Evidence for self-other effects and structure-related attentional mechanisms in the primo/secondo performances of clarinetists

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This study aims at understanding the mechanisms of on-line synchronization of instrument performance in musical ensembles. When playing with others, a performer must synchronize the results of his own actions with the actions of the others. When playing in a real situation like in an orchestra, performers take advantage of acoustical and visual information in order to improve the synchronization. However, performers are also capable of accompanying another performer solely from an acoustical recording.

A series of studies in the literature have shown that musicians play better with themselves than with others [1,2,3]. This is known as the "self/other effect" in action recognition and simulation and has been demonstrated in other action-perception tasks, like the recognition of handwriting [4] and the outcomes of dart throwing [5]. In the present study, we analyzed the synchronization patterns of professional clarinetists.

Six professional performers were recruited in Belo Horizonte, Brazil. All them knew each other. The recordings were done in two sessions: in the primo session, they played a short excerpt of the "Dance of the Peasant and the Bear" of Igor Stravinsky's ballet Petrushka, where "the peasant plays the pipe and the bear walks on his hind feet". This excerpt, in which first and second clarinets play solo in unison (soli a 2), presents a real performance situation, that demands synchronization in every single note. They were instruct to play in their preferred expressiveness. Nevertheless, before they started playing, three beats of metronome imposed the execution tempo. In the second session, some days later, they played the same excerpt as secondo while hearing all primo executions. They were told to follow the primo the best they could. After hearing each primo execution once, the performer played the secondo part four times (takes) while hearing the primo through a earphone in their right ear.

The onsets of each note were automatically detected using a software developed in a previous study [6]. The asynchrony between primo and secondo is defined as the absolute value of the temporal difference between the onsets for each note. The high skewness of the asynchrony distribution was compensated using a Box-Cox power transform [7]. A generalized linear mixed model (GLMM) [8] was fitted to the transformed data using the following fixed factors: WHO (with levels "self" and "other"), TAKE (a continuous factor going from 0, the first take, to 3, the last take), and CLASS (the class of each note with two levels: "first" being the notes at each strong beat, when present, and "nonfirst", the other notes). Three random factors where also considered: PRIMO (the influence of the primo performer), SECONDO (the influence of the secondo performer) and TIME/SECONDO (the coefficient of variation of the asynchrony during the excerpt).

A simple statistical test using the whole duration of the execution was used to insure that the clarinetists were really trying to follow the

primo execution and not simply playing from memory what they played as primo themselves. The GLMM fit showed that the mean asynchrony is around 30 ms with a statistically significant drop of 6 ms when performers played with themselves. This is coherent with results found elsewhere. No significant TAKE effect was found, probably because the musicians could learn how to accompany from hearing the preliminary primo recording. All three random effects were significant, what demonstrates that, first, some performers are easier to follow than others, second, some performers are better followers than others and, third, performers behave differently as regards the adaptation of the synchronization during the excerpt.

Another interesting result is the fact that a significant CLASS effect was found. Asynchrony is about 5 ms lower for the notes at strong beats. This opens the avenue for analyzing our data under the prospects of the dynamics of attending, as well as for understanding how the synchronization patterns may arise from the musical structure of the excerpt [9,10].

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This is particularly important when the performers are in a primo/secondo situation, where the part being played is the same for both persons and both performances should sound in unison

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first note of each strong beat