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1. *INTRODUCTION*

Giovanni Vailati's premature death in 1909, at the age of forty-six, silenced a distinctive and original voice in Italian philosophy. In his work, so different in tone and method from Croce's idealism and anti-scientism, we find reflected and developed most of the great problems and themes which have come to the fore in twentieth-century philosophy and semiotics. In spite of his remarkable linguistic skills, encompassing both modern and classical lan-

guages, Vailati's philosophical orientation did not derive directly from the Italian humanist tradition nor from the Idealist traditions of German transcendental philosophy. Rather, Vailati was professionally trained in physics and mathematics and had been Peano's assistant at the University of Torino before becoming a teacher of mathematics in secondary schools. H. S. Thayer, in his classic *Meaning and Context: A Critical History of Pragmatism*,[1] said of Vailati that

> his work displays a meeting of intellectual currents that were to determine the later character of modern philosophy: Peirce's pragmatism and his interest in signs and the analysis of concepts; the interest of the Vienna Circle, 1923, in formulating the methodology of verification and a criterion of meaningful (i.e., the cognitive use of) language; the mathematical, critical, and analytical investigations of language, logic, and science by Ramsey and Wittgenstein. (332-33)

Into his work—as well as into that of Peirce's, with which it has an intimate theoretical as well as historical connection—flowed many of the chief problems and concerns of the whole history of philosophy and of the sciences, particularly the natural sciences, and out of it emerged a set of heuristically fertile insights and proposals that not only anticipated many later discussions and problems, but still have relevance and importance for our present situation.

Vailati's philosophical project was nourished most of all by a deep immersion in the history and methods of the exact sciences—especially the history of mechanics and the history of mathematics as paradigms of the deductive sciences—and by a recognition of the revolutionary importance of pragmatism and of the turn toward the analysis of meaning and language that was one of its central foci. His posthumously collected *Scritti*, edited by Mario Calderoni, Umberto Ricci, and Giovanni Vacca (Leipzig and Florence: Barthes and Seeber, 1911), which includes almost all his published work (the *Scritti* has 213 entries), displays a range of concern, reading, and reference that bears witness to a philosophical culture of the highest caliber. Vailati's correspondence, a substantial selection of which can be found in his *Epistolario*, edited by Giorgio Lanaro (Turin: Einaudi, 1971), displays an extraordinary range of contacts, including exchanges with Vilfredo Pareto, Ernst Mach, Lady Welby, Franz Brentano, Benedetto Croce, Mario Calderoni, and many others.[2]

My highly selective and introductory discussion will be limited

here to the themes of Vailati's percipient, pragmatically oriented analysis of modern science from an epistemological, linguistic, and sense-critical point of view, and his exploration of language from a critical, analytical, and constructive point of view. The overarching matrix is Vailati's pragmatism, the inner bond that connects him with that epochal movement in American philosophy, and with the relatively short-lived Italian continuation and development of pragmatism in the work of Papini, Calderoni, and others who collaborated on the Florentine journal *Leonardo* during those fateful years in the first decade of this century, before the overpowering presences of Croce and Gentile took their toll upon the diversity of Italian philosophical culture.

2. SCIENCE AND THE TRANSFORMATIONS OF DEDUCTION (ARISTOTLE, GALILEO, PEIRCE, BERKELEY)

The core of Vailati's analysis and evaluation of the significance of modern science, the topic of his spellbinding essay "Il metodo deduttivo come strumento di ricerca" (*SF*: 59-92), lies in his thesis that the rise of the modern mathematical natural sciences effected a pivotal change in the ideal of deduction as a means of knowing. When Aristotle, Vailati thought, considered the nature and scope of deduction, he had in mind for the most part deduction in geometrical demonstrations or in rhetorical argumentations. What they had in common was their focusing upon a privileged set of premises or axioms, which were more certain and necessary, and their use as foundations and bases for the increase of certitude that would result from the deduction of sets of conclusions from them. A properly conceived deductive method transmitted certitude from premises to conclusions. Both processes—the strictly formal one of geometry and the more informal one of rhetoric— were subject to derailment due to the illusions deriving from the imperfections of ordinary language, or from what Vailati also called "il linguaggio comune" (*SF*: 62). Deduction was to help us to avoid [*evitare*] these illusions and to facilitate [*facilitare*] reasoning processes through long chains.

The distinctiveness of the classical view of deduction, in addition to its concern with certitude, was exemplified in the privileged role played by the premises. They were to be taken as "given," while deduction itself would show, through inferential processes, what conclusions were in agreement with them. In cases of conflict with alternative conclusions resulting from other

deductive processes, our own premises, as embedded in "linguag-
gio comune" or "linguaggio ordinario," were authoritative. This
was ultimately the root of the classical reliance upon the "argument
from authority," potentiated to an incredible degree by the Schol-
astics for whom deduction was first and foremost a "good conduc-
tor" [*buona conduttrice*] of evidence and certitude (*SF*: 74). It was
the overuse of this method as a support of dogmatism and
traditionalism that caused Bacon to attack the deductive method
as aprioristic and to oppose to it the ideal of a science based on
induction and practical experiment.

   Galilean physics, however, did not wholeheartedly adopt the
Baconian ideal. To be sure, Galileo proceeded deductively, but
his goal was not certitude. Deduction for him, Vailati pointed out,
was rather the means for the "explanation and anticipation of
experience" [*spiegazione e anticipazione sull'esperienza*] (*SF*: 65). Vai-
lati attempted to encapsulate the radical difference exemplified in
the working out of Galilean methods in a stupendous passage:

> The mental processes that make up the most essential part of the
> modern methods of explanation and of scientific research, taking,
> that is, by means of deduction, theories to their ultimate conse-
> quences, for the purpose of confronting them with some fact known
> or eventually knowable to be incompatible with it, the utilization
> to the highest degree of every known law to see up to what point
> it suffices to give an account of all the particulars which are encoun-
> tered in the facts in which its action is manifested and to establish
> what unexplained residuum it still leaves open to our further inves-
> tigations, the combining of more laws for the purpose of using
> them in the analysis of a complicated single phenomenon, all of
> these operations, no one of which is possible without the help of
> deduction, appear to be completely foreign to the spirit of those
> first [scientific] investigators. The dislike of deduction in all the
> cases in which it is of no use to *prove* something of which one was
> first in doubt, the inability to avail oneself of it as a means to secure
> us against too hasty generalization, increasing in a certain way the
> points of contact between each theory and the facts from which it
> can await a confirmation or a contradiction, the lack of patience,
> and I would say as it were the lack of abnegation, necessary for
> drawing out accurately the consequences of hypotheses or princi-
> ples less intuitive and less solid than those of geometry, laying
> oneself open to the risk of obtaining as a unique result of one's own
> efforts the conviction of having started from poorly grounded sup-
> positions and of having to redo the same work by taking a different
> point of departure, not being satisfied with vague analogies, but
> pretending that the agreement, among the phenomena being com-

pared, is verified down to the most minute particulars accessible to our senses or to the control of instruments and measurements, these are so many characters or marks that are connected to the same above indicated difference, that is, that between the old methods and those to which are due the instances of rapid progress of the physical sciences in the last three centuries. (*SF*: 71-72)

Such is Vailati's delineation of the hypothetical-deductive method. It consists in "l'attitudine . . . a meravigliarsi a proposito" [the ability . . . to be amazed on purpose] (*SF*: 67), in the movement from the haphazard interrogation of nature to the provocation of nature, to subjecting it and the inquirer to risks.

Later in his groundbreaking essay, Vailati offers us another ringing passage:

It is this reduction of a fact, or of a law, to other more general laws or facts that constitutes what we call *scientific explanation*, and it is important to note how the advantages inhering in this process do not depend at all on the circumstances that the facts or the laws, upon which a given explanation is grounded, are presented to our mind as more familiar or more evident in themselves than those that we are explaining by means of them. Deduction, applied in such a way as a means of explanation, permits us to embrace, with one glance and with one single act of the mind, a variety and multiplicity of facts, the consideration of which would demand a quite large amount of operations and of distinct intellectual efforts. With its aid we manage to locate ourselves at a point of view from which the analogies, the relations, and the connections, among the phenomena that we are investigating, are explained to our intellect just as the topographical particularities of a region are offered to the view of one who contemplates them from a high point. Deduction multiplies in this way our abilities to perceive order, uniformity, constant laws in the midst of the tumultuous succession of facts and events, or, to say the same thing with an expression from Plato (*Republic*, Bk 7), it puts us in a position to *discern the one in the midst of the many* [*to en pollois oron*] and to discover with the eyes of the mind the immutable poles around which turn the chaos and the perpetual comings and goings of phenomena and of sensations. (*SF*: 87)

Vailati thought of science in realist terms, in spite of his not infrequent admiring references to Mach's epistemology. What he shared with Mach, however, was a profound appreciation of the role of *idealizzazioni semplificatrici* in the construction of scientific theories:

The ease with which such simplifications lend themselves to bring-
ing us to new conclusions, by means of purely mental operations
and independently of any direct examination of the concrete facts
to which they refer, and the absolute uselessness of any appeal to
these to guarantee the correctness of the deductions themselves,
leads us sometimes to lose from view that requisite investigations
must precede the application of the results obtained to real cases
in order to establish whether, by means of them, the conditions
are truly present that the theory supposes, whether, by means of
them, that is, the influence of all those causes the theory has not
taken into account is then really and truly able to be ignored. (*SF*: 91)

The modern scientific process of deduction involves a mutual
adjustment of theoretical idealization, chains of deductions, and
the demands of experience itself. From an examination of the
significance of the rise of mechanics, which for him was of funda-
mental epistemological importance, Vailati contended that con-
cepts are fundamentally instrumental in nature (*SF*: 55), that an
intellectual combat of ideas takes place not just between thinkers
but within each thinker (*SF*: 57), that there is an intrinsic aesthetic
character to mechanics that turns theory-construction in this do-
main into a kind of "scientific poem" (*SF*: 58), so that coherence,
symmetry, and coordination of ideas are marks of scientific and
theoretical quality. The drive toward simplicity and economy that
Vailati ascribes to the science of mechanics is really the drive
toward system and is not to be thought of in strictly Machian
terms.

Further, Vailati was deeply impressed by Peirce's pragmatic
analysis of meaning and by its connection with the development
of the experimental sciences on the one hand and of mathematical
logic on the other. The Peircean central contention was that the
valore or *significato* of an assertion is to be found in the "practical"
consequences (*SF*: 237) entailed by it and by its constituent terms.
Vailati will give a faithful and clear account of this pragmatic
maxim in his later essay "Le origini e l'idea fondamentale del
pragmatismo," published in *Rivista di psicologia applicata* in 1909
(in *SF*: 331-46). But the peculiarity of Vailati's development of a
philosophy of science (and ultimately of a philosophy of language)
within the confines of a pragmatic epistemology is that for him
the premises, postulates, and axioms of a theory are treated as
propositions like other propositions, with no divine right. A theory
as a concatenated network of premises, conclusions, and lines of
inference is to be compared to a constitutional or democratic re-
gime where the postulates are temporarily placed in charge to

perform certain functions in the public interest, that is, in this case, the pursuit of objective knowledge. The distinction between premises and conclusions, on this view, is merely functional or pragmatic, since in the last analysis all the constituents of the theoretical system would be bound together in a mutually self-implicatory way.

Vailati's antifoundationalism is intrinsically connected with his pragmatism. For Vailati scientific knowing, while a privileged form of knowing, is not based on impregnable intuitions or insights. It consists of a vast web of theses and hypotheses that have been developed from sets of simplifying idealizations and whose practical (conceptual) consequences have been elaborated in the greatest detail by complicated chains of inference. As Vailati put it in his review of Duhem's *La théorie physique* (*SF*: 220-22), a theory is "un insieme di ipotesi" (*SF*: 222), which, while ideally confronted with experience as a whole, nevertheless must be put to the test in individual cases and, perhaps, sacrificed in parts (*SF*: 222) in order to save the theory as a whole. Science is a systematized form of risk taking, a willingness to fall into error for the sake of truth. In this conception of science, Vailati was agreeing with Peirce's characterization of the "experimental mind" at the beginning of his essay "What Pragmatism Is" (*Collected Papers*, 4.530*ff*), where the provisional character of premises and postulates is meshed with their heuristic fertility.

A further aspect of this matter, that also looks forward to Vailati's analysis of language, is his assertion that the development of modern mechanics and mathematical logic entails the recognition of the central role of *implicit definition* or *definition by abstraction* in our ways of talking about and symbolizing the world. The main point is: we cannot assign a meaning to isolated words. The key words of a theory—"mass," "force," "inertia," and so forth—are defined within the contexts of sentences or assertions. They are not independent contents of abstracted or abstractable intelligibilities but elements within a complex system of differences, connections, and contrasts:

> It is necessary then to admit that a theory, or a collection of hypotheses, can have a meaning even when we cannot properly attribute one to the individual parts, or affirmations, that contribute to its constitution: in the same way that a phrase can have a determinate sense without that being the case for all the words of which it is composed, each taken by itself. (*SF*: 222)

Indeed, Vailati thought that many of philosophy's own central words also cannot be "defined" directly, but rather than this being a license to inflate concepts and theories to no end, pragmatism entails a kind of radical surgery while admitting all the time an open-ended development of theories and explanatory concepts sufficiently flexible and creative to deal with an ever-changing and evolving experience, both individual and social. These are themes developed in Vailati's essays "Il linguaggio come ostacolo alla eliminazione di contrasti illusori" (*SF*: 325-30) and "Il pragmatismo e i vari modi di non dir niente" (*SF*: 347-57).

The pragmatic maxim was formulated by Vailati, echoing Peirce, in the following way in his essay "Le origini e l'idea fondamentale del pragmatismo" (*SF*: 331-46):

> the sole means to determine and to clarify the sense of an assertion consists in indicating what particular experiences one intends with it to affirm will be produced or would be produced, given certain circumstances [*il solo mezzo di determinare e chiarire il senso di una asserzione consiste nell'indicare quali esperienze particolari si intenda con essa affermare che si produrranno, o si produrrebbero date certe circostanze*]. (*SF:* 331)

These experiences, however, are by no means subjective. The whole point of the maxim is to make assertions more objective by subjecting them to a set of constraints and controls. Assertions refer essentially to "anticipations or previsions of all sorts" [*aspettazioni o previsioni di qualsiasi specie*] (*SF:* 335), and this, Vailati shows in an illuminating analysis of some points from Berkeley's *Theory of Vision*, applies even to the beliefs about present facts or to facts that have already occurred:

> In his *Theory of Vision*—which is really a true and authentic theory of "prevision"—Berkeley, in opposition to the current opinion according to which the size, position, and distance of objects would be seen by us in the same way that we see their color, showed how our visual sensations are, by themselves, simply incapable of furnishing us immediately with such types of information, and that the distances, the forms, the dimensions of the objects that we see are not "seen" by us but "foreseen," or inferred by the symptoms or signs of them that our visual sensations, in the real sense of the term, furnish us with.
>
> The distances, the forms, the dimensions are, that is, in a certain sense, read and interpreted by us in a process analogous to that with which we manage to read and to interpret any other species of "signs"[3]; we can be said, for example, to see the genius or the

stupidity of a person when we read something they have written. (*SF:* 335)

Berkeley's *esse est percipi* really means *esse est posse percipi* (*SF:* 336). Vailati accepts this "semiotic" analysis as equivalent to a "pragmatic" analysis. The existence or non-existence of a thing boils down to the possible existence of determinate experiences (*SF:* 336), which can come to us or which we can provoke by our voluntary actions.[4] These *previsioni* are contained in our beliefs and do not have to be actualized or made explicit except in cases when our beliefs are interrupted or we fall into doubt. Vailati is here, as in many other places, a faithful interpreter and presenter of the Peircean theses, pointing out the wide range of consequences that flow from accepting the pragmatic axiom and seeing how we can assimilate it to a semiotic analysis of perception, a topic Peirce never ceased to deal with in great detail on his own.

3. THE LINGUISTIC DIMENSION IN VAILATI'S WORK

Vailati never ceased to occupy himself with language as a philosophical problem. On the one hand, his approach was informed through and through by the rhetoric of suspicion[5] (and the suspicion of rhetoric), and this brought him into close proximity to Nietzsche, Peirce, Lady Welby, and Wittgenstein in particular. Vailati's approach, however, is Socratic rather than Nietzschean or Freudian or Marxist. Philosophy was to put us on our guard against pseudo-distinctions and pseudo-abstractions and show us "how to make our ideas clear," that is, reveal the ultimate conditions of linguistic meaning (and non-meaning), traced by Vailati to pragmatic conditions. On the other hand, philosophical reflection on language had also a descriptive and a constructive task: to perform a phenomenological inventory of our language forms and concepts and to delineate the various logical grammars of our expressive means. I want to focus here, though not exclusively, on the latter task, as exemplified in two substantial and fresh essays, "I tropi della logica," which, with a semantic orientation, deals with metaphors of mental processes, and "La grammatica dell'algebra," which, in the syntactic mode, examines the structure of algebra from the linguistic point of view.

"I tropi della logica" (*SF:* 195-203) is not only a piece of substantive language-analytical philosophizing in its own right, but it also points ahead to and compares favorably with the type of analyses undertaken much later by Wittgenstein and Ryle, within

the tradition of analytic philosophy, and by George Lakoff and Mark Johnson in recent years in their provocative discussions of the ubiquity of metaphor and of metaphorical constructions of "the mind."[6]

Taking deduction [*il dedurre*], the logical operation par excellence, as his object of analysis, Vailati asks whether we *de facto* schematize it according to diverse images and, if so, what they are. Answering in the positive to the first question, Vailati distinguishes three root metaphors, each of which represents one aspect, or system of aspects, of this paradigmatic *"processo mentale"*: 1) *appoggio/sostegno* [support/prop], 2) *contenere/includere* [containing/including], and 3) *salire/scendere* [ascending/descending].

The first group of metaphors focuses on the classical role of deduction as "a means of making our knowledge certain" [*un mezzo di accertamento delle nostre cognizioni*]. But, on the classical view, certitude is dependent on the certitude of the premises, to which the conclusion is attached by a thread [*filo*] of argument. Certitude is transmitted in a straight line, so to speak, from premises to conclusions. It literally "depends" on the premises, hangs from them. Greek science, logic, and geometry shared the same ideal of deductive system and gave cognitive priority to the system of premises, axioms, or postulates from which the process of deduction started out (the theme of "Il metodo deduttivo . . ."). The validity of the premises and their mutual coherence came either from their self-evidence or from the fact that they did not give rise to contradictory conclusions. At the same time, however, the images of *"appoggio"* or *"sostegno"* define a schema of "support," of premises as the "base" or "foundation" upon which the conclusions "rest." Greek thought was obsessed with the problem of foundations, especially in deductive systems, where, it was thought, the ideal of the human mind was most exemplified. While, to be sure, deduction was a process, and hence a development in time, it was the *completed* process, as exemplified in a unified set of properly related propositions, that the Greeks most admired. Hence, Plato's praise of geometry, the cultural influence of Euclid's elements, and so forth, in spite of Aristotle's own contributions to rhetoric and what is now called informal logic.

Vailati points out that this image does not correspond to the new view of deduction as it has been revealed in the rise of modern mechanics and in modern mathematical logic. Premises and conclusions are joined together by "mutual attraction," mutual dependency. The process of deduction is likened to a group of Alpinisti joined together by a rope (*SF:* 199). Deduction is much more like

an explication [*spiegazione*] than a demonstration [*dimostrazione*] in modern scientific systems, because the premises and axioms have no permanently privileged status, but play their role within a constitutional or democratic realm. Going beyond his claim that induction is "a reasoning process *without foundations*" [*un ragionamento senza fondamenti*] (*SF:* 374, n4), Vailati would seem to imply that deduction itself, as it functions within the realm of the idealizing physical sciences and in modern mathematical logic, is more a means of discovering just what a theory or set of hypotheses mean, or could imply, with respect to their bearing on experience, than a device for insuring the certitude of a process of reasoning, or finding a rock-solid base. The aim of modern science is understanding, not certainty. Here Vailati parallels exactly, it seems to me, the view of science proposed by Peirce and worked out by Dewey in his *The Quest for Certainty* and *Logic: The Theory of Inquiry*. Theories are organisms for Vailati, whose parts are mutually dependent and tied together by intelligible bonds discerned by inferential processes which could begin at any place in the organism.

The second group of operative metaphors, found in the pair *contenere/includere,* thinks of conclusions as *implied* by premises or the premises as *contained* in the conclusion, in fact, explicating the conclusion that is deduced from it. By relying upon this schematization, Vailati points out that we are led to think of deduction as the *extraction* from premises of what they already contain, of what is *implicit* in them. Deduction is a cognitive movement from the implicit to the explicit. But what, we might ask, happens to the cognitive status of the conclusion if it is already "in" the premises? How is a conclusion "in" its premises? Aristotle tried to answer this question by having recourse to an analogy based on the contrast between form and matter. Deduction, in his view, is likened to the work of a sculptor who releases the figure from the block of marble. Vailati, for his part, modifies, in an enlightening way, the analogy, by pointing out that the deductive process, so understood within this image schema, should be compared rather to the production of a lens [*lente*] or a dagger [*pugnale*]. This shift in the metaphor illustrates the greater and deeper cultural shift in the cognitive role of deduction: from the explication of what is already there to an instrument for seeing, by means of the theory, what would otherwise be inaccessible (the lens metaphor) or for penetrating (the dagger metaphor) to the inside. It is in this light that we are to understand Vailati's comment about "the task of deduction as the organizing activity of our knowledge in view of

the attainment of determinate ends, not excluded, it is understood, that of leading to the quest for acquiring new knowledge" (*SF:* 200). Hence, deduction has a properly heuristic role to play in the development and organization of knowledge.

Vailati has a view of deduction as active, contrasting it with other purely or predominantly passive operations (in his view) of observation, contemplation, or registration of the data of experience or of intuition. Deduction must be likened to a conscription [*coscrizione*] rather than to a census [*censimento*] (*SF:* 201).

But there is even more to the container image. It allows us to think of premises as simpler than the conclusions, as, in fact, the elements out of which the conclusions are composed. It is in effect a chemical analogy, and is latent even in Euclid's *Elements* and in Plato's *Theatetus* (206-08), where the fundamental principles of the various sciences are likened to the letters of the alphabet. In Vailati's view, however, the weakness of the chemical image is that it exaggerates the role of simple truths over against complex truths and creates the supreme ideal of scientific research as the determination of truths absolutely primordial, indecomposable, atomic [*primordiali, indecomponibili, atomiche*], "fit to generate all the others by means of their different groupings" (*SF:* 201). This is the Leibnizian ideal that likens truth to numbers.

To this ideal Vailati opposes an essentially pragmatic one. Simplicity and complexity, he points out, are extremely relative, depending on the goal of the affirmation, where it is uttered, weight of the treatment of which it is a part, etc. (*SF:* 201-02). Indeed, going further, Vailati argues that whether a proposition is demonstrable or a concept definable depends, in the one case, on what premises one accepts or, in the other case, on what *other concepts* one supposes as given (*SF:* 202). It is this shifting nature of the premises and of the concepts that reveals just how indebted Vailati is to his study of the history of science.[7]

The third group of metaphors, based on the image-schema of ascending/descending [*salire/scendere*], encompasses both deduction and definition, the latter of which is often represented as consisting in the ascent from particular intuitions to more general concepts *under* which the particulars fall (*SF:* 202), an echo, as is obvious, of the Porphyrian tree.[8] Vailati points out that metaphors of groups two and three share the notion that deduction involves passing from the general to the particular and that the upshot of definition can also be a movement from a more general notion to a particular notion (*SF:* 203). Hence, Vailati seems to be himself thinking in terms of an organism or of a web. These are, it is

apparent, themselves very powerful metaphors and images.

Comparing the metaphor of *rischiaramento* [*Erklärung*], which is a light metaphor, with that of *salire*, Vailati points out that the latter has the advantage of foregrounding not only seeing, but commanding and power, "come quando si parla di alture dalle quali si *domina* una data regione" [*a commanding view*] (*SF:* 203). There are, it is clear, many different heights, with relative advantages and disadvantages.

These exemplary analyses of the language of the mind, of those root metaphors that not only pre-structure our pictures of ourselves but also the procedures we use to structure our world and to set cognitional goals for ourselves, are heuristically fertile and permanently valid contributions to the hermeneutics of knowledge and illustrate the power of a linguistic phenomenology to contribute to an analysis of mental processes.

4. THE GRAMMAR OF ALGEBRA

The principal focus of Vailati's philosophical work was, as we have seen, twofold: an analysis of the significance of modern scientific methods and an analysis of the importance of language for philosophical reflection as a whole. The core of his approach to language was fundamentally semantic, for it was through the concepts carried by languages that human beings gained control over their world and entered into cooperative arrangements in social life, steering and evaluating both their technical and their ethical actions with respect to ends in view.

While the analysis exemplified in "I tropi dell logica" is resolutely semantic in orientation and in method, the groundbreaking essay "La grammatica dell'algebra" (*SF:* 304-24) offers us a precise and illuminating comparative account of the syntactic structures of algebra and natural languages. In it Vailati touches upon issues dear to general semiotics, whose principal goal is the description, classification, and comparison of sign systems of every sort.

What does an analysis of algebra, from the "grammatical" or "language" point of view, tell us?

The foundation of the comparison is that while other sign systems, such as the ideographic, which bypass phonetic representations may not have "words" in the strict sense of the term, their elements perform the same functions. These second types of writing systems utilize alterations in the form, or in the order of signs, to perform the analogous functions of natural languages realized by inflexions, prepositions, signs of predication and of

interrogation, conjunctions, and so forth. Algebra, music, as well as other ideographic systems, while engaging in a kind of competition with natural languages, resort to various expedients and have a special character all their own, which, in the case of algebra, is not to be restricted to the brevity and precision of algebraic notation with respect to numbers or to quantities.

Besides its advantage as a means of expression, the language of algebra, Vailati notes, is advantageous as an instrument of research and of proof (*SF:* 305). But, unlike the signs of arithmetic and music—which Vailati groups together as "nomenclatures" rather than languages and whose tasks are the description and decomposition into their elements of given groups of sensations or of complex actions—algebra and its semiotic partner chemical notation can enunciate true and authentic propositions (that is, propositions with objective reference) and deduce their consequences (*SF:* 306).

The first point of comparison focuses on the parts of speech (*SF:* 307*ff*). Vailati agrees with Max Müller that "language begins where the interjections end" [*il linguaggio comincia dove le interiezioni finiscono*] (*SF:* 307). Interjections are "full" of meaning in themselves and have no syntactic bond with other interjections. This syntactic bond, Vailati points out, is crucial for the joining of names, adjectives, verbs, and so forth to make phrases and propositions. Merely mentioning the name of an object, without joining it to other words in a syntactic matrix, is insufficient to determine what we intend to say. Vailati was very aware of the necessity of a syntactic field, in Bühler's sense, or of a linguistic situation, in Wegener's and Gardiner's sense, wherein the single linguistic units had to be set in order to do their work.[9]

This is extremely clear in the case of prepositions, which "mean" nothing without the addition of other words (*SF:* 308). Thus, "above," "beside," "after," and so forth always open up what Karl Bühler called *Leerstellen*, or empty slots, which have to be filled by other linguistic units. There are nouns and adjectives that also demand complements in order to signify: "*coetaneo*" [contemporary of], "*compaesano*" [fellow countryman of], "*maggiore*" [greater than], "*posteriore*" [following upon] (*SF:* 309). "*Nomi relativi*" have a "transitive" character, analogous to the transitive character of verbs, with which they have the further factor in common that they can be translated into verbal form. "So and so is the *enemy of* such and such" [*Il tale è nemico del tale altro*] or "this object is *higher than* another object" [*il tale oggetto è più alto del tale altro*] can be translated into "one person *hates* another

person" [*la tale persona* odia *la tale altra*] or "a certain object *surpasses,* or *goes beyond*, another object" [*il tale oggetto* supera, *o* sopravanza, *il tale altro*], and so forth (*SF:* 309-10). Vailati explicitly refers to Peirce's theory of relations: bivalent, trivalent, and so forth (bivalent: *insegnare* [to teach], *maestro* [teacher/master], *donatore* [donor]; trivalent: *vendere* [to sell], *comperare* [to buy]) (*SF:* 310). In plurivalent verbs, which are multiply transitive, the prepositions perform the role of connecting organs. To be sure, Vailati points out, the increasing number of "valences" governing the relation of verbs and complements would lead to ambiguities if there did not appear on the scene prepositions (or inflections) corresponding to the diverse "cases" of nouns. Telegraphic speech (addresses, financial statements, etc.) dispenses with them, however. "*Spedite plico segretario*" [send the packet to the secretary] is clear by reason of the semantic content of the words. But in the case of "*dico male di Tizio a Caio*" [I am maligning Titius to Caius], "*dico male a Caio di Tizio*," the dropping of the prepositions would make the sentences completely ambiguous (*SF:* 310-11).

Using the above points of reference as his analytical notions, Vailati subjects algebra to a grammatical analysis.

The first point to note about the special grammatical and syntactical characters of the language of algebra is the absence of intransitive verbs (*SF:* 311). The signs of equality or inequality are the equivalents of transitive verbs, and without them we have only "*expressioni algebriche*," not propositions. Such algebraic expressions as a+b, a×b, a−b [la somma *di a con b*, il prodotto *di a per b*, la differenza *tra a e b*] are of the same structure as the linguistic expressions "*l'urto* di *un corpo* con *un altro*" [the impact of one body with another], "*il disprezzo* di *una persona* per *un'altra*" [the denigration of one person by another], "*la distanza* tra *un punto e un altro*" [the distance between one point and another], and so forth, which function as relative nouns [*nomi relativi*]. So, the signs of equality and inequality, with the help of the signs of operations (addition, subtraction, etc.), exercise not just the functions of bivalent verbs but also those of any number of valences, and thus are able to express relations between many numbers, helped by the important device of parentheses (*SF:* 311-13).

The transitive verb character of algebraic signs is not their only defining property. They have the property of "syllogistic transitivity" (*SF:* 314*ff*). If, for example, *A* is a *concittadino* [fellow citizen] of *B* and *B* is a *concittadino* of *C*, then *A* is a *concittadino* of *C*. This is not the case with *creditore* [creditor]. The verbal signs of algebra (=, <, >) have this property. The axiom "two quantities

equal to a third are equal to one another" is the fundamental principle of algebra, which has been extended to cover and to subject to algebraic treatment non-mathematical or non-numerical relations (*SF:* 315).

Vailati points out that language often expresses the relation of two objects to one another by specifying the diverse points of view in which they are equal, or unequal (*SF:* 316-17). Two persons can be "equal in stature," two buildings "equal in height," two climates "equal in health." While, we—in English and Italian, say—use the preposition "in," Greek and Latin, for example, use the accusative and the ablative, respectively. So, such expressions as sine a = sine b, area ABC = area DEF are the algebraic equivalents of such sentences as "the stature of person so-and-so is equivalent to the stature of some other person," and so on (*SF:* 317).

Algebra also avails itself of implicit definitions. While sine functions are defined explicitly, areas are defined implicitly, by "definition by abstractions." Vailati refers to the Greek use of *logos*—translated by him as *"rapporto"*—in Euclid, as in *"le tali due grandezze* hanno lo stesso rapporto *delle tali altre due"* or *"il rapporto tra tali due quantità* è equale a (*o* maggiore, *o* minore di) *quello tra le tali altre due quantità."* Proportions, then, and proportional relations, exemplify implicit definitions (*SF:* 317-18).

Transitivity and commutativity do not always go together, though in the case of the definition of equality they do, and also in the definition of perpendicularity or parallelism. "Divisibility," however, does not share this property. That one number is divisible by another does not mean that the other is also divisible by the first (*SF:* 318-19).

In definition by abstraction, terms are defined by their use in expressions or propositions and are not free-standing units. Examples cited by Vailati: *giudicare a una data stregua* [to judge according to a certain standard], *andare in solluchero* [to go into rapture], *averne a iosa* [to have something galore], *andare a zonzo* [to loaf, or to loiter or to saunter], *di primo acchito* [at first sight, at once]. Another example: the exchange value of something [*il valore di scambio*] is defined in relational rather than absolute terms. But it is clear that it is the great use of implicit definition in algebra and mathematics that distinguishes it so clearly from ordinary language (*SF:* 320).

This inability (or non-necessity) to define explicitly what one is talking about has, for Vailati, implications far outside the realm of algebra and mathematics. While the decomposition of concepts by means of a specification of their elements has a certain useful-

ness in pedagogical situations, with which Vailati was much concerned, the term to be defined is perhaps best grasped or taught through direct observation of the facts or the relations which it is being used to express, through, that is, paradigmatic examples. This is also, in Vailati's view, the way of cutting short the interminable discussions on "time," "space," "substance," and the "infinite" (*SF:* 321*ff*).

Algebra uses the aforementioned means—the transitive verbal forms of =, <, >, nouns represented by numbers and variables, operation signs (+, −, ×, ÷)—to express isolated propositions. But in algebra, just as in natural language, we form chains of expressions in order to express relations of dependence or independence. Natural language uses conjunctions, which perform, with respect to propositions, what prepositions do with respect to nouns. But unlike natural languages, algebra has need of only one conjunctive sign to express consequence, represented by the word "therefore." In addition to consequence, however, it needs three other signs: for negation, for conjunction ("and"), and for disjunction ("or"), which are, of course, coin of the realm of symbolic logic, too (*SF:* 322-23).

Vailati clearly saw as one of the tasks of a systematic philosophy of language to study the "various systems of ideographic notations used in modern science, for example, in geometry, in chemistry, in kinematics, not to speak of the representational procedures used by geography and the diagrams used by statistics" (*SF:* 323).[10] In his opinion, the study of "artificial signs" merits just as much attention as the study of the signs of "natural" languages that have been adapted to different ends and sharpened by many voluntary and individual factors.

Vailati closes his essay with some further reflections on the pedagogical implications of what he has tried to do. The emphasis on explicit definition in both the teaching of languages and the teaching of algebra is deleterious. Both should be grounded in exercises of interpretation and conversation. Here is, Vailati thinks, a real chance for mutually beneficial exchange between the two putatively separate domains, the literary and the scientific.

Vailati has clearly shown that algebra has a grammar and a syntax, which systematizes a set of elements that correspond to the linguistic elements of nouns, transitive verbs, conjunctions, and prepositions. Implicit definition, or definition by abstraction, is the rule in algebra. As a study of relations it proceeds best by paradigmatic example, by exemplification. In fact, from the pedagogical side, algebra and the teaching of language have much

in common, for they are most successful when they do not rely on explicit definitions, but on the strategy of forcing the "seeing of connections," in Wittgenstein's sense. Hence, in this essay, as well as in many others, Vailati has produced a piece of comparative, general semiotics and a piece of pedagogical advice at the same time.

5. *PHILOSOPHY AND THE RHETORIC OF SUSPICION*

By foregrounding "the unconscious subjection of thought to language in the various fields of intellectual activity" [*l'inconscia schiavitù del pensiero alla parola nei vari campi d'attività intellettuale*] (*SF:* 117), Vailati anticipated, in spirit and in content, much later work in the language-analytic tradition. While the analysis found in "I tropi della logica" is a kind of linguistic phenomenology and that found in "La grammatica dell'algebra" belongs to comparative semiotics, many of Vailati's essays and reviews belong to the critique of language and to the problem space of the rhetoric of suspicion.

Vailati's analysis of this theme, which runs through his work from start to finish, is illuminated quite clearly by an analogy with which he begins his essay "Il linguaggio come ostacolo alla eliminazione di contrasti illusori" (*SF:* 325-30). Just as we are born into a society we have not created and are subjected to its rules, obligations, and rights, so our assimilation of a language as a system of distinctions and classifications strictly limits, as well as makes possible, our field or power of expression. Vailati notes that Galileo had to fight, for example, against the obstacles embedded in traditional language—distinctions between natural and violent movement, between terrestrial and celestial phenomena, between naturally heavy and naturally light bodies, between essentially hot and essentially cold bodies, between intrinsically good and intrinsically bad conductors of heat, and so forth (*SF:* 326). These distinctions, with all their conceptual baggage, belonged to that traditional "rete" inherited by Galileo, the freeing from which, at least partially, was necessary for him to create the new science of mechanics. The "*linguaggio comune*" and the "*linguaggio ordinario*" (*SF:* 327) contained also the results of past theoretical decisions, which had to be reformed. Both science itself and philosophy were to perform this task. In fact, the critical function of philosophy arises at this point and gives to Vailati's work on language, at least in this respect, its distinctively "Socratic" character. This is evident in the following pregnant text.

That part especially of philosophy that has as its object the analysis
and criticism of the fundamental concepts and criteria of knowing
and acting demands to be, so to say, rethought in every succeeding
generation; otherwise it runs the risk of losing all its efficacy and
of ending up damaging, rather than helping, those who undergo
in a passive way its influence.

The processes that lead to the elimination of the distinctions that
are gradually coming to be recognized as superfluous or unjustifi-
able are no less necessary for the healthy development of scientific
and philosophical thought than is, for the life of the body, the nor-
mal and non-interrupted activity of the organs of secretion. (*SF*: 328)

This is truly an "eliminative" conception of philosophy, but unlike
certain strands of analytic philosophy, Vailati did not think that
philosophy as such would pass away once it had resolved or
dissolved the knots in our understanding that linguistic problems
or scientific problems have produced. For the descriptive role of
philosophy, its task of reflecting upon the logical grammars of
our various means of expression, is never repudiated by Vailati,
who, in this respect, remains a critical pragmatist.

In his essay "Il pragmatismo e i vari modi di non dir niente"
(*SF*: 347-57), Vailati illustrated the nature and scope of his critical
pragmatism. It is truly a "language-critical essay," paralleling
many of analytic philosophy's procedures as well as its tone. In
this essay Vailati classified four types of propositions as "not say-
ing anything": 1) those that have become "true by definition" (as
when originally synthetic propositions have been transformed
into analytic propositions: e.g., the transformation of the law of
inertia into a conventional axiom); 2) those that have become "false
by definition"; 3) those that have been constructed within a "*pro-
cesso di generalizzazione*" whose role as means for given logical or
practical ends has been forgotten; 4) those that take for an expla-
nation propositions that merely reformulate other propositions
(*opium facit dormire quia habet virtutem dormitivam*—Comte's
"metaphysical explanations").

Terms such as "*tagliare nel vuoto*" [to cut in the void] (*SF*: 213)
and "*spostamento*" [shifting, Vailati's own English word] show the
affinity between Vailati's inner motivation and the trajectory in-
stantiated in Wittgenstein's work. Language for Vailati can "spin
its wheels" and "go on holiday." One part of Vailati's philosophical
effort is to determine just when this is so, so that the various
knots and entanglements of our intellect in language can be cut
and unloosed. In this, philosophy would be oriented to diminish-
ing distinctions, to clearing the linguistic thicket, to opening a

space wherein real sense can be expressed and controlled. Another part of Vailati's effort is to *"fare aumentare le distinzioni"* [to cause distinctions to increase]. This is necessary in order to do justice to the reality coming to articulation in the language, which otherwise might be cloaked by a defective articulation. Distinctions, then, are not only resolved in philosophy but also generated.

In his essay "La caccia alle antitesi" (*SF:* 210-19), Vailati specifies three types of procedures for generating and resolving distinctions and tries to show that the attack often does not abolish a distinction, but establishes it in a different context and framework, with a different theoretical bite.

The first approach holds that there is no precise line of demarcation between the groups of facts presumed to be distinct and that one passes from the one to the other by means of intermediate stages or gradations. But in this case, Vailati points out, distinctions are actually multiplied. The discussion of determinism and contingency, for example, exemplifies this category and avails itself of this procedure.

The second approach contends that the properties that are supposed to be distinct are possessed by both classes, or by neither of them. This approach, Vailati notes, only succeeds in putting in better light the distinct properties, as happened in the case of those who criticized the notion of cause. Sometimes the line of demarcation is shifted (*spostamento*) [*spostamento dolle distinzioni*], or one adds a second line of demarcation to it, or one just segments the field, as in the distinction between *apparenza (fenomeno)* and *realtà (essenza, noumeno)*. Such is also the distinction between egoism and altruism. Discussions about the differences between quantity and quality belong here.

The third procedure of attempting to abolish distinctions is exemplified in the erroneous tendency to "interpret a phrase that expresses a relation among many objects as if it had to have a meaning for each one of them taken separately" (*SF:* 215). Another example is the case of the law of inertia in mechanics, which only makes sense when we specify the spatio-temporal references within which the uniform rectilinear movement of a body occurs. Inertia in itself does not exist any more than the application of the term "antecedent" or "successor" to numbers is an absolute ascription. The same number can be both, just as a city can be both "east" and "west."

So, for Vailati, philosophy is caught between the two poles of generating and abolishing distinctions. In this sense it is a linguistic exercise that straddles the fence between the Scholastic

maxim of *distingue frequenter*, which pursues the path of differences, and the traditional philosophical task of finding general concepts, universals, the absolute.

Philosophy, as practiced by Vailati, is an activity that forms and cultivates the critical powers of the person engaged in it, generating new mental habits. Its focus is a reflection upon cognitive methods, a clarification of concepts, a determination of the conditions of sense, both linguistic and non-linguistic. Vailati's work encompassed historical epistemology, linguistic phenomenology, comparative semiotics, and a sense-critical pragmatic analysis. Rejecting the road of oracular and monological philosophy, Vailati embedded philosophy in the web of cultural discourse as a whole, with which it intersected, both theoretically and practically, at just about every point. And it is this comprehensiveness, combined with an authentic modesty about philosophy's powers, that makes Vailati's work a model for us as well as a permanent source of insight.

1. Indianapolis: Hackett, 1981 (rev. ed.).

2. Vailati has been frequently anthologized. Already in 1916 appeared, with Carabba di Lanciano, the volume *Gli strumenti della conoscenza*, edited by Mario Calderoni, and in 1918, with the same publisher, appeared *Il pragmatismo*, edited by Giovanni Papini. These two volumes have now been reissued, with Calderoni's preface and edited by Biagio Loré, as *Metodo e ricerca* (Lanciano: Carabba, 1976). The first volume of *La cultura italiana del '900 attraverso le riviste* (Turin: Einaudi, 1960), edited and introduced by Delia Castelnuovo Frigessi, is devoted to the journal *Leonardo* and contains eight essays by Vailati. Ferruccio Rossi-Landi published a collection *Giovanni Vailati: Il metodo della filosofia* (Bari: Editori Laterza, 1957 (revised 1967)) containing eight essays, with important introductory materials and notes. This was followed by a volume *Scritti filosofici*, edited by Giorgio Lanaro, in 1972 (Naples: Editrice Fulvio Rossi), and reissued in 1980 by La Nuova Italia Editrice in Florence. The Rossi-Landi and Lanaro volumes have important bibliographical information concerning the secondary literature, mainly in Italian, on Vailati. Finally, we now have a new edition, in three volumes, of the *Scritti*, edited by M. Quaranta and introduced by L. Geymonat: I. *Scritti di filosofia*, II. *Scritti di scienza*, III. *Scritti di scienze umane* (Sala bolognese: Arnaldo Forni Editore, 1988). An important biographical sketch will be found in *Scritti*, pp. I-XXIX (by his cousin Orazio Premoli) and a "Ricordo di Giovanni Vailati" by Luigi Einaudi in *Epistolario*, pp. XIX-XXVI. Unless otherwise noted, all page references in the present essay will be given to the Lanaro volume, which is perhaps still the most accessible and handy. It will be cited as *SF*. All translations are my own.

3. The same idea is found in Eco's *A Theory of Semiotics*, pp. 163-67, 248. See also my essays, "Notes on the Semiotic Model of Perception," *Philosophical Inquiry* 2/2+3 (1980), 496-507 and "Die Überwindung der Assoziationspsychologie durch zeichentheoretische Analyse: James, Peirce, Husserl, und Bühler," *Zeitschrift für Semiotik* 10/4 (1988), 149-73.

4. One of the benefits of reading Vailati is to follow his citation path and to come upon forgotten or at least neglected authors. One of these is Gyula Pikler, a Hungarian psychologist and philosopher, who also wrote in English

and German. Rossi-Landi notes that Vailati showed the greatest admiration for his ideas and utilized them in his discussions of pragmatism. Vailati was especially interested in his *The Psychology of Belief in Objective Existence* (London: Williams and Norgate, 1890). Pikler's analysis completes, in Vailati's opinion, the work of Berkeley, Hume, and Mill in the construction of a pragmatic epistemology. While this is an admittedly ironic fusion of various theoretical positions, the upshot of Vailati's discussion is that objects are permanent possibilities of sensations or experiences. For Pikler, and Vailati agrees, the "existence" of material objects and their properties is established by the same means that we use to establish the existence of our attitudes, or cognitions, or our memories. It seems that we have here a use of "dispositional concepts," in the sense of analytic philosophy. Hence, the powers ascribed to human beings are "virtual," and not necessarily actual. Even the analysis of our own immediate consciousness is in virtual terms for Vailati, or in terms of "*previsioni*," whether we are dealing with how a given thing "appears" to us at a certain time, or with the expression of a present sensation, a momentary state of mind (*SF:* 344). Self-deception is possible, on Vailati's terms, because our dispositions and beliefs can be in opposition to our actual actions. Dispositions are "programs of action" (*SF:* 345):

> The "inner" world no less than the "outer" world is not only made up of what, at a given moment, is found "in act," but also of what is found "in potency"; to the one as well as to the other one applies the statement of Pikler that "the 'would be' of presentation is the 'is' of objective existence." (*SF:* 345)

5. See especially Vailati's essays "Sull' arte d'interrogare" (*SF:* 204-09), "Un manuale per bugiardi" (*SF:* 292-99), and "Il linguaggio come ostacolo alla eliminazione di contrasti illusori" (*SF:* 325-30).

6. George Lakoff and Mark Johnson, *Metaphors We Live By* (Chicago: Chicago UP, 1980); Mark Johnson, *The Body in the Mind* (Chicago: Chicago UP, 1987).

7. See Michael Polanyi's stimulating discussion of the nature of premises in his *Science, Faith, and Society* (Chicago: Chicago UP, 1946; repr. 1964), pp. 85-90 and in his *Personal Knowledge* (Chicago: Chicago UP, 1958), pp. 160-71.

8. See Umberto Eco's discussion of the Porphyrian tree in his *Semiotics and the Philosophy of Language* (Bloomington: Indiana UP, 1984), ch.2.

9. See my essays "Bühler und Gardiner: Von der Indikation zur Prädikation," in Achim Eschbach (ed.), *Bühler-Studien* (Frankfurt am Main: Suhrkamp, 1984), pp. 117-55 and "Articulation as Emendation: Philipp Wegener's Anti-formalist Theory of Language," in John Deely (ed.), *Semiotics 1984* (Washington, DC: America UP, 1985), pp. 577-87, and my book *Karl Bühler: Semiotic Foundations of Language Theory* (New York: Plenum, 1982). The three masterworks of language theory that intersect with Vailati's approach are Wegener's *Untersuchungen über die Grundfragen des Sprachlebens* (Halle: Max Niemeyer, 1885), translated as *The Life of Speech* and contained in *Speech and Reason*, with a contribution by D. Wilfred Abse, "Language Disorder in Mental Disease" (Charlottesville: Virginia UP, 1971); Alan Gardiner's *The Theory of Speech and Language* (Oxford: Oxford UP, 1932); and Karl Bühler's *Sprachtheorie* (Jena: Fischer Verlag, 1934).

10. We now have a large literature on this topic, which I cannot go into here. I would, however, like to mention a remarkable but little known book that focuses on this domain and that will easily lead one to other materials: James Bunn, *The Dimensionality of Signs, Tools, and Models* (Bloomington: Indiana UP, 1981). See also my article, devoted to this book, "Sizing up Signs," in *Kodikas* 6/1+2 (1983), 115-32. George Mounin, *Semiotic Praxis* (New York: Plenum, 1985), also has interesting treatments of the same themes. I have discussed this book in my review article "Between Signification and Communication," *Semiotica* 65/3+4 (1987), 327-42.