**International Journal of Applied Behavioral Economics**
Volume 10 • Issue 1 • January-March 2021

# Book Review

# How Behavior Spreads:
## The Science of Complex Contagion

Reviewed by Bianca-Elena Mihăilă, University of Bucharest, Bucharest, Romania

*How Behavior Spreads. The Science of Complex Contagion*
*Damon Centola*
*©2018 by Princeton University Press*
*296 pp.*
*$35.00*
*ISBN: 978-0-691-17531-7*

We are witnessing an era in which almost everything around us is shareable. Posts on social media are now characterized by the large numbers of people that received the information, their "viral" character. How do things end up being shared and ultimately have an effect on the people who share them? Damon Centola offers an explanation that starts from the science behind the spread of things, not only through cyberspace, but also in an offline environment.

Damon Centola is a Professor in the Annenberg School for Communication, the School of Arts and Sciences, and the School of Engineering and Applied Sciences at the University of Pennsylvania, where he is Director of the Network Dynamics Group. Before coming to Penn, he was an Assistant Professor at M.I.T. and a Robert Wood Johnson Fellow at Harvard University. In his book "How Behavior Spreads. The Science of Complex Contagion" he proposes new intriguing ways of how changes to the social network of a population can be used to impede or accelerate the spread of innovative behavior. Centola's book represents an important contribution to the social network analysis combining simple information on how behavior spreads with theoretical insights under the umbrella of computational social sciences.

The book starts with a theoretical introduction to social network analysis research, complemented by clear empirical examples. The author talks about the evolution of the concept and its role enfolded in time. Social networks are considered a useful way of detecting patterns of fragmentation or integration of characteristics such as political or religious beliefs, health or buying behavior. This introduction focuses on the main concepts in the field of social networks so that the reader can understand the message of the book without encountering comprehension problems.

Starting from the idea of Granovetter that everything can be diffused through weak ties, Centola demonstrates that the diffusion process depends on: (1) the type of the contagion: if it is simple or complex, (2) level of exposure to a certain behavior and (3) the decision to accept it or not. There are situations where *multiple exposure* to the same infected individual may be sufficient for simple contagion to spread. Still, when it comes to complex contagion, the multiple exposure is not sufficient anymore. What matters here is the *multiple sources* of exposure. Thus, for complex behavior to spread, the individual must be exposed to multiple sources. Centola is proposing an exceptionally clean way of adopting behaviors, without individuals to be policed or coerced into adopting them. The *minimal requirement* is only that individuals are embedded in social networks that provide them with relevant sources of social reinforcement.

If the first part of the book was concentrated on theory and on creating the right mindset for the reader to evaluate the book, the second part is focused on the power of examples: online healthy behaviors, spreading digital innovations and creating organizational identities through social networks.

Centola teaches us a very important lesson. The relational aspects of our social networks change the way we use social capital. Significant part of Centola's work is based on this thesis and he offers important empirical examples related to health issues (Centola, 2011; Centola, 2013; Centola, 2020). He continues his journey in

understanding diffusion patterns in multiple domains. In "How Behavior Spreads" he argues that even though there are numerous examples related to finding a job through social networks or buying expensive products, the health-related issues are more important than those: a cancer screening or a vaccine can be life altering actions. Following the work of Graham Colditz at the Harvard Medical School, Centola created an online health community (named Healthy Lifestyle Network) with the purpose to see whether providing people with the right kinds of social networks would promote the spread and adoption of a certain behavior. The diffusion process was initiated by a "seed node" in each network that sent a message to his alters encouraging them to adopt a health-related behavior, namely joining a health forum website. Centola looks at clustered and random networks and the results showed that the first ones significantly accelerated the spread of adoption in every case. Starting from computational examples, the clustered network is important because it creates stability (e.g. if a group A adopts a new behavior and one member "defects", the group is not falling apart and the others continue to reinforce the groups use of that behavior) and because they limit early adopter's exposure to the rest of the network. This experiment, together with numerous computer simulations, illustrated that innovative behavior does not only apply to individuals, but also to groups. Thus, Centola shows the advantages of wide bridges over brokerage ties arguing that the last ones may lead to side effects such as *tertius gaudens* ("the third who benefits"). While a broker across a structural hole can exploit both sides for his individual advantages, one advantage of wide bridges will be that individuals on both sides of the bridge might have multiple contacts in common.

In this context, Centola proves two aspects: first, why this type of behavior is considered a complex one and second, what is the difference between adoption versus maintenance. If the first feature is a personal one (because the individual must put effort and spend time in order to create an account or to search around various pages), the second is a collective one, related to the social influence of the network in which the individual is embedded in. Consequently, the key to Centola's approach is that for individuals to adopt complex behavior, they have to be exposed to social reinforcing. The results from the health forum website showed that individuals who received multiple signals from others who created an account were the ones that returned more to the forum after the experiment was over, in comparison with individuals that received one, two or three signals.

An important correlation appears between receiving reinforcing signals for adoption and the likelihood of being more engaged with the adopted behavior. Hence, clustered social networks may be a valuable structural ally not only for promoting the diffusion of challenging new behaviors, but also for increasing their maintenance. The results also expose that actors who have the most resistance to adopting a behavior may be the most committed to it once the threshold is finally reached.

Centola brings into discussion the idea of homophily as an effect of the network. In another health network experiment, the author studied the differences between non-homophilous and homophilous social networks regarding the adoption of a diet monitoring tool. The results showed that while both networks offered social reinforcing,

the homophilous design network provided social reinforcement that came from relevant peers. He concluded that *homophily creates empathy*. The implication here are that changing the social context in which people make decisions alters their choices.

The book ends with an epilogue that can serve as a mini-book itself. The three appendixes (The Ethics of Social Design, Methods of Computational Science, and Technical Appendix for Models) serve as an introductory discussion about computational social sciences and the ethical concerns that can arise when designing social networks to influence behavior change. The discussion brings into light the fact that we still do not know everything about how behaviors spread. We still do not have a receipt unanimously accepted about how to spread diffusion effectively.

Centola draws attention on two important methodological issues: (i) the "practice of science" and (ii) "the uses of science". The first one is subject to the emergent advancing technologies and to computational social sciences that can pose several new challenges on how science is advancing. Regarding the second methodological issue, Centola highlighted that unfortunately, the literature on these topics does not provide much guidance about how social research should be used once it has been published.

Along with the ideas related to how science is produced and used, Centola raises some important questions about external validity of relative pristine world of a controlled experiment. The most stringent two questions refer to whether an outcome that occurs within an experimental setting would also occur in a more natural setting and if the results that are found can be generalized to other settings. Even though Centola explains that these can be addressed through robustness and replication, the discussion still remains open in terms of practical implementation.

The book is very well-written and full of empirical examples that generate a provocative discussion regarding diffusion. In the spirit of debate, a first critical comment is related to how the author employs a relational perspective rather than focusing more on the attribute level of the individuals. Centola shows that having access to a certain social capital may increase the probability of changing our behavior. Naturally, one may ask what type of social capital is needed. We know from previous work that attribute data such as age (Argys & Rees, 2008), sex (de la Haye et al., 2010), body mass index (de la Haye et al., 2011; Valente et al., 2009) or same political ideas (Halberstam & Knight, 2016) may influence the spreading and acceptance of a certain behavior. A second observation is that the book presents only the good face of social networks. We also know from previous work (Ali et al., 2011; Ali & Dwyer, 2010; Tucker et al., 2013) that the social network possesses the power to negatively influence behaviors, beliefs or ideas. Starting from drug use or alcohol consumption, the peer effects may even lead to illegal practices. This is a crucial dimension that needs to be included in order to build a comprehensive image about how behaviors spread in general and how reinforcement and relevance emerge in different social contexts in particular.

The theoretical implications, the methodological questions and the empirical examples can place the book among other scientific works that deal with the same subject such as Valente (1995, 2010), Christakis and Fowler (2009); Christakis (2019)

or Barabasi (2003). The book addresses a broad audience because of its multiple layered content. From graduate students in computer and social sciences to researchers that are interested in experimental designs of social research and simulations, to people that simply want to find out more about how their behavior is influenced by their social network, the book is an excellent and inspiring source of information. Given the message the book is trying (and succeeding) to convey - social design may be used to enhance individual's capacity of choice- I am sure that it will be *diffused* accordingly.

## REFERENCES

Ali, M. M., & Dwyer, D. S. (2010). Social network effects in alcohol consumption among adolescents. *Addictive Behaviors*, *35*(4), 337–342. doi:10.1016/j.addbeh.2009.12.002 PMID:20051311

Ali, M. M., Amialchuk, A., & Dwyer, D. S. (2011). The Social Contagion Effect of Marijuana Use among Adolescents. *PLoS One*, *6*(1), e16183. doi:10.1371/journal.pone.0016183 PMID:21264337

Argys, L. M., & Rees, D. I. (2008). Searching for Peer Group Effects: A Test of the Contagion Hypothesis. *The Review of Economics and Statistics*, *90*(3), 442–458. doi:10.1162/rest.90.3.442

Barabási, A. L. (2003). *Linked: The new science of networks*. Academic Press.

Centola, D. (2010). The spread of behavior in an online social network experiment. *Science, 329*(5996), 1194-1197.

Centola, D. (2013). Social media and the science of health behavior. *Circulation*, *127*(21), 2135–2144. doi:10.1161/CIRCULATIONAHA.112.101816 PMID:23716382

Centola, D. (2020). Physician Networks and the Complex Contagion of Clinical Treatment. *JAMA Network Open*, *3*(1), e1918585–e1918585. doi:10.1001/jamanetworkopen.2019.18585 PMID:31899525

Christakis, N. A. (2019). Blueprint: The evolutionary origins of a good society. Hachette UK.

Christakis, N. A., & Fowler, J. H. (2009). *Connected: The surprising power of our social networks and how they shape our lives.* Little, Brown Spark.

De la Haye, K., Robins, G., Mohr, P., & Wilson, C. (2010). Obesity-related behaviors in adolescent friendship networks. *Social Networks*, *32*(3), 161–167. doi:10.1016/j.socnet.2009.09.001

De la Haye, K., Robins, G., Mohr, P., & Wilson, C. (2011). Homophily and Contagion as Explanations for Weight Similarities Among Adolescent Friends. *The Journal of Adolescent Health*, *49*(4), 421–427. doi:10.1016/j.jadohealth.2011.02.008 PMID:21939874

Halberstam, Y., & Knight, B. (2016). Homophily, group size, and the diffusion of political information in social networks: Evidence from Twitter. *Journal of Public Economics*, *143*, 73–88. doi:10.1016/j.jpubeco.2016.08.011

Tucker, J. S., de la Haye, K., Kennedy, D. P., Green, H. D. Jr, & Pollard, M. S. (2014). Peer Influence on Marijuana Use in Different Types of Friendships. *The Journal of Adolescent Health*, *54*(1), 67–73. doi:10.1016/j.jadohealth.2013.07.025 PMID:24054813

Valente, T. W. (1995). *Network models of the diffusion of innovations* (No. 303.484 V3).

Valente, T. W. (2010). *Social networks and health: Models, methods, and applications*. Oxford University Press. doi:10.1093/acprof:oso/9780195301014.001.0001

Valente, T. W., Fujimoto, K., Chou, C.-P., & Spruijt-Metz, D. (2009). Adolescent Affiliations and Adiposity: A Social Network Analysis of Friendships and Obesity. *The Journal of Adolescent Health*, *45*(2), 202–204. doi:10.1016/j.jadohealth.2009.01.007 PMID:19628148

*Bianca-Elena Mihăilă is a PhD Candidate of University of Bucharest, Faculty of Sociology and Social Work, Romania. Her research interests are scientific collaboration networks, transnational co-authorship networks and transnational migration workforce, employing a personal network design. Her current research topics are related to measuring scientific productivity within academic communities from a social network's perspective, measuring the impact of transnational co-authorship networks on scientific productivity and exploring the impact of transnational social fields upon migrants' job seeking strategies.*