School of Mathematical and Statistical Sciences
Arizona State University

M E M O R A N D U M

DATE: 03/28/2023

TO: Faculty and Students

FROM: Professor(s) Mark Reiser Steven Saul
Chair/Co-Chairs of Julia Phelps
Defense for the MS in Statistics
Committee Members Thomas Morgan

DEFENSE ANNOUNCEMENT

Candidate: Julia Phelps

Defense Date: Wednesday, April 12, 2023

Defense Time: 12:00 PM

Virtual Meeting Link: https://asu.zoom.us/j/4791125674

Title: Simulating Cooperative Behaviors in a Subsistence Population: An Agent-Based Modeling Approach

Please share this information with colleagues and other students, especially those studying in similar fields. Faculty and students are encouraged to attend. The defending candidate will give a 40 minute talk, after which the committee members will ask questions. There may be time for questions from those in attendance. But, guests are primarily invited to attend as observers and will be excused when the committee begins its deliberations or if the committee wishes to question the candidate privately.

ABSTRACT
-See next page-

PO Box 871804 Tempe, AZ 85287-1804
(480) 965-3951 Fax: (480) 965-8119
http://math.asu.edu

ABSTRACT

Humans cooperate at levels unseen in other species. Identifying the adaptive mechanisms driving this unusual behavior, as well as how these mechanisms interact to create complex cooperative patterns, remains an open question in anthropology. One impediment to such investigations is that complete, long-term datasets of human cooperative behaviors in small-scale societies are hard to come by; such field research is often hindered both by humans' long lifespans and by the difficulties of collecting data in remote societies. In this study, I attempted to overcome these methodological challenges by simulating individual human cooperative behaviors in a small-scale population. Using an agent-based model tuned to population-level measurements from a real-life marine subsistence population in the southern Philippines, I generated dynamic daily cooperative behaviors in a hypothetical subsistence population over a period of 1500 years and 42 overlapping generations.

Preliminary findings from the model suggest that, while the agent-based model broadly captured a number of characteristic population-level patterns in the subsistence population, it did not fully replicate nuances of cooperative behaviors observed in the subsistence population. In particular, statistical models of the simulated data identified reciprocity-based and need-based cooperative behaviors but did not detect kinship-motivated cooperation, despite the fact that kin cooperation traits evolved positively and reciprocity cooperation traits evolved negatively over time in the agent population. This discrepancy may reflect a complex interaction between kinship and reciprocity in the agent-based model. On the other hand, it may also suggest that these types of statistical models, which are frequently utilized in human cooperation studies in the anthropological literature, do not reliably discriminate between kin-based and reciprocity-based cooperation mechanisms when both exist in a population. Even so, the completeness of the simulated data enabled use of more complex statistical methodologies which were able to disentangle the relative effects of cooperative mechanisms operating at different decision levels. By addressing remaining pattern-matching issues, future iterations of the agent-based model may prove to be a useful tool for validating empirical research and investigating novel hypotheses about the evolution and maintenance of cooperative behaviors in human populations.