

# Cartography in a Complex World: from Interactions to Maps

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Economic and social systems are differentiated, multipartite, integrated, and dynamic. Data about these systems, now available on unprecedented scales, often are schematized as networks. Such abstractions are powerful, but even as abstractions they remain highly complex. It therefore is helpful to decompose the myriad nodes and links into modules that represent the network. A cogent representation will retain the important information about the network and reflect the fact that interactions between the elements in complex systems are weighted, directional, interdependent, and conducive. Good representations both simplify and highlight the underlying structures and the relationships that they depict; they are maps.

We present a new conceptual framework for turning large and sometimes messy networks into powerful, useful maps by tracing information or monetary flow on the network. By adopting an information-theoretic approach, we can measure how efficiently a map represents the underlying patterns of flow on a weighted and directed network. We can measure how well the map compresses the structure of the full network. And we can measure how much detail is lost in the process of simplification. As a result, we are able to formalize and quantify the millenium-old tradeoff that cartographers face between detail and simplicity.

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