The complex link between filter bubbles and opinion polarization

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There is public and scholarly debate about the effects of personalized recommender systems implemented in online social networks, online markets, and search engines. Some have warned that personalization algorithms reduce the diversity of information diets which confirms users' previously held attitudes and beliefs. This, in turn, fosters the emergence opinion polarization. Critics of this personalization-polarization hypothesis argue that the effects of personalization on information diets are too weak to have meaningful effects. Here, we show that contributions to both sides of the debate fail to consider the complexity that arises when large numbers of interdependent individuals interact and exert influence on one another in algorithmically governed communication systems. Summarizing insights derived from formal models of social networks, we demonstrate that opinion dynamics can be critically influenced by mechanisms active on three levels of analysis: the individual, local, and global level. We identify what theoretical and empirical research on these three levels is needed before one can determine whether personalization actually fosters polarization or not. Next, we describe how the complexity approach can be used to anticipate and prevent undesired effects of communication technology on public debate and democratic decision-making, arguing that carefully calibrated formal models can be used to conduct virtual crash-tests with digital communication systems.