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Effect of synchronized or desynchronized music listening during osteopathic treatment: An EEG study

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Abstract

While background music is often used during osteopathic treatment, it remains unclear whether it facilitates treatment, and, if it does, whether it is listening to music or jointly listening to a common stimulus that is most important. We created three experimental situations for a standard osteopathic procedure in which patients and practitioner listened either to silence, to the same music in synchrony, or (unknowingly) to different desynchronized montages of the same material. Music had no effect on heart rate and arterial pressure pre- and posttreatment compared to silence, but EEG measures revealed a clear effect of synchronized versus desynchronized listening: listening to desynchronized music was associated with larger amounts of mu-rhythm event-related desynchronization (ERD), indicating decreased sensorimotor fluency compared to what was gained in the synchronized music listening condition. This result suggests that, if any effect can be attributed to music for osteopathy, it is related to its capacity to modulate empathy between patient and therapist and, further, that music does not systematically create better conditions for empathy than silence.

Descriptors: EEG/ERP, Heart rate, Unconscious processes, Normal volunteers

Head into an osteopath's office, or in most manual therapists' offices for that matter, and you'll often hear background music. Similar to music designed to help customers shop (North, Hargreaves, & McKendrick, 2000) and office workers concentrate (Lesiuk, 2005), some music is produced specifically to accompany osteopathic treatment (e.g., Dury, 2004).

Music is indeed not simply a hedonic stimulus: it has been associated with therapeutic effects, for example, pain relief (Mitchell, MacDonald, Serpell, & Knussen, 2007) and motor rehabilitation (Rojo et al., 2011), and thus may well interact, positively or negatively, with osteopathic treatment (specifically in this study, the osteopathic procedure known as *total body assessment* or TBA). Yet, there has been no published study on the effect of using music in conjunction with TBA.

Musical stimulation is relevant to osteopathy in many aspects. First, music listening provides relaxation (Knight & Rickard, 2001), which is a known facilitating factor for manual therapies (Anderson & Seniscal, 2006). Second, music listening unconsciously interacts with muscle activity (Safranek & Raymond, 1982) and stimulates motor and premotor cortices (Bengtsson et al., 2009), as does TBA (Shepavlnikov et al., 2000). Beyond such direct effects, the sole activity of jointly listening to the same music may also have unsuspected effects on the therapist's interaction with his or her patient. First, the emotions evoked by music have been linked to the mirror neuron system, which is thought to be involved in empathy (Chapin, Jantzen, Kelso, Steindberg, & Large, 2010), and synchronized music listening was shown to increase trust and cooperation (Anshel & Kipper, 1988), which have a positive influence on medical treatment (Price, Finniss, & Benedetti, 2008). Second, synchronized music listening serves to establish rhythmic synchronization between listeners, a behavior known to stimulate wide networks of auditory, premotor, and motor areas of the brain relevant to manual therapies (Chan, Penhume, & Zatorre, 2006; Overy & Molnar-Szakacs, 2009). Rhythmic synchronization may be especially relevant to osteopathy, as its practitioners typically put great value in their haptic adaptation to a patient's "internal rhythm" (Wernham, 1988), a holistic concept that has been linked to various physiological variables such as breathing, heart rate (Laval, 2002), and cerebrospinal fluid dynamics (Nelson, Sergueef, Lipinski, Chapman, & Glonek, 2001). By providing an external clock, music may either facilitate or distract the manipulative rhythmic entrainment sought by the practitioner, and in turn influence the actual or perceived effectiveness of osteopathic treatment.

It therefore remains an open question whether music listening can facilitate osteopathic treatment, and, if it does, whether it is listening to music or listening to a common stimulus that is most important. To investigate this effect, we created three experimental situations in which patients and practitioner listened either to silence, to the same music in synchrony, or to different desynchronized montages of the same material. This design

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allowed us to test two hypotheses: First, if music listening facilitates osteopathic treatment per se, we should observe greater treatment effectiveness in the two music conditions (synchronized and desynchronized) compared to the silence condition. Second, if empathy is a facilitating factor, we should observe greater treatment effectiveness in the synchronized music condition than in the desynchronized music condition. These two effects may be observed conjunctly, to different degrees; for instance, if both are important factors, we may observe more effect of treatment in the synchronized music condition than in the desynchronized music condition, and more effect in the desynchronized music condition than in the silence condition.

We assessed the effectiveness of TBA with physiological measures (arterial pressure and heart rate), which we both expect to decrease with improved treatment effectiveness (Ducos, 2000), patient and practitioner questionnaires designed to yield larger measures for more pleasing and effective treatments (see Methods), as well as electroencephalographic (EEG) recordings of the patients' sensorimotor cortex activity on a simple motor task executed before and after treatment.

In more detail, we used the EEG paradigm of mu (μ) rhythm event-related desynchronization (mu-ERD). Mu-ERD measures the sudden decrease in a subject's electrical scalp activity in the mu-frequency band (8–12 Hz) following the onset of a task. Significant mu-ERD is typically associated with motor tasks, such as arm, hand, or finger movements, both active or passive (Alvarez-Linera, 1999), actual or imaginary (Pineda, Allison, & Vankov, 2000), and is thought to represent an increased mobilization of neuron populations in the motor and sensorimotor areas. Beyond motor tasks, mu-ERD has also been associated with tasks involving empathy (Yang, Decety, Lee, Chen, & Cheng, 2009), as well as music listening (Li, Hong, Gao, Wang, & Gao, 2011). Therefore, it seems reasonable that effects of either music listening or synchronized "empathetic" listening on a TBA patient's motor fluency should be reflected in mu-ERD. While some debate exists (see Pineda, 2005, for a review), greater amounts of mu-ERD (i.e., greater decreases of power in the mu frequency band) are typically thought to reflect greater neuronal mobilization and therefore more difficult or effortful tasks; for instance, finger movements in elderly subjects are followed by a more widespread ERD over motor and premotor areas than in young subjects (Derambure et al., 1993). We therefore take a decrease of mu-ERD between pretreatment and posttreatment measures to indicate greater treatment effectiveness.

Method

Participants

Twelve healthy, right-handed adults (female = 6, mean age = 29) participated in the study as patients, and one 29-year-old female qualified therapist participated as the practitioner. None of the patients had any medical counterindication to TBA, nor were under medication known to interact with EEG measurement. All had normal hearing.

Procedure

Experimental sessions consisted of a series of pretreatment measures (physiological and EEG), followed by a 20-min partial TBA treatment, and then a posttreatment series of the same type of measures. One experimental session (including installation, pretreatment measures, treatment, and posttreatment measures) lasted about 1 h. Patients went through three sessions, 1 week apart, in which the experimental condition was varied in random order. In all sessions, patients were treated by the same practitioner.

At the beginning of each session, patients were fitted with the EEG recording apparatus, asked to lie on the treatment table, and to execute a series of 40 imaginary moves of the right arm (four series of 10 moves, prompted by an auditory cue every 4 s, separated by a pause of 40 s) while we recorded their EEG. We then measured their arterial pressure and heart rate.

Patients were then subjected to a partial TBA treatment.[1] During TBA, both patient and practitioner were fitted with headphones and listened to one of three types of audio stimulation (music1, music2, or white noise) according to the experimental condition (synchronized, desynchronized, or none—see Materials below).

After treatment (which was precisely timed at 20 min), we again measured the patients' arterial pressure and heart rate, then recorded their EEG while they executed 40 imaginary moves in the same procedure as the pretreatment measures. Patients and practitioner then responded to a series of questions evaluating the treatment's physiological effectiveness, its facility, and pleasantness, and the participant's perception of being synchronized to one another during treatment.

Materials

Stimuli in the S (synchronized) and D (desynchronized) conditions were both manipulations of the same material, an instrumental movie soundtrack selected for its slow, contemplative atmosphere (Zimmer, 1999). Twenty 1-min excerpts were extracted from the soundtrack, and annotated by a musician expert (the third author) for their sound intensity (quiet/loud), rhythmic strength (pulsated/not), and emotional valence (positive/negative). Two separate montages of the extracts were then produced by concatenating them in continuous 20-min sequences (m1 and m2), such that

1. Intensity, rhythm, and emotional properties of the extracts within each montage should alternate (e.g., m1 = loud/quiet/loud/quiet . . .).
2. Extracts placed at the same position in both m1 and m2 should be maximally different in their intensity, rhythm, and valence properties (e.g., m1 = loud/quiet/loud/quiet and m2 = quiet/loud/quiet/loud).

In addition, transitions between extracts were shifted by 20 s in m2 compared to m1 (Figure 1), so that even the transitions between excerpts did not happen at the same time. As a result, m1 and m2 contained the same material (thus had presumably the same arousal, rhythmic, and emotional influence on both participants), but were experienced as optimally desynchronized from one another when played simultaneously.

Patients and practitioner in condition S were both presented m1; patients in condition D were presented m2, while the practitioner was presented m1. In this manner, we ensured that the condition S or D was blind to both the patient (who could not hear the

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[1] Also known as general osteopathic treatment (GOT), the TBA is a standard osteopathic procedure, which consists of the consecutive mobilization by the therapist of every joint in the body, from head to toe. TBA is thought to result in the reharmonization of all bodily structures, which are conceived as interdependent (Ducos, 2000). More precisely, in this experiment, patients were subjected to a partial TBA in the supine decubitus position, in which only the upper part of the body was treated, starting with the right side, then left side. The treatment focused, in this order, on shoulder, thoracic diaphragm, vertebrae, and abdominal visceral mass.

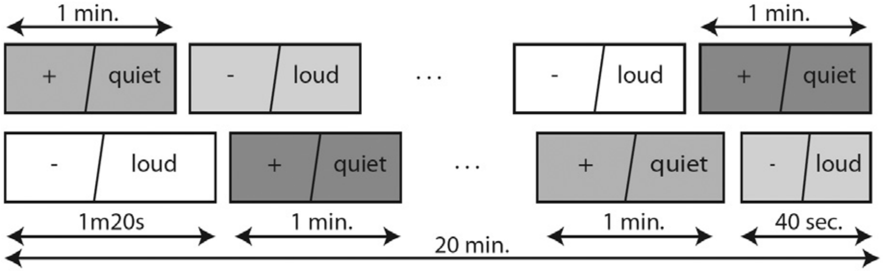

Figure 1. Stimuli used in the S and D musical conditions are 2 different 20-min montages of the same 20 1-min extracts, only in a different order. Extracts placed at the same position in both montages are chosen to differ in both intensity (quite/loud), emotional valence (+/–) and rhythmic strength (not represented here). Additionally, the onset of transitions between consecutive extracts are shifted by 20 s. When played concurrently, both sequences are experienced as optimally desynchronized from one another.

practitioner's music) and the practitioner (who could not infer what music the patient was hearing from her own, unchanged stimuli). In the N (none) condition, patients and practitioner were both presented with the same continuous, 20-min, low amplitude (−20 dB) white noise (recorded silence). Note that, contrary to the difference between S and D, the difference between the N condition on the one hand, and the two S and D conditions on the other hand, was not blind to the participants.

Heart Measure Procedure

We recorded diastolic and systolic arterial pressure, as well as radial pulse, before and after treatment, using a wristband tensiometer (THUASNE, approved by the British Hypertension Society). The pretreatment measure was done after the patient had lain down for 10 min. The posttreatment measure was done immediately after treatment.

Questionnaire Design and Validation

The patient questionnaire consisted of two questions related to the treatment's physical effectiveness, three questions related to the treatment's pleasantness, and one question related to their perception of being synchronized to the practitioner during treatment. The practitioner questionnaire consisted of three questions related to physical effectiveness, two questions related to the treatment's pleasantness and facility, and two questions related to their perception of being synchronized to the patient during treatment. For patient and practitioner, the three questions related to synchronization were only asked during the two musical conditions S and D. The exact wording of the questions, in French, was chosen in collaboration with a professional osteopath. See Appendix for an English translation.

All answers were coded as scale data between 0 (*not at all*) and 10 (*very much*), so that greater values indicated greater treatment effectiveness and pleasantness.

Questionnaire scores were subjected to factor analysis to validate their a priori loadings on the three categories of physical effectiveness (PHY), pleasantness (PLEA), and synchronization (SYNC). Patient questions for PHY and PLEA loaded correctly on two factors (all factors > 0.68, total variance explained: 79%), and, in both factors, had Cronbach's alpha indicating good reliability (PHY: alpha = 0.87, PLEA: alpha = 0.84). Practitioner questions for PHY, PLEA, and SYNC loaded correctly on three factors (all factors > 0.70, total variance explained: 76%); within each factor, reliability was good for PLEA and acceptable for SYNC (alpha = 0.72) and PHY (alpha = 0.69). Consequently, we averaged question scores to generate a single score in each category PHY, PLEA, and SYNC.

EEG Procedure

The EEG was recorded from the 64 scalp sites of the 10–20 system, using a 64-channel BioSemi ActiveTwo system. Horizontal eye movements were recorded with electrodes placed on the outer left and right canthus. Additionally, two reference electrodes were placed on the patients' left and right mastoids. Signals were sampled at 2048 Hz, and acquired with BioSemi's ActiView software. Seventy-two datasets were recorded overall (12 patients, three conditions, pre- and posttreatment).

EEG signals were analyzed to remove artifacts using the EEGLAB toolbox for MATLAB (Delorme & Makeig, 2004). The continuous data was rereferenced to the two mastoid channels, downsampled to 512 Hz, and high-pass filtered with cut-off frequency 1 Hz. Independent components were then extracted using EEGLAB's runica routine, and artifact components were identified in all 72 datasets using the ADJUST procedure (Mognon, Jovicich, Bruzzone, & Buiatti, 2011). We rejected one patient (6 datasets) for abnormally high number of artifacts (41/64 independent components [ICs]). Signals from the remaining 11 patients were then processed to remove artifact ICs ($M = 12.2$, $SD = 5.6$ components removed out of 64 in each dataset). We finally discarded all but the five channels corresponding to the patients' sensorimotor cortex (from left to right, C3, C1, Cz, C2, C4).

To quantify the mu rhythm ERD, we extracted epochs of 4 s, corresponding to 1.5 s prestimulus and 2.5 s poststimulus, where the stimulus is defined by the time of the auditory cue used to prompt the imaginary movement. This resulted in 40 epochs in each dataset. Each epoch was then segmented into successive 1-s windows with 900-ms overlap, convoluted with a Hanning window and Fourier transformed to obtain their power spectrum in the frequency range (8 Hz−12 Hz; i.e., 5 frequency data points at frequency resolution 1 Hz).

For each dataset and for each of the five motor EEG channels, we discarded the first 10 epochs with lowest mu rhythm activity in the prestimulus period. Mu-ERD was then expressed in each of the remaining 30 epochs and for each of the five EEG channels as the percentage power decrease between the poststimulus activity and the prestimulus activity, using the procedure illustrated in Figure 2. For each epoch, we identified the frequency fmax in the range (8 Hz−12 Hz) corresponding to the maximum power spectrum $A = \max Pa(f)$, $f = 8 \ldots 12$, where Pa is the average power spec-

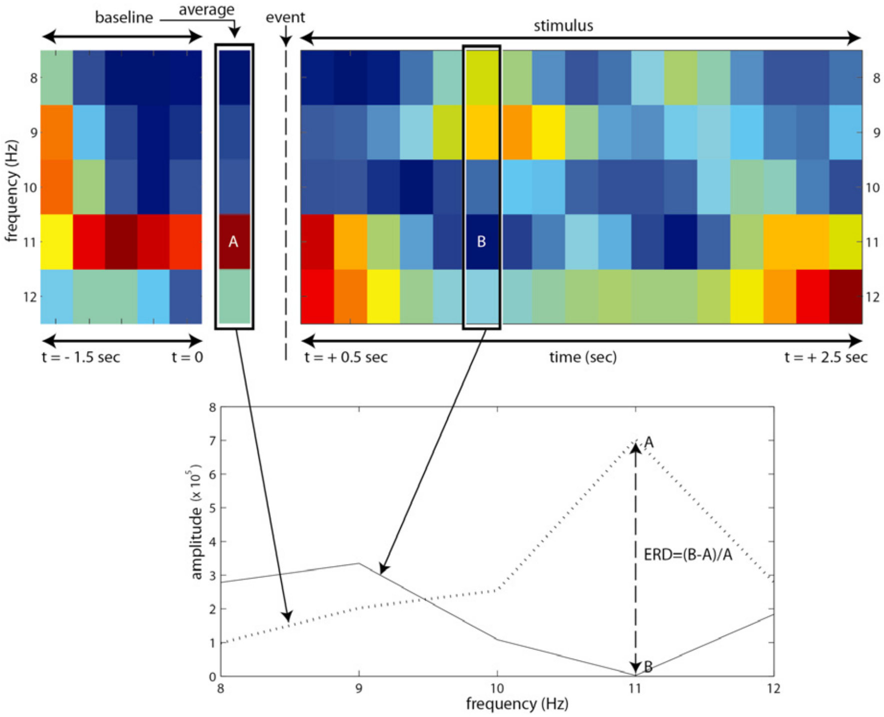

Figure 2. Schematic representation of the procedure used to quantify mu-ERD in each experimental trial. Top: spectrogram showing power spectrum in one EEG channel (C3) on 5 successive 1-s windows pre-event, and 15 windows postevent, over the 8–12 Hz frequency range. Bottom: Two superimposed power spectrums, showing the position of the maximum peak A in the average power spectrum in the pre-event section (dotted line) and the window with minimum peak power B at the same frequency in the postevent section (continuous line). ERD is expressed as the percentage power decrease between B and A.

trum Pa(f) = mean P(t,f), t = −1.5, . . . , −1.1, over all 5 prestimulus windows (1.5 s prestimulus). We then identified the minimum value of the power spectrum B = min P(t, fmax), t = + 0.1 . . . + 1.5 at the frequency position fmax over all 15 poststimulus windows (2.5 s poststimulus, without overlapping the stimulus). We computed the epoch ERD as the percentage decrease from A to B, that is, ERD = (B − A)/A(%), which we then averaged over all epochs for each EEG channel, patient, and experimental condition.

Results

We tested the two hypotheses (music better than silence, and synchronized music better than desynchronized music) with separate analyses.

To test for a facilitating effect of the two musical conditions over silence, we analyzed patient and practitioner questions separately, using in each case a repeated measures multivariate analysis of variance (MANOVA) with condition as a 3-level repeated factor (S, D, N), and the two question scores PHY and PLEA as multivariate measure, testing for a main effect of condition. The main effect of condition on the practitioner's PHY and PLEA scores was significant: $F(4,7) = 5.72$, $p = .023$; the main effect of condition on the patients' PHY and PLEA scores was marginally significant: $F(4,7) = 3.43$, $p = .07$. Mean scores for patients' PHY and PLEA questions and scores for practitioner's PHY were higher in the two musical conditions S and D than in the silence condition (N).

Similarly, we analyzed the patients' EEG data using a repeated measures MANOVA, with condition (3 levels) and treatment (pre/post) as repeated factors, and ERD in the five EEG channels as multivariate measure. The interaction of condition and treatment was nonsignificant: $F(10,1) = 1.44$, $p = .57$.

Finally, we analyzed the three heart measures (diastolic, systolic arterial pressure [AP], and heart rate) separately, each as a repeated measures ANOVA with condition (3 levels) and treatment (pre/post) as repeated factors. We found no main effect of the osteopathic treatment on either systolic or diastolic arterial pressure, or on heart rate, and no interaction with the experimental condition. In summary, a facilitating effect of the two music conditions over silence was supported by questionnaire data, but not by either EEG, heart rate, or arterial pressure.

To test for a facilitating effect of the synchronized music condition over the desynchronized music condition, we conducted separate tests on the same measures (questionnaires, ERD, heart measures) using a two-level factor for condition (S, D). In addition, we conducted an extra repeated measures ANOVA, with a two-level condition (S, D), on the SYNC questionnaire measure, which was only collected in the two music conditions. The 2-condition repeated measures MANOVA on PHY and PLEA revealed a significant main effect of condition for the patients: $F(2,9) = 7.81$, $p = .011$,[2] but not for the practitioner: $F(2,9) = 1.70$, $p = .23$. Patients judged that the treatment with desynchronized music was less physically effective but more pleasing than with synchronized music. Neither the patients nor the practitioner reported any difference of synchronization (SYNC score) between the S and D conditions at the statistically significant level (see Figure 3).

The 2-condition repeated measures MANOVA on the patients' mu-ERD scores revealed a significant interaction of condition (S or

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[2] Greenhouse-Geisser adjusted univariate tests: PHY: $p = .38$, PLEA: $p = .06$.

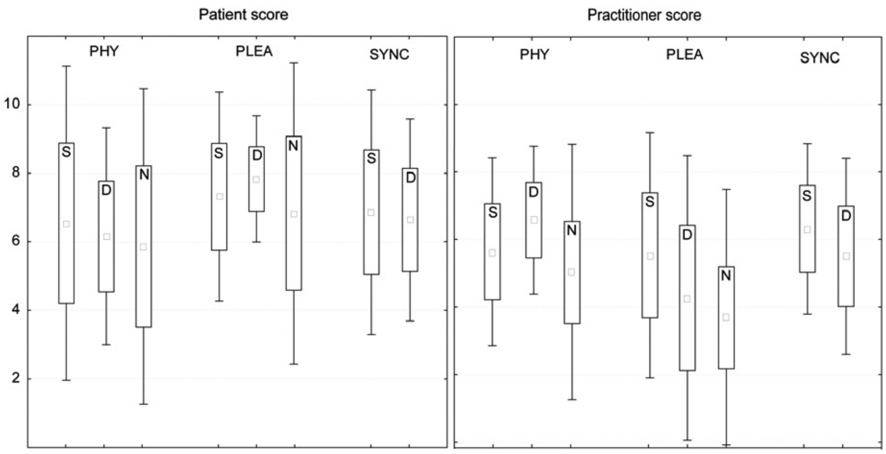

Figure 3. Box plots of questionnaire scores of physical effectiveness (PHY), pleasantness (PLEA), and synchronization (SYNC), as judged by patients (left) and practitioner (right), in the three conditions: synchronized music (S), desynchronized music (D), and no music (N).

D) and treatment: $F(5,6) = 5.53$, $p = .03$,[3] with a decrease of mu-ERD in all but one electrode in the synchronized music condition (from $M = -76\%$ to -73% ERD), and a marked increase in the same electrodes in the desynchronized music condition (from $M = -69\%$ to -76% ERD), see Figure 4. Also, mu-ERD in electrode C4 did not seem sensitive to treatment of condition, maybe because it is ipsilateral to the right arm movement used to generate the ERD response. Mu-ERD in the N condition stayed constant at −75%.

Finally, we analyzed the three heart measures (diastolic, systolic AP, and heart rate) separately, each as a repeated measures ANOVA with condition (2 levels: S or D) and treatment (pre/post) as repeated factors. We found no main effect of the osteopathic treatment on the three measures, no interaction between condition and treatment for the two arterial pressure measures, and a marginally significant interaction between condition and treatment for heart rate: $F(1,10) = 3.65$, $p = .08$. The patients' heart rate decreased following treatment in condition S, while it increased posttreatment in condition D.

In summary, a facilitating effect of the synchronized music condition over the desynchronized music condition was supported not only by questionnaire data, but also by EEG and heart rate.

Discussion

It is common belief among osteopathy practitioners that music should be a facilitating factor for therapy. However, reasons for

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[3] Greenhouse-Geisser adjusted univariate tests: C3: $p = .16$, C1 = 0.03, Cz = 0.07, C2 = 0.11, C4 = 0.89.

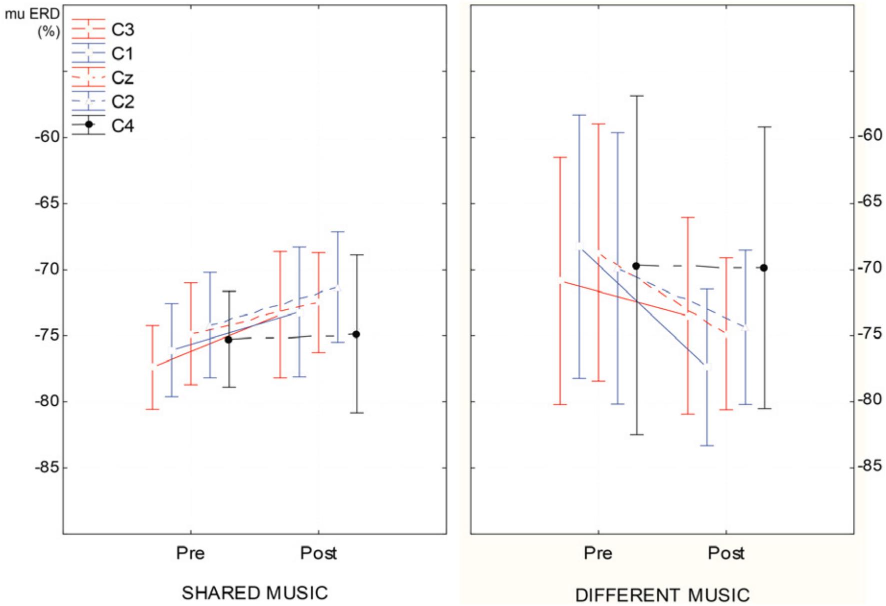

Figure 4. Effect of synchronized or desynchronized music listening on mu-ERD before and after treatment. In all but one electrode (C3, C1, Cz, C2), treatment in the synchronized music condition was associated with an decrease of mu-ERD (from $M = -76\%$ to -73% ERD) while treatment in the desynchronized music condition was associated with an increase of mu-ERD (from $M = -69\%$ to -76% ERD). Mu-ERD in the N condition stayed constant at −75% (not shown).

such an effect remain unclear: first, music may provide better relaxation for the patient; second, it may also create increased empathy between the patient and therapist. The present study is the first to investigate these two possible explanations, not only by comparing osteopathy in music and silence, but also by comparing synchronized versus desynchronized music listening. Crucially, the synchronized or desynchronized nature of the two music conditions remained blind to both the patients and practitioner, who could not identify which listening situation they were in.

The main result of our study is that, even though patients reported finding the two musical situations more pleasing than the silent situation, EEG data showed that these subjective impressions were not reflected at the physiological level: the two musical situations had no positive effect compared to the silent situation, and the only significant difference was found comparing synchronized versus desynchronized music. When listening to desynchronized music, patients' EEG recordings showed a marked increase of mu-ERD following treatment, a cortical signature suggesting that the condition had a negative influence on the gain of sensorimotor fluency that can be attributed to treatment.

On the one hand, these results thus confirm that music has the capacity to modulate the effect of osteopathic treatment both at the psychological and physiological level. On the other hand, it also reveals that, despite the patients' and practitioner's subjective reports, music does not amplify the effect of treatment; in fact, in our (rather unnatural) desynchronized condition, even the opposite happened: when a patient and their practitioner listened to desynchronized music, the effect of treatment (as measured indirectly by mu-ERD) was reduced. These results indicate that, if any effect can be attributed to music, it cannot solely be due to its inducing greater relaxation in the patients, but rather to its affecting some aspects of the social interaction between practitioner and patients. Because music is so closely related to empathy (Anshel & Kipper, 1988; Rabinowitch, Cross, & Burnard, 2013), it seems plausible that jointly listening to desynchronized music can reduce the amount of empathy between the listeners, and thus limit the effect of osteopathic treatment.

The specific ways in which we manipulated the musical stimuli to synchronize or desynchronize them may inform us as to what psychological/physiological features are involved in creating better or worse empathy. First, desynchronized stimuli differed according to their emotional valence, as well as their acoustic intensity, which correlates with emotional arousal (Dean, Bailes, & Schubert, 2011). It is therefore possible that experiencing different emotional states concurrently resulted in a loss of felt or perceived empathy between the patients and practitioner. Empathy accuracy is often judged by a person's ability to correctly identify and mimic the other's affect (Cramer, Goddijn, Wielinga, & Evers, 2010); even unconsciously, empathetic subjects respond to a cue of arousal (e.g., distress) in others by experiencing distress themselves (Hoffman, 1984). Music in particular has been described as a powerful medium to "share emotional states" (Trevarthen, 1980), a feature increasingly believed to explain the surprising role held by music in our species' evolution (Cross, 1999) and ontogenetic development (Trehub, Schellenberg, & Hill, 1997). Second, desynchronized stimuli in this work differed in their level of rhythmic strength (pulsated or not), a musical characteristic resulting in motor entrainment (Chan, Penhume, & Zatorre, 2006). Because motor mimicry and coordinated rhythmic behavior can be viewed as primitive forms of empathy (Bavelas, Black, Lemery, & Mullet, 1987), it seems possible that experiencing separate states of entrainment (some vs. none, fast vs. slow) can also lessen the amount of empathy in a social interaction. It has been shown, notably, that attending to a musical rhythm not only stimulates areas of the auditory and motor cortices, but also the mirror neuron systems (Chapin, Jantzen, Kelso, Steindberg, & Large, 2010), a structure involved in many forms of empathetic behavior (but see Hickok, 2009).

If desynchronized music, either because of its promoting different emotional states or motor entrainment, is detrimental to empathy and in turn to the effectiveness of treatment, one may question, then, why synchronized music does not promote more empathy than no music at all. Indeed, we did not find any statistical difference of mu-ERD recordings between silence and synchronized music. First, the silent condition is obviously not an empathetically neutral condition: in silence, even with eyes closed, the patients can still hear the practitioner move, feel her breathing, and perceive a variety of nonverbal auditory cues that can be strong promoters of empathy. For instance, simple features of respiratory movements such as inspiratory and expiratory rates are known to be sufficient to infer a subject's emotional state among the emotions of joy, sadness, fear, anger, erotic love, and tenderness (Bloch, Lemeignan, & Aguileira, 1991). Second, it is also possible that, if synchronized music can indeed help establish empathy on the one hand, it can also mask many of the empathy cues otherwise available in silence, thus weakening its positive impact. Perhaps a better situation would be when music is not listened to over separate headphones, but in free field over speakers; this remains to be tested.

On a minor note, one should finally observe that we found no significant main effect of osteopathic treatment on any of the physiological measures investigated in this study (heart pressure, heart rate, mu-ERD), but only interactions with silence or music conditions. Evidence of main effects of osteopathic treatment in the literature remains scarce and contradictory: for instance, Chenneberg (2008) reports on increased diastolic and systolic pressure after treatment, while Ducos (2000) finds decreased measures; cranial osteopathy has been associated with changes in alpha band EEG recordings, but these effects remain unexplained (Miana et al., 2013). Several factors could explain why we do not find such differences here: first, contrary to the clinical groups tested in previous research, participants in our study were a nonpathological population for whom effects may be smaller. Second, treatment in our study only consisted of an upper body TBA, while arterial pressure effects were previously reported for lower body TBA (Ducos, 2000).

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Appendix

Patient Questionnaire

Physiological effectiveness. (A1) *I feel an increased ease of movement after treatment*, (A2) *I feel less muscular or skeleton fatigue after treatment*.

Facility and pleasantness. (A3) *The treatment allowed me to relax*, (A4) *The treatment allowed me to let go of intellectual tension*, (A5) *I feel greater "harmony" with my body after treatment*.

Synchronization. (A6) *During the treatment, I felt that the practitioner moved synchronously with the music I was hearing*.

Practitioner Questionnaire

Physiological effectiveness. (B1) *I felt able to restore greater amplitude of movement for the patient with this treatment*, (B2) *I* *felt able to restore greater speed of movement for the patient with this treatment*, (B3) *I felt able to restore greater fluency of movement for the patient with this treatment.*

Facility and pleasantness. (B4) *Restoring the patient's physiological balance was easy*, (B5) *Treating the patient did not require any particular concentration or mental effort.*

Synchronization. (B6) *Finding and synchronizing to the patient's rhythm was easy*, (B7) *I was able to synchronize to the patient's rhythm throughout the treatment*.

All answers were coded as scale data between 0 (*not at all*) and 10 (*very much*).