Looking through Wasserstein's glasses and Hilbertian glasses to a muti-agent optimal control problem and the associated Hamilton-Jacobi equation

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Hamilton-Jacobi equations in Wasserstein space arise naturally in mutli-agent Control problems.

There are several definitions for viscosity solutions of these equations. There are intrinsic notions introduced by Gangbo-Nguyen-Tudorascu and in a slightly different way by Marigonda-Quincampoix. Lions proposed a different point of view in witch the Wasserstein space is seen through the Hilbert space L^2_P. This point of view was recently proved to be also interesting for trajectories and values function in Wasserstein space (see Cavagnari-Orrieri-Lisini-Savaré and Jimenez-Marigonda-Quincampoix). We describe these points of view and how they are related. We will provide a way to see Lions definitions of viscosity solutions through Wasserstein's glasses and we will see why it is meaning-full in the setting of control theory.