Objectives. Response inhibition relies on both proactive and reactive mechanisms, which exert a synergic control on goal-directed actions. In studies evaluating inhibitory control, responses are usually recorded by a key-press method. However, the analysis of discrete variables (present or absent responses) could be insufficient to capture dynamic features of response inhibition. In the present study a mouse-tracking procedure was used to evaluate the movement profiles related to proactive and reactive inhibition, by comparing the performance in a cued Go/No-Go (GNG) and a Stop Signal Task (SST). The cued GNG mainly involves proactive control whereas the reactive component is mainly engaged in the SST. We hypothesize that different movement profiles could be associated with inhibitory failures in these experimental paradigms, reflecting the influence of proactive and reactive mechanisms on motor preparation and execution.
Methods. Fifty-three participants performed the cued GNG (consisting of two conditions: high vs. low Go-stimulus probability) and the SST. Performance was recorded by a mouse device positioned in the centre of a board. In the Go-conditions, subjects were instructed to move the mouse as quickly and accurately as possible in the direction indicated by the Go-stimulus (i.e., left or right) until they reached a set barrier. In the No-go/Stop conditions they were requested to suppress the response. Velocity profiles extrapolated from mouse trajectories both for responses obtained in the Go-conditions and for inhibitory failures were evaluated. Movements were classified as *one-shot* when no trajectory corrections were observed. Multi-peaked velocity profiles were classified as *non-one-shot*.
Results. A significantly higher percentage of one-shot movements was found in the SST (81±9%) compared to both conditions of the GNG (high condition: 21±34%, low condition: 30±33%) when subjects failed to inhibit responses ($p<0.001$), with consequently higher non-one-shot profiles proportion in the GNG. Conversely, no differences in responses profiles emerged between tasks for Go-conditions.
Discussion. When the inhibitory mechanisms engaged were mainly reactive (as in the SST), trajectory corrections to the initial motor plan observed for inhibitory failures were less frequent. In contrast, the opposite trend emerged when the inhibitory demand was mainly proactive (as in the cued GNG). Smooth trajectories observed in rapid movements classified as one-shot may suggest that the influence of inhibitory control processes on motor planning may be absent or marginal. We hypothesized that proactive control may be responsible for unsmooth profiles in inhibition failures, supporting a differentiation between these tasks.