## Mouse Kinematics as implicit index of decision dynamics

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Intertemporal choices (ITC) are decisions involving a trade-off between costs and benefits occurring at different times as, for example, whether to save money on a pension fund to ensure a peaceful aging, or to spend them to enjoy a pleasant holyday now. In a nutshell, intertemporal decisions require participants to choose between a smaller but immediate reward, and a larger one which will be available in the future. Literature has shown that in intertemporal choices, people tend to display a preference for smaller-sooner reward over larger-delayed ones, a phenomenon known as Temporal Discounting (TD). In order to disentangle the mechanisms underlying intertemporal decision-making, across several studies, we recorded and analyzed mouse movement kinematics during intertemporal choices in a large sample of healthy participants, as well as, across clinical populations affected by gambling disorder (GD) and cocaine use disorder (CUD). In the first study on healthy volunteers, we found specific pattern of decision dynamics (i.e., mouse kinematics) associated with the selection of "immediate" versus "delayed" rewards, which well discriminated between a "shortsighted" (i.e., participants with strong preference for smaller-sooner rewards) versus a "farsighted" (i.e., participants with strong preference for larger-later rewards) behavior. In a second study, mouse kinematics of GD was compared with matched healthy control (HC) participants. The results revealed a peculiar pattern of mouse trajectories associated with the selection of immediate and delayed rewards that was able to discriminate between GD and HC. Finally, we collected mouse kinematics from a group of CUD patients both in a baseline session and after the administration of a 2-week

intensive repetitive transcranial magnetic stimulation (rTMS) protocol. Half of the patients underwent a high frequency (15 Hz) rTMS session on the left DLPFC, while the other half underwent a sham treatment. The results showed a significant difference in the mouse kinematics between the sham and active stimulation groups in the post-rTMS treatment, indicating a modification of the implicit decision-making mechanism that suggested the emergence of a trend toward delayed gratification. Overall, these data suggest that mouse kinematics represents a reliable implicit index of decision-making, unveiling critical aspects of cognitive processing underlying intertemporal decisions. These results have also important implications for the assessment and rehabilitation of clinical population with reward-related disorders.