Mario Alai · Marco Buzzoni
Gino Tarozzi *Editors*

Science Between Truth and Ethical Responsibility

Evandro Agazzi in the Contemporary Scientific and Philosophical Debate

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Preface

This volume is a tribute to Evandro Agazzi and his work by Italian and international scholars, former direct or indirect pupils, friends, colleagues or associates who esteem him and are grateful to him for long years of discussions, advice and fruitful philosophical exchanges. These essays were first presented at the international congress "Science Between Truth and Ethical Responsibility. Evandro Agazzi in the Contemporary Philosophical and Scientific Debate", held in Cesena and Urbino (Italy) from 22 to 24 April 2014. That congress, like this volume, intended to celebrate his 50 years of academic activity, by offering a systematic study and critical discussion of his many and often pioneering contributions to a wide spectrum of philosophical issues.

Agazzi constitutes an extraordinary example of rigorous and original thought, successful professional leadership and organizing capacities at the international level. His teaching spans widely on scientific knowledge, its nature, limits and requirements, as well as on the connected questions of ethical responsibility, on its anthropological presuppositions and metaphysical backgrounds. The exemplar clarity of his explanations and lectures helped us and many others to see their own way into these difficult problems and to progress along directions he has indicated or suggested.

The papers collected here express, each in its own way, admiration and gratitude for his work, in the conviction that paying homage to a great philosopher means analysing, interpreting and disseminating his ideas, but even more importantly critically discussing them and taking advantage of their fecundity as a starting point for further advancements in the field.

Evandro Agazzi graduated from the Catholic University of Sacred Heart in Milan, under the supervision of Gustavo Bontadini. He then studied physics at the State University of Milan, philosophy of science in Oxford and mathematical logic in Münster. After becoming "libero docente" in philosophy of science and in mathematical logic, he taught various disciplines, both scientific and philosophical, in a number of universities (sometimes even simultaneously): those where he lectured for longer periods are the Catholic University in Milan, the University of Genoa, the Superior Normal School in Pisa, the Università Vita Salute San

Raffaele in Milan, the University of Fribourg (Switzerland), the Universidad Autònoma Metropolitana in Mexico City and the Panamerican University in Mexico City. In these and other universities he gave courses in philosophy of science, theoretical philosophy, philosophical anthropology and philosophy of nature, as well as mathematical logic, advanced geometry and complementary mathematics.

The development of Agazzi's philosophy is clearly explained and related to its historical context by Fabio Minazzi's article "Evandro Agazzi Philosopher. An overview". But at the same time Agazzi was also very active as an editor, organizer and cultural leader: in Italy, in 1978, he founded the journal *Epistemologia. An Italian Journal for the Philosophy of Science*; soon thereafter, for the publisher Franco Angeli in Milan, he started the collection "Epistemologia"; he then chaired the Centre of Studies on Contemporary Philosophy of the Italian National Council of Research; he became president of the Italian Philosophical Society and of the Italian Society of Logic and Philosophy of the Sciences. Furthermore, he chaired the most important international philosophical societies and academies: the International Academy of Philosophy of Sciences (from 1978 to now); the International Federation of Philosophical Societies (as president from 1988 to 1993, then as honorary president); and the International Institute of Philosophy (as president from 1993 to 1998, then as honorary president).

Agazzi's earliest researches concerned the foundations of mathematics and logic, on which he wrote *Introduzione ai problemi dell'assiomatica* (Agazzi 1961) and *La logica simbolica* (Agazzi 1964). He rejected a purely formal viewpoint, holding that what human thought can discover or "see" in these areas exceeds what can be proved (Agazzi 1961, p. 199). An "eidetic meaning" is needed not just for interpreting a formal system, but also for laying down the composition and transformation rules, since we must understand what they prescribe. This already sets clear limits to the possibilities of artificial intelligence, as he argued in later works (Agazzi 1967, 1981a). These ideas have been further developed and systematically argued for in his recent book *Ragioni e limiti del formalismo. Saggi di filosofia della logica e della matematica* (Agazzi 2012).

Empirical sciences, however, represent the main subject of Agazzi's vast philosophical enquiries. Here he always held that science can aim at truth in the realist sense, avoiding both the Scylla of scepticism on the possibility of reaching the truth, and the Charybdis of the dogmatic illusion that truth has already been completely achieved. A key role is played in this respect by his distinctions between reality and objectivity, and between two senses of objectivity: as in-principle intersubjectivity and as reference to the object. On the one hand, he notices that the agreement among people about cognitive content does not hinge on their "private" data, but on the public actions they perform. On the other hand, operations constitute the specific "objects" of each particular discipline. Thus, the very conditions that define a science by structuring its proper objects also provide intersubjective knowledge of those objects (Agazzi 1969, Chap. 10, 2014, Chaps. 1 and 2).

More recently, at least since the volume *Il bene il male e la scienza* (Agazzi 1992 [2004]) and up to *Scientific Objectivity and Its Contexts* (Agazzi 2014),

Agazzi has studied scientific objectivity in its relations to the social reality, from a system theoretic viewpoint: the scientific-technological system is fully autonomous as to its cognitive value, but it is an "open adaptive social system", interacting with other social systems; as such, it cannot just aim at maximizing its own internal goals, but must respect the constraints provided by different systems, such as the economic, political or energetic system. Among them, it must also respect the system of moral norms and values.

These central issues in Agazzi's philosophy are discussed by many contributions to the present volume. The main features of his general philosophy of science are analysed by Craig Dilworth ("The Perspectivist Conception of Science"), Marco Buzzoni ("Science and Operationality"), Mario Alai ("The Issue of Scientific Realism"), Vincenzo Fano and Giovanni Macchia ("Scientific Progress and Verisimilitude").

On the basis of this general theoretical framework, over the years Agazzi has carried out special researches on a number of particular issues. Some (though not possibly all) of them are accounted for by other papers of this volume. To begin with, he has offered important contributions to the foundations of the special sciences: contemporary physics, in particular quantum mechanics (discussed by Gino Tarozzi's "Philosophy of Physics"); mathematics, (a subject explored by Marco Borga's "Foundations and Philosophy of Mathematics"); artificial intelligence (analysed by Mariano Bianca's "Artificial Intelligence"); sociology (the topic of Giuliano Di Bernardo's "From Physics to Sociology"); and education (accounted for in detail by Giuseppe Bertagna in "Between Education and Pedagogy").

According to Agazzi, the requirements of objectivity and rigour, characteristic of the natural sciences, can be satisfied also by the human sciences, since they are independent of quantitative methods. Besides, deductive rationality must be supplemented by argumentative and hermeneutic rationality (Agazzi 1979). Furthermore, when it comes to the psychological and pedagogical sciences, a key role is played by the principle of dignity of the human person. Agazzi devoted long reflections to this principle and to pedagogical theories, and he founded and directed for many years *Nuova Secondaria*, the main Italian journal for high-school teachers and administrators.

Of course, he developed his philosophy of science in connection with deep considerations on other closely related philosophical disciplines, which are the focus of a third group of contributions: Pierluigi Graziani's "Philosophy of Mathematics and Logic", Antonio Livi's "The Issue of Alethic Logic", Jure Zovko's "Interpretation and Hermeneutical Judgement" and Carlo Penco's "Philosophy of Language".

But philosophy of science cannot be detached from an even wider theoretical horizon, including the anthropological, historical and more widely cultural dimensions of science, and Agazzi's philosophical contributions span over all of them. Anthropology is dealt with in "Philosophical Anthropology", by Matteo Negro; the historical and complex dimensions of science are discussed by Giuseppe Gembillo in "Science, Historicity and Complexity"; the strict relations between philosophy and history of science is the subject of Flavia Marcacci's "Epistemology and History

of Science"; and the cultural and intercultural dimension of philosophy is the topic of the essay ("Contributions to Latin American Philosophy") in which Lourdes Velàzquez examines the impact of Agazzi's thought in shaping the philosophical landscape of a whole continent.

A further decisive dimension of science is the ethical one, which is also presupposed by (and presupposes) anthropology, education and history. To ethics Agazzi has dedicated a great amount of work in recent years, variously dealing with the moral issues raised both by science and technology as human practices (ethics of science and technology), and by the ever more advanced forms of control and intervention on human and animal life that scientific and technological progresses make possible (bioethics). His contributions to the former area are examined by Boris Yudin in "Ethics of Science and Technology", and Alfredo Marcos in "The Autonomy of Science in a System Theoretic Approach".

There is a bidirectional relation between science and technology on the one side and ethics and anthropology on the other. On the one hand, in fact, as noticed above, science and technology are an "open adaptive social system", which must harmonize with other social systems, including the system of moral norms and values (Agazzi 1992 [2004], Chap. 14). On the other hand, however, both the natural and the human sciences are involved in the justification of moral norms and values.

Unlike the natural world, mankind and its activities are characterized by the ought-to-be. Values are projections of the ought-to-be, i.e., "the ideal models which work as regulative parameters for human operations, performances and actions" (Agazzi 1992 [2004], p. 127). In turn, values are justified through an "image of the human nature": this image is based on biology, psychology, sociology, psychoanalysis, etc., and it should offer a plausible model for human behaviour and actions. This is not falling into the naturalistic fallacy of deducing "ought" from "is", but acknowledging that "it is rational to demand that man behave in accordance with his own constitutive conditions, and accepting the contrary, even if it could be done, would not be rational" (Agazzi 1981b, p. 18).

According to Agazzi, a ground for ethical norms shared by different cultures, religions or philosophies can be provided by the already mentioned principle of human dignity. Consciousness is the *proprium* for human persons, which people can and ordinarily do have; but since it is not a substantial feature, it can be acquired or lost, but persons do not cease to be human when it attenuates or vanishes. Hence, the deprivation of this property cannot become a reason for discrimination (see Agazzi 1992, pp. 28–39, 1992 [2004], Chap. 10). These and other issues concerning the relationships between ethics and the biological sciences are discussed in Gonzalo Miranda's essay "Bioethics".

Finally, any philosophical discussion of science must be set on the background of the most general and encompassing attempts to understand reality, i.e. metaphysics and religion. These are the subject of Paolo Musso's "Metaphysics and Ontology" and Juan José Sanguineti's "Religious Faith, Natural Science, and Metaphysics". In particular, for Agazzi, although metaphysics is a "brief" discourse, it is a necessary presupposition of scientific knowledge. Besides, science

cannot substitute nor limit the autonomy of religious faith, for the latter answers questions which science, by its own nature, cannot address.

As mentioned at the beginning, the best homage we can pay to an authentic master of thought, besides knowing and interpreting his or her ideas, is establishing a critical dialogue with them. This too is something we learned from Agazzi, from his attitude towards his own teachers, Gustavo Bontadini in the first place: for he was able to learn from them, with humility, deep respect and gratitude, and at the same time to become an original and intellectually independent thinker.

True dialogue may become easier, *as a matter of fact*, when some basic philosophical assumptions are shared; but *in principle,* it requires above all keenness in the quest for truth and disposition to critical (and self-critical) thinking. The two must always go together, but can be declined in the most different ways, depending on one's personality, background and attitudes. They can elicit objections on particular claims or doubts on basic assumptions; suggest alternative but complementary perspectives; allow to develop cues in the master's ideas, or draw from his or her teaching original and autonomous research strategies. In all of these senses, each of the contributors to this volume can be considered a pupil of Evandro Agazzi and indebted to his research in philosophy.

While this work originates from the desire to acknowledge these debts, and to honour so many years of academic activity and philosophical *paideia* by Evandro Agazzi, it could not have been thought of and published without the patronage and financial help offered by various institutions: thus, we gratefully thank the University of Urbino "Carlo Bo" (*Centro Interuniversitario di Ricerca in Filosofia e Fondamenti della Fisica*—CIRFIS), the Department of Basic Sciences and Foundations of the University of Urbino—*DiSBeF*; the University of Insubria, Varese (*Centro Insubrico "Carlo Cattaneo" e "Giulio Preti"*); the University of Macerata (*Dipartimento di Studi Umanistici*); the University of Messina (*Centro Studi di Filosofia della Complessità* "*Edgar Morin*"); the National Academy of Sciences, Literature and Arts of Modena; the City of Cesena; and the International Academy of Philosophy of Sciences.

Cesena, Genova, Bologna
December 2014

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Evandro Agazzi Philosopher

An Overview of His Thought

Fabio Minazzi

Abstract The paper outlines an overall picture of Agazzi's philosophical thought and of its coherent development. In fact, in the beginning Agazzi worked on epistemology, and in particular on the philosophy of mathematics. Then he was led to consider science from a more general and systematic point of view. Thus, reflecting on science and its cultural value, Agazzi's research broadened again its scope, taking into account the links between science, technology and society. But this brought him to analyze the relationships between scientific knowledge and moral reflection. In turn, such a critical survey of the interplay of science and morality required a study of the possible connections between human knowledge and a properly metaphysical dimension. In this last field Agazzi has always referred to the tradition of Western thought, using the method of *analogical discourse* to construct his metaphysical discourse. Finally, Agazzi has just published a book devoted to the problem of the *objectivity* of science, but more in general of human knowledge: a work which rounds up his reflection, highlighting its internal coherence and critical potentialities.

1 From the Aristotelian Categories to the Kantian Critical Trichotomy?

On the occasion of the presentation, at the University of Genoa, of the challenging and complex "encyclopaedic" volume *Filosofia, Scienza e Bioetica nel dibattito contemporaneo. Studi internazionali in onore di Evandro Agazzi* (which I organized, edited and published in Rome, 2007, in the prestigious series of the Presidency of the Italian Council of Ministers, see Minazzi 2007a), Carlo Penco shrewdly observed

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that, to speak comprehensively and coherently of Agazzi's work and thought, one might properly invoke the celebrated Aristotelian categories of *quantity*, *quality*, *relation* and *modality*. As analytically shown by the first systematic and chronological bibliography of Agazzi's output (which significantly concluded the volume mentioned above[1]), the "quantity" of works produced by him, in a life of intense labour, is truly extraordinary. In fact, by exploring Agazzi's *works and days* one discovers that his life has been configured, first and foremost, as a constant effort and unflagging commitment to research, study and reflection, which has left a highly significant mark in his publications (more than a thousand in the period between 1955 and 2006, though his activity has also been pursued steadily until today). The arithmetic and aseptic average of some dozen publications a year records this methodical work unfolding from the years of his university education to those of his maturity. But in addition to the *quantity* of this production we have also to bear in mind, naturally and most importantly, its intrinsic *quality*, with the output over time of works that have had a profound impact on the Italian epistemological research as well as in the context of the international debate. Indeed the many languages which Agazzi has used in the course of his life to present his thoughts are always closely intertwined, giving rise to a very significant international presence. This is, of course, hardly the place to retrace Agazzi's extraordinary career in teaching and research, his work as a visiting professor (which has taken him to a number of European and American universities), or his intense activity as a lecturer (which has taken him to almost every continent and many countries in Europe, Asia, the Middle East, Africa, North America and Latin America). Not to mention the numerous academic appointments and positions in Italian and foreign scientific associations, or his widely varied editorial responsibilities, the numbers of awards, accolades and honorary degrees he has received and much else. However, precisely the admirable sum of these appointments and all these different cultural and editorial responsibilities helps us to better understand not only the specific *quality* of his scientific work, but also the distinctive nature of the multiple international relations that Agazzi has succeeded in forming and building in the course of his scientific and philosophical research. Therefore, speaking of Agazzi is speaking of a philosopher who has always placed himself in an *international* context, up to the point that his cultural presence abroad has come to be even more significant than his presence in the Italian context, where he has worked well for an entire academic life. Last but not least, precisely the consideration of the *intrinsic quality* of his multiple international relations enables us to finally clarify Agazzi's *modality* of "doing philosophy". This modality has always been that of a dialogue and debate at the highest international level, in exchange with the chief interlocutors of the different traditions of thought in the different continents. Penco was thus right to evoke the celebrated Aristotelian categories in presenting a concise and unified overview of Agazzi's work, because the *quantity* of his publications, their intrinsic *quality*, as well as the many international *relations* and the specific *modalities* with which Agazzi has made, step by step, his intellectual journey, in their

[1]See Minazzi (2007b: 1351–1402).

problematic and dynamic whole, constitute a sparkling jewel and an extraordinary cultural polyhedron that is noteworthy for its intrinsic theoretical, purposeful and organizational texture.

However, without denying the heuristic interest of this Aristotelian reference, I think that to grasp dynamically the same qualitative as well as quantitative growth in Agazzi's work, it is perhaps appropriate to follow another suggestion, that which Immanuel Kant delineated in the final pages of his *Critique of Pure Reason*, where he notes how, in the last analysis, the fundamental questions that man must seek to answer by philosophical reflection are basically only three: *What can we know? What ought we to do? What may be hoped?* Three seemingly "simple", and perhaps even "banal", questions but from which arises a powerful *critical trichotomy* that Kant develops within his innovative and fruitful perspective of transcendentalism. For this particular reason the domain of *knowledge* concerns, according to Kant, the descriptive and prescriptive order of scientific objectivity and cognitive truth (that is, the nature of human knowledge), while the question concerning *duty* makes reference to the prescriptive and legal order of ethical correctness, and the normative rules which assume, in society, the form of our particular moral duty; finally *hope* refers to the self-reflexive order of emancipation and authenticity, precisely the teleological order inserted and rooted in the world of praxis. As I have illustrated in my book devoted to the *Teleology of Knowledge and Eschatology of Hope*,[2] this fruitful Kantian critical trichotomy configures, for the whole of Europe and in general for human civilization, a complex and highly articulated philosophical and civil project, in which *knowledge* and *freedom* constitute two different yet intertwined terms in a *single movement of social self-emancipation*. Its driving force is precisely that historical utopia that, in the form of hope, is the keystone of this dynamic and always open-ended tension, between the critical increase of knowledge and the gradual broadening of the civil legacy of freedoms and human rights. This Kantian critical trichotomy, however, went into crisis with the Hegelian and Romantic turning-point that split the ties between knowledge and freedom, delineating a grotesque dichotomy in which the three Kantian transcendental orders were inevitably reduced to three specific historical spheres of pragmatic activities. In this way knowledge was reduced to mere technical instrumentality at the service of economic labour, while the moral plane was dissolved in the dimension of inter-subjective communicational language, and hope was reduced to the need for a liberating mythical praxis, self-reflexive and symbolic, which finally found its emblematic historical expression in the Frankfurt School's critique of ideology.[3]

However, precisely the heuristic strength of the Kantian critical trichotomy offers, at least in my opinion, an adequate hermeneutical instrument to better understand not only our own time but also Agazzi's path of philosophical

[2]See Minazzi (2004).

[3]For a discussion and clarification of this grotesque degeneration of the Kantian critical trichotomy the reader is also necessarily referred to the observations made by Petitot (2009).

reflection and its progressive critical and speculative expansion. Agazzi, in fact, made his scholarly debut with the volume *Introduzione ai problemi dell'assiomatica* (1961), through which he became known as a fine philosopher of science who mastered, with high expertise, the debate related to mathematical logic and the tradition of Hilbert's formalism, in particular. His first studies were mainly (but not exclusively) devoted to logical issues (for example, with *Logica simbolica* of 1964 and with various other entries on mathematical logic appeared in 1967 in the *Enciclopedia filosofica* of the Centro di Studi Filosofici di Gallarate), but Agazzi then published a significant and important epistemological work, *Temi e problemi di filosofia della fisica* (1969) in which his theoretical interests take into more direct consideration the problem of physical knowledge in all its paradigmatic value. Agazzi has never abandoned his initial interest in logical-mathematical thinking, as is attested not only by the book *La simmetria* which he edited in 1973, and above all by his many studies of mathematical logic which have more recently been collected in his volume *Ragioni e limiti del formalismo* (2012), which republished essays in the philosophy of logic and mathematics that appeared along almost the whole of Agazzi's scientific work. It is a fact, however, that this constant interest for reflection within the logical-mathematical framework is then woven with a progressive and significant expansion of his speculative interests, to include the philosophy of physics and the epistemological significance of the history of science and the notion of progress (to which he devoted a volume on *Il concetto di progresso nella scienza*, published in 1976). Let us simply remember the demanding publication of the chief work of a classic of science such as Maxwell: Agazzi made the annotated Italian translation of his celebrated *Treatise on Electricity and Magnetism*, (published in two volumes in 1973 in the "Classici della scienza" series founded and directed by Geymonat for UTET in Turin). So if in 1978 Agazzi published *Le geometrie non euclidee e i fondamenti della geometria* (written in collaboration with Dario Palladino), in the same years he also embarked on a reflection on the problem of meaning, to which he devoted a collective volume of *Studi sul problema del significato*, which he edited in 1979; it brought together the results of a celebrated major seminar he had organized and directed for many years at the University of Genoa. Also in these years he published as editor *Modern Logic. A Survey* (1981) and authored several papers dealing with the relations between science and religion (*Science et foi. Perspectives nouvelles sur un vieux problème*, 1983, and *Il pensiero cristiano nella filosofia italiana del Novecento*, 1980). He also promoted and edited a collective *Storia delle scienze* (1984, in two volumes), a reflection on *Weissheit im Technischen* (1986) as well as a comprehensive stocktaking of *La filosofia della scienza in Italia nel* '900 (1986), without failing to investigate the links between *Philosophie, Sciences, Métaphysique* (1987), the relations between *Linguaggio comune e linguaggio scientifico* (1987), the problem of *L'objectivité dans les différentes sciences* (1988), *Probability in the Sciences* (1988), a theoretical debate (conducted in open and sincere dialogue with Geymonat and the present writer) on the relations between *Filosofia, Scienza e Verità* (1989), the analysis of the relations between *Logica matematica e logica filosofica* (1990), as well as a question

on *Quale etica per la bioetica?* (1990), *La comparabilité des théories scientifiques* (1990), *The Problem of Reductionism in Science* (1991), the study of the link between *Science et sagesse* (1991), and the investigation of *Philosophy and the Origin and Evolution of the Universe* (edited in collaboration with Alberto Cordero in 1991).

This variety of investigations found a kind of emblematic and programmatic outcome in his ambitious monograph *Il bene, il male e la scienza* (1992, promptly translated into several languages: German, French, Spanish, Hungarian, Polish, Russian, and English), with which Agazzi's reflection, after having dealt with many aspects of the broad field of objective knowledge as it is configured in many scientific disciplines, felt the need to also address certain ethical issues directly relevant to the ambit of duty that oversteps the horizon of knowledge as such. To this perspective also belong, moreover, other publications in the field of moral philosophy, such as the collective volumes which he promoted and edited on topics such as *Bioetica e persona* (1993), *Philosophy and Cultural Development* (edited with Ioanna Kuçuradi in 1993). This astonishing plurality of interests and energy of scientific production in Agazzi's intellectual life and profession is testified by the simple listing of some of his publications in the last two decades: *Cultura scientifica e interdisciplinarità* (1994), *Filosofia della natura. Scienza e cosmologia* (1995), *Le techno-science et l'identité de l'homme contemporain* (1997), *Realism and Quantum Physics* (ed. 1997), *Philosophy of Mathematics Today* (edited with György Darvas in 1997), *Advances in the Philosophy of Technology* (edited with Hans Lenk, in 1999), *The Problem of the Unity of Science* (edited with Jan Faye, in 2001), *Complexity and Emergence* (edited with Luisa Montecucco, in 2002), *Valori e limiti del senso comune* (2004), *Operations and Constructions in Science* (edited with Christian Tiel, in 2006), *Science and Ethics. The Axiologic Contexts of Science* (edited with Minazzi, in 2008), *Le rivoluzione scientifiche e il mondo moderno* (2008), *Relations Between Human Sciences and Natural Sciences* (edited with Giuliano Di Bernardo in 2010), *Evolutionism and Religion* (edited with Minazzi in 2011), *La ciencia y el alma de Occidente* (2011), *Ragioni e limiti del formalismo, Saggi di filosofia della logica e della matematica* (edited with a Foreword by Minazzi in 2012), *Representation and Explanation in the Sciences* (ed. 2013), *The Legacy of A.M. Turing* (ed. 2013).

This already intense and exceptionally fruitful program of research, study and reflection then finds a significant culmination and theoretical crowning in the publication of his most recent work, looked forward to for some twenty years, his systematic study *Scientific Objectivity and its Contexts*, published by Springer in 2014.

As shown even by this concise and elliptical overview of the most important volumes published and edited by Agazzi in over fifty years of scientific and academic research, it can certainly be said that this thinker, building initially on a strictly epistemological study, has gradually expanded his research program, taking into consideration many problems and issues that have ultimately led him to develop a broader, more systematic and "complete" philosophical reflection, capable of dealing with moral philosophy and the very significance of the presence of

man in history. Precisely for this reason I evoked the Kantian critical trichotomy above. Not so much to place Agazzi's thought forcibly under the "Kantian bushel" (the reasons for his evident critical distance from the horizon of the Kantian critique are too many and also extremely profound, see below), but rather to highlight how the overall articulation of his scientific-philosophical research enables us to grasp, thanks to the Kantian critical trichotomy, the whole openness and the rhythm of the theoretical breadth of his original proposals. This is also because, as Kant himself well knew, these three different questions concerning knowledge, duty, and hope, are reduced, ultimately, to a single, strategically decisive question: *what is humanity?* And Agazzi himself arrived rather early at such a reflection on humanity, considered from multiple points of view, and he significantly argued that, in his view, the main problem of contemporary culture (to put it in his own paradoxical words) is trying to "*prove the existence of man*" with the same commitment that in other times philosophy has devoted to the task of proving the existence of God.

2 *Philosophy as Rational Understanding of the* Lebenswelt

But how has Agazzi sought to conceive philosophy? And how does he understand the precise meaning of the *conceptual work* peculiar to philosophical reflection?

> I conceived it - recently replied Agazzi himself - as the effort to rationally understand the complex 'world of Life' in order to find a rationally justified solution to the 'problem of Life.' By the world of life I mean the totality of whatever falls within experience and surrounds us, namely the set of material, natural, historical, social and cultural conditions in which we are immersed and conduct our lives. By the problem of life I mean the need to find the 'right' way to conduct one's existence in order to 'save the value of Life", i.e. to give it a positive *sense.* In both cases philosophy is characterized as a *rational* inquiry that arises 'from the point of view of the Whole' (or, in other terms, of the *Absolute*), investing the totality of experience to ask oneself if, from the comprehension of it, arises a solution to the problem of life. That is tantamount to saying an answer which, in particular, is capable of attributing a sense within the totality of experience itself, or requiring a dimension of the Whole that goes beyond the totality of experience (solutions of the problem of the Absolute of the immanent or trascendentist type respectively). In the case that this undertaking fails, we will have an *irrationalist* outcome, or if it arrives at conclusions that are neither positive nor negative, we will arrive at an *agnostic* position (Agazzi 2013: 8, italics in the text).

This quotation enables us to immediately attain a detailed framework of reference within which the conceptual work of philosophy (at least according to Agazzi's approach of overt rationalist aspiration) is confronted with a highly articulated complexity of problems and open questions directly connected with life and its pragmatic problematicity. It is not very difficult to discern an underlying affinity between this position of Agazzi and the tradition of phenomenological research which has always related the *experience* of the world of praxis to a need for *rational understanding* of life and its problems, a critical understanding that is then capable of establishing a relationship of authentic "critical suspension"

(*epoché*) of that experience, so as not to be a victim of the most uncritical and pervasive immediacy and pragmatism of life itself. But in Agazzi there is also the emergence of a different *critical* and even *metaphysical* curvature.

Critical, because our philosopher relies, in the first place, on the intrinsic *reasonableness* of the solutions gradually developed and applied in different historical and theoretical situations. In other words, Agazzi sees human reason as certainly, to put it again in Kantian and Husserlian terms, a precious and irreplaceable *function of the critical integration of experience*, but Agazzi then adds to this heuristic, *Aristotelian* function, the ability to always develop open and dynamic critical solutions, capable of finding his own strategic Archimedean point of reference precisely in the *reasonableness* of the solutions adopted. In other words, for Agazzi critical rationality is configured as a balanced heuristic instrument for the conceptual understanding of the complex articulation of reality. A "reasonable" heuristic instrument which, in each specific case, identifies a possible emergent solution as the most suitable and, indeed, the most "reasonable", namely as the solution most capable of understanding the rich articulation of the real, without however ever slipping into prejudicial, rigid or abstractly dogmatic positions. For this reason the critical rationality to which Agazzi increasingly appeals is always configured, in all his works, as a patient art of knowing how to unravel problems, weaving rational arguments that always analyse the whole of reality, seeking to offer the light of rational understanding as a dynamic and plastic reason that illustrates the complex aspects (*phenomena*) of reality.

Metaphysical, because Agazzi does not neglect to deal also with "the point of view of the Whole". In his philosophical argument we can in fact see that, within this specific critical perimeter of conceptual understanding, the reason which Agazzi addresses constitutes, at the same time, a peculiar practice (an argumentative praxis) which does not ignore the "point of view of the Whole" or of the Absolute. Precisely on this ground is then delineated the second component of this rationality, namely the explicitly *metaphysical* component, whose Aristotelian root, however, is critically mediated through the whole history of Western thought, without of course neglecting the specific formation of Agazzi himself at the school of Bontadini which, on this specific point, emerges very clearly (because on this point Agazzi agrees with Bontadini's critique, 1947, 1952, 1996 of the so-called "dualistic metaphysical realism", namely the "naturalistic assumption of the transcendence of thought", introduced by Descartes which is seen as surviving even in Kant, see Agazzi 1996). In fact, as has been noted, in Agazzi the requirement of the Whole (with a capital initial, just as the word "Life" is also capitalized in his text) is one with the "Absolute" and in this same ambit significantly emerges the aspiration to a "totality of experience" that constitutes, in fact, an explicit and systematic metaphysical requirement. In fact, if one bears in mind what Kant writes about the *Transcendental Dialectic,* in his first *Critique*, in which the philosopher of Königsberg brings out just the fact that the "aspiration to the totality of the requirements for the single reality", "opens, inevitably, to the metaphysical dimension" (in the worst sense of the term, meaning the illusion of knowledge) one can perceive how on this particular point a significant divergence exists between

Agazzi's program of philosophical research and that opened up by the revolutionary Kantian transcendentalist breakthrough. Agazzi certainly does not in the least defend metaphysics in its traditional strictly ontological approach, precisely because his thinking is constantly interwoven and nurtured by a continuous critical comparison, moreover one that is extremely sophisticated, with the latest critical reflections conducted in different fields of philosophic and scientific knowledge. Precisely for this reason Agazzi always has the critical sagacity to re-propose the requirement of placing himself "from the point of view of the Whole", as a heuristic point of view, capable of recovering, by using the method of "analogy", the prospect of the "Absolute" *within* and *beyond* the more limited and circumscribed ambit of human experience. But precisely this strategic point reveals his distance from a qualifying component of modernity, namely that conceptual tradition which—with Kant, but not only with Kant, of course—holds that it is not critically legitimate to go *beyond* the ambit of any possible experience. This theoretical approach stresses, in fact, the constantly circumscribed, limited and always finite character of possible human knowledge. Agazzi does not, however, endorse this need for critical caution and being at the same time aware of all the problematicity of the traditional metaphysical ontologism, raises the need to be able to satisfy a "point of view of the Whole", appealing in particular to the use of *analogy* as a privileged and fruitful instrument in order to defend positively the theoretical *possibility* of being able to construct this particular path of metaphysical inquiry (see Agazzi 2014: 437–455).

On the other hand, this twofold rational need, at the same time *critical* and *metaphysical*, enables him also to avoid two opposite uncritical dogmatisms that often occurred in the history of Western thought: namely the dogmatism of *scientism* (which transforms science itself into an absolute and a sort of taboo, above all possible criticism) and conversely the dogmatism of *fideism,* (which is opposed in an abstract and prejudicial attitude to scientific knowledge and pursues an alleged absolute symbolic knowledge of reality). Once more, against these two uncritical unilateral approaches, which result in unique forms of irrationalism, Agazzi maintains the *sense of critical measure* of his sophisticated rationalism, directed towards the identification of multiple *rational arguments* capable of better illuminating the complex nature of human knowledge, always studied and grasped in its intrinsic historical and conceptual determinacy.[4]

This enables us to better understand the original epistemological approach with which Agazzi has always analysed the peculiar nature of scientific knowledge. Our philosopher, in fact, has not only always defended the precise cultural value of the scientific tradition (see Agazzi 2008a, b), but has always grasped the nature of scientific knowledge, highlighting both its *criticality* and the nature of its *rigour*, and its intrinsically *objective* scope (Agazzi 2014). In other words, for Agazzi science

[4]From this point of view his annotated edition of the writings of Maxwell (1973) remains emblematic, as well as his own *Storia della scienza* see Agazzi (1984), to be compared with that of Geymonat (1970–1976).

constitutes *objective, critical* and *rigorous* knowledge that is such precisely because it delineates, at the highest possible level (albeit always within a certain technical-cognitive patrimony historically configured) an objectivity, a criticality and a rigour which are conceptual and dynamic paradigms of reference. However, Agazzi, while recognizing the fundamental role of this threefold characterization of modern scientific knowledge, at the same time points out its insufficiency in providing a critical understanding of the very patrimony of knowledge available to us from the history of scientific thought. In other words, in his view, objectivity, criticality and rigour are *necessary* components but certainly not *sufficient* to characterize the entire nature of scientific knowledge as a whole. Agazzi feels, in short, the need to supplement these characteristics with the consideration of the *foundation* and *sense* of these same kinds of scientific knowledge. Again Agazzi feels, in short, the requirement that an adequate understanding of the philosophical critique of science entails, in turn, a recognition of how much lies "outside" science itself, because, in his view, *value judgments* themselves cannot find their adequate justification *within* science (for the critical analysis of this complex problem of contemporary philosophical and epistemological reflection, I allow myself to make reference to the collective work that we jointly edited, see Agazzi and Minazzi 2008).

In any case, precisely this particular epistemological-critical approach has enabled Agazzi, from his earliest studies on the philosophy of physics, to avoid, critically, both every possible *phenomenalist* outcome and any drift that has led many epistemologists to talk about a hypothetical science of the *unobservable*. Even in the case of the philosophy of quantum physics Agazzi has instead qualified science as *objective knowledge*, distinguishing, however, two different meanings of *objectivity* itself, i.e. a *weak* objectivity from a *strong* objectivity (Agazzi 1974: 339–357, 2014: 51–57). In fact, if we limit ourselves to defending the *weak* sense of objectivity, science is inevitably reduced (and returned) to a dimension of mere *public intersubjectivity* that is rooted, ultimately, in the linguistic consensus of a given community of scientists. But Agazzi holds that in science there also exists another component, equally fundamental and indispensable, that goes well beyond mere consensual public intersubjectivity, and is rooted precisely in the actual cognitive capacity of scientific thought, which enables us to know the world, revealing some significant aspects of its material and real configuration. Therefore, on this level of *strong* objectivity Agazzi defends the full and legitimate *realist* scope of scientific knowledge, in complete harmony with the classic lesson of thinkers such as Aristotle, Galileo, Newton, Darwin, Maxwell and Einstein.

If the epistemological position of Agazzi is set in relation to the, albeit prominent and complex, traditions of the conventionalist phenomenalism (from Duhem to Poincare, to give just two emblematic names), of the logical empiricism that grew out of the *Wiener Kreis* (which then went through various epistemological phases and seasons, in which Carnap has, however, always been a key point of reference, and so coming down to Hempel's most mature reflections) and Popperian falsificationism itself (not to mention the outcomes of his school, from Lakatos to Feyerabend), it is now easy to understand the originality and uniqueness of the

realist position supported by Agazzi. In the first place, because in his reflection on science Agazzi has always defended *the reasons of realism,* so finding himself in a position of substantial isolation and originality. In fact, much of the epistemological debate of the twentieth century has been decidedly anti-realist. And even when it has defended the reasons of realism—as, for example, a philosopher like Popper did, throughout his life—it was a minimal realism, closer to that typical of common sense. In short, it was configured as an uncritical realism that failed to develop a philosophical vision, critical and fully articulated, of its own perspective. To clearly grasp all the reasons and also the theoretical and philosophical features of Agazzi's epistemological realism, it would suffice to bear in mind the intense and memorable discussion, theoretical and dialogic, that he (and the present writer) conducted with a long-standing realist and acknowledged father of the Italian philosophy of science like Geymonat (with whom Agazzi himself had studied, immediately after his early training under Bontadini: see Agazzi et al. 1989, but see also Agazzi 1985, 2001, 2009, as well as Geymonat 1977, Mangione 1985, Minazzi 2001, 2009, 2010). In this regard we should not overlook the influence on Agazzi's thought exerted by an original thinker like Mathieu, in particular by the valuable study that Mathieu devoted in the sixties to the problem of objectivity in science and modern and contemporary philosophy (Mathieu 1960).

In any case, in relation to the different positions that interpret objectivity as mere intersubjectivity, as invariance, or, again, as correspondence to the objects dealt with in a scientific theory, Agazzi, ever since *Temi e problemi di filosofia della fisica*, has had no doubts in stating that, in his view, "the right position of correct realism is rather that which, between objective and real, sees a relationship of *inclusion*: all that is objective is real, even though not all that is real is objective" (Agazzi 1974: 365). Agazzi is thus induced to support a position of original *critical realism* (see Agazzi 2014: 243–312), precisely because he has clearly in mind an observation that has instead often been overlooked or removed from the philosophical debate of the twentieth century, namely the critical awareness that

> The concept of truth is never, in practice, absolute but relative, in this precise sense: a proposition (or set of propositions) is almost never true or false *simpliciter*, but true or false *of* a certain universe of objects, so that the question itself concerning its truth is not formulated completely until one says *of what objects* it must be true. In practice, therefore, the truth is always a truth within a theory, because only within it are objects, as we know, given (Agazzi 1974: 369, italics in the text).

But then how can we qualify the "objects" of scientific knowledge? For Agazzi, the best solution to this challenging question lies in recognizing that "the object is *nothing more* than the sum of *all* its determinations" (ibid.: 370, italics in the text), with the result, then, that if we agree to grasp the determinations of objects as real and existing, consequently the objects must also be thought of as real and existing. The realism proposed by Agazzi, however, is "critical" precisely because it never overlooks the fact that, in the history of thought, the twilight of a determined and genuine scientific theory does not mean recognizing that it was *false* (as would claim the Popperian falsificationism which is thus forced to offer a cemeterial

vision of the history of science[5]), but rather that it was *partial*. As a result, its replacement by a new theory always involves the development of a new approach that will be *better* than the previous one, precisely because it will enable us to seize a larger number of determinations of the reality that is the object of our study.

On this plane we therefore see how Agazzi agrees with the Kantian approach, according to which human knowledge is always circumscribed and delimited, because, to quote again Agazzi,

> an absolute truth could not be anything but a truth that applies *to all possible objects*, that is, a truth that by holding true for all possible objectivities, focuses on reality no longer as objectified, but *as such*, which, therefore […] goes beyond the ambit of consideration of science and rather concerns philosophy (which, characteristically, when it wishes to give itself a cognitive task, proposes the study of *reality as such* and is configured as *metaphysics*) (Agazzi 1974: 369-370, italics in the text).

With this we can clearly see that Agazzi's significant proximity to the epistemological horizon of Kantian transcendentalism is characterized, however, by a specific and wholly decisive difference. Indeed, though admitting (with Kant) that all human knowledge is always confined to certain specific objects within precise cognitive boundaries, Agazzi yet seeks also to recover the "point of view of the whole", as a characteristic and specific investigation of philosophical inquiry which, in his view, leads to that *metaphysics* which Kant instead intended to definitely banish from the epistemological plane (reserving it only a different function within the world of practice and our ethical choices).

In any case, for Agazzi it is the *predicates* that define *operationally* the object of scientific knowledge, precisely because the object, by its intrinsic epistemological nature, is configured as "a structure of relations, most of which can be the result of operations but whose 'being together' is not justified by any operation, despite having to be objectively verifiable" (Agazzi 1974: 374). The very presence of this conceptual framework (as rightly pointed out, among others, by Weyl (2009), explicitly mentioned by Agazzi) stresses how the nature of the objects studied by science cannot be deduced solely from the experimental dimension. Indeed the *conceptual determination* of the said structure depends on a theoretical component that is not reducible, *without residuals*, to the plane of experimental experience (*pace* all the systematically reductivist dreams variously cultivated and replicated, by the tradition of classical empiricism, and Viennese logical empiricism). Also Geymonat in *Filosofia e filosofia della scienza* states that "the history of science shows us that in many cases progress was achieved by the replacement of principles, immediately suggested by observation, with others, seemingly much more contrived and more distant from the facts" (Geymonat 1960: 60). For this reason Agazzi concludes by observing that

> experience, in other words, by itself 'does not speak'; it is rather like the oracle of Delphi, of which Heraclitus said that it 'neither speaks nor conceals, but gives signs',

[5]On this point, however, I may be permitted to refer the reader to Minazzi (1990, 1994).

> i.e. it provides the basis for the constitution of the semantic logos, but does not explicitly indicate an apophantic logos. Just like the response of the oracle, experience has to be "interpreted" and this interpretation is primarily an intuitive act: 'In science,' Goethe wrote, "everything depends on what can be called an *aperçu*, on a recognition of what underlies phenomena. And this recognition is infinitely fruitful (Agazzi 1974:376).

In other words, the real world that we want to know is always, in Galileo's words, "deaf and inexorable": experiences become significant not so much thanks to experience as such, but thanks to that particular "point of view" (the *aperçu* Goethe speaks of) by virtue of which we can construct a theory with which, in the words of Kant, we interrogate nature in the same way as a judge examines a defendant or a witness, forcing nature to answer *our* questions, though we know that nature's answers are also decisive for our own theories since they can, in fact, verify or falsify the predictions derived from our particular theoretical framework.

3 From Intensional Semantics to a New Conceptual Image of Knowledge

The mention of the relation between the semantic logos and the apophantic logos, which concluded the previous section, not only explicitly brings out again the link that connects Agazzi to the classical and fundamental Aristotelian lesson of the *Organon,* but once again indicates his proximity to (and at the same time also his critical distance from) the lesson of Kant, with particular reference to the breakthrough connected with transcendentalism. To the extent that Agazzi emphasizes and highlights the irreplaceable role of theory in the constitution of experimental experience it is evident his similarity with a classical Kantian problem. Actually he notes that "even outside a Kantian discourse, one cannot help but recognize the authenticity of this fact and draw precisely the consequence that, without a minimum of theory, one cannot even *begin* to do science" (Agazzi 1974:377). However, in Agazzi's case this very recognition has led to a progressively comprehensive rethinking of the philosophical problem of meaning (Agazzi 1979), also by advancing a complex examination of the philosophical roots of the different senses of meaning. Indeed, faced with the so-called "linguistic turn", and also against the related "relativistic turn" which has variously characterized the post-neo-positivist philosophy of science, Agazzi was gradually induced to develop an original and detailed analysis of the *intensional semantics* of empirical theories, explicitly raising the problem of the impact of semiotics on the philosophy of science, according to a research program and reflection currently consigned, in its most significant achievements, to the pages of his book *Ragioni e limiti del formalismo* (Agazzi 2012). A critical reflection on Hilbert's formalism and also on the heuristics developed by the axiomatization of scientific theories was the theoretical ambit in which Agazzi's philosophical exordium was already delineated since the publication of his *opera prima* (Agazzi 1961) and constitutes a fruitful and ever-present thread running through nearly all his highly articulated program

of philosophical research. Indeed Agazzi has gradually and increasingly specified how the *scientific object* cannot fail to emerge as a peculiar *intellectual construct.* But the very recognition of the existence of this intellectual construct has since led him not only to clarify the eminently relational nature of truth, but also the reasons for a critical realism that cannot but accept a perspective aimed at safeguarding a valid epistemological pluralism capable of identifying the multiplicity of different *levels of reality* investigated and studied by different scientific disciplines. Within this specific dilatation of his program of philosophical research, Agazzi has reconsidered the link that can be established, even within a strictly axiomatized theory, between the *syntactic* component (related with the linguistic and conceptual plane), with its precise *meaning*, as well as its relation to the horizon of *referents*. As is well known, in philosophy and methodology of science it is usually held (think of Morris, Carnap or even Tarski, to suggest only a few exemplary names) that the task of semantics is to assign a specific "interpretation" to a set of syntactic symbols that are held to be "devoid of meaning". In this perspective, the attribution of meaning to a theory is interpreted, *à la* Russell, as the assignment of certain referents (individuals or groups of individuals *et similia*) that appear to be appropriate to the theory to be interpreted. Now Agazzi's perspective, in an attempt to develop a three-level semantics, opposes this conceptual and logical approach, which is widespread and shared by both epistemologists and mathematical logicians. In his view, in fact, the task of semantics is certainly to assign a sense or a meaning to linguistic expressions, but Agazzi also believes that this task is quite different from (and independent of) that of associating referents to syntactic symbols.

This critical perspective draws, in particular, on Gottlob Frege's logical reflection, but it is also conscious of an older tradition of thought that goes back directly to scholastic logic. According to this approach it is necessary to distinguish between meanings and referents, both because meanings, by themselves, do not constitute referents, and also because neither do referents, by themselves, constitute meanings. Agazzi writes in this respect:

> This distinction was clearly developed by scholastic logic as a distinction between *intentio* and *suppositio* and was recovered by Frege in the distinction between *Sinn* and *Bedeutung* […]. Hence it is far from obvious that when we offer an "interpretation" of a formal system, associating its expressions with certain referents, we give a meaning or sense to these expressions. Naturally, we can offer them meanings (senses), but this requires us to associate with them certain conceptual entities and not referents […]. This resistance to merging meaning with reference has a long tradition in the history of philosophy. It is implicit, for example, in all the criticisms of the so-called ontological argument for the existence of God, and is at the root of the Kantian demand that some "synthetic" (i.e. empirical) condition must be present in order to be able to attribute the character of knowledge to a statement" (Agazzi 2012: 249).

Frege's semantics lays particular stress on the objective contents of thought [the *Gedanken*], by means of which the *conceptual plane* of scientific thinking is rightly brought out fully, and is recognized as a precondition for the determination of the referents:

> This is all the more true if we reflect on the fact that, according to him [Frege, *ed.*] referents can be reached only through the sense and for this reason he attributed a sense even to proper names, which are the typical *linguistic signs* which have individuals as their referents. But this three-level semantics lost its intermediate level already with Russell and the meaning of *linguistic signs* was reduced to their referents or denotations, although Russell remained Fregean in some respects. This trend was reinforced in the extensional semantics for formal systems introduced by Tarski and developed in model theory in mathematical logic" (Agazzi 2012: 250-151, italics in the text).

But, in this way, the paradoxical exit was the losing sight of the specific and autonomous (though relative) *conceptual plane* that always qualifies the scientific enterprise, hence precisely that component of *the conceptual framework* through which we can develop the very notion of the "scientific object", as we have seen. This, however, confirms, from the point of view of Agazzi's espistemology, the close link that always exists between the objective knowledge brought into being by scientific theories and the defence of a critical realism. For what reason? Precisely because, to quote Agazzi again,

> the realist position argues that the scientific discourse has a real referent. As is well known, at least since Frege's famous essay on *Sinn* and *Bedeutung*, which recovered distinctions and concepts already widely present in the scholastic treatments of the *suppositio* and the *intentio* of terms, a difference exists between the *meaning* of a term (Frege's *Sinn*), which is a content of thought expressing "what is meant" by that term, and its *referent* or *denotation* (the Fregean *Bedeutung*), which is an object constituting "that about which" that meaning is thought or expressed. Unfortunately, such a distinction has been left unproductive by those who, for a fairly long period of time, have occupied a prominent position in developing theories of meaning, that is by mathematical logicians, who have quickly embraced, with regard to the interpretation of formal calculi, an extensionalist semantics according to which the meaning of a term is the set of its referents (Agazzi 1985: 175-176).

The needs of "practicality" adopted by mathematical logicians to justify abandoning Frege's distinction (an abandonment reinforced by the hegemony exercised by the Hilbertian formalism according to which a formal set of symbols does not possess any meaning, except that of so-called "implicit definitions"), produced an increasing separation between *meaning* and *referent,* leading to the curious (epistemological) paradox of legitimating both a discourse devoid of meaning (which then would not say anything) and a discourse devoid of referents (which then would not speak of anything). The aim of science, however, is very different; it is

> to be a referential discourse, since it cannot be affirmed that a statement is true without admitting that it is true of something. […] The empirical sciences make use of non-linguistic operational criteria of reference in order to grasp the referents of many of their propositions (those that directly describe experimental results), but now we can also add that the same theoretical concepts of a theory must have a 'real' referent (Agazzi 1985:180).

Precisely this recognition enables one to understand the specific function of the apophantic logos which is different from the semantic, because

> the institution of the apophantic logos is characterized by the fact that, in addition to the meaning, there emerges the referent and, moreover, in such a way as not being

> independent of meaning. In fact the search for the referent requires a non-linguistic activity […] which is in many cases (especially in the case of science) actually of a markedly "practical" kind, such as operatively manipulating by means of instruments, observing in appropriately created conditions, and so forth. This activity therefore consists in *exploring the world* and not in *exploring language*. […]. The apophantic logos is therefore one which institutes the *notion of truth* directly related to that of reference" (Agazzi 1985: 182, italics in the text).

This then enables one to better understand why

> Each scientific discipline is presented as a discourse that intentions reality from a certain 'point of view', namely proposing to investigate only certain aspects or qualities of it; for that reason it selects a limited number of "predicates" and, in order to be successful in its referential effort, it associates them with some standardized *operations*, which we can call 'criteria of objectification' or 'protocollar criteria' or 'criteria of referentiality'. It is these operations that 'cut out' the specific objects of a given science from the vast ambit of reality and, precisely because they are transactions that do not apply to anything, but to referents already identified (the 'stuff' of everyday experience which is practised within a certain historically determined community) and moreover subject to empirical, and not purely linguistic or intellectual, manipulations, single out specific referents that are necessarily *real* (Agazzi 1985: 188, italics in the text).

A much more complete and elaborated presentation of the theses presented here regarding the peculiar semantic and operational foundation of Agazzi's realism is offered in Agazzi (2014), the life-work in which he has presented the global portrayal of his epistemology. We have preferred to give a documentation of these positions with reference to older publications, in order to show the continuity of the maturation of these ideas.

This overall outcome of Agazzi's critical realism thus proves particularly attuned to other very different programmes of philosophical inquiry—for example with that of a highly original Italian philosopher like the critical empiricist Preti (on whom see Preti 2011 and Minazzi 2011), or with that of the "regional ontologies" of the phenomenology outlined by Husserl in *Ideen zu einer reinen Phänomenologie und phänomenologischen Philosophie* (1913)—which, however, also insisted on both the specific and fundamental *conceptual dimension* of the scientific process as well as the desirability of recovering, heuristically, but also phenomenologically, the fruitful scholastic doctrine of *intentionality* and *suppositio*, in order to develop a richer, more articulated, appropriate and plastic critical image of scientific knowledge.[6]

This specific philosophical approach in Agazzi's reflection also explains the original way in which our philosopher has always been able to engage discussions with some of the principal positions of his time, highlighting their inherent one-sidedness and also their dogmatisms. Take, for example, the problem of the historical determinacy of scientific theories or, again, the no less extensive and profound debate about the alleged "neutrality" (or non-neutrality) of scientific knowledge or, again, the debate concerning the relation between science and

[6]On this point, however, I may be permitted to refer the reader to Minazzi (2011).

ethics, or also the relation between science, evolution and religion (for which, in this context, I refer only to Agazzi 1992 and Agazzi and Minazzi 2011). In all these cases, by using an approach based on general systems theory (see Agazzi 1978), Agazzi identifies the privileged comprehensive system of reference, and then takes into consideration the multiple subsystems, *open* and *adaptive*, in accordance with the systems-theoretic methodology inaugurated by Bertalanffy (1968), which he has, however, reworked in a fruitful way within his epistemological and even philosophical reflection. Therefore, while many interlocutors in these debates insist on contrapositions that constitutes a drastic and unilateral "*aut*/*aut*", Agazzi, on the contrary, has always endeavoured to investigate critically the links of connection, relationship and coordination (i.e. "*et*/*et*") that can (and must) be identified, always considering them as flexible and complex, mirroring in such a way the actual articulation of a real world, the tangled skein which must always be unravelled, *à la* Leonardo, with critical intelligence, taking into account its multiple, varied and even conflicting actual components, so as to be able to hope to grasp, to again quote the genius of Vinci, any possible "threads of truth".

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