Collective behavior is a universal property of biological, social, and many engineered systems. However, the study of collective intelligence—roughly, the production of adaptive, wise, or clever structures and behaviors by groups—remains nascent. Despite that, it is growing in various disciplines, from biology and psychology to computer science and economics, management, and political science to mathematics, complexity science, and neuroscience.

With the launch of Collective Intelligence, we aim to create a publication that transcends disciplines, methodologies, and traditional formats. We hope to help discover principles that can be useful to both basic and applied science and encourage the emergence of a unified discipline of study.

Collective Intelligence (the Journal) is a global, peer-reviewed, open-access journal. It will feature research articles, perspectives, dialogues, and artistic expressions, all geared toward a community of scholars in many disciplines.

In this editorial, we highlight issues in collective intelligence research where attention will aid in discovering principles, concepts, and tools needed to unify the discipline. We proceed with a light hand, guided by recognizing that our role is to facilitate deep, provocative analyses and discussions rather than to define and, therefore, delimit the field.

What is collective intelligence?

We can find collective intelligence in any system in which entities collectively, but not necessarily cooperatively, act in ways that seem intelligent. Often—but not always—the group’s intelligence is greater than the intelligence of individual entities in the collective. These entities can be molecules, cells, biological organisms, computers, organizations, software components, or machine learning systems. They may perform tasks such as identifying phenomena, making predictions, solving problems, or taking actions.

Though often characterized as an emerging discipline, collective intelligence, or at least its core ideas, can be found in many fields going back many years. Thinking about collective intelligence has a long history, including theories...
of invisible and visible hands, the organization of science, and the 18th-century Republic of Letters. Notably, the modern scientific study of collective intelligence dates back, at least, to Condorcet and Adam Smith in the 18th century. Since then, scholars in economics, computer science, sociology, neuroscience, biology, political science, physics, and management have long pondered how, when, and why collectives exhibit intelligence.

The spread of the Internet, advances in neuroscience, crowdsourcing and citizen science projects, and the popularization of research on the collective behavior of ants, bees, birds, and fishes has brought ideas from collective intelligence into daily life.

Nevertheless, the study of collective intelligence has not yet made broad use of the conceptual or technical rigor characteristic of other related fields. Compare, for instance, how the study of dynamical systems, statistical mechanics, and condensed matter physics has permitted the development of first principles approaches to pattern formation. One aim of this Journal will be to facilitate interdisciplinary cross-fertilization and encourage the creation of shared models, concepts, principles, and measures.

**Research Questions and Challenges**

It is easy to see the potential of collective intelligence research to serve as a unifying force in the sciences. Its “nuts and bolts” methodological and conceptual questions apply across scales - how to characterize minimal and optimal algorithms for aggregating and storing information; how to derive macroscopic collective outputs from microscopic inputs; how to measure the robustness and vulnerability of collective outcomes, the design of algorithms for information aggregation; the role of diversity in forecasting and estimation; the dynamics of problem-solving in groups; team dynamics and complementary and synergistic roles; open innovation processes, and, more recently, the practical options for combining artificial and collective intelligence.

Despite this potential, the collective intelligence scholarly community is currently distributed over somewhat independent clusters of fields and research groups. We hope to bring these groups together. In this spirit, we will provide space for cross-cutting research aimed at principles of collective intelligence but also for field-specific research.

How should we understand the objectives of collective intelligence in different contexts? These can include identifying an object, making predictions, solving a problem, taking action, achieving an outcome, surviving in a dynamic environment, or a combination of these. Clarity on objectives is essential to measure or evaluate collective intelligence.

What can we learn about how collective intelligence addresses different types of problems, such as the characteristics of static, stochastic, and dynamic environments? For example, if stochastic, is the distribution of states best described as coming from a fixed distribution, as produced by a Markov Process, or as deeply uncertain? If a multi-agent system, to what extent do those entities cooperate or compete? What combinations of hierarchies and various forms of self-organization—such as markets, democracies, and communities—can align goals and coordinate actions?

What causes collective intelligence? How are the core processes needed for intelligence—such as sensing, deciding, and learning—performed in very different types of collective systems? What precisely is the relationship between diversity and collective intelligence (where the patterns are much more complex than often assumed)? Or the roles of synchrony and synergy in teams? What are some non-obvious patterns, such as how a slow learning rate among some population members maintains memory? What is the role of noise (as discussed in our first published dialogue), which, while harmful to the individual, can be potentially beneficial for the collective? When can a propensity for mistakes be helpful?

How should we understand the relationships between levels? For example, can aggregate or macroscale variables be derived from microscale interactions and mechanisms, or vice-versa?

Where does collective intelligence reside, and how is it stored—in individual heads, encoded in interaction networks and circuits, or embodied in the interaction of a group with its environment?

How are trade-offs handled in different contexts—speed and accuracy, focus and peripheral vision, exploration and exploitation?

These—and dozens of related questions—are relevant to many disciplines, and each may benefit from insights derived from others, particularly if we can develop common principles and concepts.

We also note that the Journal will not be limited to academic inquiry. We aim to use it as a platform for academics and practitioners—whether in public policy, markets, or civic action—to learn from each other. For example, are market manipulations such as the Reddit-GameStop short squeeze examples of collective intelligence failures or exploitation by powerful actors? Can mechanisms for modulating information flow in neural systems or social insect societies be adapted for human systems to prevent disinformation and misinformation from spreading on social media? How can the deliberation processes best amplify or reflect the capabilities of a population? Can global bodies like the IPCC or IPBES synthesize and apply global observations, interpretations, and real-time learning?

This link to practice is vital, as a richer understanding of collective intelligence offers the potential for better design...
of the systems we depend on to solve complex, shared problems. Indeed, the Journal’s release occurs at a time of two epic collective intelligence failures: the responses to COVID and climate change. Those failures occur despite mountains of academic research, governmental actions of unprecedented scale and scope, coordinated market responses, and, for the most part, well-intentioned individual reactions. Nevertheless, these two failures alone provide sufficient reasons for starting a new journal that can accelerate our understanding of how to do better.

A note of thanks

We end with notes of humility and gratitude. We thank the Journal’s publishers, Sage and ACM, for their expertise and infrastructure, Nesta for funding open access, and our families and colleagues for their support. But, most of all, we thank the community of collective intelligence scholars whose passion, brilliance, and talents will—we believe—forge a new scientific discipline with enormous spillover and—we hope—help make the world a better place.