

Collective Intelligence

Towards a Conversation

By Liam Kavanagh, PhD



Art / Earth / Tech

Collective Intelligence	3
I. What is Collective Intelligence?	4
To Define or not to Define — A preliminary question	4
Some quick arguments against strong definitions of Collective Intelligence	5
Longer Conceptual Clarification	6
What is Intelligence?	6
What are Collectives?	8
“Collective Intelligence” as the Name for a Conversation	9
II. A Dozen issues in Collective Intelligence	10
1. What kind of collective intelligence can best understand collective intelligence?	11
2. Diversity and Expertise	11
3. Collective Wisdom	13
4. Addressing the Western Cultural Attitudes Towards “Rationality”	14
5. Recognising the importance of culture?	16
6. The Importance of Trust	17
7. Can techno-fetishism be remedied?	19
8. Questioning the Metaphor between Individuals and Collectives	20
9. How can we get more good unsolicited advice?	20
10. Environmental Degradation as Demonstration of the Need for Collective Intelligence	21
11. Managing Manageability	22
12. Is the sky the limit?	22

Collective Intelligence

This paper explores the basic idea of “Collective Intelligence” – the ability of groups of people to take intelligent collective action – and raises a number of issues in this area that intersect with Art Earth Tech’s broader interest in a wiser society. Collective Intelligence (CI) is exciting in that it depends on emerging science of the mind whilst recognizing the need to look beyond individual, isolated brains towards group thought and action. This is especially important to consider in the present moment, when new possibilities for group deliberation are being created and perfected all the time using information technology.

Collective Intelligence might seem like an unnecessary addition to the list of social sciences, which have long been concerned with how groups of humans function. But investigators of collective intelligence are specifically interested in understanding how groups think well and in conceiving of new ways in which they could think better, using ideas from social science as well as information technology. Collective Intelligence research may help group processes improve in a similar way that research on individual thought has helped individuals engage in meta-cognition -- to monitor their own thought for biases or shallow and hasty thinking. For example, researchers at the MIT’s center for collective intelligence have looked at the factors that predict the quality of small groups to perform tasks[1], showing that evenness of input and emotional intelligence play a huge role. Thinkers like the influential researcher Cass Sunstein and Geoff Mulgan, the founder of Demos, are interested in identifying the principles that will allow us to assemble new intelligences composed of individual minds and information processing technologies [2,3]. All of these researchers agree we are in the early days of the field.

In this paper, I try to clarify the concept of Collective Intelligence for readers, arguing that, though it is misguided to expect a perfectly precise definition of Collective Intelligence, it can be usefully be thought of as the ability that allows a group to learn to take useful actions over time. This applies to groups that act in a centrally organized manner (like in a bureaucracy), or in a decentralized manner (as in a market). Just like human intelligence, we will not find a single cause for this ability, but probably a number of principles that

contribute to groups' effective functioning. Rather than trying to deduce these principles, I then move on to identify a number of issues in Collective Intelligence that are of interest to people interested in promoting a wiser world.

I. What is Collective Intelligence?

Collective Intelligence can be thought of as the ability of a group of people to learn about complex and changing circumstances and respond usefully. This is an area of rising interest, for example Europe's largest research charity, Nesta, has begun funding programs in Collective Intelligence, and MIT has started a centre for CI. At the same time, innovations that provide means of pooling collective knowledge, such as wikis, prediction markets, and online forums, draw a great deal of public participation and news coverage.

A major reason for this growing interest in Collective Intelligence is that we live in an age of growing complexity and information overload. The amount of work required to understand the issues of our complex society is always increasing, ever farther out of the reach of an isolated individual. Fortunately, we are equipped with an ever expanding set of technical tools for sharing and organizing information, as well as unprecedented advances in our understanding of individual humans minds. There is both great need and seemingly great potential to achieve greater Collective Intelligence, but we are really just getting started on creating a real science of Collective Intelligence.

To Define or not to Define — A Preliminary Question

The emerging possibilities for networks of minds and machines, and the many applications of them, means that our potential for Collective Intelligence is changing all the time. It may seem reasonable to some readers to eschew the pursuit of neat definitions, grand algorithms, or a unified theory of Collective Intelligence, at this stage. Instead, the most interesting way of studying CI might be to look at specific issues that we face in putting together minds within a cultural, technological and organizational context so that they arrive at useful actions. After looking at a variety of such related efforts, principles will tend to emerge.

At the same time, some consideration of what we mean by “intelligence” and “collectives” will be helpful, especially since experience shows that Collective Intelligence strikes many people as an unuseful and vague concept. I therefore start with a preliminary discussion that, whilst not providing a precise definition, might convince readers that the study of Collective Intelligence is something that has substance.

Some quick arguments against strong definitions of Collective Intelligence

1. Artificial Intelligence does not define intelligence precisely, despite trying to create intelligent machines. There have been efforts to define intelligence, especially in the early days, but nothing more precise has been agreed upon than Turing’s original notion that something was clearly intelligent if it could fake being human [4]. Ambitious people want to get machines to pass the Turing test (successfully fake being human), but they spend relatively little time asking what intelligence is and a lot of time looking at how intelligent things (like humans) work, and getting machines to work similarly, often by using general principles they notice in humans. By analogy we might wonder if a precise definition of collective intelligence is needed.

2. When I took my first graduate course in Neuroscience with Professor Vilayanur Ramachandran, he chastised us for fretting over definitions. “People argued endlessly about what life was,” he said. “All of that didn’t matter much, eventually by studying living things, we found DNA and now you could define life as things that have DNA”. This is a good story, but defining life as things that have DNA is still arguable. If a machine that is smarter than humans comes along and reports conscious experiences of deep feeling, we will probably agree that it is alive, even if it doesn’t have or even want children. I told Rama this, and he chuckled, and agreed without concern -- the central point remains: the study of life has clearly come a long way without anybody coming up with a perfect definition of life. In a similar example, physicists cannot define what “physical entities” are, and no major advances in the field have been made by thinking about what physics is, rather past study of particular interesting phenomenon like stars,

falling objects, and magnets have resulted in useful concepts like “matter” and “energy” that would not be recognized by early investigators like Galileo. Now if physicists are forced to define physics many will say “the study of matter and energy” (see [5] for more detailed discussion of these points, grounded in cognitive science).

Longer Conceptual Clarification

I think the concept of Collective Intelligence does not have to be precisely defined because the concept, itself, is unlikely to be used to make precise explanations of *how and why* groups work well. Instead “Collective Intelligence” is something that we assume a collective to have when we believe that it behaves usefully. The term “Collective Intelligence,” can also be used to refer to a particular area of study or conversation, which focuses on the factors that allow the collective to think and act usefully. The use of the term is not less specific or more vague than is the common usage of the term “Artificial Intelligence,” which both refers to something that machines have that allows them to solve hard problems, and to a field that tries to figure out how to get machines to solve hard problems.

Still, considering the concepts of intelligence and collectives might be useful for achieving the feeling of clarity that people are after when they seek definitions. One can get to know a concept, gaining a feel of what it can do or cannot do for you, without making it totally precise [see 5].

What is Intelligence?

Something is intelligent when it can manage to adjust its behavior in a way that works. Observers decide whether a behavior has good consequences (as in a robot that passes an obstacle) or amounts to a correct answer (e.g. does an AI correctly identify a pattern as a cat). We say that organisms are intelligent when they change their behavior in ways that help those organism live well. When dealing with a machine, we generally say that a machine is intelligent when it is observed doing something that benefits its user, or fulfils the purpose that the designer had for it. With collectives we likewise say the collective is

intelligent when it shows that it can change its behavior in a way that benefits its members.

We don't really explain a behavior by saying that shows intelligence. If you ask a friend how a dog managed to let himself out of the house by opening a doorknob, your friend might tell you "I don't know, he's just smart" — but this actually sort of a circular explanation. This is another way of saying, "he did what works because generally he does what works". Our friend would say that dog was "lucky" in opening the door if the dog often failed to learn simple things. But if the dog has responded effectively to many situations in the past, our friend decides that it has "intelligence," a mysterious thing that causes him to act effectively in many areas. So by calling something intelligent we do not explain *how* its useful behavior happens, rather we identify a specific useful behavior as part of a general pattern of useful behavior. Knowing that the dog is intelligent means we won't be surprised by the dog's next useful behavior, but this knowledge doesn't help to explain just how the dog figures out how to open a door.

We can get sophisticated, and conceptualise different kinds of intelligences, but those concepts only allow us to be more specific about what kind of past actions make us expect what kind of future actions. We say somebody has "mathematical intelligence" when they show an ability to solve math problems, but do not necessarily use words very well, and this helps us expect future good performance in math, but doesn't tell us much about how math is done. At most the fact that verbal and mathematical intelligence can be separated implies that you will need different explanations for mathematical and verbal performance, but still contributes little towards either of these explanations. Analogously, by using the term "collective intelligence" we indicate that we need another explanation for group intelligence than we need for individual intelligence, but seeking better definitions of CI may not help us find this explanation.

Artificial Intelligence and the cognitive sciences try to explain intelligence not by refining the concept of intelligence until it is perfectly precise, but by examining the many ways the brain and mind work, or trying to produce intelligent machines (e.g. machine learning methods are inspired by examining neural networks). For example, improved

explanations of mathematical and verbal intelligence have come from showing that the brain specialises into various parts that have particular abilities that help with different tasks for example spatial areas are involved in mathematics. As the variability of approaches just within the human brain implies, there is not a single correct answer to how intelligent behaviour is formed -- but there are also overarching principles in the way the intelligence works, which have been used to create some of machine learning technologies that grab headlines today. It seems quite possible that the same is true of Collective Intelligence -- there are probably some principles but there also may not be a single answer to the question of how CI is achieved.

So, in short, Collective Intelligence is not a term that we will use to create explanations of behavior, it just describes the kind of (collective) behavior that we are interested in producing and explaining. As we are not using it to make rigorous and precise explanations, I am inclined to believe that it doesn't need more precise explanations than have already been offered.

What are Collectives?

A collective is a group of people, but are all groups of people collectives?

It might be tempting to say that groups must actively and consciously work together in order to be viewed as having Collective Intelligence, but we think of markets as having a sort of Collective Wisdom, even if their members don't think of themselves as working together. Groups such as corporations, and bureaucracies recognize themselves as a collectives, and take intentional actions to address goals, they sometimes show great intelligence, but for different reasons than free markets. I think that neither intentional or unintentional collectives should be neglected, because if our end goal is useful action, it doesn't matter whether "group intentions" were necessary for those actions.

To get started investigating Collective Intelligence, the important question is: "What groups can we look at, in order to find some principles of how groups can effectively

‘decide?’”. An investigation will narrow naturally when we limit ourselves to questions about collectives that are *tractable, interesting, and important*.

1. For example asking “how does the French Nation collectively decide how to act together to make the best collective life?,” is an interesting and important question but not tractable because there are simply too many things going on in the French nation’s shaping of its life for a rigorous understanding to take place within a workable project.
2. Asking how the collectives known as markets arrive at the prices of industrial commodities like coal might be tractable and important, but might not be as interesting as other topics if we believe that economics already has good explanations of such phenomenon — many less studied phenomena are waiting to be investigated.
3. Asking how Pétanque Teams decide about strategies, might be fascinating from a purely strategic point of view, and might be tractable because the game’s rules are simple, but it may not be very important in the greater scheme of things. Winning Pétanque games is not a matter of grave importance, and the game has a quite unusual structure, so generalizing what we find here to more impactful settings would often be quite difficult.¹

“Collective Intelligence” as the Name for a Conversation

It might be more interesting to view Collective Intelligence not as a concrete entity, but a term that points towards a conversation or field of inquiry.

Practitioners of the various social sciences have long thought about groups as being dumb or smart, and so we might ask why there is a need for a new conversation about Collective Intelligence. I would point to three different developments:

¹ Some academic research would go into this kind of question. This could be interesting if the game lent itself to studying broadly applicable theoretical questions about collective intelligence that we really thought was important, but which could be answered by using Patangue as a case study.

1. There is growing sense that on a social scale we haven't really figured out how to make decisions in the best way possible. Global warming is a great example of this, but there are many others.
2. Accumulated knowledge in the various sciences studying human behavior and "information processing" may have given us a better basis for thinking about collective intelligence.
3. There is a growing sense that various disciplines studying society must come back together somehow. Perhaps it seemed reasonable, at some stage, that the divided social sciences would converge back together as they progressed towards a common truth. This development doesn't seem to be just around the corner. Interdisciplinary exchange on tractable, interesting, and important questions about how collectives can work better seems a more practical approach to bringing divided expertise together.
4. Information technology and artificial intelligence are creating new possibilities for dealing with information on the social scale. This creates a demand for rigorous ideas that could inform the use of technology and the formation of new institutions.

These developments point to the need for a new conversation. Collective Intelligence can be the name of that conversation. Words that seek to define the borders of big conversations are usually vague -- biology and physics are not well defined terms -- so insofar as we use "collective intelligence" to describe a body of inquiry, we shouldn't be too frustrated by its lack of definition. It will be more frustrating if we do not find that studying one collective intelligence issue helps us to understand other issues, as well.

Keeping with this approach, I raise some issues to stimulate useful conversation and experimentation, with both immediately practical and "bigger" social implications.

II. A Dozen Issues in Collective Intelligence

These are a dozen issues that are interesting in Collective Intelligence, some drawing on previous work, and some pointing to issues that have not been as thoroughly considered. I offer these as food for thought, that hopefully will stimulate people to think about issues are of the most personal interest to them. Please suggest your own issues!

1. What Kind of Collective Intelligence can Best Understand Collective Intelligence?

Collective Intelligence is too big a topic for any one person to be expert on all of the relevant aspects. Like other complex subjects, it is best studied by a thought community capable of pooling expertise. The meta-level of how best to study its subject, as a collective, is a challenge that is directly within the subject matter of the field. The issue is not only identifying existing expertise and interesting cases of CI, but designing methods to integrate the expertise and collaboratively investigate interesting examples of CI.

Foreshadowing a recurring theme in this set of 12 issues, it is worth contemplating the role of emotional attachment in combining perspectives on Collective Intelligence. Putting together perspectives from many backgrounds is necessary, and people from different backgrounds have different views, to which they can be very attached. Creating a space or a culture in which these can be discussed openly and which emotional support is offered seems very important, and in line with what Art / Earth / Tech has already been doing.

2. Diversity and Expertise

An extremely important aspect of a group's intelligence is its diversity -- in background, information, and perspectives. Basically the more information, and ways of looking at a problem that we have to choose from, the more likely we are to find an approach that works, and, at least for many problems, the average of many persons opinions tends to be better than any one person's opinion.

A sexy example of this is prediction markets, which predict a great number of phenomena with surprising accuracy. The secret here is basically that a great number of independent perspectives are pooled in order to come up with a range of bets on an outcome. The average bet is often stunningly accurate. Research also shows the more diverse are the participants in the prediction market, the more accurate are its outcomes. An important element of these markets is that participants can increase the weight of their opinion by "gambling" more in the market, so that a few very sure contrarians can counterbalance

many misguided people. In many pursuits, prediction markets outperform experts by substantial margins.

The flip side is that communication and consensus can be more difficult with more diversity, and technical expertise is still important. A lesser known aspect of betting markets is that casinos regularly do not balance their bets -- that is, casinos stand to win or lose money depending on the outcomes of games. Regularly, the casinos bet against the public and win using sophisticated statistical models assembled by experts to do the job. The trick is that these models are refined by using thousands of past games that are very similar to any particular game, so the Casinos already have all of the relevant data brought to bear on the problem. The strength of markets, as recognised by Hayek, is to bring information that is not widely available to bear on a single price but sometimes experts can organise a huge amount of relevant info in a very principled way so that they know better than the crowd.

Creating diversity of perspectives can be done by getting more diverse group members, but also by group procedures. To take a simple example, group brainstorming on a new issue is less effective than individual deliberation on the same issue, followed by group discussion. Individual deliberation allows for a truly independent perspective to be developed by each group member, before these are combined through group deliberation. Maintaining independence of thought is not easy in contexts where repeated interactions between group members is necessary.

“Groupthink” is a name for a notorious phenomenon in which the group comes to simply reflect the opinions of a few members, who speak first, loudest, or have a high position, while the rest of the group simply agrees with those members, so there is no diversity of influence on the collective’s opinion. The agreement is then taken by these influential members to be evidence of the correctness of their views, creating a false confidence, which allows them to overlook evidence that is contrary to their opinions. In general preventing too quick of a convergence, and allowing dissenting voices and rare and troubling information to be heard are agreed upon by researchers as big concerns facing groups [6].

3. Collective Wisdom

It is worth asking how “collective intelligence” is different than “collective wisdom.” Intelligence is intuitively more identified with solving technical problems, but resolving emotionally charged disputes within oneself and with others is more associated with wisdom. In collectives, more wisdom is required on the part of individual members in order to reach satisfactory outcomes of any kind, including fairly technical ones.

For example, most would agree that group conversations can be compromised not just by a lack of brainpower, shared vocabulary and experience, but by the temptation to overindulge in the pleasure of speaking, by the difficulties of disputing calmly with sensitivity to others’ concerns, by hesitance of expression, and by inability to let go of opinions.

Research has begun to back up this intuition, showing that the factors that most help a group be greater than the sum of its parts are: average ability in mind reading tasks (emotional intelligence) the tendency to take many turns in speaking, and the number of women in a group [1]. These three measures make up the MIT research group’s “Factor C,” which is independent of average group IQ, and correlates more strongly with group performance of a variety of difficult tasks.

There is no accepted measure of group members’ attachment to their preconceived notions in psychology, but many would agree that this introduces a lack of ability to consider certain possibilities, and thus the means by which certain ends are pursued can be restricted. If a standardised measure of non-attachment were developed it might also correlate very strongly with group performance.

Another way in which wisdom is distinguished from intelligence is that it involves keen intuition. At a social level, our information processing relies heavily on language, measurement, and explicit rational argument, while intuition may play quite a different role than it does within the individual. This is especially true as regards information technology based solutions. Perhaps Collective Wisdom and Intelligence would benefit

from special consideration the role of intuition in group conversations, especially large group conversations, and practices which would allow intuition to be put to its best use.

One way of distinguishing between intelligence and wisdom is that intelligence is the ability to find a means of reaching certain ends (“how should I reach my goal?”), while wisdom is the ability to determine worthy ends (“what is my goal?”). “Values” is the term used to describe why our goals are the way that they are. If many of the hard questions (from immigration policy to choosing our group’s next topic of discussion) ultimately come down to a question of values, then perhaps we are really after collective wisdom. Broaching values is almost synonymous with politics, and makes our conversation difficult, but it seems wise to simply accept the sources of differences and try to find a way to address these, rather than skirting the issue.

4. Addressing the Western Cultural Attitudes

Towards “Rationality”

Any view of “human nature” will influence the way that we organise ourselves and conceive of the challenges of collective action. The West has a very particular ideal of rationality which tends to shade into a belief that people are actually “rational”. There is very little evidence that people are naturally dispassionate thinkers. Beliefs and actions are shaped by political ideology [7] conformity, the desire to avoid shame or inferiority from being wrong, the allure of wishful thinking, and so on [8]. Despite this, disputing individuals often describe each other as “stupid” rather than as emotionally attached to their self-image, group approval or other personal interests. If we could really see belief systems as the result of attachments to feelings, then perhaps we could deal with them better.

When an individual’s behaviour and thought manages to approach the ideal of rationality, it is often through cultivating an emotional attachment to a positive view of themselves as intelligent and rational. There are reasons besides vanity for maintaining a skeptical and rigorous disposition to information and ideas, this may help us find out what is true (to arrive at stories about the world that can survive examination), which can be useful and

intellectually pleasurable. Examining our beliefs is not always great fun, though, so we have emotional incentives to abandon rationality sometimes, as well.

Since everyday life and human history has powerfully shown us the benefits of trying to hold beliefs that can be tested according to their own standards, society is generally socially approving of feats of cleverness and level-headedness. Gaining respect and approval from others for one's "brainpower" is very inwardly satisfying in terms of pride, self-regard, and confidence. Gaining a taste for these rewards tends to involve an attachment to a self image of being intelligent, skeptical and rigorous.

This attachment has both good and bad consequences. The drive to gain approval for rationality, smartness or even genius, is simultaneously an incentive to confront facts and create impressively smart explanations. On the other hand, Egoic attachment to one's self-image as smart or rational can create a need to prove one's smarts to oneself and to others. This makes disagreement among those with an attachment to their own high ability for rationality challenging, as the correctness or incorrectness of each person's views is seen to reflect on this ability. Problems emerge because not everybody can successfully be driven by an ego attachment to their superior intelligence and rationality, unless they all privately cling to the truth of quite different personal answers.

There are some issues on which we tend to converge. The law of gravity is widely accepted, and there is a lot of agreement over the way to treat a cold or how to set up a computer. Such agreement tends to arise in "technical" areas. The simple explanation for this is that technical domains are those in which there is often no emotional payoff for holding beliefs other than those that can stand up to testing, and in these fields beliefs tend to more easily falsifiable, so clinging to an opinion is difficult. For example if one way of building a bridge is easier, carries more weight, and is less expensive than another, we are often forced to agree that the way of building a bridge is better and converge on building bridges in a similar fashion.

As soon as people get emotional incentives to believe a particular technical theory, though, it becomes political — for example, if two people built different bridges using two

different described above, we would be unsurprised if they are not straightforward about the difficulty, cost and effectiveness of their own bridge, giving onlookers difficulty learning from the two examples. Bridge performance and design is relatively easy to check, and so the merits of the two bridges will come out, in the end, but not all technical disputes are as easily resolved.

In another example, the publication process in science is widely agreed to be contentious, emotional, and political, with authors developing deep emotional attachments to their ideas and experimental findings supporting a certain view of a particular political. With theories, patterns of evidence and methods of analysis that are beyond the grasp of all but a few specialists, resolving disputes can take decades. The Collective Intelligence of science thus suffers.

So when one's argument is hard to prove, and pride or other interests are at stake, bad ideas are discarded more slowly. Here, defensiveness and biased (sometimes surreally so) arguments in favour of one particular way of seeing and doing things tend to crop up.

Another way to approach to achieving good decisions might be for group members to reduce emotional attachment to ideas, be less abrasive, develop greater appreciation of knowledge for its own sake, and cultivate a sense of duty to the whole group that will help to alleviate individual ego concerns. Not everybody can be a standout scientist and derive warm feelings of pride from their skill in rational thought and argumentation, but we all can enjoy the pleasures of a clear and inquiring mind, we can all appreciate that developing our own perspective is important for the health of the group.

5. Recognising the Importance of Culture?

Culture means the shared ideas, customs, and social behaviour of a particular people or society. In other words the stable cognitive and behavioural patterns of a group. Culture is very difficult to think about precisely because this single term refers to a sweeping variety of practices and beliefs (see e.g. for review of the wide variety of perspectives on culture.) On the other hand, the question of culture won't go away. As mentioned in the discussion of rationality above, the cultural values that reinforce critical thinking, open debate and

freedom of expression are other values that we take for granted that are hugely important for collective intelligence. The “soft” subject of culture might not seem like the first place to look for improvements in collective intelligence, but this is a thought that we might want to reconsider. Not just what cultural practices are best, but how to promote them, is a hugely important question.

6. The Importance of Trust

Trust is important at all levels of organization from small groups to society as a whole -- if we want to collaborate to understand the big picture at all we must be able to trust sources of information, if we want to do something collectively, we must trust one another's work. It is impossible to avoid the need to trust when there is too much work for each person to check all of it.

Interpersonally, repeated experience with a person, their effectiveness and conscientiousness, knowledge of their reputation, and social bonding may help to create trust. In organizations, the salary and performance feedback can be additional solutions to the problem of trust. However many societies seem plagued by a lack of trust outside of the confines of tight knit groups and formal organizations. Distrust in institutions such as government, business and science results in inability to act on issues such as global warming or to accept vaccination recommendations. Much of the allure of creating institutions in the first place is that they can create not just capacity for performing information gathering and action, but a reputation that makes their conclusions and actions legitimate in the eyes of many, allowing collective action. Institutional reputation has declined significantly, however.²

New possibilities for building trusted information outside of social interactions might be suggested by platforms like wikis or prediction markets, but within a limited range of activities. The essence of these is that many people check each other's work, and a trustworthy source emerges out of relatively anonymous interaction. On the other hand Wikipedia relies on the ability to agree on facts, and its rules stipulate that participants

² <https://hbr.org/2017/01/survey-peoples-trust-has-declined-in-business-media-government-and-ngos>

report accurately what is already agreed upon as fact or in summarising views. It is not clear that Wikipedia encourages convergence on what to do, it may only be a good central repository for collecting what has already been said about what should be done. We probably won't bet on prediction markets to tell us exactly how cancer can be cured, even if they might slightly improve our ideas about when a cure will happen and its general characteristics.

It may seem that more direct involvement is necessary to make up for reduced faith in institutions, but it is worth considering the difficulty in creating trust in a group. Suppose that I mistrust government guidelines. I really want to get down to the bottom of organic food's health benefits, so I get together with a group of friends that I trust completely, who agree to go into these issues, looking at the science, criticisms of that science. Imagine, for the sake of argument, that we all decide that there are real health benefits that surprise us, despite our optimism about organic food. After all of this, we may become activists, but how shall we convince others? If we were to assemble our own version of the evidence it will be just another report, to go with the dozens out there. Unfortunately, digesting any convincing summary demands a level of detail that may be challenging to all but the most devoted of readers.

Our hypothetical group might save some time for others, who do not know us, by a synthesis and explanation, but perhaps only to a certain level that is still too high for most people to afford, perhaps even if we explain it in person. Even then others must at least trust that we've thoroughly looked into research and aren't omitting important facts. So our trust within the group does not easily turn into action, for anybody outside of the group. One approach is for groups (like me and my friends) to form a new institution, and slowly build a reputation and gain trust. This however takes a great deal of time, and so it is worth investigating other possibilities.

One question is whether existing interpersonal connections can be leveraged more effectively to create social change. Political campaigns have long known that recruiting people who can speak local languages effectively is the way to make inroads on contentious issues, but mobilization of large groups of people to shift opinions tends to

happen only irregularly. Are there ways of changing this process or speeding it up using advances in understanding of minds or new technology?

No easy answer presents itself, at least to me. One small way that research may contribute to rebuilding trust may be to convincingly link the values of institutions and society to decreased collective intelligence. Listening to the concerns of Brexit and Trump voters, nationalist movements, and those mistrustful of institutions generally reveals that the skepticism of institutions may stem from skepticism of the motivations of those running them. It seems many are simply not convinced that the government, business or most NGOs care about them, and are honest. This again hints that collective intelligence, even (especially?) at the broadest social level, is a problem of emotional and cultural concern. Just saying this, is not enough, the hard work may be to show convincingly what specific values (or lack thereof) are behind (perceived) collective dysfunction so that something can be done.

7. Can Techno-Fetishism be Remedied?

Appropriate expectations for technology is a pressing topic for our times. To the extent that we think that new technologies such as block chains, data scraping, apps, and wikis will solve our information problems for us, we will not do the hard work that is necessary to put our heads together. As mentioned, new technology may open up exciting possibilities, but as Evgeny Morozov has argued with regards to democracy, we often mistakenly assume that information technology will lead us to better, more open and freer outcomes. Actually, plenty of dictatorships use technology to increase their power (as do terrorist organizations). Similarly, it is dangerous to assume that CI will “just happen” due to new tech.

Part of the means of combating techno-fetishism is achieving faster synthesis of the possibilities and limitations of new technologies. For many reasons, the rate of innovation ever more greatly outpaces institutions capacity to convincingly consider, on behalf of society, the possibilities and limitations of emerging technologies. Expertise in the technology itself is not easily recognised or put together with the expertise needed for a specific implementation. Also decisions not to use a technology or abandon it after an

experiment are not as widely reported as decisions to use it, leading to undue optimism. Though we will never develop a means of quickly figuring out exactly what tech can and can't do, faster and more useful anticipation of technological possibilities is probably possible if we address these difficulties.

Just as important is a real reckoning with the tendency of our imaginations to run wild with the possibilities for new tech. Hype cycles such as the. Dotcom bubble, cryptocurrency mania, 3D printing, block chains mania, and etc seem to explode despite the fact hype cycles have been accepted as a fact of life within the tech industry for decades, showing that it is very hard to manage expectations. In order for us to use technology to manage the future, we may require a serious reexamination of our assumptions about it.

8. Questioning the Metaphor between Individuals and Collectives

A great deal of ill results from "personifying" large groups of people. For example, we talk about "The Palestinians" or "The Israelis" as though these are individuals who make decisions, and then try to make moral judgements about who is right and who is wrong, losing sight of the fact that Jewish Settlers and left-wingers and the Palestinians authority and Hezbollah are quite different entities and so dealing with either Palestine or Israel as though it is a single person may not really achieve much. A similar tendency sometimes appears when talking about corporations or government institutions. There are real parallels between groups and individual cognition, but we must not overstate these in our desire to wrap our head around collectives. For example earlier in this piece it was mentioned that Collective Intelligence can allow groups to function better by understanding their collective thought processes and that this is similar to how findings from psychology on biased or heuristic thinking can play in allowing individuals to think better. Though this is true the metaphor has its limits -- one such limitation is that group emotional attachments cannot necessarily be handled in the same way that individual emotional attachments are handled. An individual may, if they are willing, examine their emotional attachments through introspection, there is no directly analogous group

process. Group members must go on what they see, and individuals often strive to present an image of themselves as objective in order to give their arguments credibility. Thus the group's attachments may be quite murky -- making them more transparent will involve individual introspection, but might also be helped along by group level processes designed to encourage more emotional honesty.

9. How can we get more good unsolicited advice?

Things that we don't think to improve on are the bulk of things we could improve on. At the same time, a given person can probably coach another person, on something, but we don't know what that something is. For example when you move to have roommates people see you doing things the way that you normally do them and conversations ensue. For example I remember a college roommate taught me to brush my tongue. Because I was visible to Matt as we brushed teeth next to each other, he was made aware that I was not brushing my tongue, and so there was transfer.

The problem is that looking at another's practices is time consuming, as is trying to follow advice. Life coaches are people that help collect good practices and share the ones that others need, and their popularity is a sign of demand for curated exposure to the different things that our diverse and experimental culture has cultivated. Also, browsing websites such lifehacker may also help out, but can we think of other ways to increase the spread of information that we don't even think to look for?

10. Environmental Degradation as Demonstration of the Need for Collective Intelligence

If anything clearly demonstrates the need for advance in collective intelligence it is climate change. This is true not only because climate change is dire, but because, despite media attention, and a strong scientific consensus that implies serious action should have started years ago (see e.g.), no conclusive action has yet taken place. Translating an important understanding gained by a few into acceptance of that understanding and action by the whole, is very hard, even in the information age.

The cumulative hours spent on a single report of the International Panel of Climate Change would take up many lifetimes, so it is beyond any one person's ability to trust it by checking the work that went into it. The concerns voiced by climate scientists have also remained somewhat abstract to most of their audience which can only feel a bland taste of what is to come. This abstract and hard to understand scientific consensus has also been cast in doubt by some people whose interests are threatened by this consensus and those who mistrust the scientific community's conclusions for various reasons. Intellectually complex problems, which experience does not give us a good intuitive grasp of, and which require members of a collective to get into conflict with our received habits of thought and action are probably a permanent feature of a world where we embrace constant innovation. So the problem of addressing climate change, which is sure to continue to attract attention, is a good test case for understanding, or at least arguing the need for, collective intelligence.

11. Managing Manageability

Complicated strategies for addressing issues turn into complicated management problems later. The more complicated the action, the more complicated is the problem of anticipating and managing its consequences. Can Collective Intelligence keep up with the unintended consequences of myriad sophisticated interventions which have unforeseeable outcomes? This consideration might lead us to consider the attraction of simplicity in technology and organizational structure and to look for principles that can help us manage the manageability of our organizations.

12. Is the sky the limit?

The limits on our imagination for Collective Intelligence depend on what we see as open to change. At its absolute broadest, CI can touch on the organization of society as a whole. As mentioned, trying to understand decision making of the whole nation is nearly impossible, but this does not mean that the form of particular institutions such as political parties legislatures or a bureaucracy is beyond the scope of a reasonable conversation or an unworthy end goal. Concerns with achieving intellectual tractability and avoiding charges of grandiosity may guide us away from such questions, but on the other hand the time to "think big" may be here.

At the turn of the millennium, it seemed reasonable to many to entertain Francis Fukuyama's claim that we were at "the end of history," when western liberal democracy and corporate capitalism were bound to continue far into the future, as humanity had reached its most advanced state [10]. This seems comical in retrospect, after the events of the last 17 years including failures of democracy to continue spreading, the continuing inability of governments to address climate change, amazing advances in technology, and the rise of right-wing populist movements.

The rising feeling for redesigning society presents even more of a challenge, since the feeling that we had already found "the worst system other than all the rest" precluded many from thinking both seriously and freely about this issue for decades. Though technically free, we haven't been able to have big conversations without calling each other "commie," "capitalist pigs," "xenophobes," "hippies," and so on. Technology and increased understanding of human minds may fuel our imagination but there are a lot of possibilities out there waiting to be tried -- proposals for E-government to range from reformist to revolutionary. All of these can ultimately be thought of as problems of Collective Intelligence. Change at this level is obviously easier said than done, but if nothing else, seeing ourselves as helping to take small steps towards that great goal can be highly motivating.

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