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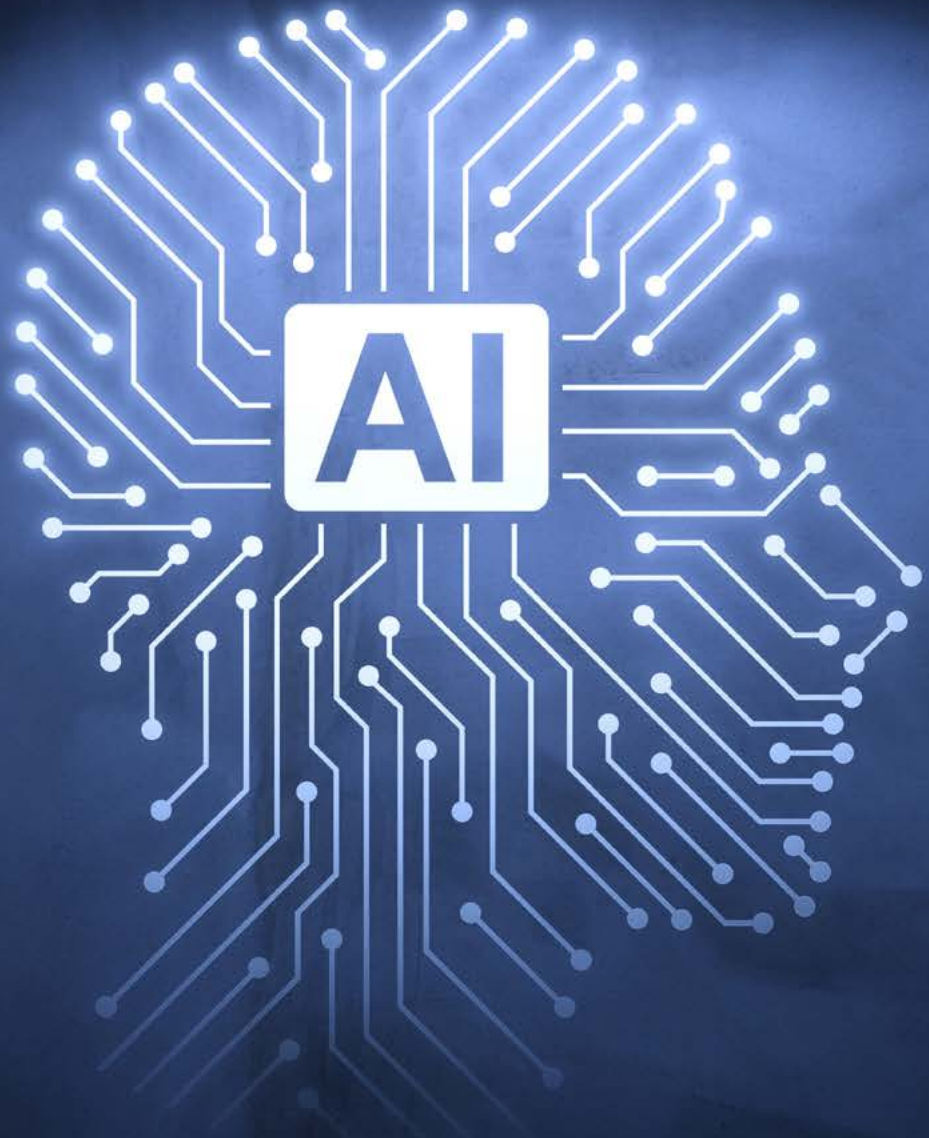

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SWARMING TOWARD NEW COLLECTIVE INTELLIGENCE FRONTIERS FOR BUSINESS

BY: LOUIS ROSENBERG, GANESH MANI, & ANITA WOOLLEY

Vox populi, wisdom of crowds, swarming, and collective intelligence are all related but slightly different frameworks that aim to elicit consensus opinions or novel approaches from a group. These frameworks are inspired by the animal kingdom, where we often observe creative, efficient problem-solving from groups of ants, bees, fish, and birds.

Can we mimic these processes for human decision-making? Researchers in collective intelligence at the Tepper School of Business at Carnegie Mellon University and partners from Unanimous.ai are evolving new frameworks for these processes. By examining how Large Language Models and chatbots can aid in this process, we can further amplify the ability of groups to harness collective knowledge to make decisions and solve problems.

This can include answering questions such as "What will inflation be next year?" (via a group of economists or business owners), "What is the best treatment for a certain disease?" (via a group of clinicians), "What proposition should go on a ballot?" (via a citizen focus group) or "Which product design should we finalize and go to market with?" (via a consumer panel).

New research on conversational swarm intelligence (CSI) conducted by researchers at the Tepper School of Business and Unanimous.ai aims to integrate two influential contributors to collective intelligence that are often difficult to integrate.

The first contributor is the wisdom of crowds. It is well known that aggregating input from large human groups can produce more accurate predictions, assessments, estimations, and decisions than most individuals acting alone can produce. However, traditional approaches to gaining the wisdom of crowds involve or require individuals to work independently to avoid bias, making it difficult to combine with a second significant contributor to collective intelligence — the synergistic possibilities of conversation.

It is equally well known that conversational deliberation is an essential process for enabling groups to brainstorm ideas, debate alternatives, surface insights, build on the thoughts of others, and converge on collaborative solutions. If we could combine these two methods, we could both leverage the wisdom of large crowds and enable conversational synergies, amplifying collective intelligence to new levels.

Unfortunately, traditional conversations do not scale. Extant research suggests the ideal size for real-time deliberation is four to five people. Above that size, the "airtime" per person quickly drops below what most people need or prefer and reduces the ability of collaborators to share ideas and respond to others freely. Once a group exceeds 12 to 15 people, it becomes a series of monologues, not a conversation. Given that, how could we possibly enable deliberation among 50 people, or 500, or even 5,000?

Research by Ganesh Mani, distinguished service professor of innovation practice at the Tepper School, and Louis Rosenberg, founder of Unanimous.ai, explore a technology called Conversational Swarm Intelligence (CSI), inspired by the dynamics of biological swarms. CSI is modeled on the dynamics of fish schools, in which thousands of members can reach collective decisions so quickly, that they can evade predators.

How do fish do this? Each fish detects vibrations in the water around it, giving it a sense of the local sentiment (speed and direction) of neighboring fish. And because each local subgroup overlaps with other subgroups, information can quickly propagate across the entire population. Of course, we humans aren't fish and can't hold conversations in overlapping subgroups. In fact, we find it deeply confusing to hear more than one conversation at a time.

Conversational swarm intelligence technology solves this using AI agents powered by Large Language Models. In particular, CSI divides large human groups into small subgroups, each sized for optimal conversation. It then adds an AI agent to each subgroup, tasked with observing the group and sharing real-time insights with other subgroups, enabling insights to propagate across the entire network.

Ongoing research aims to explore the benefits of CSI using a beta software platform called Thinkscape, currently being tested with authentic human groups.

Fig. 1. Architecture for a Conversational Swarm Intelligence with AI agents assigned to each subgroup for passing and receiving conversastional content.

(Source: Towards Collective Superintelligence: Amplifying Group IQ using Conversational Swarms)

A recent study by Rosenberg, Mani, and colleagues is a testament to CSI's potential. Utilizing the Thinkscape platform, groups who engaged in Raven's Advanced Progressive Matrices tests achieved intelligence test scores that were two standard deviations above the individual average score, and one standard deviation above the score achieved by the wisdom of crowds — the current gold standard. This underscores the capacity of CSI to elevate collective intelligence, suggesting a paradigm shift in how group decisions are approached and optimized.

Unanimous.ai has also partnered with faculty and students in the Tepper School's Master of Science in Business Analytics (MSBA) to examine some business use cases. A recent student pilot has examined how Thinkscape compares to the quality of information produced by focus groups, a common but labor-intensive and expensive approach to gathering input for business decisions. Using CSI, the platform can gather input from more than 50 individuals simultaneously to generate ideas and evaluate their relative attractiveness in a more statistically valid sample.

In another pilot, Thinkscape groups consisting of Tepper School staff, students, and alumni generated proposals to provide input to the school's current strategic planning process. In less than half an hour, groups from different parts of the Tepper School

community could ideate, elaborate, and evaluate ideas to provide actionable input for future planning.

The implications of CSI in business are vast and varied, promising a revolution in collaborative efforts and strategic decision-making processes:

• Enhanced Decision-Making: By leveraging the collective intelligence of diverse teams, businesses can make more informed, accurate decisions, mitigating risks associated with biased or uninformed individual judgments.

• Innovation and Problem-Solving: The dynamic interplay of perspectives within CSI frameworks can spur creativity, leading to innovative solutions for complex challenges. This is particularly relevant in fast-paced industries where adaptive, forward-thinking strategies are paramount.

• Strategic Planning: CSI can transform strategic planning by incorporating a broader range of insights and forecasts, ensuring that organizational strategies are robust, adaptable, and aligned with collective wisdom.

• Team Dynamics and Morale: The inclusive nature of CSI promotes a sense of belonging and contribution among team members, potentially enhancing morale, motivation, and productivity.

Conversational Swarm Intelligence represents a frontier in harnessing the power of collective human intellect, with significant implications for business practices. Complex real-world problems can often benefit from both human and machine expertise. For example, developing policy to guide emerging technologies requires understanding subtle cultural attitudes that humans can best provide and real-time analytical capabilities at which machines excel.

Integrating human and machine voices in real-time CSI deliberations may lead to innovative solutions that would not otherwise be found. Businesses can achieve unprecedented decision-making accuracy, innovation, and strategic agility by fostering environments where collective wisdom is acknowledged and actively cultivated.

The partnership between the Tepper School and Unanimous.ai has led to the development of foundational principles of CSI, and opportunities to validate its efficacy through academic research and explore its multifaceted applications in the business sphere. This demonstrates the power of the partnerships that the Tepper School develops with industry in shaping the future of organizational decision-making and strategy.

Louis Rosenberg, CEO, Founder and Chief Scientist
Unanimous.ai

Ganesh Mani, Distinguished Service Professor of Innovation Practice
Tepper School of Business, Carnegie Mellon University

Anita Woolley, Associate Dean, Research and Professor of Organizational Behavior and Theory
Tepper School of Business, Carnegie Mellon University

The Tepper School of Business and Unanimous.ai collaborated on research that found CSI helped groups of people select better fantasy football players.