

Diversity and Community: The Role of Agent-Based Modeling

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Community psychology involves several dialectics, or tensions between possibly opposing concepts or points of view, perhaps even paradoxes, such as between rights and needs, theory and practice, and between respect for human diversity and sense of community. This latter dialectic has recently been explored by Townley, Kloos, Green, and Franco (2011), and further elucidated with the application of some methods relatively new to community psychology, namely agent-based modeling and network science, by Neal and Neal (2014) and Stivala, Robins, Kashima, and Kirley (2016). This paper discusses the community-diversity dialectic, and some other potential dialectics, and suggests that a diversity of academic fields can contribute to research in community psychology.

The Diversity-Community Dialectic

Townley et al. (2011) suggested that contexts which foster respect for diversity may be distinct from those that foster a sense of community, citing empirical studies that demonstrate an inverse relationship between diversity and sense of community. They argue that this conflict may

be resolved by expanding the definition of “sense of community” to focus more on bridging social capital rather than bonding social capital – that is, more on inclusive links between communities or groups, rather than on exclusive links that more tightly bond members within a community or group. However Neal and Neal (2014) argue that this is only a semantic, rather than practical, resolution of the dialectic, and use agent-based modeling to simulate social network formation in neighborhoods to show that the dialectic arises from two well-known principles of social tie formation: homophily, the preference for similar others, and spatial proximity.

The model used in Neal and Neal (2014) has two phases. The first is based on the Schelling model of residential segregation (Schelling, 1971). Two types of agents are randomly placed on a grid (representing a neighborhood), and then move until a specific level of spatial integration is achieved. In the second phase, social network ties are formed based on the principles of homophily (agents prefer to form ties to others of the same type) and proximity (agents prefer to form ties to nearby agents). It is then shown that there is a negative correlation between diversity, measured as the average fraction of dissimilar neighbors, and sense of community, measured as the clustering coefficient of the social network. This leads Neal and Neal (2014) to conclude that community psychologists must seek a contextually appropriate balance between diversity and community using “divergent reasoning”.

The agents in the Neal and Neal (2014) have only a single “type”, which cannot change, which might represent, for example, race (as in the original Schelling segregation model). Stivala et al. (2016) extend the model by combining it with the Axelrod (1997) model of cultural dissemination, in which agents have a vector representing cultural features, which are subject to change based on homophily and social influence – that is, agents similar on some cultural

features are likely to become more similar by adopting other cultural features of similar agents. In this extended model there are therefore both immutable (the original “type”) and mutable (cultural) features. It is then shown that, when there is a sufficient level of tolerance and cultural diversity, the negative correlation between diversity and community can break down, as social ties formed due to cultural homophily are sufficient to overcome the dissimilarity on the immutable attribute. The practical implication of this is that it is further support for the concept of “boundary spanning”: cultural attributes, such as opinions or tastes, can, if they become sufficiently aligned, be used to overcome barriers of difference on immutable attributes.

A Diversity of Meanings: Diversity, Segregation, Culture, and Community

Although the work of Neal and Neal (2014) and Stivala et al. (2016) has so far been described as discussing the relation between *diversity* and community, it is perhaps more accurate to describe them as describing the relationship between *segregation* (or its converse, integration) and community, as suggested by the use of the Schelling segregation model. Indeed Neal and Neal (2014) explicitly associate increased integration in the model neighborhood with respect for diversity. However diversity also has other meanings, including that explored in Neal (2015), where diversity is taken to mean the percentage of the minority group in the neighborhood, while segregation is the fraction of one’s neighbors of the same type, as before. This type of diversity, the number and relative proportions of different “types” of people (for example, ethnicities or religions) can be measured in a large variety of ways, and is often used in the economics literature, for example. It is worth noting that some of these diversity measurements have their origins in ecology, a field from which community psychology has a long history of borrowing concepts. This is also the conception of diversity that is used in the

Axelrod model of cultural dissemination, which is measured by the number of size of “cultural regions” in that model (Axelrod, 1997). Community psychology, however, has a somewhat broader understanding of diversity, which focuses not merely on the existence (and quantification) of different cultures, races, and so on, but on understanding of, and respect for, such differences.

Agent-based modeling, and the simplifications and explicit definitions of concepts it requires, has been useful here in two ways. First, demonstrating that the diversity-community tension can emerge from the simple tendencies of homophily and proximity. Second, suggesting a way to bridge this gap between diversity and sense of community, by enlarging the concept of diversity to include cultural features and the process of social influence.

In addition to these different interpretations of “culture”, there is another distinction, between cultural diversity and “cultural distance”, the degree of cultural dissimilarity between groups. There is a potential dialectic here between diversity and distance: In the context of migration within Europe, there is evidence that the cultural diversity of a region increases its attractiveness as a migration destination, while greater average cultural distance lowers its attractiveness (Wang, De Graaff, & Nijkamp, 2016).

The concept of diversity as relative proportion, rather than integration, could be easily incorporated into the model of Stivala et al. (2016), as indeed it was in Neal (2015), and an implementation of the concept of cultural distance is already present in the Axelrod model on which the former is based.

The concept of “sense of community” is also not easy to define, and a rather simplistic definition based on triadic closure was used by Neal and Neal (2014) and Stivala et al. (2016): a more highly clustered social network is assumed to facilitate social cohesion and hence a

psychological sense of community. Neal (2015) takes a more sophisticated approach by using the concept of “social capital”, exploring the tension between bridging and bonding social capital and using the network science concept of the “small-world” network, in which the community has the potential to develop both bridging and bonding social capital simultaneously.

What the Schelling Model Can Teach Us

It might seem from the discussion above that the understanding of diversity, culture, and community in fields other than community psychology, and particularly the necessarily simplified and specific definitions required for agent-based modeling, would severely limit the usefulness of such techniques to community psychology. However, I hope to show by a short review of research using the Schelling model of residential segregation, that valuable lessons and insights can arise from such models, and that there is a useful dialectic between theory (including agent-based modeling) and the problems of the real world.

The main result of the original Schelling model is that a small preference for similar neighbors leads to a much higher level of segregation than that required to satisfy the individual preference, and, in general, Schelling’s work has shed light on how individual preferences are related to observable outcomes on a larger scale, and has been very influential. This model applies not only to residential segregation by race, but many other situations, for example gender segregation in occupations (Pan, 2015). Schelling’s original model necessarily contains a great number of simplifications, and among these is the assumption that individuals’ preferences are homogenous, so both groups have the same level of preference for similar others as neighbors, although Schelling does briefly investigate a case where the preferences of the two groups are not identical. It was, however, noted as long ago as the 1950s that some research appears to show

that it is mostly, or perhaps only, White residents who have such a preference (Allport, 1954, p. 272). (It is also interesting to note that Allport, in discussing ethnic migration in American cities, refers to “a game of social checkers” (Allport, 1954, p. 268), while Schelling literally used colored chips or coins on a checkerboard-like grid, rather than a computer program, to experiment with his model (Schelling, 1971)). Despite the influence of, and continued research on, the Schelling segregation model, it was more than thirty years until a thorough analysis of asymmetric preferences in the Schelling model was published, showing that this is still enough to lead to a very high degree of segregation, while also allowing the incorporation of socioeconomic variables (Clark & Fossett, 2008). Some subsequent developments of Schelling models of residential segregation have incorporated empirical data about residential preferences, showing that exclusionary practices and institutional discrimination are not only not necessary for segregation to result, but may not even be sufficient (Macy & Van De Rijt, 2006). Fossett and Dietrich (2009) show that the results in the Schelling model are robust to the size and shape of cities, but that the “scale of agent vision”, the number of neighbors that an agent “sees”, is an important factor. In other words, social dynamics are more important than urban geography, surely a very relevant result for the practice of community psychology.

As noted by Clark and Fossett (2008) the importance of the Schelling segregation model is that it really does have a social context and meaning, and does direct our attention to understanding the socioeconomic inequality and social dynamics that lead to segregation. Further, the history of the Schelling model displays a dialectic between theory (model building) and actual community concerns: Schelling’s paper was of theoretical interest only and rarely cited until a resurgence of debate about urban segregation in the USA in the 1980s and 1990s (Clark & Fossett, 2008), at which point it provided a theoretical basis for explaining segregation,

which has since been reinforced, as briefly discussed above, by empirical research and further enhancements of the model.

Conclusion

The use of computational social science techniques such as agent-based modeling, as well as network science, and contributions from diverse fields, such as economics, sociology, computer science, mathematics, and physics, can make important contributions to community psychology. This is not only in illuminating dialectics such as those between community and diversity, or the bridging and bonding aspects of social capital (Neal, 2015), but also in helping to understand and plan for practical community interventions (Lawlor & Neal, 2016). Network science can also help us understand how racial segregation can be present not only in real communities, but also on the web (McIlwain, 2016).

As illustrated by the history of the Schelling model of residential segregation, there is a useful dialectic between theoretical, computational, and mathematical work in model building and analysis, and the real-world problems of community psychology.

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