Cascade effects, not mechanical failures, more often responsible for poor performance in London commuter trains

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A team of researchers affiliated with several institutions in the U.K. has found that cascade effects are more to blame for poor performance by London's commuter train system than are mechanical failures. In their paper published in the journal *Royal Society Open Science*, the team describes their analysis of London's commuter train network and what

they found.

Prior research has shown that London's commuter train services are not as good as riders wish them to be—last year, services were on schedule just 86.9 percent of the time. And almost 5 percent of trains never made their runs at all or were significantly late in doing so. This is a big problem for a lot of Londoners who use the rail services to get back and forth to work—approximately 1.7 billion passengers travel each year. The government has even suggested that such delays result in lost productivity and economic activity in the region. In this new effort, the research team took a serious look at the commuter rail service that serves London and areas around it to pinpoint the problems.

Anecdotal evidence suggests that most commuters believe delays are caused by technical issues, but the researchers found this was not the case. By building models and simulations of the system, they found that most delays were caused by cascade effects and that there were a lot of factors at play in the occurrence of such effects. They noted that a small delay at one station could result in a slightly longer delay at the next, and so on. The researchers call it a form of a feedback loop. They suggest a pragmatic solution is simply for trains experiencing delays to skip a station on their routes. Doing so would allow for resetting the clock, so to speak, allowing the train to get back on schedule.

The simulations also showed that network structure in some instances led to the likelihood of delays leading to cascading effects. They describe the situation as coherent networks outperforming incoherent ones, and suggest changing routes on some lines might improve efficiency.

More information: Alessio Pagani et al. Resilience or robustness: identifying topological vulnerabilities in rail networks, *Royal Society Open Science* (2019). DOI: 10.1098/rsos.181301