

**The effects of sleep deprivation and chronotype on the perception of emotional facial expressions – An experimental study**

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**Introduction:**

Sleep disruption is linked to impaired cognitive and emotional processing, which may potentially give rise to an increased risk for developing emotional difficulties. Meanwhile, previous research showed that chronotype, i.e. individual differences in their preferred timing for rest and activity, is associated with psychopathology. In this study, we aimed to examine the effects of sleep deprivation and chronotype on an individual's ability to recognize facial expressions of emotions.

**Materials and methods:**

Young adults (N = 21, Age:  $20.10 \pm 1.84$  years, Female = 52.4%) with normal or corrected to normal vision and no history of psychological disorders and sleep problems were recruited to take part in this experiment. Participants underwent two experimental conditions (well-rested at home vs. one-night of sleep deprivation in the laboratory) in the counterbalanced order. In both conditions, participants completed an emotional facial expression judgment task in the morning (9:00-10:00am) following rest/sleep deprivation, where they were asked to identify and rate the intensity of four kinds of emotional faces (happy, sad, fearful, and angry). Chronotype preference was measured by the reduced Morningness-Eveningness Questionnaire (rMEQ). Non-parametric tests were used to examine group differences across the conditions.

**Results:**

Participants were classified into 3 groups based on their rMEQ scores: Evening-type (N = 6), Intermediate-type (N = 11) and Morning-type (N = 4). In well-rest condition, there was a significant difference in the accuracy of identifying fearful faces ( $\chi^2 = 8.133, p = .017$ ) and a marginally significant difference in the accuracy of identifying happy faces,  $\chi^2 = 5.492, p = .064$  across the three groups. In particular, morning-type group had the highest accuracy of identifying both facial expressions ( $1.00 \pm 0.00$  and  $0.99 \pm 0.03$ , respectively). In the sleep deprivation condition, there was no difference in the accuracy of identifying emotional faces among the three groups. An ART ANOVA showed a significant main effect of chronotypes on the accuracy of identifying fearful faces,  $F(2,36) = 6.75, p < .01$ , where morning-type group had higher accuracy than intermediate-type,  $t(36) = -3.05, p = .01$ ; and evening-type,  $t(36) = -3.56, p < .01$ . An ART ANOVA showed that there was a marginally significant interaction effect of chronotypes and sleep condition in the accuracy of identifying happy faces,  $F(2,36) = 2.75, p = .08$ . In particular, evening-type group had significantly higher accuracy than morning-type group in sleep deprivation condition,  $t(36) = 2.30, p = .03$ . In addition, morning-type group showed significantly higher accuracy when well-rested, relative to when sleep deprived,  $t(36) = -2.08, p < .01$ .

**Conclusion:**

Our findings demonstrated the effects of sleep loss on compromising individual's ability to recognize emotional facial expression. In addition, there were differential effects of chronotype on emotional perception in response to sleep deprivation. Further research is needed to investigate the mechanism underlying the association between chronotype, sleep loss and disrupted emotional perception.