Quantum chaos can be characterized by an exponential growth of the thermal out-of-time-order four-point function up to a scrambling time $u^\star$. We discuss generalizations of this statement for certain higher-point correlation functions. For concreteness, we study the Schwarzian theory of a one-dimensional time reparametrization mode, which describes AdS2 gravity and the low-energy dynamics of the SYK model. We identify a particular set of $2k$-point functions, characterized as being both "maximally braided" and "$k$-OTO", which exhibit exponential growth until progressively longer timescales $u^\star(k) = (k-1)u^\star$. We suggest an interpretation as scrambling of increasingly fine-grained measures of quantum information, which correspondingly take progressively longer time to reach their thermal values.