Cognitive modeling of complex behaviour
8-12 January Lorentz Center@Snellius

Description and aims

There is a gap between psycholinguistics, cognitive psychology, and cognitive science on one side, and mathematical psychology and computational modeling on the other. In mathematical psychology and computational modeling, cognitive models are often developed with a focus on very minimalistic tasks with simple stimuli and many repetitions of the same questions, in domains such as simple decision-making or perception. In contrast, psycholinguistics, cognitive psychology, and cognitive science often focus on more complex behaviors, such as reading, word recognition, turn-taking, and naturalistic decisions, but often lack formal models to explain these behaviors. This disconnect can create challenges for researchers and practitioners in these fields, as they may struggle to apply the insights and techniques developed in mathematical psychology to more complex behaviors. Consequently, we need to build a much more widespread ability to think computationally and build computational models according to the researchers' questions and theories. This was the main aim of the Lorentz workshop.

This workshop aimed to foster collaboration and critical reflection across these two communities and create concrete examples of models and associated challenges in creating them. In concrete terms, workshop attendees collaborated in teams to address the modeling of different complex tasks–tasks that were brought forth by domain experts in a call prior to the workshop. We sought to measure the success of the workshop by each team's ability to go through the process of modeling and encounter challenges in this process, as well as the team's ability to produce documentation of these discussions and the hurdles encountered during the process.

Our short-term goal was to initiate a discussion on the modeling of complex tasks and situations. Our long-term goal was to foster an increase in modeling efforts addressing complex behaviors. This necessitated raising awareness among computational modeling experts about the specific needs of domain experts, and developing techniques to meet those needs. Additionally, we aimed to empower domain experts with exposure to computational modeling skills beyond relying solely on existing models.

Scientific outcomes

In order to realize our short-term and long-term objectives, the workshop intended to document the work of each group through an online reporting tool. We originally intended that each group created a lab notebook that outlined the process of formalizing a specific complex behavior. Additionally, we intended that there were daily reflections in the form of short videos. In practice, we used a Slack space to have participants coordinate in their groups. We encouraged them to take notes but did not mandate a specific medium. We recorded the videos of each end-of-day presentation.

Our original aim was to compile a theme issue that showcases selected projects and provides meta-reflections on modeling strategies. However, we found it made more sense to let each group develop their own final products, since those varied a lot - from the draft of a paper tackling a specific case of cultural evolution in cockatoos and their human neighbors, to grant application plans, passing through additions to existing modeling software packages. In the last session we made a detailed plan for one final paper to be written about the meta-level results of our workshops - which will use specific examples from the groups to characterize

different suggestions on how to tackle the modeling of complex behaviors. The networks established during the workshop will foster collaborations between domain experts and computational modelers, forming the foundation of this emerging field focused on modeling complex behavior.

Scientific breakthroughs or "Aha" moments

We discovered that probably one of the most important ingredients for successful computational modelling of complex behaviour is intellectual empathy—the willingness to invest in trying to understand each other and scientific domains beyond our own.

Another important realization was that modelling is a team effort. The different teams got so far because there was a meeting of lots of different viewpoints and expertises, which reduced the probability of getting stuck. Originally we thought that a model could eventually also be created by a domain expert after enough training, but towards the end we felt that modelling was more of a team effort.

Format of the workshop

On the first day, we started with an introduction activity, followed by a series of short talks by expert modellers. We ended the day with a series of short pitches by domain experts on possible things to be modelled and a final discussion. Then on the second day we split into groups according to interest in the different topics, and these groups discussed what kind of model would be best to capture these phenomena, as well as fleshed out more specifically what the phenomenon was to be modelled. This day, and the next day, ended with brief presentations of each of the four groups. The third day focused on how the model would look in general, and then on the fourth day, participants moved closer to a prototype. The final day of the workshop was spent reflecting in groups on the process itself and developing guidelines for modelling complex behavior, which were presented to the full group. The afternoon was left free for people to leave or continue to work in their individual groups.

Other comments

We very much enjoyed the workshop, and saw participants sparkling as well. It's such a precious opportunity to have the space and time to actually think and develop ideas! The Lorentz Center staff was fantastic, helping us out with things like organizing recordings on a whim, and helping us find a medical doctor for a participant who needed medical care. We felt so held! It was also fantastic that as organizers we didn't need to worry about practical details, which freed us up to focus on the intellectual process and the group dynamics.

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