Scaling Sustainable Development Cooperation through Executing and Educating about General Collective Intelligence

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Introduction

Recent innovations in a decision-science called General Collective Intelligence or GCI[1] suggest that our current decision-making systems are not reliably capable of selecting optimal sustainable development solutions when those solutions have certain well-defined characteristics, and that selecting these optimal solutions might be required in order to have the capacity to reliably achieve the sustainable development goals[2]. However, GCI identifies how it might be possible to break through those barriers in order to radically increase impact on the SDGs[3], increasing the value created by sustainable development to the point that it becomes sustainably self-funding and development can be achieved not just at the scale at which funding is available, but at the scale at which it is needed. If valid, this is a profoundly important and disruptive innovation for all economies globally. However, the immediate challenge isn't whether or not the predictions for the impact of this General Collective Intelligence on sustainable development are valid. Instead the most immediate challenge is that GCI is complex enough that the feasibility of this technology can't reliably be assessed without orchestrating cooperation between a larger set of skill sets than can typically be achieved without funding, and at the same time funding isn't typically provided to approaches before the feasibility of those approaches has been assessed. This creates a catch 22 situation in which the question of whether GCI is potentially the most important innovation in the world with regards to the SDGs can't reliably even be asked by any group with the resources to answer it. As a result of this catch 22, globally there is currently zero research funding dedicated to exploring the potential impact of GCI on the SDGs. Despite a number of papers having been published on the topic in peer reviewed journals, all research is currently being conducted by siloed individuals who volunteer their time to do so, which severely limits the research that can be conducted, along with practically eliminating the possibility of interdisciplinary collaboration, which in turn results in a lack of good quality data to confirm these hypotheses, and a lack of ability to involve research influencers who typically direct research funding policy and who drive mind share, which hampers the ability to disseminate this research in high impact journals.

This paper provides an overview of potential strategies for overcoming the barriers that prevent groups from even assessing the potential impact of General Collective Intelligence on sustainability and sustainable development, as well as an overview of how educating about General Collective Intelligence creates the potential to exponentially increase impact on sustainability and sustainable development.

Modeling Social Good

According to the "collective social brain hypothesis"[4] large groups can't reliably even understand what social good actually means. If so, this is a fundamental barrier preventing any program or platform from optimizing that social good. The collective social brain hypothesis posits that human groups evolved so that individuals who see themselves as vulnerable will tend to use type 1 or intuitive reasoning in matters concerning social protection and inclusion, which includes all of our most sensitive and

controversial issues related to sustainability and sustainable development. Furthermore it suggests that their reasoning will prioritize encouraging the group to protect rights unconditionally and to expand who will be included in that protection. For the same controversial social protection issues, the theory posits that individuals who see themselves as protectors will tend to use type 2 or rational methodical reasoning to prioritize responsibility and to encourage the group to exclude those whose actions who in their opinion have made them ineligible for that protection. The challenge is that type 1 and type 2 reasoning simply come to different conclusions that can't reliably be reconciled. As a result, any conclusion that groups come with regards to what constitutes social good might be determined by the demographics of the decision-makers, and the predisposition of those demographics to either of these cognitive biases, rather than the correctness of any reasoning or of any information either group bases their reasoning upon. If discerning what constitutes social good is not reliably achievable without GCI in some circumstances, this predicts a limit to the social good that can reliably be achieved by any group without GCI, including any corporate environmental, social, and governance (ESG) programs.

However, the theory also suggests that small groups with tight social bonds personally linking people of the same and opposite reasoning styles have an innate general problem-solving ability at the group level (an innate general collective intelligence or c factor[5]) that allows them to switch between type 1 and type 2 reasoning to reliably come to whatever consensus they believe maximizes social good. In addition, the theory predicts that a GCI might provide an artificial general problem-solving ability at the group level (an artificial general collective intelligence or c factor) that allows large groups to reliably converge on an understanding of social good in a similar way.

Examples of social protection issues that are controversial and irreconcilable in large groups include those issues for which some might prioritize one's right to make choices, and where others might prioritize one's responsibility for the consequences of those choices. Either side might feel it is self-evident that they are right, but if the collective social brain hypothesis is correct then rather than arriving at our opinions because we seek out and understand reasoning that is "correct", instead we find reasoning to be correct when it is based on the opinions we are innately predisposed to have, opinions which can't reliably be swayed by any arguments or information. If to any degree people are born with these predispositions, and if these predispositions largely determine our perspectives on some of the key issues concerning sustainability and sustainable development, such as what one considers to be fake news or censorship about climate change, then the only way to resolve these issues in large groups is to subjugate or eliminate the half of the population that might have been born with the predisposition not to agree with us, or to deploy a GCI that can bridge these differences in a way that significantly increases our ability to achieve collective impact such as collective well-being or impact on sustainability. Though it might seem obvious to some that the first approach (subjugating the half of the population that doesn't agree with us) is untenable because of the impact of doing so on the collective well-being, the collective social brain hypothesis suggests that due to an effect called the "technology gravity well", in the absence of GCI all of our current organizational and political approaches towards the SDGs must effectively trend towards this far less effective strategy.

Using General Collective Intelligence to Radically Scale Impact on Social Good

A General Collective Intelligence is a hypothetical platform that enables groups to self-assemble into potentially massive networks of cooperation in order to execute collective

reasoning with what might be exponentially greater general problem-solving ability. Though a complete GCI has not yet been implemented, studies of designs of platforms approximating a GCI appear to confirm this potential for increasing impact[15]. A General Collective Intelligence uses a construct called a “functional state space”[8] to represent all possible concepts and all possible collective reasoning processes which groups might use to define problems, or through which groups might discover solutions that achieve optimal impact on those problems. A GCI also uses a separate functional state space to represent all possible processes of cooperation that might be involved in the execution of that collective reasoning, cooperation through which those optimal outcomes might be significantly increased[6].

One key benefit of GCI is that compared to ordinary collective intelligence (CI) solutions, a GCI has general problem-solving ability at the group level, as well as the potential to exponentially increase that general problem-solving ability[7]. Another is that it has been hypothesized that GCI is required to solve “collective optimization” problems in which a collective outcome is optimized by optimizing outcomes for each individual[3]. Without a decentralized mechanism for self-assembling networks of participating individuals to execute any given self-organized process, processes and participants are free to become aligned with the goals of a single individual or subset of individuals that act as a centralized process owner.

This is important because there are a great many processes involved in achieving the SDGs, ranging from selecting which SDG to target, to agreeing to how the problem of achieving that SDG will be defined, to selecting solutions. Wherever these processes are centralized they cannot be separated from being aligned with the interests, decision-making capacity, cognitive biases, or other limitations of centralized decision-makers[3]. Removing these limitations requires general problem-solving ability at the group level in order to solve the problem of decentralization in general, and therefore in order to solve every problem of introducing decentralization to every possible decision-making process. However, it is also predicted that the idea of GCI can't reliably be spread. One predicted reason is that GCI is too different to fit inside most SDG related decision-making. Another predicted reason is that most SDG related processes unintentionally limit themselves to participants who are not part of the fringes most likely to propose such radially different solutions. Processes also might limit suggestions to solutions that meet the cognitive biases of process owners (what process owners think should solve the problem) as opposed to being open to any solutions with the greatest projected fitness at actually solving the targeted problems. In addition, work that is of a greater scale than can be casually completed with in one’s spare time with a volunteer effort requires funding, and most research grants might inadvertently only provide funding eligibility to specific countries, and to people with specific academic qualifications, which again excludes people who are again part of the fringes traditionally likely to have explored such radically different approaches (such as marginalized peoples who have actually been affected by the SDGs and who are working outside the system to come up with unique solutions to solve these problems in their local context). Aside from constraining the funding for disruptive innovation so that in effect innovation can’t be too disruptive, it might also be true that this centralization in every group decision-making process other than funding decisions also constrains disruption in the same way. At a detailed level all of this is predicted to occur due to a complex interplay of factors that is so difficult to understand that these factors remain invisible. General Collective Intelligence however potentially allows this complex interplay of factors to be seen at a high enough level that it becomes simple to understand, and so that it is plain to see rather than being invisible.

The absence of GCI has implications as well. Any technology or other tool can be seen as a mechanism for improving outcomes achieved by its owner. An exponentially more powerful mechanism for individual optimization is then necessarily a centralized process that eventually might exponentially increase ability to solve problems for some single company, government, non-governmental organization, or other individual entity. On the other hand an exponentially more powerful mechanism for collective optimization is necessarily a decentralized and distributed process that eventually might exponentially increase ability to solve problems for all. Without GCI, as technology advances a phenomenon called the "technology gravity well" is predicted to cause decision-making to prioritize the interests of an ever decreasing minority of individuals and businesses at the expense of achieving collective social good, and is predicted to do so far faster than collectively optimal choices can be understood and made by any group[3].

Since one of the key goals of individual optimization is removing any limits to the ability to optimize individual outcomes, and since AI is such a powerful tool for accomplishing this goal, this hypothesis predicts that civilizations will continue to fall deeper into the technology gravity well towards more and more powerful AI until the emergence of an exponentially more powerful system of individual optimization like AGI makes a system of collective optimization like GCI impossible[3]. Since this fall into the technology gravity well is predicted to be accompanied by the removal of protections against abuse, while also radically increasing ability for corporations, governments, and other entities to be abusive, this predicts unprecedented levels of abuse and control on the part of the entity that falls to the bottom of the well first. This potentially represents a negative outcome for every entity except the one at the top of this hierarchy who would be expected to gain all possible technological advantages to control more revenue than any entity that has ever existed. The other option is to use GCI to escape the technology gravity well, which potentially represents a positive outcome for the vast majority of individuals, businesses, and other entities.

In functional state space wicked problems have a simple representation[2] as problems involving concepts that are not precisely located, and that require navigating a region that is too large for the cognition involved to be able to define those problems. In addition to spanning a longer distance through functional state space than any reasoning the cognitive system can sustain, these problems also might have solutions that require concepts be located more precisely and therefore specified with too great a level of detail for the cognitive system to be able to discover them.

The need for GCI can be summarized by the statement that any decision-making that directly targets problems through our choices, rather than indirectly targeting problems through a vastly more powerful decision-making system such as GCI that finds choices we can’t discover on our own, can’t reliably solve problems that individuals find to be “wicked problems”. This is counter intuitive, since if true it means that well-meaning people who are fixated in their belief that the solution to social good lies in any individual leader, any political, or organizational system, any education, news or other means of disseminating information, or anything else they can choose directly, rather than thoroughly evaluating indirect solutions like GCI, might actually be the ones ensuring that the most pressing problems of social good such as sustainability cannot be solved.

The simplest pattern of intervention through which GCI might impact sustainability and sustainable development is through use of GCI to scale sustainable development

cooperation to a degree not reliably achievable otherwise. This begins with modeling all possible value chains of businesses or other organizations that deploy products and/or services which collectively achieve far greater impact on sustainability and sustainable development than any single project alone, and where the cooperation between these businesses or organizations increases probability of impact so that in combination with the increase in magnitude of impact this might increase value to the point that the impact becomes sustainably self funding and can be achieved at the scale at which impact is required rather than the scale at which funding is available. GCI is also used in these value chains to orchestrate the collectively intelligent cooperation required to search all possible candidate value chains for those that maximize impact, as well as to orchestrate the cooperation required to deploy those value chains. This pattern of solution can potentially be used to target any of the SDGs through deployment of entire value chains of self-supporting local businesses that together might reliably achieve a radical increase in impact. Furthermore, where these value chains already exist, this potential to increase impact can be validated, and where those value chains are proposed but don't yet exist, feasibility assessments might be used to assess the viability of such strategies.

This however is only one pattern of collectively intelligent cooperation that might be used to radically scale sustainability and sustainable development. If general problem-solving ability means ability to solve any problem in general, the exponential increase in general problem-solving ability predicted to be possible through GCI applies to every process from design to recycling for every product or service everywhere that can be modeled with functional state spaces. When talking about reducing greenhouse gases through reducing consumption, it's important to recognize that as far back as one hundred years ago manufacturers could make light bulbs that lasted one hundred years, but they gathered together and came to agreement that none of them would make a light bulb that lasted more than a few months[9,10,11,12]. This highlights a key problem with current strategies towards reducing the consumption associated with climate change and other environmental degradation. It isn't that consumption can't be radically reduced by better engineering, but that current business models can't do anything else but reward businesses for maximizing consumption.

In recycling, modeling products and services in terms of functional state spaces and the use of GCI might enable sustainability solutions that are impossible otherwise, like radically reducing greenhouse gases through an exponential reduction in consumption as a result of an entire ecosystem of GCI based products that cooperate to become far more durable, reusable, and recyclable than could possibly be accommodated by any business model today, at the same time as using GCI to significantly increase green economic growth despite that reduction in consumption to make new business models possible[13]. Patterns of collectively intelligent cooperation that are believed to account for the majority of opportunities to increase impact on sustainability and sustainable development have been defined for use in a wide variety of engineering disciplines and for a variety of basic sciences in order to create the capacity to radically increase the societal impact of engineering and the sciences[14].

Creating the Ability to Assess the Feasibility of Scaling Impact on Social Good through GCI

There are a number of challenges predicted in validating the GCI model. One is that the collective social brain hypothesis suggests that even where GCI might be the only likely way of radically increasing capacity to solve the problem of achieving some collective

outcome such as social good, groups will be polarized between type 1 or intuitive reasoning and type 2 or rational methodical reasoning, where this polarization breaks the ability of groups to choose optimal solutions. Type 1 reasoning makes it impossible for groups to choose interventions like GCI that are not similar to patterns of interventions observed in the past. On the other hand type 2 or rational methodical reasoning is typically not effective at achieving the great mind share required to build the broad collaboration and attract the considerable resources necessary to implement such an idea. An implementation of GCI might solve this problem by bridging the polarization between these two reasoning types, but this creates the circular problem that GCI is needed to create the capacity to reliably implement a GCI, since implementing GCI is the precise problem we're trying to solve. Another challenge is that the Human-Centric Functional Modeling[8] required to define the functional state spaces necessary for the implementation of GCI, also defines a model for complexity of concepts, a model for complexity of reasoning, and a model for general problem-solving ability in comparison with these functional models of complexity. These models predict that GCI is too complicated of a concept for groups to reliably understand or communicate without GCI. However, GCI is just a model of nature's adaptive problem-solving process, and nature has already solved the problem of whether the chicken or the egg came first. Through mimicry of nature (bio-mimicry) it might be possible to copy nature's solution of implementing some small subset of an adaptive problem-solving process and using that subset to create enough value to develop more of the process itself. In other words, nature develops something a little bit like a chicken, and uses that to create something a little bit like a chicken egg, and uses the evolutionary advantage gained to develop something a little bit more like a chicken that lays something a little bit more like an egg, in an iterative process.

One goal for future work is to conduct a workshop that will use the results of surveys of computer science experts on this topic to help governments, donors, development finance institutions, and others to assess the feasibility of using General Collective Intelligence to radically increase impact on sustainability and sustainable development. The purpose of doing so is that even if it might be feasible for GCI to achieve an exponential increase in impact on sustainability or sustainable development per program dollar, donors and sustainability professionals might not be equipped with the specialized expertise in modeling and other computer related disciplines that might be required to assess this claim. In order to overcome this challenge, this prospective upcoming workshop on General Collective Intelligence and Sustainability will invite governments, donors, and other stakeholders to leverage the expertise of a range of computer science and other disciplines in order to have those experts assess parts of these claims on their behalf where required.

This survey experiment attempts to use an iterative GCI based approach to construct a complex survey from a set of very simple surveys. Beginning with a set of surveys that assess consensus among a group of specialized experts regarding a number of narrow claims in their fields, the results from this set of surveys are used in another set of surveys to assess consensus among computer science experts regarding a single broad claim based on the assumption that these narrow claims are true. The results from this second set of surveys is in turn used in a third set of surveys (table 1) to assess consensus among sustainable development experts regarding a single broad claim in sustainable development based on the assumption that the broad claim in computer science is true. The narrow claims are that "GCI can exponentially increase narrow problem-solving ability in a wide number of areas for systems that can be represented in

terms of a functional state space", and that "a wide range of systems can be represented in terms of functional state space"), where those claims are applied to a seven widely different academic disciplines (physics, mathematics, biology, psychology, computing, systems science, sustainability). The single very broad claim in computer science is that it is reasonable to assume that "GCI can exponentially increase general problem-solving ability for any system that can be represented in functional state space", if experts in a wide enough variety of disciplines agree that "GCI can exponentially increase narrow problem-solving ability". The single very broad claim in sustainability is that it is reasonable to assume that "GCI can exponentially increase impact on sustainable development", if qualified experts in a discipline such as computer science (which provides a definition of general problem-solving ability) agree that "GCI can exponentially increase general problem-solving ability" and therefore can exponentially increase ability to solve any problem in general.

Survey 1: Is it Feasible that General Collective Intelligence can Exponentially Increase Impact on the SDGs Per Program Dollar?

Question 1: Based on ***[Explanation of Method for Determining Consensus that GCI can Exponentially Increase General Problem-Solving Ability]*** do the individuals surveyed have sufficient expertise in their disciplines to validate whether achieving an exponential increase in general problem-solving ability through GCI is feasible?

Question 2: Based on ***[Explanation of Relationship Between Exponential Increase in General Problem-Solving Ability and exponential increase in impact on sustainable development per program dollar]*** if you agree that the individuals have sufficient expertise in their disciplines to validate whether achieving an exponential increase in general problem-solving ability through GCI is feasible, and if an exponential increase in general problem-solving ability implies an exponential increase in impact on sustainable development per program dollar, is achieving an exponential increase in impact on sustainable development per program dollar potentially feasible?

Table 1: *Survey to assess feasibility of achieving an exponential increase in impact on sustainable development per program dollar through GCI. The two explanations "[Explanation of Method for Determining Consensus that GCI can Exponentially Increase General Problem-Solving Ability]" and "[Explanation of Relationship Between Exponential Increase in General Problem-Solving Ability and exponential increase in impact on sustainable development per program dollar]" are provided in the actual survey form.*

However assessing the feasibility of the claim that GCI can exponentially increase general problem-solving ability is on its own insufficient to ensure that any SDGs related research or implementation activities result from this assessment. It's also essential to define a process of collective intelligence based cooperation to create sufficient value to ensure there is funding available for such activities. As mentioned, General Collective Intelligence identifies patterns through which cooperation between projects might be used to increase the value of those projects to the point those projects are sustainably self-funding. These patterns must be employed to raise funding for initiatives that are more inline with the objectives of existing SDGs research, engineering research, and other funding programs, but that each might also incorporate funding for part of this

assessment so they together they fund all of it. Aligning interdisciplinary cooperation between research projects in this way might ensure this feasibility assessment is made despite it falling outside conventional lines of inquiry.

A School for General Collective Intelligence

Validating the applicability of GCI to the wide variety of disciplines in engineering and the sciences involved in potentially every process along the entire life-cycle of every product or service involves research across this wide variety of disciplines, and disseminating this information at scale requires creating education in the areas of this research. All of this involves more effort than can be justified in the budget of any single SDGs research project. In order for the exponential increase in impact predicted with GCI to be feasible, there must be some means of increasing the number of sustainability or sustainable development projects that can benefit, so that the economy of scale reduces the proportion of funding required to be allocated towards research and education in the use of GCI to increase impact on sustainability and sustainable development, so that allocation of this funding toward GCI is feasible in relation to the funding allocated towards the SDGs themselves.

The design for one currently targeted program of collectively intelligent cooperation involves launching a School for Collective Intelligence, which will offer four year degrees in engineering and in the basic sciences on how the use of Human-Centric Functional Modelling and General Collective Intelligence might radically increase the societal impact of those engineering disciplines and basic sciences[14]. The larger goal is to use this School for Collective Intelligence to ensure there are a sufficient number of engineers to support a Collective Intelligence based Program to Accelerate Achievement of the Sustainable Development Goals (CIPAA-SDGs) that has also been designed, and which is intended to drive the investment of hundreds of billions of dollars in sustainable economic development through collectively intelligent projects that being sustainably self-funding can reliably be deployed at this scale.

This CIPAA-SDGs program is being designed to ensure sufficient labor demand to fund this education. But initial research must first be conducted using public research funding to elaborate how GCI might be used in each engineering or science discipline. This requires either a centrally managed project funded through a single massive grant, which as in the case of other large projects like CERN might take decades of lobbying the engineering and science advisory bodies of multiple nations, or it requires organizing multiple individuals to apply for separate grants, where their activities are aligned so that in aggregate they meet the demands of this meta-project. Due to the predicted technology gravity well, which suggests there is only a limited time window to implement GCI before the natural evolution of technology makes it impossible, waiting decades to launch GCI might introduce unacceptable risk to global plans to achieve the SDGs. The alternative is to continue to spread knowledge about GCI through the low impact channels that have so far proved accessible, until some funding source becomes available that lacks the constraints to eligibility, the constraints to solutions allowed, and the other constraints that currently prevent funding research on GCI from being reliably achievable by the outsiders who have conceived it.

Conclusions

GCI is predicted to have profound capacity for impact on the SDGs, where that impact is not predicted to be reliably achievable otherwise. However, existing decision-making processes involved in organizations tasked with achieving the SDGs might lack the

capacity to reliably detect the fact that they might be incapable of achieving the SDGs without GCI, and also might lack the capacity to assess the potential of GCI to overcome these barriers. Furthermore, though applying GCI to the various engineering and science disciplines involved in processes along the entire life-cycle of potentially every product or service might radically increase the sustainability of those processes, as well as our collective ability to achieve sustainable development, it might be true that without GCI being incorporated into the funding allocation process, the research required to do so can't reliably be funded. However, the flip side is that lack of sufficient collective intelligence to collectively understand these effects implies that outcomes are unpredictable. This very same unpredictability means that any of these barriers might suddenly and randomly be overcome to a degree too great to ever be anticipated.

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