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A Formal Approach to Attitude
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Appendix G

Summary

G.1 A Formal Approach to Attitude

Attitudes, the liking or disliking of an object, are formed through several different processes (e.g., Fazio, 1995, 2007; Zanna & Rempel, 1988), range from being stable and impactful to being fluctuating and inconsequential (e.g., Krosnick & Petty, 1995), and are related to several core constructs in social psychology – in short, attitudes are highly complex. Given the complexity of attitude it might seem that it is in vein to try to develop formal theories on attitudes. Yet, recent developments in psychology specifically and complexity science more generally have shown that complex behavior can be the result of relatively simple processes interacting with each other. In this dissertation, I develop and test several formalisms on attitude relying on few fundamental principles.

The approach formulated in this dissertation rests on two fundamental assumptions. First, attitude elements (i.e., beliefs, feelings, and behaviors vis-á-vis an attitude object) directly interact with each other (e.g., judging snakes as dangerous leads to feeling afraid of snakes) and these interactions can be modeled by representing them in a network structure. Second, interactions between attitude elements become more pronounced as more attention and thought is directed at the attitude object, implying that attitudes are unstable and inconsistent (high in entropy) when one directs little attention to the attitude object, while attitudes become more stable and consistent (low in entropy) when one thinks frequently about the attitude object.

Part I introduces the Causal Attitude Network (CAN) model, which represents a measurement model of attitude based on the assumptions that attitude elements form a network of direct causal interactions. Chapter 2 provides a detailed description of the CAN model, which uses the Ising (1925) model to simulate the dynamics of attitudes in an idealized fashion. I discuss the CAN model's assumption that the structure of attitude networks conforms to a small-world structure in which attitude elements similar to each other form tight clusters. Attitude strength is formalized as network connectivity in the CAN model and I show that this formalism provides a parsimonious explanation of the differences between strong and weak attitudes.

Chapter 3 provides a tutorial on how to apply the CAN model to empirical data and how to perform network analysis on attitude data. First, I show how one can estimate attitude networks and use data on attitudes toward Barack Obama during the election of 2012 as an illustration. Second, I discuss how one can calculate standard network measures, such as community structure, centrality, and connectivity. Third, I show how one can simulate data from an estimated attitude network and illustrate consequences of varying connectivity and of targeting central versus peripheral attitude elements.

Part II provides empirical tests of the CAN model. Chapter 4 tests the central assumption of the CAN model that highly connected attitude networks correspond to strong attitudes. For this, I use data from the American National Election Studies (ANES) from 1980 to 2012 on attitudes toward presidential candidates. First, I estimate attitude networks of groups differing in political interest and show that political interest and network connectivity are highly related. I then test whether network connectivity is related to two defining features of attitude strength – attitude stability and impact on behavior. I show that network connectivity is strongly positively related to attitude stability and the attitude's impact on behavior, providing support for the CAN model's hypothesis that highly connected attitude networks conform to strong attitudes.

Chapter 5 illustrates the CAN model's applied value by testing whether network structure can be used to forecast impact of specific attitude elements and impact of the global attitude on voting decisions. Using simulations, I first show that the CAN model predicts that highly connected attitude networks have the strongest impact on behavior globally and that in any attitude network central attitude elements have the highest impact on behavior. I test these hypotheses on data from the ANES from 1980 to 2012 and find strong support for these hypotheses. Additionally, I show that the CAN model allows one to forecast with high accuracy the specific impact of attitude elements on voting decisions.

Part III introduces the Attitudinal Entropy (AE) framework as a general theory of attitudes. Chapter 6 discusses the main principles of the AE framework, which builds on the CAN model, and connects the basic principles of statistical mechanics to attitude research by means of analogical modeling. The AE framework rests on three fundamental principles. First, attitude inconsistency and instability represent two related indicators of attitudinal entropy, which implies that attitudes gravitate towards inconsistent and unstable states. Second, energy of attitudinal representations serves as a local mechanism to reduce the global entropy of attitudes. Third, attention and thought have a similar effect as (inverse) temperature has in thermodynamic systems – thought and attention reduce attitudinal entropy. I show that several well-established effects in the attitude literature, such as the mere thought effect (Tesser, 1978) and heuristic versus systematic processing of arguments under low versus high involvement (e.g., Petty & Cacioppo, 1986), follow from the AE framework. Additionally, I discuss the AE framework's implications for ambivalence and cognitive dissonance.

Chapter 7 provides a reply to several commentaries on Chapter 6. In this reply, I first discuss the aim of the AE framework and provide some clarifications of its main principles. Second, I discuss the AE framework's implications for dual-process models and evaluate whether the AE framework provides novel predictions. Third, I apply the AE framework to measurement of attitudes and to the interpersonal realm. Finally, I provide an online app, in which the basics of the AE framework are implemented, to make the formalisms of the AE framework more accessible.

Chapter 8 introduces the Learning Ising Model of Attitude (LIMA), which adds Hebbian learning to the AE framework. The LIMA thereby provides an explanation for how attitude networks, which are able to reduce entropy, develop. In several simulations I illustrate the dynamics of the LIMA. First, I show that Hebbian learning leads to networks, which efficiently reduce entropy. Second, I model feedback between instability of attitudes and the attention directed at the attitude object, implement learning of dispositions of attitude elements, and provide an illustration of attitude change. I discuss the LIMA's contribution to the unification of research on attitudes, its relation to Hopfield network models and Boltzmann machines, and potential avenues for future research.

I end by discussing (1) how the different formalisms developed in this dissertation relate to each other, (2) how the formalisms might be applied to intra- and interpersonal interactions between attitudes, (3) on what time scales the formalisms operate, and (4) the possibility of estimating individual networks. I then place the formalisms developed in this dissertation in a broader perspective and discuss their implications for the nature of attitudes. I argue that the essence of attitudes is a structural one and that successful theories on attitudes can only illuminate the structure of attitudes but not the properties of the constituents making up this structure. I then discuss measurement from the perspective of the approach of this dissertation, which might lead to novel definitions of measurement error and measurement bias. Additionally, I connect this dissertation's approach to coarse-graining (i.e., the smoothing out of irrelevant information to arrive at an effective theory) and by this provide a possible avenue for a novel perspective on mental causation. Finally, I discuss how the approach of this dissertation relates to structural realism in philosophy of science. I conclude that the principles developed in this dissertation not only provide the building blocks for a theory of attitude, but can also serve as a blueprint for the dynamics of mental representations in general.