Changes in temporal cognition as a measure of "bodymind" contagion between dancers and spectators

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Coline Joufflineau[1,3], Coralie Vincent[2,3], Asaf Bachrach[2,3]

coline[dot]esterase[at]gmail[dot]com | coralie[dot]vincent[at]univ[dash]paris8[dot]fr| asafbac[at]gmail[dot]com

1: UMR 8218,Institut ACTE, Paris 1 | 2: UMR 7023, CNRS/Paris8 | 3: Labodanse Labex ARTS H2H

https://labodanse.org/

Introduction

TIME PERCEPTION: Temporal cognition is an indicator of our "body-mind" state at the present moment (Bergson, 1896; Husserl, 1904-1905; Pöppel, 1997; Wittmann, 2011). The perceived duration is linked to our internal tempo (Baudoin et al., 2006) and can expand or contract according to internal and external events. Our internal tempo is entrained by a musical tempo or the rhythm of the one we are watching (Laroche et al., 2014), or the one beside which we are seated (Richardson et al., 2007). Two components are considered to play a major role in changes in perception of temporal intervals: attention and physiological arousal (Cahoon, 1969). That is why we consider changes in time perception as an indicator of **inter-personal "body-mind" state contagion**.

DANCE SPECTATING: Aesthetic response consists of the activation of embodied mechanisms encompassing the simulation of actions, emotions and corporeal sensation (Freedberg & Gallese, 2007). The co-presence of bodies inherent to live performance brings about kinesthetic empathy (Foster, 2011), interactive coupling (Dumas et al., 2014), and physiological synchronisation (Konvalinka, 2011) between the dancers and the audience that we name **"body-mind" state contagion** .

In this study we worked with the french choreographer Myriam Gourfink who have been using a contemplative practice for more than twenty years to produce **an extremely slow and continuous dance** based on extended respiration and body-oriented attention (Gourfink, 2013).

Goals

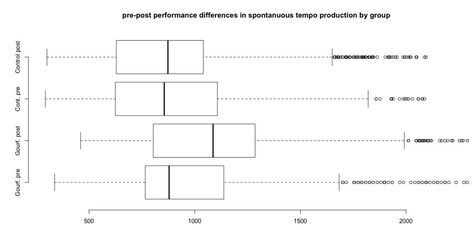
1/ Quantify changes in temporal cognition after spectating a very slow dance based on a contemplative practice.
2/ Evaluate whether these changes are related to the experiential reports of the spectators concerning interoceptive and exteroceptive attention.
3/ Evaluate whether these changes are related to changes in physiological arousal.

Methods

As part of the project Labodanse (Joufflineau and Bachrach, 2016), we administered to an audience two measures of temporal cognition before and after a 40-min live performance (12 subjects in group A and 8 subjects in group B): a Spontaneous Tempo Production (STP) task (McAuley et al., 2006) and a task assessing the temporal window inducing the Apparent Motion effect (AM) (Marusich & Gilden, 2014). The same temporal tasks (group C, 14 subjects) were tested with a control choreography of the same duration but that is not based on a contemplative practice (no voluntary control of breathing or attention, standard speed). Experiential reports concerning interoceptive and exteroceptive attention, arousal and engagement were collected post performance (semi-directed questionnaires). Physiological data (heart and breathing rate) were also collected as indicators of physiological arousal.

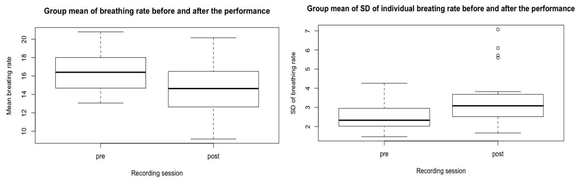
Exploration of body-mind contagion during live contemporary dance performance

SPONTANEOUS TEMPO PRODUCTION



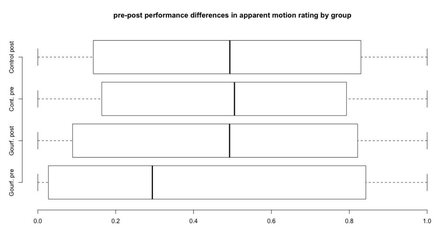
Participants: 20 subjects (group A, Gourfink = 9, group C, Control = 11).
Task (based on McAuley et al., 2006)**:** Three blocks: (1) Tap as fast as you can in a regular fashion (100 taps), (2) Tap as slow as you can in a regular fashion (20 taps), (3) Tap in your internally paced tempo (70 taps). Data analyzed using Linear Mixed Models (LMM) (LME4 for R, Bates et al., 2015).
Results: We observed a significant slowing down of STP (t=15.010, p<2e-16) after the Gourfink performance. This effect was not observed in the control condition.

PHYSIOLOGICAL RHYTHMS



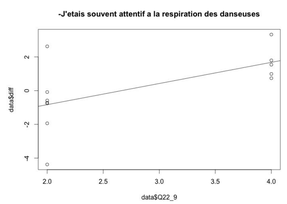
We compared (using LMM) the mean and SD of breathing rate (BR) and heart rate (HR) for 20 subjects (groups A and B) during a 15 min period just before and just after a Gourfink performance. BR and HR were both significantly lower after the performance. Standard deviation of both BR and HR is higher after the performance: While the changes in physiological rhythms indicate an overall decrease in arousal post-performance (an interpretation supported by individual reports), these changes were not correlated with either task effect size.

APPARENT MOTION



Participants: 21 subjects (Gourfink = 10, Control = 11).
Task: 36 trials. 6 trial per frequency (0.75; 1; 1.25; 1.75; 2.15; 2.75 Hz). Every trial lasted 5 s. Participants had to indicate their subjective response to the question “Do you see two disks that alternate or a disk which moves”? on a continuous scale (from “two spots that alternate” to “a circle which moves”). Data analyzed using LMM.
Results: After the Gourfink performance, AM was reported with longer temporal intervals between the flickering d (t=4.017, p< 6.53e-05). This effect was not observed in the control condition.

SUBJECTIVE REPORTS



We correlated the individual responses with the individual effect size for the two cognitive measures. We found three significant correlations between Individual effect size for the apparent motion task and adherence to the three following statements: "I had the impression to have gone on a trip or a promenade during this representation", "I found this piece intellectually stimulating", "I often paid attention to the breath of the dancers".

Conclusion

We interpret the STP results as a slowing down of the internal tempo of spectators. The AM results suggest an expansion of the perception of duration, in other terms an expansion of the “psychological present moment” (Wittmann, 2011). The absence of similar results in the control condition argues that these effects were due to the specific quality of Gourfink’s choreography. Regarding these results we consider measurable change in time perception to be a quantified proxy of a “body-mind” change of the spectators.
While the changes in physiological rhythms indicate an overall decrease in arousal post-performance (an interpretation supported by individual reports), these changes were not correlated with task effect size. Correlations with subjective reports show a link between paying attention consciously to the breath of the dancer and the change in the perception of apparent motion. In a preceding study we found that the breathing synchronization between dancers and spectators during the choreography were more important for spectators that report that they had “paid attention to their own breath many times” (Bachrach et al., 2015). Our results suggest that paying attention to breath, our own one or the one of others, seems linked to the increase of inter-subjective process of attunement and **“body-mind”** contagion.