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Heterogeneous nodal responses in cascade dynamics on multiplex networks KYU-MIN LEE, Korea University, CHARLES D. BRUMMITT, University of California, Davis, KWANG-IL GOH, Korea University — Structure and dynamics of multiplex network systems have been intensively studied recently, revealing nontrivial results such as facilitated cascading failures and new type of phase transitions unforeseen in the single-level systems. However, most studies about multi-layered, network of networks have mainly considered the case of single nodal response to multiple layers, that is, every node responds to the multiple layers in identical way. Most complex systems like human society, however, function not only through various kinds of relations but also through heterogeneous response behavior across agents, indicating a new level of complexity. To address it, here we formulate a threshold cascade model on multiplex networks with a mixture of two response functions: OR and AND rules. For the OR response, nodes are activated if enough neighbors in any layer are active, whereas for the AND response, the nodes activate only if enough neighbors in all layers are active. Coexistence of these two response rules is shown to control between facilitation and inhibition of cascading failures, and moreover, it can also control the type of transitions to global cascades between continuous and discontinuous ones. We will discuss the implication of the results in the context of social dynamics.

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