# A Bridge Between Languishing and Flourishing

## The Meta Learning Model

Marcial Francisco Losada, Ph.D
Founder of Losada Line

The Meta Learning model (ML) is now used in all five continents in a variety of areas such as psychology, education, health, sports, coaching, management teams, organizational development, finance, marketing, sales, client service, software development teams, negotiation, politics and international conflicts. More than 3800 citations of my work on teams can be found in Google Scholar. We have collected data about work teams in a variety of countries during a period of thirty years, including Chile where we have worked with corporations such Bci, BHP Billiton, Codelco, Telefónica, Hatch, Prosegur, Abcdin, Banchile, and Transbank. We have the largest database about interaction processes in teams existing at the moment. Based on these data we have developed a more advanced versión of the ML model. I say more "advanced" because this new version incorporates one of the most fundamental principles of the advanced sciences. This is the principle of symmetry that links energy to symmetry. I will develop this principle in relation to teams later in the article.

When I started to work in my two labs in the US in Ann Arbor and Cambridge in 1985, I was interested in demonstrating that there was a strong connection between the interaction processes of a team and its performance. My goal was to find the critical variables that had a significant influence on performance. By "critical variables" I mean those that account for more than 75% of performance. After working for ten years with teams from various US companies, I discovered the variables that actually ended up accounting for 91% of performance. Following the principle of parsimony in science (explaining the maximum with the minimum), I ended up narrowing the search to only three bivariate variables: positive-negative feedback, other focus-self focus, and inquiry-advocacy. Using bivariate instead of univariate variables proved to be decisive to incorporate symmetry in my model. Coding these variables on a second-by-second basis utilizing a bank of computers and several observers, I managed to generate a time series that revealed the team's interaction patterns after a cross-spectral analysis. Just like music requires a succession of notes to generate melodies, harmonies and rhythms, in the same way we need a lot of data ordered over time to do the kinds of mathematical analyses that would reveal the patterns of human interaction. This is particularly critical to unravel the complex dynamics produced by humans interacting within a team.

The novelty of this approach generated a strong interest not only in academia but also in the corporate world. Several corporations in the US and Europe such as Apple, General Motors, Boeing, Merck, American Express, DTE Energy, Nokia, Opel, Mondragón and Roche became interested in my work as well as several foundations and research centers such as Bell Labs, Los Alamos National Laboratory, Kellogg Foundation, Mellon Foundation, Institute for the Future and Stanford Research Institute. My labs were visited by professors at MIT, the University of Michigan and other universities such as Harvard where I was invited to give a talk at its business school.

In Cambridge, I met the renowned mathematician Gian-Carlo Rota. He held the Norbert Wiener chair at MIT mathematics department and taught differential equations, probability and combinatorics, a field where he was recognized as a top expert. Gian-Carlo Rota was the only professor in the history of MIT to teach both math and philosophy (he taught phenomenology and was an expert on Husserl and Heidegger). He did something with his students that showed the kind of man he was: He gave chocolate bars to the students who asked good questions. He was a charmingly unpredictable man. I'll never forget the day when he came to visit me at my lab in Cambridge. I spoke to him in Italian and he told me: "Don't bother, I speak Spanish." My Italian must have left much to be desired and from then on our conversation proceeded in Spanish. He spoke it perfectly, almost without an accent. He immediately wanted to see my data and the types of mathematical analyses and modeling I did with them. Once he was satisfied with my approach, he invited me to lunch. On our way to the restaurant we didn't talk; we alternatively recited lines of poetry in Spanish that we both knew by heart. We exchanged ideas on numerous occasions. We liked to explore our common interest in mathematics, philosophy, poetry and good food. He kept me abreast of the new advances in mathematics that could be relevant for my work. He did this with great enthusiasm and clarity, qualities without which I could not have enjoyed his explanations. Gian-Carlo wanted me to move to Cambridge (I lived in Ann Arbor) so that we could have more frequent exchanges.

Professor Rota had much interest in my work and wanted it to be known widely. He sent my article The Complex Dynamics of High Performance Teams to the journal Mathematical and Computer Modelling (1999) where it was published without modifications and is now widely cited. Other MIT professors who came to my lab in Cambridge, such as Arnoldo Hax, Ed Schein, and Robert Solow, Nobel in economics, encouraged me to publish my findings about team dynamics. Professor Rota invited Nicholas Metropolis, the distinguished mathematician and physicist, expert in modeling (he designed the Monte Carlo method with John von Neumann and Stanislaw Ulam) to my lab in Cambridge. After becoming familiar with my work, doctor Metropolis invited me to deliver the prestigious annual conference, Director's Colloquium, in Los Alamos National Laboratory, a world renowned center for the study of nonlinear dynamics. This conference was broadcasted to the California university system that includes universities such as Berkeley and UCLA.

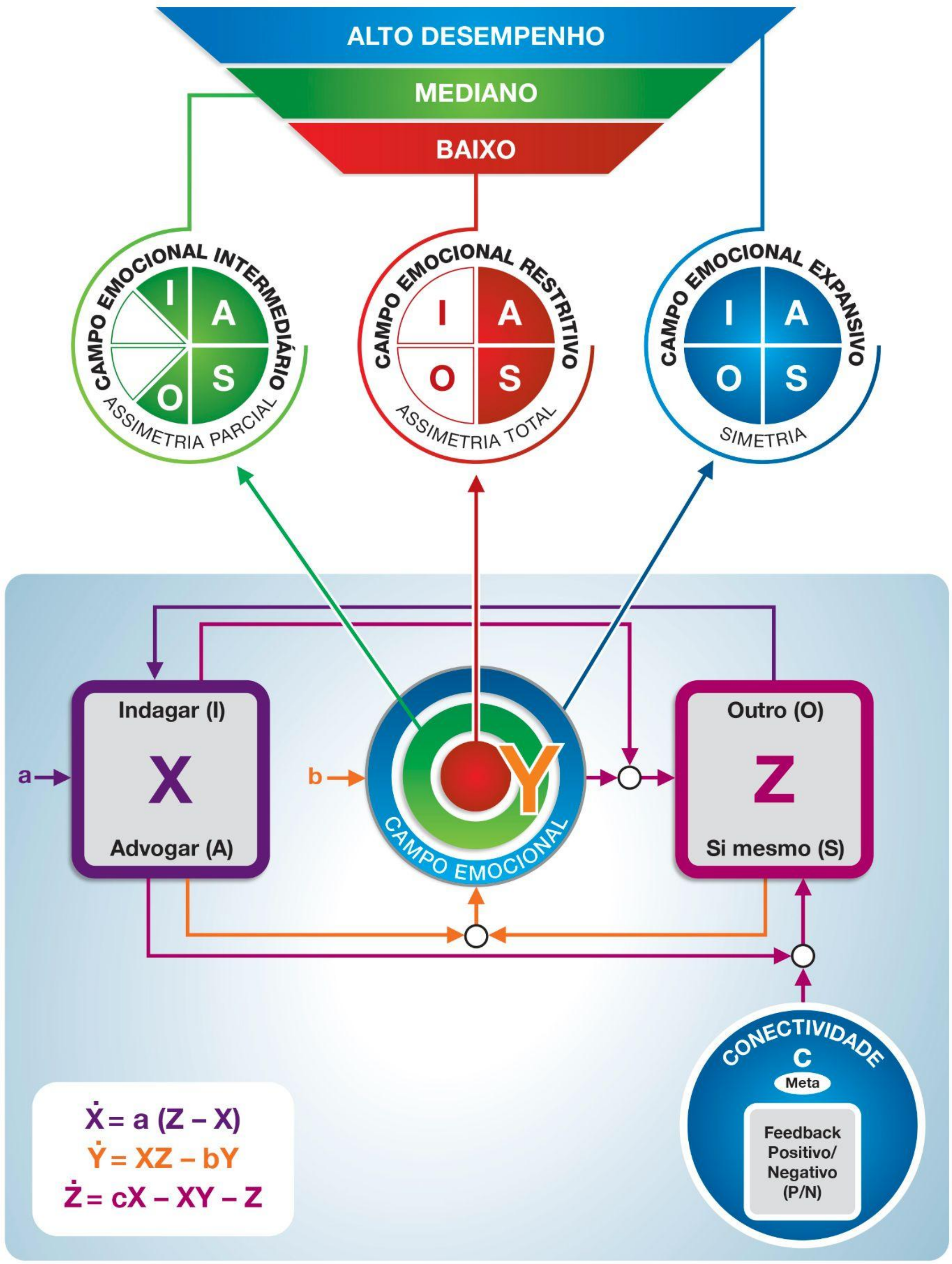
My lab in Ann Arbor was visited every year by the graduate students of psychology and also by foreign visiting professors, as well as the faculty of the University of Michigan. The university asked me to head a multidisciplinary center for which I had secured funding. Among the members of the center was the professor of engineering Charles Vest, future MIT president, who in this capacity invited vice president Al Gore to visit my lab in Cambridge. While I was well aware of the pioneering character of my work, I never imagined the amount of interest it generated in such a wide audience. Even today I keep asking myself, why so much interest? Why is it that the ML model, with such simple differential equations is so powerful? The reader will find part of the answer in my article A Historical Record of my Work with Teams in my site losadaline.com. Here I will try to answer this question under the perspective of the more advanced version of the model. Working with organizations that span all the way from Finland to Patagonia (where I worked with Methanex), I have come to the conclusion that it is not enough to define performance using indicators such as profitability, client satisfaction and 360- degree evaluations. Something else is needed to account for the good performance of some negative companies. I realized that these companies normally have high turnover and bad health indicators. I needed to add another criterion for high performance: Flourishing. At the end of this article I will develop the concept of flourishing in relation to the ML model, and I will argue that organizations need to be more than just a "good place to work" and must become a place where people can flourish.

The name"meta learning" is used to emphasize that this learning goes beyond previous learnings that failed to create the conditions for sustainable high performance and flourishing. 80% of teams fail to reach these conditions and can not find the way out by using traditional linear methods. The ML model is a nonlinear dynamic model that shows how to break the barriers that keep people and teams languishing. We can conceive of the ML model as a bridge between languishing and flourishing. I will present a graphic of the model and then I will explain, step by step, all of its variables and parameters as well as the connections between them. I use different geometric forms to represent variables (rectangles), emotional fields (circles), and performance level (triangle). This is the graphic we use with all our clients in our

diagnoses and interventions. As a result, our clients have a clear representation of where they are stuck and how they can liberate themselves from this predicament. I use colors to differentiate the various components of the model as well as the connections that represent the nonlinear differential equations. I did this in order to make the model understandable for people with no formal training in differential equations. Most of our teams are made up of engineers who can follow these equations, but I also have had teams composed only of lawyers who were able to follow the model in the graphic version that follows.

LOSADA

# MODELO META LEARNING (v. 5.0)



Let's start at the bottom of the dark blue rectangle. There is a dome-shaped figure that contains Connectivity (c), Goal, and Positive/Negative Feedback. Connectivity is the model´s control parameter. If a team is highly connected, the better its performance will be. If we increase the connectivity of a team, we increase its chances for high performance. Think of a football, basketball or volleyball team. A better connected team will get better results compared to a less connected team. You can have great individual talents, but if they are not well connected, a team with less individual talents but better connected will stand a better chance to win. Good leaders know this and they realize that it is not enough to hire talented people, it is necessary that talented people connect well with each other. A good leader understands that it is not enough for individuals' talents to add up, they must achieve a multiplication effect. At the center of the dome we find the Goal. Unless a team has a goal, it is not a team but just a group of people. Teams connect having a goal in mind, and they connect even better if they have the goal in their heart. Nonetheless, it is not enough to have a goal to generate strong, lasting connections.

At the bottom of the connectivity dome we find the positive/negative ( the P/N ratio). The majority of strong, lasting connections are achieved through an adequate P/N ratio. The rest of the connections are established through the other variables of the model. All these connections contain energy, just like chemical bonds do. This energy is due to the oscillatory character of the cross-correlated behaviors which induce harmonic resonances and constitute what we call nexi, or connections captured by the cross correlation. The number of nexi constitutes the connectivity level of a team. An oscillation has frequency and we know from physics that frequency and energy are linked. Connectivity is basically energy directed towards achieving a goal. We can think of connectivity as a vector: Its magnitude is the amount of energy provided by the nexi and the goal provides the direction.

Most feedback is given with respect to the goal: How well and how fast is achieved. Another part of the feedback is given with respect to the interaction processes themselves. What is an "adequate" P/N ratio? The one that divides high performance from medium and low performance. This ratio was found empirically after more than 2000 diagnoses of teams in a variety of organizations and diverse countries over a period of thirty years. The ratio is 3:1 (3 positives for each negative) and is known as the Losada ratio. The best team we have worked with has a P/N ratio of 5.83 (after six months of training in ML.) This team is from Bci, a highly regarded financial institution in Chile. This team managed to surpass the previous limit of 5.71 also achieved by another Bci team. We have been working with Bci for over six years now. Bci has awarded us the Innovation Prize in recognition for our work. The worst team we have diagnosed had a P/N ratio of 0.75, that is, it was more negative than positive. This team was not trained in ML; we just did the diagnosis (it happens every so often that the worst teams stay at the diagnosis level and don't move on to the training process).

My findings have been corroborated independently by a number of researchers. John Gottman, a top expert in marriages, found the same results as mine: Lasting, happy marriages, have P/N ratios over 5. Marriages that often end in divorce have P/N ratios of less than 1, where negativity prevails. John is a mathematician and psychologist who shares my methodology. He was at my lab in Cambridge where he had the opportunity to get well acquainted with my work. As a result of that visit he invited me to give a seminar to his post-graduate students and later invited me to work at his institute. Several doctoral dissertations in different countries have corroborated my results and recently the physicists Patricio Pacheco and Rafael Correa, published an article in the Journal of Physics (2016) where they replicated my results using the same variables and nonlinear differential equations that I used in my model. In science, there is nothing as convincing as independent corroboration.

When we measure the P/N ratio we must always take into consideration that we give feedback not only with words but also with our nonverbal expressions. Most of the time, without even noticing it, we are giving feedback to people, even if we don't talk. Science published an article in October 2010 where the authors show that for high performance teams the key factor is to recognize nonverbal cues. With Dr. Geralda Paulista, who did her doctoral dissertation on the nonverbal aspects of my model, we have incorporated nonverbal expressions to determine the P/N ratio, as well as the other variables in the ML model. Furthermore, our training requires that team members learn not only to recognize nonverbal clues but also incorporate these nonverbal expressions in their behavioral repertoire. We know that the impact of nonverbal expressions in human behavior can surpass that of verbal behavior.

The P/N ratio is a powerful variable in human interaction. Both John Gottman and I are amazed at what this ratio can reveal even in a very short period of time both in teams and marriages. A study done at the medical school of the University of Michigan, published in American Journal of Cardiology (2006) showed that with only 10 minutes of observation of the P/N ratio of a couple, this ratio predicts if one of the spouses with congestive heart failure will be dead or alive four years later. Numerous studies have shown the power of the P/N ratio in a variety of situations, but very few manage to give a satisfactory answer for the reason for this power. How come this ratio says so much in such a short time? This is a good question that, like a good wine, requires a resting time. The moment is now ripe to give you my answer. The P/N ratio is powerful because it gives us much more than **information** regarding how well or how bad we are doing something—which is the most common answer. We won't understand the power of the P/N ratio unless we realize that it is a source of **connectivity** that provides **control**, generates **energy**, and induces **symmetry**, when it reaches 3:1. The Losada ratio itself is not symmetric, it is a generator of symmetry in the other variables of the model. In physics, a charge (positive-negative) is a generator of symmetry. By being a generator of symmetry, the P/N ratio can separate high from low performance. If it is less than 3:1 there will be asymmetry in the other bivariate variables, i.e., there will be much more self-focus and advocacy than other-focus and inquiry, and performance will be low.

Information, connectivity, control, energy, and symmetry are critical properties for a complex system to function efficiently. Depending on how and how often we give positive and negative feedback we can connect or disconnect with other people. Not every positive feedback connects us, nor all negative feedback disconnects us. We must often ask ourselves whether our feedback connects or disconnects us, because connectivity is the control parameter of the ML model. Let's not forget that our gestures are as important as our words when we give feedback. In my labs, I discovered that a genuine smile has a .96 probability of being answered by another smile. The P/N ratio generates sustainable energy when it reaches the Losada ratio and drains energy when it is below that ratio. The P/N ratio allows us to control systems with different degrees of complexity. Simple devices, such as a thermostat, are controlled by negative feedback alone. But complex living systems require the right P/N ratio. It has been well documented that in living systems, the P/N ratio can induce and maintain symmetry (homeostasis) in the physiological processes necessary for life. Notice that symmetry in human beings is always dynamic, approximate, never mathematically exact. If we were perfectly symmetric beings we would be artificial, like a robot, and that is why robots would be more convincing if we introduce a little asymmetry in them. Researchers have shown that we are attracted to people with approximate symmetry in their faces. We are dynamically symmetric beings: we can walk thanks to the symmetry of our legs and feet, we have stereoscopic vision thanks to the symmetry of our eyes and we can hear stereophonically thanks to the symmetry of our ears. But our symmetry goes well beyond seeing and hearing.

Let's continue our tour of the model. In the right-hand side of the black rectangle we find the bivariate variable Other-Self. High performance teams are able to maintain a dynamic equilibrium between self-focus and other-focus. When connectivity is high (more than 75%) this variable will be balanced, it will have approximate symmetry. On the contrary, low performance teams are self-centered, they rarely pay attention to the concerns of others. These teams are asymmetric with respect to this variable. Symmetry plays a fundamental role in the ML model: It shows up again in the bivariate variable Inquiry-Advocacy on the left-hand side of the black rectangle. The best teams are able to generate approximate symmetry in this variable. The worst teams advocate almost all of the time. The few questions they ask are not generative; they don´t provide the opportunity for other people to show their knowledge in a way that may contribute creatively to the task at hand. People have a strong need to show the best of themselves. Good questions allow them the opportunity to do so. The best teams excel at asking generative questions and by doing so, they are able to advocate more convincingly.

Notice that Inquiry-Advocacy, Other-Self, and Positive/Negative feedback are all colored gray and have a rectangular form. This means they have something in common: They are the observed behaviors (observables) that we use when we diagnose a team. We give feedback on these behaviors to team members every time we have a workshop with them. The majority of teams go through three or four two day workshops, so they get plenty of feedback on how well they interact with other team members. By learning to monitor these critical variables, they are able to avoid recurrent behaviors that drain energy, such as excessive self-focus and advocacy.

By keeping a dynamic balance between these variables, teams learn to generate expansive emotional fields that provide the necessary energy to achieve long-term, strategic goals. Once a team incorporates the ML training into their day-to-day activities they will be able to remain a high performance team for as long as they are a team. I use the term “incorporate” in its original Latin meaning: “put into the body.” Storing knowledge in the head is not enough, the body needs to be engaged. Once a team can feel the good results of practicing the ML model, then they will “meta learn.”

At the center of the model we find the Emotional Field. The concept of field was introduced in psychology by Kurt Lewin, a Gestalt psychologist, during the 1940s. I studied with several of his disciples at the University of Michigan and since then I have looked for a way to use the concept in my work with teams. This effort led me to study the concept of field in physics where it was originally developed by Faraday and Maxwell in the 19th century. Today, the most advanced theory in physics is known as Quantum Field Theory. In this theory, particles are viewed as excitations of a field (quanta), not as isolated objects. In psychology it is not sufficient to study people as if they were isolated. Some time ago Google focused on how to build the perfect team and discovered that “analyzing its workers as individuals wasn’t enough to improve results; the key was to influence the behavior of working teams providing a way for them to express their emotions.” As people interact with other people, be it in teams or marriages, they generate emotional fields that, as any field, contain energy. These fields in turn influence people’s behavior. I have discovered that these fields have magnitude and levels of symmetry that can be measured using the model´s equations. These measures allow us to classify fields in three categories: 1) Restrictive emotional fields where we can find emotions such as fear and anger. 2) Expansive emotional fields where enthusiasm and happiness can be found. 3) Intermediate fields where surprise and doubt can be found, among others that cannot be classified as expansive or restrictive.

It is not possible to fully understand a team or a marriage without taking into consideration the fields they generate with their interactions. Since we are born, we are part of a field provided by our family, our friends and enemies, our teachers and later in life, our bosses. We, in turn, can do something to modify the emotional fields where we find ourselves. Fields are not static, rigid, structures; they are dynamical, flexible and malleable. We don't live all the time in the same fields; they oscillate, expand and contract, just like any other dynamical structure in the universe. What counts is not to get trapped in restrictive emotional fields where our possibilities for action are reduced, but to generate expansive emotional fields, so that we can have access to a wider spectrum of possibilities. We can be the architects of the fields where we would like to live. A good mother or father, a good teacher, a good leader, is one who knows how to generate expansive emotional fields where flourishing is possible. The ML model shows us how to generate such fields.

The concept of field is central in the ML model and that is why we have located it at the center of the model. The magnitude of the fields is represented by the radius of three concentric circles colored blue, green, and red. The blue circle has the larger radius and, consequently, larger magnitude, followed by the green circle and ending with the red one that has the smaller radius. The colors represent the different energy levels of the emotional field: Blue is high, green is medium and red is low. This is in agreement with the frequencies of the visible spectrum: The frequency of blue is higher than green which in turn is higher than red. Physics tells us that energy and frequency are related by the equation that gave birth to quantum physics ($E = hf$, where $h$ is Planck's constant.) Emotional fields can be characterized by their energy levels and also by their symmetry. As we have seen, an emotional field is expansive when we are able to achieve symmetry in other-focus and self-focus as well as in inquiry-advocacy. These variables are asymmetric in low performance teams and, consequently, not enough energy is generated to achieve demanding, complex tasks. Symmetry not only generates energy, but sustainable energy. Long-term strategic goals require energy that lasts over time.

Emotional fields are powerful because they affect a team performance, the harmony of our relationships and our well-being. A low performance team is characterized by asymmetric, restrictive emotional fields that do not generate enough sustainable energy to achieve strategic goals in time. A high performance team is able to generate symmetric, expansive emotional fields that provide sustainable energy for the team to reach strategic goals in time. It is not enough for a team to have good, well-defined goals; they must also learn to generate expansive emotional fields. Imagine an archer pointing her arrow to a target. The target is the goal and for the arrow to reach the target, the energy provided by the tension of the bow is needed. If the target is far away a lot of energy is needed. Without energy we cannot reach worthy destinations. Values are worthy destinations. All organizations have values, but what counts is if these values have the necessary energy to achieve them. If not, they are just declarations of good intentions.

Expansive emotional fields are also characterized by P/N ratios of at least 3:1; but no more than 6:1. Excess positivity can be detrimental for learning. We need negative feedback to correct undesirable behaviors, but we must keep in mind that excess negativity does not provide the necessary energy to achieve strategic goals. This is why we need to act within an adequate P/N range. This range is known as the Losada zone: P/N cannot be less 3:1, nor more than 6:1. I will explain why in the next paragraph. Expansive emotional fields are located within the Losada zone and open many opportunities for action; restrictive emotional fields are below the Losada zone and close possibilities for action. Fear constrains our actions mostly to escape, but enthusiasm not only opens many possibilities, but actions that seemed impossible become achievable. Below the Losada zone, emotional fields are asymmetric and restrictive. Excessive advocating and self-focus closes the door to innovation which is fundamental to survive in a world that is increasingly more complex and competitive.

established a P/N ratio of 6:1 as a maximum for two reasons: 1) After observing a great number of teams over a period of thirty years, we have found that the best team achieves a P/N of 5.83 after six months of training in ML. 2) All the potential energy available to teams is transformed into kinetic energy when the magnitude of the emotional field reaches 32. This magnitude is equivalent to a P/N ratio of 6:1. If there is no more potential energy left to be transformed into kinetic energy, the Lagrangian (kinetic minus potential energy) reaches its maximum and 6:1 has to be a limit.

There is a third reason that also validates the Losada ratio as a provider of limits. Harmonic analysis indicates that a maximum could be found one octave above the minimum limit to achieve high performance, which is the 3:1 Losada ratio. The octave above 3:1 is 6:1. Why is it that an octave is the double? In a piano the central A has a frequency of 440 Hz (orchestras tune in this frequency); the A one octave above has a frequency of 880 Hz. Furthermore, the sub and supra harmonics of the Losada ratio should provide two limits; one between low and medium, and another between high and top performance, respectively. Then, these harmonics give us four performance levels: Low, medium, high and top. My data confirm these categories and we use them in all our team diagnoses. When we do our first diagnosis of an organization's teams during pre-training, we order them according to these categories and we ask the human resources managers to do the same thing according to the performance data they have. We don't have any previous knowledge of their performance data. When we compare our ranking with theirs, the rank-order correlation is .954. This means that the variables of the ML model account for 91% of the variance in actual performance.

When I was at the University of Michigan, I used to spend a great deal of my time in the mathematics and physics libraries. It was in the latter that I found the original 1822 French edition of the great mathematician and physicist Jean-Baptiste Joseph Fourier's magnum opus. I still feel the emotion of holding in my hands his Théorie Analytique de la Chaleur where I found the following phrase: "If we could perceive the order of phenomena, it would produce in us harmonic resonances." Harmonic analysis, also known as spectral analysis or Fourier analysis, is used to decompose a complex function into basic elements represented by trigonometric terms. Fourier was well aware that his analysis could be used to model a variety of phenomena.

It was thinking about the power and generality of this analysis that I developed the system for analysis and data modeling MIFAS (Michigan Interactive Fourier Analytic Synthesizer) for which the US government granted me citizenship at the request of the University of Michigan.

When I collected the time series for my doctoral dissertation, I performed a Fourier analysis to discover the cyclical patterns in the quit rates of the US manufacturing industries. Then I did something unusual: I bought a sound synthesizer to listen to this data. Perceiving phenomena through as many senses as possible might reveal what otherwise could remain hidden. We see data, but we don't hear it. If you think about it, music to some extent is about making mathematics sound (pun intended). The composer and concert pianist, Diana Dabby, got her Ph.D. in electrical engineering and computer science at MIT by using the same nonlinear differential equations I used in my model, to create musical variations of music by Bach, Bartók, and Gershwin among other composers. As much as I advanced in my work with the help of mathematics, I believe I would not have reached the necessary depth to find the foundations of the complex human interaction processes, nor the passion to persist against the difficulties in finding them, without the constant presence of music in my life. Many of my discoveries have been possible by letting myself be taken by the hand of the great composers. I am a subscriber to the Digital Concert Hall of the Berlin Philharmonic (highly recommended) which often allows me to find the best in myself and gives me the splendid opportunity to study closely the broad spectrum of nonverbal expressions of its conductor, Sir Simon Rattle. I believe that in music we can find the most arcane secrets of the universe. Pythagoras already suspected this and Nietzsche summarized it masterfully: "Without music life would be a mistake" and "Those who were dancing were considered insane by those who couldn't hear the music". Einstein, who could not only "hear the music" but played it (he played the violin with Max Planck at the piano) said that he would have been a musician if he wouldn't have been a physicist. He declared: "I see my life in terms of music." Our lives have tempi and dynamics: Sometimes we stay in the adagio and can not reach the allegro. Some prefer the pianissimo, others the fortissimo. I like the andante espressivo during the day, but I prefer the adagio at sunset and the largo at night. Fortunately, we are all different and this allows us, when we collaborate harmoniously, to offer a broad spectrum of emotions, as the great orchestras do.

There are two additional parameters in the ML model that I have designated a and b. Parameter a represents the organizational "viscosity" or resistance to change; that is, how bureaucratic is the organization to which the team belongs. Parameter b represents the negativity bias. This bias is well-documented in the psychological literature and refers to the tendency that human beings have to give more weight to negative than positive events. This probably gives us an evolutionary advantage:

Negative events can threaten our survival, while positive events do not. In order to overcome the negativity bias without suppressing it, we need to generate P/N ratios of at least 3:1. Here is why:

Low performance teams have P/N ratios of 1:1 on average, and medium performance teams have P/N ratios of 2:1 on average. These ratios are not enough to overcome the negativity bias. I found that the negativity bias is 2.67 (each negative event weighs 2.67 more than a positive event). I came to this result by calculating the ratio of the angles of the negativity gradient (48 degrees) and the positivity gradient (18 degrees) in John Gottman's studies with thousands of marriages. To overcome the negativity bias we need 3 positives for every negative. That is why the Losada ratio is 3:1 Notice that while this ratio overcomes the negativity bias, it does not suppress it: There is room for one negative for every three positives. Without negative feedback, systems run amok, and this is especially true of living systems like human beings who are often in need to improve their relations with their fellow human beings by making right what was wrong.

All the components of the model are linked by lines that represent the differential equations that give life to the model. I use colors to match equations with lines in order to facilitate the visual flow given by the dynamics of the connected components. The initial conditions are given by the first few minutes we observe the team. The boundary conditions of the model are $18 \leq c \leq 33$, for c = 18, 19, … , 33, where c is connectivity. The key to these differential equations is that they are able to represent **different symmetric regimes** which **correspond to different performance levels**. Low performance teams operate within the range $18 \leq c \leq 20$ where asymmetry towards self-focus and advocacy is very well represented by the equations. Medium performance teams operate in the range $21 \leq c \leq 24$ where the partial asymmetry is portrayed by the equations (there is a bit of inquiry and other-focus but they don't last.) High and top performance teams operate within the range $25 \leq c \leq 33$. This connectivity range corresponds exactly to the Losada zone, defined previously as a P/N range ( $3 \leq P/N \leq 6$). Within this zone, teams are able to maintain a dynamic equilibrium or approximate symmetry between self and other-focus as well as between advocacy and inquiry. This is captured perfectly by the equations. We have thus another validation of the Losada ratio as a provider of limits: The lower and upper limit of the Losada zone, this time in terms of the level of connectivity. We can thus portray the Losada zone as the range where symmetry resides. Top and high performance both have symmetric regimes; we differentiate them by the magnitude of the emotional field. Both are expansive emotional fields, but the expansion reached by top teams oscillates between 88% and 100%, a range that is only reached by 7% of teams.

It is a remarkable property of this nonlinear model that simple changes in the level of connectivity can represent such a wide spectrum of symmetry levels spanning from asymmetry through partial asymmetry to approximate symmetry. This is impossible to do with a linear model. As notable as this ordering of symmetric regimes is, it is even more notable that these regimes correspond exactly with the performance levels of a team. For me, this is an encounter between truth and beauty that generates those harmonic resonances anticipated by Fourier when we discover the order of phenomena.

Connectivity is a measure of how much people resonate with each other and is measured by the number of nexi (strong and lasting bonds) that team members generate through their interactions. When the cross-correlation function (equivalent to the inverse Fourier transform of the cross spectrum) of the team´s interactive behaviors is highly significant ($p \leq .001$), we have a nexus, a lasting bond. A high cross-correlation is really a measure of symmetry: it shows how many people are in the same wavelength. We can now realize that the causal chain that unites connectivity with performance has the following links: It starts with connectivity that when is high (over 75%), induces symmetry, mediated by P/N (at least 3:1), in the bivariate variables, which in turn generate an expansive emotional field providing sustainable energy to achieve and maintain high performance. I am convinced that in this powerful causal chain resides the success of the ML model and is what makes sustainable learning possible; what I call meta learning. To solve the sustainability problem of organizational interventions represented for me one of the most urgent tasks in organizational psychology.

I will finish this presentation of the ML model emphasizing the importance of symmetry and showing its implication for the future of the social sciences and its impact on society.

We have seen that as the bivariate variables Inquiry-Advocacy and Other-Self approach symmetry, expansive emotional fields are generated that provide sustainable energy to reach long-term goals. High performance teams are full of this lasting energy generated by symmetry. When we observe these teams their energy is contagious. They are able to complete their tasks as if they didn’t have to make a great effort. They enjoy what they are doing and time doesn’t seem to pass for them. They have learned that time and energy go hand in hand (in fact, they are Fourier transforms pairs). Low performance teams rarely have the time and energy to finish their tasks and when they do they often end up exhausted. These teams are stuck in self-focus and advocacy and rarely ask generative questions. Their energy is very low and their performance suffers. When we observe these teams we also suffer watching how difficult it is for them to overcome these limiting behaviors, but we also know that all teams can reach high performance once they learn to practice the ML model. In fact, there is not a single team which has gone through our training that has not become a high performance team. To observe the joy and enthusiasm of these teams when they celebrate the passage from low or medium performance to high performance, justifies our work. We are always encouraged to know that reaching high performance is not only possible but sustainable when a model incorporates symmetry among its critical variables.

Symmetry plays a fundamental role in the advanced sciences, mathematics and the arts. It is a concept that encompasses many disciplines. In fact, it is one of the few concepts able to do so. In physics, it is so critical that Phil Anderson, Nobel prize, wrote in Science: “It is slightly overstating the case to say that physics is the study of symmetry.” Several other Nobel laureates in physics echo this notable remark. An exceptional mathematician, Emmy Noether, proved that symmetry is linked to the main conservation laws in physics such as the conservation of energy, charge and momentum. By linking symmetry to conservation laws, Emmy Noether opened the gates to the great advances in physics. It was by studying her theorems that I managed to find the solution to the sustainability of energy in working teams and then design a training method with Dr. Geralda Paulista for sustainable interventions. Einstein had a very high opinion of Emmy Noether and he wrote her obituary. Einstein told the members of the famous mathematics department at Göttingen (only men) that they had a lot to learn from this woman. In fact, it was the director of the department, David Hilbert, one of the greatest mathematicians of all time, who hired Emmy Noether to help him solve a problem involving Einstein's field equations for general relativity. Einstein was one of the first to realize the power of symmetry by using it in formulating both his special and general theory of relativity. It was by following symmetry principles that Einstein could find the equivalences between energy and mass, space and time, gravity and spacetime curvature.

There exists a mathematical language that scientists use to work generatively with symmetry. This language is known as group theory and it was introduced by the young mathematician Évariste Galois, who used his theory to solve the problem of the quintic equation that mathematicians have tried in vain to solve for centuries. Soon after that, Galois died in a duel before his twenty-first birthday. In his very brief life Galois changed mathematics forever. More than 40 years passed before mathematicians recognized Galois' genius. It is impossible to imagine what humanity lost with this senseless and premature death. Fortunately, group theory was later developed by Camille Jordan, Sophus Lie, Felix Klein, Arthur Cayley, Eugene Wigner and Hermann Weyl, among others. More recently, John Horton Conway, the creator of the cellular automation Game of Life, advanced the field greatly by his publication of the atlas of finite groups. To advance in their fields, physicists and chemists utilize group theory. Many problems in chemistry are solved by first determining the molecular symmetry. Molecules are classified according to their symmetry which permits to explain and predict their chemical properties. The standard model of particle physics can be synthesized by using only three symmetry groups: U(1) x SU(2) x SU(3), one of the greatest achievements in the history of science. Galileo said that the book of nature is written in the language of mathematics. We can say that the grammar of this language is group theory.

Symmetry is defined mathematically as "invariance under transformations." This is a definition of an unfathomable depth. We could say that symmetry consists of finding Parmenides (invariance) in Heraclitus (transformations). It is not necessary to choose between what doesn't change and what changes continually. I used to be a strong Heraclitus advocate, but I came to terms with Parmenides thanks to symmetry. Symmetry is a bridge to cross the dilemmas of paradoxes. Symmetry shows us that what seems impossible is only a limitation in our thinking. If we are ever teleported, they probably will use symmetry principles, because in transforming us to be sent they will have to maintain the invariance of who we are so that we arrive on the other side being who we were. I say this half-seriously, half-jokingly. I have studied symmetry for several years now and I have come to the conclusion that it is a limitless source of inspiration that allows me to live in friendly terms with the unexpected. I live with the hope that symmetry helps me to escape Plato's cavern where we mistakenly believe the shadows (transformations) are reality (invariance).

I have often asked myself why it is that symmetry has not penetrated in the social sciences beyond the obvious. It is true that economists consider equilibrium as one of their fundamental criteria and sociologists and political scientists worry about social equality. For lawyers, justice is a fundamental theme. Psychologists have worked extensively in reciprocity ("tit-for-tat", for example), cognitive dissonance (asymmetry), and empathy, among other topics. But I still don't see the unifying force of symmetry providing the necessary impetus to become closer to the advanced sciences. Which are the invariances that we must seek and which are the group of transformations that preserve them? One could say, paraphrasing Phil Anderson, that it is not an exaggeration to say that the social sciences will reach new frontiers when they learn to harness the power of symmetry. We have seen in this article how connectivity, mediated by the P/N ratio, induces symmetry in the bivariate variables of the ML model which generates sustainable energy that makes possible emergent properties such as the multiplication of talents. This is not a utopia, we see it happening all the time in our training of teams.

But we must go beyond this: We must think explicitly about the role of symmetry in the understanding of the complex interaction processes involved in negotiation, international conflicts, legislation, distribution of wealth, and other urgent problems we have yet to solve. Which are the critical bivariate variables in these processes? Which is the generator of symmetry for these variables? ¿How can we generate expansive emotional fields to increase our possibilities for action? A deep understanding of the role of symmetry in these processes would project a new, brighter light which would allow us to see not only how to improve the quality of life in our organizations but the creation of more just societies where flourishing is possible for all. Not all countries have great energy resources, but all can have access to the sustainable energy that human flourishing provides. The greatest resource of a country are its people and one of the most urgent tasks facing our politicians, teachers, parents and entrepreneurs is to create the conditions for people not to be lost in languishing.

People languish when they cannot express the best of themselves in their homes and workplaces. This leads them to excessive self-focus, closing themselves to the world and not being able to create lasting bonds with others. This condition generates restrictive emotional fields where the possibilities for effective action are reduced to a minimum. In the US, only 20% of adults flourish. This percentage coincides with the one for high performance. It is quite likely that this statistic applies to other countries and is warning us about the low level of realization for most people and how much potential is lost. It is not enough to feel sorry for them: We must be guided by the conscience of how much is left to be done.

believe it is not sufficient for organizations to be a "a great place to work," they must also be "a great place to flourish." It would be a great achievement for humanity if by the middle of the 21st century we could say that the majority of our schools, universities and corporations have become a place to flourish. Flourishing must begin in our families, where we have the first opportunities to learn to put ourselves in the shoes of others, to connect with them, understanding their needs, fears and dreams. But this is not enough. We ourselves must be capable of expressing our own needs, fears and dreams so that others have the opportunity to put themselves in our shoes. By generating this symmetry between other and self, the separation between "You" and "I" is dissolved into "We." To achieve this is necessary to learn to ask generative questions that allow us to know who the others really are. By asking generative questions we will be able to advocate convincingly for a better world; not just our world, but a world where everybody has a place for flourishing. This can only be achieved by experiencing the power of symmetry in our lives: the power of balancing self-focus with other-focus as well as advocacy with inquiry. We can conclude then that symmetry and flourishing go hand in hand. It's not by chance that the term "flourishing" comes from "flower," one of the most symmetric creations of nature.

At the beginning of this article I anticipated that the ML model can be a bridge between languishing and flourishing. To cross this bridge we need to find the best in ourselves. One doesn't find oneself unless one is willing to reach out of oneself. By going to the encounter of the Other we will experience the power of the symmetry between Self and Other, thus generating the sustainable energy that will allow us to complete the great tasks that we have pending as humanity.

In developing the ML model, I have tried to give a solid scientific foundation to something that humanity has known for at least two millennia, regardless of its spiritual tradition: "Love thy neighbor as you love thyself." Love is the greatest of all symmetries, the Great Invariance. Which are the transformations we need to experiment to preserve this invariance? Knowing this ethical imperative for so long and still not being able to live it fully shows that this is one of the less traveled roads. My hope is that many of you dare to walk this road so that all of us can have a better final destination. My contribution has been to provide a map to help you find and stay on this road.

Florianópolis, Brazil
Valentine´s Day, 2017