

Questions and Answers: Valentina Ferretti Interviews Tom Saaty

The following interview aims to stimulate the discussion about the key characteristics of Multicriteria Analysis techniques. In particular, the interview will work through the conceptual lens of decision processes taking place in the field of urban and territorial transformations.

Valentina Ferretti: Multicriteria Analysis was introduced during the 1960s in the field of Operation Research. More recently it went through an independent evolution, and it has now become a point of reference for many disciplines which are concerned with the analysis of decision processes. Which elements of Multicriteria Analysis make it possible for many disciplines to find consensus in its use? What is the relationship between Multicriteria Analysis and Operation Research? Has this relationship changed during the years?

Tom Saaty: *Let me answer this question by recalling my personal experience. In 1959 I wrote the first book about the mathematics used in Operation Research¹. About 10 years later, I was consulting for the Pentagon in Washington and the presence of trade-offs among the criteria in the project naturally led me to Multicriteria Analysis. Since Operation Research deals with optimization of one criterion, it is thus based on single criterion decision analysis.*

Since the 1970s, Multiple Criteria Decision Making (MCDM) research has developed rapidly, and has become a hot research topic because many complex practical decision problems involve multiple and conflicting criteria as well as multiple objectives. Therefore, over the past few decades a number of MCDM methods have been developed to deal with the measurement of tangible/intangible conflicting criteria and with the measurement of the alternatives of a decision with respect to these criteria. MCDM methods now have their own societies and their own journals and represent a consolidated field of research.

Both the AHP and ANP, the fields of multi-criteria decision making that I developed, are descriptive approaches to decision-making. They evolved out of my experience at the Arms Control and Disarmament Agency (ACDA) in the United States Department of State during the Kennedy and Johnson years. The reason why I was invited to join ACDA was probably because of the work I had done for the military using the mathematics of Operations Research.

A key aspect for the increasing the use of MCDM methods is that decision making is a central activity of all people; it is usually done so automatically that we do not even realize that we are doing it every moment of every day of every year for all our lives. This silent and inarticulate approach worked well for us when humanity was fragmented and individuals and groups of people could act on their thoughts without having to think of others very much.

¹ Saaty T. 1959. *Mathematical Methods of Operation Research (Dover Phoenix Edition)*. New York: Dover Publications.

Today, the world has become extended and interdependent and many of its resources are becoming scarce and valuable, including water, air, land, grains and vegetables and minerals. So now we have to work conscientiously together to choose our important courses of action. We have to justify these actions not only to ourselves but also to others, so we can live in harmony and with minimum conflict (Saaty and Sagir, 2012)².

We need to think and decide in bigger ways than ever before and in very general ways. Decision making today depends much on intuition, but it needs to be transformed into a dependable science. Nearly all of us have been brought up to believe that clear-headed logical thinking is our only sure way to face and solve problems. But experience suggests that logical thinking is not natural to us. Indeed, we have to practice, and for a long time, before we can do it well. Since complex problems usually have many related factors, traditional logical thinking leads to sequences of ideas so tangled that often the best solution cannot be easily discerned. Since we are concerned with real-life problems, we must recognize the necessity for tradeoffs to best serve the common interest. To be really useful, this process should also assist in building consensus and reaching compromises.

We need to make decisions that are both desirable and survivable, rather than simply ones that we like best, without regard to how effective or lasting they may be. Predicting outcomes plays an important role in making such choices.

I would suggest the following elements contribute to the increased use of MCDM methods: - it is simple to construct;
- it is adaptable to both groups and individuals;
- it is natural to our intuition and general thinking;
- it encourages compromise and consensus building;
- it does not require inordinate specialization to master and communicate;
- the details of the processes leading up to the decision making outcome are easy to review.

Valentina Ferretti: Evaluation criteria and elicitation of weights are issues that have been the focus of a broad debate within the scientific international literature, and numerous approaches have been proposed. In your opinion, what are the most critical aspects and drawbacks with regards to these issues? Does a trend line exist for research in this context?

Tom Saaty: *The first, and fundamental, step needed to develop a Multicriteria model is structuring the MCDM model. . To structure is to design and put together smaller components into larger ones and these again into still larger ones. Structure involves three ideas: wholeness, transformation and self-regulation. Structures give rise to the idea of formalization that concerns flows in the structure to fulfill certain functions designed to meet certain objectives of varying priorities. While the structure exists regardless of the*

² Saaty T, Sagir M. 2012. Global awareness, future city design and decision making. *Systems Engineering Society of China & Springer-Verlag Berlin Heidelberg*. 21(3): 337-355

flows within it, the flows themselves are dependent on the particular structure and need mathematics to describe them. Their description depends on the choice of the theoreticians involved (Saaty and Begicevic, 2010)³.

It is a highly demanding process of creative thinking and understanding to structure our problems and piece together the different ideas about what must be done, and is at least as important as (and can be far more complex than) performing the operations within a structure. We tend to think of structures as physical objects around us, but most structures are built in our minds for our own convenience to understand occurrences around us that are both physical and mental. Fundamentally structures are no less mathematical in nature than are operations and transformations that take place within them, but as yet we are not as sophisticated in dealing with them (Saaty and Shih, 2009)⁴.

In the field of decision making, creating a structure is the first step in organizing, representing and solving a problem. A structure is a model, an abstraction of a problem. It helps us visualize and understand the relevant elements within it that we know from the real world, and then use our understanding to solve the problem represented in the structure with greater confidence.

Determining the factors that are the criteria and the way they are put together into a structure that influence the decision is a very demanding task. When we have a problem, and feelings and ideas that need to be expressed in a certain way, we often have difficulty with how to put them all together and connect them in an appropriate way to represent the causes and effects of the problem. To formulate an initially unstructured decision problem, we attack it by assembling its elements into sub-hierarchies, each sub-hierarchy dealing with a part of the problem. Then we arrange them into a single overall hierarchy in decreasing order of influence. A hierarchy is a structure for organizing influences from sources to sinks, so that each element in a level of the hierarchy, except for the single top element known as the goal of the decision, is subordinate or is a sub-criterion of an element immediately above. A major purpose of structuring hierarchies in decision making is to make it possible to compare the importance of the elements (criteria and alternatives) in a given level with respect to the elements in the level above, and to derive priorities from the judgments expressed numerically. A hierarchy is a special case of a network with connections that go only in one direction. A network has clusters of elements, with the elements in one cluster being connected to elements in another cluster (outer dependence) or the same cluster (inner dependence). Hierarchies and networks occur abundantly in personal life, in businesses and corporations, and in government strategy, public policy, the health care

³ Saaty T. and Begicevic N. 2010. The scope of human values and human activities in decision making. *Applied Soft Computing*. 10(4): 963-974.

⁴ Saaty T. and Shih H.S. 2009. Structures in decision making: On the subjective geometry of hierarchies and networks. *European Journal of Operational Research*. 199, 867-872.

industry, military strategy, non-profit organization strategy, planning and so on (Saaty and Begicevic, 2010)⁵.

There are two important requirements that a structure must fulfill:

- It must be logical in identifying and grouping similar things together.*
- It must be complete, with nothing left out that has an important influence.*

No matter how a structure is validated, group participation with knowledgeable people is a good way to ensure its logicality and completeness. This type of thinking is a complex mental process involving cognition, pattern matching, associative memory and knowledge, judgment, comparisons, and imagination. To find a good structure and to identify a new alternative which is a possible way to act imagination, one of our most treasured attributes, can be extremely helpful to overcome our psychological inertia and expand the solution space so that some creative ideas can be generated.

Creative thinking and decision making thus work together very closely. To make a decision one needs creative thinking, at least to design a structure of the factors in the decision. And to think creatively one needs to make a variety of decisions to be able to proceed in depth and breadth, knowing what to include and how and where to include it. For greater details about such considerations the reader might consult my book about creative thinking and problem solving⁶.

Following this reasoning, establishing the structure may be considered more of an art than a science. Once one has the structure, it becomes easier to convey to others the influences which drive that decision. All possible factors should be included in the structure. All sides to the discussion should be able to include the factors they feel appropriate. Later, the process of prioritization by the different stakeholders will weed out the unimportant or irrelevant factors and can be given appropriate weightings and then combined with the positions of the majority.

Because decision-making is the most frequent activity of all people all the time, the techniques used today to help people make better decisions should probably remain closer to the biology and psychology of people than to the techniques conceived and circulated at a certain time. These are likely to become obsolete, as all knowledge does, even though decisions go on and on forever. This suggests that methods offered to help make better decisions should be closer to being descriptive and considerably transparent (Saaty, 2005)⁷. Trade-offs will always exist between economic development, in the material sense, and the welfare of society and environment.

⁵ Saaty T. and Begicevic N. 2010. The scope of human values and human activities in decision making. *Applied Soft Computing*. 10(4), 963-974.

⁶ Saaty T. 2001. *Creative Thinking, Problem Solving and Decision Making*. Pittsburgh, PA: RWS Publications.

⁷ Saaty T. 2005. *The Analytic Hierarchy and Analytic Network Processes for the Measurement of Intangible Criteria and for Decision-Making*. Chapter 9, pp.345-407 in *Multiple Criteria*

Comparative or relative judgments made on pairs of elements to ensure accuracy are a great help in this direction. In paired comparisons, the smaller or lesser element is used as the unit, and the larger or greater element is estimated as a multiple of that unit with respect to the common property or criterion for which the comparisons are made. This approach involves breaking the problem down into finer and finer parts, so that one is called upon to give a judgment comparing only a pair of issues in each judgment. This avoids mixing too many aspects of the problem and not knowing what goes with what to obtain the final answer.

Valentina Ferretti: A further element of discussion with reference to the structuring phase of a decision problem and to the definition of a coherent family of criteria, concerns the possibility of interaction among the criteria being identified. This issue is the subject of a broad debate from which very different points of view seem to emerge. Could you share with us your vision with reference to this issue?

Tom Saaty: *Interdependence is a very important subject in decision making. You should use methods that take it into account. If we think about it carefully, everything can be seen to influence everything else including itself, directly or indirectly, according to many criteria. The world is far more interdependent than we know.*

The concept of a network is useful in helping us to portray the complex relations of real-world problems. There are many examples of networks in transportation, computer science, neurology, operations research, flow problems, business, and marketing, and in human society.

The ANP which uses network structures is a logical way to deal with dependence. By freeing us from the burden of ordering the components in the form of a directed chain as in a hierarchy, The ANP frees us from the burden of ordering the components in the form of a directed chain as in a hierarchy and rather represents any decision as a directed network. This allows the structure to develop more naturally and closer to what actually happens in the real world (Saaty and Vargas, 2006)⁸.

Valentina Ferretti: Since currently the trend focuses on participative design and planning processes, a crucial element for decision processes taking place in the context of territorial transformation assessment is the presence of multiple stakeholders with different values and conflicting objectives. What relationship exists between the need to include different stakeholders in the decision aiding process and the available mathematical tools? What are the most suitable modalities of participation to facilitate an effective interaction

Decision Analysis: State of the Art Surveys, edited by J. Figueira, S. Greco, and M Ehrgott, Springer (2005).

⁸ Saaty T. and Vargas L.G. 2006. *Decision Making with the Analytic Network Process: Economic, Political, Social and Technological Applications with Benefits, Opportunities, Costs and Risks*. New York, New York: Springer's International Series.

between the analyst and the stakeholders, and to generate collective learning effects?

Tom Saaty: *If the MCDM method satisfies the requirements that I suggested while answering the first question, then one of the most important applications of Multicriteria Analysis is to support participative processes and conflict resolution problems. To be applied to conflict resolution a method must provide a way for each conflicting party to evaluate the costs and risks of giving up some of what it has, in return for the benefits and opportunities for getting what it wants from the other party.*

Let me recall in this context my professional experience with the Israeli-Palestinian conflict⁹. This conflict is not a single isolated problem to be solved, but a system of people with conflicting aspirations. Physically, the problem is geographic with two parties desiring the same piece of land, but its origins are deeply rooted in people's history and beliefs and in their attachment to a land consecrated by their great religions.

Despite the best efforts of diplomats and world leaders over a period of more than sixty years, a satisfactory resolution has not emerged. What we suggested and used is a holistic model that explores feedbacks from various criteria and input from key constituents. Over a 3-day period, the panel, comprised of three to five representatives from each side, structured the problem, defined the constituents and developed several potential alternatives. The process was not without conflict and negotiation of its own. At times, the panel differed on various definitions, on the structure of the model, and on the potential solutions. However, there was nearly always unanimous agreement on the nature of the conflict, with little debate within either side about the underlying concerns or where the power and influence belonged that could bring about termination of a 66-year old confrontation. Similarly, there was practically no problem in identifying the key constituents.

In the context of participative decision processes, the following aspects are of fundamental importance:

- *Detailed and advanced planning of resources (in terms of time, budget, places, number of actors, etc.);*
- *Inclusion of a moderator to facilitate the process and ensure that all parties agree before moving on to the next step in the process;*
- *A knowledge that language and understanding matter;*
- *Use of visualization tools (to ensure mutual understanding);*
- *Interpretation of the result, not just as a set of numbers produced by the model, but as a road- map and learning process for all the actors.*

Valentina Ferretti: Another crucial issue for the development of a Multicriteria Analysis approach concerns the modeling and management of uncertainty. This issue is particularly undeniable for applications within the

⁹ Saaty T. and Zoffer H.J. 2013. Principles for implementing a potential solution to the Middle East conflict. *Notices of the AMS*, 60(10), 1330- 1322.

field of territorial transformation projects where both quantitative and qualitative data are characterized by high levels of uncertainty. Within our discipline, we usually use sensitivity analysis more often than robustness analysis. Could you share with us your vision with reference to the different aspects of this issue?

Tom Saaty: *I propose three approaches to deal with uncertainty which are not mutually exclusive.*

1. In any decision one expects to consider favorable and unfavorable concerns. Some concerns are sure things while others are less certain but have a likelihood of materializing. The sure concerns are called Benefits and Costs, while the uncertain concerns are called Opportunities and Risks. We refer to the four concerns collectively as BOCR. For each of the four BOCR merits we have a system of control criteria that we use to assess influence. The result is that such control criteria and/or their subcriteria serve as the basis for all comparisons made under them, both for the components and for the elements in these components.

2. Sensitivity analysis is the way to test the stability of the outcome. This is a widely used method for quantitative model assessment in many disciplines in order to validate the feasibility, robustness, and reliability of a model or a method. Sensitivity analysis refers to the study of how the uncertainty in the output of a mathematical model or system (numerical or otherwise) can be apportioned to different sources of uncertainty in its inputs. To practitioners, it is most important to understand the sensitivity of a model's outputs to simultaneous variations in several parameters. Sensitivity analysis is thus a way to predict the outcome of a decision if a situation turns out to be different compared to the key prediction(s). Therefore, an MCDM method should be capable of assessing the stability and validity of outputs to imprecise values for the variant values of some of the model's parameters.

3. When we create a structure to make a decision we assume that the decision maker needs to know all the important factors that go into that decision, but that may not always be true. In making a decision we learn that there can be factors inadvertently left out that could have led to a different outcome. There are many factors that influence outcomes in decision making, and these factors may straddle the spectrum of possibilities from very low to very high. We often impatiently assume that we can reduce the diversity of factors to only a few—what we at a given time consider to be the important ones. But in real life, there may be numerous not-so-important determinants of an outcome, and these low-priority determinants could collectively be very influential in shaping a decision. A serious weakness in decision making to date is the mixing and reduction of all factors into the few that one habitually assumes to be the important ones. We propose the use of the concept of “other” as a

criterion to complete a set of criteria with an expert giving the judgments that would help give closure to the question of the uniqueness of ranking¹⁰.

Valentina Ferretti: It is interesting to think about the historical evolution of Multicriteria Analysis techniques. These methods were introduced in business-oriented contexts characterized by a data-driven approach, while recently they have started to attract increasing interest in the context of public decision processes, which are usually more value-driven. In your opinion, how is Multicriteria Analysis trying to adapt in order to cope with this growing need?

Tom Saaty: *Multi-decision problems bring us head-on to the question of ordering our values, a subject in order topology and not in metric topology. Values are enduring guides for establishing priorities for activities to enable us to best apply our mental and physical resources to obtain the greatest overall benefit. We use values to relate and interpret everything that we learn and experience. They are the focus around which our thinking revolves. Value is an anchor that binds our energies, our thoughts, and our actions. In a sense, our values are us. They are not something abstract and eternal. Many people believe that value theory, which is so fundamental to decision-making, is the most important area in philosophy.*

All religions and most philosophical movements have been concerned with value theory to some degree. In philosophy, value theory, or axiology, concerns itself with the notion of goodness. There are two categories of goodness: ethics, concerning the morally good, and aesthetics, concerning the artistically good, or the beautiful. Value theory also concerns social goodness, and considerations that are of such great importance in economics and political science. Value defines “good” and “bad” for a community or society. It affects everyone’s life—maybe all life forms and not just people (Saaty, 2007)¹¹. The interested reader is referred to K. Baier and N. Rescher for a comprehensive list of values¹².

Valentina Ferretti: Traditionally, the assessment of public policies and projects has developed based on a mono-criterion approach (for instance, the Cost Benefit Analysis). More recently, assessment procedures have started to make use of Multicriteria Analysis techniques that are able to take into account the multidimensionality of the systems under evaluation. What is, in your opinion, the relationship between these two approaches? Does a complementarity exist? Does a substitutability exist? Is it a matter of merging one tool into the other?

Tom Saaty: *With reference to the relation between Multicriteria Analysis (MCA) and Cost Benefit Analysis (CBA), I would like to say that both*

¹⁰ Saaty T. and Ozdemir M. 2006. The unknown in decision making: What to do about it. *European Journal of Operational Research*, 174, 349-359.

¹¹ Saaty T. 2007. Multi-decisions decision-making: In addition to wheeling and dealing, our national political bodies need a formal approach for prioritization. *Mathematical and Computer Modelling*, 46, 1001–1016.

¹² K. Baier, N. Rescher (1969). *Values and the Future*. New York: The Free Press.

approaches have pros and cons. The direction of research in this context should move towards possible integrated approaches that are capable of fostering synergies and stimulating innovation. With particular reference to territorial transformation evaluation, MCDA presents some key advantages over CBA:

1. Environmental decision making is characterized by multiple conflicting objectives. In this context, MCDM methods support multi-stakeholder interactions in making trade-offs between different objectives explicit. MCDM thus supports negotiation and interactive learning processes while reducing the problem to a single monetary value as is done in CBA which loses important information.

2. MCDM avoids the necessity of placing a monetary value on every aspect involved in the decision. As a result, it avoids a range of theoretical and practical shortcomings (i.e. mental account biases such as the elicitation of the Willingness to Pay from one environmental good in isolation from other goods and aggregation biases such as the choice of the appropriate population and time period as well as discount rate).

Valentina Ferretti: Within the field of environmental sustainability assessments, it is often necessary to take into account qualitative criteria that are not easily monetized. We can think, for instance, about the assessment of the quality of the landscape, the historical/architectural value of a public good, etc. Usually, the evaluation of these aspects makes use of symbolic matrices that give rise to strong critiques due to the inherent subjectivity of the evaluation approach. What is, in your opinion, the best way to deal with intangible aspects?

Tom Saaty: *The word intangible is most commonly used to describe things that are recognized but not easily quantified or measured. The challenge is how to deal with the measurement of intangible factors that arise in order to make tradeoffs with the other tangible factors when both benefits and potential benefits, costs and potential costs are involved. The solution is to make pairwise judgments, using a 9 point fundamental scale¹³, which represents the normal range of human sensitivity to phenomena that are homogeneous. The numbers used in this scale are absolute and not ordinal numbers. To say that one thing is five times more important than another, which is what it means to use the number 5 from the fundamental scale, is a much stronger and more meaningful statement than to just assign an arbitrary number to it. A number from the fundamental scale can thus not be changed to another number and still convey the same sense.*

To deal with intangibles scientifically, we thus have to pairwise compare them to derive the relative priorities. Making comparisons is our biological heritage. It was there long before measurement scales were invented with their

¹³ Saaty T, Sagir M. 2012. Global awareness, future city design and decision making. *Systems Engineering Society of China & Springer-Verlag Berlin Heidelberg*. 21(3), 337-355.

arbitrary units, and gradually used in science to develop scientific theories about the physical universe.

The intuitive idea behind the AHP¹⁴ is exactly this. The fundamental scale AHP uses is comprised of absolute numbers derived from stimulus-response theory to quantify judgments in making reciprocal pairwise comparisons of elements in a matrix as to dominance with respect to a given property.

Valentina Ferretti: The evaluation procedure that should accompany the design/planning process after the very first structuring and judging steps, in order to support defining objectives to be pursued and generating alternative options is another very important aspect in our discipline. How can such a procedure be structured, in your opinion, in order to cope with this need and be integrated in a virtuous design/planning cycle?

Tom Saaty: *In my opinion, there are four fundamental aspects to which we should pay particular attention when structuring the decision aiding process:*

1. Detailed and advanced planning of the whole process with reference to the people involved (Who to invite? How many people?,) the resources that are needed (Who is going to fund the process?), the allocation of time, the location, the means to support the activities, etc.

2. A balanced group of experts (not only technicians, but also people from society and politics).

3. Promoting the engagement of the participants by always keeping them updated and periodically verifying that everybody has the same understanding of the problem under consideration.

4. Ensuring justification (of consequences, of the procedure and of the approach)

Valentina Ferretti: Given the increasing interest in Multicriteria Analysis from different disciplines, which aspects should young researchers and practitioners pay more attention to in the near future? What are, in your opinion, the new frontiers of research in decision science?

Tom Saaty: *Speaking about future directions for research I have two interesting suggestions for young researchers and practitioners.*

Most of the factors that determine the structure of a decision depend largely on the feelings and memories of the decision makers, and that leaves room for doubt about the completeness of most decisions. Decision makers would be helped by having a general well-researched list of factors available for some of their complex decisions in order to have greater assurance that their

¹⁴ Saaty, T.L., 1990. How to make a decision: The analytic hierarchy process. *European Journal of Operational Research*, 48 (1), 9–26.

decisions are comprehensive and right. To do that, they need wide exposure and familiarity with the full spectrum of human values and environmental opportunities¹⁵.

There have been two major attempts to document the structure of more than a thousand kinds of decisions in the AHP/ANP classified according to their area of application. There are two dictionaries of hierarchies. The first, the Hierarchon¹⁶ and the new forthcoming Hierarchon of 2014 are books of many examples of hierarchically structured decisions that descend from a goal through criteria, sub-criteria, actors, diverse kinds of influences wielded by the actors, groups affected, their objectives and the alternatives of the decision. The two-volume Encyclicon¹⁷ deals with decisions with dependence and feedback.

But these are only a beginning because we need lists of attributes and areas of human enterprise so that governmental, regional, group and individual decision makers can have greater assurance about the completeness of their factors. Although what we have here has been the subject of a great deal of research by numerous people over a period of 80 years, it is certain that it still needs further elaboration and debate to broaden its scope. There is thus still much more work to be done on the subject of structures in decision making and what should go into them. Moreover, there remains the question of the classification of policies and alternatives, a concern that has not yet been dealt with systematically in the field of decision making.

The second line of research that I foresee concerns the environment of the future, our future cities. Over the next thirty years, two thirds of the world's projected close-to-10-billion population is expected to live in urban locations. This mass migration to cities creates a significant challenge for city planners as they work to create a sustainable infrastructure to support the vast population growth, whilst being sensitive to the preservation of cultural heritage and historic landmarks as well as existing structures already shaping the development of the dense conurbation. Ensuring that environmental awareness and protection, economic growth and social wellbeing also remain at the heart of a city's urban strategy is also paramount to success. The future thus requires better planning and design of our world and a scientific way of making decisions that includes all of us in the judgment process and not simply the elite among us.

Why do we need to design our future cities in harmony with the changes that occur and the necessary sustainability to meet the requirements of a better future? What responsibility do we have to future generations? We have the responsibility to leave the environment in as healthy a condition as that which we inherited it. We need to respect the balance of nature's ecosystems when

¹⁵ Saaty T. and Begicevic N. 2010. The scope of human values and human activities in decision making. *Applied Soft Computing*. 10(4), 963-974.

¹⁶ Saaty T. and Forman E.H. 1996. *The Hierarchon: A Dictionary of Hierarchies*. Expert Choice.

¹⁷ Saaty T. and Cillo B. (2007). *The Encyclicon Volume 2*. Pittsburgh, PA: RWS Publications.

we use its resources, and also consider ending illegal and destructive logging, destructive fishing and polluting industries. We also need to take a look at our lifestyles and consider the things which may contribute to climate change.

The past we inherit; the future we create, the saying goes. To create a credible future that is founded on our global values and priorities we need to learn how to deal with the immense variety of factors and with the expanse of the many dimensions of this variety. Our progress depends on our ability to make effective decisions that depend on one another in their causes and effects, on inputs and outputs and on being able to reach out to the smallest and largest causes and effects of which we are aware.

In this context a fundamental role is played by the design of alternative future cities. The research trend that I foresee is thus about MCDM in supporting the design of better cities and a better environment for the future, in the effort to shrink the world to building the collective mind of the inventive species, homo-sapiens.