From Laboratories of Experimental Epistemology: A billet-doux

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Preface

One year ago, Anastasia and I were playing a card game together when a call came. It was late here in Oregon and when I saw that the call was from my very good friend Sebastian, my heart sank. Why on earth would he be calling me so late at night? I knew what happened before he told me – Humberto, or the doc, as we lovingly referred to him, had passed on. Just a day or two before Sebastian's call, I had a video call with Humberto, Ximena and Sebastian. As always, I was so happy to see them all and remember telling Humberto how well he looked before we shared our love and said goodbye. So when I received Sebastian's call and learned that he had passed peacefully, I felt him. All our conversations seemed to roll into one consciousness and a warm tranquility came to me with Humberto's message – be still and see what comes. A year later, the result of that stillness has been written in the following report to the Global Society for Organizational Learning and my love letter to Humberto.

Over many years, much has been written about the Biology of Cognition, Biology of Love and Autopoiesis and less about Cultural-Biology Humberto developed with his co-founder of the Matriztica School, Ximena Davila. As I reflected on this history, I sensed an epistemological disconnection. Many had read Humberto's work and elaborate upon it by re-constituting it as a rationale theory such as when Humberto and Francisco's theory of molecular autopoiesis was applied to organizations and social systems. I too did this. Conducting research I found that people with developmental disabilities typically institutionalized were loved and supported by a network of their co-workers. My headline being – I have found evidence of autopoiesis. Being the wonderful friend he was, Humberto gently asked, "Dennis what are you obscuring when you refer to autopoiesis?" It was then I realized my answer – love, care, productivity, mutual support, wellbeing and social

transformation. In the stillness following his passing, I immersed myself in Humberto's papers written in English. I read and re-read his studies of the optical nervous systems of frogs, salamanders, pigeons and octopus and read the 1950 Reith lectures presented by Humberto's professor JZ Young. What came to me were two things. The first, was the awareness that while many wrote and talked about Humberto's contribution to our understanding of living systems, no one had studied social systems using Humberto's measures of structure and organization in human social systems. The second, was how Humberto discovered a biological epistemology, something Piaget realized was missing. In this epistemology, metaphysical spaces, once thought to be inaccessible became accessible. What a fantastic opportunity for all of us to explore the nature of our human nature!

Over the past two years we have experienced COVID, the effects of climate change and most recently war in Europe all disrupting our daily lives. The pain and suffering from experiencing our elders dying alone from COVID, our neighbors losing their communities in climate fires and people of the Ukraine being subject to horrendous attacks has raised our global consciousness as to the importance of living well together. Within these heartbreaking events, we also saw how compassionate we humans can be and how our love and caring comes to those in great pain and suffering. Those metaphysical spaces, rejected by Victorian philosophers and mathematicians, have become, not only obvious to us, but critical to our social wellbeing – the subject of this report.

I began writing this report in 2015 while staying with Humberto at his home in Santiago. We both experienced difficult loss. Humberto's partner passed just days before Anastasia and I lost our daughter to systemic scleroderma. Humberto invited me to stay with him and every morning after breakfast we would spend an hour or two reading and writing

followed by our usual silliness that would have us both laughing uncontrollably! My dear friend, being the dear friend he always was, knew I had become socially isolated and invited me to stay in his mother's casita and receive his tender love.

A few years later, I reacquainted my SoL relationship with Heidi Sparkes Guber during a Matriztica course. It was then that I discovered Arie de Gues' call to action. Heidi and I invited a group of global SoL folks to reflect on how we do what we do when we live and work well together. Heidi's support gently brought me back to the SoL community and those wonderful colleagues I had been missing – Irene, Goran, Agota and many, many others. I believe that the world needs SoL more than ever. Not because of its theoretical underpinnings but because the quality of relations we share. I am very grateful to Heather, Alain, Goran, Luca, Sanjay, Lonnie, Greg, Gwen, George Greenfield, Alan, Roslyn, Cristina, Agota, Alison, Annika, Camila, George Roth, Guus, Marsha, Ray and many others who have joined us.

Lastly, we are living in a world we couldn't have imagined 2-3 years ago. A world we cannot afford to wait to adapt to. Despite these changes we are living, Hyphn, Cascade Medical Center and HP opened a space to study how their employees work so well together, and I am especially grateful to George Greenfield, Tom Reinhart, Shastan Jee, Matt Newstrom and Paul Nash and the employees of Hyphn, Cascade Medical Center, HP, Lavernge and First Mile for their support.

I will end this introduction where I started by saying, Humberto I miss you and am so grateful for our wonderful friendship. Your teaching was so deep, I'll always be learning from you and your loving so deep, I'll always be loving you.

May 6 2022

Eugene Oregon

Chapter One An epistemological call to action

There has been a call to action for some time now for management transformation as our economy increasingly places value on knowledge while, at the same time, it reassesses the value of an economy that accelerates climate change. Many have called for this transformation and for me, Arie de Gues couldn't have been clearer. Arie led Royal Dutch Shell's Strategic Planning Group and continued to develop as a management theorist who contributed to the theory of organizational learning. His academic training included an introduction to Swiss psychologist Jean Piaget and his innovations in the domain of child development. In 2014, at the Society for Organizational Learning (SoL) Global Forum in Paris, Arie triggered a call to action to the young audience.

> I think what is needed, what is waiting for you, the next generation, is to find ways to change the internal structures of business and governmental institutions to become much more in harmony with the value systems that have developed since the second world war. That's your job. That's waiting for you and that's a very difficult problem. That's really organizational learning by accommodation. Re-read Piaget. Then you know what you've got to do.

The purpose of this report is to share the last two years of learning by accommodation with SoL colleagues from around the world. When I became aware of Arie's talk in Paris, I was inspired to collaborate in a practice of accommodative learning and discovery science. I drifted back in time and remembered learning about Piaget at the University of Idaho while studying child development in collaboration with the University of Washington's Experimental

Education Unit. And what ties all this together, what is fundamental in transformation, is the notion of epistemology – our theory of knowledge. This is what Piaget wrote in his book Biology and Knowledge:

> ....almost no theorist of logico-mathematical knowledge has thought of explaining (human) knowledge by going back to the obviously necessary frameworks of the living organizations. (Piaget, 1971)

I intend to go much deeper into epistemology in this report. Piaget was quite right to say no one had explained epistemology from the perspective of living organizations including Piaget himself. This would be done by my good friend, Humberto Maturana. And to you my dear friend Humberto, this is a love letter.

Now this is quite something I have set out to do. I intend to do so by 1) describing how the liberation of people with developmental disabilities grew out of a new epistemology, 2) review the history of Humberto's Biology of Cognition, 3) present three open case studies that extend Humberto's Epistemological Experimental Laboratory to social sciences, and 4) describe a new inductive theory arising from my own epistemological social laboratory experiments. Let me begin by saying that learning via accommodation, precisely as Arie describes in and its role in transformation has a history of changing society as a proven practice.

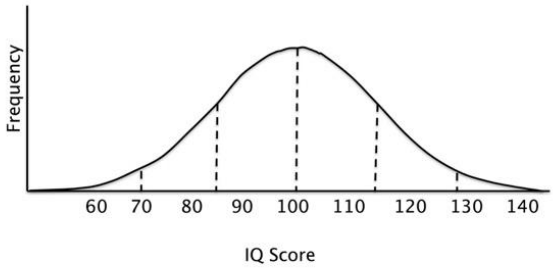
Chapter Two An Experimental Epistemological Laboratory for social change

In 1975 two events gave shape to my entire career. The first happened during a University of Idaho psychology class field trip when we visited Eastern State Hospital outside of Spokane, Washington. The institution (shown above) had wards for women on one side and wards for men on the other, separated by a tall administration building. This architectural design reveals the purpose of the hospital - to control the reproduction of people who appeared and behaved differently than others. Eastern State Hospital was the result of the *eugenics* social movement based on a unproven theory that uncontrolled breeding of "unfit" humans would threaten to end the human race. Eugenics grew from being a novel theory in the UK to social control practices in the US, then to the holocaust in Nazi Germany and continues today driven by fear, racism and violence.

The second event was quite extraordinary. The passage of the Developmentally Disabled Assistance and Bill of Rights Act (Act) set forth a sweeping social change movement that brought eugenic practices to an end and replaced them with community-based services

for children and adults diagnosed as having developmental disabilities ("Developmentally Disabled Assistance and Bill of Rights Act," 1975). The Act required continuous improvement in teaching and training practices that gave evidence that people with developmental disabilities were living well in the communities they and their families lived. The purpose of the Act was to fund a liberation movement that ended the institutionalization, forced sterilization, abuse, and neglect of the “unfit”.

The eugenics movement identified the “unfit”, isolated them in state-run hospitals, forced sterilization upon them, and abandoned them to face unimaginable atrocities. All this was justified by a theory that defined intelligence as being distributed around an arithmetic mean. This epistemology treated knowledge as a physical possession that could be measured by IQ tests.



Eugenic theory claimed that people with IQ’s less than 60 were subhuman and incapable of learning, justifying the abuse and neglect in state institutions. That is, until Morton Birnbaum established the right to treatment for those involuntarily held in state institutions and Federal Court Judge Frank Johnson decided in favor of the right to treatment for those held in Alabama state hospitals (Johnson, 1971, 1972) (Birnbaum, 1960).

Living in language

To stop the admission of children with developmental disabilities to state hospitals preschool services had to be invented. But where to start? First, we abandoned eugenics practices such as using IQ scores to determine intelligence. Second, we observed the children's behavior and then wrote a person-centered plan that established our goals and accountability. We collected baseline data and compared daily measures of the child's behavior to the baseline data to evaluate the effectiveness of our services. University research resulted in new breakthroughs in positive behavior change and University staff taught parents, teachers, and aides how to apply their research in community-based settings.

For those observing our teaching strategies, our preschool classrooms created pandemonium, not control. Our strategy was to elicit language development for each child. We thought that if the young child independently coordinated actions with others, the less likely they were to be institutionalized. Language development was key to the child's intellectual development, and we turned to the psychologist Jean Piaget to help guide our work. His work in child development was an approach that helped us develop our teaching strategies in our experimental preschool while changing our epistemology from the ones used to justify their imprisonment.

Ours was an ontogenetic approach that studied how each child adapted to our experimental preschool as we replaced IQ tests with daily observations of the child's development. We no longer saw these children as a problem but as children living in physical, cognitive, emotional, spiritual, and social development as they adapted to the lively preschool environment we teachers designed to conserve and expand their wellbeing. We used the

Preschool Profile to collect our baseline and daily data on each child's development. Organized as a matrix, the Preschool Profile collected data on gross and fine motor, preacademic, self-help, art, play, social and language skills in age ranges from 0-12 months to 60-72 months (Appendix I). Our primary focus was on languaging – each child's independent recursive coordinations of actions with others. Day by day we realized that our preschool pupils were advancing in their development and adapting to the preschool environment we had established for learning.

> It sounds more like an adult cocktail party, or a school recess, than a school classroom. The "precision teacher" performs like a coach, an advisor, and an on-line instructional designer. She arranges materials and methods for the students to teach themselves, including self-counting, timing, charting, and one-on-one direction and support. In this precision teaching (PT) classroom there is almost no lecturing. The entertainment is the thrill from students' visible performance gains. All the students are performing at once. It is noisy. It is mayhem. How can you tell how the students are doing? From their charts! (Lindsley, 1992)

Our success was both individual and collective. Individually, students were becoming more independent and engaging more and more with their family and peers – they were developing. Collectively, data from our preschool ended the option of sending children to institutions. You see, we teachers were also developing socially, emotionally, cognitively, physically, and spiritually. With each child's growth we grew too. We all were learning that intelligence was not an inherent possession that could be tested, but instead behaving in a

manner that allowed us all to adapt to the constantly changing liberation movement. And without being aware that this was so, we proved Humberto's explanation of intelligence:

> "Although one can refer to intelligence as a phenomenon, because it is a configuration of relations between processes occurring during structural coupling, it is not directly observable and thus cannot be measured. All that can be observed are instances of consensuality or of ontogenetic adaptation in the form of intelligent behavior. The IQ Test can, at most, estimate a subdomain of the domain of consensuality between the observer and the subject.
>
> No biological basis can be found for racial, social, or educational discrimination based on intelligence since the word 'intelligence' does not refer to a discrete individual attribute or property." (Maturana R & Guiloff, 1980)

This was an exciting time for those of us in the new civil rights movement. We were scientist-practitioners practicing behavioral psychology in community settings that ultimately changed US society by replacing eugenics institutions with community-based teaching, training, and support services.

First and foremost, we learned how to *recognize* positive social change. I choose the word recognize to refer to an emergent process of "*seeing anew".* Our learning was no longer guided by a predetermined theory, like eugenics, but by studying the growth in development of the preschool children we were teaching. Applying Piaget's theory of child development was the process of accommodation, discovery learning or inductive social science. By studying our daily progress, we *recognized we were contributing to large-scale social change.* We

literally saw a new society arising without eugenics theory – a society prohibiting imprisonment because those with developmental disabilities had the unalienable right to life, liberty, and the pursuit of happiness. It would be a mistake to limit Piaget's theory of accommodation to the children we were teaching because we teachers and administrators were learning through accommodation as well. For we scientist-practitioners our preschool was an epistemological experimental laboratory and as we felt the consequences of the young liberation movement love, joy, and celebration were always present.

Chapter Three Humberto Maturana's living systems epistemology

The history of serving people with developmental disabilities was peculiar from an epistemological perspective. In our daily practices we learned people thought to be incapable of learning could learn sophisticated subjects and work tasks. We knew that the eugenics theory of intelligence was mistaken and the data we collected on a daily basis gave proof to the large-scale social change as children and adults with developmental disabilities became part of our daily living and wellbeing. Our change from the epistemology of physical logic to the epistemology of development was changing society. What I did not know at the time, was the unfolding new epistemology in neuroanatomy and neurophysiology emerging from a collaboration between psychologists, ethologists, physiologists, zoologists, biologists, and anthropologists.

Humberto's professor JZ Young

In 1954 Humberto Maturana received funding from the Rockefeller Foundation to study biology at University College London with JZ Young (whose students referred to him as JZ so I will as well). Around this time, JZ delivered the Reith Lectures based on his book, Doubt and Certainty in Science (Young, 1950a, 1950b, 1950c, 1950d, 1950e, 1950f, 1950g, 1950h). These lectures present a unique record of the views JZ presented to Humberto and his classmates and of JZ's unique approach to teaching.

JZ was a zoologist and neurophysiologist who studied memory and learning of cephalopods and taught his students by involving them in his physiological studies of the relationship between structure and function (Altman, 1997).

While philosophers described a scientific method of philosophy (Russell, 1914, 1915) as a controlled process of analysis without preoccupation with the results of experimentation, JZ described science as a process of “muddling through”.

> I have often thought that one of the characteristics of scientists and their work is a certain confusion, almost a muddle. This may seem strange if you have come to think of Science with a big S as being all clearness and light. There is indeed a most important sense in which science stands for law and certainty. Scientific laws are the basis of the staggering achievements of technology that have changed the western world, making it, in spite of all its dangers, a more comfortable and a happier place. But if you talk to a scientist you may soon find that his ideas are not all well ordered.
>
> He is busy with other things, trying to get some piece of apparatus to work, finding a way of measuring something more exactly, or making dissections that will show the parts of an animal or plant more clearly. You may feel that he hardly knows himself what law he is trying to prove. (Young, 1950a)

JZ did not limit his scholarship to neurophysiology but broadened it to include history, psychology, anthropology, mathematics and “many other things”. He was critical of biologists describing human beings by only the characteristics they share with other animals, (eg eating,

walking, digesting, etc.). To JZ this was short sided and overlooked what made humankind especially unique from all other animals.

> What then are the special characteristics of modern man? Surely the chief one is that of co-operation between individuals. Man's large brain is used to develop an intricate social system, based mainly on communication using words.(Young, 1950a)

JZ believed that studying the processes of the brain that accompany speech and thought would lead to understanding the brain as a system. This is where I find that JZ, involving his students in his research studies, one of them being Humberto, claimed the best way to understand our bodies was to think of them as machines. Today it is easy to find criticism of understanding organizations as machine, while ironically these were the early descriptions of living systems.

> The conception of living bodies as machines, having, as we say, structures and functions, of the whole modern development of biology and medicine. (Young, 1950b)

JZ also used metaphor to explore new discoveries of our brain. A simple metaphor treated the brain as a calculating machine. Our sense organs sent "information" (multisensorial experiences) to regions of the brain where the information triggered new behavior and was "stored" (as memory). It would be a mistake to suggest that JZ turned his metaphors into physical models – they were simply jumping off points for him to practice what Piaget called accommodative learning- learning by seeing anew.

> The brain is not by any means a simple recording system like a film. Recognition of this fact of our relativity is one of the most revolutionary developments of the thought of the present time. Its importance is only now dawning upon us very gradually, and it is a main purpose of these lectures to show you what the change means. Many of our affairs are conducted on the assumption that our sense organs provide us with an accurate record, independent of ourselves. What we are now beginning to realise is that much of this is an illusion; that we have to learn to see the world as we do. These ways of acting that we learn give us a rhythm of behavior. (Young, 1950d)

Here JZ reveals the "brain as computer" fallacy, something Humberto did as well in his discovery that the brain does not link us to a reality that is independent of observers. How did JZ "see the world as we do" ? To answer this question, he focused on behavior.

> The life of the newborn child consists largely of sleep, periods, that is, in which numbers of brain cells are firing in unison. We know this because electrical records show that in a baby there are very large and regular brain waves. This unison or synchrony becomes broken up by the nerve impulses arising from the receptor organs, internal or external. The receptors are so arranged as to alert the organism that its needs are not satisfied; it must be up and doing. The hungry baby wakes and cries, giving the sign stimulus that brings the mother's attention. At first it kicks and clutches at random until it obtains the milk. When the stomach is filled, the hunger impulses from it stop, the brain returns to its simple synchronous activity, and the baby goes to sleep. But in the course of each waking episode there are changes going

> on in its brain. Actions, at first random, develop into little sequences, according to patterns developed during previous wakings. These have become printed or otherwise recorded in the brain.

To complete his work, and a requisite for those students studying with him, JZ practiced ethology or the study of animal behavior by observing animals in their natural environment, and studying human behavior and social organization using the biological sciences. JZ's ethology was not limited to cephalopods but to humans as well.

> Mankind uses symbols, especially words, at all levels in his daily life, to convey his wishes and intentions to others. I have been so interested to follow the use of the more central symbols that I have perhaps seemed to forget the innumerable humbler ones. It is the daily uses which are important and practical. My thesis is that the use of words to ensure co-operation is the essential biological feature of modern man, the way he gets his living. (Young, 1950e)

My last point is how advanced JZ was a systems scientist. I hesitate to use the popular word *systems thinker* because it does not fit when it comes to JZ's thinking. He first dispensed with rule of analysis dominating scientific materialism he dismissed as "outmoded".

> What I want to criticise is the idea that by dividing and dividing one will ultimately find in some way the real or true unit, which gives full knowledge of the body. This is an outmoded materialism which I am sure still lingers in many people. (Young, 1950g)

He concluded that the organization of a living system is best understood by studying patterns and focusing on what is conserved.

> If living things consist of no steady fabric of stuff but are continually changing, what is it then that is preserved? What is it about those chromosomes that makes them the bearers of heredity? What is it that makes each life in some sense the same from year to year? Individual chemical atoms remain in the cells for only a short time; what is preserved must be the pattern in which all these interchanging atoms are involved. 'Pattern', you may say, 'what do you mean by that? Are you comparing me to a carpet?' That is just the trouble—we find it hard to get a proper model. Living patterns are not stable like those on pictures or carpets. A whirlpool might be a better simple analogy—the pattern of swirls in a river. The matter of these swirls is continually changing and yet there is a sense in which they remain the same. We might say that the flow through them is organised in a particular way. 'Yes, but organised by what or by whom?' In the case of the river it is by the historical events of the past that have left a certain arrangement, so that the water must flow through making just those patterns and swirls. So in the case of the body the organisation is such that the matter must flow through in certain ways. (Young, 1950g)

The nature of reality in living systems

We can see the influence JZ had upon Humberto through; 1) his descriptions of living systems as machines having structure and function, 2) his use of ethology in neurophysiology research, and 3) his view of science as a process of "muddling through". Humberto brought

this to his own studies of nervous systems, and, as he replicated the research studies of others, he discovered something that had eluded scientists. A deep bias in their research led them to base their studies as if an independent reality existed. This too was the attitude Humberto had as he replicated the optic nerve studies of Nobel laureate RW Sperry.

Nobel laureate RW Sperry

After receiving his Ph.D. in Zoology at the University of Chicago in 1941, Sperry completed a year of post-doctoral studies as a National Research Council fellow at Harvard under psychologist Karl Lashley. As a student of Lashley's, Sperry continued to study the relations between brain and behavior by integrating physiology and ethology. Sperry's research shed light on the debate over nature and nurture and the extent to which our behavior is determined by our genes versus being shaped by adapting to our environment.

> How big a role does heredity play on behavior? The experiments cited here show that in the lower invertebrates, at least, many features of the visual perception – the sense of location and direction in space, the organization of patterns, the sense of position of the visual field as a whole, the perception of motion, and the like – are built into the organism and do not have to be learned. (Sperry, 1956)

Sperry won the 1981 Nobel prize in Physiology and Medicine for his collaboration on split brain research. His neurophysiological approach examined how changes in the nervous system altered behavior.

Humberto wrote about Sperry with Bernard Poerksen (Maturana Romesin & Poerksen 2004) and described a difference between what Sperry and he saw while conducting experiments with frogs, salamanders, pigeons and octopus.

> Let me select a number of experiments carried out by the American biologist Roger Sperry in the forties. Roger Sperry removed one of the eyes of a salamander, severed the optic nerve, rotated it 180 degrees, and carefully put it back into its socket. The optic nerve regenerated and the vision of the rotated eyes in the animals returned after some time. Everything healed but there was a crucial difference: The salamanders threw their tongue with a deviation of 180 degrees, when they wanted to catch a worm. This noticeable deviation corresponded exactly to the degree of rotation of the eyes; therefore, an individual animal turned around when there was a worm in front of it, and then threw out its tongue.
>
> With these experiments, Roger Sperry wanted to find out whether the optic nerve was capable of regenerating and whether the fibers of the optic nerve would re-grow to join their original projection areas in the brain. The answer is: it does indeed happen. He also wanted to find out whether the salamanders are able to correct their behaviour, whether they are capable of learning – and whether they would, after repeated tonguing, hit the worm again in order to eat it. The answer here is: No, that is not possible; the animals keep tonguing with a deviation of 180 degrees; they starve to death if they are not fed. When I myself heard about these experiments and

replicated them I realized, however, that Roger Sperry had formulated a misleading question that tended to obscure the observed phenomena.

He started out from an assumption that the salamander aims at a worm in the external world with his tongue. His question implied, as Gregory Bateson would have said, a whole epistemology, a specific world view. It takes for granted implicitly that the external object is processed in the brain of the salamander in the form of information about its shape and location. The salamander, consequently makes a mistake; it does not process the information coming from outside correctly. However, I find it much more meaningful to interpret the experiment in a completely different way. The salamander, I would maintain, correlates the activities of its nervous system, which lead to the movement and ejection of its tongue, with the activities of a certain portion of its retina. If it is shown the image of a worm, it throws out its tongue; it does not, as it would appear to an external observer, aim at a worm in the external world. The correlation given in this case is an internal one. Seen in this way, it is not all surprising that it does not change its behaviour, that it does not learn.

It was in 1955 in England that I replicated Roger Sperry's experiments – and it took another ten years for me to penetrate what I was actually doing and what had until then remained obscure for me. Only then did I understand the way the nervous system operated, i.e. its operation with internal correlations. When I performed experiments on the colour perception of pigeons in 1965 in Chile, I proceeded from assumptions quite similar to those made by Roger Sperry. My goal was to show how

the colours in the external world, which I had specified in terms of their spectral composition to secure the replicability of my experiments, are correlated with the activities of the retina. I wanted to establish the connections between Red, Green, and Blue and the activities of the retina and the retinal ganglion cells. What did the red, green and blue objects release?

At first I thought that my recordings were not yet accurate enough so I tried to refine them and to improve my recording instruments. My procedure was as follows: While the pigeons were shown colour tables, the activities of their retinal cells were recorded by means of fine electrodes. Numerous continually re-designed experiments only showed, however, that all of the cells more or less reacted to all the different spectral compositions. No significant correlation between the activities of certain cells or cell groups and the spectral composition of the colours could be read off the minimally different modes of cell reactions. The marginal differences in the modes of reactions were not significant.

One day, however, I realized that my expectations might possibly be never fulfilled because a correlation between the external stimulus and the internal reaction just could not be established. Only then I began really to appreciate Roger Sperry's experiments and their hidden epistemology, and to envisage the nervous system of an organism as a closed system. That was the turning point which gave my thinking new direction.

> The consequences was a momentous change with regard to the goal of my research and the traditional point of view. Suddenly, I found myself outside the traditions of perception research. Suddenly I was confronted by epistemological questions. What does it mean to know if we consider the nervous system as a closed system? How can the process of cognition be understood at all?

What the frog's eyes tell the frogs brain

Humberto's dissertation at Harvard described the optic nerves of frogs by using an electron microscope. Light microscopy could not distinguish the axons of the optical nerves of frogs, and Humberto's use of electron microscopy revealed that the optic nerve of the frog contained a half million nerve fibers, ten times more that those that could be seen using light microscopy (Lettvin, Maturana, Mcculloch, & Pitts, 1959; H.R. Maturana, 1959; Maturana Romesin, 1960). His research findings led to a collaboration with JY Lettvin, WS McCulloch and WH Pitts all working at MIT's Research Laboratory of Electronics. Prior to Humberto's electron microscopy, it was believed that the retina responded to the presence and absence of light. Light "on" would activate optical nerve and light "off" would deactivate optical nerve impulses. As an extension of Humberto's dissertation, this new study showed that this was not the case. The study looked at the frog's eye differently. Instead of asking what occurs when different points of the retina are stimulated, the researchers asked how does the optic nerve function? They described optical nerve bundles that were not triggered by light but by the sharp edge of an object either darker or lighter than the background, or, as an object moving as an arc through the field of vision. The change in the researchers question was of ethological origins, emphasized not only in the title of the collaborators paper, "What the

Frog's Eye Tells the Frog's Brain" (Lettvin et al., 1959), but also described in their papers' introduction.

Behavior of a frog

A frog hunts on land by vision. He escapes enemies mainly by seeing them. His eyes do not move, as do ours, to follow prey, attend suspicious events, or search for things of interest. If his body changes its position with respect to gravity or the whole visual world is rotated about him, then he shows compensatory eye movements. These movements enter hunting and evading habits only, *e.g*., as he sits on a rocking lily pad. Thus his eyes are actively stabilized. He has no fovea, or region of greatest acuity in vision, upon which he must center a part of the image. He also has only a single visual system, retina to colliculus, not a double one such as ours where the retina sends fibers not only to the colliculus but to the lateral geniculate body which relays to the cerebral cortex. Thus, we chose to work on the frog because of the uniformity of his retina, the normal lack of eye and head movements except for those that stabilize the retinal image, and relative simplicity of the connection of his eye to his brain.

The frog does not seem to see, or at any rate, is not concerned with the stationary parts of the world around him. He will starve to death surrounded by food if it does not move. His choice of food is determined only by size and movement. He will leap to capture any object the size of an insect or worm, providing it moves like one. He can be fooled easily not only by a bit of dangled meat but by any moving small object. His sex life is conducted by sound and touch. His choice of paths in escaping enemies does not seem to be governed by anything more devious than leaping to where it is darker.

> Since he is equally home to water, and on land, why should it matter where he lights after jumping or what particular direction he takes? He does remember a moving thing providing it stays within his field of vision and he is not distracted. (Lettvin et al., 1959).

Discussing their findings, the authors confirmed a proposal of Sperry. By studying the structure and organization of the frog's optic nerve fibers, they mapped the patterns of the fibers on the retina. They repeated Sperry's procedures, without turning the eye around 180 degrees, severing one nerve, and waiting three months for the nerve's regeneration. As Sperry proposed, the fibers regenerated in the same region they were first mapped. They also found that the braiding of the regenerated fibers had regenerated exactly as they were before the surgery.

Humberto's laboratory of experimental epistemology

One year after Sperry had received the Nobel Prize for his split-brain research in 1960, Humberto was back at the University of Chile's School of Medicine and established his Laboratory of Experimental Epistemology. Humberto co-authored a paper published in Science – Directional Movement and Horizontal Edge Detectors in the Pigeon Retina (HR Maturana & Frenk, 1963) with one of his first students, continuing the teaching methods of his professor JZ Young. The presence of edge detectors in pigeon retinas brought them to conclude that while excitor and inhibitor processes play a role in the component of cells, it is the spatio-temporal configuration processes in the input that give cells their sensitivity. Now from an ethologists perspective, the inclusion of spatio-temporal processes is validated

whenever we observe the behavior of animals (including we humans) and see that our behavior changes over both space and time.

> Excitatory and Inhibitory processes certainly play a role as components of the input to the cells, but it is to the spatio-temporal configuration of these processes in the input that the cells appear to be specifically sensitive, and thus it is this configuration which we have to consider as the actual stimulus to the cell.
>
> In general we think of cells of a particular kind will respond to all events that occur in the outside world, in the organism, or in the nervous system capable of producing such a configuration in the input, treating them as equivalent. In other words, we think that a cell will treat these events as members of the same class, the class being defined by the specific configuration to which the cell is sensitive, and hence by some element common to the organization of all events that produce it. The meaning of the class will arise from the context (functional, behavioral, and so forth) in which the cell activity occurs and the activity developed a cell when responding will thus represent this class. (HR Maturana & Frenk, 1963)

Humberto continued his research by studying the optical system of the octopus, just as his professor JZ had done (Boycott, Lettvin, Maturana Romesin, & Walls, 1965) and studying the synaptic connections of centrifugal fibers in pigeon retinas (HR Maturana & Frenk, 1965).

The practice of combining ethology, anatomy, psychology, cognition, anthropology, neurophysiology, neuroscience and biology unveiled a new epistemology to Humberto. His laboratory excursions brought him to a stunning development in cognition, anything said about cognition necessarily must begin with biology. This led to his epistemological breakthrough. Cognitive theories formed without regard for our biology were so incomplete that their epistemological grounding was now in question. This was also behind Piaget's epistemological insight – the logico-mathematical epistemology had not considered the organization of the living.

Besides his voluminous writing on cultural-biology with the co-founder of his Matriztica School Ximena Davila, much of Humberto's writings have been on the biology of cognition (H. Maturana, 1980; H. Maturana & Bunnell, 1998; H.R. Maturana & Varela, 1980, 1992; Maturana Romesin, 1978; Maturana Romesin & Poerksen 2004). His epistemological explanations carry through all of his writings, but at the same time, each composition brings us another, deeper look.

The Biology of Cognition

Humberto wrote a report for Heinz von Foerster's Biological Computing Laboratory titled *Cognitive Strategies*. I remember Humberto telling me a story many of us have heard him tell. It was his first presentation at the Biological Computing Laboratory at the University of Illinois (Maturana Romesin, 1974). "Dennis," he would tell me, "The first thing I wrote on the chalkboard to begin my lecture was, 'Everything said is said by an observer!'", as he broke

out into one of his deep and contagious laughs. Indeed, this is also how he begins his *Cognitive Strategies.*

> My purpose in this article is to discuss cognition in relation to man and the unity of man, in an attempt to show that any notion that we may have about the unity of man is bound to our views about knowledge and reality. Since everything that I say is said as an observer addressing other observers, I shall consider the statement that "any human action implies knowledge" as a sufficient experiential characterization of cognition, and let any additional connotation arise in the course of the article. (Maturana Romesin, 1974)

He goes on to list a set of beliefs held by philosophers, mathematicianss and scientists regarding cognition based on the epistemology of scientific materialism and objectivity.

1. We exist in an objective world that can be known and about which we can make cognitive statements that reveal it as an independent reality whose validity is, therefore, independent from us as observers.
2. We obtain knowledge through our sense organs by a process of mapping the objective external reality onto our nervous system, accomodating our behaviour to the structure of the world revealed through this mapping.
3. Information represents an actual physical magnitude that can be measured objectively as a property that characterizes the organization of an observable system. (Maturana Romesin, 1974)

Following a well-established history of research practice conducted by JZ, Sperry, and many others, Humberto followed his data. There were no exceptions in his findings. Animals, including humans, live each instant of their living seeing a world determined by the structure of their nervous systems. From complex optical nerves to the simplest of eyes, Humberto saw the same phenomena. Events external to the animal (humans) trigger activations in a network of bundles of nerves, in spatio-temporal processes just as exhibitor and inhibitor nerves in the pigeon's retina were constantly triggered through edge detecting optic nerves (HR Maturana & Frenk, 1963). With this finding, Humberto wrote of the notions concerning cognition other scientists held and their epistemological blindness. Realizing that any theory of knowledge had to begin with living systems, Humberto's epistemology brought into question the philosophy popularized in the Victorian Age that 1) dismissed relational networks (Eisler, 1993), 2) separated the observer from the observed (Pearson, 1912), 3) replaced human narrative with statistics (Pearson, 1912), 4) claimed that the only legitimate scientific process was analytic (Russell, 1914), and, 5) warned philosophers not to become occupied with data as scientist do (Russell, 1914).

Living systems

I suppose the one book Humberto published that quickly became a favorite of mine is Autopoiesis and Cognition: Realization of the Living (H.R. Maturana & Varela, 1980). In his introductory comments he describes cognition as an operation of distinction. An observer can distinguish an unity from its background as a simple unity. If the distinction is made recursively in a manner that we can now distinguish components within the unity we are

observing, we recognize composite unity a system formed by the recursive observations of the interactions between the components of the composite unity. The relational interactions amongst the components define the unity and give the unity its identity because it is through the component's interactions, we distinguish it as a unity. Now at the same time we distinguish the unity as a composite unity, we can also observe it as a simple unity. Perhaps an example is in order.

Imagine you are walking in a forest when your path turns sharply, and you look out over a wide-open space. On a hill side far away from you, you see a tree. You cannot make out the details of the tree, but you can distinguish it as a tree. As an observer, you are distinguishing a tree - a simple unity from its hillside background. You enjoy trees, so you make a small deviation from your hiking path and turn towards the tree. Getting closer you can now distinguish the tree trunk from its branches and see leaves on the tips of the branches. The trunk, leaves and branches are components of the tree and now you are distinguishing the component parts and the relations amongst them, as a composite unity. Notice how you can now see the tree as a simple unity and a composite unity whose component relations bring about the tree's identity, perhaps as an oak tree or a redwood tree.

The relations amongst components that bring forth the unity as a particular system are the system's organization. Humberto's organization arises only in the relations amongst the components of the system not in the components themselves. It is the structure that includes both the components and component relations. Interestingly, structure can change

while organization remains invariant. Thus, organization, the system's identity, can be conserved in a variety of structural configurations until the structure changes to the point that the organization ceases to function.

Continuing in his introduction, Humberto writes that as organization is brought forth through the relations between components nothing can really be said about the components themselves. This brings Humberto to structure.

> The actual components (all their properties included) and the actual relations holding between them that concretely realize a system as a particular member of the class (kind) of composite unities to which it belongs due to its organization, constitute its structure. Therefore, the organization of a system as the set of relations between its components that define it as a system of a particular class is a subset of the relations included in its structure. It follows that any given organization may be realized through many different structures, and that different subsets of relations included in the structure of a given entity, may be abstracted by an observer (or its operational equivalent) as organizations that define different classes of composite unities. (H.R. Maturana & Varela, 1980)

Following JZ Young (Young, 1950b), Maturana and Varela described systems structurally but realized organization was no longer constrained to materiality, thus, establishing a new epistemology quite different from that of scientific materialism where reality is defined as an independent three dimensional physical world.

> We thus believe that the classical distinction between synthetic and analytic should be refined. Within the synthetic one should distinguish two levels: the materially synthetic (i.e. where materiality entersperse into consideration), and the nonmaterially synthetic (i.e. where materiality is implied but is, as such, irrelevant) (Varela & Maturana Romesin, 1972).

The observer

How does it feel when we begin to recognize this new epistemology described by the biology of cognition? Maturana and Varela offer this to those studying their textbook, The Tree of Knowledge:

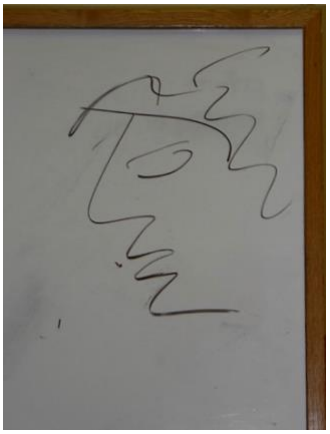
> If we have lured our reader to see himself in the same way as these phenomena, this book will have achieved its first objective.
>
> Doing that, of course, will put us in a circular situation. It might leave us a bit dizzy, as though following the hands drawn by Eischer. This dizziness results from our not having a *fixed point of reference* to which we can anchor our descriptions in order to affirm and defend their validity. In effect, if we presuppose the existence of an objective world, independent of us as observers and accessible to knowledge through our nervous system, we cannot understand how our nervous system functions in its structural dynamics and still produce a representation of this independent world. But if we do not presuppose an objective world independent of us as observers, it seems we are accepting that everything is relative and anything is possible in the denial of all lawfulness. Thus we confront the problem of understanding how our experience, the

praxis of our daily living- is coupled to a surrounding world which appears with regularities that are at every instant the result of our biological and social histories.

Indeed, the whole mechanism of generating ourselves as describers and observers tells us that our world, as the world which we bring forth in our coexistence with others, will always have precisely that combination of solidity and mutability, so typical of human experience when we look at it up close.

Nonetheless, we evidently cannot break away from this circle and step out of our cognitive domain. It would be like changing – by divine fiat – the nature of the brain, changing the nature of language, and changing the nature of our becoming. We would be changing the nature of our nature (H.R. Maturana & Varela, 1992).

How do we do what we do?



Humberto made his epistemology clear and introduced it during his lectures by drawing the observer on his whiteboard to remind his students of his living philosophy. He returned to the observer in his paper "Biology of Cognition" (Maturana R, 1970).

Cognition is a biological phenomenon and can only be understood as such; any epistemological insight into the domain of knowledge requires this understanding.

The observer is a living system and an understanding of cognition as a biological phenomenon must account for the observer and his role in it.

Humberto wrote of how his new epistemology impacts applied social scientists:

> Each social system empowers, through its peculiar manner of operation, certain people to make definitions of normality or abnormality, of health or sickness and, in consequence, the right to be heard and to be obeyed in these domains. In our present western culture this power or authority is socially bestowed to those people under the assumption that they master an objective knowledge, and that this knowledge enables them to distinguish among their fellow human beings those who would be in the category of the psychologically sound from those who would be in the category of the psychologically ill. Furthermore, this social franchisement for psychopathological distinctions under the notion of objective knowledge is, indeed, a social empowerment that, through its demand for social obedience, treats social actions founded on a transcendental (objective) truth, such as special teachings, medications or reclusion, as legitimate and adequate social actions to deal with the people distinguished (and characterised) in that manner.
>
> The operating rule of modern human societies is the concession of power under the assumption that he or she who has knowledge of an objective independent reality has an intrinsic right to it. Indeed, if we are immersed in the supposition that we exist in a universe in which things are as they are, intrinsically independent from us ("the child is lazy" "the coffee is bad"), and if we are immersed in the belief that we can characterise them as they intrinsically are because we have a privileged access to their objectivity, then we have no alternative but to correct the other for his or her errors,

> or to punish him or her for being naughty, appropriating to ourselves the power to do so through the right to be obeyed which objective knowledge gives. A claim to objective knowledge is an absolute demand for obedience.

Humberto's epistemological insights brought forth his "objectivity in parenthesis" as he discusses the ontology of explaining.

> Whenever we want to compel somebody else to do something according to our wishes, and we cannot or do not want to use brutal force, we offer what we claim is an objective rational argument. We do this under the implicit or explicit pretence that the other cannot refuse what our argument claims because its validity as such rests on its reference to the real. We also do so under the additional explicit or implicit claim that the real is universally and objectively valid because it is independent of what we do, and once it is indicated it cannot be denied. Indeed, we say that whoever does not yield to reason, that is, whoever does not yield to our rational arguments, is arbitrary, illogical or absurd, and we implicitly claim that we have a privileged access to the reality that makes our arguments objectively valid. Moreover, we also implicitly or explicitly claim that it is this privileged access to the real that allows us to make our rational arguments. However, is this attitude about reason and the rational rationally valid? Can we in fact claim that it is its connection with reality that gives reason the compelling power that we claim it has or should have? Or, conversely, does reason give us a partial or total access to the real so that we can claim for reason the compelling and universal validity that we pretend it has when we attempt to force

> somebody else with a rational argument? Now, and in order to answer these questions, let us consider the operational foundations of rationality. (H. Maturana, 1988a)

In another paper "The bringing forth of pathology" (Mendez, Coddou, & Maturana R, 1988) Humberto and his co-authors present an alternative to rational arguments based on an independent reality often present in family counseling and other therapeutic services.

> This we must understand: if the members of a family are united by the passion for living together, and act with objectivity-without-parenthesis in the possession of truth, they cannot but struggle to impose upon each other what is correct and what is the *truth,* and they cannot but do so as an ethical and moral obligation of proper coexistence, falling necessarily into a recurrent network of conversation for characterisations and accusations which unavoidably leads to suffering. This situation changes when we put objectivity in parenthesis, and changes both for the family and for the therapist. Yet, this change is not a mere shift of emphasis, it is a change that involves a fundamental change in our responsibilities. Indeed, the question of pathology disappears as a central question for us therapists, and the suffering and unhappiness of the individuals appear instead as the fundamental experiences of the members of the family that command our attention in the consultation. The descriptions of their sufferings that the members of the family bring to the fore reveal the network of conversations that constitutes the organisation of the system (family) that these descriptions connote, revealing its domain of possible disintegrations. In

> these circumstances, our therapeutic task is to contribute to the disintegration of that system (the family in our case) so that something else appears in its stead. If, when this happens, the passion for living together is conserved, then the consulting people will integrate another family in which that suffering of its members will not be a constitutive feature because these, *de facto* or through awareness, will operate with objectivity-in-parenthesis.

For practitioners like me, Humberto opened a new reflective space for observers formerly bound to a physical epistemology that treats knowledge as something possessed with a focus on pathology, to an epistemology that treats knowing as a flow the actions in our daily living and focuses on adaptation to an constantly changing external environment. Reflecting upon this I realized that my student teaching at the preschool was the beginning of forty years of in an experimental epistemological social laboratory. In this epistemology I was learning how our relational behaviors of loving bring forth a myriad of social relations such as mutual respect, caring, co-inspiration, support and collaboration that created a culture of living and working well together.

Chapter Four Love expands social intelligence.

As you will see, my own epistemological experiments brought me to Humberto. I was managing two research grants at the University of Oregon's' Specialized Training Program. Ever since my student teaching at the University of Idaho, my career formed in the development of epistemological experiments. From 1979 to 1983 my laboratory was a electronics assembly business I started in Bend, Oregon. There we proved that adults being abused and neglected in state institutions could be productive workers in community settings. This resulted in the closure of two of Oregon's eugenic era institutions (Oregon Legislative Assembly, 1981) and new federal legislation, called supported employment, that funded service professionals to support people with developmental disabilities in private businesses.

At the Specialized Training Program I was responsible for two research projects to understand the social and financial impact of supported employment. One of our findings were that the workplace included networks of networks of conversations, so we created an Integration Guide for service professionals to track social interactions. I agree with JZ Young – science is about muddling through. This is Piaget's accommodative learning, discovery research and since the supported employment policy brought service professionals to private business, once again I was studying adaption including how I was adapting my research to a new setting I could influence but not control.

Quite accidently, my research, like Humberto's explored new measures of structure (using social network analysis (Knoke & Kuklinski, 1982)) and organization (using grounded

theory (Glaser & Strauss, 1967) and naturalistic inquiry (Lincoln & Guba, 1985)). At NEC America, located in Hillsboro Oregon, our research revealed networks of networks of conversations. For example, assembly workers discuss work in one network, caring for a co-working in another and what to have for lunch in still another network of conversations. While those actively participating in the network form the constantly changing structure, the organization or purpose of the network is conserved. One network supported a co-worker with developmental disabilities with exemplary results.

At NEC America

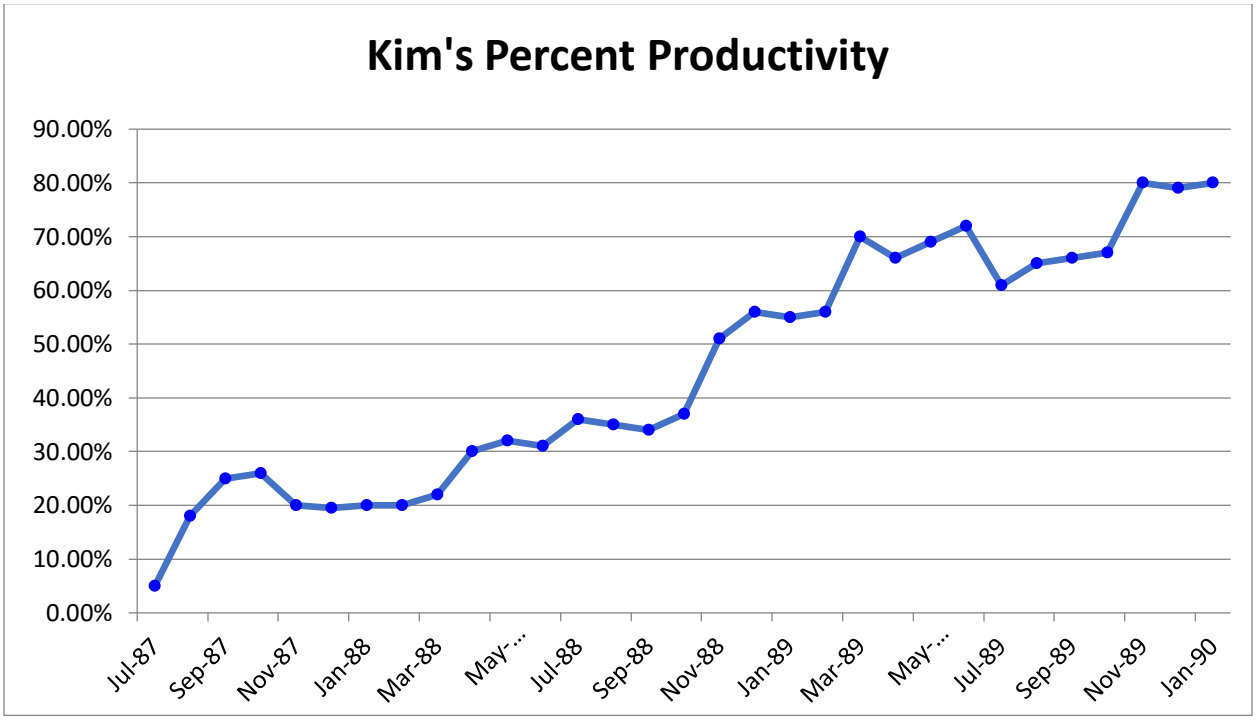
The improvement of services for people with developmental disabilities is a cycle that explores societies capacity to care for people subject to intense pain and suffering from abuse and abandonment in eugenic era institutions. An extraordinary professional inventing new supported employment practices was our colleague Wendy Taliaferro. In one of the first demonstrations of supported employment, Wendy showed how important adaptation is.

Our data pointed to an unexpected path, one we could see coming and one we couldn't design for. This happens often in epistemological laboratories. We had decided to conduct both our social and financial impact research studies in one setting – NEC America Oregon Plant. This gave us a more holistic view of the impacts of supported employment.

Wendy is a fine example of Humberto's professional acting not with authority but with responsibility for constantly expanding the wellbeing of those she served. She could have acted with authority by claiming that her education and new supported employment policies entitled

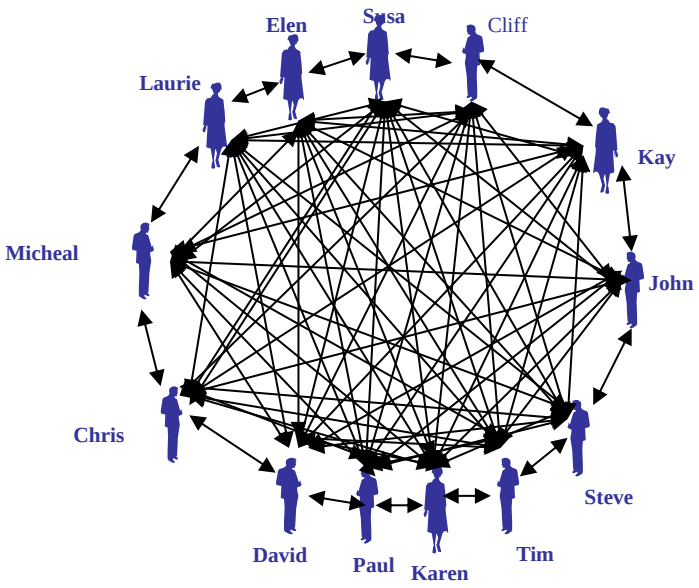
her to control the relations between workers with and without developmental disabilities, but she did not. So when NEC America assembly employees wanted to learn how to train and support the people she was serving she helped arrange specialized training sessions and soon the NEC America employees were successfully training job tasks to their co-workers with developmental disabilities (Mank, Rhodes, & Sandow, 1988).

The data from our research on the economic effects of supported employment showed an unusal spike in productivity. Between September and November of 1988 the productivity of Kim nearly doubled.



We used social network analysis to collect data on Kim's support network. This data showed us that Kim's support had expanded from Wendy's professional support to a network of co-workers. The data also showed us that the network was not hierarchical but the most

cohesive social structure where everyone in the network identified everyone else in the network as a supporter of Kim.



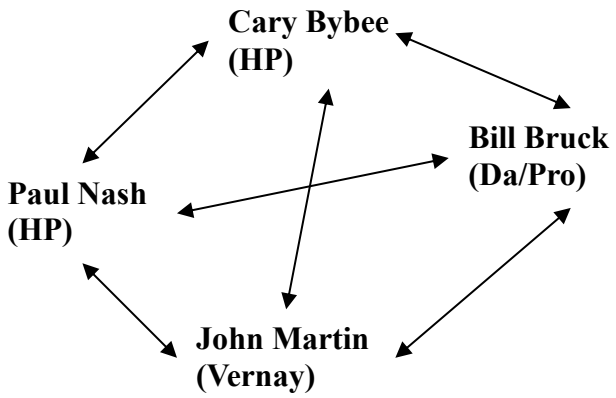
We could see Kim's hours increasingly becoming more like her co-workers, and her attendance the same, as she was learning new electronic assembly skills. Our data was telling us that the supported employment system we University staff invented was being replaced by a social support network forming, waxing, and waning based on an individual's needs and guided by the preferences of those in the social network to care for others.

I presented these research findings at the Biology, Cognition, Language and Society: International Symposium held at Belo Horizonte Brazil in November of 1997. It was there that I met Humberto shortly after his opening lecture and it was love and friendship at first sight. We met again at his laboratory of experimental epistemology at the University of Chile and

then again in Lima Peru. Soon after that Peter Senge and I met Humberto in Santiago and after a long conversation we invited Humberto to present at the Society for Organizational Learnings first annual meeting at Amherst. He kindly accepted and we are quite fortunate to have a paper transcribed from his lecture and his reflections on love:

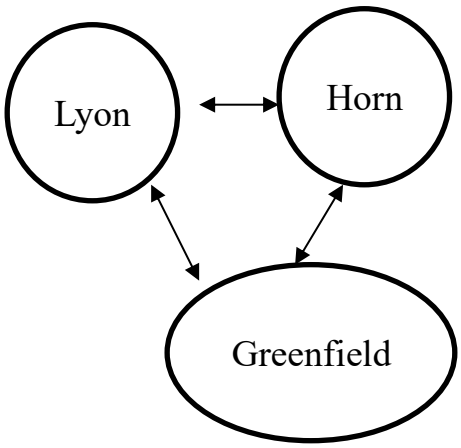
> Besides language, there is another peculiarity about human beings, namely that we are loving animals. Now I know that we kill each other and do all those horrible things, but if you look at the story of the transformation of Shell Oil, or other similar transformations, you will see that it is a story of love. The problems of Shell Oil were solved through love, not through competition, not through fighting, not through authority. They were solved through something very, very different. They were solved through the only emotion that expands intelligent behavior. They were solved through the only emotion that expands creativity as in this emotion there is freedom for creativity. The emotion is love. Love expands intelligence, and enables creativity. Love returns autonomy, and as it returns autonomy, it returns responsibility and freedom in us.
>
> Humans are those animals that have expanded living in love. We have become dependent on love in the sense that we become ill of body and soul if love is interfered with. Sometimes conditions arise in our culture so that some bad ideas persist in spite of their badness. I think competition is one of those bad ideas that is destructive, and yet it persists. (H. Maturana & Bunnell, 1998)

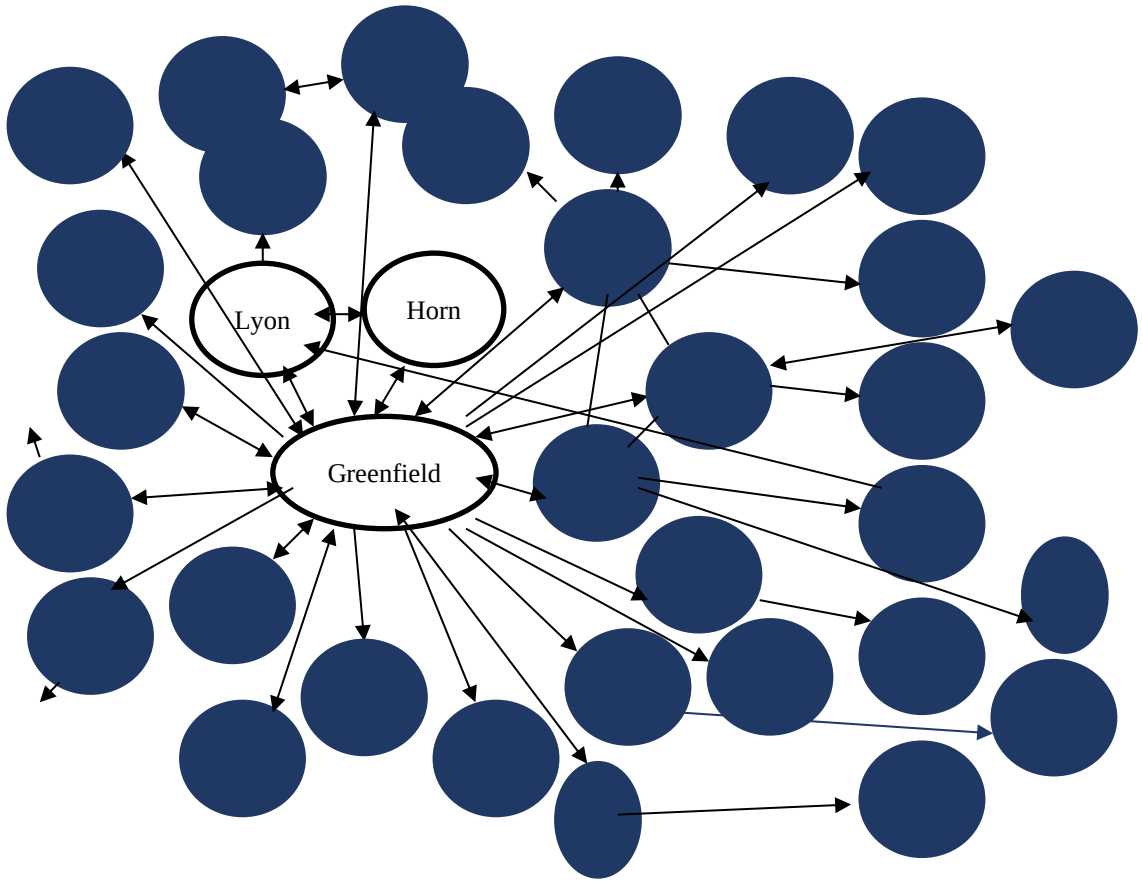
In 1999, I was invited to bring social action research to Hewlett Packard's Inkjet Business Unit. The business was growing quickly and in the first social action research study we discovered that the business unit's plastic engineering group had transformed the supply chain in to a collaborative social system (shown below), whereby everyone in the network recognized everyone else in the network as a legitimate contributor to the discovery of new material compatibilities. Their discovery shaved 15 weeks off new product development in a fast paced and highly competitive inkjet business.



Around this time, HP was planning for a ten-fold increase in inkjet cartridge manufacturing as George Greenfield, the quality program manager, identified costly quality escalations that threatened the business. Instead of organizing a "hit team" to solve the quality problem, the HP site in Corvallis Oregon followed the social action research data and Humberto's living systems epistemology. George led his team by listening to his colleagues, abandoning the traditional command control management practice. In George's social network maps we can see how love expands social intelligence, from the first network of

conversations to his last social network map. This is important – the larger the network the more vast the knowledge and collective intelligence.





I had become a founding research member of SoL and invited Humberto, Peter Senge, Goran Carstedt and other SoL members to Corvallis Oregon to reflect on our data and

Humberto's living systems epistemology. The reflections from George Greenfield and Peter beautifully capture how the change in our theory of knowledge felt.

> At the time we were experiencing a rash of pesky quality problems that diverted our precious resources. We had two choices: assign a team of specialists to solve the problems, as we had in the past, or employ the methods and techniques espoused by Sandow. We chose the latter, and as they say, "The rest is history!" Sandow and Allen's article talks about the power of real listening to influence learning. During this time we made the choice to listen to the advice of our own leaders and experts throughout the business about what HP needed. We had not realized how much knowledge was embedded in our own internal networks. By listening, we learned what we needed to do together to improve the overall quality of our products in a way we would not have if we had continued to operate in our old ways.

> The leaders in our collaborative social network focused on pertinent information, like metrics displaying the quality issues, with the result that problems were spotted faster and resolved more quickly and completely than ever before. The business has now gone more than three years without a serious quality issue and we have virtually eliminated the "distribution thrash" common in earlier periods.

> The business results were stunning. Equally important, however, was the way employees and vendors felt about their role in the work. A feeling of well-being and accomplishment permeated the organization. Being at work was a joy. We were happy with each other.

> And best of all, we knew we had made – and could continue to make – a difference to the business through a new way of getting our work done. George Greenfield (Sandow & Allen, 2005)

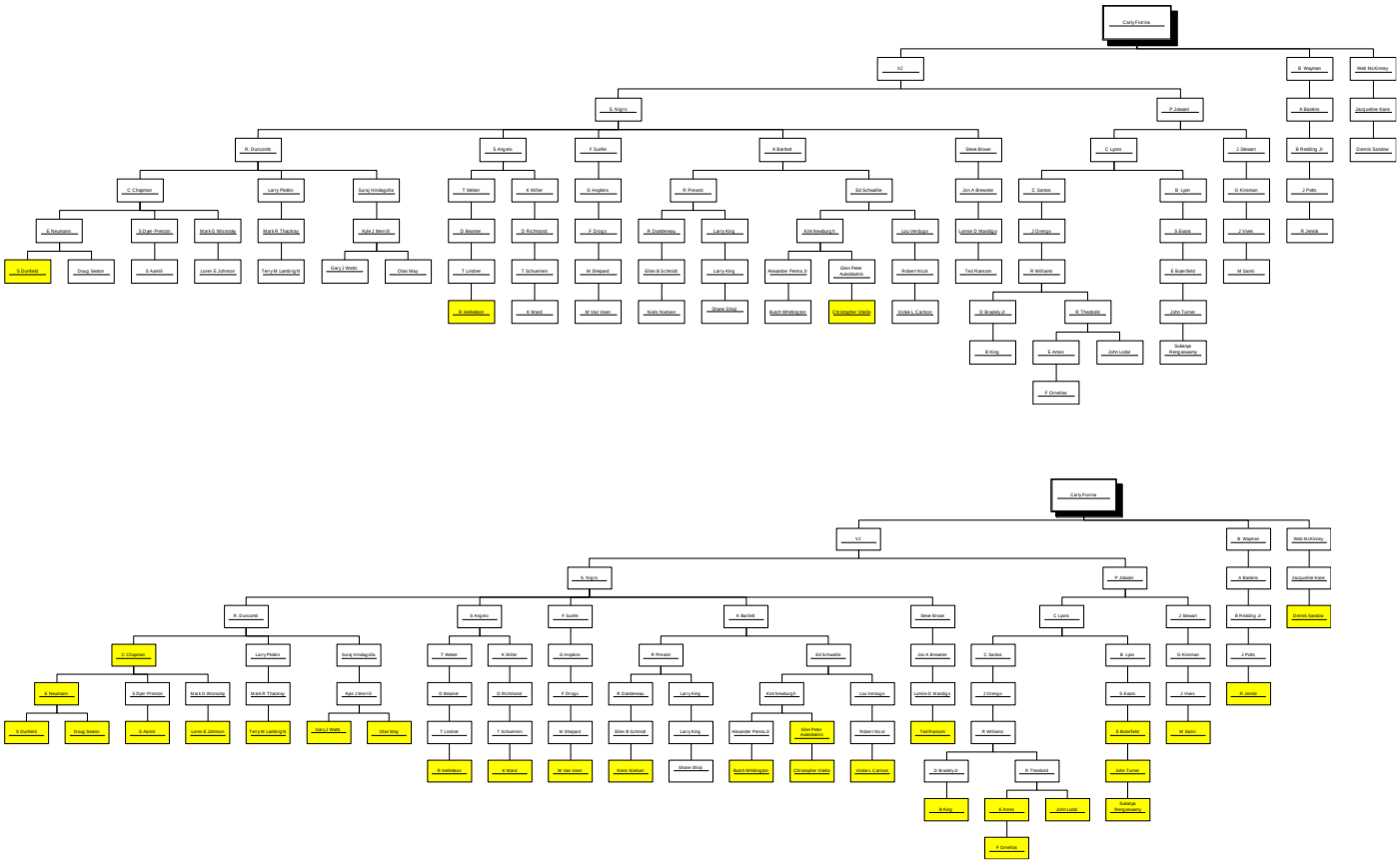
Peter has the wonderful capacity to reflect his learnings back to the SoL community and joined HP executives and staff in attending Humberto's lectures at the HP campus.

> In my judgment, the research on social collaboration that Sandow and Allen, along with many colleagues at Hewlett-Packard (HP), have done represents a landmark accomplishment in the emerging philosophy and practice of knowledge- based management. I first learned about this work when I attended a two-day workshop that HP hosted for Humberto Maturana, the Chilean biologist cited in the article. The fact that a company would get together almost one hundred engineers and managers, including Anne's boss, the "Ink Supply" division general manager, for two days with an eminent scientist of living systems was itself surprising. But what was even more surprising was that the participants were there to learn how to deepen work many were already doing. For some years, Dennis had been listening and learning from several engineering teams in this division, seeing first hand how they did their work and who they depended upon to do it. As he introduced initially skeptical engineers to social network mapping, they found that it gave them a tool to legitimate and explain to their managers how and why their personal networks mattered. Managers started to pay attention as the evidence linking particular social networks and the results they achieved became compelling. For the first time, the engineers had a language to

reinforce their claims that reorganizations and other manag ment actions taken without an understanding of these networks often had negative side effects that outweighed the intended benefits. This is why the interest in the Maturana workshop extended well beyond the intellectual – which made the juxtaposition of this pragmatic motivation with its content even more striking.

In those two days, Maturana shared with the eager HP engineers his fifty-year journey of understanding "the biology of love." Starting as an MIT post-doctoral experimental biologist trying to understand how "the frog sees a fly," he had gradually established a radical new foundation for understanding perception in living systems. Perception, Maturana explained, is not ultimately about what we *see* but what we can *do*. From an evolutionary perspective, "catching flies" matters a good deal more than "seeing flies." In human systems, the quality of perception is inseparable from the quality of collaboration; it is about the coordination of action that arises in networks of social interactions. Effectiveness depends on the qualities of the social relationships. When we are distant from one another, when we distrust or feel at risk, our relationships and consequently our awareness suffers. Conversely, when we build trusting relationships that allow us to be open, honest and vulnerable with one another, our ability to sense and respond to complex and changing environments grows. "Love, allowing the other to be a legitimate other, is the only emotion that expands intelligence," Maturana declared to the HP engineers and managers. And they understood what he meant. (Sandow & Allen, 2005)

I was inspired by the culture of the HP way and collective intelligence it brought forth. In 1995, the political scientist, Robert Putnam, hypothesized that social capital formed both horizontally and vertically across the traditional organization chart (Putnam, 1995). In 2003, HP plastics engineer, Chris Vitello, invented “healthjet” a new technology that applied inkjet technology to health care. He mapped the network (shaded in yellow) as it grew and for the first time, collected data validating Putnam’s deductive theory.



Humberto and Ximena Davila co-founded the Matriztica School in Santiago and began offering courses in cultural biology for SoL members. In 2011, Humberto and Ximena presented cultural biology at a Sol Sweden workshop and Peter was kind enough to prepare a short talk in advance of their course.

In 1999-2000 Humberto Maturana did a 2 day workshop in Oregon for this division of Hewlett-Packard. I thought it was just a amazing experience. There were 150-180 managers, most of whom were engineers, spending two days talking about the Biology of Love. You don't expect to see that all the time. It was a tremendous mind stretching activity, but, most importantly you could feel the seriousness of the intent, and you knew that this was going to get integrated and have a real impact on how they managed and how they lead.

The big question is always not interesting seminars, not intellectually inspiring ideas but the doing of it. When you go deeper and deeper into the work of the Matriztica School you come to realize that this is their perspective as well – its all in the doing, its not in the talking. My hope is that the event in SoL Sweden is catalytic and more and more of the SoL communities around the world understand the practical significance of this work.

As I say that, I need to go back again to the way Dennis Sandow has served as a absolutely brilliant integrator of taking the thinking, the principles, the deep understanding that the Matriztica School embodies and bring it into forms that can really have an impact on practical day to day work. First the spirit, the spiritual underpinnings of collaboration. Why do we collaborate? Well we collaborate because its in our nature to work with each other. I think the most underestimated resource in any enterprise is the relatively untapped desire people have to help one another. The

spirit of generosity, the joy of working together. Dennis took this field of understanding social networks and said, ‘Why don't we reflect on our wellbeing?’, ‘Why don't we reflect on those times at work when we produce something that not only has been a astounding or significant accomplishment but something we feel good about. We not only feel good about the accomplishment, we feel good about the work we did to accomplish it.’

The integration of process and output all around this very simple but potent idea of when we are generating wellbeing. Because when we are generating wellbeing we innovate. When we generate wellbeing we solve problems that otherwise don't get solved. When we generate wellbeing we come into a field of trust and mutual exploration. We don't have to have the answer. It’s not about implementing somebody’s tool. It’s about how we together can create the outcomes we want to create and experience the joy in the doing.

Dennis got everyone in this big division of HP living two questions. ‘How do we accomplish work we are really proud of?’, and, ‘How do we generate wellbeing in the accomplishing?’ and he started to see them as more and more inseparable.

Eventually, they summarized all this in a very beautiful, kind of to me one sentence articulation of the guiding spirit of what’s always been there in all the work we really had the pleasure to be involved with and that’s the statement that all examples of

sustained high performance are achieved only through creating social wellbeing. All examples of sustained high performance are achieved only through creating high levels of wellbeing. When I first saw this I thought – Wow!

And that is a beautiful example of the integration of understanding the Matriztica School and organizational learning.

Chapter Six Social Action Research Today: How do we do what we do when we are working and living well together?

To understand how social systems, conserve and expand their living and working well together social action research studies organization using qualitative practices and structure using social network mapping. This data was collected in the Spring of 2020.

Cascade Medical Center

Cascade Medical Center is a rural health center in Cascade, Idaho. I received an email from my friend and HP collaborator, George Greenfield. George is one of those folks who is simply a great pleasure to know. Always positive, thoughtful and compassionate, George is the epitome of a leader in management and quality improvement and just plain fun to be with. Since we worked together at HP, George had retired and was on Cascade Medical Centers Board of Trustees. On a zoom call, George introduced me to the CEO of the center, Tom Reinhart. As our conversation moved from introductions and discovering our common Idaho backgrounds, I began to explain social action research as a systemic process for studying wellbeing at work. George sensed an discomfort in Tom and laughing said something like, “I know how far-fetched what Dennis is saying sounds!”

At the time we could see the COVID virus growing in the Pacific Northwest and realized it was only a matter of time before Cascade Medical Center would be affected. I was a bit surprised when, despite the coming of COVID, Tom suggested we move ahead with the social action research and ask his staff how they work so well together. What follows is mission, vision and values of Cascade Medical Center and the social action research findings.

Their mission statement:

> "Our mission is to save lives and improve the health and well-being of our community"

Their vision:

> Cascade Medical Center is focused on being an independent Critical Access Hospital and Rural Health Clinic that improves the health of those we serve.
>
> Through prudent management of its staff and facilities and relationships with regional providers, CMC provides a wide range of medical services while operating in a cost effective manner.
>
> CMC staff takes individual and collective responsibility for its actions and works as a cooperative, integrated team that uses its skills for the benefit of the patient and organization.
>
> Our staff treats each other, the patient, and the organization with dignity and respect.

Their values:

> Integrity
> We provide dependable, trustworthy care.
>
> Compassion
> We demonstrate caring and concern for the physical, emotional and spiritual well being of whom we serve.
>
> Quality
> We strive for an environment of continuously improving quality of care.
>
> Stewardship
> We manage our time, talent, and financial resources responsibly.

Organizational coherences

Following Maturana and Varela, I study social systems by using qualitative methods to understand the *organization* of the system – or what gives the social system its identity.

Openness and transparency

- Communication is open. You can go talk to anyone you want when you need to.
- I appreciate that our CEO has open communication and monthly meetings.
- In the office there's an openness to ask questions, without judgement. For new people that's nice.
- It's pretty open communication that keeps the work flow going.
- Its about being transparent. If you have concerns you can talk to anyone. This makes us want to work together.
- Tom's great at creating transparency for all employees at all levels.
- It's quite unusual to have this many people working so well together. They can talk together without going through their supervisor.
- If you have a question you can ask because there is no right or wrong question.

Family

- We are one family and we take care of each other.
- You are family.
- The first time I came here to interview for a job the lady at the receptionist's desk greeted me saying – We are one family – and she made me smile and laugh.
- Now it feels a lot like family. I linger and hangout with staff after my shift is over.
- Everybody is so interconnected and we live in a small community and when patients come in they become family too.
- It's nice that we're small and have a family feel.
- When patients come here they are not a number. They are family when they come here.

Communication

- I think that for the most part our working well together stems from communication.
- I appreciate that our CEO has open communication and monthly meetings.
- Communication is key and allows us to keep above average worker satisfaction.
- Our communication is open.
- I also work with the business office and we share a great sense of communication and collaboration in an open setting.
- We all seem to communicate well together. If we need imaging as soon as possible we can just go to the Department to get them.

Community and care

- In this community, everyone cares for everyone in the community.
- I really do enjoy the positive atmosphere. It's not only us, it's the community.
- We know the people in our community and they know us.
- The community is not a number.
- We go out of our way to care for our community and to care for each other. It comes natural.
- We live in a small community.
- Our community supports us well too.
- It's also a cool place to live. Most of us like living here so the location is a small component.

Help and support

- So at Board meetings I have more meals to cook and people will help clean up the tables so I can cook. They just jump in. I don't ever have to ask for help.
- We're all in health care to help people. There's the paycheck plus the feel good power of helping people.
- There's also an amazing amount of selflessness here. If you need help staff will work late or work in the evening to help you.
- We're flexible in helping people out. I appreciate helping people out on many levels, not just health.
- If someone gets behind, others jump in to help.
- As long as I've worked here it's been pretty great how people help out and back up each other. People are willing to shift their schedule for days off and if there is any sort of issue with rooming patient everyone's willing to help out. It seems like it's pretty natural.

Tom

- Tom reports on how we are doing and where we're going and seeks our feedback.
- When I needed to take time off to be with my son, Tom said family first. I appreciate that!
- Sometimes I think I annoy people because I often talk about how great Tom is. He asks about us and really cares.
- Tom has been great for morale. I've worked for four CEO's and Tom's the best. Tom's really good at building teams.
- Tom's a down to earth guy and asks us for our opinion.
- It feels like Tom is a cheer leader in how the staff works together.

People are not numbers

- They are humble and kind and it blows me away. I've never worked with nicer people. They are selfless. You are not a number.
- I've worked at other health care places that make you feel like a number. They make you feel like they don't want to know who you are.

Trust

- People feel trusted and they want to reciprocate at all levels.
- I'm given the freedom to work things out and that makes me feel trusted and responsible. If you are micro-managed you don't feel trusted.
- I feel as part of the organization in ER well supported and trusted by our Medical Director, Nursing Director and Lab personnel.
- I feel supported by the structure, the trust and the comradery – all of the pieces are there.
- There is a high level of trust and with that there are written and unwritten expectations to perform.

Cohesion

- We have expectations on what work is all about so the interpersonal relationships need to be cohesive.
- We work cohesively.
- We have to work so close together.
- We were separated in the past so one department didn't know what the other department was doing but now we work together as a whole.
- Our CNO Teri Coombs creates cohesiveness and is so helpful and supportive of the people that work for her so we take care for her.

Freedom

- Our Director lets us work things out instead of micro-managing us.
- There's not the barriers of the large corporations and we've given our employees the freedom to fix problems.
- Our new providers are on the same page as us and by letting us all do our jobs instead of telling people what to do brings confidence.

Amazing

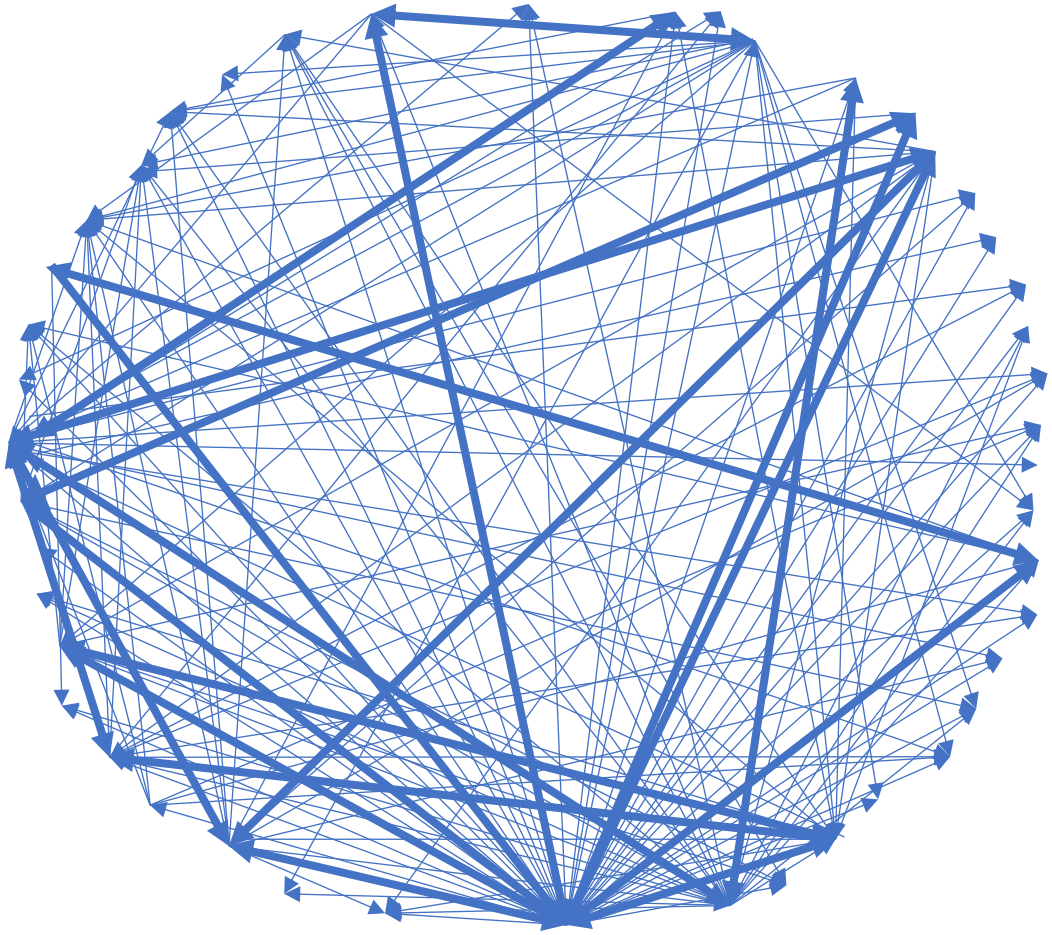
- They noticed how I felt and their compassion was just amazing.
- It's an amazing place to work.
- It's quite an amazing group of people I work with.
- The cook is super amazing. She knows I'm allergic to walnuts so she puts them on the side. She demonstrates attention to detail and love.
- The quality of their leadership is something I've never seen. It's pretty amazing.

Wellbeing at work

- I actually look forward to going to work on my shift. That's not always been the case in other organization's but it is here. Feeling excited about going to work is a nice plus.
- It makes it easy to return to work and makes me want to pay it forward.
- Across the board the staff are willing to contribute to each other's success. The staff are happy, positive and caring.
- The people I work with are fabulous. We need to know our roles and how we work well together.
- At work we are happy and joke around.
- In other hospitals, Doctors act like they are better than you but I haven't seen that here. I never feel that way at my hospital. They communicate with you like your people. When you're out of the room and at the nurse's station he's not the Doctor. We are equal human beings. That's how we are.
- I've been here for 5 months. I feel very welcomed by everyone. Over all our staff are very good people with really good intentions. They bring out the best in each other.
- I love working here.

Social network structure

This is the social network structure of those collaborating (shown as dark bold lines) at Cascade Medical Center when working well together. It was a small sample with around 30% of the CMC employees participating. I say this because even if 10-20% more participants completed the survey, the network is very likely to show an expansion in collaboration. The



network also shows social capital as functional departments, or silos, are included in the network. Lastly, Tom's position in the network is at the bottom 6 o'clock position. Here I can see the organizational coherences, especially the reflections concerning Tom, on the network map as he is central to the collaboration. Centrality is a measure of connectedness and is as

simple as counting the number of bold lines connecting Tom. There are 9 connecting Tom to other employees.

Hyphn

Hyphn is a office space developer located in Portland Oregon. After completing the Cascade Medical Center social action research, Heidi Sparks Guber and I invited a group of folks interested in the Society for Organizational Learning to join us to reflect upon Arie de Geus' call to action. One of those who joined us for our regular zoom calls was Heather Leachman Beck the director of workplace innovation at Hyphn. Heather invited me to do social action research at Hyphn and I must admit I was not prepared for the experience I was about to have.

SmithCFI was a 75-year-old office furniture dealer and installer when Hyphn acquired it, and it was easy for me to imagine a mature business model showcasing the latest in Steelcase furniture. I remembered my time at HP's Inkjet Business Unit and how I was met by a receptionist at a security check point. I swiped my security badge and entered into the site filled with cubicles and small meeting rooms. When I first visited Heather at Hyphn I was confused. We entered into a beautiful setting that looked much more like a five-star hotel than a office furnishing business. Passing by a wet bar and a café like setting, my confusion gave way to insight – Hyphn designed the setting to foster positive social interactions. When Heather introduced me to the partners who established Hyphn, I learned of their innovative strategy – to create healthy spaces that improve productivity, innovation, and wellbeing at

work. The partners, Shastan Yee and Matt Newstrom reflected on their business strategy in a 2018 Oregon Business article (Newman, 2018).

> "In the past, [office design] was about the bottom line—finding the cheapest rent and furniture you can," said Matt Newstrom, co-principal of Hyphn, a Portland-based company specializing in workplace strategy and office furniture solutions (with another office in Bend). "Now, company leaders are realizing: physical space matters, and it needs to reflect the business vision, the culture, and must encompass its workers' needs."
>
> "Behavior creates culture," said Newstrom. "Your workspace is an enabler of inspired behavior."

Hyphn is about connecting their customers to the high performance working well together or social wellbeing brings about.

> "It's about understanding: what do your people need to perform at their best?" said Jee.
>
> "The newer generation wants to feel creative and inspired at work," said Jee. "They see the workspace as a destination—they want to be happy to go there."
>
> "This isn't a 'one-size-fits-all' model. You can't just buy a ping pong table and make everyone happy," said Jee. "For this to work, you must truly understand your culture and work patterns, without just taking it at face value."

What Matt and Shastan had done went well beyond giving lip service to the somber issues confronting workplace health (Public and Commercial Services Union, 2004), once inside their design studio and immersed within their culture I could feel the wellbeing resulting from their management practices. I was amazed by how the Hyphn team generated

social support networks so critical to our social health (Marmot, 2004). Time and time again, workplace challenges daunting to most organizations, were seemingly effortlessly addressed in Hyphn's culture. When I asked them where we should begin the social action research, like Tom at Cascade Medical Center, they too asked, "How do we work so well together?"

I was delighted when they agreed to doing the social action research and even more so when Heather Leachman Beck joined me in practicing the social action research. Doing so is not easy because when one studies their own organization their co-workers might assume that they already know the answer to the questions being asked. Heather did a wonderful job and before we were done collecting data, she was independently practicing social action research.

What follows is Hyphn's mission and values followed by the social action research findings.

Hyphn's mission statement:

> At Hyphn, we enhance our community's potential one workspace at a time. Using research, data, and experience, together we design and deliver inspiring workplace solutions that enable you to do your best, feel your best, and achieve your best.

Hyphn's values:

We're One Team

> Our best results are not created by a lone team member, but by a well-practiced and aligned team - one team, one dream! When we're inspired to seek a fresh perspective or view our task through a teammate's lens, everyone wins. We harness the power of

team to push each other to grow, to hold each other accountable, and to pick each other up, reminding each other that **we're better together.**

We've Got You

Bring us the most complex or delicate project you have, and we'll collectively say, "on it." We serve and advise our clients with expertise, proactiveness, integrity, and creativity. Together, we all rally around the notion that we're not satisfied until our clients are taken care of. And when our clients hop on a call or walk through our doors, they can truly feel that **we're partnered for success.**

We Never Settle

What we offer has evolved far beyond our industry's benchmarks —we're our clients' strategists, advisors, and consultants on all things space. And we're not done. We believe in challenging ourselves, taking risks, innovating, breaking molds and failing forward everyday. We will never stop learning, growing and getting better, because we know **success doesn't stand still**.

We Love to Laugh

Work shouldn't be a drag, life is too short. It's one of our greatest points of pride that we can bring our whole selves to work, our curiosity, belly laughs, goofy energy, and a sprinkle of self-deprecation (all in good fun of course). Work can be hard, deadlines can be stressful, patience can run short, but don't worry we can count on each other to keep perspective and **bring the fun (bucket) to work.**

We Build Community

Our mission is to improve the world one workspace at a time, but it's our values that empower us to make a much broader impact in our communities. We are here to support each other, protect our environment, and help out our neighbors. We are impelled to give of our time, energy, and resources to improve the world we are a part of, knowing **we make a difference.**

Organizational coherences

Once again using qualitative research methods we can study the *organization* of a social system as a way of seeing the nature of the relational behaviors that conserve the social network identity, listed here as organizational coherences.

Collaboration

- We have come up with collaborative tools, which help us figure things out and get things done.
- I help and we work together.
  Through community, collaboration, communication and having common goals.
  Collaboration; we are a team
- I have a team and we work extremely well together. Nothing is done without all of the team members knowing about it. This creates trust. I'm lucky to be part of that team.

Communication

- Communication is key. There are so many emails. A phone call or quick meeting will solve many of these communication issues. Challenge ourselves to 15 or 30 minute meetings to be effective.
- You need more dialog and 2 way communication. Now we're involving leads in the pre-install meetings. This is the first job we've tried it. He got here a day early and understood the problem.
- We try to be as open as possible so there is a flow of communication. We can't do this with all aspects of the business but for the most part are open.
- Through community, collaboration, communication and having common goals.
- One thing that bugs me is when people don't give me the information I need. DiSC has helped me to understand what I need and also that I don't always get it from the people I work with.

Family

- There is a family orientation here where friendships emerge from working together.
- This is a family atmosphere. Our communication is sometimes messy and other times not so much.
- Most people feel like Hyphn is a family of sorts and at the end of the day we all have each others back.
- This may sound funny but being here at Hyphn feels like a family. When someone leaves I feel sad and when I talk to new employees they talk about how good it feels to work here.
- The grander picture is that this is my home away from home.

Authentic/full self

- People come here not just to work but to be themselves.
- There has been a big focus on people doing their best work. Hyphn has done a really good job of creating outlets where people can work on their own. There's encouragement for creating something new and there's endless possibilities.
- People work better because of the social-work balance.
  It's a place where you are encouraged to be your true self and are encouraged to be.

Culture

- This is the first time I've worked in a place like this. What brings me here every day is the people working here and wanting to be together with them. With that comes a lot of trust. Hyphn does an excellent job in hiring people and empowering people to do excellent work. The quality of internal relations are also felt externally and validated and they want to be part of our culture.
- When we are working well together it is light hearted, fun, goofy, honest, sincere and empathetic. We all feel for each other and this is how we work best. We are trying to get at the root of solving our problems and our leadership is not afraid of addressing problems.
- The combination of Matt and Shastan shifted our culture from what it was. It really felt like having a totally different mindset. They said things like the designers are important and that felt good.
- We really wanted to empower teams by giving them the tools to be successful. We keep culture top of mind. We believe it's an entirely different culture than the one that was here before.
- Hyphn has a real culture. In other companies I've worked for, culture is made up. Hyphn's culture has come together organically.

Mutual respect

- We have a great amount of mutual respect and enjoyment of one another.
- We have respect for each other and we're all here for the customer.
- There is mutual respect for each team member.

Clarity around roles and responsibilities

- One thing is when we each understand the job we are doing. We all have a role in the process. If we don't know what it takes to be successful, we can't work well together.
- What I value is telling me what you need and when you need it. Those that don't do that are a challenge for me.

- It helps that we have teams with specific roles. Hyphn sets the expectation for everyone to know their role.
- There are a lot of different jobs and personalities here and we don't always know what our role is. It's good to remind each other and be aware of what others' needs are on your team that you may not be aware of on mixed teams.
- Having a clear structure of roles and responsibilities.

Help/support

- I love the work we are doing is not just about growing Hyphn but caring for those outside of Hyphn.
- When we work well together we are all challenged but there is such a strong support network you feel confident you can do new things. I love talking about our feelings and that's appreciated by everyone. We want to spend time together inside and outside of work. The time we spend outside strengthens what we do inside of work.
- The energy is so good that people want to help. It's a very good and positive experience.
- Everyone has each other's back, not only for work but emotionally as well. Operationally, not as much sometimes. We are there to support each other. The work we have put in has helped.
- All people are good to work with. Pedro speaks english and spanish and helps me. Work isn't a problem when we help each other.
- There's a general realization of support here. There's a very few people who when asked to help out with something don't do so. Pushback is around wanting to help but not being the best support. That leads to being connected to the best resource. Cat and Troy are examples of this.

Positivity

- The energy is so good that people want to help. It's a very good and positive experience.
- When there are not positive experiences, there's healthy conversations about what we should be.
- My experience has been the most positive experience I've ever been part of. I would say within my aligned team, what's great is having the trust and ability and being accountable for ourselves.
- I am happy to work with others, everyone is a good person here.
  Overall I love the Hyphn leadership. Little things help and the positive energy is outstanding.
- Many say it, but this company really cares about their employees. I love that every situation is approached positively.

Relationships

- Here at Hyphn I think what really is so strong is that there's a strong personal connection. It's important for people to have a personal connection
- and make time for relationships. This creates a deeper understanding through empathy which connects us personally and at work.
- This is the first time I've worked in a place like this. What brings me here every day is the people working here and wanting to be together with them. With that comes a lot of trust. Hyphn does an excellent job in hiring people and empowering people to do excellent work. The quality of internal relations are also felt externally and validated and they want to be part of our culture.
- We have a tight knit group in the field.
- By connecting on a personal level like asking How was your weekend? So you know the people you work with and understand each other's personality.
- Our friendships/relationships allow us to work better together. Not one person should be a single point of failure. Even if you don't like the task, if you enjoy the people you are working with, it's ok.

Trust

- This is the first time I've worked in a place like this. What brings me here every day is the people working here and wanting to be together with them. With that comes a lot of trust. Hyphn does an excellent job in hiring people and empowering people to do excellent work. The quality of internal relations are also felt externally and validated and they want to be part of our culture.
- Hyphn does a good job at maintaining regular feedback. Our leaders are great advocates for those they support. There's a lot of trust in people knowing what they need. We are all learning together and trying to be better humans together and truly doing things together. Things like garden hobby groups and reading groups pop up.
- My experience has been the most positive experience I've ever been part of. I would say within my aligned team, what's great is having the trust and ability and being accountable for ourselves.
- Trust blended into confidence in myself. Tim has helped me build confidence. For example, he went on paternity leave and said Miranda has responsibility for the clients we have.
- We want cleaner hand-offs not to follow hierarchy. The rule here is not to be a jerk. There's trust here.
- I have a team and we work extremely well together. Nothing is done without all of the team members knowing about it. This creates trust. I'm lucky to be part of that team.

Values

- I really enjoyed developing our core values. It allowed everyone to be part of the process.
- I'm embarrassed being called boss. We quickly smashed the hierarchy and flattened the organization. Believing it takes every person to make the business work is important. We all need each other, our core value of one team shows this.
- Having our five core values is important. People don't necessarily adopt all five values but every single person aligns with at least one of them. Knowing our mission and goals helps us know what we want to accomplish.

Ops/design divide

- The barrier between Ops and Design is slowly going down with more and more departments working together. That's nice to see over the last couple of years.

- During the past year we didn't miss a day of work while everyone else is at home. We are in a separation mode.
- There's a gap between Design and Ops. Since we've become Hyphn, it's improved. Ops works during the day and go home at night. Used to be that they would go out after work for a beer but not now.

Freedom

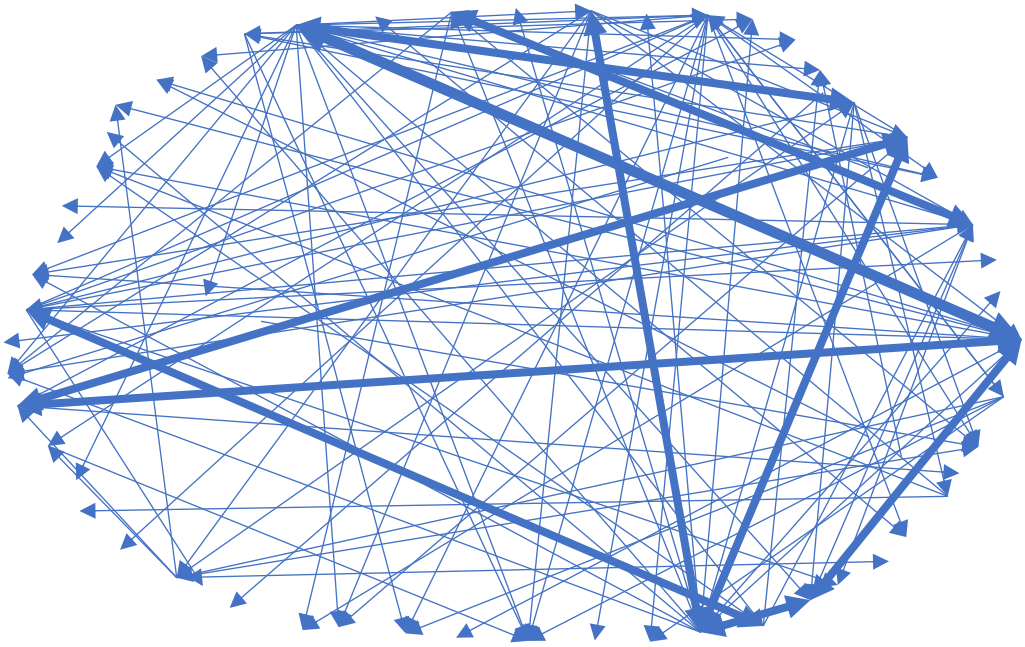
- Being able to ask questions as they arise, and get answers easily and quickly, is very helpful.
- I think people need unscheduled work time where you don't have an agenda or scheduled meetings. People are more effective when they aren't working at 100% all week to meet deadlines.
- There is truly a community here. It doesn't feel like a hierarchy. There are personal connections instead of hierarchy. We can talk to anyone at any time and that is freeing.
- We really wanted to empower teams by giving them the tools to be successful. We keep culture top of mind. We believe it's an entirely different culture than the one that was here before.
- Trying to create freedom for how people come together. Trying to put complimentary skills together and having a light management touch. This will create self-directed teams.
- The less we are focused on traditional management and the more we focus on people being free and responsible for their own work. The feeling that I can take my ideas to my supervisor or manager without feeling hierarchy allows me to work better.

Improvement/success

- Their concept of fail-forward and learning. It exploded all these opportunities and ways of working. It gave me purpose and shifted my mind set to
- start looking at ways that I work and how I can improve myself and my teams, not just showing up for a job!
  What's great is we want to improve to continue to evaluate our process and how we work as a team. That's really great.
- We really wanted to empower teams by giving them the tools to be successful. We keep culture top of mind. We believe it's an entirely different culture than the one that was here before.
- We're honest which I enjoy and without being honest we cannot be successful.
- There has been success with aligned and functional teams, especially those that are meeting regularly. I manage the PM team and that is better than ever.
- I like the focus on strategic initiatives and how Hyphn is always trying to improve. It's great for people with that mindset. Field team does not have time to work on those sorts of things. Tech and install can't share their ideas in the same way. I can work on as many Kaizens or STIPs as I want.
- I like that we try things and fail forward. To try and have it not work is encouraged. It doesn't have to be perfectly planned out.
- There's an overwhelming desire to see others succeed. Why do I do this? To be part of someone's career growth.

Social network structure

With only 35% of Hyphn employees completing the social network survey we can see reciprocal relations (bold blue lines). It is likely that with more people responding to the network survey, data would have shown even greater cohesion.



Ocean bound plastics project in Haiti

When my small business employing people with developmental disabilities produced electronic components for HP printers the evidence of the productive capacity of our workforce closed eugenic era institutions. The HP production engineers were making data base decisions and as long as we met HP's quality and delivery expectations our business grew. This is when I began to understand the HP way, later described in Dave Packard's 11 simple rules:

1. **Think first of the other fellow.** This is THE foundation — the first requisite — for getting along with others. And it is the one truly difficult accomplishment you must make. Gaining this, the rest will be "a breeze."

2. **Build up the other person's sense of importance.** When we make the other person seem less important, we frustrate one of his deepest urges. Allow him to feel equality or superiority, and we can easily get along with him.

3. **Respect the other man's personality rights.** Respect as something sacred the other fellow's right to be different from you. No two personalities are ever molded by precisely the same forces.

4. **Give sincere appreciation.** If we think someone has done a thing well, we should never hesitate to let him know it. WARNING: This does not mean promiscuous use of obvious flattery. Flattery with most intelligent people gets exactly the reaction it deserves — contempt for the egotistical "phony" who stoops to it.

5. **Eliminate the negative.** Criticism seldom does what its user intends, for it invariably causes resentment. The tiniest bit of disapproval can sometimes cause a resentment which will rankle — to your disadvantage — for years.

6**. Avoid openly trying to reform people.** Every man knows he is imperfect, but he doesn't want someone else trying to correct his faults. If you want to improve a person, help him to embrace a higher working goal — a standard, an ideal — and he will do his own "making over" far more effectively than you can do it for him.

7. **Try to understand the other person.** How would you react to similar circumstances? When you begin to see the "whys" of him you can't help but get along better with him.

8. **Check first impressions.** We are especially prone to dislike some people on first sight because of some vague resemblance (of which we are usually unaware) to someone else whom we have had reason to dislike. Follow Abraham Lincoln's famous self-instruction: "I do not like that man; therefore I shall get to know him better."

9. **Take care with the little details.** Watch your smile, your tone of voice, how you use your eyes, the way you greet people, the use of nicknames and remembering faces, names and dates. Little things add polish to your skill in dealing with people. Constantly, deliberately think of them until they become a natural part of your personality.

10. **Develop genuine interest in people.** You cannot successfully apply the foregoing suggestions unless you have a sincere desire to like, respect and be helpful to others. Conversely, you cannot build genuine interest in people until you have experienced the pleasure of working with them in an atmosphere characterized by mutual liking and respect.

11. **Keep it up.** That's all — just keep it up!

In the following social action research study of HP's ocean bound plastics project you'll read references to the HP way by employees of HP's project partners, Lavergne and First Mile.

Lavergne

Lavergne is a global leader in manufacturing recycled plastics.

Lavergne's commitments:

Your business - Many things make us run. Your business success, for one. We love to help you shine in your category. To help you become a leader in the new circular economy.

Quality - We do everything to deliver the best product, the best performing recycled resin available today.

Our family - To make quality happen, we need our people, partners and clients. We can't make it alone. In a circular ecosystem, everyone counts.

Our society - Our family commitment extends to the public and to our institutions. We take our role in the community and our impact on the environment very seriously.

Our environment - And naturally – maybe our biggest driver – we care for our planet. Our mission is to make plastic circular. With our clients, we design and implement sustainable plastic ecosystems. Because virgin plastic is no longer a viable option.

Hewlett Packard

Vision:

Our vision is to create technology that makes life better for everyone, everywhere — every person, every organization, and every community around the globe. This motivates us — inspires us — to do what we do. To make what we make. To invent, and to reinvent. To engineer experiences that amaze. We won't stop pushing ahead, because you won't stop pushing ahead. You're reinventing how you work. How you play. How you live. With our technology, you'll reinvent your world.

First mile

The First Mile ®, an initiative of Thread International and WORK, formalizes waste collection networks in low-income communities and bridges the gap for global brands to purchase from these responsible supply chains, while diverting plastic waste from our oceans and landfills. Our work maps waste sheds and helps brands and NGOs understand how best to tackle the social and environmental issues inherent to informal waste economies and implements those solutions directly. We have created supply chains that have

saved millions of pounds of plastic from landfills and the ocean, created income generation opportunities for thousands of collectors, and developed programming that has curtailed and remediated child labor in landfills, undercut bad faith practices like predatory lending, and ensured that families can safely make the transition to the formal economy, all while supplying over a dozen global brands with First Mile approved materials that they and their consumers can be proud of. We have experience working with waste collectors in over a dozen low-income countries. Our work focuses on goals 1, 3, 4, 8, 9, 11, and 12 of the Sustainable Development Goals.

Organizational coherences

Putting OBP in HP products

- In my first role, we've found that one resin is certified at 20% is good for ink compatibility. In 2018 OPB was introduced in resin. 2020-21 we've leveraged OBP to use in more parts such as print heads and waste containers. It is a good resin and can help us reach our goal of 75% recycled plastics.
- In our case, we've been able to match the performance of OBP resin to virgin resin. So inkjet cartridges now incorporate OBP from Haiti.
- Another big element is HP can see the difference between post-consumer and post-industrial recycling. We've pushed the boundaries in terms of high % of post-consumer recycled content while incorporating OBP and this done at scale impacting billions of dollars of new finished products.
- There is a groundswell from the bottom of the company that is getting a boost from management. Our plan now is for high end, low end and pc's to have a lot more OBP.
- Incorporation of ocean bound plastics into HP Print and Personal Systems products including cartridges (Corvallis), monitors/displays and computers (Houston) and workstations (Ft Collins).
- The other application was in fans that use PBT. PET and PBT are very similar and we could mix 30% of OBP into PTB batches. That lets us figure out how to use more. The goal being to get the industry on board and its starting to work. Microsoft has a OPB mouse and Dell is also using OPB resins.
- Now we (HP) have over 50 products using OPB.

Having a positive social impact in the daily living of Haitians.

- .
- Our senior purpose was to make the lives of the collectors better.
- HP is not afraid to expand the definition to include social impact. There is not a single moment when we talk about ocean plastics without talking about people.
- There are approximately 1,000 families that we support. We can raise their quality of life while they are cleaning up their island. It is a very challenging country.
- This goes back to Bill and Dave's belief that companies should be good citizens in their communities
- Every day we all wake up and do it for the people of Haiti. OBP is one thing but helping the community is another thing.
- So we ask, How can we disrupt the OBP to improve the quality of living for Haitians? They have an incredible work ethic and they know what to do. We have to collaborate with them to learn how to intercept waste.
- Ellen got $50,000 for the kids of collectors and she was getting computers and printers donated while we were making technical decisions.

Adapting to difficulties doing business in Haiti

- We got a wash line running by teaching people who had no experience or knowledge to do so. We had a grand opening but with COVID, earthquakes and the assassination the facility has been limping along. We're getting better month by month and now we're using 4 truck loads per month.
- Of course, there is a lot of concern changing material so there's been some nervousness but its been heartening and exciting to see how HP is embracing the project.
- There were challenges in the supply chain so HP is in the process of redesigning its supply chain. This new process will help us work closely with partners like Lavergne. The supply chain is standardized around virgin petroleum resins and changing that supply chain has been difficult.
- There were huge challenges and HP could have given up but the people on this project are so passionate they would not give up.
- We've had recent events like the earthquake and killing of Haiti's president and we are making sure that staff are safe at work within our company and with First Mile for the collector systems people.
- Earthquakes and politics have had us challenged in the supply chain. As example we couldn't ship out of Haiti because roads were blocked so we have had to adjust the % OBP just to be cautious and making sure HP can meet its OBP commitment, we ensure HP meets the OBP use commitments.
- There's been a lot of gang violence with 7 gangs running the country, the President gets assassinated while the pandemic shuts down travel and we are having people shot at. Then there was the earthquake. There's no future for them so we try to shine a light.
- There were huge challenges and HP could have given up but the people on this project are so passionate they would not give up.

Human investment and expanding productivity

- Ellen got $50,000 for the kids of collectors and she was getting computers and printers donated while we were making technical decisions.
- Ellen, being the force of nature that she is, not only got social safety net funds but wanted to simplify the supply chain. She thought what if we could wash the material? She goes off and gets $2 million for a new wash line with all of the turmoil going on in Haiti. We would make the investment and then be paid back through materials that were collected and washed.
- My understanding is that the incorporation of recycled products began with inkjet cartridges. Then they invested in R&D to incorporate it in other products and now they are up to 50 or so.

- They've invested $2 million in a new wash line. That increases the value of collection in the country and the income of the collectors.
- What's unique about HP is their involvement throughout the supply chain. Many companies have good relations with their tier 1 and 2 suppliers, but HP has good relations throughout the supply chain. They've got everyone on board and are investing in extra washing capacity.
- At the beginning Haiti's production processes were manual – the old way. Now we have upgraded production technologies making it a cleaner and safer industry.
- They make $3/day and we're trying to elevate that to $10/day. We're teaching them about quality. Then we can increase the price. Its about reducing waste and making plastics better.
- In terms of our relations HP and Lavergne have partnered to build a factory. We take care of operations and First Mile makes sure that people have food on the table. Even if people cant pickup bottles, they make sure that they have food.

Working well together: wellbeing at work

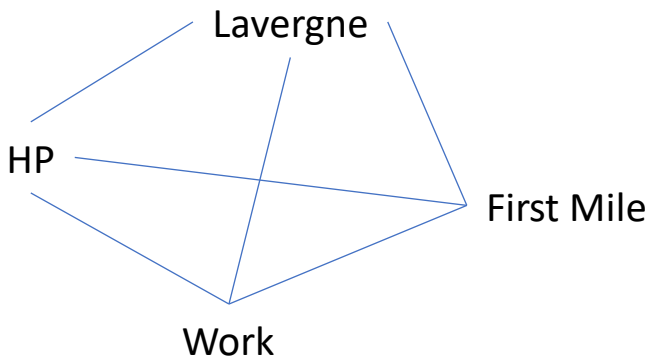
- The team is very receptive and I've been happy to work on the project.
- Jean Luc and I needed to build trust.
- Jean Luc and I had been working together for 15 years and we had become such good friends. We both have huge respect for each other.
- It comes to three things – collaboration, transparency, and integrity. This is the formula to make it work.
- I'm extremely grateful. HP is a great partner. They make us better and force us to get to the other side of problems and challenges. We're able to transform research into products.
- There's this huge cross-discipline group that gets together every week and are really engaged in talking about sustainability. It's been empowering.
- There is a groundswell from the bottom of the company that is getting a boost from management.
- It was great how we got support from procurement.
- We have common goals. This is very important. Corporate goals usually pull people together.
- We share a common understanding on sustainability.
- Jean Luc us a true visionary. He sees way into the future and has converted Lavergne into a manufacture of recyclable resins. The relations between HP and Lavergne are decades old.
- This goes back to Bill and Dave's belief that companies should be good citizens in their communities. There is a strong sense of responsibility to do good. Dean knew Lavergne could do this and brought me online.
- Its amazing to work with these people.

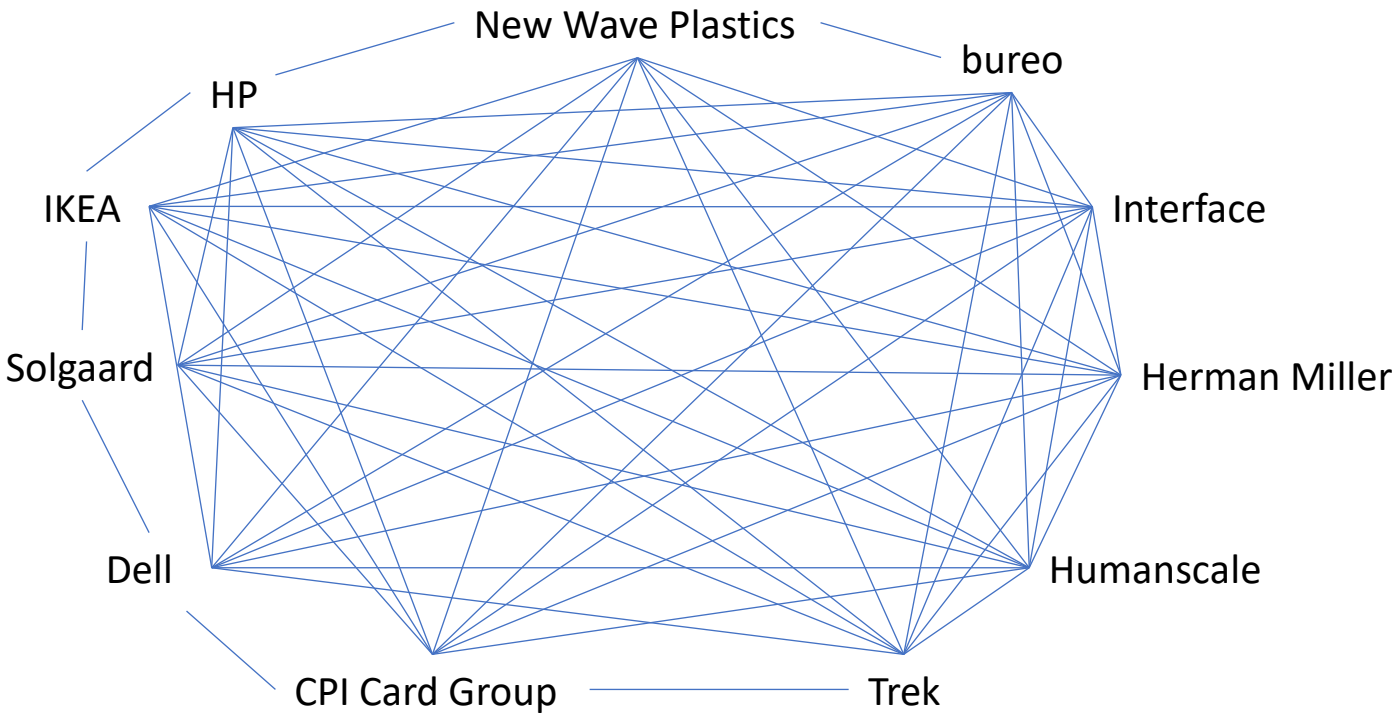
Knowledge in action-learning is doing

- You can talk about something forever but you don't know what you don't know until you act.
- Because we work with waste collectors from around the world and visit them in their homes we learned the definition needed to be expanded.
- You learn by doing and you accept that you are going to fail. If you aren't failing, you aren't learning. This is the foundation of our relationship – to go outside the square. We say turn impossible to I'm possible.
- We share knowledge and intent with HP and they share knowledge and intent with us. And if it is ok to say, there is no bullshit.
- We're going to incorporate more OBP into HP products in a skunkworks culture.
- Its taken almost 3 years of a lot of hard work solving real problems and now we have the right people and are using marketing to get to scale.

Social network structure

The following corporate network maps show the network of collaboration that has resulted in HP using recycled plastics in their computer and printing products and the New Wave Plastics network. The maps are an indicator of large-scale systems change occurring as an increase in collaborating organizations.




New Wave Plastics
bureo
HP
IKEA
Interface
Solgaard
Herman Miller
Dell
Humanscale
CPI Card Group
Trek

Chapter Seven The fifth dimension: the metaphysical space of human social systems.

Our Victorian epistemology viewed knowledge as a three-dimensional physicality. Humberto revealed a biological epistemology in his studies of closed nervous systems. His epistemology was not bound by physicality, nor, the assumption that animals, including humans, have access to an independent reality. We all see the world through our own unique nervous systems and consensually coordinate our recursive social actions through our network of conversations. Beyond the third dimension lies the dimension of time and the understanding that time is irreversible. Metaphysics refers to the study of those phenomena that cannot be understood through the Victorian epistemology of a physical reality. Humberto's epistemology opens the space for metaphysical studies of our human nature, as reported here, and I have found that we can study social systems by studying the organization and structure of our networks of conversations that conserve living well and living well together using social action research. Physical science references a 3 dimensional space while the nature of time as irreversible is a 4^{th} dimensional space. For me the 5^{th} dimensional space is a metaphysic arising from Humberto's epistemology of living. It is all too tempting to create a deductive theory explaining the 5^{th} dimension as a mathematical model, framework, or roadmap. What I prefer is to explore the 5^{th} dimension as it emerges by reflecting upon how we do what we do when we explore the expanse of the nature of our human nature of our natural psychic space. I have found that reflecting upon how we do what we do living and working well together recursively evokes a new question – Now that we know how we do

what we do when we are living, learning, and working well together how will we do what we do together?

When I was a student, I was fortunate to learn from my master teachers who had abandoned the eugenics theory of intelligence as we co-created a new epistemology of child development and grounding of actions based not on pathology but ontology. And just as letting go of IQ freed us and allowed us to follow our new epistemology, the first step in exploring the 5th dimension is to let go of the Victorian laws that influenced science and scientific method. A few laws I have mentioned before I will repeat again.

1. Separating the observer from the observed. Karl Pearson wrote that social scientists were members of the "herd" they wished to study and the need for a " higher type of medicine man" that could "repress sternly the personal and place himself outside the herd for the advancement of science." (Pearson, 1912).
2. Replacing human narrative with statistical calculus. Pearson described the "bricks for the foundation of our new structure" of eugenics when he wrote "We depart from the old sociology, in that we desert verbal discussion for statistical facts." (Pearson, 1912).
3. Separation of emotions from science and scientific methods. The philosopher Herbert Spencer applied Darwin's work on biological adaptation to the social sciences as a new theory of "the survival of the fittest" (Spencer, 1864). He also wrote that "passion perverts judgement" and that emotions created "subjective difficulties" (Spencer, 2002).

4. Separation of morals from science and scientific methods. Francis Galton was a statistician who invented the word eugenics to describe the theory based on Spencer's survival of the fittest (Galton, 1892). He wrote, "We must leave morals out of the discussion, not entangling ourselves with the almost helpless difficulties as to whether a character as a whole is good or bad." (Galton, 1904).
5. Separation of wholeness from science and scientific methods. The logic philosopher, Bertrand Russell, did not believe in "complex systems bound together into some kind of unity" thus dismissing systems science (Russell, 1914).
6. Science and scientific method are always analytic. Dismissing the existence of systems led Russell to claim that the essence of scientific philosophy was analysis, not synthesis (Russell, 1914).
7. Separation of religion and ethics from science and scientific method. Russell wrote of two motives that grounded his philosophical questions. One was from ethics and religion and the other from science. He choose science over ethics and religion claiming that both were "never impartial an thus never scientific" with one caveat. Philosophers should follow science but "not be occupied with scientific facts" (Russell, 1914).

These seven guidelines for practicing social science generate blindness because they dismiss much our human nature and history as social beings and alter our capacity to understand our human nature. If followed, the guidelines leave us with an illusion of social separation. In order to enter into the 5th dimension of human social systems we learn through

Piaget's accommodation – seeing the world as it is without judgement, preconceptions or deductive theory, just as Arie de Geus had suggested. To do so we must free ourselves from the Victorian laws governing pseudo-science and logic theory. To better understand social impacts leading toward the conservation and expansion of social wellbeing, I propose seven remedies for improving our understanding our human nature.

1) Integrating the observer and those they observe. We cannot separate the observer from the observed. We are all observers. By accepting everyone they observe as legitimate observers, the observer generates a reflexive network of conversations and a criterion of validation, or, being understood.
2) Using systemic listening to generate valid human narratives. By taking action on the next five remedies, we can bring forth a social understanding that is validated by all of those participating in a reflexive flow of studying social impact and social wellbeing. This does not imply that human narrative replace statistics, but, acknowledges that statistical formalisms emerge within a network of human narratives.
3) Understanding emotions and feelings. Human beings are emotional beings. Our emotions flow within our multisensorial system and through our network of networks of our conversations. Accepting our emotional nature will lead to a greater understanding of wholeness.
4) Acting in an ethical network. Our actions to understand social impact need to occur in a network of networks of conversations coordinating social caring. From the living systems philosophy of cultural-biology (Dávila et al., 2009; Dávila Yanez, 2011; Maturana Romesin & Davila, 2006; Maturana Romesin & Davila Yanez, 2016; Romesin

Maturana & Dávila Yáñez, 2008), ethics is not a matter of moral judgment, but, a cultural flow of caring for others and ourselves.

5) Integrating science and spirituality. In our daily living, we can see the social impact of science and spirituality. They both arise in networks of conversations and generate knowledge. In integrating science and spirituality, spiritual experiences will become a legitimate domain for scientists to study and empirical studies will become a legitimate practice for spiritualists.
6) Understanding systemic social impact. There can be little or no value in analyzing systems. Doing so studies the parts of a system and disregards relations amongst the parts. Social and biological systems are best understood by understanding the relational behaviors that determine everything that occurs in the system. Because so little work has been done in the social systemic domain, an inductive approach should not begin with problems, but with the social, biological and financial wellbeing being accomplished in our daily living together.
7) Listening systemically. We are all systemic listeners. Our earliest languaging experiences as children are relational. Science is not restricted to analysis but in systemic-systemic abstractions of the coherences of our daily living brought forth in social action research and cultural-biology (Dávila Yanez, 2011; H. Maturana, 1988b, 2000; H. R. Maturana, 1988; Maturana Romesin, 2007, 2014; Maturana Romesin & Davila, 2006; Maturana Romesin & Davila Yanez, 2016; Romesin Maturana & Dávila Yáñez, 2008).

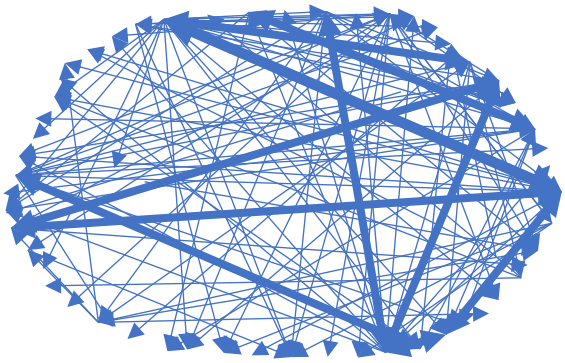
Once we are free from the limitations of the logic-mathematical epistemology established during the Victorian Era we begin to recognize our natural world by seeing it from a perspective of the epistemology of the Biology of Cognition. By studying the structure and organization of our modern institutions we can "find ways to change the internal structures of business and governmental institutions to become much more in harmony with the value systems that have developed since the second world war." as Arie de Geus suggested at the 2014 Global SoL forum in Paris.

Humberto wrote me describing science as explaining the coherences of our daily living with the coherences of our daily living. He describes coherence as regularities in the flow of our daily living.

> Thus we confront the problem of understanding how our experience, the praxis of our daily living- is coupled to a surrounding world which appears with regularities that are at every instant the result of our biological and social histories. (H.R. Maturana & Varela, 1992)

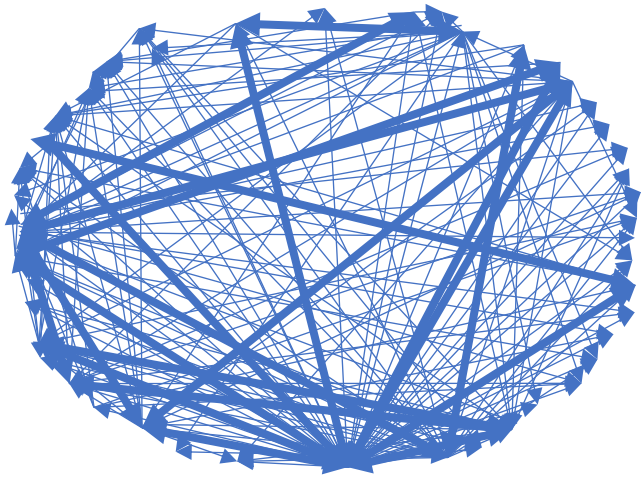
I have shared the social action research findings from the studies of Cascade Medical Center, Hyphn and HP. Now I would like to invite you to study the following data because this is the muddling through process in science. I order to simplify this task I will present organizational coherences without the narrative detail and will begin with the Hyphn and Cascade Medical Center data. As you read through the organizational coherences and study the social network maps, what do you see as regularities or coherences that connects them all?

Hyphn's social system structure and organizational coherences.



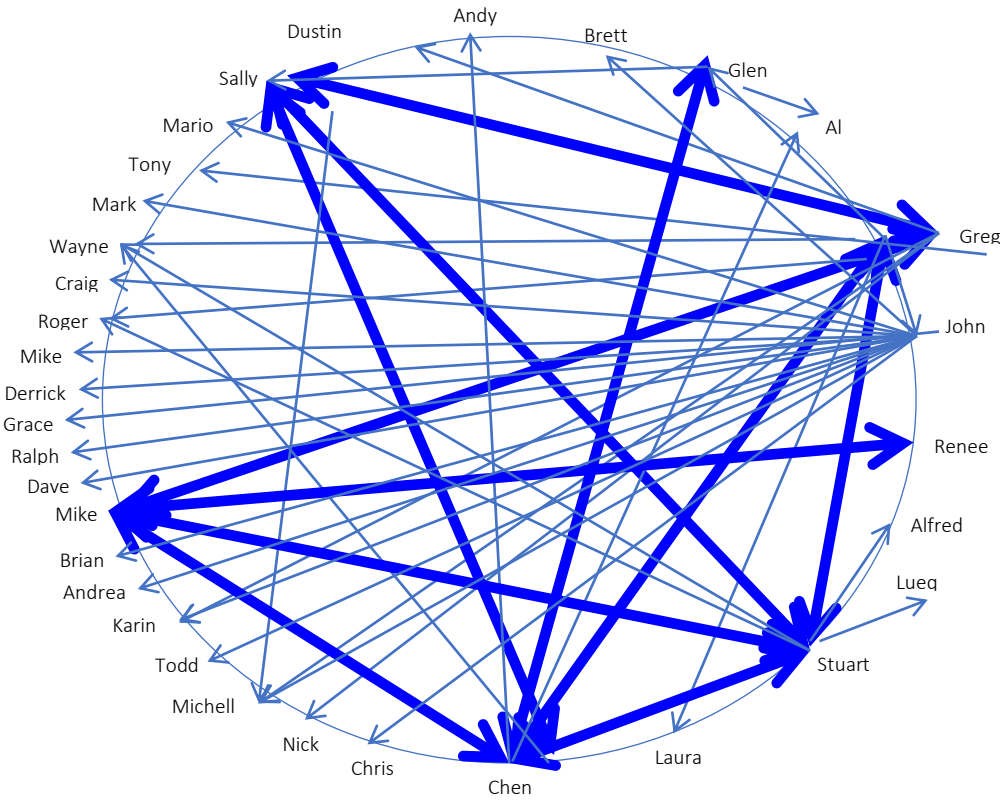
Freedom	Trust	Help and Support
Communication	Family	Wellbeing at work
Openness and transparency	Collaboration	Improvement and success
Mutual respect	Positivity	Values
Relationships	Culture	Authentic full self
Ops/ds divide	Clarity around roles and responsibilities	

Cascade Medical Center social system structure and organizational coherences.



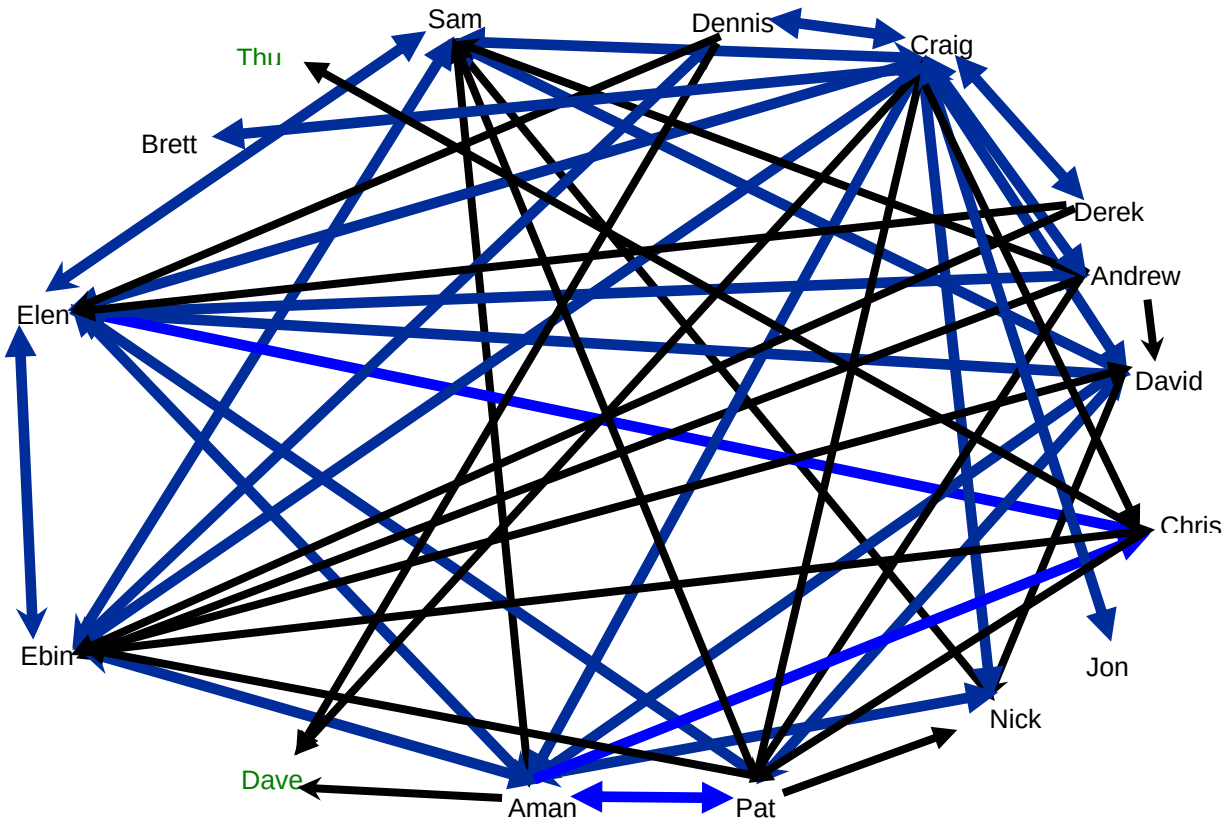
Freedom	**Trust**	**Help and Support**
Communication	**Family**	**Wellbeing at work**
Openness	**Cohesion**	Community and care
People are not numbers	Amazing	

Cholestech invented and manufactured the LDX diagnostic for testing lipids and glucose. Cholestech was acquired by Inverness Medical Innovations and saved $1.5 million in the acquisition. Here is the network structure followed by the organizational coherences.



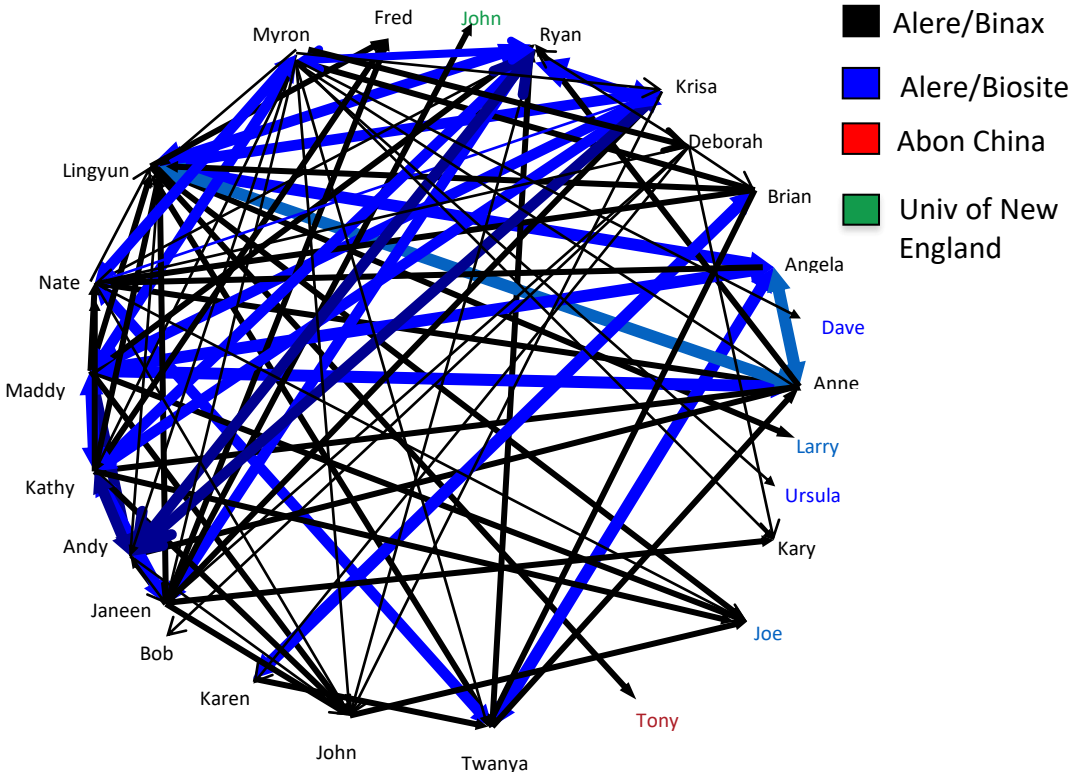
Performance	Openness	Support
Requirements	Autonomy	Leadership
Collaboration	Learning	Communication
Wellbeing	Scope	Documentation

Biosite invented and manufactured diagnostics that required micro-fluidic science applied to the development of “fingersticks”. A group of scientists and production engineers solved a vent leak in the fingerstick. Here is the structure and organizational coherences:



Openness and sharing	Forced collaboration	Elation and wellbeing
Aman focusing the meeting	Productivity	Group composition
Brainstorming	Facilitation	

Binax is a virus diagnostic inventor and manufacture that recently invented the COVID lateral flow diagnostic. In this study, Binax improved the sensitivity of testing by 50-fold while reducing the cost to 1/10 the cost of diagnostic testing.



Openness	Learning	Collaboration
Cohesion	Collaboration challenges	Flexibility
Honesty	Wellbeing	Support
Recognition	Freedom	

What the data telling us.

Humberto's biological studies used measurement (electron microscop, etc) to produce his data. This data he compiled across his studies to create an inductive theory he called the Biology of Cognition. Social action research uses measurement (social network mapping and qualitative research) to produce data. The data compiled across the studies I've shown here I will use to create an inductive theory of wellbeing (TOW).

Before I present the TOW, I invite you to look over the data from Cascade Medical Center, Hyphn, HP Ocean bound plastics, Biosite, Cholestech and Binax and discover for yourself the coherences of coherences across the six studies.

Why do we see a collaborative social structure instead of the traditional organization chart?

And, why do we hear that freedom, openness, support, collaboration and wellbeing from six very different organizations?

Finally, why do we not hear about theories, models, frameworks and other tools bringing forth living and working well together.

It is as important to attend to what is not being heard as it is to attend to the coherences we find.

Chapter Eight A theory of living and working well together

Returning to Arie de Geus' proposition that organizational learning by accommodation be applied to bring the internal structures of today's institutions in line with our post WWII values, I'll begin this section with evidence of illbeing in the workplace. In 2003 a Whitehall II study of government organizations showed 1) those workers reporting low job control had more than twice the likelihood of having coronary heart disease when compared to those workers reporting high job control, 2) those workers reporting low social support at work had a 60% greater likelihood of having ill mental health than those workers reporting high social support, and, 3) those workers in high effort- reward jobs were 35% more likely to have coronary heart disease when compared to those workers in low effort-high reward positions (Public and Commercial Services Union, 2004). More recently, a 2020 global survey of 4,000 scientists showed 1) Around 80% of the survey's participants — mostly academic researchers in the United Kingdom — believed that competition had fostered mean or aggressive working conditions, and half described struggles with depression or anxiety, 2) nearly two-thirds of respondents reported witnessing bullying or harassment, and 3) 43% said they had experienced it. Today we need scientist more than ever to help us adapt to virus, disease, climate change as well as food and water security. Out of the 4,000 scientists surveyed "one-quarter of respondents thought that the quality of research suffered in the unsupportive environments. The same proportion had felt pressured by their supervisors to produce a particular result (Abbott, 2020).

When we review the social action research data we can see that our history of managing the workplace from the Victorian epistemology is out of balance, or asymmetric to our post WWII values such as freedom, openness, collaboration, support and living well together, not to mention the absence of emotions, ethics and relationships grounded in logic theory. What can be done?

In 1975 we didn't have time to generate deductive theories to save people with developmental disabilities from the horrors of eugenics institutionalization, instead we need to act quickly and collectively, and we did. Six months after my business in Bend Oregon proved those most vulnerable in state institutions could work legislation passed the Oregon Legislature that closed institutions and invested in community-based services for children and adults. I believe we are in the same urgent circumstance today. We need a theory of wellbeing that comes from our employees, just as Hyphn and Cascade Medical Center have shown us. And because wellbeing is a dynamic experience in our daily living we need to, as Arie suggested, to help institutions change their internal structures by creating their own theory of wellbeing using social action research studying how they do what they do when they create high performance by living and working well together.

Over the years, I have heard comments like, *"Maturana is a great scientist. Too bad his writing is so hard to read."* Humberto once told me a story about sending his Biology of Cognition paper to Heinz von Foerster, but before sharing the story I should be clear that Heinz and Humberto were best of friends. When Heinz received Humberto's paper, he kindly re-wrote it and returned it to Humberto. Humberto was livid and replied to Heinz and telling

him that Heinz had ruined his paper. When I have heard this story and others comments about Humberto's writing I realized that writing is grounded in our own epistemology and the logical-mathematic epistemology of the Victorian era has evolved into a style of writing that analyzes our daily living and presents in a logical order to make a rational argument for the argument we are presenting.

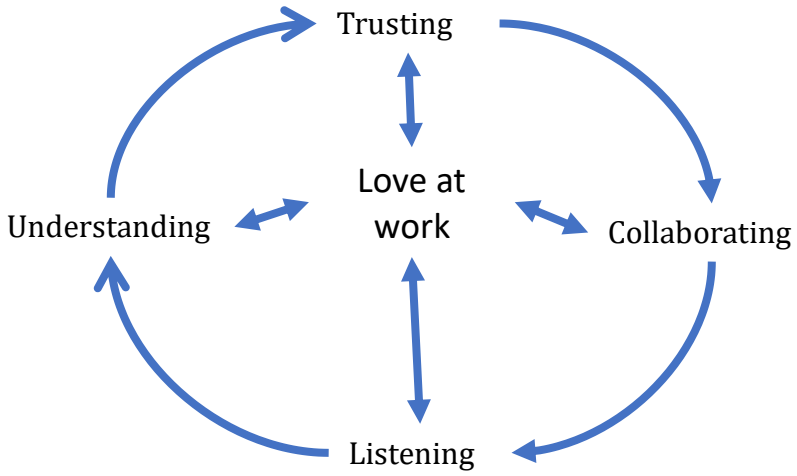
Since this project and writing has come to me after Humberto's passing as I remained still to see what would come I knew I wanted to write a love letter to Humberto, the gift of doing social action research and the kind and generous people who I have lived with and learned from. Now I would like to answer a personal question. Now that I know I know how we do what we do when we live, learn and work well together; how will I do what I do to expand living, learning and working well together. I will write about my theory of wellbeing from Humberto's living system epistemology. Before doing so, I want to thank my friend Sebastian Gaggero for his collaboration on early drafts of this writing.

Science is the explanation of the coherences of our daily living with the coherences of our daily living, from a set of procedures and operations that, if set in motion, would bring forth the phenomena explained (Maturana R, 1990). Social science is the explanation of the social coherences of our daily living with the social coherences of our daily living. And what are social coherences? They are consistencies in the flow of relational behaviors that constitute social systems. And what are social systems? They are networks of networks of conversations conserving our living well together happening in a spontaneously changing present. In this

report we have presented the social coherences in social systems at Cascade Medical Center, Hyphn, HP, Lavergne, and First Mile.

Humans are mammals that live in language and language is how we coordinate our actions. Language happens in the present moment as we follow the path of our desires whether they lead to us to a path of collaboration, competition, fear, aggression or caring for others. These desires happen in the constantly changing present, guided by our inner feelings and emotions.

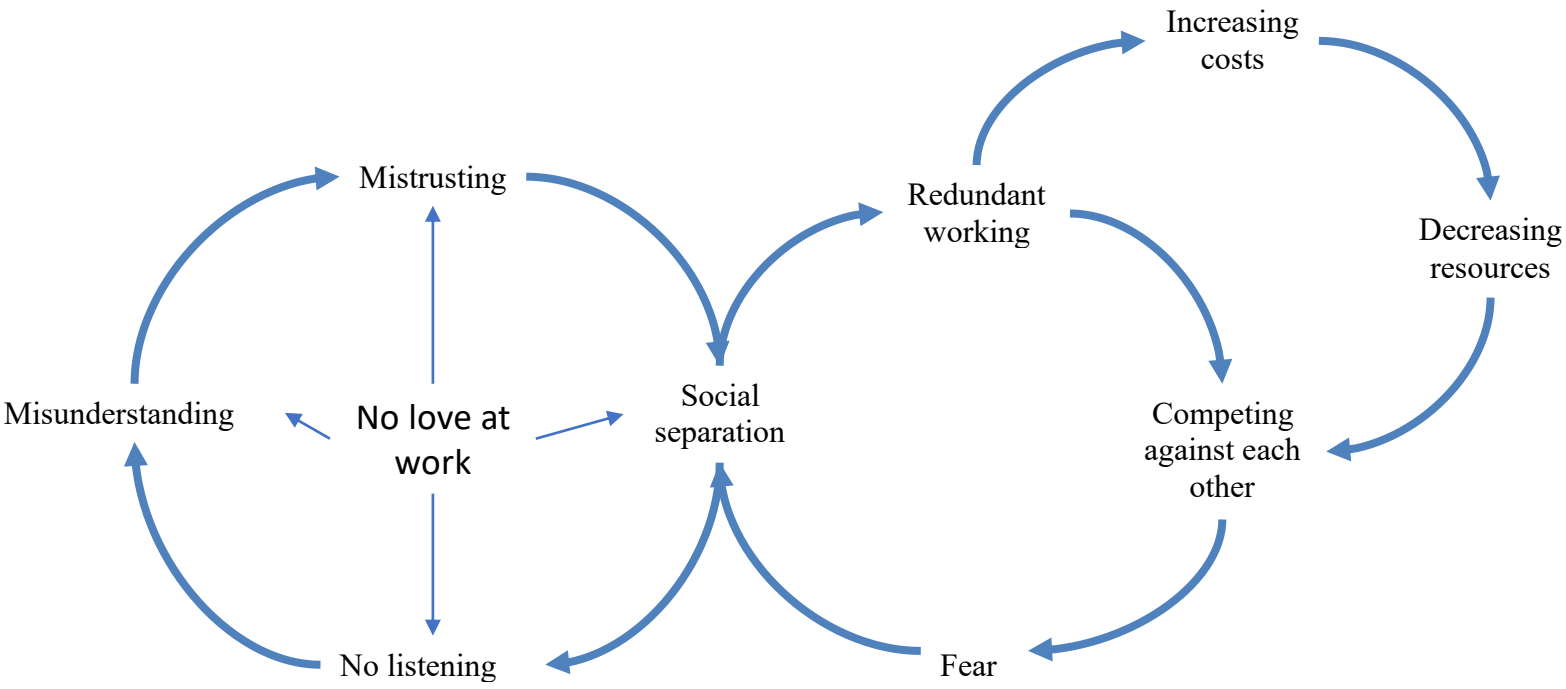
. This manner of understanding is the criterion of validation of what has been heard by others. When understanding occurs, trust emerges and conserves and expands collaboration in a continuous recursive cycle of living well together (Jewell-Larsen & Sandow, 1999; Sandow & Allen, 2005). We follow the path of our collective desires when we collaborate. This comes naturally to us in our desire to conserve our preferences for living well together. Collaboration is a flow of conversations in a network of networks of relational behaviors that conserve our preferences for living well together in our daily living. Our collaborating generates listening and from our listening, understanding emerges. Understanding is not a claim made by the listener. Understanding is a claim another person makes about the quality of listening of the listener.



Collaboration happens in an ethical, social network where everyone in the network cares for everyone else in the network including themselves. Mutual caring for the wellbeing of others in the ethical social network arises from our collective emotions of love as everyone in our network of collaborative doings is accepted by everyone else in the network as a legitimate contributor to the wellbeing of others and themselves.

This is our natural preference - to collaborate and conserve our preferences for living well together, and this forms a network of networks of conversations we call social systems. Social systems form in a flow of conversations giving shape to our relational network of networks that conserve and expand our living well together and we transform this flow of living into an object and turn the verb of living well together into the noun – social wellbeing. When we turn verbs of loving, supporting, caring, understanding, trusting, listening and collaborating into nouns described as models, frameworks, roadmaps, or theories we no longer are

explaining our living but an abstraction that we hope will trigger living well together and frequently love disappears.



Social systems are not organizational networks although they may occur in organizations if people are given the freedom to follow their preferences to live, learn and work well together. Hence organizations are not social systems, nor are they living systems. Social systems are embedded in a social matrix that nurtures our collaborative social relations formed in the conservation of our preferences of loving, caring and collaborating. The social matrix forms in systems of systems that bring forth social systems at work.

At work, we prefer to live in a network of conversation that conserves our living and working well together in a constantly changing network of relational behaviors that generate social systems we realize when everyone in the network of conversations conserving our living

well together feels that everyone else in the network of conversations conserving living well together are collaborating in their network of conversations consensually coordinating work tasks. We wish to be seen, heard, felt, and understood and to mutually support, respect and co-inspire ourselves and others to be most productive and do our best work.

When we pause to ponder how we do what we do when we are living well at work, we realize that as biological beings we intermesh knowing how we do what we do when we are living well in the consensual coordination with others in our explanations of living well together. When we recognize that now we know how we do what we do as biological beings, we realize that any explanation of wellbeing is self-referential, self-explanatory and flowing in ethical cultures forming in networks of networks of conversations where care arises for oneself and others.

Because our explanations of living well are self-referential, they occur in a network of network of conversations where our freedom creates, conserves, and expands our living and working well together. We live free whenever we act in our networks of networks of conversations without being impeded by the control of others or ourselves. We live free socially at work, in a management culture conserving our conversations that conserve our natural preferences to live well together without being restrained by social controls.

This manner of explaining our process of explaining wellbeing may or may not be validated at any moment we are living. When one accepts this manner of explaining the process of explaining wellbeing, one may or may not begin to know a metaphysic awareness that intertwines our daily living with a natural philosophy of knowing. The Industrial Era's logical metaphysic separates science from the metaphysic space, and because space was defined as a

three dimensional physical space, spirit, emotions, ethics and relational behaviors lie outside the boundaries of the Industrial Era metaphysic. A Biological Era metaphysic has been recursively developing over a generation of original work in Biology of Cognition, Mollecular Autopoiesis, Biology of Loving and Cultural-biology (H.R. Maturana & Varela, 1980; Maturana Romesin & Verden-Zöller, 1996; Romesin Maturana & Dávila Yáñez, 2008).

In the cultural-biological metaphysic knowing arises through the nature of our humanness, living as biological beings that live in systemic relational-emotional flows of ethical networks of networks of conversations caring for ourselves and others, whose caring in the conservation of wellbeing make transparent our emotional, spiritual, ethical and relational behaviors. In daily living that brings forth the validation of our explanations of explanations of wellbeing we ***re-cognize***, (as "to know anew"), the world of wellbeing we create, conserve, and expand.

The theory of wellbeing then, is generated in a continuous recursive network of reflective conversations concerning how we do what we do in conserving and expanding living well and living well together. The theory of wellbeing at work occurs in a regular reflective conversation coordinating our collective work tasks intermeshed with the regular conversations conserving our living well together. Hence, the theory of wellbeing that we validate in the work culture today is not the same theory of wellbeing at work that we will discover in the future. Relating to our concern for the scientific contributions required to study, understand, and adapt to climate change I propose that the theory of wellbeing be regularly studied, conserved and expanded in scientific work cultures.

Lastly, by understanding that the co- creation of value and wellbeing arises through networks of conversations in which openness, freedom and caring for one another is crucial, and the way in which we observe these phenomena validates that living well together as loving beings is the source of intelligent action we find that annual individual performance review processes be replaced by studying or collective performance whenever it occurs and celebrate both our accomplishment and the relational behaviors that brought forth high performance.. Issues such as the climate emergency, inequality, lack of access to clean water, war are among many other problems that can not be solved using the Victorian epistemology and require a process of listening in which the joint creation of value and theory of wellbeing are brought forth. I invite other scientists in social and organizational fields to allow themselves to live the experience and verify what I claim here in their own living. This is not a process that will lead us to right or wrong answers, but it will be a mirror to the healthiness and productivity of what is being collectively done, in a never-ending process of continuous improvement and expansion of value and wellbeing.

Appendix One Preschool Profile Example

	Understanding Language	**Oral Language**
0-12 months	Looks at people who talk to him. Responds differently to a variety of sounds. E.G. phone, vacuum, closing doors, etc. Responds to simple directions accompanied by gestures E.G. come, give, get.	Makes different vocal sounds. Makes different consonant-vowel combinations. Vocalizes to the person who has talked to him. Uses intoxication patterns that sound like phrases: E.G. intoxications that sound like scolding, asking, telling.
12-24 months	Responds to specific words by showing what was the name:E.G. toys, family members, clothing, body parts. Responds to simple directions with gestures: E.G. go, sit, run, walk.	Asks for items by name. Answers Where's that? With name of object. Tells about object or experiences with words used together (2-3 words): E.G. more juice.
24-36 months	Responds to Put it in and Put it on. Responds by selecting correct item: Big vs little objects. One vs more object. Identifies objects by their use: E.G. Show me what mother cooks on by showing stove or Show me what you wear on your feet by showing shoe.	Asks questions. Answers Where is it? With prepositional phrases: E.G. in the box. On the table. Answers What can you do with a ball? E.G. throw, catch. Answers questions about function: E.G. What are books for? Tells about something with functional sentences which carry meaning:E.G. Me go store. Me hungry now.
36-48 months	Responds to Put it beside and Put it under. Responds to commands involving two objects: E.G. Give me the ball and the shoe. Responds to commands involving two actions: E.G. Give me the cup and put the shoe on the floor. Responds by selecting correct item: E.G. Hard vs soft items. Responds to walk fast by increased pace and to walk slowly by decreased pace.	Answers Which one do you want by naming it. Answers if..what & what when questions: E.G. If you had a penny what would you do? What do you do when you are hungry? Answers questions about function: E.G. What are books for? Asks for or tells about with grammatically correct sentences: E.G. Can I go to the store? I want a big cookie.
48-60 months	Responds by showing penny-nickel-dime. Responds to command involving 3 actions: E.G. Give me the cup, put	Asks how questions. Answers verbally to Hi and How are you? Tells about something using past and future tense.

	the shoe on the floor and hold the pencil in your hand.	Tells about something using conjunctions to string words and phrases together: E.G. I have a cat and a dog and a fish.
60-72 months	See pre-academic skills	Child will have acquired basic grammatical structure including plurals, verb tenses and conjunctions. Following this developmental ability, the child practices with increasingly complex descriptions and conversations.

Baseline September 29 1976

Midterm December 20 1976

End of term June 6 1977

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