DIURNAL INDIVIDUAL DIFFERENCES AND PERFORMANCE LEVELS IN SOME SPORTS ACTIVITIES

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Summary.—A morningness-eveningness questionnaire was administered to 34 golfers and 23 waterpolo-players to assess the influence of diurnal individual differences on the athletic performance levels. No differences in the diurnal type ("morning" vs "evening" individuals) were found among low-performing athletes, while in the high-performing group golfers had higher morningness scores than the waterpolo-players. The results suggest a relation between the diurnal type, performance level, and the time of day when the match is played (morning for golf and evening for waterpolo).

The outcome of sport games largely depends on the balance of the potential abilities and optimal arousal (Martens, 1974). Research on circadian rhythms has shown significant variations over the day in the subjective arousal and in the speed and accuracy with which people perform motor and cognitive tasks (Colquhoun, 1981). Also, substantial individual differences in the habitual activity patterns have been shown measuring the performance at different times of day. Kleitman (1963) was one of the first authors to suggest the existence of "morning" and "evening" individuals, with intermediate types between the two extremes, according to an "early" and a "late" peak in body temperature and efficiency curves over the day. The differentiation between "morning" and "evening" types has become a topic of systematic physiological and behavioral investigation. A phase difference for several physiological variables and performance levels in motor and cognitive tasks has been found between these two extreme types, with a phase advance for the "morning" types as compared with the "evening" types (Kerkhof, et al., 1981). A time-of-day difference in subjective arousal and fatigue has also been shown between these two types (Fröberg, 1977).

The question arises whether diurnal individual differences influence levels of athletic performance. The present work sought to answer this question by investigating the expressed preferences for morning and evening of athletes performing sports activities which typically utilized different hours during the day for matches.

**Method**

Fifty-seven male athletes (22 to 28 yr. old), homogeneous in terms of sport experience (about 7 yr.) and performing two different sport activities,
golf and waterpolo, with match hours, respectively, in the morning (8 a.m. to 16 p.m.) and late the evening (20 to 23 p.m.), served as subjects. Two groups in both of the sport activities were formed. The first (10 golfers and 8 waterpolo-players) was formed of athletes who showed high performance and occupied the top national levels and the second group (24 golfers and 15 waterpolo-players) was formed of athletes who had low performance relative to that of the former group.

All the subjects filled out an Italian version (Mecacci & Zani, in press) of the morningness-eveningness questionnaire of Horne and Östberg (1976). There were 19 questions inquiring about habitual bed and rising time, preferred time of physical and mental performance, and subjective fatigue after rising and before going to bed. Scores range from a minimum of 16 (extreme "evening" type) to a maximum of 86 (extreme "morning" type). The questionnaire has shown an acceptable reliability on both physiological and statistical bases. Scores on the scales are related, for example, to circadian variation in oral body temperature ("morning" types having an earlier temperature peak) (Horne & Östberg, 1976). On the other hand, the reliability of the scale was computed as coefficient alpha. The coefficient was .89 \((p < .001)\) for a sample of 259 USA college students (Posey & Ford, 1981).

**Results**

A two-way analysis of variance with the two sport activities (golf vs waterpolo) and two performance levels (high vs low) as factors showed the golfers had obtained on average significantly higher morningness scores \((M = 56.8, SD = 10.9)\) than the waterpolo-players \((M = 52.6, SD = 7.8)\); there was a significant interaction between the sport activities and the performance levels (Table 1). Tests of simple main effects showed, as expected, the mean score of high-performing golfers \((M = 59.6, SD = 13)\) to be significantly higher \((t = 12.6, p < .001)\) than the mean score of the high performing waterpolo-players \((M = 47, SD = 5.3)\). No significant difference \((t = .09)\) was found between the mean scores of the low-performing golfers \((M = 55.6, SD = 10.5)\) and waterpolo-players \((M = 55.5, SD = 7.6)\). See Fig 1.

As predicted, golfers showed an earlier preferred activity phase than water-

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
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<tbody>
<tr>
<td>Total</td>
<td>56</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between golfers and waterpolo-players (1)</td>
<td>1</td>
<td>438.23</td>
<td>5.20</td>
<td>.05</td>
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<tr>
<td>Between high and low performance levels (2)</td>
<td>1</td>
<td>62.23</td>
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<td></td>
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<tr>
<td>Interaction between (1) and (2)</td>
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<td>469.37</td>
<td>5.05</td>
<td></td>
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<tr>
<td>Error</td>
<td>53</td>
<td>92.86</td>
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polo-players. However this difference is clearly manifest only in the high-performing athletes. Whereas, in fact, the latter showed large inter-group differences, low-performing athletes had quite similar mean scores. Certainly, having practiced golfing in the mornings and vice versa waterpolo in the evenings, one would expect to do better in matches which came at the time one was accustomed to performing those skills. As the two groups were homogeneous for sport experience, it is difficult to suppose that a change in the habitual activity phase occurred only for the high-performing athletes. It might be likely that practicing harder, these athletes developed stronger habitual activity phases than the low-performing athletes. On the other hand, at high levels of performance, it is important for the athlete to have optimal psychophysiological conditions. A diurnal typology, expressing a differentiated trend of arousal levels during the day, might influence athletic performance when it is in agreement with the hours for a match. The relationship between diurnal typology and sport activities should be validated by further research on the diurnal variation of psychophysiological parameters of athletes.

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