Human Swarms, a real-time paradigm for Collective Intelligence

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Overview

Although substantial research has explored the emergence of collective intelligence in real-time human-based collaborative systems, much of this work has focused on rigid scenarios such as the Prisonerôs Dilemma (**PD**). (Pinheiro et al., 2012; Santos et al., 2012). While such work is of great research value, thereôs a growing need for a flexible real-world platform that fosters collective intelligence in authentic decision-making situations. This paper introduces a new platform called **UNUM** that allows groups of online users to collectively answer questions, make decisions, and resolve dilemmas by working together in unified dynamic systems. Modeled after biological swarms, the **UNUM** platform enables online groups to work in real-time synchrony, collaboratively exploring a decision-space and converging on preferred solutions in a matter of seconds. We call the process *"social swarming"* and early real-world testing suggests it has great potential for harnessing collective intelligence.

Background

Humanity is a tribal species, owing our evolutionary success to our ability to collaborate in social groups (Axelrod, 1981; Rand et al., 2011). This said, modern life has expanded the scope of human interactions so widely, our tribal norms may no longer be sufficient to maintain a cooperative stance among dependent parties (Green, 2013). Even among small social groups, collaborators rarely congregate in the same place at the same time, decisions often being made via email and text. For larger groups, *discussion forums* are commonly used for distributed online decisions, with conclusions based on asynchronous user inputs such as ñlikesò and ñup-votesò. Unfortunately, asynchronous polling doesnôt leverage our natural capacity for compromise and consensus-building. In fact, recent studies suggest that asynchronous polling, as used by mainstream social media sites and forums, greatly distorts group-wise decisions by introducing biasing effects known commonly as *herding* or *snowballing* (Muchnik et al., 2013).

From Polls to Swarms

As introduced above, there is a growing need for new online platforms that facilitate collective intelligence and support collaborative decision-making without employing traditional asynchronous polling. To address this, we developed UNUM, a real-time collective intelligence engine that is modeled after natural biological swarms. UNUM enables groups of users to answer questions *in synchrony*, the participants working as a unified dynamic system through real-time feedback loops.

When using the UNUM platform, swarms of online users can answer questions and make decisions by collaboratively moving a graphical **puck** to select among a set of possible answers. The puck is generated by a central server and modeled as a real-world physical system with a defined mass, damping and friction. Each participant in the swarm connects to the server and is provided a controllable graphical **magnet** that allows the user to freely apply force vectors on the puck in real time (Fig. 1). The puck moves in response to swarmôs influence, not based on the input of any individual participant, but based on a dynamic feedback loop that is closed around all swarm members. In this way, real-time *synchronous control* is enabled across a swarm of distributed networked users.

Figure 1: a human swarm of user-controlled magnets collaborate in synchrony to move a graphical puck as a unified collective intelligence.

Through the collaborative control of the graphical puck, a real-time *physical negotiation* emerges among the members of the online swarm. This occurs because all of the participating users are able to push and pull on the puck at the same time, collectively exploring the decision-space and converging upon the most agreeable answers. But do the answers have value?

Early Testing and Results

To test the value of human swarms, we enlisted groups of novice users and asked them to make predictions on verifiable events: the outcome of the NFL playoffs, the Golden Globes, and the 2015 Academy Awards. In all cases, the predictions made by swarms were substantially more accurate than the predictions made by the individuals who comprised each swarm. In fact, in all cases the predictions made by swarms out-performed even the highest performing individual in each group. The swarms also out-performed the average polling results across the full population of participants. This suggests that swarms offer a powerful alternative to the traditional poll-based methods of harnessing the wisdom of groups.

For example, when predicting the 2015 Academy Awards, we polled 48 individuals with a written survey, asking them to predict the top 15 award categories. Using the most popular predictions to represent ñthe wisdom of the crowdò, the group collectively achieved **6 correct predictions** for the top 15 award categories (40% success). This was our baseline dataset, the low success rate reflecting the fact that this group of users had no special knowledge about movies.

To test swarming, we then selected a 7 person sub-group of the full population and asked them make the same predictions, but now as a unified dynamic system. The 7 individuals were typical performers on the written poll, ensuring equity with the full 48 person population. Each of the 7 individuals were networked over standard internet connections to a central server from different remote locations.

Working as a unified swarm, the group of 7 individuals achieved **11 correct predictions** for the top 15 award categories (73% success). In other words, a sub-group that was only 15% the size of the full population had a success rate that was nearly double. We believe this is a highly promising result and speaks to the potential for harnessing the wisdom of social groups through real-time swarming.

It should also be noted that real-time swarming is a high-speed process, all decisions made within 60 seconds or less. Thus, in addition to improved accuracy of predictions, this form of collective intelligence is uniquely efficient.

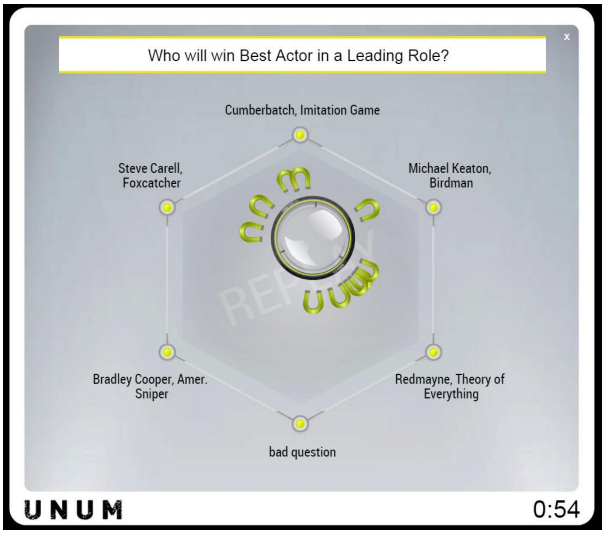

Figure 2: screen-shot of a real-time social swarm in the process of predicting the Best Actor category of the 2015 Academy Awards.

As a point of reference, experts at the New York Times made similar predictions for the 2015 Academy Awards. These experts possessed far deeper knowledge than the novice members of our study. We assume these experts invested far more than 60 seconds on each prediction made. Still, the New York Times only showed a 55% success rate.[1] Thus, a group of 7 novices, functioning as a social swarm, made predictions that surpassed industry experts. Although not conclusive, this result suggests that social swarming may provide a means of achieving expert-level insights from groups of non-experts.

Discussion and Conclusions

Why are swarms better than polls? Our analysis suggest that while polls are good at characterizing the average views of a population, without real-time feedback control, polls offer no means for groups to explore options and find consensus. Swarms, on the other hand, allow users to continually update their intent in real-time, assessing how their views combine with the other participants to achieve an acceptable outcome.

In this way, each participant in a swarm is not expressing a singular view, but is continually assessing his own personal conviction across the range of possible options, weighing his confidence and preference in real-time. With all participants doing this in synchrony, the swarm quickly converges on solutions that seem to maximize the collective confidence and preference of the full group. We believe this is why swarms are able so efficiently capture the groupôs wisdom.

We are currently conducting additional studies to quantify the effectiveness of social swarms, not just to make accurate predictions but in facilitating group decisions. Of particular interest is whether decisions made by real-time swarms are more or less satisfactory to the participants than decisions made by traditional polling. Initial results suggest that social swarms yield more satisfactory decisions than votes or polls.

Finally, to help drive exploration of social swarming, we have made the UNUM platform accessible to any academics who wish to run their own user tests. Academic researcher can request a free account at www.unum.ai

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References

Axelrod R, Hamilton WD (1981) The evolution of cooperation. Science 211:1390ï1396.

Greene, Joshua (2013). *Moral Tribes: Emotion, Reason, and the Gap Between Us and Them*. Penguin Press.

Lev Muchnik, Sinan Aral, Sean J. Taylor. Social Influence Bias: A Randomized Experiment. Science, 9 August 2013: Vol. 341 no. 6146 pp. 647-651

Rand, D. G., Arbesman, S. & Christakis, N. A. (2011) Dynamic social networks promote cooperation in experiments with humans. Proc. Natl Acad. Sci. USA 108, 19193ï19198.

Pinheiro, F. L., Santos, F. C., and Pacheco, J. M. (2012). How selection pressure changes the nature of social dilemmas in structured populations. New J. Phys., 14(7):073035.

Santos, F. C., Pinheiro, F. L., Lenaerts, T., and Pacheco, J. M. (2012). The role of diversity in the evolution of cooperation. J. Theor. Biol., 299:88ï96.

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[1] http://carpetbagger.blogs.nytimes.com/2015/02/19/oscars-2015-the-carpetbaggers-predictions/