
Iterated Communication Through Negotiation

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Abstract

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1 Introduction

One of the first philosophers of language, Ludvig Wittgenstein, posited that "language is use" [2]. This idea, that the use of language is what gives it its meaning, is a profound statement that also has consequences for how we think of language. Wittgenstein saw language as wholly tied to its use, there could be no language separate from reality or possible use. To this end, he defined language games as games with simpler forms of language "consisting of language and the actions into which it is woven".

Recently, the AI community has taken this philosophy of language and sought to use it as the basis for the communication of autonomous agents [1]. The field of "emergent communication" seeks to understand language starting from the most basic of language games; the goal is to teach agents to communicate amongst themselves grounded in a simpler world described by some "game." This game can be one of

2 Related Work

3 Reproduction

3.1 Emergent Communication Through Negotiation

3.2 Utility

4 Exploratory Extensions

4.1 Utility Sampling

A negotiation game is not interesting if the interests of the two parties do not clash. One consequence of randomly sampling utilities is that there is no guarantee on the clash of utilities in negotiation as the players could have non-zero utility only for the items that their opponent has zero utility and negotiation is simplified. To combat this issue, it is proposed to guarantee non-zero utility to every item.

Another issue is that in the social case, one player's utilities could dominate the other's $u_j^1 > u_j^2 \forall j$. In such a case, the optimal strategy for both players is to give all items to the player with the dominating utility, and again the player. The final split is therefore pareto optimal, but doesn't feel "fair" for the

31 side of the dominated player. A similar situation for a selfish agent would generally lead to a more
32 even split with a smaller total reward. For this reason, we can experiment with avoiding domination
33 situations by normalizing the utilities so that each agents utilities all sum to 15.

34 **5 Iterative Negotiation**

35 **5.1 Pareto Optimality**

36 **6 Conclusion**

37 **Acknowledgments**

38 Use unnumbered third level headings for the acknowledgments. All acknowledgments go at the end
39 of the paper. Do not include acknowledgments in the anonymized submission, only in the final paper.

40 **References**

41 **References**

- 42 [1] Kyle Wagner, James A Reggia, Juan Uriagereka, and Gerald S Wilkinson. Progress in the
43 simulation of emergent communication and language. *Adaptive Behavior*, 11(1):37–69, 2003.
- 44 [2] Ludwig Wittgenstein. *Philosophical investigations*. John Wiley & Sons, 2009.