Using Agent-Based Modelling to Exercise Theoretical Reasoning in Social Psychology
An Exploration and Tutorial

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Abstract

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1. Background

Social psychology has a problem of complexity. This problem is not unique to social psychology or the social sciences (Macy and Willer), but the approaches that social psychologists use to study social psychology have had limited success (Grossmann et al.; Open Science Collaboration; Muthukrishna and Henrich). Following the replication crisis, there has been an increased focus in the social sciences on rigour in research process, leading to the creation and adoption of open science practices (Nosek et al.; Bauer). A survey of psychology researchers found that they perceived the benefits of preregistration most for planning analyses and generating hypotheses (Sarafoglou et al.). Others argued that a major reason for the replication crisis in psychology is a lack of cohesion in the theoretical foundations guiding research (Muthukrishna and Henrich). Recently, a large sample of experts in the social sciences participated in a survey to gather their predictions for different domains of societal change following the COVID-19

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pandemic (Grossmann et al.). They found that social scientists did not perform better than chance for this task, in contrast to previous studies that found social scientists performed better than laypeople in predicting the outcomes of laboratory experiments of these same domains (Grossmann et al.). This gap in prediction accuracy was attributed to inadequate causal models (Grossmann et al.). Together these findings suggest that social psychologists lack theories that encompass the complexity of social phenomena in the real world.

1.1. A Problem of Complexity

Experimental designs allow us to isolate causal relationships between variables, but extending this approach to systematically define multiple aspects of a phenomenon quickly leads to a combinatorial explosion. Overarching theoretical frameworks are the opposite in this regard. Rather than having to test an impractically large space of possible hypotheses to develop comprehensive models, a theoretical framework defines a limited space of possibilities that can be supported or disproven by existing or new data (Muthukrishna and Henrich). The authors argue that dual inheritance theory, an evolutionary theory, is a suitable framework to guide reasoning for social behaviours (Muthukrishna and Henrich). Evolutionary theories are bottom-up approaches that can produce higher level outcomes emerging from the consequences of lower level mechanisms (Miller and Todd). Transitioning from top-down to bottom-up theories could provide social psychology with models that describe the complexity in the real world, but this complexity becomes part of the model.

1.2. A Problem of Emergence

At first glance, it may seem that using bottom-up theories to understand complex systems is merely shifting the problem of understanding complexity from the system to the model itself. For example, evolutionary approaches to understanding human cooperation has yet to describe the breadth of cooperative behaviours observed in the real world (Henrich and Muthukrishna). This is an inherent challenge of a bottom-up approach. The phenomenon we are interested in becomes an emergent property of the theory rather than an explicit part. But reorienting the phenomenon into a bottom-up view does allow for

2. Agent-Based Models

Macy and Willer; Axelrod and Hamilton; Bianchi and Squazzoni

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