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Decoherence and the Quantum Theory of the Classical

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Abstract: I will describe three insights into the transition from quantum to classical. After a brief discussion of decoherence I will give (i) a minimalist (and decoherence-free) derivation of preferred states. Such pointer states define events (e.g., measurement outcomes) without appealing to Born's rule $(p_k = |\psi_k|^2)$. Probabilities and (ii) Born's rule can be then derived from the symmetries of entangled quantum states. With probabilities at hand one can analyze information flows from the system to the environment in course of decoherence. They explain how (iii) robust "classical reality" arises from the quantum substrate by accounting for all the symptoms of objective existence of preferred pointer states of quantum systems through the redundancy of their records in the environment. Taken together, and in the right order, these three advances (i)-(iii) elucidate quantum origins of the classical.