

Synthesising an ABM Population Representative of an Indigenous Population: Modelling Science Meets Indigenous Knowledge and Lives

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Abstract. The Tati Tati Indigenous peoples are traditional custodians of lands and waters near Robinvale, Victoria, in Australia. There are estimated to be 600 Tati Tati Traditional Owners, with 200 living on Country. This research was co-created and led by Tati Tati researchers. The Millu (or Murray) River flows through Tati Tati Country, and Tati Tati identify strongly as River people. This paper discusses a project designed to understand the intergenerational opportunities and benefits for Tati Tati from the return of water and control of natural resources. We use qualitative data from consultations with the community to synthesise an artificial population for an Agent-Based Model (ABM). A primary challenge for this project is gathering rich data for a relatively small population and preserving Indigenous values and epistemologies using ABMs—a tool based on the Western Knowledge System (WKS). We conducted consultations—conducted as a “yarn”, which is an open-ended discussion—with a focus group to quantify the community’s demographics in an indicative, non-self-descriptive manner. Data on factors such as age distribution, household structure, socio-economic status, education levels, cultural practices and connection to the land and waters were collected while overcoming concerns about privacy and identification and being subject to non-Indigenous researchers’ surveys. This data was used to develop a framework for synthesising an artificial population that incorporates the above-mentioned themes and fairly represents the Tati Tati population while preventing individual identifications. Our approach highlights the importance of adopting culturally sensitive methods for gathering data, using qualitative techniques to derive quantitative data, and putting ethics of data capture and data sovereignty at the forefront of the methodology. This approach has the potential to generate more accurate and nuanced insights into the social, cultural, and economic dynamics of Indigenous communities, which can better inform policy and decision-making processes.

Keywords: Agent-Based Modelling · Qualitative Data · Indigenous Knowledge · Synthetic Population

1 Introduction

For Tati Tati Traditional Owners, along with over 40 First Nations in the Murray-Darling Basin, water is central to cultural, social, and spiritual identity.

Water supports livelihoods, the well-being of plants, animals, and people, and the transfer of traditional knowledge. Despite the continued assertion of their rights to use and manage water, First Nations groups are under-represented in ownership of water and excluded from water management decisions and practice [1,2].

There are increasing calls to enable Traditional Owners to exercise their rights to water through greater access, ownership and control of water. Recent research highlighting the continuing deprivation of First Nations' fundamental rights to water has proposed legal, policy and governance options to address this through the delivery of Cultural Flows [3,4]. These are First Nations-controlled water rights underpinned by spiritual, cultural, environmental, social and economic connections, which offer a model for integrated land and resource assessment, planning and management. Cultural Flows are distinguished from environmental flows, allocated to improve the health of rivers, wetlands and floodplains, by their wider contributions to the wellbeing of First Nations people; yet relationships between the health of waterways and the health, wellbeing, and prosperity of First Nations people - over generations and across the life course - remain poorly understood. There is also limited recognition by key policy and investment decision-makers of the potential of traditional methods of caring for Country as a long-term pathway to enhancing environmental sustainability in the Murray Darling Basin and health and wellbeing of Traditional Owners.

In settler-colonial nations like Australia, population statistics play a crucial role in shaping state policies towards Indigenous peoples. However, population statistics are far from neutral counts [5]. Assumptions about Indigenous identity and ways of life are embedded in decisions about what to count, who gets counted and how. Too often, data collection is driven by government imperatives, not by the questions deemed important by Indigenous peoples themselves. There is a tendency to take deficit-oriented rather than strengths-based approaches to information gathering, which constitute Indigenous peoples as problem subjects in need of state interventions and reforms. As an act of resistance to these practices of misrecognition and stigmatisation, Indigenous peoples in Australia have not fully participated in state data collection processes leading to the well-known problem of an Indigenous undercount in the national census and other administrative data [6].

2 Qualitative Data Collection

The history of statistical misrecognition casts a shadow over an ABM project of this nature. It informs our decision to work with Tati Tati Traditional Owners and let them tell us what data is important to them and why. We have two Tati Tati researchers as chief investigators on this project and they have lead the design of design collection in conversation with the non-Indigenous researchers. They proposed a focus group approach to data collection through the practice of "yarning". The Australian Indigenous concept of "yarning" is a form of communication that involves having an open-ended discussion in a relaxed and informal

setting. It is similar to having a conversation, but it is more focused on storytelling, sharing knowledge, and building relationships. In Indigenous cultures, "yarning" is an important way of passing on knowledge, traditions, and culture from one generation to another. It is a way of learning about the world around us and understanding our place in it. It is a valuable qualitative resource for researchers engaging with the Indigenous communities [7–10].

The important characteristics of focus group are a spread of ages, experiences of living on and off Country, exposure to a variety of Tati Tati Traditional Owners, etc. Free Prior and Informed Consent and principles of Indigenous Data Sovereignty mean that participants were providing ongoing, not 'set and forget', consent and there are regular checkpoints where consent is (re)established. The data is first and foremost owned and controlled by the Traditional Owners, and it is only with their consent, that the data can be shared or distributed.

One challenge was to explain the creation of a synthetic population and modelling to the focus group. Alongside the usual scepticism or incomprehension that is expressed by non-modelling audiences, there was also the concerns about how the data will be used and whether it would do justice to the rich histories and experiences of the participants. The need to quantify rather than qualitatively describe information presents ongoing concerns, but the group have also recognised that there is power in numbers when addressing government decision makers who control resources. Overall, the leadership and involvement of the Tati Tati researchers on the project has been indispensable in overcoming the above concerns. There is a sense of trust in the judgement of the researchers, and therefore a willingness to participate despite reservations.

There will be approximately four consultations with the group. The first consultation was designed to build the basic demographics of the synthetic population. This involved asking participants "For the Tati Tati mob that you know. . . ." what is the age distribution, employment and education characteristics, household structures and composition, and other similar basic demographic features. The participants deliberated in a group as well as providing their own answers to those questions. We were thus able to see differences based on the age and life experience of the participants. For example, older participants had much lower levels of settler education attainment due largely to social exclusion and state policies which limited both expectations and possibilities for education. Whilst younger participants were subject to state policies of age-based compulsory school attendance and expectations had also changed. Through the consultation, which occurred outdoor by the river over about 4 to 5 hours, we were able to collate the information necessary to build a synthetic population. The next consultation will involve identifying what participants think are the values and experience that matter to Tati Tati. The third consultation will involve understanding what kinds of opportunities a return of water creates for Tati Tati. This could be economic or cultural or political opportunities. A final consultation will explore the relationship between the return and control of water and the values and experiences that matter to Tati Tati. In other words, how the return of water reshapes values and practices and livelihoods.

3 Conversion to Quantitative Data and Results

Honouring the understanding of Indigenous Data Sovereignty principles, we release the data only after explicit consent for publication is obtained from the wider Tati Tati community. Hence, this section will describe the nature of the results without making a reference to actual results obtained through the synthesising of the model population.

The promise made to the community, in the words of [author 1], at the first consultation session was, "... we will not be publishing starting data or the outcomes of the modelling – we will be publishing the ABM process ...", as a response to a Traditional Owner expressing their distrust in the data collection process.

Throughout the yarning process described above, one researcher (Social Scientist) took note of the qualitative comments, while another (Agent-Based Modeller) took note of the approximate proportional values discussed. For example, if the community was discussing the number of teenagers in their community, a potential answer could be "There are as many teenagers as kids, but not as many as people in their twenties." In this case, we would note down "Kids: x , Teenagers: x , Twenties $> x$." After the consultation, the notes were reconciled between the two researchers and, in consultation with the Indigenous researchers, percentage values and uncertainty scores were established. These were then used to generate probability distributions and associated standard deviations for creating the ABM. Using these probability distributions, we created synthetic populations whose average demographics will be presented back to the focus group at the upcoming consultation session.

4 Discussion and Conclusions

This abstract introduces the challenges faced by the Tati Tati Indigenous peoples and the complex academic exercise of modelling their cultural and economic futures in relation to sovereignty over water and natural resources. This can be considered a 'wicked' problem suitable for modelling as an ABM. However, we also discuss the challenges surrounding quantitative data such as census data, which typically informs ABM population synthesis, as well as the need to model a small population while ensuring privacy and individuality. We discuss the practice of yarning, which has been recognised as an ideal bridging tool to the Indigenous Knowledge System (IKS). We use this tool to engage in consultations with community members to gather rich qualitative data rather than relying on sparse quantitative data. In conclusion. The use of qualitative data collection methods allowed us to establish quantitative approximations that have provided more comprehensive and relatable synthesis of an artificial population, while respecting issues around identification and privacy in a community with a smaller population.

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