



Collective Intelligence, the Future of Internet and the IEMML

Interview to Pierre Lévy by Art Farley and Massimo Lollini

Part I: Collective Intelligence

Massimo Lollini (ML): Welcome to our interview, we are very glad to meet you. My name is Massimo Lollini and my colleague is Art Farley. The readers of *Humanist Studies and the Digital Age* are already familiar with the idea of collective intelligence, but today we would like to start by going deeper into this notion and its development in the context of the evolution of the Internet and the digital humanities. What is the importance of collective intelligence for your work, and in relation to the history of humanities computing?

Pierre Lévy (PL): Big question, I think that the notion or even the expression “collective intelligence” has been coined by ethologists studying the social animals, and they have shown that social animals manifest a behavior implying collective intelligence, like the anthills, the beehives, and even the termites, but also the schools of fish, the flights of birds, the social mammals, and of course the primates. So, this notion predates humanity, but of course there is a new level of collective intelligence with humankind because of language, symbolic thinking, the ability to transmit a lot of knowledge from generation to generation and the building of complex social institutions that do not exist in the animal kingdom. So, human collective intelligence, I would say, is stronger than animal collective intelligence, and it's a new layer, the symbolic layer or the cultural layer. And for me, there is an evolution of human collective intelligence that is related to the communication media.

I think that there was a new kind of collective intelligence after we invented writing systems, because it allowed the accumulation of knowledge, new kinds of memory, and then with the invention of the printing press and then with the electric or electronic media. So, anything that augments the power of language augments human collective intelligence. I think that with the Internet, we reach a new point, a new threshold in the history of collective intelligence. Because we have a medium with the almost complete disappearance of the constraints of a physical space, and the memory is accessible from any point on earth, a full kind of ubiquitous memory. Also, everybody has the ability, at least theoretically, to add

something to the common memory. There is a communication from many to many, and there is also not only a connection of people but also of all the documents. There is more or less a unique, big mass of that, more or less accessible to everybody.

For me, it is as if there is a kind of stigmergic communication. This is a communication by the intermediary of a common shared environment. I can say that almost the entire humanity, if not today but in a few years, will be able to add to this common memory and to read data on this common memory; and the communication between the people is made through the shared common memory. So, every time we like something, every time we share or we retweet, every time we buy something online, and so on ... in fact any kind of engagement will transform the relationship between data, not only for us but also for the others. So, and this is not only a quantitative modification, but we have also the ability to tag or to categorize data in our own way and so on.

So, this is really a transformation of the common memory that is made by everybody at the same time. Here we have a dialectic of the individual and the collective and also a dialectic, at the same time, of the collective and the common memory. So, this is the stigmergic communication as a new kind of collective intelligence. And I would say that, of course, it is for the moment very opaque and imperfect. There are a lot of problems, but we should go in the direction of making this collective intelligence reflexive to help people to understand what they are doing together. What is the role for the individual or for the small group in the transformation of collective memory? There will be systems to give back to the people an image of their cognitive operations and so on. This is what I call the perspective of a reflexive collective intelligence.

ML:

In a previous interview a few years ago, you held that the impulse behind collective intelligence is the search for the actual living unity of human knowledge despite human scattering in space and time. In some of your work you see the far origin of this impulse in Medieval philosophy and theology, in the attempt to find vehicles of communication between the celestial worlds emanating from God and mortal humanity dispersed in time and space. What does your idea have in common with medieval philosophy and mysticism and how does it differ from them? How would you characterize your idea? In terms of theological mysticism or of philosophical utopianism? Or would you rather prefer to see it simply as a form evolution or technological revolution without any particular ideological connotation?

PL:

It's a very big question. Well, the idea, of a world of ideas that is common to the whole of humanity is already there in Plato's work, or even in

Aristotle's work, in this idea of the divine that is the thought thinking itself. And this is, for example, in the philosophy of Aristotle and even more in its Neoplatonic interpretation, the whole world is moved by the process of self- thinking of the divinity that is a kind of motor or engine for the movements of the whole universe.

So, this is an idea of a big intellect that is at the center, or at the top of the universe. It's a very old idea and related to philosophy in general. It's not a particular trend, of course, it has been a little bit forgotten in modern philosophy, but the old trend of philosophy was organized around this. And what is interesting for me is that in the Middle Ages some philosophers tried to reconcile the ideas of Plato and Aristotle with the ideas brought by the monotheistic revelation, like for the Jews, the Christians, and for the Muslims. And they said basically that there was this big infinite, absolute intellect in the sky, in heaven, but not a physical heaven, of course, it's a cosmological, philosophical heaven. And there are some people that are more oriented to the divine intellect than others. And these people, the prophets, are more or less playing the role of an interface between the divine intellect, and the limited, finite, and imperfect intellects of the human beings.

The whole process is a top-down process with the intermediary of the prophets and the revelation. And I think that we can use this abstract model of the relationship between an absolute intellect, or in an idea of intellect, that belongs to the whole of humanity and the individual people who are mortal, finite and imperfect. So, instead of having a top-down model, we can imagine a bottom-up model where the real living and mortal people are thinking together, adding to the common knowledge and participating in the construction of the global intellect. So, our idea of collective intelligence is not any more a universal intelligence emanating toward the human beings, but just the opposite, the human beings contributing to the construction of a common intellect and of course benefiting from it.

Art Farley (AF):

This collective intelligence sounds like science to me. But it tries to do it from a bottom-up perspective. What can we observe? What can we see? Can we develop a global understanding of reality from our observations?

PL:

You are totally right. And I agree with you. So, I would like to make a comparison or a metaphor, if you want. If you think about the situation at the time of ancient Egypt, at the time of the pharaohs where one or two percent of the population were able to read and write; they were the scribes. They were working for the big palaces or for the Temples. They were the public servants and the priests and the rest of the population were farmers and they did not know how to write. If you had said to these scribes that several centuries after their death and after the end of their civilization,

there will be new civilizations where eighty percent of the population would be able to read and write, they would be very surprised. They would not believe you. For them, reading and writing was a privilege of a very small minority. So, if we take this example and we say, okay, today the scientific community is a small part of the human population, and it is a kind of intellectual elite. But maybe in one or two centuries, the majority, the great majority of human population will function the way the scientific community is working today. With better instruments, not in printed scientific journals, but in a big collective memory online which you can access very easily. You can have knowledge on demand with very easy-to-use interfaces and so on and not only get the knowledge but also add to it. The whole human population could function exactly as the scientific community or at least an ideal version of the scientific community, because we know that it's not perfect.

ML: So your idea of collective intelligence is not hierarchical, so to speak, it doesn't come from a top-down impulse but from a bottom-up one; so, it is basically a reversal of the great chain of being, the idea that everything emanates from the *ens perfectissimum*. On the other hand, I think that the inspiration in your work is not only scientific but also ethical. You refer quite often to the idea of good as being something that the human collective intelligence is looking for and projected toward. How can the collective intelligence, conceived as a modern technological and scientific revolution, attain that ethical dimension that you have in mind quite often in your work?

PL: Well, I think that the ethical dimension is also something that is there from the beginning in philosophy in general, you know, the idea of Good in Plato's work is like the sun in the world of ideas. So, aiming at the Good, I think, is what every philosopher is doing and also what we should all try to do, at least in a certain part of our activity. But for the particular case of collective intelligence, I think that there is a kind of symbiosis or a circular causality between human collective intelligence and human development. By human development, I mean education and a good environment. I have a model of human development that has an actual part and a virtual part. In the actual part, you have everything that allows physically a communication and memory, the media, the messages, the libraries, today the web, and so on. Everything that allows us to communicate.

Then we have all the material, the health of the human bodies, the health of the environment, all the physical and technical equipment. And there is also the social dimension, the people, individuals, their relationship, the trust, the harmony of the social roles. So finally, all the signs, all the beings and all the things at the actual level and at the virtual level, you have knowledge, accumulation and continuous renewal of knowledge, all kinds

of knowledge, not only scientific or academic knowledge, but everything that helps us to live. You have the values, the rights, the obligations the governance, everything that is related to ethics, law and so on. And finally, all the know-how competences, the economic resources, all these things that encompass the power, what we are able to do. So, if you relate all these dimensions of human reality, and if you understand that all of these dimensions are interconnected, you have a kind of general model of human development. And this manifests itself, for example, in the life expectancy in public health, the degree of education, in the economic prosperity and so on. So, all of this is human development, and I think that this human development is very closely related to our degree of collective intelligence. It works as an engine; collective intelligence is the engine of human development, and human development is the basis of collective intelligence. That's the general perspective.

ML: In one of your earlier articles and more recently in your book *World Philosophy* you write that the “cosmos thinks in us”. What do you exactly mean by that and how is a collective intelligence relating to a cosmological idea?

PL: This is a very complex issue that would take one or two semesters to develop. First, we have to understand that for each different culture there is a different image of nature or the cosmos. The cosmos in which we live today in the twenty-first century in Western societies and so on, is very different from the cosmos in which our ancestors lived. They had a completely different representation. The way in which we perceive the world around us is a very important part of our identity, of the way we think. We think with this world, with our society, with our tools, with our institutions, but also with the nature around us, or at least the way we imagine that this nature works. Okay? We think with our brain, of course, but we think also with our language, with our techniques, with our world view and so on. So, this intermingling between the internal part of the subject and the external part of the subject –of the subject that I'm trying to illustrate– it's like a Möbius ring. There is a continuous transformation from the inside into the outside and the outside into the inside.

ML: We have another question that was triggered by the reading of *World Philosophy* where you write that the planetary movement toward the universal interconnection finds its roots directly in the race to power: economic, commercial, scientific, technical, cultural, and political power. Contrary to what is happening today with the emergence of the ideology of sovereignism everywhere, you argue that the more a political regime, a culture, an economic form or an organizational style has interconnections the better it will survive and succeed in contemporary environment. For you, the best way to maintain and develop a community no longer consists

in raising, preserving or extending frontiers within a territory but to improve the quality of relationships in its own reality as well as with other collectives. You see this process as facilitated by the emergence of Internet and virtual communities that have substituted for the city as a physical space. It looks that the target that you set for humanity is to learn to go beyond conflicts and differences that distract from its fundamental unity. What is this deeper reality that humans need to learn to appreciate? And how would this process be possible? A look of contemporary world political situation seems to clearly contradict your perspective. Sovereignism, wars, including cyberwars, seem to prevail ... and China is developing its own Internet...

PL:

There is a lot of information and questions in what you just said. First, I would like to say that historical evolution is not necessarily led by good intentions or by a particular deliberate plan. It's more an emergence from a lot of local actions, and people don't realize what will be the effect of all their actions. No, it's an emergence. And very often you have very dirty things like sex, money, fights for power and all these things that we don't like, but they exist very strongly. They are more or less leading the world; actions that are led by all these things that we don't like very much, can have an effect that is unexpected and that is not so bad, for example. It's not an example, it's a basic fact. There were 1 billion people at the end of the 19th century and there is more than 7 billion people today. The life expectancy in the same period of time has augmented for the whole population of the planet by 20 years. At the end of the 19th century, there was 15 percent of the population that was literate. Today, more than 80 percent. And I could go on and on, for example, it is true that the inequalities between people are augmenting, but for me, what is much more important is that extreme poverty has sharply decreased in the last century; all of these new realities were led by these horrible things like a lust for money and power. Of course, there were also good intentions, and people working to teach other people or to help them in the medical sector.

And there were also good political leaders and so on. But there were also bad people. What I am looking at is the general evolution. And of course, if we read the news, we say, oh, it's worse and worse, and the worst president, a horrible situation, people hating themselves. But if you look back at the time of Hitler and Mussolini, we realize that it is always horrible. But we have to take a step back and look at the general trends and do what we can to improve the situation. I am confident that despite all the conflicts the world has improved, and I don't think by the way that conflicts will ever disappear and maybe it's a good thing that there are conflicts, but of course we could try to solve these conflicts by symbolic means instead of shedding blood. Of course, this would be a possible evolution. I don't think

that we will reach a situation where there will be no conflict, but the way to solve the conflict will probably evolve. And, by the way, despite all the wars of the 20th century and despite all the horrible violence that there is today, if you look at the numbers there is less violence today than there was in the previous century. So, we should not look only at the titles of the news, if we look at the big numbers, we will have a different picture.

Okay, the Chinese have their own Internet. The same is true for the Russians and the Iranians. But it is still more or less the same computers. It is still the urls; it is still http, and so on. There are a lot of Chinese students in the US, lots of American investments in China and so on. It is not so divided.

ML: So, you are saying that the wars and conflicts that surround us are bad, but if we look at the big numbers and the big trends, we will see a sort of movement toward improvement or an improving situation that will not erase all the problems but still will allow us to reach a better position.

PL: Also, I think that the trend toward a kind of unification by communication but also by the movement of population, exchange of students, tourism, all the things that connect people. If you look at the number of people that are traveling, for example, not just communication by electrons but bodily transportation, there is effectively a movement toward a unification of the planet.

AF: I'm just thinking about embedding all of this discussion about intellectual development and knowledge into the reality of climate change and the human impact on the environment. As you just mentioned, many people are traveling. Do you think every time you get on that plane what's happening to the environment? You know, when you get on the plane, you can ignore it; we go along, and I drive downtown. At some point we're going to have to get on the ball and change the way we're doing things. So how do you see collective intelligence interacting with changes to the physical planet that will be coming?

PL: Okay, I am looking at a particular trend that is the extraordinary developments of sensors everywhere on the planet, not only for the temperature and atmospheric pressure and so on, but also everything that helps us to observe the evolution of the ecosystems; also, all the sensors that are now, in our cities, the very representation in the virtual, into digital form of the physical world. So, we have more or less a kind of model of the planet inside of the digital world. It's not complete, but we can see that it's slowly, slowly happening. So, if we could have a representation of the effects, I mean in real time, of the effects of the human actions on our physical environments and back, the effects of the transformation of the environment on the human population. And if people were immersed not

only in the physical world, but also in this model that shows them the effects of what they do collectively, they could do things in another way. I think that this perspective of human collective intelligence should be coupled, or put in the loop, with a model of our planetary environment. That's the direction toward which we are heading.

ML: I have a question about how you relate the notion of collective intelligence to the new media. I would like you to explain the differences that you see between the use of internet and collective intelligence and the use of traditional and social media in today's culture. Is it possible to differentiate these two realities that are, after all, connected?

PL: I'm not sure that I'm able to respond to your question, but I can give a personal experience. I asked my students to take notes in class, not on paper or not even on a Word document that will stay in the hard disk of their computers, but to take their notes on Twitter with the hashtag of the class. So, in this way they can share their notes; their notes become searchable. They can compare the different points of views that they have or different understandings of the same discourse, that is the discourse of the professor; or when they have something to read, they have to tweet a kind of summary of what they have read with the link, and they can see, ah, these students have a different summary from mine. And they can discuss also when they have questions; not only the professor, but other students can respond to the questions. And finally, another very big advantage of this method is that I can check if they have understood the right thing. When you have 200 students in front of you, you cannot possibly check if they have understood, but if you can read the notes, you see immediately what are the misunderstandings. So, this is an example of a use of social media by contrast to the old media and of the practice of collective intelligence at a small scale.

In the 1990s, you know, I said that collective intelligence was a fractal concept. I was meaning by this that it is something that is true at different scales. But today I would say that it is a scalable concept, so you can begin small and then you can apply the same principle at a bigger scale. So, for me this is an example of good use of the social media. I would take another, little example in my experience. I'm on Twitter, and what I'm doing is making a kind of collection of experts on different subjects. For example, in geopolitics, I have a list of experts on Turkey, a list of experts on Iran, the list experts on Egypt, a list of experts on Israel and so on, because I'm very interested in the Middle East. Also, I have a list of experts in artificial intelligence, experts in blockchain and all these new technologies, crypto technology and so on, and I have more or less 30 lists.

When I have questions about what is happening in this field or what's happening in this region of the globe, I go to my list and I read what the experts have to say. They can have diverging advice, but I can make my own opinion. I would not be able to do this thing with the old media, with television and newspaper. It would be absolutely impossible. So, I can set up my own intelligence agency, if I use correctly the social media and I would not have been able to do this in the 20th century, for example. Of course, you need training to be able to do this, it takes time. But there is a big reward.

ML: Okay. So, you have a positive view of the interaction between media, new media, the Internet, and collective intelligence. Of course, what we read every day is not so positive.

PL: I read the same things, you know. I'm not going to repeat what all the newspaper are saying because you already know it.

AF: The students want to know if the media and the Internet are creating for us a post-truth world. I just want to add a little bit to that. As you said, for your class, the way you're using Twitter, you can watch what the students do and then, in a certain sense as God, you come in and say, "oh, this is really the correct interpretation of what I've said"; this is as opposed to the way that most people use the Internet, which is, "oh, here's three people that think like I do. I think that's really how it is." And then soon you have five groups, different groups of students, all coalescing around their different interpretations, with no God to tell them what's true.

PL: Okay, yes. I might seem more or less like God. But every student is able also to read what all the students have said, and they are also able to ask questions or give different responses, and so on. I'm not in a unique position. My position comes from the fact that I am the professor and that I know better than them and also take the time to do this work; but they have the same possibility, and I try to teach by example, by what I am doing, like making lists of experts and so on. I'm trying to teach them to do the same. As for the question of post-truth, you know, I really don't agree with this, because if you think about the 1920s of the 20th century when there was a state radio that was streaming propaganda in the streets, with only the voice of the dictator. That was one thing. This was real control of the mind, and there was no free press and so on. Today, of course people are lying, but let me tell you that there are lies from the beginning of language. You can speak, you can lie, but the fact is when you have different voices, it's easier for you to be able to discover what is the truth from your point of view. So, truth is not something that is already there in the world, it emerges from discussion. People say, ah, there is this fact, but the other people say there is another fact, and some other people another fact; some

other people are trying to distract the attention, and they are lying. But truth can only emerge from a conversation, and only for people who practice critical thinking.

If we go back to the scientific community, if everybody has the same theory, there is no scientific discussion anymore. What I say to my students is, you know, no theory is true. The theory is always hypothetical. At the beginning, they are shocked. No, maybe a fact can be true. But when you begin to try to explain the facts, develop a causal system, you tell a story that is already a hypothesis. Okay? So, the situation where television tells the truth, and we are happy because we know the truth and it is a reality and everybody agrees. This is the real totalitarianism.

ML: Collective intelligence produces a form of deterritorialization, but at the same time I see a counter movement because the use of collective intelligence tends to be localized, tends to identify some areas of the world to requalify through the collective intelligence tool. So how can these two tendencies combine with each other: the one toward deterritorialization and the other toward localization and requalification of a territory through the collective intelligence?

PL: There is no contradiction between the two trends, it's more a paradox than a real contradiction. I can give you again a very simple personal example. I live in a small village in a rural area and we have a Facebook group of the village, and every time that someone has lost his cat or has a small problem in a particular home and so on, we communicate immediately in the village. So, we know each other and we help each other, thanks to this very simple Facebook group. Of course, Facebook is a huge network with 2 billion users, but we have a very local Facebook group and it works. At a bigger scale, there is this trend of the smart cities or smart territories where the equipment of the cities and the transportation and the quality of the atmosphere and all the factors that affects the life of the inhabitants are registered, computed and sometimes given back to the inhabitants. There are all these aspects of every territorial or local collective intelligence. On the other side, these cities are nodes in global networks of communication, business, science, and so on. So, there is no contradiction between making these local nodes stronger and making the whole network global network stronger.

ML: At the beginning of our interview, you spoke about how a collective intelligence brings about new forms of memory. How is that possible to preserve the memory of what you are doing with your local community and the wider world community? How is the memory of Internet collective intelligence working?

- PL:** I think the first thing to preserve is the memory of the past centuries, everything that is in the museums and the libraries; recently, there has been a huge museum that burned in Brazil and probably only a very small part of it has been digitized. So, the whole memory is lost and this is a terrible tragedy. First, we have to preserve the heritage and then maybe we have to realize that we are not going to record everything. It's almost impossible to record everything, but we will have to do some selection to filter this and to try to decide what will be the data set that we will preserve for future analysis, understanding and so on. This is a huge political and epistemological problem that cannot be solved in general. We have to see it every case.
- AF:** How do we filter out what has happened? There's a big difference between intelligence and knowledge. You know, everything we do, I can say stupid things, but that reflects intelligence, because I'm an intelligent being. I could even put together that stupid idea and broadcast it to people, so there will be many, many stupid ideas getting put into it daily, as well as the knowledge that is getting put into this collective intelligence. How will we ever be able to pull that apart? I'm not quite sure what the tools will be. As you indicated, it could be political as well as other dimensions that will pull that apart.
- PL:** I would say that there are special communities or subcommunities particularly in charge of knowledge. In Universities and in big companies, there are people in charge of knowledge management to record what has been proven by the experience and so on. So, I think that's the main difference. The knowledge has been filtered through experience, reflection, testing and so on and then preserved and we say, okay, this is knowledge, this is precious and that's it, but maybe we are wrong and will improve this and will replace bad knowledge with better knowledge. There is no perfect response. You know, it's a constant quest, the quest for knowledge.
- AF:** We have upped the scale of the size of that filtering that needs to be done with the Internet and all its connections. As you said, everyone can contribute, everyone can contribute daily to what is there. To find a way to filter that and to find the knowledge that is in collective intelligence will be one of the biggest challenges, I think, for the future.
- PL:** A lot of all these contributions will be just ignored and some other contributions will be acknowledged, shared, implemented, and tested. It's the real process that is messy. But there is no other way to find what is knowledge and what is not, but we have to imagine new ways to do this at this scale of the Internet. That's the real challenge.
- AF:** I agree.

Part II: The Future of Internet and the IEML

ML: Last time we spoke a lot about collective intelligence. Today, the focus is going to be on your most recent work, especially IEML. But before going there, we would like to have a little transition. The question we have is related to the fact that you formulated your idea of collective intelligence and cyber space more or less 20 years ago. Is there anything new in digital humanities that makes you change the way you present collective intelligence or the very notion of collective intelligence in cyberspace? More specifically, we are curious to see if you think that these big ideas of collective intelligence and cyberspace have been incarnated or not in the worldwide web as it is right now. So, two questions: Is there anything new in digital humanities computing that makes you adjust your vision of collective intelligence or cyberspace? Second question: Is the worldwide web right now an incarnation or a possible location of collective intelligence and of cyberspace as you conceive them?

PL: *Collective Intelligence*, the book in French, I wrote before the existence of the worldwide web. In fact, it was just the Internet at the time. It's a philosophical vision of the future, a philosophical vision of what could be a global civilization based on the digital and the general interconnection of all the computers, and all the phones and so on. Those platforms did not exist at the time, but we can agree that the smartphone is a computer put in your pocket.

So, I don't have anything to remove from this vision. The vision is still there, the question is how far are we from this vision? We have of course a long way to go, and maybe we will never arrive. My goal was to indicate a direction of evolution. It was not the prediction that this will happen. So, I'm going to answer your question in the vision of Tim Berners-Lee, the creator of the web. The worldwide web for him, even if he didn't use the exact expression at the time, the worldwide web was a tool for collective intelligence. Even at the time, more particularly for the scientific community that he was working with (physicists), there was this notion of a tool for collective intelligence from the beginning.

But once you have a tool it's one thing; it's another thing to use it in the best possible way. For me, when I spoke about collective intelligence, it was to answer the question: What is the best thing we can do with the Internet? It is collective intelligence. If there is the internet, there is the possibility of a fantastic era of collective intelligence on earth. Okay, it's the best thing we can do. So, at the time, the movement of the open source software maybe existed, but it was not well known. It was very underground. And today, I think that the majority of the software on the planet is open source. This, for me, is a very good example of collective intelligence, in action. If you look at some things so popular as Github, for example, to stay in the same sector, everybody can look at the code of other programmers. You can copy; you can make comments; you can improve. So, this is for me a very good example.

A second very good example is Wikipedia. There everybody can be a contributor, and there are a lot of editors and a lot of people who are able to learn something from this fantastic online encyclopedia. These are two very small examples, but you can have a lot of particular communities that are able to organize themselves thanks to the Internet. Now of course there is publicity and propaganda, manipulation, bots, and trolls, but you cannot assume that, because we have a fantastic tool of memory, reasoning, computing and coordination, miraculously human nature will change and people will stop lying or committing crimes or fighting with each other. These are two different things. So, I think the web is a good, a very good, tool for collective intelligence, but you know, Tim Berners Lee himself saw recently that the web has been confiscated by the big platforms, the famous, Google, Facebook, Amazon, and so on. And he thinks that we should do something else. I have read this proposition that is very interesting. So, basically, he's proposing that we, the users, have a better control on our own data. This is an idea that a lot of people have currently, that there is something like a sovereignty of the individual over its own data that should be added, because they are human rights or something like this. Today, more than 60 percent of the human population is connected to the Internet, very soon it will be 90 percent, and all the political discussions, all the information, and all the educational resources and everything are organized by the Internet and is disseminated like data. And, basically, all the symbols that are used to make a living society are today digitized.

I think that this idea of the sovereignty of the individual is something that is very important. And I think the next step will incorporate this principle. So, this is one thing; another thing is precisely my proposition. We have today a kind of universal addressing system for the computers, all the servers. This is TCP IP, the Internet. We have a universal addressing system for the data that is independent from the computers. It's the level of the web, the url if you want. And I think that it's not enough. We should have a universal addressing system for the concepts or the ideas or the categories because today the web is fragmented by the different natural languages, the different disciplines, the different classification systems and so on. And here I am not speaking about the file formats. Okay. We need standards for everything. I am speaking about the concepts themselves. I'm speaking about language. I'm speaking about semantics. So, in the current state of semantic division, I think there's a need for a new layer of universal addressing system.

It is very useful to augment and make it reflective, because if we don't have reflexivity, the process of collective intelligence will not be as useful as we would expect or as we would like it to be. So, we need critical thinking; we need reflexivity; we need open dialogue; we need open access to the desktop, all these things. My program is to open collective intelligence and the knowledge commons, the data that could be useful for science, for education, for public health, for the preservation of our ecosystems and so on. First, enlarging and augmenting the commands, and, second, I think that it is very important that our processes, like the model, the algorithms, and older tools that we use to process the data, should be as transparent and open as possible. Without

this transparency, to have a scientifically based, collective intelligence is impossible. One of the things that is notoriously difficult to explicitly make transparent is meaning.

So that's why I invented this language, as a means to make meaning transparent, actually more transparent than the natural languages. What does this transparency mean? It means that it should be as computable as possible. So, I spent more than 20 years inventing this language. It was very, very difficult. And in doing it, I understood why other people, were not doing it because it's almost impossible. So, what I have now is a language like any natural language, like French, English, Mandarin, Arabic and so on, that allows you to express any idea you want and its opposite because, of course, because it is a language, you have a possibility of negation, of interrogation and so on. We can say everything, and you can say all the differences and nuances in meaning as what you want, as long as you respect the grammar. This Is one thing.

And the other thing is that this language is also a regular language, in the sense of Chomsky, because of a very rigorous syntax and, above all, there is a complete parallelism between the semantics and the syntax in this language, which is of course not at all the case with ordinary natural languages. If you can combine these two aspects, the fact that you can express any kind of meaning or concept, and the fact that the semantics is computable, you have a good intermediary, a good interface between human beings and computers, not only between computers, but also between networks of computers and data centers and so on. And, on the other hand, you have a good pivot language between the natural languages. Let's say you translate one particular text in natural language into IEML, and, once it is translated, you can very easily translate it into all the other natural languages.

With IEML, every word, every phrase, every text is like a particular point in a symmetrical coordinate system. And, it is inherent to the language that any point, any expression of the language, is automatically in connection with the other points. And so, you know, what are the most resembling points around the point, you know, the semantic relationship between the different points of this semantic space and so on. It's like a geographic coordinate system, and it's very symmetric at the mathematical level. It's a very symmetric coordinate system. So, all the computations can be done automatically so it will improve search, and improve automatic translation, and I have designed it to be one level of universal addressing above the web, an addressing of concepts. So, we will be able to coordinate better our collective intelligence and to make it reflexive. It will be like a mirror on which we will be able to see what's going on in terms of cognitive processes, what are people speaking about, what the data is about and so on, not just quantitative, but qualitative. And, of course, if the qualitative is clear, the quantitative would be better.

AF: Interesting. Clearly within AI, people have tried to do translations and automatic translation. There were all the approaches of going from word to word, and then getting funny things happening. That's how people, at a raw level, will try to do the translation. The idea in AI was to develop some core language into which you would

translate, say Spanish, into this universal representation of meaning; then we would translate that back to another language. So these are similar ideas; these were never easy algorithms and processes to write? You said, well it will be easy to go from IEMML to this language into that language. To me, those are major research projects to figure out how to do that. It's not an easy thing to do. Easy is a flexible term; I understand. We see that you're doing some important work. I mean you have a team of people doing some work. Are there people who are actually working on translating English into the IEMML or other things? Because that seems to me to be the challenge; to be able to get from language into a point in your semantic space is a nice idea, but how do we move around there and move back into our language or another?

PL: It is relatively easier to go from IEMML to a natural language than from a natural language to IEMML, because in IEMML, the meaning is already formalized. Instead, in a text in a natural language, the meaning is not formalized, so you have to disambiguate and so on. So, when I say easy, I mean it's easier to go from IEMML to natural language than the opposite way. That problem, natural language to IEMML is difficult; I know because we tried.

AF: That was my point.

PL: So, not to say that it is a piece of cake. Of course, it's a huge research program and everything about IEMML is a research program. I have the dictionary, and I have the syntax of the language. This, and all the applications, is a huge research program.

AF: You have the formalism. You have it formalized. You know, those are the big issues; getting in and out, having a tool that someone can use to interact with IEMML. You seem to hint that there could be an input tool into the language and things like that. This leads me to a bigger question. It is about the relationship of humans to collective intelligence and to this language and other things like that. You've been talking some about algorithmic intelligence, as well, if that's the same as collective intelligence; I see you have a paper mentioning it. You say that we're going to get to a state of algorithmic intelligence that has capacities for reflection and creation, communication, collaboration, learning, analysis, and synthesis of data that will be infinitely more powerful and better distributed than they are today. And you, and as you noted earlier, we're making a small move toward that.

Thinking exponentially, how we've been able to push some of this, it could be quasi exponentially more powerful. So, my question is, what do you do as this develops? What is the role of humanity and humans in this future system that you are imagining? Think of driverless cars, that are just a small step in trying to do that, where you have a car that has all the sensors, that can look around and that can drive itself. Plus, it is connected to the collective intelligence, such as Google maps, so it can look and see, oh the traffic's heavy over here. It can pick the best route, the optimal route. Much better than a human could do it. These cars are going to end up being safer than a human driver with only two ears and two eyes. So, is the human out of the loop essentially. Once we get to such a big thing and we just ride along on the car. Perhaps

we'll have scientistless science, because the system will be able to process data much better, think of the next experiment, and conduct that experiment faster than we can develop ideas and new theories. So, I just keep getting a feeling that this is potentially great, and I think we're all pushing for it, but we're somewhat leaving ourselves eventually out of the loop. Do you see that?

PL: I open my phone. I put on the GPS with Google map and it gives me an itinerary that I don't know. Why are they doing this? Okay. I will take it. It's shorter because there are traffic jams, and it finds automatically the best, the best itinerary. I prefer the shorter path. It comes from the information that is given by all the people in their cars. So why not? I think the use of this is an example already of smart city, a service that is not given by the mayor or the official city, but it already works like a smart city. So, I think we are going to do more and more in this direction, not afraid at all of the autonomous cars or things like this. We have trains that are, that could go without a chauffeur since years and years. So, it's a difference in degree, not even a real qualitative difference.

I speak about algorithmic intelligence, because I have studied a lot the history of cognition. You have a basis that is in our genes, in our brain, and we have exactly the same brain as the prehistoric people. Okay. We have exactly the same intelligence, the same brain, the same genes, the same ability to speak and to reason and to tell stories and so on. This is the same for all human beings, but then, when you invent writing necessarily, the people who have writing, they have a better memory. They can accumulate information; they can go through all this information and make inferences. They have a better critical thinking, because the knowledge is in front of us. It's not just the identity with the narratives and so on. So, there is a kind of a written intelligence, and even, okay, let's stop at the difference between orality and writing.

Then we can go into details, different kinds of writing systems, either ideograms, alphabetic writing. What is your numbering system? What kind of coding of the numbers allows you to make the better algorithm and so on. So, the coding of the information augments our cognitive abilities, but it's an external augmentation. It's not because our brain is different. It's because we have a lot of apparatus around us that allows us to make common memories, to make new operations, and things like this. And then you have the printing press. So, the ability to have several libraries, easy access to information. Remember before that we were obliged to recopy the books by hand. It was not easy to have access to information. The printing press was one, not the only, but one of the bases of the scientific revolution of the modern time, because the memory was discharged of remembering of all this information, because it was in the libraries, people were able to observe more and to experiment more.

So, basically, cognition is not only a biological process, it's a biological, technical, institutional, and symbolic process. Today we are shifting from the cognitive system based on the printing press and on the classic electronic media, radio, television, telephone, and so on, to a cognitive system that is based on the cloud, the

smartphones, the personal computers, machine learning and so on. So, we have to take this into account and it will help us. And, you know, shortly after the invention of the alphabet or the introduction of the alphabet in ancient cultures, people were very afraid. Ah, it's terrible. We have no more memory. The memory will be in the books, and so on. There was one famous dialogue of Plato (Phaedrus) about this theme. They'd say, writing makes us stupid, because we don't cultivate our memory anymore. So, it's an old process. It has not begun with the computer, but it's a new step and we have to embrace it in order to stay in control, to understand what's going on, what do we want to do with it.

We don't want be replaced by artificial intelligence. We want to be augmented by artificial intelligence. We have to take advantage of these new tools, new possibilities, to create new symbolic systems adapted to the current technology. Because let's say today, when we write, we write one letter after the other, a word or a phrase is a sequence of characters, and we don't remember that this has been done to register the sounds not the meaning. But today the computers, they don't care about the sounds. They want to compute the meaning. That's why I invented IEML.

AF: What's interesting is I think all technology is invented to take us out of the loop. As you said, I can write, I don't have to spend all that time trying to memorize things. If I have a wheel, I don't have to put everything on my back. If I have a calculator, I don't have to add. What will human experience be like? What will be the type of human cognition we need to develop in the future? That is what is interesting, especially from an educational perspective. Do we need to teach kids to multiply anymore? Maybe they need to know or maybe not. People keep saying, oh, we have to teach them to problem solve now. That's interesting. Maybe we don't quite know how to do that, however.

PL: It's a little bit of what you were saying. We have to know how to command that system and keep being in charge of the system, which is really high-level thinking. It's very meta-thinking. I don't have to drive the car anymore, but I might have to plan my vacation or something like that. The car will take me wherever I want to go as long as I have a really good reason to optimize my experience. So anyway, how are you seeing it? I guess, what's left for humans? We could say art is left for humans. High level planning is left for humans. Not in a bad way. I mean that we will focus on that. There'll be a new world. There's a new level of cognitive cooperation that we have to develop.

What is left for humans, of course, is creation. Everything that involves a formalization because the computers need something formal to work, but they cannot formalize it themselves. So, everything that is creative, but also everything that is social, because you know there will still be babies; there will still be people that are ill; there will still be old people. Human beings are inherently and naturally social. So, everything that involves social interaction, I don't think that this will be completely replaced by robots. It's almost impossible. And even in the social media, when we discover that there is a

bot in front of us, we don't like it; we want real people. So, I think that communication will not disappear at all. Not at all. We will multiply our communication and that's it. By the way, that's very addictive. What is really addictive in social media is the communication, and before social media I remember very well you were in the classroom, the professor was speaking and you were speaking with your neighbor, because we were already addicted to communication.

ML: Well, I, I have another question. We did not speak so far about the anthropological spaces that you identified in your work. Is IEML taking us to a new anthropological space or not? Is it still within the cybersphere or is it a new step? Specifically, I wanted to ask you about the *noosphere*. Is it related to what you do?

PL: The theory of the anthropological spaces was formulated 25 years ago, and today I have a tendency to make an analogy between these spaces and the dominant medium of the time. For example, what I call the earth is more or less related to the medium of primary orality before writing, a more direct communication with nature, with the cosmos, and so on. Then what I called the territory is very related to writing because it's also the beginning of the state, beginning of agriculture, the beginning of management of complex societies, and so on. Then, the space of what I called the commodity space where more or less when you have the alphabet, you have also the birth of money and of more abstract economic exchanges and the development of commerce.

Of course, there is an enormous inflation, let's say, of the commodity space with the printing press and the industrial revolution, the global markets and so on. What is important to understand is that none of these anthropological spaces will ever disappear. The earth is there, the territory is there, the commodity space is there, even as anticapitalistic as you are, I think it will never disappear. It's there. But what we can do is to use the internet and the new growing algorithmic intelligence to build a new anthropological space on top of all the others. In such a way that it pilots the functioning of all the other spaces. The next space, I call it the knowledge space, a kind of ecosystem of ideas, of the human race at the global level, an ecosystem of ideas that we will be able to observe.

In observing these ecosystems of ideas, we are observing our own cognitive processes. That's the whole point of IEML. It is to give a symbolic foundation for this process of a reflexive collective intelligence to occur and to make the relationship with knowledge the dominant factor in the evolution of human society. That's the point. We will never suppress conflicts or power fights, or injustice, or crime. There is always a dark side. I'm not completely utopian, but let's do what we can to improve the situation and to be more conscious of what we are doing together and of the way in which we are in symbiosis with the environment.

ML: I saw that you launched the IEML in September 2018. There was a tweet about the launch. Is there a way to see the project in an application?

PL: At the beginning of the summer I went to Bologna. I was invited by the Foundation Golinelli about this project. A lot of people there were very interested. I made also a public event in Montreal. The problem is that for the moment, I don't have a lot of money.

What is giving me hope is that I'm working with Louis van Beurden who is a young mathematician and engineer who just got a master in AI and NLP. I am also currently in a big team that is working in the field of digital humanities at the University of Montreal. So, you have to be very patient, as I have been. I am on this project for more than twenty years, and if you read the book *Collective Intelligence*, I was already speaking about a super language. I have taken one step after the other. I could give you the link to the dictionary, but I'm not sure that it will be useful today because there are not all the explanations, and so on. But I'm slowly writing the manifesto; there will be applications. Before building an international team working on this project, I need to build some pedagogical tools. Because it's a language, you'll have to explain how it works, and you cannot explain a language in one hour.

It's like any language; it's complex. So, I'm going to write this book, and I'm going to record a series of videos explaining the language, paradigm by paradigm. I have already a deal with the University of Montreal to record the series of videos on this language, and once there is a critical mass of people knowing about the language and able to work on certain projects, that will be concrete progress. But there is a lot of preconditions to make it work properly. If you give me money now, I don't know what to do with it, because I need a pedagogical basis and a small group of people who are well versed in the language. Today we have three or four people, and that's not enough.

ML: How long will it take to develop concrete application?

PL: Between one and three years, if I'm lucky one year, otherwise three years. But it will happen.

AF: Very interesting. That's an important vision. Something to aim toward. You're giving people something that they can work toward. Trying to make it real. So that's very nice.

PL: I think of even limited projects, especially in the field of digital humanities, because I have always had digital humanities in mind when I was doing it. And, frankly, for the natural sciences, people have specialized languages to express the objects of the natural sciences, like in chemistry you have atoms; in physics everything is very well defined. But in humanities and social sciences, no. It is in this field that we have the biggest need for tools of explicitation, comparisons and so on. A precise qualification of things. So, I think it's the best field.

ML: It's a metalanguage basically that is different from the search for the perfect language that has been going on since the beginning of humanity, basically. The language that would allow global communication.

- PL:** Yes. it's going in that direction. Perfect? Okay... Perfection is impossible in human matters. I would say it will be better than the tools that we have right now.
- ML:** All the attempts to find the perfect language have failed so far. I think that your approach is different because it's a metalanguage and because you have in mind a workable practical language.
- PL:** It's not supposed to be spoken; it's supposed to be a code between the natural languages and the algorithms, and all the apparatus of computations and so on. If you do the comparison in a practical way, at least for the foreseeable future, you should compare it to the documentary metalanguages. Let's say you use the Dewey system or the library of Congress, which are in fact classification systems. On the other hand, you have the semantic metadata for all classifications or ontologies in the framework of the so-called semantic web. IEML is neither an ontology nor a classification. It's a language. So, you can express anything you want and any classification you want; you can compare different classifications, different ways to organize the data, and so on. So, it's a tool for semantic metadata.

Appendix

Some paradigms of morphemes for the IEML

Pierre Lévy

IEML has the following three properties *simultaneously*:

1. It is a *philological language*, according to Louis Helmslev's definition, i.e. it has the same power of expression and translation as a natural language.
2. It is a *regular language* in the Chomsky sense (its syntax is calculable)
3. Its *semantics can be calculated*, from the level of the morpheme to the level of the text.

From a mathematical point of view, IEML is a “topos”, i. e. an algebra (a regular language) in relation of morphism with a topology of semantic relationships.

On a philosophical level, I took up the challenge of inventing a symbolic system that makes the most of the new digital environment to serve human cognitive augmentation.

It is impossible to explain the IEML parallelism between syntax and semantics in a couple of pages only. I will nevertheless show some paradigms of morphemes that will give the reader some taste of the IEML grammar. Then I will show on one example how the morphemes are arranged to compose a word (or a sentence).

Keyboard

IEML morphemes are made of these 35 letters.

The small cap letters on the left of the keyboard result from the non-commutative multiplication (substance x attribute) of the (U, A, S, B, T) primitives.

The punctuation marks (: . - ' , _ ;) show the seven layers of recursive multiplication.

All IEML morphemes are the output at layer n of “paradigms” which are multiplication tables from input morphemes at layer n–1. The generation of any morpheme implies the weaving of its semantic relations with other morphemes.

There are one hundred paradigms organizing around four thousand morphemes in the current dictionary. The morphemes can be used to build an unlimited quantity of words and the grammar allows for sentences and super-sentences as complex and nuanced as necessary for human expression.

Ecosystems of collective intelligence

The morpheme s.o.-k.o.-' (collective intelligence) has s.o.- (concern for thought) in substance and k.o.- (desire for social bond) in attribute. The paradigm of layer 4 displayed in the paradigm "Ecosystem of CI" has s.o.-k.o.-' (collective intelligence) in constant substance and [M:O.: = j. (idea) + g. (message) + h. (subject) + p. (individual) + c. (object) + x. (body)] as variable attribute. The three rows underline the complementarity between knowledge and messages, people and their ethics, biophysical ecosystem and power. The first column, related to virtuality, interconnects networks of knowledge, will (ethics) and empowerment. The second column, related to actuality, joins networks of messages (or documents), social networks and physical equipment, including physical bodies.

s.o.-k.o.-'M:O.:-' collective intelligence ecosystems		
	s.o.-k.o.-'M:U.:-' virtual human development	s.o.-k.o.-'M:A.:-' actual human development
s.o.-k.o.-'S:O.:-' ecosystem of signs	s.o.-k.o.-'j.:-' ecosystem of ideas, knowledge networks	s.o.-k.o.-'g.:-' ecosystem of messages, documents ; information networks
s.o.-k.o.-'B:O.:-' ecosystem of people	s.o.-k.o.-'h.:-' ecosystem of subjectivities, ethical dispositions, converging willpower	s.o.-k.o.-'c.:-' ecosystem of interpersonal relations, social networking
s.o.-k.o.-'T:O.:-' ecosystem of things	s.o.-k.o.-'p.:-' ecosystem of power (competence, finance, morale)	s.o.-k.o.-'x.:-' biophysical ecosystem, interconnected bodies

Figure 1. Ecosystems of collective intelligence.

Dialectics of collective intelligence

“Dialectics of collective intelligence” is a paradigm of layer 5 which refines on the paradigm of layer 4 that we have just described. Each row header represents a cell of the paradigm “ecosystems of collective intelligence” of Figure “Ecosystem”. The rows represent the ternary dialectic that underlies the cells of this previous paradigm. The paradigm “Dialectics of CI” is a semantic declension of the former paradigm according to the triad S B T, where S (first column) indicates abstract aspects, B (second column) is related to a personal and affective dimension and T (third column) is bound to concrete and pragmatic facets.

s.o.-k.o.-'M:O:-',M:-',_ _ collective intelligence ecosystems: ternary dialectics			
	s.o.-k.o.-'M:O:-',S:-',_ _ formal or abstract moments of collective intelligence	s.o.-k.o.-'M:O:-',B:-',_ _ subjective and affective moments of collective intelligence	s.o.-k.o.-'M:O:-',T:-',_ _ practical and objective moments of collective intelligence
s.o.-k.o.-'j:-',M:-',_ _ ecosystem of ideas, knowledge networks	s.o.-k.o.-'j:-',S:-',_ _ study / practise of sciences	s.o.-k.o.-'j:-',B:-',_ _ study / practise of the arts	s.o.-k.o.-'j:-',T:-',_ _ study / practice of wisdoms
s.o.-k.o.-'g:-',M:-',_ _ ecosystem of messages and documents, information networks	s.o.-k.o.-'g:-',S:-',_ _ study / improvement of content creation	s.o.-k.o.-'g:-',B:-',_ _ study / improvement in communication	s.o.-k.o.-'g:-',T:-',_ _ media literacy / media development
s.o.-k.o.-'h:-',M:-',_ _ ecosystem of subjectivities, converging willpower, ethical disposition	s.o.-k.o.-'h:-',S:-',_ _ exercise / refinement of governance	s.o.-k.o.-'h:-',B:-',_ _ respect / refinement of values	s.o.-k.o.-'h:-',T:-',_ _ respect / refinement of rights and obligations
s.o.-k.o.-'c:-',M:-',_ _ ecosystem of interpersonal relations, social networking	s.o.-k.o.-'c:-',S:-',_ _ playing / developing social roles	s.o.-k.o.-'c:-',B:-',_ _ maintaining / building trust	s.o.-k.o.-'c:-',T:-',_ _ maintaining / developing social connections
s.o.-k.o.-'p:-',M:-',_ _ ecosystem of powers, system of strength	s.o.-k.o.-'p:-',S:-',_ _ skills maintenance / development	s.o.-k.o.-'p:-',B:-',_ _ maintaining / strengthening morale	s.o.-k.o.-'p:-',T:-',_ _ collection / use of resources
s.o.-k.o.-'x:-',M:-',_ _ biophysical ecosystem, interacting bodies	s.o.-k.o.-'x:-',S:-',_ _ technology maintenance / development	s.o.-k.o.-'x:-',B:-',_ _ maintenance / improvement of public health	s.o.-k.o.-'x:-',T:-',_ _ maintenance / improvement of a bio-physical environment

Figure 2. Collective intelligence ecosystems: ternary dialectics.

A sustainable human development implies a continuous exchange of resources between the six cells of table "Ecosystem". The internal dialectic of these cells is further detailed by the paradigm of Figure "Dialectics". The fabric of collective intelligence as a whole is described in more detail in other paradigms of the dictionary like

<https://dev.intlekt.io/morpheme/O:M:-O:M:-'s.o.-k.o.-'>

Skills

At the level of *grammar*, we find fundamental capacities for action, “basic” competencies. But this does not necessarily mean elementary skills; there can obviously be very high degrees of linguistic competency, self-mastery or sensory motor refinement. Grammatical competencies involve the self. They imply discursive or symbolic abilities with regard to signs, emotional or affective energies with regard to beings, and physical skills with regard to things.

Dialectic includes interactional competencies. In the signs row, the grammatical mastery of codes serves knowledge of a wide variety of subjects, leading to reasoning, and dialog.

S:M:e-M:M:u-wa.e-' sign related skills									
	S:M:e-s.u-wa.e-' image	S:M:e-b.u-wa.e-' language	S:M:e-t.u-wa.e-' computing	S:M:e-k.u-wa.e-' symbol	S:M:e-m.u-wa.e-' performing arts	S:M:e-n.u-wa.e-' literature	S:M:e-d.u-wa.e-' information science	S:M:e-f.u-wa.e-' music	S:M:e-l.u-wa.e-' research
s.e-M:M:u-wa.e-' basic competencies	s.e-s.u-wa.e-' drawing, painting	s.e-b.u-wa.e-' mastering a second language	s.e-t.u-wa.e-' counting, calculating	s.e-k.u-wa.e-' reading, writing	s.e-m.u-wa.e-' play comedy / act	s.e-n.u-wa.e-' vocabulary	s.e-d.u-wa.e-' information search	s.e-f.u-wa.e-' singing, music / playing	s.e-l.u-wa.e-' interpreting natural signs
b.e-M:M:u-wa.e-' culture	b.e-s.u-wa.e-' visual refinement	b.e-b.u-wa.e-' interpreting, guiding	b.e-t.u-wa.e-' logic, programming	b.e-k.u-wa.e-' personal interpretation	b.e-m.u-wa.e-' performing arts	b.e-n.u-wa.e-' literary erudition	b.e-d.u-wa.e-' documentation	b.e-f.u-wa.e-' musical erudition	b.e-l.u-wa.e-' scientific erudition
t.e-M:M:u-wa.e-' creative abilities	t.e-s.u-wa.e-' image creation, graphic design	t.e-b.u-wa.e-' eloquence	t.e-t.u-wa.e-' computer science, software engineering	t.e-k.u-wa.e-' symbol creation	t.e-m.u-wa.e-' staging, artistic direction	t.e-n.u-wa.e-' literary writing	t.e-d.u-wa.e-' information architecture	t.e-f.u-wa.e-' musical composition	t.e-l.u-wa.e-' scientific research

Figure 3. Sign | related skills.

In the being row, self-esteem and self-mastery serve egalitarian, mutually respectful relationships with others. Conflicts and divergent interests are settled through negotiation, while agreements and promises are managed contractually.

B:M:e-M:M:a-wa.e-' being related skills									
	B:M:e-s.a-wa.e-' understanding	B:M:e-b.a-wa.e-' speech	B:M:e-t.a-wa.e-' memory	B:M:e-k.a-wa.e-' commitment	B:M:e-m.a-wa.e-' benevolence	B:M:e-n.a-wa.e-' discernment	B:M:e-d.a-wa.e-' truthfulness	B:M:e-f.a-wa.e-' health / well being	B:M:e-l.a-wa.e-' safety
k.e-M:M:a-wa.e-' obligations to oneself	k.e-s.a-wa.e-' understanding oneself	k.e-b.a-wa.e-' speaking sincerely	k.e-t.a-wa.e-' memory training	k.e-k.a-wa.e-' following a discipline	k.e-m.a-wa.e-' become friend with oneself	k.e-n.a-wa.e-' self-evaluation	k.e-d.a-wa.e-' having a cool head	k.e-f.a-wa.e-' taking care of oneself	k.e-l.a-wa.e-' self-protection
m.e-M:M:a-wa.e-' obligations to others	m.e-s.a-wa.e-' understanding others	m.e-b.a-wa.e-' speaking wisely	m.e-t.a-wa.e-' fidelity	m.e-k.a-wa.e-' collaborative attitude	m.e-m.a-wa.e-' solicitude	m.e-n.a-wa.e-' moral judgement	m.e-d.a-wa.e-' truth seeking	m.e-f.a-wa.e-' causing well-being, caring for people	m.e-l.a-wa.e-' norms / law abiding
n.e-M:M:a-wa.e-' obligations to a community	n.e-s.a-wa.e-' to give purpose to a group	n.e-b.a-wa.e-' representing a group	n.e-t.a-wa.e-' establishing a tradition	n.e-k.a-wa.e-' giving oneself as an example	n.e-m.a-wa.e-' inspiring harmony	n.e-n.a-wa.e-' forging values	n.e-d.a-wa.e-' releasing the truth	n.e-f.a-wa.e-' prevent, heal	n.e-l.a-wa.e-' protecting a group

Figure 4. Being | related skills.

In the things row, sensory-motor competencies serve technical know-how involving the manipulation of tools and machines, and the ability to create and maintain concrete environments for life and work.

T:M:e-M:M:i-wa.e-' thing related skills									
	T:M:e-s.i-wa.e-' sports / techniques related to interface / translation	T:M:e-b.i-wa.e-' sports / technique related to media	T:M:e-t.i-wa.e-' sports / techniques related to transportation / container	T:M:e-k.i-wa.e-' sports / techniques related to society / exchange	T:M:e-m.i-wa.e-' techniques related to games / seduction	T:M:e-n.i-wa.e-' techniques related to fire / energy / matter transformation	T:M:e-d.i-wa.e-' sports / techniques related to precision / measurement	T:M:e-f.i-wa.e-' sports and techniques related to bodies / organisms	T:M:e-l.i-wa.e-' sports / techniques related to space
d.e-M:M:i-wa.e-' sensori-motricity / body-mind coordination.	d.e-s.i-wa.e-' body-mind disciplines, yoga, tai-chi, meditation	d.e-b.i-wa.e-' dance, body language, body art	d.e-t.i-wa.e-' driving, riding, steering	d.e-k.i-wa.e-' team sports, ball games	d.e-m.i-wa.e-' corporeal aesthetics, fashion	d.e-n.i-wa.e-' culinary arts, catering, food / drink production	d.e-d.i-wa.e-' shooting, aiming sports	d.e-f.i-wa.e-' gymnastics, athletics, body building	d.e-l.i-wa.e-' martial arts, combat
f.e-M:M:i-wa.e-' technical abilities	f.e-s.i-wa.e-' integration of disparate data and/or software	f.e-b.i-wa.e-' content production	f.e-t.i-wa.e-' production / maintenance of vehicles / engines	f.e-k.i-wa.e-' commerce, sales, purchase, barter, economic transactions	f.e-m.i-wa.e-' decoration, furnishing, design	f.e-n.i-wa.e-' laboratories, plants with furnaces, chemistry, metallurgy, pottery	f.e-d.i-wa.e-' instruments of control, measurement, computing	f.e-f.i-wa.e-' intervention on an organism, surgery, graft, prosthesis, medical treatment	f.e-l.i-wa.e-' civil engineering, roads, bridges, tunnels, mining, construction
i.e-M:M:i-wa.e-' industry related skills	i.e-s.i-wa.e-' large scale data processing, cloud computing	i.e-b.i-wa.e-' communication network	i.e-t.i-wa.e-' packaging / storage / transportation networks	i.e-k.i-wa.e-' finance, economic strategy	i.e-m.i-wa.e-' game, entertainment	i.e-n.i-wa.e-' energy production / distribution	i.e-d.i-wa.e-' metrology, robotics	i.e-f.i-wa.e-' agriculture, breeding, biotechnologies	i.e-l.i-wa.e-' architecture

Figure 5. Thing | related skills.

Once again, dialectical competencies are not “medium” competencies between grammar and rhetoric. Each dialectical competency can be distributed on a scale of excellence from minimal to exceptional.

The capacity to get things done is to be found in the rhetoric column. Communication strategies organize signs and messages so as to accomplish a work of persuasion, reframing (or even deception) as effectively as possible. Leadership, the ability to inspire or direct a group, acts on beings, in particular on their social cohesion. Finally, engineering is about making things work on things, combining mechanisms for a particular purpose. Once again, rhetoric is in no way the “summit” of the competencies since there are obviously many degrees of strategic abilities, from weakness to maximum effectiveness.

Let us now examine a differentiation of the paradigm M:M:e.- at the next layer.

Skills related to signs

Let's analyse the paradigm “Skills related to signs”

- We have in *substance* s. (reflexion) b. (language) t. (memory) multiplied by e. (can). We recognize s.e.-, b.e.- and t.e.- (grammar, dialectic and rhetoric of signs) of Figure "skills"
- We find in *attribute* the nine dimensions s. b. t. k. m. n. d. f. l. (see the keyboard) that are multiplied by u. (say, express) in order to indicate actual communication. The paradigm of Figure “skills related to signs” is therefore a semantic declension – or a differentiation – of s.e.- , b.e.- and t.e.-
- The constant mode (the third variable of the semantic multiplication) is wa.e.- (mastering competences) [link: <https://dev.intlekt.io/morpheme/wa.e.->].
- The meaning of the letters is redefined according to the context of the paradigm. For example, n. (world) in the sixth column stands for literary arts because it is multiplied by u. (say, express) and is used in a paradigm of competencies related to signs. Literature expresses the "world" of a culture. The reader can see that, as usual, for each row or column, the letters are exactly the same, except for one syntactic role that varies.

Skills related to beings

The paradigm “Skills related to beings” is organized in the same way that the previous paradigm except that it shows the semantic declension of k.e.-, m.e.- and n.e.- instead of s.e.-, b.e.- and t.e.-. In addition, a. (commit) is used to modify s. b. t. k. m. n. d. f. l. instead of u. (say, express), because the paradigm is about the actualization of values and good intentions.

Skills related to things

The skills related to things is organized as the two previous paradigms and it expands the third row of the (simple) skills paradigm.

The structure of a word in IEML: the example of “colonialism”

There are nine syntagmatic roles – or cases – in IEML: the process or verb, the initiator or grammatical subject, the interactant or grammatical object, the recipient or beneficiary, the time, the place, the intention, the manner and the cause. The process is the root of the syntagmatic tree. Every actant subordinated to the process (initiator, time, cause, etc.) can be precised by a quality or adjective and – recursively – by a subordinated actant.

At the level of the word, each syntagmatic role can be fulfilled by a lexeme that is composed by an inflection poly-morpheme (the first parenthesis in Figure 6) and by a content poly-morpheme (the second parenthesis). Several lexemes can be linked at the same syntagmatic role by a junction (like “and”, “or”, “but”, etc.).

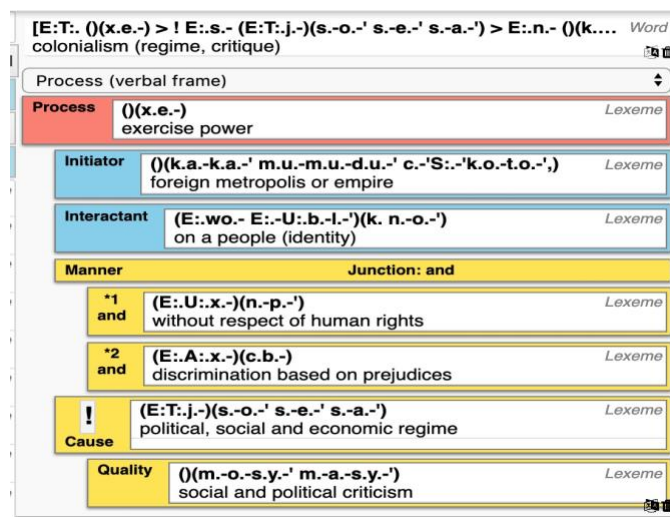


Figure 6. Possible IEML interpretation of “colonialism.”

Figure 6 shows one possible interpretation of the English word “colonialism” in IEML. Each lexeme is translated by a short line. Figure 7 shows the translation of every morpheme individually.

lexeme	role	flexion	content
	process E:T:.		exercise of power x.e.-
foreign metropolis or empire	initiator E:n.-		city, political unit, country k.a.-k.a.-' other m.u.-m.u.-d.u.-' city, empire c.-'S:-'k.o.-t.o.-',
	interactant E:d.-	singular, one single E:wo.- on, above, on top E:-U:b.-l.-'	society k. cultural singularity, resistance n.-o.-'
	*1 and manner E:f.- E:S:-k.u.-' j.-U:-'d.o.-l.o.-', *2 and manner E:f.- E:S:-k.u.-' j.-A:-'d.o.-l.o.-',	without E:U:x.- with E:A:x.-	human rights, deontology (respect) n.-p.-' language of exclusion or hate, discrimination c.b.-
	cause E:s.-	structure, formal cause E:T:j.-	political organization s.-o.-' economic organization s.-e.-' social organization s.-a.-'
	quality cause E:s.- E:U:.		political critique m.-o.-s.y.-' social critique m.-a.-s.y.-'

Figure 1: [E:T:.(x.e.-) > E:n.- (k.a.-k.a.-' m.u.-m.u.-d.u.-' c.-'S:-'k.o.-t.o.-') > E:d.- (E:wo.- E:-U:b.-l.-')(k. n.-o.-') > E:f.- E:S:-k.u.-' j.-U:-'d.o.-l.o.-', (E:U:x.-)(n.-p.-') > E:f.- E:S:-k.u.-' j.-A:-'d.o.-l.o.-', (E:A:x.-)(c.b.-) > ! E:s.- (E:T:j.-)(s.-o.-' s.-e.-' s.-a.-') > E:s.- E:U:.(m.-o.-s.y.-' m.-a.-s.y.-')]

Figure 7. Translation of “colonialism” morphemes.