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(G*) Entropy, Networks, and Design

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Some of the most intriguing thermodynamic phases in nature involve an interplay between multiple types of degrees of freedom. However, multiple types of degrees of freedom are also a common feature of design problems in distributed systems that can be cast in terms of complex networks. Here, we show that generic network models of design exhibit an intricate interplay between configurational and conformational entropy. This interplay produces behaviours in non-matter systems that have direct analogues in conventional condensed matter. We give concrete illustrations of these behaviours using a model drawn from naval architecture, but our results have implications for distributed systems more generally. Our framework provides new tools for describing how competing degrees of freedom shape the space of design choices in complex systems.

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