Background.

Solving complex social and economic problems requires generating solutions that are not only technically feasible, but also satisfactory to a large group of stakeholders with competing needs and interests. This research will investigate the juncture of negotiation frameworks with models of collective problem-solving, taking advantage of a theoretical isomorphism in the models to show how negotiation can be understood as group problem-solving, and vice-versa. By studying negotiation from a collective intelligence and management-as-engineering perspective, this research will seek to identify process design principles that can improve the likelihood of finding optimal agreements in complex situations.

The core insight of this research is the observation that typical "exploration in fitness landscape" models of problem-solving, a popular approach in collective intelligence research, are compatible with standard negotiation case study frameworks. Specifically, solutions in each case—solutions to an engineering problem, or proposals offered in a negotiation—can be expressed as a vector in a multi-dimensional space, where each slot in the vector represents some engineering feature or an issue in the negotiation. The value of the entry represents the particular solution for that feature or issue. While this approach may sound like an anemic description of negotiation, it is an exact description for a popular classroom case study of a complex multi-party, multi-issue land deal where solutions can be represented as discrete ordered options on 5 different issues.

Negotiation can be examined as exploration in a fitness landscape by a brief consideration of how negotiations happen at a table. Consider a group of people: some person makes a proposal, S, with a list of options that satisfy a set of issues. People being heavily driven by anchoring, the next proposal is going to be somehow determined by S, e.g. maybe a version of S with some things modified to satisfy the new proposer. Perhaps sometimes a person might make a sudden break from the discussion with a radical new proposal. As one example of a research question, this theoretical framework implies the following: when is that sudden jump helpful? And, thinking about the occasional benefits of noise in evolutionary optimization: how much is optimal? We can also consider this question in the context of practice, and ask: what can make noise more helpful? What can make the search process more likely to turn up solutions that maximize joint payoff?

The collective intelligence research paradigm, broadly considered, implies three distinct approaches to studying negotiation as collective problem-solving. The first is a direct examination of negotiation as a synchronous group process, i.e. a conversation, using theoretical models and laboratory experiments to identify factors predicting optimality. The second approach follows the crowdsourcing paradigm, and involves generating playable case studies of target issues to be solved, and inviting large numbers of people i.e. a 'crowd' to simulate the negotiation, and report their outcome. The third approach blends the crowdsourcing and the process paradigm, adapting tools from digital democracy and governance to create a platform designed around the principle of interest-based negotiation where a crowd can contribute solutions, comments, and evaluations of solutions. By recruiting

contributors whose needs and interests overlap with those of the target group—e.g., members of different groups in a climate negotiation—the resulting solutions can be evaluated not only along technical lines but in terms of their ability to satisfy all the target stakeholders.

Notes

A key strategy in negotiating complex agreements is to seek "integrative potential" which means finding arrangements that carefully align parties' needs and interests to maximize joint value, rather than focusing only on claiming value for one side (Fisher et al., 2011). In multi-party, multi-issue negotiations, even finding any agreement at all can be difficult (Kteilly et al., 2020).

This poster will examine multi-party, multi-issue negotiation as a collective intelligence process by taking advantage of a theoretical isomorphism between formal models of collective problem-solving and behavioral frameworks of negotiation. The collective intelligence framework inspires novel approaches to intervention design for improving negotiation outcomes.

The core insight of this research is that multi-party, multi-issue negotiations can be formally described in terms that are commensurable with models of problem-solving in networks. Collective problem-solving models

Fisher, R., Ury, W. L., & Patton, B. (2011). *Getting to yes: Negotiating agreement without giving in*. Penguin.

Kteilly, N., Whitson, J., Wang, C., & Akason, D. (2020). *Fillmore Lawns* [Case Study]. https://new.negotiationexercises.com/product/fillmore-lawns-2/