Timing and Visual Feedback Constraints during Repetitive Finger Force Production in Schizophrenia

Previous literature has shown that self-produced forces are perceived as being weaker due to mechanisms of sensory reafference attenuating perceptions of self-generated feedback. Without reference stimuli, healthy controls (HCs) exhibit a compensatory overproduction of force; however, reafference mechanisms are disrupted in Schizophrenia (SCZ). Although previous work has studied self-produced forces in relation to externally generated stimuli, it remains unclear whether reafference mechanisms can be calibrated with visual feedback in SCZ as has been shown in HCs. Furthermore, while the control of force and timing have been investigated separately little is known regarding their interactions in SCZ. The purpose of this study was to compare force production and motor timing in SCZ and HCs. Participants performed a unimanual, repetitive pinch-grip force production task to a visually-specified target force of 16N in synchronization with an auditory metronome set at 2Hz. Conditions varied such that the visual, auditory or both reference stimuli were unpredictably removed 10s into experimental trails. Following this, participants were instructed to make continued responses at the same rate and with the same force level for the remainder of the trial. Both HC and SCZ groups produced similar forces when visual feedback was present and displayed a systematic overproduction of force following its removal; however the degree of force overproduction was significantly reduced in SCZ. Following removal of the auditory metronome, inter-response-intervals (IRIs) were shorter and more variable for the SCZ group compared to HCs. Application of the Wing-Kristofferson timing model showed that increased IRI variability was attributed to disrupted neural timekeeping processes, as opposed to motor implementation. Furthermore, timing variability did not significantly interact with the force constraints of the task. These findings support the hypothesized dysfunction of sensory reafference and neural timekeeping mechanisms in SCZ, but show they can be calibrated by visual and auditory feedback, respectively.