Computational representation of social complexity for decision making: the case of climate change, migration, and social conflict

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Abstract

This chapter illustates how computer simulations can help us foresee critical situations in populations where climate change may cause water scarcity. In particular, we exemplify a city in the central Andes of Peru whose conditions related to deglatiation, urbanization, and population growth, may bring water scarcity. The main technique used is agent-based modeling, which will combine quantitative and qualitative information. The results show possible scenarios of water scarcity leading to drastic migration and social conflict, a situation not yet evident as a public problem. This work provides recommendations for this likely and undesired scenario.

Keywords: Social complexity, agent-based modeling

Introduction

Social problems are mainly complex. That is, combine environmental, technological, psychological, social, political, and cultural issues. This complicates policy and political decision making as one branch alone of the government can not solve public problems effectively, but involving several branches and multilevel decision makers will not make the discussion more efficient.

This chapter presents social simulations via agent-based modeling (ABM). As Macy and Willer (2002) propose, ABMs will allow the social scientists to change their modeling efforts to represent societies as interactions among variables into a different paradigm where social life can finally be represented as interactions among adaptive agents who influence one another in response to the influence they receive.

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A major social concern that needs profound reflection for the future of humanity is climate change; particularly if it affects the availability of water (Robinson & Klobucista, 2023). But even if climate change were not a concern, population and city growth by themselves will challenge the best efforts for water management (Unesco, 2018).

This work will combine information from both sides, climate change and population growth; and will show how to implement some interesting individual level decisions that may affect the aggregate in unintended ways. Qualitative and quantitative, yet incomplete, information from a city in the central Andes of Peru will be used to exemplify that as these trends may continue, it is worth asking:

- Is it possible that drastic migration patterns appear?

- Is it possible the emergence of social conflict in the area?

This work supports the hypothesis that those questions have affirmative answers, if no anticipatory action is carried on timely. The area chosen, Huancayo[1], has been under study by different scholars and institutions whose objectives are similar yet lacking inter disciplinary integration. Different public research institutes are working to produce either glaciological, hydrological or climatological updates on the area; isolated researchers are doing small-scale models to whether alert of different local water risks or propose adaptation programs in the communities more likely to be affected by the nature trends.

Water scarcity and droughts have an slow onset (Singh et al., 2021), so as time passes by, the majority of urban and rural settlers do not pay much attention to this issue. These people in the watershed are not experiencing a critical condition, or at least not worse than the country-wide average conditions. In this situation, this work is presented in the right moment to serve as an input for anticipatory political decisions, as neither are effective measures currently implemented. However, the presence of different actors with different goals and beliefs, makes it challenging for mainstream modeling techniques to provide the right guidance, so this work hopes to contribute methodologically to avoid a negative future for Huancayo.

Since the Introduction is where references in papers first show up, let us incorporate some now. There are some intricacies to be aware of when using LaTeX to write your paper (yes, there is a LaTeX command to make it look fancy like that, because of course there is). Referencing something **in text** is done by dropping the name in text with the year followed in parentheses; lucky for us LaTeX handles it with the right command, like Wilensky and Rand (2015). But maybe you want to just include it all at as a **parenthetical**? LaTeX can do that as well (Steinbruner et al., 2013).

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[1] We are using the name of the Province of Huancayo, but we are precisely dealing with the area that comprises the political Districts of Huancayo, El Tambo and Chilca that depend on the water from the Shullcas River.

Table 1

Sample words from this hypothetical experiment.

First word	Second word
Yeet	Yoink
Hot	Lit

Method

DELETE THIS SECTION - this is an informative section, not something to be included in your final paper.

I have tried to include the most I've seen asked of students in these papers. You may not need to fill out all of these boxes, in which case you can just delete them. Along with this subsection.

Also, I have seen many different combinations of these boxes - e.g., in one of my papers, I had a "participants and materials" section followed by a "procedure and measures," but cannot remember why it was written that way. Maybe it is what the journal wanted? Moral of the story here: go with what the person who is making the decision about the quality of your paper wants. If they want everything in its own little box, do it. If they want some boxes combined, do that.

Just make sure you delete or comment out this subsection!

Participants

Talk about the people who participated in your study. How many students, sourced from where, reimbursed how, ethics assured by what?

Materials

What materials were used in the course of this experiment? Try to walk the line between being overly specific (i.e., "pens were standard Bic Clio Stic of medium thickness") while still having enough detail someone else could read your paper and replicate what you used.

Sometimes it can be helpful to include the stimuli used in the experiment. For example, here is an example table (Table 1) of words that were used in this hypothetical experiment. If you make use of the label command, LaTeX will handle numbering things for you.

References

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