Is work-induced arousal manipulation a catastrophe for investigating the arousal-performance relationship?

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Introduction

To adequately investigate the relationship between arousal and performance, arousal should be manipulated on different levels and standardized as a percentage of a person's maximal arousal (Arent & Landers, 2003). In literature, the arousal manipulation is most often work-induced, for example by treadmill exercise according the heart rate reserve. This method allows strict control of the arousal manipulation but the ecological validity is very low. Moreover, factors as fatigue can influence the relationship between arousal and performance. The assumptions of the cusp catastrophe model should also be tested by several manipulated arousal levels (Cohen, et al., 2003). The purpose of present study was to investigate the relationship between arousal and balance beam performance by applying different levels of standardized anxiety-induced arousal.

Methods

Fourteen female sub-elite gymnasts performed three attempts of a compulsory balance beam routine at four different heights (0.20m, 0.80m, 1.25m and 1.70m). The routine consisted of four elements, but only the acrobatic element (flic flac) is studied in this investigation. Arousal and cognitive anxiety were measured continuously by respectively heart rate and by a retrospective self report scale (Cottyn, et al., in press). Five standardized arousal levels were calculated from the heart rate data during the preparation period of the acrobatic element according to the rest heart rate standing still on the balance beam and the maximum heart rate. Five judges scored the routines according the FIG rules. The occurrence of a fall during the acrobatic element was monitored to investigate assumptions of the cusp catastrophe model. Every single attempt was treated as a separate variable (N = 163) and between subjects statistics (5 x 2 ANOVA) were used for arousal level and FALL-NO FALL.

Results

Only four arousal levels were obtained because none of the attempts reached the 80-100% arousal level. A significant lower (F1,163=10.40, p<0.05) performance score was found in the FALL condition compared to the NO FALL condition. Also a significant interaction was found between arousal level and FALL-NO FALL condition (F3,163=3.60, p=0.015). Further analysis revealed that there was no significant relationship between arousal and performance in the NO FALL condition, but a significant quadratic relationship occurred in the FALL condition (F46,50=3.67, p<0.05). During the preparation period of the acrobatic element, a significant higher score for cognitive anxiety was found in the FALL condition, compared to the NO FALL condition (F1,163=5.59, p=0.019).

Discussion/Conclusion

The results of present study reveal a significant U-relationship between arousal and performance under conditions of increased cognitive anxiety (FALL condition). These data contradicts the inverted-U hypothesis. However these data fit the cusp catastrophe model that assumes that performance significantly drops under levels of moderate arousal and increased cognitive anxiety. Further research on the arousal-performance relationship should use anxiety-induced arousal manipulation methods instead of work-induced.

References


Table 1: Mean (SD) of the performance score of the acrobatic element according to the four different levels of arousal during the preparation period.

<table>
<thead>
<tr>
<th>Arousal level</th>
<th>NO FALL</th>
<th>FALL</th>
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<tbody>
<tr>
<td>0-20%</td>
<td>1,73 (0.04)</td>
<td>1,32 (0.25)</td>
</tr>
<tr>
<td>20-40%</td>
<td>1,52 (0.48)</td>
<td>0.8 (0.56)</td>
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<tr>
<td>40-60%</td>
<td>1.6 (0.15)</td>
<td>0.65 (0.59)</td>
</tr>
<tr>
<td>60-80%</td>
<td>1.52 (0.22)</td>
<td>1.37 (0.26)</td>
</tr>
<tr>
<td>CA</td>
<td>2.39 (2.04)</td>
<td>3.33 (2.33)</td>
</tr>
</tbody>
</table>

Table 1: Mean (SD) of the performance score of the acrobatic element according to the four different levels of arousal during the preparation period and the mean (SD) of cognitive anxiety (CA) during the preparation period of the acrobatic element.