CSC2552: Review 4, Paper 1

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Paper 1

This 2003 paper by Muhamad, Dodds and Watts is a *digital virtual-lab experiment* attempting to investigate the 'small world' hypothesis through the examination of email forwarding statistics between experimental subjects and their targets. The main results suggest that successful chains are constructed primarily through intermediate to weak ties, without the reliance of centralised highly-connected acquaintances, mostly through professional relationships and in five to seven steps.

One significant weakness of this paper is that it is vulnerable to the problem of *heterogeneity*. This is best seen in the results of table 1 which show measurements across all members in all chains. Indeed, the search characteristics measured here represent the average effect but this is likely not the same for everyone, especially for people in different stages of the chain. Another related methodological issue lies within the use of an *experimental* approach rather than an *observational* one. Indeed, a more modern observational study, using Facebook friendship data for example, could reveal the dynamics at play at a much larger scale thus bypassing the major small-data limitation of this study. Since no causal effect was investigated here, an observational approach could yield a much wider range of conclusions with limited compromises required. Indeed, this has been the dominant approach in this field for subsequent years, mostly due to the rise of prevalence of big data and social media sites. Most notably, in [1], the '6 degrees of separation' hypothesis was confirmed for Facebook, the largest social network ever analysed. Other notable weaknesses of this paper include latent unobserved variables as well as issues with sample selection bias.

In a contrast, a major strength of this paper's experimental methodology is its reduced design complexity. Having people simply send trackable emails via a website makes the study far less vulnerable to the *boomerang effect*, as discussed in Bit By Bit [2]. However, this simplicity is a nonetheless a trade-off as it limits the scope of the paper's conclusions. Indeed, such a limited scope also reduces the paper's *external validity* as there is very little evidence to suggest that the results would generalise to different mediums. For example, perhaps connections on LinkedIn would only require three steps and would mostly originate from co-workers rather than friends. Another strength of this paper is the limited ethical impact as well as the identification of a specific *mechanism* to explain how searching is done in global social networks, in this case predominantly through friends that are either geographically close or professionally similar to the target.

The implications of this paper's results are significant as they provide further evidence, within the computational realm, to support the 'small world' hypothesis, originally penned by Milgram and Travers [3]. While the results could be interpreted as being a bit dated by now, they have been shown to still hold true in modern times by later studies [1]. Nevertheless, the authors could perhaps have leveraged an *armada strategy* to reinforce the *validity* of their results.

[1] Ugander, J., Karrer, B., Backstrom, L. and Marlow, C., 2011. The anatomy of the facebook social graph. arXiv preprint arXiv:1111.4503.

[2] Salganik, M. J. (2017). Bit by bit: social research in the digital age. Princeton University Press.

[3] Travers, J., Milgram, S. (1969) An Experimental Study of the Small World Problem. Sociometry 32, 425.