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Perspective

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The potential and challenges of AI for collective intelligence

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Abstract
Tackling large scale problems like climate change and the Sustainable Development Goals, requires taking a collective approach. Artificial Intelligence (AI) offers tremendous potential to enhance collective intelligence, both as an actor that contributes to the solution directly, and as a tool and mentor that helps coordinate human collective intelligence. *Collective Intelligence* invited experts and practitioners to highlight key challenges and explain how they employ AI to advance novel solutions — Christoph Riedl & David De Cremer.

Keywords
Artificial intelligence, citizen science, climate action, democracy, SDG

From artificial to collective intelligence: perspectives and on the ground experience from the UNDP accelerator labs network

By Gina Lucarelli, Erika Antoine-Souklaye adapted from UNTAPPED: Collective Intelligence for Climate Action by Aleks Berditchevskaia, Alex Albert, Kathy Peach, Gina Lucarelli, Alberto Cottica

Much attention is directed to the exponential sophistication of generative artificial intelligence models. In the context of sustainable development, the conversation tends to portray AI as a double-edged sword[1]: on the one hand, AI is believed to hold the potential to accelerate progress towards the Sustainable Development Goals (SDGs) - UNDP estimate digital tech directly contributing to 70% of SDG targets. On the other, it is feared to amplify bias and widen equity gaps among communities offline.

On climate action specifically, concrete use cases are nascent. For examples, we're learning that feature detection algorithms used on low(er) quality satellite imagery or high(er) resolution drone imagery can help detect crop disease (such as bean crops in Cabo Verde[2] and cocoa trees in Cameroon[3]), and monitor illegal pollution (like in the air in India,[4] on the ground in Guatemala,[5] the Philippines,[6] Serbia,[7] and Viet Nam[8] or below the ground in Bolivia,[9]). It's in an early stage, but this is a clear pattern emerges from 18 countries of the Global Majority via experiments led by the UNDP Accelerator Labs and its network of ecosystems.

At its best AI, and technology at large, can be used to augment and scale the intelligence of groups.[10] Combining human and machine intelligence unleashes the potential to reach 8 billion people with more of us doing our part to monitor, plan and imagine a climate trajectory very different from the one we are on. **This collective intelligence can advance climate action and the Sustainable Development Goals by generating more real-time, localized climate data; and by mobilizing more people, bringing a diversity of perspectives.**

By connecting local and indigenous knowledge to data and technology, collective intelligence approaches can help drive improve representation of local communities in climate adaption measures.[11] Smallholder farmers with access to better data about weather or climate-resilient crop varieties are able to take smarter individual actions.[12] In cities, sharing data about the real-time spread of flooding or disease outbreaks helps people take more coordinated action[13] to reduce the impact of these types of crises exacerbated by the climate crisis.

However, collective intelligence initiatives are far too few, sometimes disconnected from each other and off the radar of decision makers. Finding ways to take hyper-local collective intelligence initiatives (which are best suited for climate adaptation) to scale is a challenge. Our research and experience point to the need for a balance between standardization of data collection methods and localized citizen science. Even as we embrace some of the local knowledge that may not fit data formats, citizen data needs to be more standardized. Ultimately though, the biggest gap in CI for climate action is the use of data for decision making. Because citizen generated datasets and local knowledge are under-used by decision makers, two things need to happen. Data should be made less patchy. And decision makers need to be more acceptive towards new forms of data, stories and knowledge when allocating resources to climate adaptation and mitigation efforts.

As the world's largest distributed R&D network for the SDGs, the UNDP Accelerator Labs Network is tapping into collective intelligence to drive experimentation for sustainable development in three ways:

- by learning from farmer innovators and citizen scientists to support better climate resilient food systems,
- by learning from those in informal sectors who create value from waste to inform a broader circular economy agenda
- by continuing to apply computing techniques to tackle pollution and build climate resilient food systems, while we also build out an experimentation agenda to combat the spread of mis- and disinformation on climate and other sustainable development issues.

We call upon, together with Nesta's Centre for Collective Intelligence Design International organizations, academics, change makers and innovators to take steps to put public participation and local expertise at the forefront of climate action. For individuals looking to get involved: find (or start) a local group to collect environmental data, based on common data standards such that localized data collection can be aggregated to show environmental damage, or rehabilitation at a larger scale. UNDP Accelerator Labs are looking for new partners to build a global commons[14] for sustainable development innovation.[15]

The AI4CI loop

By Seth Bullock, Nirav Ajmeri, Mike Batty, Michaela Black, John Cartlidge, Robert Challen, Cangxiong Chen, Maggie Chen, Joan Condell, Leon Danon, Adam Dennett, Alison Heppenstall, Paul Marshall, Phil Morgan, Aisling O'Kane, Laura G. E. Smith, Theresa Smith, Hywel Williams

While Artificial Intelligence (AI) research often targets problems that are *monolithic* (help a drone avoid obstacles; summarize a document; find a bug in some code; solve a difficult logic problem), here our focus is problems that are *collective* in nature:

- help minimize a pandemic's impact by informing the coordination of mitigating interventions;
- help manage an extreme weather event using real-time physical and social data streams;
- help avoid a stock market crash by managing interactions between trading agents;
- help guide city developers towards more sustainable coordinated city planning decisions;
- help people with diabetes collaboratively manage their condition while preserving their privacy.

Developing AI for this type of problem presents distinctive challenges: extracting reliable and informative patterns from multiple overlapping and interacting real-time data streams; identifying and controlling for evolving community structure within the collective; determining local interventions that allow smart agents to influence

collective systems in a positive way; developing privacy-preserving machine learning and advancing ethical best practice and governance; embedding novel machine learning and AI in portals, devices and tools that can be used transparently and productively by different types of user. To address these challenges a productive combination of collective intelligence research and AI research is required.[16,17]

We characterize this challenge in terms of the "AI4CI Loop" — *Gather Intelligence*: collect and make sense of distributed information; *Inform Behavior*: act on that intelligence to effectively support decision making at multiple levels. While the first "aggregative" half of the loop is conventional within AI and data science, integrating it with the second "disaggregative" half of the loop in order to deliver support for individual users that is bespoke to their situational context is more novel. Moreover, combining the two halves requires new human-centered design principles, new governance practices and new infrastructure appropriate for systems that deploy AI for collective intelligence at scale.

The AI4CI Loop foregrounds key AI for Collective Intelligence research issues that range across Human, Technical and Scale dimensions (though they are interrelated and should be approached holistically). *Human Dimension*: trust (users should be able to trust the system with their data and trust the support that they are offered), representation (marginal members of a collective should be served by the system and not disadvantaged by it), and usability (system design should enable users to engage productively). *Technical Dimension*: non-stationarity (regime shifts should be anticipated and accommodated), privacy (machine learning should not compromise anonymity), value-alignment (agent behavior should be prosocial and ethical). *Scale Dimension*: Operating at national or inter-national scale can help address some of the social and technical challenges, but presents its own attendant challenges in terms of guaranteeing robustness, good governance, and environmental sustainability.

The AI for Collective Intelligence research hub[18] addresses the AI4CI Loop across five important application domains (healthcare, finance, the environment, pandemics, and cities) and two cross-cutting themes (human-centered design and infrastructure and governance), connecting AI researchers with domain-specific academics and stakeholder partners to pursue case study research projects and build capacity, capability and community in order to achieve AI for Collective Intelligence at national scale.

PSi: A scalable approach to community-led deliberation in public decision-making

By Niccolo Pescetelli and Georgina Denis

In public service, community engagement is essential for effective policy-making. Given the complexity of public sector issues—ranging from healthcare to housing and public safety—decision-makers must navigate various dependencies, uncertainties, and diverse opinions on how to proceed. By integrating the voices and expertise of diverse community members, government agencies and policymakers can create policies that are better informed, widely supported, and address the real needs of the people they serve.

However, compromising between different community priorities is a complex challenge. Public policy decisions often impact many stakeholders, including residents, community organizations, service providers, and advocacy groups. While surveys and other tools can aggregate opinions, they do not foster community dialogue. They often lack the depth needed to inform complex decisions and the transparency to create community buy-in.

Deliberation offers a solution by fostering more inclusive and transparent decision-making. By involving a broad spectrum of stakeholders, deliberation facilitates exchanging diverse perspectives to bridge ideological divides and generate consensus and compromises. In areas such as public health, housing, or environmental policy, widespread community buy-in is vital for the success of these policies.

However, as the size of the community involved in deliberation grows, so do the challenges of facilitating effective dialogue and consensus-building. Issues such as unequal participation, social biases, and information overload can hinder the collective intelligence of large groups. The scalability of conversations poses another significant hurdle, as the number of possible person-to-person interactions grows exponentially with group size.

To address this challenge, we have developed Psi,[19] an online platform for real-time group deliberation that supports decision-making on open-ended problems. Joining a PSi conversation is similar to joining a Teams or Zoom meeting. PSi leverages an iterative process where participants are randomized to small group meetings, each tasked with discussing a subset of crowdsourced ideas related to a policy or healthcare question. Participants discuss and vote on the ideas, with the most supported ones advancing to subsequent discussion rounds until the conversation converges to a deliberated collective decision. Large language models further analyze the conversations, providing a scalable approach to understanding granular data.

The key innovation of PSi lies in its ability to scale conversations logarithmically with group size. PSi ensures that the number of rounds required to reach a collective decision grows logarithmically with the total number of participants. This means that even with millions of people, a collective decision can be reached in a reasonable time. For instance, the entire UK population (67 million people) would take less than 2 h to reach a deliberative outcome on a chosen topic. Another advantage is that consensus emerges entirely from local interactions because participants directly interact only with a small subset of the larger group. The

decentralized conversation structure, over independent parallel discussions, limits the influence of any single individual and makes the process resilient to manipulation.

A recent study involving 300 Democrats and 300 Republicans in a discussion on abortion rights in the United States demonstrated PSi's robustness to polarization bias. We found an inverse correlation between how polarizing each idea was and how many votes it received during the discussion, suggesting that highly polarizing ideas did not gain traction. The PSi method was recently applied in a public consultation with London residents on police accountability and scrutiny. The consultation reached 1390 citizens and provided recommendations for the Mayor's Office and the Police & Crime Committee.

PSi offers a powerful tool for scaling deliberative decision-making in communities and governments. By overcoming the traditional barriers to large-scale deliberation and drawing on communities' collective intelligence, PSi opens up new possibilities for inclusive governance and more effective public service delivery.

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Notes

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