Chapter 6

Conclusion

This dissertation explored how computational models of bias and behavioral experiments can inform the design of human-machine collaborations, accounting for, and adapting to human behavior. In particular, we considered multiple computational methods for modeling bias and heuristics at three levels of abstraction, including bias in spatial auditory attention, individual decision making, and finally, in group decision making. Chapter 3 described a new model of attentional bias in spatial auditory attention and showed how this was incorporated into ACT-R. The resulting auditory module expanded ACT-R's functionality to model users in situations where audition is important. Chapter 4 compared four models of the underlying cognitive functions involved in making decisions when faced with potentially inaccurate information. These results represent a first step in analyzing how warnings affect a users' ability to process feedback and are significant for considering the design of feedback and warnings in automated recommendation systems. Finally, Chapter 5 looked at how behavioral experiments can give new insights into the models used to simulate behavior in group decision-making scenarios. We investigated how people choose whom to vote for in approval elections and, through an experiment, showed the broad range of sincere votes that people make, depending on the properties of the

election. Applying human behavior to theoretical models of approval voting opens up new opportunities for creating realistic simulations of voter behavior.

In general, this dissertation explored computational methods for simulating bias at different levels of complexity and abstraction. I developed cognitive models using a variety of methods, including constraints, diffusion modeling, instance-based learning, and reinforcement learning, and showed when each of these is appropriate for modeling various forms of bias. Additionally, I showed how models of bias can be integrated into cognitive architectures, making them accessible for modeling human behavior in the context of other cognitive mechanisms and in human-machine integration tasks. Finally, I showed how both cognitive models of behavior and behavioral data collected from experiments can provide insights into the design of new algorithms and technologies that must adapt to human biases and behavior.

6.1 Published or Submitted Papers and Presentations

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Scheuerman, J., Harman, J., Mattei, N., Venable, K. B., (2019). Heuristics in Multi-Winner Approval Voting, presented at *Workshop on Behavioral EC at the 20th ACM Conference on Economics and Computation 2019* [25].

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