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## Quantum communication assisted by environment


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Quantum communication takes places by using quantum systems as information carriers. These latter are subjected to noise when going from the sender (usually named Alice) to the receiver (usually named Bob) with the result of information corruption and reduced possibility for reliable communication. This process is formally described by completely positive trace preserving maps on the set of states of quantum carrier system (density operators). Such maps admit unitary dilation hence an interpretation as unitary interaction between the (carrier) system and the environment. In this picture it is usually assumed that the users have no access to the environment and information transmission capacities are evaluated according to that.
Of course assuming perfect control of the environment, namely freedom in its initial state preparation as well as in its final state measurement, will lead to an ideal channel with perfect information transfer. However one could think to have a partial control on the environment.
On the one hand we consider the possibility of accessing the final state of environment. In this scheme we can make a measurement on the final state of the environment and considering its classical result recognize what kind of error has occurred on the system due to the interaction with the environment. Then, a proper correction should be performed on the system to reduce the effect of decoherence and reclaim information lost there.
On the other hand we consider the situation in which the sender can prepare the initial state of the environment while the receiver has not access to its final state. This gives rise to a family of channels that can be regarded as an isometric channel with the input as system and environment to output system for given fixed unitary operator acting on the system and environment.
These two possible scenarios will be then characterized in terms information transmission capacities.