Sex and the Ivy League

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Life is strange. As a child I followed a peaceful inner path that led to matching professional and family lives. In harmony with my goals, I felt able to achieve what was important. I was a 'tomboy' attracted to masculine arenas and accomplishments, and did not think of myself as a woman. A good challenge is for me the spice of life.

Yet somewhere along this path I met uncontrollable forces, full of sound and fury, that thrust me up close into the stormy transition of women's roles at the turn of the 21st century.

Sex is a powerful force; it is the battleground that shapes the creation and the survival of the species. This is clear. Yet nothing could have prepared me for the response to this life force that I observed during my professional journey as a mathematician and an economist, in two male dominated fields. I joined Columbia University, a great Ivy League institution, in 1977, recruited by two eminent economists Ned Phelps and Robert Mundell. Only much later I learned from the American Association of University Women that Columbia is known as one of the most problematic institutions for the progress of women in academia and one of the most resistant pockets of male dominance in the US University system. For me, Columbia has become a challenge to meet, and the road to merge my internal and external lives: my personal values with my public life.

Two reflections

This thumbnail sketch will focus on a strange and even bewildering period of my life that was dominated by issues of sex within the Ivy League. The choice of focus is not idle, because these issues lend clarity to my values and add significance to my life. They led me to distill two simple reflections that changed my life and that I wish to share with the reader.

The first reflection is that for a woman to survive and to thrive she must learn to turn negative responses into positive resources. This is a perverse reversal to the Pavlovian response. I call this, for short, '**turning dung into fertilizer**.' I believe it is one of the most important elements for women's success and happiness. It is a wonderful recipe for dealing with the 'glass ceiling', a well-

known and somewhat cruel situation where the more you succeed, the more you get punished. Think of it this way-- energy is energy — and simply changing the sign of the response one receives from negative to positive allows one to use all the energy received constructively, and turn it into a survival tool. In mathematical terms, this is "life modulo two." It is the absolute value of the response that counts, not the sign.

For women who are at the frontier, there is one positive feature of the strategy of transforming 'dung into fertilizer.' When using negative responses as fertilizer, one never runs out of resources.

The second reflection is simpler, and perhaps more fundamental. It is that **the only genuine source of happiness in life is the feeling of being useful to others**. Nothing else does the job. This is true for anybody. It is not achievement or success, it is not money. It is this feeling of being useful that counts. This is why the issues of sex and the Ivy League are important to me, and below I explain why.

David and Goliath

My struggle for justice within the University met with the administrations' indifference and scorn for many years, eventually leading to a lawsuit that became a David and Goliath epic of sorts, lasting 11 years so far. The American Association of University Women, an association that encompasses over 160,000 women in the US, now supports my case as a landmark. It is expected to go to trial in New York next year. Almost paradoxically, throughout this arduous process my inner path actually strengthened. My internal peace and happiness were fortified. I learned to see more clearly what was important in life and in my work. I achieved compassion for other women many of whom had lives much more difficult than my own, and the desire to help them out. I had the privilege of achieving a connection with many University women whose life I appear to be reliving in this journey. This connection has made my life better; indeed I believe it has made me a better person because now I can be useful to others. I can try to prevent others from reliving my own life. This is a rare privilege. As I have learned, it is the only true source of happiness.

Born in Buenos Aires after WWII

I was born in Buenos Aires at the end of World War II, into a warm and loving family of Jewish intellectuals who fled the Russian 'pogroms' at the turn of the 20th century and migrated to Argentina to build a future. I was the second of three children of a wonderful and very prominent man, Salomon Chichilnisky, who built many hospitals in Argentina and a large part of its National Health system as the Secretary of Health in Juan Peron's government and beyond. My father started life carrying loads in the docks in the port of Buenos Aires to support his parents, brothers and sisters. Against all odds he became a medical doctor and the first Jew to became a Chaired

Professor of neurology at the School of Medicine of the University of Buenos Aires, in Neurology. He eloped with my mother, Raquel Gavensky who was a child from a wealthy fur exporting family, and was as beautiful as she was intelligent and kind, 25 years younger than my father. Both were wonderful. They died while I was in my thirties.

Discovering Mathematics and Eduardo Jose

Attending high school in Buenos Aires, at an advanced all-girls school called Instituto Nacional de Lenguas Vivas, I discovered that Jews were not really welcome. Being the first in the class did not help. Being the first in the class did not help. I always worked hard and had the best grades but somehow I could never make it to the position of raising the flag in the morning's convocation in the school's old patio, a position that is given to the best students. There was always something missing. Finally when all excuses were gone, in my last year in that school there came a day when without doubt I was the only one that could raise the flag in an important school event. I was full of pride as my illusion was finally to be fulfilled. Suddenly, hours before the event, the schoolmistress found that there was a small spot in my white uniform. I called my mother home and she rushed to school with another fresh uniform and gave it to the headmistress. However after she was gone the schoolmistress discovered to my surprise that there was a small button missing in the second uniform. My wonderful mother brought then another button, but when she came back for the second time — they had put me in a small room to wait for her and somehow nobody could steer her to where I was. There she stood with the button as I waited for her in another room of the school, and we never met. In the meantime, the ceremony unfolded and my mother stood there watching as someone else raised the flag. This was the last time I could have done this act at the school. My mother thought that I had done something wrong by being kept away in this manner — and so did several others who knew that it was my turn to raise the flag. The suspicion lingered in the school since then, and I learned first hand what it means to 'blame the victim' -- without of course knowing those exact words at the time.

In my junior year at high school I started taking courses informally at the University of Buenos Aires. Initially, I tried Philosophy and Sociology, because I always thought that those were the main topics facing humankind and the areas where more progress was needed, namely in human and social organization. However I gave up these topics quickly in favor of Mathematics--Mathematics seemed clearer and therefore easier---with the idea of going back to social issues later on. I wanted to do Mathematics that would be applied to resolve social problems. I thought that studying Mathematics first would give me a control of the 'technology' that economists use to validate their theories and their policies. I felt it was important to 'control the technology'—rather than 'be controlled by it'--- since many economists appear to fear the mathematical foundations of economics and adopt theories or policies based on what they learn from others mathematical models. I always liked the idea of creating my own mathematical models, rather than adopting somebody else's. Mathematics was a pleasure to learn. I think of it as the natural language that the brain uses to communicate with itself.

My first child, Eduardo Jose, was born in Buenos Aires at about the time I finished high school. Eduardo Jose was a healthy, happy, beautiful and loving baby who grew up to become my best friend and ally. He is now a professor of neurobiology at the Salk Institute of the University of California in San Diego, where he lives with his wife Sascha and baby Ariella. While in retrospect Eduardo Jose had a hard life, born in Buenos Aires and growing up in the US with little money and while his mother was completing two PhD degrees, he was the greatest source of pleasure and sense of accomplishment for me. It is true that children are the greatest pleasures in life.

A Military Coup led to MIT

Just as I was about to start college in Buenos Aires, there was a 'coup d' etat' and a military junta took over Argentina and closed down the University. The students demonstrated against their actions. A notable American mathematician from MIT, Warren Ambrose, was at that time a visiting Professor at the University of Buenos Aires. He was hit and hurt by the military police when they closed down the campus and after this incident decided to go back to MIT and take some of the brightest PhD students he met in Buenos Aires with him. I had not started college yet, nor did I know much English, but through the college courses I had taken informally Ambrose and others recommended me as a 'special student' to the Mathematics Department at MIT. I became a special PhD student without having gone to college, with the task of proving myself in the first year of graduate studies in order to be accepted as a regular student. Thus in 1967 I moved with baby Eduardo Jose to Boston where I started my 'test year' at MIT.

My adviser at MIT was the excellent and late mathematician Norman Levenson, a specialist in ordinary differential equations, and a kindly man who wished well. He recommended that I should give all of this up. He told me that being a woman, a single woman with a small child, and having to compete with PhD students in a top Mathematics Department when I had not even gone to college myself, was an impossible task. He recommended that I move instead to Boston University to study a lesser subject such as computers. However, the Ford Foundation generously provided me with a scholarship, and I completed my first year of PhD courses at the graduate program in Mathematics ranked first in the class, thus becoming officially a PhD student at MIT. Eduardo Jose, now almost 2 years old, lived with me through this process sharing a room in Cambridge Massachusetts. The hardship of this enormous effort solidified our bond. During this period I met Alberto Baider also a PhD student at MIT and now a Professor at Hunter College in New York, and Ahmad Chalabi, who was also a PhD student of Mathematics at MIT working with Warren Ambrose, and who since then became a leader of the Iraqi opposition to Saddam Hussein and the founder in 1992 of the Iraqi National Congress in London. Overcoming enormous difficulties, this period fortified my will and my belief that hard work can conquer almost all. It was the beginning of my view that women need a 'reverse Pavlovian' response to succeed. After that record of success, I was accepted also at UC Berkeley where I completed my PhD in Mathematics in 1971.

UC Berkeley-- Jerry Marsden, Moe Hirsch and Steve Smale

My PhD adviser at UC Berkeley was Jerrold Marsden, a prominent Canadian mathematician who specializes in fluid dynamics. Other mentors included well-known mathematicians Stephen Smale and Moe Hirsch – all of whom became aware of the difficulties that I had to face as a female student of Mathematics. My PhD dissertation was on 'Group Actions on Spin Manifolds' and appeared in the Bulletin of the American Mathematical Society in 1972 where it was accepted with great reviews by the editor and two referees, who I believe were Shlomo Sternberg and Roger Penrose, a distinguished mathematician and a wonderful physicist respectively. Shlomo became a friend who became years later the Chairman of the Mathematics Department at Harvard University. The topic was very attractive, and established a pattern in my life, dealing with the intersection of two fields that rarely come together: algebraic topology and physics. I used this to explore the possible 'shape' of a Universe in which there was a conservation of 'spin angular momentum'. This dissertation dealt with questions such as the finiteness of the Universe and its global geometrical structure, an area that has continued to be very fashionable years later. Given the positive response my dissertation had, it was tempting to continue that path. While at UC Berkeley I worked also for the cause of women students who had a hard time, with small children—like myself—and created the first US University 'child care center' within the Berkeley Campus, with the help of the United Automobile Workers Association, a child care center that Eduardo Jose attended himself at the time. I understand this center is still working and has been imitated at other universities.

After completing my PhD in Mathematics I discovered from Jerry Marsden that other students had attributed my PhD dissertation to him, which was unseemly and untrue, and the record was subsequently cleared. This was difficult to understand indeed shocking to me, since Marsden never worked on Algebraic Topology himself, which was the core of my dissertation. Since that time, UC Berkeley became known for the problems that women had in their Mathematics Department. Several lawsuits successfully litigated against them for gender discrimination, gaining tenure at UC Berkeley for women such as Jenny Harrison who had been unfairly denied it. Charity Hirsch, Morris Hirsch's wife, became a leading figure in assisting the cause of women faculty in the entire University of California system. Charity was also the person who suggested to me in 2002 that the American Association of University Women should hear about my case, and arranged the introduction to Amy Houghton who leads their Legal Advocacy Fund, resulting in their adopting and funding my case against Columbia at the end of 2002.

PhD in Mathematics and creating Basic Needs

Towards the end of my studies at UC Berkeley, my father became very ill and I started commuting to Buenos Aires to see him. He was seventy years old. To support this expensive traveling I started working in Argentina part-time—in particular while completing my PhD in Mathematics I took a job as a Director of Modeling at Fundacion Bariloche, located in the town of the same name in the

south of Argentina. My job was to create a mathematical model of the world economy, which was later called the Bariloche Model. I was collaborating with an interdisciplinary team of prominent Latin American scientists, including geologists, sociologists, population experts, computer scientists, political scientists and economists. Their aim was to rebut the Club of Rome's Limits to Growth vision of a world in which developing countries could not, and should not, grow because otherwise they would exhaust the Earth's resources. In the Bariloche model I created the concept of "development based on the satisfaction of basic needs." This led to my first two publications in Economics, "Economic Development and the Satisfaction of Basic Needs" published in 1977, and in 1976 Catastrophe or New Society: A Latin American World Model, a book co-authored with the Bariloche team. Both of these publications introduced Basic Needs in the literature and implemented it empirically with data from five continents. The name itself was created in those publications, and the concept of Basic Needs became my first real contribution to Economics-- a somewhat radical concept at the time. It was nevertheless adopted by 166 nations in 1987 at the Earth Summit of Rio de Janeiro who voted it as the cornerstone of efforts to define Sustainable Development. Basic needs is now officially part of the Brundtland Commission's definition of sustainable development, but at the time I had to threaten to resign my job in Bariloche because the rest of the team wanted the model to focus in GDP maximization rather than on satisfaction of Basic Needs as I wanted. Maximizing GDP was not, in my view, the main goal of development for the world economy, nor the way to use the Earth's resources wisely. I won, and Basic Needs became the trademark for the Bariloche Model igniting interest and controversy around the world. Our book was translated in 8 languages, and it was read all over the world—in France it was published by the Presses Universitaires de France and called, very suitably, Un Monde Pour Tous. People still write to me about Basic Needs and the Bariloche model. Eventually Basic Needs penetrated the United Nations system and the World Bank, becoming a world standard in re-thinking fair and sustainable economic development.

The great and late mathematician and economist Tjalling Koopmans and William Nordhaus, his distinguished Yale colleague, gave the Bariloche Model and Basic Needs a very supportive reception organizing an entire meeting at the International Institute for Applied Systems Analysis (IIASA) in Vienna, Austria in 1976. After that Koopmans became a strong supporter and Nordhaus, also very supportive, wrote at the time an article that commended the Bariloche model and its goal of satisfying Basic Needs as a unique combination of 'radical thinking with state of the art technical expertise'.

Back to Argentina and a second PhD

After completing a PhD in Mathematics at UC Berkeley, I went back to Buenos Aires in 1972 where I was appointed as a Member of the Presidential Cabinet of Banco Central of Argentina, the country's monetary authority. This high level position would allow me to build a career in economic policy with political influence in Argentina like my father had. I took this job during a period of democratic presidential rule, and the career path seemed very attractive. Yet I saw first hand how decisions on monetary policy were made, and how little we knew about it all. It was then

that I decided I wanted to go back to the social sciences, and study economics to understand fully the role of markets, particularly international markets, which I considered key.

I received a scholarship from the Central Bank of Argentina to obtain a second PhD, this time in Economics, and was accepted both at Yale University and at UC Berkeley. I decided to go back to Berkeley where I obtained officially a PhD in Economics in 1976. During this period, while I was completing my second PhD, my father died in Buenos Aires. This was heartbreaking. My mother joined me in Berkeley where we lived with my son Eduardo Jose for some time. But she was heartbroken and homesick, and went back to Buenos Aires, where she herself died about six years after my father.

This period, when I lost my father and then my mother, was the worst part of my life. Adding to the pain, the legal system in Argentina prevented me from visiting my parents towards the end because at the time the law gave all rights to the father for the traveling of the child. This meant that I could not travel to Buenos Aires unless I left Eduardo Jose in Berkeley—which was impossible. My father and mother died without seeing Eduardo Jose again, their dearest grandchild. This taught me a bitter lesson—at that time in Argentina, marriage gave men undue rights on a woman's life and made it more difficult to take care of one's children. This strengthened my commitment to do what I could so future women would not face similar situations.

Harvard University and Kenneth Arrow

In 1974, I left Berkeley to go to Harvard University, with a master degree in Economics but before completing an official PhD in Economics. At Harvard I was to work as a Research Associate with Kenneth Arrow in an Office of Naval Research (ONR) grant. Kenneth Arrow became an important mentor for me. The research position at Harvard involved collaborating also with Peter Kalman an excellent economist and friend from the State University of New York at Stoney Brook, who sadly died prematurely a few years later. At the time I went to Harvard I had successfully finished all my courses and PhD exams, and also completed a first draft of a PhD dissertation in Economics that I produced for Gerard Debreu, my PhD adviser at Berkeley. However obtaining the second PhD in Economics proved to be more difficult than the first because of the personalities involved, and particularly because of their attitude towards women.

As a foreign woman and a single mother, I started to face bewildering circumstances in the submission of my second PhD dissertation. This led me eventually to abandon all the research done in the first dissertation I wrote in Economics and to write, two years later, while I was teaching at Harvard and after publishing several articles, a third and completely different PhD dissertation. This was the second dissertation I wrote in Economics, and the third PhD dissertation I wrote in my life. In 1976, while I was teaching at Harvard, I was awarded officially a PhD in Economics with Gerard Debreu as my main adviser.

I learned a great deal during this process, about how women's intellectual property is treated in the masculine world of academia. Some of my colleagues and competitors at Harvard attributed my dissertation to Morris Hirsch who was then a visiting professor at the Mathematics Department at Harvard. I was blissfully unaware of this unseemly and incorrect claim. However, Moe Hirsch found out himself and confronted the colleague and competitor who had initiated the rumor. Kenneth Arrow heard about this too, and did the same. My colleague claimed to have been 'joking' and was told by them that such comments are 'not jokes' and he apologized. Interestingly, he apologized to them and not to me, the main affected party. This 'joke' may have cost me a great deal; in particular Kenneth Arrow and Michael Spence at that point found it very difficult to obtain a fair hearing for a tenure track position for me at Harvard then—as the rumors, while eventually dispelled, raised questions at the time. Eventually I left Harvard and the terrible 'joke' became clearly known as such and I was vindicated.

All this made me aware in the years that followed of the plights of other women in Ivy League universities whose intellectual work had been stolen or duplicated with impunity, or attributed to others. Such episodes were familiar to these women; particularly at the time they obtained their PhD dissertations. Recently, several women at the American Association of University Women who I had the privilege to know told me similar stories. A couple of women I knew, from Yale and from Princeton, were sufficiently depressed that they thought of committing suicide. Recently I saw a documentary on the work of Rosalind Franklin, whose work in London was a key part of finding the structure of DNA. Yet her work is not mentioned along with that of the other authors, Crick and Watson, not even by the president of Princeton University who is also a woman and a biologist, in her 2003 editorial article in the Princeton Magazine, about the 50th anniversary of the discovery of DNA structure. I left Harvard to go to Columbia, where I thought the situation was then better, although eventually it followed the same overall pattern.

While it is hard enough to compete with men in academic research, obtaining credit for what one has accomplished proved to be much more difficult. Years later in the book "The Outer Circle" these findings were substantiated by the co-authors, several sociologists who included Jonathan Cole who later on became a Provost at Columbia University. The book documents that academic citations are consistently biased against women. Men resist giving women the basis for measuring academic achievement. They successfully deny them credit for their work in the form of academic citations. This problem is true today and in my case it has only become worse as my work has become better known.

Although at the time I won the battle and completed my PhD in Economics, I may have lost a war. It was a war that I did not know existed. I was simply trying to do my best, unaware of the effect that broken stereotypes could have on others, and certainly unaware at the time of the 'glass ceiling.' Things do not get easier as you progress and prove yourself —they get more difficult. As a woman, the more you succeed, the more you are punished.

Teaching at Harvard and traveling to Bariloche

By 1976 I became a Lecturer at Harvard, where I taught Mathematical Economics. During the time I was there, from 1974 to 1978, I published some of the defining work in my career, in particular the book on the Bariloche Model and Basic Needs, Catastrophe or New Society, the work that introduced Hilbert spaces in Optimal growth theory and solved outstanding problems of duality in that area, and some of my best work on international trade in which I showed that export-led growth can backfire as a foundation for growth in a country with abundant labor supply and must be replaced by policies that shore-up domestic markets.

Towards the end of that period I also published my work on international aid or Transfers, and on Topology and Social Choice. The latter demonstrates the intrinsic geometrical structure of the paradoxes of Social Choice, and found a resolution to the social choice paradox. The latter is an area that Kenneth Arrow had initiated many years ago while he was a PhD student at Columbia University, closing a cycle in the development of the subject.

United Nations and Philippe de Seynes

Towards the end of the period at Harvard I received a visit by M. Philippe De Seynes a Frenchman who had just left his post as Under Secretary General for Economic and Social Affairs at the United Nations to lead the United Nations Institute for Training and Research in New York, UNITAR. Phillipe was an important figure in international diplomacy, and an admirable man. He thought that my concept of Basic Needs was the way to the future, and encouraged me to produce further work in that area, but like me he thought it needed international market underpinnings. Hired by him I started my official career as UN advisor running UNITAR's international research projects starting in 1976 for about 10 years. My work with UNITAR was based on the fame that the Basic Needs concept had achieved and the value that the Bariloche Model had in pursuing the development strategies for the third world.

Columbia, Ned Phelps and Bob Mundell

At the end of the period at Harvard, I met also two wonderful economists from Columbia University: Ned Phelps, a friend of Kenneth Arrow, and Robert Mundell, both of whom recruited me successfully as an Associate Professor at Columbia University starting in the fall of 1977. At that time I almost took a job as a researcher at the Bell Labs of AT&T, and was offered also by President Harold Shapiro of the University of Michigan a position as associate professor at their Economics department.

However Columbia University attracted me at the time because of the proximity to the United Nations in New York, and because of the first class people I met there. Robert Mundell is a warm

man and one of the most original and incisive thinkers I have ever met, and Ned Phelps is equally warm --- an extraordinarily distinguished economist in a class all of his own. My instincts were right, because there are truly wonderful people at Columbia. With hindsight, however, I see that I underestimated the disfunctionalities created within the Ivy League by the turbulent transition of the roles of women at the turn of the 21st century.

Sussex, Essex and Geoffrey Heal

I joined the Columbia faculty in the fall of 1977, and during 1978 I spent part of the year working at the Harvard Institute for International Development (HIID) in continuation of the growing research project I directed then for the United Nations and UNITAR, called Technology Distribution and North South Relations. In expanding this project to Europe, I started a collaboration with Dr. Sam Cole of the University of Sussex' Science Policy Research Unit, a specialist in the MIT Limits to Growth model, who joined me as a co-director of a larger UNITAR project which then included a team of interdisciplinary researchers in four continents. This project acquired a large projection in the United Nations organization and had a major impact on policy, leading to discussions and resolutions related to Basic Needs, export-led growth and international aid, supported by an excellent team of researchers.

In England I also met Geoffrey Heal, a Cambridge University economic theorist who had recently become the Chair of the Economics Department of the University of Sussex. This turned out to be a defining event in my life, because several years later in 1983 Geoff Heal joined Columbia University as a Professor in the Business School, soon he and I became prolific co-authors and Geoffrey eventually became the father of my second child, my daughter Natasha Sable, who was born in New York in 1987.

United Nations, World Bank and OPEC

By 1978 I was promoted as a tenured Associate Professor at Columbia, a year after arriving at the University, and in 1980 became a tenured full Professor of Economics at Columbia. During late 1979 and 1980 I accepted the Keynes Chair at the Economics Department University of Essex, living in England during a period of leave from Columbia University and returning to Columbia in 1981. During this period I also acted as an adviser to OPEC in several wonderful summers spent in Vienna, at the World Bank in Washington DC, and the United Nations in Geneva. Both the World Bank and the United Nations were naturally aligned and very interested in my concept of Basic Needs and in using mathematical and economic modeling to make it operational in economic terms. In Geneva the International Labor Office (ILO) of the United Nations started an entire research effort based on Basic Needs in a number of countries. Basic needs took off as a paradigm for alternative development. I also advised the World Bank on trade policy and on international aid during that period. At OPEC in Vienna, I created a computational model of the world economy where the role of their organization was seen in an integrated international market framework—

showing how high oil prices could eventually backfire for their organization. This period was full of insights in theoretical and policy terms, and eventually led to the publication of two books, The Evolving International Economy and Oil and the International Economy, both co-authored with Geoffrey Heal, which are discussed below.

North South Trade: Export Led Growth

While initially I had great difficulties publishing my work --- it was considered too mathematical and too 'different' --- at the end of the 1970's my list of publications started to grow fast, and from 1980 on my research and publications took on a life of their own.

In addition to mathematical economics, one angle that greatly interested me due to my work at Bariloche and the United Nations was to see the world divided into a North and a South, two regions that were in two very different stages of development. The North represents the nations that have already completed the industrial revolution, while the South is in the midst of a change from agricultural to industrial societies. Coincidentally, the geography of the planet is such that the industrial countries are indeed mostly in the Northern Hemisphere and the developing nations in the Southern hemisphere, which explained the North-South divide. I thought this divide was pregnant with explanatory power. In particular I thought it could be used to explain the dynamics of the world economy. I focused on two policies that I thought were misguided and could be improved: one was the emphasis on international aid as the most important way to resolve poverty and other developing nations' problems. The second was the emphasis on recommending developing nations to specialize in resource - intensive or labor-intensive exports as the main policy to accelerate economic growth. Both policies seemed wrong to me, and I looked for ways to model what I thought were the main issues, to explain them mathematically in order to offer alternatives. In the process I created a model of international trade that in time became an alternative to the existing models created by Heckscher Ohlin and by Ricardo— and ended up being called my North-South model.

At that point in time international trade was modeled either as a Heckscher-Ohlin world, consisting of two countries trading with each other who differ only in the relative proportions of capital and labor, or modeled as a Ricardian world where the two countries differ in technological productivity in two sectors. In each case the differences (factor proportions or technologies) were used to explain why countries trade with each other, and why they benefit from trade.

My view was different. I thought that the world was divided into two regions that were in two different stages of development. In one region, the 'South', labor was abundant in the sense of Arthur Lewis, namely very 'elastic' labor supplies, and technologies were quite different in terms of factor use across the two sectors. I described this by saying that the South had 'dual technologies' and 'abundant labor'. In the North matters are different. The economy is more homogeneous, in the sense that factor use is similar across the two sectors, and labor supply is

fixed as in the Heckscher-Ohlin world. In sum, my Southern region was close to the Arthur Lewis' model of a developing economy, while my Northern region was closer to a Heckscher-Ohlin model of an economy. My North-South model represented a world where Heckscher-Ohlin trade with Arthur Lewis.

I felt that seeing a world where trade occurs between such different nations has tremendous explanatory power. Such a world is quite different from one where trade occurs between equals (as in Ricardo or in Heckscher Ohlin). I was right in the sense that the results I obtained in the North South model on classic topics, such as trade policies or transfers, were radically different from the results that other economist had obtained up to that point.

My work in international trade quickly became well known, particularly my models of export- led growth and of transfers, and it started to take over my life. While the attention it received was flattering, the results created a lively controversy in the US as well as in Europe, and some hostility as well. The work on export-led growth was considered heresy by those who advocated growth for developing countries based on exports, and particularly exports of labor-intensive products. In a way, they were right in considering my work heresy. I was advocating economic growth based on strengthening domestic markets, while the 'export-led growth' vision saw the engine of growth for developing countries in the industrialized world, with the domestic economy being mostly a source of cheap labor. This to me was a neocolonialist way of looking at the economy of a developing country—and one that was dated and could not succeed in the modern world.

Another heresy: International Aid and Transfers

My 1980 results on transfers were somewhat unsettling because they turned on its head common wisdom with respect to international aid. International aid was considered at the time, to be the leading solution to the increasing North-South wealth differential. In the late 1970's and early 1980's, great economists such as Wassily Leontief were advocating international aid in their United Nations projects as a solution to close the gap between the North and the South. In my view, this was once again looking at developing nations as dependent on the industrial countries, and not the engine of their own growth.

Earlier, great economists such as Stuart Mill, John Maynard Keynes, and Wassily Leontief had anticipated that aid could help the donor more than it helps the receiver, due to the effect of market forces after the gift. While those classic economists had shown this to be a possibility, Paul Samuelson and his student Robert Mundell had argued that this effect was more of a 'curiosum' than real, that in well behaved markets aid always ends up benefiting the receiver, as it is intended to do. Their arguments view market forces as benign. My work, however, showed the opposite. I showed that international aid that ends up benefiting the donor and hurting the receiver, is a standard phenomenon. It happens in well-behaved, competitive and stable markets, and in markets that have unique equilibrium. It is not a curiosum. Markets are not that benign. This is something that Paul Samuelson and Robert Mundell said could never happen. This work appeared in my 1980

Journal of Development Economics article "Basic Goods, Effects of International Transfers and the International Economic Order", and led to a lively controversy for several years. My 1980 article dealt with what has been called the 'transfer paradox' – it refers to the fact that markets forces can subvert the intentions of international aid, because a donor can end up better off than the receiver of the gift due to market forces.

My contribution to this classic issue was looking at a world with three or more trading nations — while Samuelson and Mundell had restricted their work to worlds with no more than two countries. Here is where my mathematics helped—by allowing me to attack a more complex but more realistic problem while other economists shied away from this because of the intrinsic mathematical difficulties.

In the debate that ensued, many articles were written about the results on transfers and the export led work, and eventually in the early 1980's two separate issues of the MIT Journal of Development Economics, then edited by Lance Taylor at MIT, were dedicated to comments on these two results. One issue of the JDE had two volumes dedicated to comments on the results on export-led growth, and a second issue of the JDE was dedicated to the work on transfers. The debate was heated to the point that UNITAR, which was funding my research, received a letter from one of my colleagues calling my results 'dangerous' and untrue. Eventually, however, everybody accepted the validity of my results on transfers, particularly after an excellent geometrical article published by Geoffrey Heal and John Geanakoplos that made the points transparent and easy to grasp.

Here is the point: Transfers alter market prices. After the gift, the donor country has fewer resources but their market value goes up so the country ends up richer than before. The opposite happens to the receiver; this is the competitive market at work. The results on export-led growth were also accepted although there was some debate because the dynamical system I used was more complex from that used frequently in trade theory. The publication of these three volumes of the JDE created a stressful situation at Columbia because our Department of Economics was renowned for its contributions to international trade, the field where all this activity was taking place.

Columbia stirs and Natasha is born

After reading the previous sections, anyone that knows academia would predict that some friction might develop with my colleagues at my home institution, Columbia University. Friction is a well-known by-product of innovation. Yet the situation was complicated by my gender and by my national background. Young women from Argentina have an 'image' in the United States that does not tally with the events I related above.

Starting in the beginning of the 1980s, through the Chairs of the Department of Economics, Columbia gradually removed my ability to teach students in international trade as well as economic theory, even though they were my main fields. This was very painful as forming students is the

reason I became a professor at Columbia. I tried to remind myself—and still try—that John Maynard Keynes was never a professor of economics at Cambridge University in the UK, that he was a lecturer in Mathematics there instead; and that Kenneth Arrow was not offered the job he wanted at Columbia after he completed his PhD dissertation because his work while interesting 'was not economics'. Yet the hostility escalated as my work became better known. Indeed as I grew professionally, it became relentless. Some of my colleagues recommended to my students not to work with me, others wrote threatening letters to my sources of funding and published numerous articles against my work; others acting as editors limited the ability of authors to write extending my work in this area. The campaign against my work extended to the Columbia administration, and created a hostile climate in which it was very difficult to work. This happened even though my teaching evaluations were very good, and even though there was at some level a clear recognition of the value and interest of my work. Or perhaps because of this.

At Columbia I have excellent colleagues who tried to stop this trend, but the forces of darkness succeeded. This is not unique to Columbia—I read of very similar circumstances and events at MIT and other top Universities which led them in 2001 to create a Commission of nine university presidents, led by MIT's president, which publicly acknowledged the problem of gender discrimination against the female faculty of their universities and sought to redress it and its deleterious effects on the University. Eventually my assistants' offices at the Economics Department were destroyed and my own office made unusable, my courses were removed, I was marginalized and treated with hostility, and my salary became so low that years later it had to be almost doubled and still remained below the average of male full professors. Starting in 1981 and during ten years I pursued official efforts to overcome this injustice internally. This included internal inquiries and detailed reports by Columbia University Senate's Faculty Affairs Committee, recommending a correction to the 'injustice' that had been committed in my case. Yet the University persisted in denying me even a proper hearing.

FITEL

In December 1985 I took a short leave from Columbia and started a company called FITEL with a group of friends who included Geoffrey Heal, Eduardo Jose, and Jeff Bezos, who since then became the Founder and CEO of Amazon.com. I became FITEL's Chairman and CEO, and raised $6 million in investment that I transformed into a $30 million corporate valuation in 2 years. The company was ahead of its time. It offered financial services to support international trading of securities, services which only recently has industry started to imitate. Based on state of the art electronic technology, FITEL created the first global electronic network offering global processing and communications — one that preceded the Internet and the world wide web --- facilitating communications and matching of securities trades between US, Europe and Japan. I created the software, developed it and marketed the services, and led successfully as CEO a group of about 60 people in three continents. FITEL became a very profitable and well-known company. With offices in New York, London and Tokyo, it offered me a shelter against the hostility at Columbia, a way to succeed without being punished.

In the midst of this development, my daughter Natasha Sable was born in New York in August 1987. In my eyes, Natasha was the most beautiful and happy baby ever known. She was born sufficiently apart from my first child Eduardo Jose that I had forgotten the rigors of motherhood. Natasha's fate was to travel widely since birth, and by the time she was one year old she had her birthday party in a plane to Tokyo. Eventually the pressures of motherhood led me to sell my stake in the company, which is now a successful communications provider in Japan, and dedicate myself to care for Natasha for a year.

Increasing Returns and Oil in the International Economy

Following this period I started the study of trade with increasing returns to scale, a topic that became rather popular years later, and published several articles and two more books, The Evolving International Economy published by Cambridge University Press in 1993, and Oil and the International Economy published by the Clarendon Press of the Oxford University Press in 1996, both co-authored with Geoffrey Heal.

The Evolving International Economy focused on the theory and policy of international trade in a world divided into industrial and developing nations, a world in which increasing returns to scale were achieving increasing importance. The book was an outgrowth of the Bariloche Model for me, because it integrated the North South issues in the context of international markets. In the Bariloche model there were no international markets—while this book was all about them.

This book led to many insights and policy predictions, some of which are still unfolding today. For example, we predicted that increasing returns to scale sectors are the first to 'boom' when the market upswings, and the first to 'bust' with lows in the business cycle. For example, telecommunications and airspace industries showed extravagant growth in the dot.com boom while just about all firms in these sectors became bankrupt in today's long downswing. This was our prediction, and it has come to pass.

Our book also predicted an increasing wealth differential between the North and the South as long as such trade policies persisted, emphasizing decreasing returns exports from the South and increasing return exports from the North --- a wealth gap that unfortunately has come to pass also. The book called for an end to the resource exports policies in developing nations, proposing to strengthen internal markets as an alternative policy. I stand behind those recommendations now more than ever.

The second book during this period Oil and the International Economy, published in 1991, focused on oil as the single most strategic resource exported by developing countries. It pointed out that oil is a "double-edged sword" for those nations. We showed data validating that developing countries

that export oil do not grow more than those who import it, they grow less. This was a surprising find at the time, but has almost become common knowledge since then. We explained that exports of resources, principally petroleum, could be a curse rather than a blessing. This policy-based book contains also theoretical models showing the increased wealth divide that would occur between North – the industrial nations which export under increasing returns to scale conditions-- and South-- the developing nations that export mostly resources and labor intensive products with decreasing returns to scale.

At the end of the 1980's, a number of articles on trade and increasing returns to scale showed that increasing returns to scale on their own explain why countries trade—to benefit from increased markets. I used this to explain the emergence of 'trading blocks' and the extent to which trading blocks can be viewed as a step towards the liberalization of trade rather than a step towards isolation and trade wars between trading blocks.

Topology and Social Choice -- Social Diversity

A stroke of luck led me in 1977 to find a geometric explanation for the mysterious "social choice paradox' that Kenneth Arrow had presented in the 1950's as part of his own PhD dissertation at Columbia. This finding led to a complete resolution for the first time for the "social choice paradox", namely to a set of conditions which are both necessary and sufficient for a resolution of the social choice paradox that Arrow had found. My insight identified the problem as being geometrical in nature, using algebraic topology tools as I had done in 1977 with my PhD dissertation in Mathematics. In economic terms I was able to demonstrate that the problem of social choice could be viewed simply as one derived from excessive social diversity. There is a precise degree of social diversity that allows a solution to the social choice paradox. Beyond that, there is no solution.

Social diversity of course is a good feature of the economy — as it allows gains from trade. But my results showed that there is a limit, that beyond a certain point it renders voting systems dysfunctional.

These new results were very satisfactory for me. While I had worked with Kenneth Arrow and greatly respected his brain and his wonderful results, in truth I could never understand the 'structure' of his paradox of social choice, which he had presented in a combinatorial fashion. Arrow's combinatorial results were unclear to me. The entire literature following Arrow's lead was combinatorial, while I could only 'see' geometrical structures and spatial representations.

The breakthrough for me occurred in 1977, while I was advising the United Nations and after a seminar that I presented at the Bell Labs, in a division led by Elizabeth Bailey who was interested in hiring me at that point. I came upon a response to a question by Robert Willig, now at Princeton, which led me to the creation of a topological explanation for the problems of social choice. This led eventually to my article "Social Choice and the Topology of Spaces of Preferences" published

in an MIT journal edited by the late mathematician Gian Carlo Rota, Advances in Mathematics, in 1980, and to a number of other articles that used the first result to explain a lot of what had been unclear in the field. New results emerged that could not be obtained before, I suspect, because the right mathematical infrastructure was not available until then. Somewhat unexpectedly, Rota himself was a great specialist in combinatorial mathematics.

As a follow-up to this discovery, I published another mathematics article "Intersecting Families of Sets and the Topology of Cones in Economics" in 1994, in the leading Mathematics journal, Bulletin of the American Mathematical Society, edited at that time by the excellent mathematician Richard Palais. Here I showed, somewhat surprisingly, that the basic structure of the most important forms of resource allocation was connected with that of the social choice paradox that Kenneth Arrow had pioneered. The same mathematical structure was also the cause of problems of **market equilibrium** as well as the **'core'** in game theory. Surprisingly, the common root of all these problems is the issue of when sets intersect, and in economic terms this measures once again social diversity. This is the key issue in finding a solution to market equilibrium, for social choices and for game solutions.

In this work I showed with Geoffrey Heal the first necessary and sufficient conditions for the existence of social choice rule. By myself I showed later a rather surprising result: that the same condition is necessary and sufficient for the existence of market equilibrium, the core and social choice—unexpectedly, it is the same conditions in the three cases. Social diversity holds the key. Beyond a certain point, it prevents the economy from reaching market equilibrium, a core solution or social choice rules. This validates the key role of diversity in allowing gains from trade, while at the same time limiting most forms of resource allocation beyond a certain point.

Topology and Innovation

The initial insights to resolve the social choice problem were followed up in a series of several articles in the Journal of Mathematical Economics, Economic Letters, and in Social Choice and Welfare. Later on in 1986 I published necessary and sufficient conditions for the resolution of the paradox in Journal of Economic Theory with Geoffrey Heal. To everyone's surprise, my 1980 discovery focused on a topological 'obstruction' that has to be removed for appropriate voting to be possible. This 'obstruction' is an object from algebraic topology —an area that was that of my first work in Mathematics where I looked at the geometry of the Universe. The 'obstruction' I discovered measures the degree of 'social diversity' of the population. This concept was developed in some detail many years later in 1993, as discussed below. Recently PBS made a TV movie about my results, representing graphically the shapes of the 'cones' that define the invariant in beautiful color. These cones are, for me, an object of wonder.

More recently I refined this work with the introduction of a 'topological invariant' that decides when there is a solution to three problems simultaneously: the existence of market equilibrium social choice and the core of a game. It is called an 'invariant' because it does not depend on

numerical measurements but rather on geometrical or topological shapes. This is important in economics or in other social choices where numerical measurements are often unreliable.

This convinced me that topology, and more particularly algebraic topology, are ideal tool for the social sciences. This is a point I had already made in a lecture I gave at Harvard University, "On the Foundations of Political Economy" organized by a great economist and friend Amartya Sen, in 1990. Since then a journal has emerged on the topic, SocioTopology, created in 2002, in which I act as an editor. I was not alone therefore in thinking that algebraic topology is the 'tool of choice' for the social sciences.

My newly created 'topological invariant' is based on the homology of a 'nerve' defined by a family of sets naturally associated to the economy. This mathematical construct was never used before in economics and appeared in my 1993 article in the Bulletin of the American Mathematical Society. The concept turned out to be too advanced for the mathematical tool kit of most economists so far, and it has not been widely used yet.

The 1980 results on social choice are some of my best-known work (together with Basic Needs) possibly because Arrow is an arbiter of this area and he is more flexible and open minded than most. My work on trade is perhaps more widely known, as the number of mathematical economists is much smaller than the number of international economists. Yet the mathematical sophistication of the field of international trade is lower than that of mathematical economics, and technological innovation in international trade is generally less well received. This could be considered somewhat of an understatement.

North-South Trade and the Global Environment

Soon after the results of "Intersecting Families of Sets and the Topology of Cones in Economics" appeared in Advances in Mathematics, I published in 1994 "North-South Trade and the Global Environment" in the American Economic Review (AER). Paul Milgrom of Stanford University, a great economist and a friend, acted as an editor and showed tremendous patience and intelligence in dealing with the innovation in that piece. The AER is of course a leading journal in economics, and my new article develops and generalizes my earlier work on international trade, clarifying the linkages between global markets and the problem of the global environment. This link underlies my earlier work in the Bariloche Model and on Basic Needs. The thesis of this new article is that difference in property rights for resources explains trade between nations. Since then this has become well known and accepted. In March 2003 I gave a series of lectures to a group of students from several Danish Universities and other Scandinavian countries at the University of Southern Denmark; to my surprise, all were familiar with my 1994 results, which they took almost to be almost 'common knowledge' within the environmental literature.

The 1994 articles "North-South Trade and the Global Environment," and its 'twin' for the case of renewable resources "North-South Trade and the Dynamics of Renewable Resources," show that

differences in property rights for environmental resources predict why nations trade, and how. The North, the industrial countries, hold their resources as private property, while developing nations in the South treat resources as common property or even 'open access'. I showed that this difference in property rights regimes between the North and the South by itself explains why those countries that are not particularly rich in natural resources end-up exporting resources to others who have more. It also explains the low international prices for resources. This creates over consumption of resources and lack of technological innovation in the North, and over exploitation of resources and poverty in the South. It is the main cause for today's global environmental problems.

Overuse of the 'global commons' leads to global warming, which results from excess consumption of fossil fuels, and also to the biodiversity loss associated to the destruction of forests and watersheds ecosystems to grow cash crops or graze animals, in both cases for the international market. Export-led policies based on resources, under these conditions, benefit nobody. This article is an evolution of my first article in international trade, and it shows that differences in property rights result in apparent 'abundance' of labor and resources in the South.

A solution to the problem would be reached by improving property rights regimes in the South, so that markets can operate more efficiently. However it is difficult to change property rights on land or on petroleum. It may be easier to define property rights on the output of production, which is the environment– rather than on the inputs, which are the resources themselves. Changing the rights to use the global environment may be easier than changing property rights on land.

This leads to limits on emissions and allocating global rights to emit, potentially trading these rights globally. In a nutshell: this is the creation of global emissions markets.

I made this recommendation to Timothy Wirth while he was Undersecretary of the US Department of State, and to Larry Summers who was Undersecretary of the US Treasury in 1996 and 1997. Tim Wirth took this recommendation as the US position in the global climate negotiations. This in turn led to the 1997 Kyoto Protocol, which incorporates both limits on emissions by industrial countries and the beginning of the rights to trade them. This was a part of the Protocol, which I contributed to write directly at the 1997 Tokyo Meeting of the United Nations Framework Convention on Climate Change (UNFCCC), working with Raul Estrada Oyuela, the outstanding Argentinian diplomat who was the Chief Negotiator of the Kyoto Protocol for the UNFCCC, and its creator.

Environmental markets: Equity and Efficiency

The recent book Environmental Markets: Equity and Efficiency published recently by Columbia University Press and co-authored with Geoffrey Heal, documents the evolution of my work on the area of emission markets. It also documents the intense debate that ensued when we showed with Geoffrey Heal and David Starrett in the early 1990's that there is a connection between equity and efficiency in markets with privately produced public goods -- such as the carbon composition of

the planet's atmosphere. The book captures the entire debate incorporating articles from OECD economists as well as from Raul Estrada Oyuela himself, the author of the Kyoto Protocol.

This book began the study of markets with privately produced public goods, which I view as the most important markets in the 21st. century. Examples of such goods are knowledge and the environment. They represent the most important trends in the world economy. These markets behave differently from the classical markets with private goods. In these markets distributions of property rights matter for efficiency. Efficiency and equity are linked. These are the markets of the future.

Stanford and seeking justice at Columbia

Back at Columbia the hostility had become relentless, particularly because my work had become progressively more established and well known with time, and following my recent commercial success at FITEL. Among other rumors now some of my colleagues were saying that Natasha was not my own daughter. After more 'stonewalling' on the part of Columbia about my salary and courses, letters were sent by several friends and even by well known attorneys such as Alan Dershowitz and his former student Jack Litman to Columbia's president Michael Sovern, to try to find a rational solution. All these efforts met with no response.

Finding no way out, in 1991 I filed a claim with New York Equal Opportunity Commission (EEOC) which led also to no response, and in 1992, I started a class action suit in Federal Court for gender discrimination in salary and promotion on behalf of all faculty women at Columbia. Columbia countersued my attorneys because they had represented Columbia many years earlier, for conflict of interest. Columbia lost this case in 1994, at which point they decided to try to settle my case. They communicated this intention to my attorneys in 1994, and Dean Eduardo Macagno of Arts and Sciences, an excellent colleague, followed up the action on behalf of Columbia as described below.

While the Columbia law suit was progressing, starting in 1992 I spent a few years as a visitor to the excellent Stanford Institute for Theoretical Economics during the summers, and in 1994 and 1995 I was also Visiting Professor at Stanford University, teaching both in their Economics Department and also in the School of Engineering, Department of Operations Research, where I was invited by a distinguished mathematician Curtis Eaves. Prominent economists from the Stanford Department of Economics suggested at the time the possibility of a Chair in Economics that I could hold focused on the Global Environment, so I would stay permanently at Stanford.

Also in 1993 and 1994 I was offered by the United Nations Educational and Scientific Organization (UNESCO) an academic chair called UNESCO Chair, in recognition for my 20 years of service to the United Nations community. This chair could be held either at Stanford University

or at Columbia depending on my choice. Jorge Werthein, a political scientist from Stanford then in charge of UNESCO's office in New York and an Argentinian colleague, communicated this decision to me. Eventually this Chair was endowed to me at Columbia and since 1995 I became the UNESCO Professor of Mathematics and Economics at Columbia University. This was a singular honor since there are few chairs of that type endowed by UNESCO across the world. Columbia's Administration committed funding, space and resources for the Chair and administrative support of its activities including a program of academic visitors students and collaboration with other Universities in South Africa and South America.

One sunny afternoon while I was at the Stanford campus in late 1994, I received a call from Eduardo Macagno, a microbiologist who at that time was the Dean of the School of Arts and Sciences at Columbia and since then moved to UC San Diego. Eduardo initiated in this call a process of reconciliation on behalf of the University, promising among other matters to double my salary even before we settled the case, a reconciliation that led eventually to a settlement of the law suit between the end of 1995 and early 1996. As part of this settlement I was named also Professor of Statistics in addition to my position of Professor of Economics. I was already part of the faculty of Columbia's School of International Affairs as well as the Political Science Departments.

Equally important was the positive effect that my lawsuit had on the cause of women at Columbia. Immediately after my settlement in December 1995, Columbia University released a long-anticipated salary equity report that resulted in disclosing irregularities and led to salary adjustments of four other female professors. The University's Provost at the time, Jonathan Cole, said that the adjustments of the four female professors were part of a routine salary adjustments based on merit alone. Yet an article "Equal Job, Equal Pay" in the university's newspaper Columbia Spectator of February 12 1996 linked the events and reported that 'problematic areas for women faculty at Columbia' were 'detected' and that 'women were concentrated in the lower professional ranks.' The article concluded: "Until such a time where salaries and promotions are granted solely on a merit-only basis, the University must make every effort to discover the reason behind these discrepancies and to reverse past discrimination practices."

Axioms for Sustainable Development and Endogenous Risks

Starting in 1992, when I filed my lawsuit, and for several summers and academic years, I had the privilege of working at Stanford University with great colleagues such as Paul Milgrom, Masaiko Aoki, Kenneth Arrow, David Starrett, Curtis Eaves, Joe Stiglitz, Peter Hammond, Paul Davies, and many others. Walt Heller and Ross Starr from UC San Diego were great colleagues and friends who supported me particularly through the process of putting together the book Markets Information and Uncertainty that I published with Cambridge University Press in 1999 with original contributions from many of the best economic theorists in the US, in honor of Kenneth Arrow's 70's birthday. This followed a conference that I had organized at Columbia University in 1992 to celebrate this event. The conference was packed and went very late in the evening with

enormous participation by the audience as fitted Kenneth Arrow's warm and engaging personality as well as his extraordinary life's work. It was a heartwarming event followed by a party that Ken himself described as one of the most enjoyable celebration he had. Yet very few of my economics colleagues showed up at the event.

The period at Stanford was very productive as well as enjoyable and allowed me some rest from the rigors of the situation at Columbia. At the end of this period, to everyone's great pain and consternation Walt Heller died unexpectedly, well before his time. He was a wonderful man and a great economist, and left a vacuum in our hearts.

These colleagues and friends at Stanford and UC San Diego were and are very important to my work and to my life—they are warm and supporting people who welcomed Natasha and me during the years I spent there, and inspired me to produce some of the most advanced work I have done so far.

While at Stanford in 1993, Kenneth Arrow organized a workshop on Inequality and asked me to produce an article for presentation in it. He specifically wanted 'original" articles and not 'run of the mill' work. I took him at his word, and this led to my article "What is Sustainable Development?" where I tackle a difficult problem -- the definition of the concept of sustainable development in a way that is operational and yet truthful to its meaning. To achieve this aim, I introduced in this article two axioms that require equal treatment for the present and the future generations. This imitated the process that was followed by Von Neumann and Morgenstern in their theory of choice under uncertainty. Like them, too, through a representation theorem, I identified all the preferences that satisfy the axioms. The preferences that emerge from this process are unusual—indeed never seen before—a combination of discounted sums of utilities with a long-term factor and I called them 'sustainable preferences.' In mathematical terms, sustainable preferences are a mix of 'countably additive' with 'purely finitely additive' measures. The classical calculus of variations on which much of modern economics and mathematics are based—does not work for these new types of functionals. It must be reworked to accommodate such types of maximizing functions. Some of this work has been done but a lot remains still open.

Sustainable development

The purpose of the article "What is Sustainable Development?" was to define economics in a way that treats the present and the future in a more balanced way in most of economic theory. Economics often treats the future by 'discounting it.' Therefore any project with gains in the future and costs today, is given a low value. Discounting the welfare of the future inevitably leads to a bias against any form of development that has long-term goals, such as sustainability. This explains why our economic policies are, on the whole, not sustainable.

At the time, in 1993, economists were seeking a definition of sustainability that was as "rigorous" and workable as that used in optimal growth theory, where the future is exponentially discounted.

Taking a somewhat bold step that led to some friction, I introduced the two axioms "no dictatorship for the present" and "no dictatorship for the future." Then I identified all the preferences that satisfy these axioms.

My article "What is Sustainable development?" initially met with great skepticism by Kenneth Arrow and by Peter Hammond, both of whom thought that what I was trying to achieve was mathematically impossible. Peter Hammond helped refine the ideas with his friendly but critical stance. Arrow's great mind sought first errors and logical flaws, and gave me a really hard time, but eventually he became convinced and indeed very supportive of the concept of sustainable preferences. So did Geoffrey Heal who investigated further its properties in a book entitled Valuing the Future, published recently by Columbia University Press.

This work led to a completely new way to seeing 'time' in Economics. I used it subsequently to treat the economics of risks in an analogue mathematical fashion. This led to a number of pieces on 'Catastrophic Risks.' Small and large probability events are treated axiomatically in a more even handed fashion than allowed by the Von Neumann Morgenstern axioms and their expected utility theory that is the foundation of game theory. I showed that Von Neumann's expected utilities are insensitive to small probability events. Their expected utility theory leads to a number of contradictions pointed out in the so called 'Allais paradox', which finds inconsistencies between the way people choose under uncertainty in reality and in expected utility theory. My axioms corrected that. In doing so they identified a new way to treat catastrophic risks, namely small probability events with large consequences, a way that tallies with the observed evidence and resolves Allais' paradox.

As part of this research program I wrote with Geoffrey Heal an article "Global Environmental Risks", published in the Journal of Economic Literature in 1998. Here we introduced the idea that as humans now dominate the planet, they produce themselves the largest risks to our species. We have evolved to the point where we are own worst enemy. This led us to introducing the theory of Endogenous Risks, a name that afterwards was also used by others in a somewhat different context, and several existence theorems in economics with such risks published in the book Mathematical Economics (Volumes I,II,III) I wrote and published with Edgar Elgar in 1998.

Program on Information and Resources

In 1994 I became the Director of Columbia University's Program on Information and Resources (PIR), a program I created together with Geoffrey Heal who acted as its Deputy Director. In a short period of time, about two and a half years, PIR raised millions of dollars of research funding from public agencies such as the National Science Foundation, the United Nations (UNESCO, UNDP), and the UN Foundation, as well as private foundations such as Sloan Foundation, the UN Foundation and the Turner Foundation. PIR focused on interdisciplinary work on the Global Environment and on Risk Management. These are areas that Geoff Heal and myself pioneered at Columbia and which fit well with my work going back to Bariloche.

PIR created a series of books on the Global Environment published by Columbia University Press. Together with an excellent geologist Dr. Christopher Barton of the US Geological Survey, we created the Columbia Center for Risk Management with $1.5 million in funding from several leading reinsurance companies including Swiss Re, Center Solutions, and Willis Faber. Many students and prestigious academic visitors gathered around PIR. Raul Estrada Oyuela, the creator of the Kyoto Protocol was a Visiting Professor for a year, teaching at Columbia Law School, and we had a series of Distinguished Lectures on the Global Environment with the participation of the most important figures in the world—among others, the extraordinary scientists Lynn Margulis and Prygogin, the IBM executive Ralph Gomory, the biologist and environmentalists Thomas Lovejoy of the Smithsonian Institution and Peter Raven, the Director of the Missouri Botanical Gardens. The Director General of UNESCO Federico Mayor, and Pierre Lasserre, a french marine biologist in charge of their environmental division, visited us and provided additional resources and support towards the formation of a network of like minded Universities around the world, particularly in South America and South Africa.

Since its beginnings in 1994, PIR became my intellectual home at Columbia University, and to a certain extent also that of many students and visiting faculty who joined us. Its concept was unique at the time—and still seems unique now—as it was interdisciplinary in nature and dedicated to global issues particularly those related to pressing problems of the global environment. We created a version of the GREEN Model of the OECD, which we adapted to study the implications of global trading of emissions rights, a topic in which PIR advised the US government, the United Nations and the OECD. From these studies Geoff Heal and I published recently a book called Environmental Markets, Equity and Efficiency.

From PIR I published a large amount of scientific articles and books, in the period since 1994 to 1999, some of which were jointly with Geoffrey Heal, encompassing Economics, Mathematics and mostly focused on Social Choice, International Trade, and the Global Environment.

PIR and the UNESCO Chair

As part of the December 1995 agreement to settle the law suit, Columbia had promised to support PIR in various ways, providing its office space, matching research funds, and additional administrative resources. Separately, the Chair that UNESCO had wanted to endow at Stanford or at Columbia, providing seed funding for this purpose, fit well the themes of PIR and UNESCO decided to endow its seed resources to PIR so that the Chair's activities themselves became part of PIR. In December 1995, Columbia University committed a continuing permanent support of $50,000 a year for myself at PIR, to support research in the general research areas of the UNESCO Chair.

From the beginning, PIR was meant to be a step towards the creation of a larger University Center or Institute within Columbia University, a larger interdisciplinary umbrella that would coordinate and develop Columbia's various faculty and programs related to or focused on the Global Environment. In 1996, after the settlement, and working with ViceProvost Mike Crow who participated in the settlement, I was promised that Columbia would expand PIR into a larger effort and in particular expand its offices into the entire suit of offices where the PIR was temporarily housed in 405 Low Library. Low Library is the main administrative building of Columbia University, and it houses the office of the President of the University. PIR was poised to grow into a University wide effort and Columbia to become a major center for the study of the Global Environment. In January of 1996 the painful episode of a lawsuit that had lasted 5 years seemed to be over, and a new era of harmony seemed to have started for me at Columbia. My decision to stay at Columbia rather than move for example to Stanford University, seemed right at the time. We seemed to have succeeded in transforming 'dung into fertilizer.'

The Earth Institute and Columbia's retaliation

My hopes for harmony and productivity at Columbia University were soon shattered. As soon as the settlement with Columbia was completed in December 1995 I started receiving disturbing messages from the Columbia administration. One of the first indications was that despite their promises to provide a permanent endowment, the Columbia Trustees were given in May 1996 a proposal by the Columbia Administration to vote the endowment of the UNESCO Chair but only for a limited number of years, in direct violation of our written agreements under which this was permanent. The problem has now been partly resolved, as Columbia now admits that the UNESCO Chair is a continuing activity without a termination date, as expected, but nevertheless, the University froze its promised continuing funding two years after the settlement, with no explanation, and never restored them. Another indication came when, despite all promises to the contrary, in the Summer of 1996 Columbia created The Earth Institute, and recruited as its leader Peter Eisenberger, a prominent physicist from Princeton University who joined the Columbia faculty in September 1996 holding a Chaired position in Earth and Environmental Sciences as well as the position of ViceProvost for the Earth Institute. Eisenberger had previously created and successfully led Princeton University's Materials Institute, and was clearly a most distinguished and interesting scientist. Yet his appointment came as a total surprise to us at PIR, since we were not consulted in any way as part of his extensive interviewing process, even though The Earth Institute had the same domain of expertise and subject matter of PIR. Indeed, the Earth Institute was itself what PIR was supposed to have grown into.

The betrayal of the plan of action agreed for PIR with the Columbia administration was a blow for us all. Overnight, after two and a half years of its creation and hard and successful work, PIR became a small unit into a much larger effort, the Earth Institute, directed by a new person, Peter Eisenberger, who had a different perspective, coming as he did from the physical rather than the social sciences. The Earth Institute now included also the Lamont Doherty Earth Observatory,

directed also by Peter Eisenberger. PIR became a small speck in a larger picture. This was somewhat disturbing in view of the promises and the plans made since the beginning of 1996.

But perhaps more disturbing was the realization that Peter Eisenberger himself had been led to believe by the administration that part of PIR's space was available for the Earth Institute. This was further exacerbated by verbal communications prior to his coming that the PIR space would actually be expanded. Soon the Earth Institute occupied the space that PIR was supposed to have, and Eisenberger initially tried to remove PIR from its offices, indicating in various ways that PIR was not welcome by the administration. This was painful because clearly he was interested in building an area in which PIR could have provided the most valuable contribution in the entire University. Eisenberger changed his attitude when shown the contracts we had with the University, and a plan for sharing space was worked out.

Knowledge Revolution

One of the most interesting and thought provoking areas of research being conducted at PIR was the "Knowledge Revolution™." We created this term to describe the rapid period of change of the last few years during which knowledge is gradually replacing capital as the most important input of production. To put an imprint in our contributions I trademarked the term "Knowledge Revolution" and started the process of trade marking also "Biosphere and Society™" publishing a number of articles and conducting empirical research in these two areas. To study the Knowledge Revolution, we developed mathematical models of a new type of markets. These are markets with 'privately produced public goods,' and 'knowledge' is one of those goods as are many environmental goods.

The transforming global trend that I call the "Knowledge Revolution" is similar in scope to that which took place when capital replaced land as the most important input of production. This was the transition from Agricultural to Industrial societies, and was called the Industrial Revolution. The analogy is clear.

The topic, and the research on markets with privately produced public goods, led to a number of research projects that were funded by the Sloan Foundation as well as by the Italian Academy at Columbia University and were supported partly by Columbia resources.

Several articles were published in this period highlighting public policy issues that were the results coming from those models. One of the main policy issues was the importance of property rights regimes on Knowledge. In parallel with the historical debate on the ownership of capital when it became the most important input of production after the Industrial Revolution, property rights on knowledge are probably the most significant policy issue after the Knowledge Revolution. At PIR we developed a proposal to replace patents by (compulsory) licenses that must be traded within competitive license markets, which received much attention at the time.

The Global Environment and Peter Eisenberger

To his credit, Peter Eisenberger soon realized that PIR was the exact focus of the efforts of the Earth Institute, and adopted Geoffrey Heal and myself as natural collaborators in administrative and intellectual ways, while at the same time attempting to keep a very close and indeed symbiotic relationship with Vice provost Mike Crow. While not an expert in the Global Environment himself, Peter was clearly an intellectual powerhouse and adept at building institutions. It was heartening to observe the appreciation that he expressed intellectually for PIR's work as well as the administrative plans and fund raising efforts of PIR. Eisenberger and Heal soon were collaborating closely in the Earth Institute Academic Committee, and I was not far behind, as a member of the Committee myself. We successfully did fund raising together, organized major conferences "From Kyoto to Buenos Aires", "Managing Planet Earth" and "Natural Hazards" although I was effectively demoted by Peter's position, I had gained a powerful scientist and organizer as an ally. The situation was once again reversed, and towards the end of 1998 we managed to turn another piece of 'dung into fertilizer'.

We started to view the Earth Institute as a friendly 'umbrella organization' which was somewhat protective of the continuing attacks from the Columbia administration, including the Projects and Grants organization of Columbia University who was the body that administered our many grants.

Yet gradually matters got worse. While PIR was very successful in its mission and raised more than $2 million in research funds, accounts would not be opened on time, people would not be reimbursed promptly or were not reimbursed at all, and eventually the student's administrative personnel and distinguished visitors started to be harassed by the University administration in various ways. By 1998 the situation became almost unbearable. While PIR was blossoming and we were in great demand giving presentation of our work all over the world, with large press attention and many publications and international conferences to match, matters at our home institution were going from bad to worse. Indeed there seemed to be a negative correlation, pointed out earlier, between the accolades for the work, the attention and press clippings that ensued, and the hostility at our home institution. My administrative assistants were treated with such hostility that one by one they left PIR, and the ones that did not leave such as Greg Howard, were offered 'payments' by the Columbia administration to do so immediately, and wrote memos documenting this. Accounts were not opened, or letters from the administration to donors would not go out creating unending budgetary problems. Dr. Christopher Barton, the PIR Co-director of the Consortium for Risk Management and a distinguished geologist of the US Geological Survey, was not be paid his agreed co-director fee from existing funds, nor reimbursed for travel expenses for budgeted PIR seminars that were carried out with the agreement of the sponsors. In fact Dr. Barton has not been paid nor reimbursed to this day. Peter Eisenberger was under continued requirements and threats to his position to 'limit my leadership role' at the Earth Institute—and indeed from the written documentation we now know that the Columbia administration was adamantly opposed at any role for me that gave me a leadership position in the University of any sort. Intellectual leaders at Columbia have never been women, and from the written evidence that emerged in this case, one can see why.

The International Bank for Environmental Settlements

During this period I presented in 1996 at the World Bank Yearly meetings to a large audience a proposal which we initiated at PIR for the creation of an International Bank of Environmental Settlements, or IBES, a global institution that would have as a mandate to derive value from the world's environmental assets without destroying them. The IBES would be self financed, and would use as its source of funding the most valuable assets of the planet, our environmental resources.

I proposed this institution to update the Bretton Woods institutions created by Keynes and Meade after World War II, when I was born. They include the World Bank and the IMF among others, and were created to replace war by trade and succeeded beyond anyone's imagination. International trade between nations has grown four times more than actual world economic product in the world since then.

The Bretton Woods institutions are based on resource intensive patterns of development that they enforce in developing countries, leading to deep environmental destruction. My proposal instead is to rely on knowledge intensive development which is less damaging to the global environment. The Bretton Woods institutions have outlived their usefulness, becoming the victims of their own extraordinary success.

The International Bank for Environmental Settlements was meant to provide and implement a regulatory environment and a liquidity source for the trading of emission rights on a global scale, as the SEC does in the US, offering also loans and options to facilitate 'reversible' policies. The IBES could also commercialize (via licensing) the use of the knowledge encoded in the developing countries' biodiversity to the benefit of those countries. This IBES proposal attracted great interest by the Global Environmental Facility related to the World Bank, and by the United Nations as a whole, and I wrote in 1996 a book published by the United Nations Educational and Scientific Organization (UNESCO) and the United Nations Development Program (UNDP), which was marketed by them over the world to make this proposal a reality: "Development and Global Finance: The Case for an International Bank of Environmental Settlements". The IBES is still work in progress.

PIR and the Court's injunction on Columbia of 2000

Suddenly in June 1999 Peter Eisenberger resigned his position as Vice Provost for the Earth Institute and Director of the Lamont Doherty Laboratory, for reasons of health and for 'matters of principle'. He had an open-heart surgery operation that left him out of action for several months. We were all shocked about this unexpected development. I subsequently discovered that the

matters of principle concerned his belief that the administration's attacks on me were not only destructive to the Earth Institute but also violated prior agreements with me, and were a reflection of gender discrimination. Eisenberger was actively involved in gender discrimination efforts when he was at Princeton University and said he was 'shocked' by the Columbia's approach. While severe gender problems exist at both institutions, Princeton's President Shapiro tried to address the issue, while at Columbia there was not attempt and in fact there was denial.

When Eisenberger left, the situation fell completely into other members of the Columbia administrations' hands, and any protection that PIR had disappeared. The Earth Institute Academic Committee was folded up, removing me from participating. PIR accounts involving millions of dollars from the donors were then frozen completely, and we were unable to honor the terms of these grants because we could not reimburse our researchers or visitors. We could not even buy a pencil, hire a researcher, or pay a student or a trip. On one occasion the keys of the offices were changed without our knowledge leaving us all outside overnight, including distinguished visitors such as Yuqing Zhou and Raul Estrada Oyuela. It was almost impossible to do any work. The UNESCO Chair payments were not made as promised, leaving my administrative supplement to my salary unpaid. On top of all this, the Columbia administration started to threaten to evict PIR offices and move the entire suit of seven PIR offices into one small single office, my own faculty office in the Mathematics Department which could not in any way house the PIR materials or people. In February 2000 they put action to words, and started to dismantle one of the seven PIR offices disconnecting and destroying its computers, data and the research contained in them. These were the computers housing among other valuable work, the OECD Global GREEN Model in which we were simulating global emissions trading policies. At that point I went to the Supreme Court in New York and with my attorney Susan Davis we showed the judge the many photos we took of the destruction of the PIR offices.

In March 2000 the New York Supreme Court provided an injunction that forced Columbia University to stop dismantling PIR's offices, its equipment, research documents and data, and requiring that they preserve the status quo until further order of the Court, stopping forthwith any further destruction of the PIR offices or materials.

Men who support women

A senior official of the American Association of University Women who I met at their Islandia, New York State National Convention in March 2003, and who had been until recently a senior administrator at Penn State, told me that men who support women are heavily ostracized and treated with hostility themselves. This official also said that Universities do not view lawsuits by their faculty as a sign that there is a problem—but merely as a sign that the administration is "tough" enough, as it should be. Lack of lawsuits for gender issues may indicate 'the administration is too soft', she said, drawing from her high-ranking administrative experience at Penn State.

Although it was shocking to hear this, I was able to verify her words myself in the Columbia University case. Documentation shows that Geoffrey Heal, who was initially the Deputy Director of PIR, was heavily criticized for co-signing with me the promotion of Greg Howard, a PIR administrative assistant who is black, after he had successfully passed a University course in financial systems to achieve the promotion. For all financial matters a second signature was needed; we had to provide a second signature to promote Greg, as well as to reimburse students and visitors, pay office bills and researchers and office supplies. These payments were from the funds that I had raised myself for PIR's research, which in total represented accounts for about $2 million. Geoffrey Heal held the so-called 'DAF authorization' to perform the second signature role, mine being the first. However the Administration removed summarily in 1999 his signing (DAF) authorization and prevented him at the last minute from supporting the promotion I initiated for Mr. Howard, one of the few African-Americans at Columbia, so that the promotion would never go through. No explanation was ever offered by the administration for this.

The surprising removal of Geoffrey Heal's ability to co-sign meant that nobody would authorize payment or reimbursements. I have requested an explanation but was given none to this date. Documents have shown who has done this and when, and the single purpose appears to be retaliation. Neither Geoffrey nor me have been give any reason. Since then, I have been using thousands of dollars of private funds in order to keep up some of the activities of PIR, as all its funds have been frozen.

Dr. Chris Barton the Deputy Director of PIR's Columbia Consortium for Risk Management, which by itself had about $1.5 million in private funding, is still owed thousands of dollars for this reason. Dr. Barton is also a man of principles who has been penalized for supporting a leading woman scientist.

Greg Howard was very supportive and loyal to PIR and still works with us in what we can at PIR. He had been offered in 1999 a monetary bribe, which is also documented, by the Columbia administration, which he refused, offered to him so that he would leave PIR at a moment's notice as reported above. Greg Howard is another case of a principled man penalized for supporting women. He was never promoted and eventually left the University. The documentation shows that Columbia administration was aware that removing the DAF authorization from Geoffrey Heal to prevent that promotion was in fact against union rules.

More insidiously, the documents show also that Geoffrey Heal, who had written with me and several other top environmental science researchers in the USA a large NSF proposal (Science and Technology, or STC) was subsequently sabotaged himself on this proposal, along with me. He was singled out by name as suspect, and the documents show a clear recognition by the Columbia Administration that our NSF proposal was very strong (indeed it had passed NSF first screening) but that Columbia should not return it to NSF because Geoffrey Heal could not be trusted, as he had supported PIR and the promotion of Greg Howard. This NSF proposal had been initiated at the urging of Peter Eisenberger as a way to build up the talent pool and funding of Columbia

University's Earth Institute and PIR. It was a wonderful proposal, which I am pleased to make available to the interested reader. Geoffrey Heal was another principled man who was penalized.

Peter Eisenberger was yet another man in this list of principled men. He was penalized for his refusal to follow their instructions to engage in what he saw as discriminatory activities. The Columbia University administration asked for his resignation in writing in 1999 unless he terminated immediately my leadership positions. He responded that there was no reason for this and that Columbia Administration's behavior bordering on the illegal could put the institution at risk, recommending a reconsideration that was not accepted. This is recorded clearly in a number of documents.

Lyme Disease

After several years, the difficult situation at Columbia eventually took a toll on my health. From talking with Charity Hirsch who has a medical background and with other women I found out that this is often the case when battling a lawsuit against one's own university.

Having the luck of being healthy all my life, in the Summer of 1998 I had strange symptoms that were later confirmed to be Lyme Disease, a bacterial disease which is endemic in Eastern USA, transmitted through ticks in forests or meadows. This serious disease starts often with fever, extreme tiredness and arthritis, and eventually leads to heart failure, neurological damage, meningitis, loss of memory and eventually dementia. Although I started several treatments in 1998, after a few months of completing each treatment, the disease would re-establish itself, each time worse than before. This was frightening. In the fall of 1999 the Chief of the Lyme Disease Center of New York's Lennox Hill Hospital Dr. Argyros found that I had reached an advanced stage of Lyme disease, the last stage of the disease, and a condition that soon incapacitated me and took several years to eradicate. After a long and determined battle, in 2002 I was declared cured, although this disease is sometimes recurrent.

In the period since 1998 I was unable to teach or work as usual, although I was able to be productive otherwise in areas where writing and thinking were key, particularly during the recurrent periods in which the disease was in temporary remission. I published a large amount of work, participated when possible in conferences, and the enforced physical limitations almost paradoxically allowed me to carry out more thinking and research than ever. I understand that this is the case with others as well, and the British physicist Stephen Hawkings is an extreme and famous example. My teaching during the period was sporadic since the disease would go up and down, and when I was not well I could not stand properly, walked with a limp and was often unable to raise my arm or write, in addition to having memory lapses and extreme tiredness and lack of body strength that characterize this disease.

Later on in 2001, Columbia argued that I did not have Lyme Disease, and a high Columbia University Administration official testified about my 'pretense' despite the abundant

documentation from three physicians to the contrary, including a letter by a Columbia University doctor who Columbia itself designated to provide an opinion, and by the Chief physician who founded and is in charge of Lennox Hill Hospital Lyme Disease Center in New York, Dr. Thomas Argyros.

Columbia also argued in legal papers that my ability to work part time outside the university while teaching also part time, was proof that I was somehow violating my 'loyalty' against Columbia, in what they described as "conflict of commitment." They counter sued me for this 'loyalty' issue very recently in 2003. At the same time there is clear documentation that in March 2001, the Science and Technology Policy Committee of Columbia University, which is the body for dealing with such conflict issues, stated that 'conflict of commitment' was not defined as a University policy. The Committee found that there are 'no ground rules in place' either to decide how to proceed in a case where such a conflict is suspected. Furthermore, a high administration officer agreed on the record that no ground rules or 'definitions' have been provided since then. I exchanged correspondence with this Committee, asking for a clarification of what was the problem that the University was concerned about, but until now I still have no responses to my questions. The administration has conceded that, in any case, the only action expected if someone is found in such a conflict is 'cure.'

My attorney explains this illogical position on the part of Columbia as further retaliation and 'harassment' by the University imposing enormous costs and stress, part of their pattern of intimidation. The absurdity of the situation borders on the "Kafkaesque": I am currently challenged in Court by Columbia University for 'loyalty issues' regarding a regulation called 'conflict of commitment' that the University itself has recognized it has not yet defined, nor has it 'ground rules' to implement.

Natasha and Cross Border Exchange

The Lyme disease made everything more difficult and together with the lawsuit made this period of my life quite challenging. It took also a toll on my family life. I separated from Geoffrey Heal and eventually my lovely and happy daughter Natasha became a victim of the situation with serious consequences in her feelings and her socialization. This took an unexpected and dangerous turn of events in the fall of 2001, threatening her life. In order to support Natasha and myself while I was unable to teach, and be able to afford the high costs of a continued lawsuit, I made an effort to increase also my consultancy work when possible. With a few friends we started a company that followed the successful footsteps of FITEL in the Internet Age, called Cross Border Exchange, which started operating in 2000. This was very interesting and rewarding, and more accommodating than teaching at Columbia, with flexible time schedule adapted to my physical restrictions and the up-and-downs of the disease. It offered a refuge like FITEL from the hostility at Columbia, and provided achievement without punishment, office space and financial support in a period when the University dismantled my offices, destroyed PIR's research and froze its funds.

Life does not stop throwing new challenges. In the fall of 2001 following a particularly dangerous incident that threatened Natasha's life the Board of Directors of Cross Border Exchange agreed that I had to provide Natasha my complete priority as needed. I changed my position in the firm, becoming a consultant and a non-executive Chairman of the Board. Over time, as I overcame the disease, I went back to teaching full-time at Columbia, devoting more time to Natasha than ever. I have been able to teach full time at Columbia now for several semesters. Natasha is completing successfully her third year of high school and gradually became better. Natasha is an extraordinary child and worth every second of the time I am able to invest in her. Dedicating myself to her also made me feel useful, a great bonus in what is otherwise a difficult situation. More 'dung into fertilizer'.

What is Democracy

At present I am writing on a subject that puts together several strands of my previous work: democracy and its importance in social evolution. This is based on solid scholarship but addressed to a general readership. It was motivated by the looming global conflict between the West and the Muslim worlds.

Our species now dominates the planet. While humans or their close genetical relatives have lived on Earth for four million years, only recently has human activity reached a level at which it affects fundamental processes such as global temperatures, the planet's water mass, and the complex web of species that makes life on Earth. We have progressed to the point of becoming our own worst enemy.

The challenge now is to find paths of social evolution that allow us to reap the benefits of the breathtaking achievements in science that are not matched by our laggard social skills. These skills are lagging behind. Social evolution and organization are the key or our ultimate success of extinction as a species.

I show that populations having a majority of genes that are dominant are condemned to extinction. In a changing world, survival of the species requires a diverse gene pool.

Change is more intense and widespread than ever, and social evolution has become perhaps more important for survival than genetical evolution. Democracy, a widely accepted and admired principle to allocate resources in society, depends on the protection of minorities to avoid the Tyranny of the Majority as viewed by Alexis De Tocqueville in "Democracy in America." Dominant majorities condemn a society to extinction the same way that a dominant majority of genes condemns a population to extinction.

Starting from the work on Sustainable Development and Choice under Uncertainty with Catastrophical Risks, I define axiomatically democracy as the lack of dictatorships of all kinds and

identify all the political processes that satisfy this axiom. Through a representation theorem I show that they are a combination of a 'rule of the majority' and the 'protection of minorities'. In my view, this is what democracy means. This is my latest finding, to be published in articles and also as a book.

Against all odds

Since March 2000 I have found myself once again in an adversarial position in Court with the University. To obtain the March 2000 injunction that the Court provided to stop Columbia's dismantling of PIR's offices and the destruction of my work, I had to file a second complaint in New York Court. This was for breach of contract, including breach of our settlement agreement of 1996, retaliation, and further gender discrimination in violation of the Equal Pay Act.

The case continues today, even though all the major actors in this case are gone and there is a new University administration under President Lee Bollinger, who used to be the President of the University of Michigan, and is himself an attorney.

Initially Columbia University hired an outside counsel to defend this case, an attorney called Robert Kaplan, who tried to understand the case and after two years of working on it said that he saw the enormity of the tragedy and tried to settle the case. Following his lead we made good progress until the case was almost settled in all its larger points, with only a couple of smaller points remaining in December 2002. Yet in January 2003 Robert Kaplan was fired summarily by Columbia and replaced by another outside counsel Edward Brill, who promptly denied any wishes on the part of the University to settle except to sever the connection with the University. The case is now in the final stages of discovery involving a large number of witnesses and production of documents to match. It should go to trial in the Supreme Court of New York in early 2004.

Except for a brief period of apparent peace in 1995, therefore, I have been litigating against Columbia University since 1992, eleven years in all. Columbia has billions in resources and all the time in the world, and they are inflicting enormous costs including time costs in this litigation. This is the David and Goliath aspect I mentioned above. I would like to believe, as David, that I am stronger than Goliath because I am right.

Against all odds, I intend to win the case against Columbia University. The American Association of University Women is helping pay for the legal costs. This case represents not just myself but also many other women at Columbia who suffer similar fates. I spoke with many who related similar treatment. Recently a University spokesman recognized in an article in the Columbia Spectator that every year Columbia faces 2 or 3 new gender discrimination lawsuits. Two years, nine of the top US Universities including many in the Ivy League, formed a commission, led by MIT, for the purpose of correcting gender discrimination in their universities. These nine institutions openly recognized the serious problems of gender discrimination faced by its women

faculty. So far, Columbia has refused to join this group, and its administration denies any gender discrimination problem.

Since my first lawsuit, the University had several internal committees who found that gender discrimination exists at Columbia, reported in articles published in the Columbia Spectator, the university newspaper, and other university sources. However the University does nothing about it. I was told that the existence of other women who are discriminated against at Columbia makes it more important for Columbia not to settle my case. As strange as it may seem, they tell me that Columbia does not wish to establish a precedent for justice. There may be too many other cases to follow. As a result rather than trying to solve the problem, I am faced with silence, intimidation and scorn.

Against all odds I intend to win this case. It is an important case because of the 'glass ceiling' aspects. This is the 'final frontier' for the emancipation of women in academia. Nobody at Columbia denies my academic merits. On the contrary. There is no justification for the destruction, the hostility, and the unlawful behavior of the part of the University about courses, salary and promotion, office space and financial and personal harassment towards someone who is by their own admission a distinguished and productive professor and administrator who has taught successfully for many years, conducted excellent research and raised millions of dollars of research funds for the university community. My salary is strikingly out of line and as so are many of the salaries of other women faculty I know at Columbia. As reported in University publications, women faculty are concentrated in lower rank positions.

At this point, however, after so many years of hard litigation that cannot be recovered, an important question may occur to the reader-- a question that has certainly occurred to me in the course of many sleepless nights -- what does it mean to win?

To win means fighting for justice

It may seem self-serving, but the very act of fighting for the right cause is to win, because it brings meaning, harmony and peace to one's life.

I wish to refer the reader to the two reflections I made at the beginning of this article. Turning 'dung into fertilizer' was the first reflection. Certainly there is a lot of raw material in this situation to turn into fertilizer. But the reader may ask how does this transformation process—from dung into fertilizer-- work out in practice?

I have discovered that I can produce the best work of my life, enjoy life with my family and children, and share important moments with my friends all while this negative energy is thrown my way. As long as this is a just cause, one worth fighting, it only adds a positive aspect to my life. My family life can be happy and fulfilled, although it is obviously stressful.

Happiness is truly internal; it is internal peace and harmony that cannot be touched by external forces. Therefore my personal happiness is not at stake.

Turning dung into fertilizer

What remain therefore are my family and the public persona. This is my relationship with others. Turning 'dung into fertilizer' here means that the best I can do in this situation would be to be positive towards myself and useful to others. Enjoy my life, give love to my family and those close to me, be productive, and most importantly, try to be useful to others. Columbia's actions actually facilitate this. How is that?

After my 1995 settlement the University raised the salaries of four women, as reported above, and released an important report that was previously delayed on the problems of gender equity. This was useful. Extending this example, the American Association of University Women also plays a key role. I could become useful to its 160,000 members, to the hundreds who I have already joined and who provided a heartwarming standing ovation at the end of the speeches I gave at their Penn State and at the New York State Conventions in the months of March and April 2003. Through their response, these women have told me that my struggle is valuable to them that I represent something that matters to their lives. In June 2003 I am scheduled to join thousands of AAUW members and speak to them at their National Convention in Providence Rhode Island.

The truth is that through this case I have reached a feeling of being useful to others. This is a true source of happiness -- this case has provided me with such a source. This feeling is more valuable than academic success, or money. Those do not provide true happiness, as pleasant and as personally rewarding they may be. Columbia University has given me a course of action that is only open to me because of their negative responses, and which produces the most beautiful fertilizer of one's happiness: a feeling of connection with others that one loves, and of being useful to them. This is how one turns 'dung into fertilizer.'

I remind the reader that mine is not a personal case. Columbia does not have anything personal against me, and I admire the institution for is obvious strengths. I am loyal to its charter, which should include overcoming gender discrimination for the good of the institution itself. In fact, I have many wonderful friends at Columbia who I love and admire, and who have told me reciprocally that they love me, and say that they admire my work and my spirit. In the two AAUW events where I spoke this year, I communicated with hundreds of women and learned that their experiences are similar to mine. I learned to have compassion for other women who told me that Columbia University has 'destroyed their entire professional lives'. In a way, I am reliving their lives. Nothing can make me happier than to use my case to try to generate a better situation for many other women in the US University system. I would like to turn all this around and make Columbia a 'beacon' for gender equality in academia.

Yet while I relive the lives of so many other women in the US University system, my fondest desire has become to succeed in preventing others from having to relive mine.

Sex and the Ivy League

As I write in this wonderful June day, the first day of Spring 2003, my lawyer tell me that to his great shock Columbia's attorney seems 'obsessed' and appears to think of me as 'the devil incarnate'. Within my philosophy, I have to see this as a compliment. There are those who agree. Yesterday a group of prominent performing women including Whoopi Goldberg discussed on TV that the more powerful a woman is, and the more intelligent and more accomplished she is, the more apparent 'hate' she creates. The highly visible case of Martha Stewart, right or wrong, was seen in this light. And the message was that good looks simply add more negatives to this mix. This tally with the reverse 'Pavlovain response' I have pointed out here.

I believe that Sex and the Ivy League is an important topic. In the era of the Knowledge Revolution, Universities play an important role in the marketplace of ideas. Old fashion systems and discipline are holding us back—but eventually change must take place and we must adapt to what society needs. This is what society needs: to make up for the change that is taking place in the comparative advantage of the two genders, compensating for the genetical mix we have inherited from the Stone Age. The comparative advantage that men have had over the ages, namely brawn, is becoming less important than knowledge and social skill. Here women have no handicap. Social evolution has to catch up with genetical evolution, and make up for the fact that our brains and bodies through human evolution are not fully reflecting the needs of today's world.

The 'glass ceiling' is the cutting edge in the role of women, in the world of ideas and the frontiers of thinking. Sex and the Ivy League is a critical topic because the 'glass ceiling' is an important problem for the cause of women. While we hear everyday of sexual harassment at all levels, the glass ceiling has particular importance because we need more role models. The problem right now is at the top, where more role models are needed. Women are able to enter in the lower ranks, but not able to go all the way up. The higher they go the more discrimination they face. This is where I believe my two reflections could help most. And it is where a somewhat bewildering but exhilarating future awaits us all. A future of gender equity at all levels. A dream world where one can create, produce, succeed and be useful without being punished for it. Dear reader, men and women alike, I hope to meet you there.

For more information, see also the websites www.chichilnisky.com, and www.sexandtheivyleague.com.

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