

# Slow down and learn: Pianists and memory

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This multi-disciplinary pilot study compared two groups of eight undergraduate pianists in a 3-week, 17-session experiment of a previously unknown 4-voice fugue (C. Schumann, Op. 16/2). The experimental group (EG, n=5) used adapted *Superlearning*<sup>TM</sup> techniques, which involved relaxation and controlled breathing with music chunking and a strong auditory-visual component. The control group (CG, n=3) was left free to study as desired. Both groups were asked to study only 30 minutes daily and to keep a practice journal during the 3.5-week experiment. Three trials were done. Prior to and after each trial, a battery of psychological tests was administered (stress, anxiety, life orientation, personality), as well as stress level monitoring through heart-rate variability through the use of a non-invasive T-shirt (*VitalJacket*®) and non-invasive cortisol saliva swabs. After the Trial 1 performance, the participants considered the study completed. A surprise Trial 2 was given 3 months later, followed by a Trial 3 performance two weeks after that. The results confirmed that the accelerated learning techniques functioned, but instead of having the desired effect of relaxation, the EG was more stressed. Another surprising result was the success of the male pianists over the females, although this was not one of the objectives of the study.

*Keywords:* memory; stress; anxiety; Superlearning; pianists

Historically, performance levels in many areas have been increasing (Palmer 2006). As a system of accelerated learning and hypermnnesia, the *Super-*

*learning*<sup>™</sup> method has been used to enhance performance and acquisition in foreign languages and other areas (Ostrander and Schroeder 1979), although is rarely used in music study (Alberici 1999). The method uses 20-minute daily learning sessions that are divided into two 10-minute sessions in which the participant looks at the material being presented, then closes the eyes while listening to the same material. The presentation of the material is given in 4 s intervals of new information (spoken in various modalities of normal voice, whispered, authoritative—e.g. *le chat*, the cat) followed by 4 s of silence, then 4 s of new material, followed by 4 s of silence, and so on. During the listening part, music (preferably Baroque Adagio string movements at 60 M.M.) is played underneath the spoken material and pauses. Breathing is coordinated by exhaling and inhaling during the silence and holding during the presentation of new material. The *Superlearning*<sup>™</sup> method espouses the side benefits of improved health and retention rates. Contrary to *Superlearning*<sup>™</sup> claims, studies have shown that free recall in music performance has been poor (Segalowitz *et al.* 2001) and that gender is a factor in the memory-stress relationship (Wolf *et al.* 2001). The main aim of this pilot study is to see if the accelerated learning techniques of the *Superlearning*<sup>™</sup> system, which combine relaxation, controlled breathing, and chunking, work equally well through learning, memorizing, performing, and free recall of complex music acquisition—in this case, a previously unknown 4-voice fugue—by higher level pianists (Welch *et al.* 2008, Chaffin *et al.* 2002, Connolly and Williamon 2004, Ginsborg 2004).

## METHOD

### Participants

Eight undergraduate pianists, aged 18-25 years old who were all enrolled in the same discipline were placed into two groups: experimental group (EG) of five pianists (three female) and control group (two female). From questionnaires, the EG had more years of piano study than the CG (12.67 years vs. 9.80 years), practiced more on a daily basis (5.40 hours vs. 4.67 hours), and required less time to memorize a fugue (EG=6.8 weeks vs. CG=10.67 weeks). The majority of the pianists said that the most difficult type of music to memorize was a fugue (EG=80%, CG=100%).

### Materials

The materials consisted of (1) the musical score of the Fugue in *Eb*, Op. 16, No. 2 by Clara Schumann (1845) for both groups, (2) an altered version of a

commercial recording of the fugue (Jozef de Beenhouwer 2001, CPO Records, B00005MAV1, normal time=107 s), slowed to 60 M.M, for the EG (*Bias Peak Pro 6*), (3) musical chunks or fragments of the fugue separated by an equivalent amount of silence, plus a chunking map for each day's practice, for the EG (the musical chunks were determined by the fugue theme, musical phrases, and hands-together coordination), (4) a practice journal, for both groups, (5) pre-/post-questionnaires plus standardized psychological tests (state and trait anxiety [STAI-1, STAI-2], perceived stress scale [PSS], life orientation [LOT], personality [EPQ]), (6) *VitalJacket®* (VJ) during performances, and (7) test tubes and processors for cortisol analyses during performances. A description follows: (1) The use of the psychological tests permits the characterization of the psychological make-up of the groups (anxiety, stress, dispositional optimism, and personality dimensions) and understanding of the psychological effects of the presence or absence of the *Superlearning™* method during the different performance moments. (2) The VJ consists of a T-shirt and a small electronic device box using miniaturized components placed in a pocket that allows continuous non-invasive monitoring of the heart wave up to five days (see [www.biodevices.pt](http://www.biodevices.pt)); it permits a transthoracic interpretation of the electrical activity of the heart, or ECG reading, in real time via skin electrodes with storage in its internal memory or wireless transmission via Bluetooth technology; the cortisol salivary testing by competitive immunoassay is non-invasive and has been used in studies of memory, stress, and gender. (3) Cortisol, also known as hydrocortisone, is a steroid hormone or glucocorticoid produced by the adrenal gland or adrenal cortex as part of the hypothalamic-pituitary-adrenal (HPA) axis regulation. It is released in response to stress and to a low level of blood glucocorticoids. Despite its pathological effects on the context of long term exposure to stress factors, cortisol is relevant to cognitive performance such as memory.

## **Procedure**

Before starting the study, the students were given an orientation session, asked to sign a consent form, and respond to a pre-test questionnaire to ascertain their pianistic profile. Each group then had 3.5 weeks in which to learn the Fugue and was asked to use their respective techniques for only 30 minutes daily for a total of five days per week, registering the time of practice, local of practice, and their observations about practice. The EG used the altered *Superlearning™* techniques, while the CG was free to learn as they chose. Once a week, both groups met briefly with the project leader, who then proceeded to work for 30 minutes with the EG using relaxation and con-

trolled breathing techniques before advancing to the techniques of music chunking coupled with the breathing sequences (an altered version of *Superlearning*<sup>TM</sup> techniques). At the end of the 17 sessions, the students were filmed in a live performance (Trial 1) of the fugue. At this point, the pianists thought that the study had finished. Three months later, a surprise performance test (Trial 2) was given. Two weeks after that, the students were asked to repeat the performance (Trial 3), with only one week of preparation using their respective study techniques. All performances were filmed. Before and after all sessions, psychological tests were given and a salivary control for cortisol rating was done by oral swabs of saliva samples from each participant to test cortisol levels by a competitive immunoassay. Before and during the sessions, VJ monitoring of the heart rate was carried out.

## RESULTS

Performance results of the 3 trials were different than expected. In Trial 1, 40% of the EG (2 males) successfully performed the fugue, while 33% of the CG (1 male) was successful (time: EG=70.6 s, CG=47 s). In Trial 2, there was little difference between the groups, although EG was slightly better in memory recall (EG=15.0 s, CG=14.3 s). Both groups showed improvement in Trial 3 compared with Trial 1 (EG=79 s, an 11% improvement; CG=69 s, a 32% improvement). In Trial 3, the three male pianists again performed successfully, and the female pianists also showed improvement.

For state and trait anxiety, the EG had a dramatic rise from the pre-test to Trial 1 and was only slightly higher in Trial 3 in trait anxiety. There was little difference between the groups in Trial 2. The EG was overall more optimistic and less anxious than the CG. Using statistical analyses (SPSS 17.0) the following results were found. For state anxiety, the EG had a significant rise from the pre-test to Trial 1:  $t_4 = -3.27$ ,  $p < 0.05$  (Pre- mean=34.80, SD=2.78; Trial 1 mean=47.60, SD=5.77). In other words, the EG was more anxious in Trial 1, which could be related to the novelty of the adapted *Superlearning*<sup>TM</sup> method and the fact that Trial 1 was the first evaluation of the students with this method. The CG also had a dramatic rise from the pre-test to Trial 1, showing that the performance assessment was also stressful. However, this difference was not statistically significant. Statistical analysis showed no significant differences between groups in anxiety (trait and state) levels; however, CG perceived stress was significantly higher:  $t_6 = -2.54$ ,  $p < 0.05$  (CG mean=30.33, SD=3.06; EG mean=22.60, SD=4.83). Trials 2 and 3 showed no significant differences between groups, and in Trial 3, in both groups, identical averages are detected to those of the pre-test. No significant differences

Table 1. Mean heart rate variability (HRV) or ECG for the experimental (EG) and control groups (CG).

<i>Trial 1: Mean HRV</i>	<i>Trial 2: Mean HRV</i>	<i>Trial 3: Mean HRV</i>
<i>Not play/play</i>	<i>Not play/play</i>	<i>Not play/play</i>
EG (n=5; 3 females)= 105/139	EG (n=5; 3 females)= 107/105	EG (n=4; 2 females)= 87/115
CG (n=3; 2 females)= 93/125	CG (n=3; 2 females)= 94/84	CG (n=3; 2 females)= 87/116

Table 2. Mean cortisol levels for the experimental (EG) and control groups (CG).

<i>Trial 1: Concentration of</i>	<i>Trial 2: Concentration of</i>	<i>Trial 3: Concentration of</i>
<i>Cortisol (µg/dl):</i>	<i>Cortisol (µg/dl):</i>	<i>Cortisol (µg/dl):</i>
<i>Before/after</i>	<i>Before/after</i>	<i>Before/after</i>
EG=0.62/0.61	EG=0.29/0.33	EG=0.59/0.44
CG=0.33/0.37	CG=0.26/0.26	CG=0.36/0.30

were found in either inter- or intra-participants in the LOT and EPQ tests. These results show that both groups were more anxious in Trial 1, as would be expected. However, as the intra-participant analyses show that the EG was significantly more anxious in the Pre-test, we can infer that the *Superlearning*<sup>TM</sup> adapted method explains this increase in the anxiety levels of the students by being a new and demanding method.

The heart rate variability (HRV) found the EG group to be more anxious in Trials 1 and 2 than CG but less than CG in Trial 3. Overall rates declined in both groups between the first and last trials (Table 1).

Contrary to the desired effect of relaxing while learning and performing, the EG was consistently more stressed than the CG (Table 2), according to cortisol presence in their saliva.

## DISCUSSION

From this multi-disciplinary pilot study we conclude: (1) the *Superlearning*<sup>TM</sup> techniques adapted for complex music acquisition (i.e. fugue learning by pianists) function but cause stress in the participants and should therefore be refined because their long-term results are positive; (2) the study was gender-specific with all male pianists having 100% learning rate in less time than normal, a surprising finding requiring further study; (3) the EG and all male

participants were most successful in free recall (Trial 2); (4) musical performance has to be practiced if security is to be attained, a finding that is supported by both EG and CG and one which every good pedagogue inculcates in his/her students.

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