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Non-local boxes and their implementation in Minecraft TIMO YANNICK SIMNACHER, Brown Univ — PR-boxes are binary devices connecting two remote parties satisfying x AND y = a + b mod 2, where x and y denote the binary inputs and a and b are the respective outcomes without signaling. These devices are named after their inventors Sandu Popescu and Daniel Rohrlich and saturate the Clauser-Horne-Shimony-Holt (CHSH) inequality. This Bell-like inequality bounds the correlation that can exist between two remote, non-signaling, classical systems described by local hidden variable theories. Experiments have now convincingly shown that quantum entanglement cannot be explained by local hidden variable theories. Furthermore, the CHSH inequality provides a method to distinguish quantum systems from super-quantum correlations. The correlation between the outputs of the PR-box goes beyond any quantum entanglement. Though PR-boxes would have impressive consequences, as far as we know they are not physically realizable. However, by introducing PR-boxes to Minecraft as part of the redstone system, which simulates the electrical components for binary computing, we can experience the consequences of super-quantum correlations. For instance, Wim van Dam proved that two parties can use a sufficient number of PR-boxes to compute any Boolean function f(x,y) with only one bit of communication.

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