A general proof that context-independent mapping (or local causality) and free choice are equivalent

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Free choice assumption in a hidden variable model (HVM) means that the settings chosen by experimenters do not depend on the values of the hidden variable. The assumption of context-independent (CI) mapping in an HVM means that the results of a measurement do not depend on settings for other measurements. If the measurements are spacelike separated, this assumption is known as local causality. Both free choice and CI mapping assumptions are considered necessary for derivation of the Bell-type criteria of contextuality/nonlocality. It is known, however, for a variety of special cases, that the two assumptions are not logically independent. We show here, in complete generality, for any system of random variables with or without disturbance/signaling, that an HVM that postulates CI mapping is equivalent to an HVM that postulates free choice. If one denies the possibility that a given empirical scenario can be described by an HVM in which measurement outcomes depend on other measurements' settings, free choice violations should be denied too, and vice versa.

[1] Dzhafarov, E.N. (2021). Assumption-free derivation of the Bell-type criteria of contextuality/nonlocality. Entropy 23, 1543. https://doi.org/10.3390/e23111543

[2] Dzhafarov, E.N. (2022). Context-independent mapping and free choice are equivalent: A general proof. Journal of Physics A: Mathematical and Theoretical 55, 305304 (arXiv:2110.15910).