Performing Together?
A case study of physiological stress between soloist and audience

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Several studies looked at psychological or emotional interaction between musicians and audience while performing. Little scholarly information, however, is available regarding the physiological communication between musicians and audience. By using non-invasive immunoassay salivary cortisol testing, this study examined the physiological stress levels in a solo oboe performer and four audience members. The study was realized within the context of three live performances in two different venues and two different musical contexts in order to determine possible correlations between performer and public. Recitals 1 and 3 had the same solo program performed at the same venue of a university at the same hour of the day, while Recital 2, consisting of contemporary chamber music, was performed at a prestigious concert hall in a major European city. The results of this pilot study could demonstrate that exaggerated physiological stress of the performer was not communicated to the audience, but had rather the opposite relaxing effect on the audience, thus attesting to the professionalism of the musician in controlling the stress while maintaining a high level of performance.

**Keywords:** stress; cortisol-salivary testing; musician-audience interaction; performer-public; oboe

Several studies looked at the performer/audience relationship from various points of view, particularly the psychological or emotional (Brand et al. 2012, Broughton and Stevens 2009, Pitts 2005, Gabrielsson and Juslin 1996, Ken-
dall and Caterette 1990). Little scholarly information is available in terms of the physiological interaction between musician and the audience, especially regarding stress levels measured by salivary cortisol testing. Bohnen et al. (1991) studied individual factors of coping and trait anxiety during mental stress, while positive emotions and their relationship to stress were examined in singers by Beck (2006). Various ways of studying the efficiency of salivary cortisol testing has been done using Salimetrics (Adam and Kumari 2009, Aardal and Holm 1995). Alfano (2008) looked at salivary alpha-amylase as a biomarker for stress, while Clements and Parker (1988) considered the efficiency of frozen versus mailed salivary cortisol samples as methods of handling.

**METHOD**

**Participants**

The participants included a professional male solo oboist, as well as 4 non-musician audience members.

**Materials**

A non-invasive high sensitivity Salivary Cortisol Enzyme Immunoassy test (Salimetrics) was applied to all participants, on a normal day and on each day of the three recitals.

**Procedure**

Three normal-length recitals were performed—two of them were including the same solo recital at the same venue and same time of day while the third was a chamber music recital at a different venue and a different time of day. To increase the level of stress, difficult contemporary repertoire was chosen, including John Cage’s 4’33”, a piece with no sound performed by the musician and where both musician and audience must maintain a unique kind of concentration. In order to determine whether the level of stress in the oboist was conveyed to the members of the audience, cortisol was measured (High Sensitivity Salivary Cortisol Enzyme Immunoassay test, Salimetrics) during the performances. To fulfill the criteria of a valid comparison, cortisol was also assessed after two days without a stressful event. The time interval of the assessment remained on each occasion, starting with the first measurement after awaking, 45 minutes afterwards, 11 am, 2 pm, 4:30 pm, 6 pm, 9 pm and before going to bed. Further measurements were taken at the start, finish, and 30 minutes after each recital.
RESULTS

All subjects had a dramatic increase of cortisol levels 45 minutes after awakening (see Figure 1). The oboist showed the highest increase of all participants. All members of the audience showed no significant difference in their cortisol level in each condition (recital versus baseline), while the oboist revealed noticeable differences between his normal day cortisol levels and the days of recitals, with the highest peaks occurring at the point of performance. This peak was, however, consistently less than his peak at 45 minutes after awakening in every case.

![Salivary Cortisol Concentrations](image)

*Figure 1. Average cortisol levels of public and performer during different times of the day. DN=normal day; A=beginning of recital; B=end of recital; C=30 minutes after end of recital; R1=1st recital; R2=recital 2; R3=recital 3; O=oboist during performance; RO=oboist during normal day; P1=audience member no. 1; P2=audience member no. 2; P3=audience member no. 3; P4=audience member no. 4. (See full color version at www.performancescience.org.)*
Regarding Point A in Figure 1, immediately before the beginning of the recitals cortisol levels had not yet visibly increased. The absence of this rise can be justified by particular mechanisms associated with the glands of internal secretion. It is important to note that changes in cortisol levels in stress situations take about ten minutes to become visible in the saliva samples. In addition to the peak of waking, another peak in the cortisol curve was detected, which appears to be associated with the moments of performance by the musician. This leads to the conclusion of a correspondence to a physiological stress response, which, in this case, is the public presentation of the musical pieces. Moreover, after this stressful situation, there was also observed a decrease to normal values of cortisol levels (approximately 30 minutes after exposure to a stressful situation), which seems to indicate a return to normal by the musician.

The most significant differences are found at Point B—just after the end of the recitals—in which the inference response to stress is the highest in each of the performances and which implies an increase of stress throughout the recitals. Because of the differences of the times of the recitals (R1 and R3 began at 13:00 while R2 began at 18:30) the cortisol levels were higher in R1 and R3 at Points A and C (the beginning and 30 minutes after the end of recitals). Cortisol levels were higher near lunch time in all subjects.

The stress levels in R2 are the highest for the soloist. In spite of being a recital with other musicians in contemporary chamber music (and with an unconventional work by John Cage), the importance of this recital may have been the underlying factor for raising the stress level. The need to maintain a high level of performance that was simultaneously “judged” by performing colleagues may have been a factor for high stress.

Finally, R3, the repeated solo recital at the same venue, did not show a peak as in R1, but rather showed overall lower levels of cortisol that are close to ND levels. This fact may be related not only to intrinsic/extrinsic factors in the performer, such as emotional stability arising from a known, and therefore less stressful, environment and performance situation compared to R1 due to its repetition. In all cases, the audience members did not mirror the performer’s stress and had the opposite reaction to the performer.

To conclude, a certain amount of stress is necessary in order to maintain consciousness. Between performer and public, this preliminary physiological hormonal study shows that audience members do not reflect stress levels related to performance and that the professional musician was able to control the performance without communicating his own stress to the audience. The
results of the other tests of this multi-disciplinary study will confirm or deny these findings.

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