Categories of Compositeness, Purity, and Entanglement

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Table 1: Quantum system conditions — Compositeness / Purity / Entanglement

Condition	**Type**	
Compositeness	**Single Qubit: A**	**Two Qubits: AB (Composite, Bipartite)**
	$\|\psi\rangle_A = \|0\rangle_A$ $\|\psi\rangle_A = \|0\rangle_A + \|1\rangle_A$	$\|\psi\rangle_{AB} = \|01\rangle_{AB}$ $\|\psi\rangle_{AB} = \|00\rangle_{AB} + \|01\rangle_{AB}$
Purity	**Single State Vector (Pure)**	**Ensemble of SV's (Mixed, Mixture)**
	$\|\psi\rangle_A$, $\|\psi\rangle_{AB}$ $\rho_A = \|\psi\rangle_A \langle\psi\|_A$ $\rho_{AB} = \|\psi\rangle_{AB} \langle\psi\|_{AB}$	$\{\|\psi_i\rangle, p_i\}$ $\rho = \sum_i p_i \|\psi_i\rangle \langle\psi_i\|$
Entanglement	**Separable (Factored)**	**Entangled**
	$\|\psi\rangle_{AB} = \|1\rangle_A \otimes \|0\rangle_B$ $\|\psi\rangle_{AB} = \|0\rangle_A \otimes (\ \|0\rangle_B + \|1\rangle_B)$	$\|\psi\rangle_{AB} = \|0\rangle_A \otimes \|0\rangle_B +$ $\|1\rangle_A \otimes \|1\rangle_B$

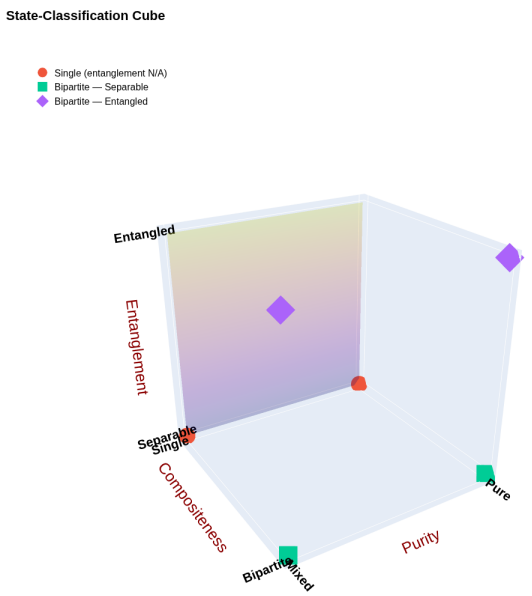

Figure 1: The three descriptive binary categories of a quantum system: Compositness, Purity and Engtanglement. **Note**: A single isolated qubit system is by definition NOT entangled with another. So two of the top corners of the cube, (Single, Entangled, Pure/Mixed), are not valid and left empty.

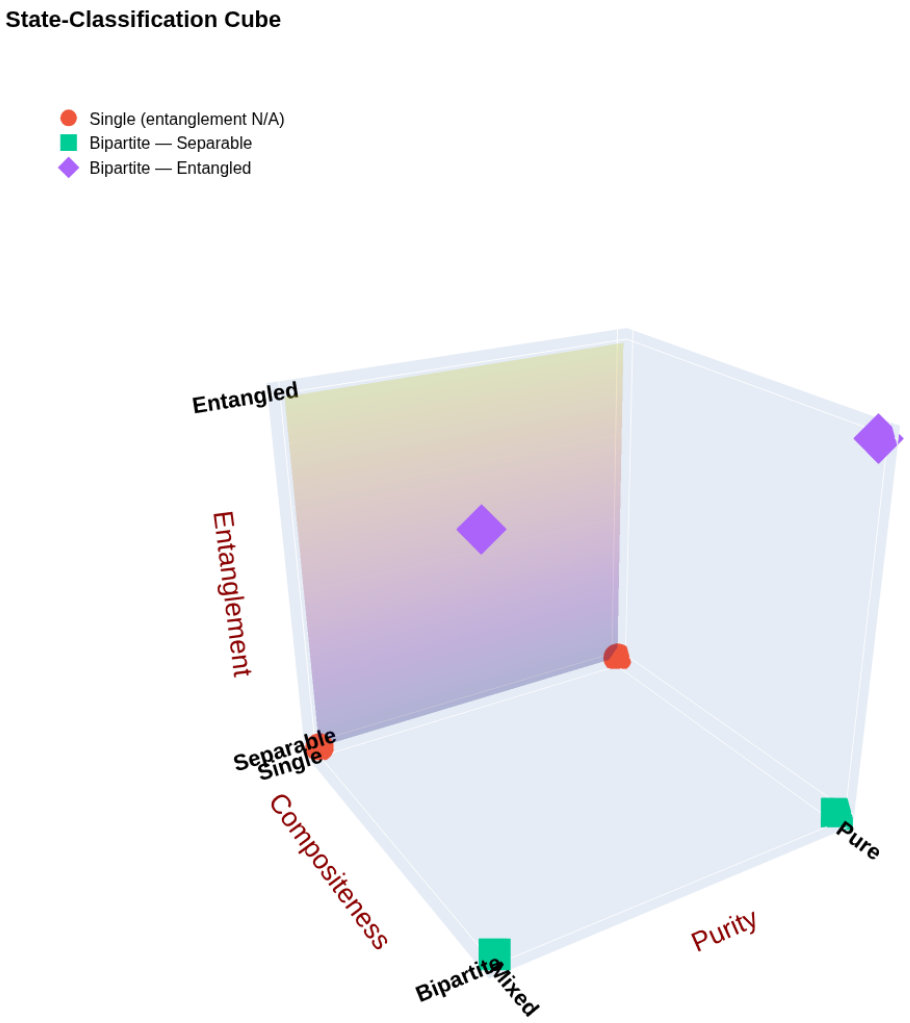

Figure 2: The three descriptive binary categories of a quantum system: Compositness, Purity and Engtanglement.
Note: A single isolated qubit system is by definition NOT entangled with another. So two of the top corners of the cube, (Single, Entangled, Pure/Mixed), are not valid and left empty.