Stress Research Institute

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Public music performance and physiological aspects of flow

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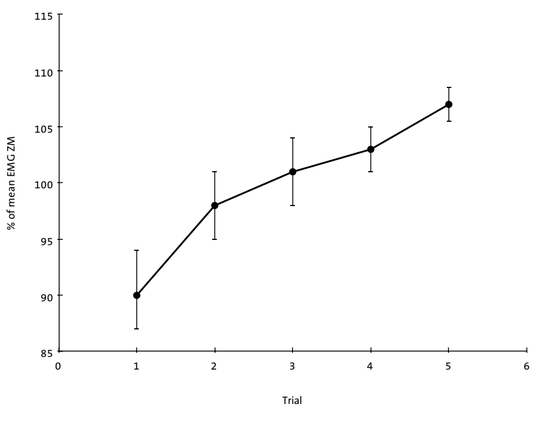
Background

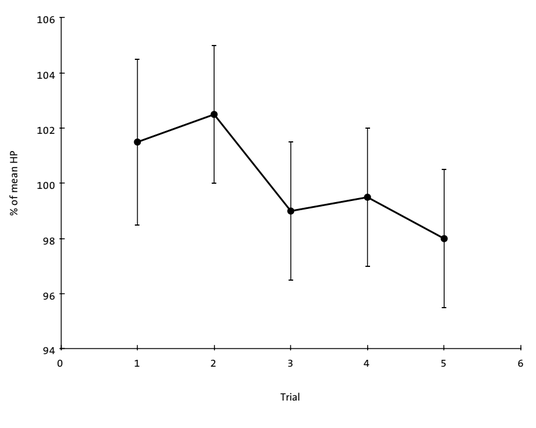
The state of flow (effortless attention) has been experienced by most people some time. The crucial components in flow are 1.) a high level of arousal 2.) a feeling that something really difficult is accomplished with success and 3.) a feeling of joy or elation (see Csikszentmihalyi 1990, Jackson and Eklund 2004, in this presentation only the three core dimensions are used in the flow assessment questionnaire).

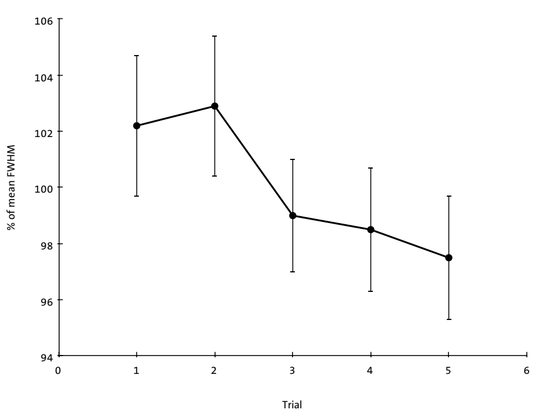
Flow experiences occur in many different kinds of situations in which individuals make strong efforts successfully, for example during sports, during theatre performances and during music performance. Our studies have aimed at an increased understanding of physiological correlates of flow.

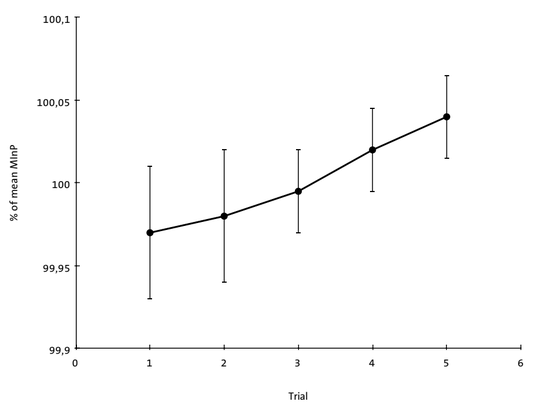
Empirical studies

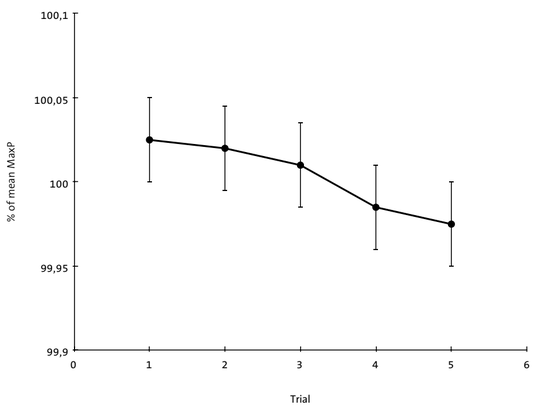
The first study (de Manzano, Harmat, Theorell and Ullén, Emotion 2010) comprised twenty-one professionally active classical pianists (18 men, 3 women, Mean age 41, SD 11 years). They were asked to select and bring a self-selected piano piece which they could play well, enjoyed playing and that would correspond to a 3-7 minutes performance. They did this in the laboratory on five consecutive occasions with 1-2 minutes of relaxation between performances. After each performance they were asked to rate the degree of flow that they had experienced using the three-dimensional flow questionnaire condensed for this study. For the statistical analysis the performances were ordered with regard to flow experience based upon questionnaire responses. 17 physiological parameters were recorded. 10 of those showed significant relationships with the degree of flow (Analyses of variance). There was an increased activity in the zygomaticus major muscle ("smile muscle"), a general physiological arousal pattern (high heart rate, high blood pressure and high pulse pressure as well as a high LF/HF ratio in heart rate variability) indicating activation of the sympathetic-adrenomedullary system during flow. There was also, however, increased respiratory depth (thus the persons were taking deep breaths but did not breathe faster). Deep breaths are generally associated with an activation of the parasympathetic system. Accordingly, in these pianists the high arousal level may have been counterbalanced by an activation of the "antistress" parasympathetic system during the flow condition.

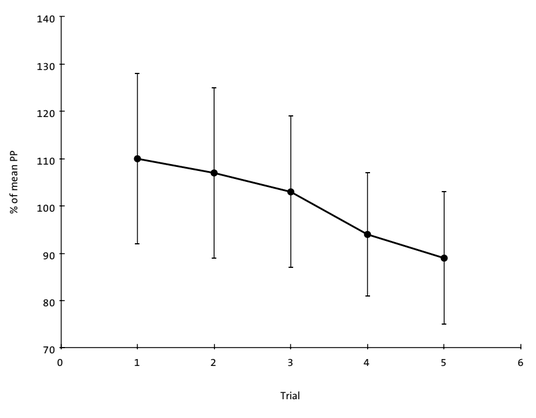


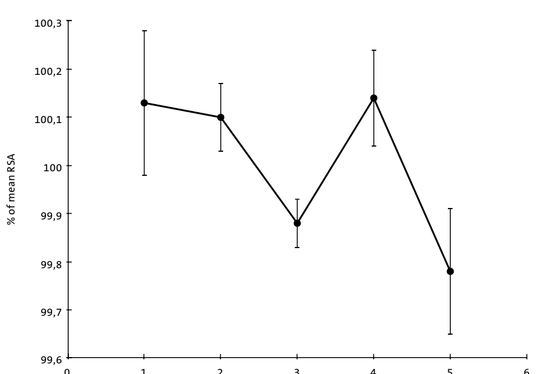


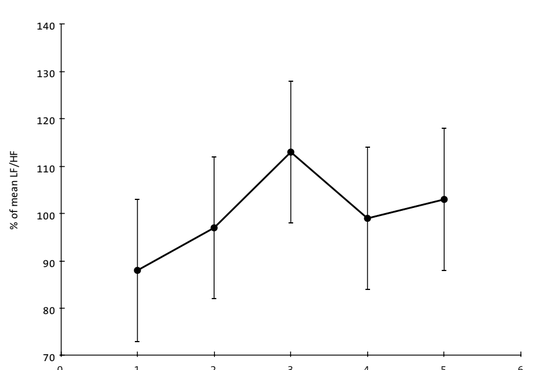












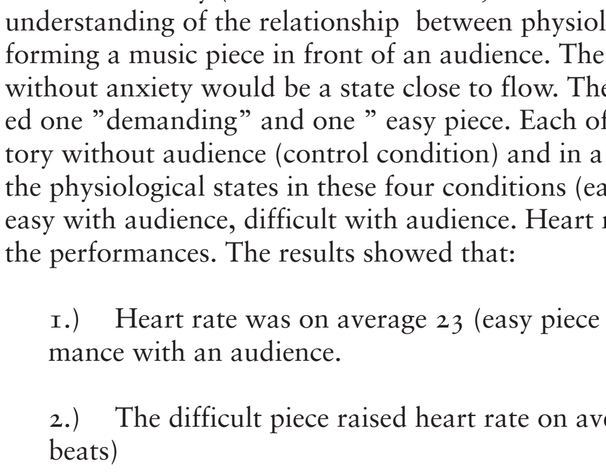
The second study (Harmat and Theorell, Music and Medicine, 2009) was designed to increase our understanding of the relationship between physiological arousal and perceived anxiety before performing a music piece in front of an audience. The underlying assumption was that performance without anxiety would be a state close to flow. The musicians (singers and flutists) themselves selected one "demanding" and one " easy piece. Each of these music pieces were performed in the laboratory without audience (control condition) and in a real concert situation. This allowed us to compare the physiological states in these four conditions (easy without audience, difficult without audience, easy with audience, difficult with audience. Heart rate and heart rate variability were recorded during the performances. The results showed that:

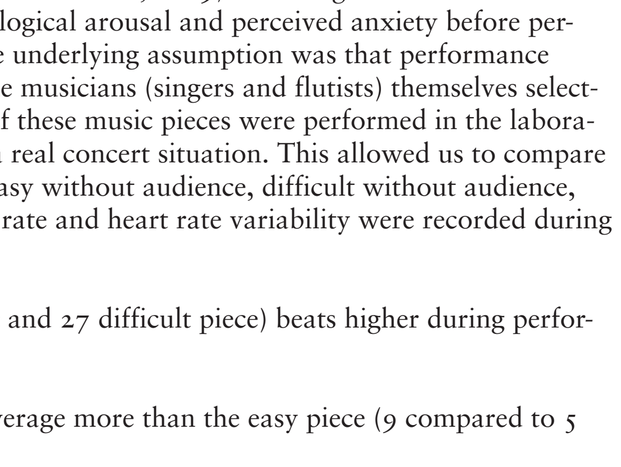
1.) Heart rate was on average 23 (easy piece and 27 difficult piece) beats higher during performance with an audience.

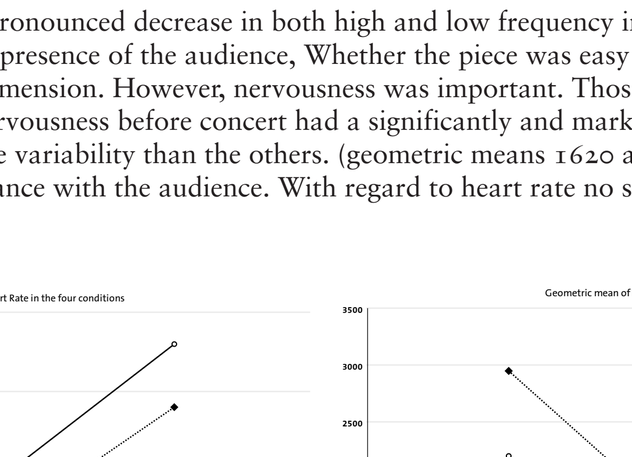
2.) The difficult piece raised heart rate on average more than the easy piece (9 compared to 5 beats)

3.) The combination of difficult piece and audience was associated with an increase on average of 31 beats per minute compared to the combination of easy piece and no audience.

4.) There was a pronounced decrease in both high and low frequency in heart rate variability associated with the presence of the audience, Whether the piece was easy or difficult was not so important to this dimension. However, nervousness was important. Those who reported that they had pronounced nervousness before concert had a significantly and markedly lower low frequency in their heart rate variability than the others. (geometric means 1620 and 206 respectively) during the performance with the audience. With regard to heart rate no such differences were observed.







Page test results: Physiological Measures vs. Flow Measures

Variable	*N*	z_L *Flow9D*	z_L *Flow3D*
EMG ZM	15	6.02***	4.57***
EMG CS	17	0.82	0.24
HP	19	1.90[a]*	2.75[a]**
FWHM	19	1.17[a]	2.25[a]**
MinP	19	1.58+	2.89**
MaxP	19	0.94[a]	2.48[a]**
MaxP - MinP	19	1.17[a]	2.84[a]**
RSA	17	2.35[a]**	1.65[a]*
LF/HF	19	1.67*	1.79*
Total power	19	2.32**	2.29**
RD	18	2.33**	2.38**
RR	18	0.33[a]	1.34
Rcycle	18	0.38	0.82
Head Amp	14	0.69	1.07
Head Fq	14	0.59	0.37
Head RMS	14	0.27[a]	0.86
Trial duration	21	0.70	0.26

Note. N number of participants; zL page test statistic; EMG ZM zygomaticus major activation; EMG CS corrugator supercilii; Hp heart period; FWHM full-width-half-maximum of the arterial pulse pressure waveform; MinP minimum estimated blood pressure; MaxP maximum estimated blood pressure; MaxP-MinP estimated pulse pres- sure; RSA respiratory sinus arrhythmia; LF/HF low frequency heart rate variability/high frequency heart rate variability; Total power total heart rate variability; RD respiratory depth; RR respiratory rate; Head Amp head movement amplitude; Head Fq head movement frequency; Head RMS head movement root-mean-square.
Trendatp.06; p.05; p.01; p.001.

[a] Signifies an inverse relationship between flow measure and physiological measure.

Conclusion

The parasympathetic system plays an important role in the conditions we have studied. During the high arousal situation characterizing flow, joy and deep breaths may play an important role counteracting adverse effects of the high arousal. Similarly, in the audience situation non-anxious subjects performing music have a much less pronounced decrease in parasympathetic activity during performance than anxious performers. This again points at the importance of counterregulation of high arousal levels.

Stress Research Institute is a knowledge centre in the area of stress and health. The Institute is part of the Faculty of Social Science, Stockholm University, Sweden and conducts basic and applied research on multidisciplinary and interdisciplinary methodological approaches.
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