



*Reason to Believe*

C. Shi

We are confronted with new information all the time. The information we face and on which our beliefs are based, is often chaotic, disordered, and even contradictory. Yet at the same time, our belief is expected to be consistent. At least, we strive for consistent beliefs. Is it possible for us to achieve and maintain consistency in our beliefs? If yes, how do we manage to extract consistent belief from inconsistent information? We attempt to answer these questions from a logician's perspective, borrowing ideas and techniques from other fields, for example, topology, formal argumentation theory, non-monotonic reasoning and Markov chain theory.

The dissertation is structured around two topics -- single-agent belief and group belief. For both a single agent and a group of agents, we take belief formation as a process of resolving the inconsistency in its basis. The difference is that in the case of a single agent, evidence is taken as the basis of her belief and in the case of a group of agents, each group member's belief is taken as the basis of the group's belief.

For a single agent, we understand the process of resolving conflicts between different pieces of evidence to be the agent's reasoning. Two forms of reasoning are investigated -- argumentational reasoning and default reasoning. The problem thus becomes how the agent coordinates her default reasoning and argumentational reasoning to achieve full consistency in her beliefs. We employ the topological semantics for evidence, formal argumentation theory and non-monotonic reasoning to tackle the problem and study the logic of the resulting notions of belief and their relationship with evidence.

For group belief, we investigate two ways of resolving conflicts between the different group members' beliefs. One is based on argumentation, and the other is opinion diffusion by social influence. We model these two forms of "group reasoning" by combining the Kripke semantics with formal argumentation theory and Markov chain theory respectively, which paves the way for our logical analysis of the notions of group belief based on them.

Throughout the whole dissertation, the recurrent theme is a tension between believing more and believing more consistently. We demonstrate that in the case of a single agent, it is possible to strike a balance in a meaningful way. For group belief, nonetheless, besides its amount of content and consistency, we also need to consider whether the aggregation of the group members' beliefs is democratic enough. So, the tension is between believing more, believing more consistently, and believing more democratically. Our proposals exemplify possible ways of relieving this tension.