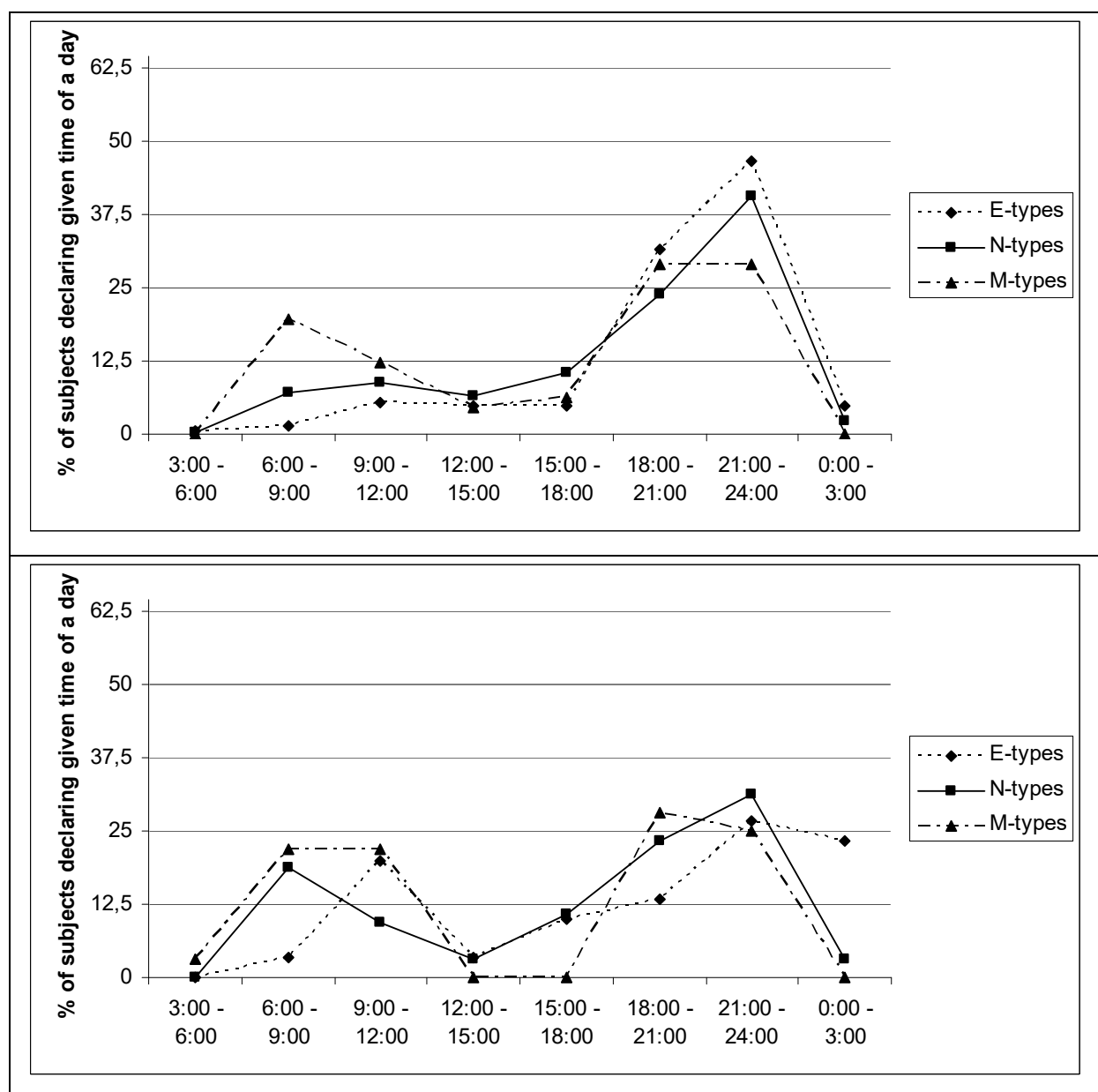


Figure 2. Percentage of subjects in each chronotype group declaring a given time interval when they usually undertook sexual activity. Females (top) and males (bottom) are presented separately. Expected percentage assuming no circadian variation is 12.5 for each time interval.

