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Conditional Mutual Information of Bipartite Unitaries and Scrambling[1] DAWEI DING, PATRICK HAYDEN, MICHAEL WALTER, Stanford Univ — One way to diagnose chaos in bipartite unitary channels is via the tripartite information of the corresponding Choi state, which for certain choices of the subsystems reduces to the negative conditional mutual information (CMI). We study this quantity from a quantum information-theoretic perspective to clarify its role in diagnosing scrambling. When the CMI is zero, we find that the channel has a special normal form consisting of local channels between individual inputs and outputs. However, we find that arbitrarily low CMI does not imply arbitrary proximity to a channel of this form, although it does imply a type of approximate recoverability of one of the inputs. When the CMI is maximal, we find that the residual channel from an individual input to an individual output is completely depolarizing when the other input is maximally mixed. However, we again find that this result is not robust. We also extend some of these results to the multipartite case and to the case of Haar-random pure input states. Finally, we look at the relationship between tripartite information and its Renyi-2 version which is directly related to out-of-time-order correlation functions. In particular, we demonstrate an arbitrarily large gap between the two quantities.

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