The Effects of Whole-Body Acoustic Stimulation on Subjective Relaxation, Verbalisation, and Visual Imagery among Professional Orchestra Musicians

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Introduction

While engaged in an intervention study evaluating the efficacy of a course on stress management for professional musicians (Brodsky, 1995; Brodsky & Sloboda, 1997), specific effects of whole-body acoustic stimulation were observed. It should be pointed out that although previous studies have attempted to document human vibrotactile sensitivities (for a review see Verrillo, 1992), as yet, there has been no systematic study of acoustic stimulation involving the whole body. Nevertheless, many researchers (for example, Standley, 1991; Madsen et al, 1991) frequently utilise a device to present auditory and vibrotactile stimulation known as the Somatron® Acoustic Massage™ System. It has been common for subjects to report this tactile-musical experience as a listening experience that is relaxing yet stimulating. Accordingly, Madsen et al conclude that "vibrotactile use in all of its various ramifications merits careful attention. Aspects relating to whole body... relaxation or stimulation caused by various frequencies without, or in combination with, various musical selections are all fertile areas for investigation" (pg. 21). Clearly, while it has been known for some time that music vibrations penetrate the body, it is essential that current studies focus on more specific effects through cautious research. During our clinical trial of a therapeutic treatment for musicians utilising the Somatron Recliner, we observed qualitative differences among responses of the sample regarding subjective relaxation, verbalisation, and visual imagery. We have every reason to believe that these differences are solely attributed to whole body acoustic stimulation, that is, the application of music generated vibration to cutaneous tissue involving large surface areas.

Method

Fifty-four (N=54) professional symphony orchestra musicians participated in the study. The majority (68.5%) were string players, with all other major orchestral instruments being represented by a minimum of three players. The average age was thirty-six (range=22-55 years), with an almost equal number of males and females. Forty-eight of the participants (89%) had completed formal music training at the undergraduate degree or diploma level.

Musician subjects were recruited via a questionnaire sent to orchestra managements. Four research sites were initiated in three cities across North West England. Musicians of each site were assigned a PIN number and listed according to descriptive criteria such as gender, age, orchestra section, principal instrument, and status (contract/freelance) - these served the random assignment to intervention conditions The procedure was two-fold: (a) three subjects were matched according to descriptive criteria; and (b) one of the three matched subjects was randomly assigned to one of the three experimental conditions. Musician-subjects were both matched *within* each site, as well as *between* sites. The three experimental conditions were:

1. Verbal. Seated in the recliner, the subjects received individual contact consisting of verbal conversation, visual imagery tasks, and relaxation exercises. This condition was identified as the control group.

2. Music. Seated in the recliner, the subjects received individual contact consisting of verbal conversation, visual imagery tasks, and relaxation exercises supplemented with pre-recorded music from commercially available cassette tapes and/or CDs presented through headrest-mounted speakers.
3. Somatron. Seated in the recliner, the subjects received individual contact consisting of verbal conversation, visual imagery tasks, and relaxation exercises, accompanied by pre-recorded music from commercially available cassette tapes and/or CDs presented through speakers embedded in the recliner at various body locations.

Each musician received eight individual 50-minute sessions over eight weeks. Every session opened and closed by completing the Profile of Mood States (POMS) Monopolar Form (McNair, Lorr, & Droppleman, 1971). The POMS was used as a method to monitor effects of emotional stimulation within sessions, as well as across the time period of eight sessions. Self-administered in roughly five minutes, whereby respondents rate sixty-five adjectives on a 5-point scale, POMS measures six affective states and a global total score. After completion of the POMS, relaxation exercises were implemented. Then, verbal conversations focused on either cognitive appraisals or career development, or focused on theories connected to action tendencies. Visual imagery tasks were implemented as means to widen self-awareness. The content of the conversations, cognitive appraisals, and imagery tasks were simultaneously transcribed throughout each session.

Results

A repeated measures analysis of variance (ANOVA) indicated statistically significant positive general effects of *time* (i.e. across eight sessions) for all musicians regardless of the experimental condition on four out of six POMS mood states. These reflected a progressive reduction in tension-anxiety [$f(1,7)=9.56$, $p<.001$], depression-dejection [$f(1,7)=2.56$, $p<.014$], anger-hostility [$f(1,7)=3.14$, $p<.003$], and confusion-bewilderment [$f(1,7)=9.43$, $p<.001$]. Further, a reduction of the total scale score was demonstrated [$f(1,7)=2.91$, $p<.006$]. However, no significant score differences were observed between the experimental conditions, that is, no interactions between *experimental condition x time* were demonstrated.

Nevertheless, specific qualitative differences were observed between both experimental music conditions (Music and Somatron) in comparison to the no-music control (Verbal) condition, as well as between the two music conditions themselves. These between-group differences were assessed through a content analysis of session transcripts.[1] The analysis attempted to account for the qualitative nature in which the subjects described: (1) how they felt after relaxation; (2) the intensity and depth of self-disclosure during narratives and cognitive appraisals offered verbally after relaxation; and (3) a count of occurrences of visual scenes during imagery tasks offered verbally after imagery exercises had concluded.

[1]The transcripts presented herein represent a random sampling of the total four-hundred thirty-two hours subject contact. While space limitations allow for only a few examples to illustrate specific points, the reader can be assured that the selection process was blind to descriptive information, and do in fact reflect the nature and character of the full sample. It should be noted that each vignette is prefaced by a case number, and that for the sake of anonymity all references to pre-principal instrument, principal instrument, secondary-instrument, as well as names of cities, concert halls, and music academies have been genericised using the labels *piano, violin, cello, London, Theatre, and Music College* - all of which are presented in *italics*. Although the sessions were not tape-recorded, every attempt was made to represent subjects' comments and narratives as original as possible including grammatical errors and use of slang. Consequently, where additional explanations were necessary, these appear between squared brackets ([ ]).

1. Subjective Relaxation. In general, the majority of musicians in the Verbal condition did not object if relaxation exercises were skipped and a session began with verbal conversation, whereas the majority of musicians in both Music and Somatron conditions disapproved if sessions did not begin with music-accompanied relaxation. It is further interesting to note that transcripts of subjects in the Verbal condition made little reference to the recliner or other aspects of the experimental environment or experience, while transcripts of Music subjects referred to several variables including the recliner, repertoire, listening behaviours, and audio quality. However, the transcripts of Somatron subjects are not only filled with statements describing their perception of the experience, or refer to the recliner, levels of relaxation, or repertoire, but highlight the affective quality of the music vibrations. It should be pointed out that verbal conversations did not take place during relaxation exercises, but following it.

The majority of the musicians in the Verbal condition referred to levels of relaxation by stating: Felt really relaxed. or Feel more relaxed now [after relaxation] than when I came in. Some commented about how their breathing patterns fluctuated throughout the exercises, while others commented how they suddenly became aware of their body. Several subjects commented about the inter-relationship between relaxation and performance.

375 At first I couldn't seem to relax my thigh muscles. [Makes little physical effort to tense his muscles. After the exercise, he says..] I feel more relaxed now than when I came in... this would be the best way to perform - alert but not tense!!

The majority of musicians in the Music condition referred to the audio quality or repertoire by stating: Don't like that piece. Didn't fancy that orchestra. or What a naff arrangement. While some felt that the music experience was great, others expressed that music might be detrimental to relaxation.

465 Session 1: Relaxation with Minuet (Bocherini) I am not in love with this piece or listening to orchestra music in general.

Session 5: Relaxation with Minuet (Bocherini)/Medley of English Airs/Elizabethan Serenade (Binge) Quite pleasurable and relaxed with the first piece. It reminds me of Grade 5 on the associated boards. The second and third pieces remind me of my early childhood. [Reminisces of a slightly restricted childhood].

The majority of musicians in the Somatron condition referred to levels of relaxation, pleasure/displeasure of vibration, interference/facility of vibration on relaxation, repertoire, comparison of the audio quality to their home stereo, and comparison of this experience to those involving the stage. However, what stands out clearly is the emotional quality of the Somatron experience - sometimes catching them off-guard *flooding* them with unanticipated feelings, while at other times elevating them to a *peak*.

352 Session 1: Relaxation with Air on a G String (Bach) The somatron takes some time to get used to.. it tickles down my back. I was glad the piece had no *violin* in it so I could listen better. I was aware that the vibrations that were going right to (through) my emotions, without my control. The piece was reminiscent of my childhood which was nice but sad. [It reminded him of a time when he lost both parents].

Session 4: Relaxation with Adagio for Strings (Barber) This really felt great! The harmonic climax of the piece was like the release of tension during our relaxation exercises. It was quite powerful, and then when the release of tension came from the music, it was like a release of the muscle tension even though I was lying motionless It felt really quite exhilarating.

Session 8: Relaxation with Pavane (Fauree)/popular orchestra arrangements of Rhapsody On a Theme of Paganini (Rachmaninov)/Summertime from Porgy and Bess (Gershwin)/When I Fall In Love (Young) - They were soupy and commercial. Awful arrangements! The third piece however made me feel safe and loved. It reminds me of [girlfriend] and she makes me feel safe and loved!

2. Cognitive Appraisal. Musicians were asked to evaluate the meaning and impact music had had in their lives prior to and during the process of becoming a musician; these were relayed in the form of an autobiographical narrative. Previously, Sloboda (1989; 1991) found that autobiographical memories of music were particularly retrievable tapping musical experiences covering a wide range. He concluded that this method was an effective means to recall significant emotional responses to music experiences. However, unlike Sloboda's previous report, our subjects' narratives reflected one of two distinctive styles which are qualitatively different: *surface-narratives* versus *depth-narratives*. While some musicians offered narratives that remained somewhat on the cognitive surface (describing their biographical history as a mere sequence of events), others went into more emotional detail under the surface (and often touched affective lines which were emotionally painful). In general, surface narratives were shorter texts reflecting on average 70 words (sd=35.07, range=37-117 words), while the depth narratives were more than twice as long reflecting on average 230 words (sd=69.80, range 261-414 words). It is interesting to note that while only 26% (or 5:19) of the subjects in the Verbal condition offered depth-narratives, 63% (or 10:16) of subjects in the Music condition and 58% (or 11:19) of subjects in the Somatron condition offered depth narratives. An example of each type follows.

375 It is an expression of self. More than expressiveness. It gave me a discipline - had to be done every day. It became an obsession. It's a focus of life. It is almost a religion.

032 I personally feel that wrongly through my life music has been a false G-d. I have given it far too much value. I thought it was the be all end all to everything else. It gave me a feeling, a personality, a purpose to strive for. Value and importance.. kudos At 3-4 I began *piano*.. my mother was my *piano* teacher. Both my parents are musicians and travel as performing musicians. It was the "kiss of death" so to speak. Mom and I didn't get on as teacher and pupil.. I was difficult to teach. At 8 I found a *violinist* who was wonderful in *London*. This teacher didn't talk down to me. From the beginning I identified myself as a *violinist*. By the age of 10-11 I had a strong feeling of destiny. I began practising from about 11 years old. The instrument gave me a great feeling. To try things out on the *violin*. I was enamoured by the repertoire. The human speaking quality. You can talk with it, or communicate through it. My twin brother was more of an extrovert than I was. Unlike me he was the life of the party. My music compensated in this rivalry. I spent much time in Youth Orchestras. Saturday workshops from 12-16 years old. At 17 I joined the *Music College*. Most of my friends are musicians (though about 5% are non-musicians). I was a late bloomer (sexually) and all my intimate contacts really only occurred from and after college. Thus, all my intimate relationships have always been with musicians. I feel that the reason for this is not just circumstance [being among musicians] but understanding. [He feels a specific dynamic relationship to the instrument.] A total togetherness. Tonal makeup, variety, big, resonant, rich. The instrument is the sound in me. I feel closer to the instrument than to humans. The way I and the *violin* sound together leaves me feeling self sufficient, needing no further human contact or relationships (only seldom do I need others).

3. Visual Imagery. Imagery tasks were implemented as a means to widen self-awareness. Conversations did not take place during imagery tasks, but following them. A content analysis of reported imagery demonstrated many commonalities regardless of condition. For example, in one task involving an imagined stage-performance, the majority of musicians were able to visualise a familiar venue complete with audience. Further, most subjects who visualised themselves performing on stage, watched themselves perform from either a location in the wings (i.e., off-stage to the right or left), or from behind the orchestra. However, and in addition to these, only musicians from the Music and Somatron conditions reported *feeling sensations as if they were actually performing on stage*.

294 The venue was *The Theatre*. I could see the faces of the audience, but they were still a general mass of people. There were identifiable members of the audience that I personalised such as my parents, daughter, neighbours, some colleagues, and a few players. They seemed to be excited. I couldn't see myself as a performer play... but I could feel

as if I was playing (felt realistic). I could feel the technical aspects of the performance. I felt as if I was playing well, not nervous, however slightly more so when I thought about my parents being in the audience. In general it was a pleasurable experience.

While visual imagery tasks involve projection and introspection, supplementing these with music and/or music-generated vibration seems to both heighten the experience, as well as evoke many more memories and associations. For example, in one task where subjects from both experimental conditions were asked to perceive the heard music as a television movie soundtrack, and visualise the *teleplay* as vividly as possible, the majority of musicians reported: (a) images of nature and the great outdoors including scenes on a beach, in the hills, or near a forest; (b) images involving motion or travel including cars, boats, or on horseback; and (c) images involving figures (some of whom were recognised as neighbours or relatives). Nevertheless, a content analysis of this reported imagery demonstrated interesting differences between subjects - albeit this time between the two experimental music conditions themselves. In general, the imagery reported by subjects of the Music condition were shorter texts reflecting on average 57 words (sd=19.20, range=36-90 words), while the imagery reported by subjects of the Somatron condition were a bit longer reflecting on average 81 words (sd=24.91, range=54-126 words). However, the main difference between these two groups surfaced by counting the occurrences of visual scenes as reported in their imagery; these reports were all offered verbally after imagery exercises had concluded. The analysis revealed that 69% (or 11:16) of the subjects in the Music condition reflected monothematic or one-scene imagery, while 79% (or 15:19) of subjects in the Somatron condition reflected multiple-theme/scene imagery. An example of each type follows.

285 Driving along the road, two people male and female, on a warm day. The car was a convertible 60's type with big chrome wings. In a national park, no trees, desert area.

387 A couple in a rooftop restaurant by the window with the city streets below. Feeling relaxed... enjoys the meal. The waiter told the man of a phone call for him, after which he came back white-faced and crying. It began to rain and pour. The window blurred. Food and drinks now looked as if it was awful. Scene of a park. Same couple but he was less defined. Girl was really happy hopping along the wall. She climbed a tree. Expressing happiness by screaming happily. Still not enough happiness and then before flying about like a bird while the man just sat in the park ignoring her. She laid down in the field and fell asleep.

Discussion

Although our primary research aim was not to explore the qualitative effects of whole-body acoustic stimulation, musicians' responses to this stimulation was of a very marked character. It must be pointed out that the transcription method used may be less than totally reliable particularly as it may be open to experimenter bias. A more valid procedure would most certainly have been to audio-tape or video-record the sessions that would thereafter undergo a process of transcription and assessment by individuals blind to experimental conditions. Nevertheless, since these effects were unexpected and unpredicted by the researchers, we may be somewhat confident that these effects are real, not artificial.

Other recent studies suggest that the effects of vibrotactile stimulation are subtle and indirect. For example, Walters (1996) reported using the Somatron to investigate the effects of vibrotactile stimulation on thirty-nine women awaiting scheduled gynaecological surgery. Randomly assigning subjects to one of three groups (vibrotactile, music only, and no-treatment control group), Walters found no significant differences between the groups regarding standardised post-operative assessments. However, in comparison to control

subjects, women participating in either music condition spent significantly less time in surgery and post-anaesthesia care, as well as received significantly less post-operative medication. Further, subjects receiving pre-intervention vibrotactile stimulation demonstrated the least systolic/diastolic blood pressure fluctuation throughout the surgical experience, in addition to significantly less post-operative apprehension. Walters concluded that conditions consisting of either music-only or vibrotactile stimulation seem to be equal in effect as "the two appeared not to differ significantly from each other on any measure apart from the self-report data" (pg. 261-262).

Conceivably, the effects of vibrotactile stimulation via the Somatron® Acoustic Massage™ System are not readily amenable to standardised psychometric assessments, but rather self-report measures, verbal narratives, and cognitive appraisals. Our data suggests that vibrotactile stimulation generates a strong sensory experience which leads to emotional intrapersonal processes that produce rich and deep post-stimulation verbalisation. An explanation for how this type of stimulation leads to these specific and distinctive effects is a matter for further research.

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