

Literary Invention

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Mr. Chairman, I am very grateful to be invited to a Symposium of a sort that we would very much like to be able to hold in France itself. I cannot say, however, that I am particularly happy to have to open a conference that is undoubtedly going to prove so fertile and yet so difficult that in all likelihood what I am about to say will appear much less invigorating and less profound than the discussions which are to follow. But this will not be the first time that Frenchmen have been called on to leave their country in order to become better acquainted with each other, and sometimes to better understand each other. Let me add that I am most grateful that you have consented to our addressing you in French. For myself in particular, I would have considerable difficulty in maintaining the high intellectual level of discussion which you have encouraged had I to express myself in another language.

My subject this evening is "Literary Invention,"¹ or more precisely, since I am not a specialist in either language or literature, the relationships of literary invention to invention in general.

In rereading the summary of this paper as I was giving it to be mimeographed, I noticed that it contained relatively little about literature and a great deal about other things. I must make my excuse for this the hope that you will not find it uncongenial to have the problem of literary invention and of all the discussions which will take

¹ "L'Invention littéraire": "literary inventiveness, discovery." The text which follows is a translation and in some instances a paraphrase of the tape-recording of M. Morazé's lecture. The footnotes have been supplied by the translator.

place here placed in a wider context. After all, since you are going to discuss not only the question of the language of criticism but also that of its place in the sciences of man, it is in this perspective that the generalizations which I shall make, even if some of them may appear somewhat obvious, will find their place.

Thus I find myself led by my own interests into speaking to you first of all about invention in mathematics. This is undoubtedly the result of the fact that as I have tried for years to discover what invention was, it has seemed to me that the authors who spoke of it in the clearest way were mathematicians. It is not that mathematicians are more gifted than other people in matters of introspection, but simply, it seems to me, that in mathematics invention appears in a system simple enough to be more easily recognizable.

Let me therefore recall that celebrated lecture by Henri Poincaré, sixty years or so ago, when he was asked by a number of Parisian psychologists to explain what in his personal experience invention was. What he said—and it has been quoted a hundred times since—was that the solution of a problem does not necessarily come about at the conclusion of a lucid and conscious effort, but that, on the contrary—especially for the really difficult problems which led him to propose entirely new formulas, creative formulas one might say—the solution had surged forth when he least expected it, at times when he was doing something quite different. The role of what he then called the unconscious is even more remarkable, since, as he says, he was led to address himself without knowing why to a certain element of the problem, or to a difficulty which seemed to be without any relationship to the general problem with which he was struggling, as if for relaxation. Then, after days or weeks, he realized that what he had thought was a contingent phenomenon was in fact precisely an element of the process of discovery which was to lead him to the final solution. The importance of the work of the unconscious in mathematical invention was thus emphasized by Poincaré, and the question was taken up again by Jacques Hadamard, who employed part of the time he spent in this country in exile during the war, in New York in fact, in extending the quest begun by Poincaré.² But the inquiry sheds light on other reflections which had long seemed incomprehensible—such as those to be found in Newton, or perhaps more precisely in Gauss, who, speaking of his *Disquisitiones arithmeticae* (1801), said: “I know that I discover things, but I don’t know *how* I discover them,

² Jacques Hadamard, *The Psychology of Invention in the Mathematical Field* (Princeton, 1945).

and when I reflect on it, I think that it can only be a gift from God, since things come to me all of a sudden without my having done anything, apparently, to merit them." The philosophers of invention have attacked the problem in all sorts of ways, and it has been possible to find in the works of musicians, Chopin or Mozart for instance, and in the works of men of letters like Valéry, expressions which seem to indicate that the unconscious processes had in fields other than mathematics the same importance as that indicated by Poincaré. But let us restrict ourselves at this point to the general recognition that the operation of the mind can and does transpire apart from periods of [conscious] invention. Were we to comment on this assertion, which I shall provisionally enlist as a valid postulate, we could refer to a number of studies made by physiologists who, notably since Nicolle,³ have long sought to reconcile the notion of invention with that of chance, as if lucky accidents had brought together extremely diverse notions, as in the case of Poincaré's discovery of Fuchsian groups and functions, belonging to mathematical domains which had never before been related and which were brought together for the first time by him in his discovery. Thus, according to this view, a chance phenomenon would account for the construction of a new idea out of the juxtaposition of diverse ideas.

In fact, however, everything we know about the process of invention contradicts this reflection of Nicolle's. It is not a pure and general act of chance which admits of inventive creation. And no invention can be wholly accounted for by the theory of probability. If Poincaré invents, or if Chopin finds the theme of a melody, or if Mozart tells us that he discovered a quartet while he was traveling through Italy in a carriage, it is not so spontaneously that the discovery appears, but rather (doubtless after an interruption) as the result of a preliminary effort of preparation, which comes about through a series of stages. First of all the thinker must be familiar with mathematics, then within this area of familiarization he must further familiarize himself with the specific problem, or more precisely with the particular fields of mathematics necessary to the elucidation of the problem in question.

But one can go beyond this way of dealing with the stages of the preliminary preparation. If we analyze closely the testimony of a whole series of scientists, poets, and inventors—musical or mechanical—we can recognize three general phases in the process of invention. In order to elucidate each of these phases, it happens that reference to Latin is particularly suitable, as the French mathematician Hadamard sug-

³ Charles Nicolle, *Biologie de l'invention* (Paris [1932]), pp. 5-7.

gested. The first phase would correspond to the meaning of the Latin *informare*. As I have just pointed out, the author or creator of the invention must familiarize himself with the use of signs and methods, he must deepen his general knowledge and pick out in this general area those particular areas which are especially suited to him. At this stage we must emphasize the importance of all the collective contributions of society. A mind alone is not capable of forming itself or of *informing* itself. It is society as a whole which has offered the inventor all the books which he has had the opportunity to read. (It happens that Gauss was the son of a gardener, whereas Poincaré came from a much more bourgeois family. Both had been able to familiarize themselves with a certain number of texts which were more or less recent products of society.) What is more, since all reasoning processes are both a function of and in relationship with all sorts of actions in daily life, I would note at this point, without going into detail, that the framework of civilization in which one lives has an exceptional importance for the inventor. It is certainly true, for instance, that Newton would not have thought of gravitation if the idea of a globe suspended in space had not become a familiar one in his century. And it is probably not without relation to the taste which architects developed at this time for the construction of cupolas like that of the Pantheon where Foucault's pendulum was to be suspended, the pendulum which was to permit an entirely new precision in measuring the speed of the earth's rotation. At this stage then, the inventor is part of a group whose products he assimilates. These products are not of course simply those directly useful to his invention, but all those which are capable of orienting his meditation in the direction of a discovery to be made.

The second moment is that in which the brain must be put to work, not simply abandoned to the contemplation of works of art or the works of civilization, not simply allowed to indulge in a passive reading, but a moment in which the brain must be put into a state of activity. Many of our contemporary authors employ stimulants at this stage. Poincaré tells us that he used to drink quantities of strong black coffee. But such things are no more than catalysts acting on the nervous system; they are insignificant in relation to the extreme concentration of attention which actually starts a mechanism. Referring once again to a Latin expression, I would say that here the word is *cogitare*, in the sense of *coagitare*. It is a question of making a whole series of notions act together, notions that one will choose from the areas which seem as close as possible to the goal in view. But these notions are assembled and made to act together without one's knowing where one

is going, since obviously the invention has not yet been accomplished. Thus an interior process begins to operate, guided by consciousness and often quite clear to consciousness, but a process which goes on even when one's attention is relaxed during periods of sleep, or while one is on vacation. As many inventors have replied when asked about it, this process as often as not is all the more successful in proportion as one's attentiveness allows it to develop freely and does not attempt to force it into a path which might be too particular and preconceived for the new idea to be produced.

Obviously the material which is put to work in this way (Poincaré used to speak of "atomes agités") is derived from the productions of society of which I was speaking a moment ago.

And then, at a certain moment of this activity of co-agitation or meditation, a light breaks through. This—as Chopin, or Valéry, or Poincaré have told us—is a "sudden illumination." A sudden illumination which forces us to insist upon the neurological character which is already implied by the fact that, outside attention or attentiveness, the process is, if not actually begun, at least continued. This is a sudden illumination which everyone agrees gives a feeling of marvelous liberation, a feeling of a sudden internal happiness. To speak in a very concrete way and without referring to experiments concerning micro-electronics, which are not yet very far developed in physiology, one might say that this feeling probably corresponds to a sort of better organization of our cerebral cells: a mass of cells which had been blocked by a problem suddenly finds itself liberated because a better organization of what I shall call later on formulas or vectors of thoughts corresponds to an improved economy of our cerebral process, liberating an energy which had been blocked, and thus giving that joyous satisfaction which is doubtless the phenomenon which reawakens the attention. For an example one might cite the joy of Poincaré when he was going for an outing in the countryside around Caen and suddenly found the solution of his problem as he was stepping onto a bus.

But if the solution to a mathematical problem, like the solution to a poetical one, is actually discovered in this way, it is one possible combination amongst many other possible combinations which have been tried in thousands of ways in the work of cogitation. This phenomenon or experience of choice in fact corresponds to the Latin word *intelligere*. I choose in the midst of a set of possibilities. On this point, Valéry, who in studying the problems of poetry tried to take up again the problem of invention, emphasizes that when he finds something,

or more exactly when he is in the process of seeking and finding at one and the same time the solution to a poetic problem, he feels himself to be two persons.⁴ He becomes double. Preceding him, without having had the same preoccupations with explicating the internal nature of invention, Renan had already said (at the beginning of his *Philosophical Dialogues*): "When I reflect, I have the impression of being the author of a dialogue between the two lobes of my brain."⁵ This anatomical metaphor would no longer be accepted by physiologists, but the doubling corresponds to the effort of bringing into action all sorts of propositions and positions and to the choice of a particular conjunction amongst many others which could have presented themselves.

But we must not visualize the operation of cogitation or meditation and the operation of intellection as two rigorously distinct operations, the one characterizing a phase precisely defined within one duration and the other, another completely distinct phase in a later duration. In reality, intellection intervenes, either consciously or unconsciously, at every moment in cogitation in order to relieve the machine of the work which is useless to it and in order to add to it what is necessary to it—just as the mathematical and arithmetical experiences of Poincaré were necessary to the solution of the problem of the Fuchsian function, which had originally appeared to him as of a purely geometrical nature. Consequently, at every instant of the process there is a simultaneous duality of interacting possible formulas and of choices which are as yet only provisional but nevertheless active and which will eventually blossom into a perfect intellection. Obviously one must beware of the great satisfaction felt as a result of finding a solution, for it alone is no guarantor of the authenticity of that solution. Hadamard once remarked to me on the number of students who would come to see him and say, "I've found a marvelous formula for resolving this form of integral." They would be so enchanted that they had no suspicion that they were not right, but a precise proof would show that they were mistaken. They would have simply forgotten an essential element. We are all aware of this, whether in our writing or in our teaching. Many students who are absolutely sure that they have

⁴ Valéry develops this idea in "L'Infini esthétique," *Oeuvres*, II (Pléiade), pp. 1342-44. See also "L'Invention esthétique," *Oeuvres*, I (Pléiade), pp. 1412-15, and the text discussed by Hadamard entitled "La Création artistique," originally read to the *Société française de philosophie* (28 January 1928) which is reprinted in *Vues* (Paris, 1948), pp. 285-303.

⁵ Ernest Renan, *Dialogues et fragments philosophiques* (Paris, 1876).

produced a magnificent essay are very surprised when we show them that, while their essay included a sudden illumination in the sense that I have already used the term, it did not amount to a discovery of authenticity.

There is authenticity only when the process of intellection has been conducted with all the desirable controls. That is to say, in the case of mathematics, all the mathematical knowledge which *must* be at the disposal of the inventor, who will verify what was produced in illumination and cogitation, will enable him to judge that it is valid. If he is a very good mathematician whose power of intellection has operated throughout the process of cogitation, then of course verification will be a mere formality. If he is not, on the other hand, then a defective piece of work will result. And in any case, apart from the verification by the man himself, there is still the verification of other mathematicians, just as you verify what I say while I am speaking. Thus there follows an effort which gives intellection its true meaning: the effort of a collective control by means of all the products of the same order elaborated by the collectivity. So that if we attempt to distinguish between the exact part played by co-agitation or cogitation in information, which comes entirely from the social, and an intellection, which is only valid if it brings into play all that is suitable in the social, we see that the phenomenon proper to cogitation depends on a kind of surface or line without thickness, or on a kind of point without any essential dimension, but which ultimately reduces considerably the part played by the personal element in invention. Is this to say that the author must be considered as not existing at all? Certainly not. If there were no men, there would be no inventions. And it is certainly in the brain of an author that the phenomenon is produced. But it is produced there insofar as the author does what? In the first place, he has put himself in a certain situation, in a certain state; he has at his disposal his cerebral cells, his body, his eyes. He has been situated in a certain social environment, as in a certain universe of signs, in a universe of information, and in the same way he has been placed in this universe in order to be able to be intelligent, that is to say in order to be able to choose with good reason the correct solution among the possible solutions available. In this function the author obviously has an essential importance.

I would say that he has an equivalent importance on a second level, which I shall dwell on at much greater length. The author supplies a certain energy, an energy which can perhaps be measured only quantitatively. This is a central problem which I don't think is one to be

discussed here, but which will be the main object of the preoccupations of physiologists and psycho-physiologists of the brain in the years to come. Whether it is a question of a quantitative energy or not, it is certainly a question of genuine energy. It is precisely on the way that this energy fixes itself to ideas, signs, and images in order to direct them toward the creation of new ideas, signs, and images that I want to insist. Not on its nature—I don't know that its nature is known—but on the manner in which it treats the problems which it animates.

The difference between mathematical and literary invention is evident in the fact that the mathematician works with signs—unhappily called symbols by most mathematicians—which mean nothing to anybody not initiated into the science of mathematics. Mathematical signs are completely devoid of any specific energy, whereas the signs presented in a book of reproductions—a painting by Ingres or Michelangelo for instance—strike us immediately without our being particularly informed on the subject. The mathematical sign is therefore a sign which by itself is devoid of energy. Consequently the work of information in mathematics consists of an operation of conditioning. These signs have nothing to say, they mean nothing, they do not by themselves strike our imagination, nor our profoundest organisms, nor our emotions. They bring about no modification in our glands, nor in the constitution of our blood, nor in the circulation of the humors, but these alien signs are then charged with signification and force, and it is after this artificial charging of neutral signs that the process of invention takes place. At the end of the process, what is produced is re-translated into signs and the signs are left in their neutrality until they are charged again, and so forth.

Signs belonging to the aesthetic universe are, however, directly charged with emotions. Without our even having to make a specific effort, these signs set off an emotional energy process within us. This or that pleases or displeases us, it inspires us with desire or disgust, but the sign paints, sculpts, or speaks directly, insofar as it carries an image which recalls something to us, which strikes our senses indirectly, or which awakens a sensation. The process which creates and orients the energy I speak of is set off by the sign. I would say that the most powerful action of poetry or aesthetics is that which lends signs—or more exactly symbols in this case—the maximum amount of force.

This is when, in spite of ourselves, after reading the first three words of a poem, we continue to read the rest; it is when, after perceiving the vague gleam emanating from a painting, we wish to look at it and

contemplate it longer. It is from the moment that a certain energy develops with great force from a work of art or from an aesthetic experience that we find ourselves facing a great phenomenon, a great poem or a great aesthetic response. This aesthetic process operates on symbols, and it is not unrelated to the disincarnated mathematical sign, precisely because it is its opposite and therefore its necessary complement. For in the work of what I would broadly call poetics, when signs or symbols are offered us, and when they are offered us less in isolation than in a sort of confrontation with each other, they wear out, they become exhausted. And when, after a long historical process, certain signs or symbols are situated in a totally exhausted terrain, they then become pure articulations, without meaning. These are the most useful words for mathematical invention, which then recharges them.

In poetry therefore there is a double quest, or rather double labor which will erode a certain number of signs. And since all signs cannot be eroded, since one cannot live in a universe of signs reduced to the state of pure articulation, the poetic effort of painting and the arts recharges other signs.

It happens that in studying these problems of linguistic economy, the economy of words or of the letters of the alphabet, or the economy of language, there has been a great deal of talk, from Saussure and all his imitators, about the example of the word "boeuf." It is certain that the word "boeuf" can lend itself to all sorts of different emotive charges. More precisely, in the temples of Egypt it was charged with a superpowerful emotivity. Many of the words which for us have become ordinary words—and "boeuf" for a biologist is no more than a sign almost as disincarnated as a mathematical sign—must have been at the origin, when they came forth from an imagination full of symbolism, carriers of a charge which invited the faithful not to an effort of abstraction but to an effort of adoration. Thus the ultimate action of poetry is both to choose among the signs with which it deals those most apt for the pure articulation of a supposedly perfect logic and, from period to period when a mode of diction or an aesthetic meaning becomes exhausted, to try to recharge it with emotions so that the process of invention may go on.

Obviously in this recharging with emotion, images play a very important role. The value of words is not in their design alone; this is especially true of pictographic writing. The pure design of writing may have value, as certain French poets have tried to show in playing with the arrangement of lines, words, and syllables. But ultimately words derive their value from the images which they bear. And here,

to evoke one of the most difficult problems of literary (or even scientific) comprehension, one could say that these images themselves or these articulations of images have value as representations of acts. Actions act on things, which images do not. Words act on images—and we find ourselves involved in a complex structure: words acting by means of images on men who act on things. We are in a sort of structure that I might call triangular, but which I think would be more complete if we called it a tetrahedral structure with four faces. But however this may be, the essential point is to note that literary production does not work with signs which are pure articulations, but with words bearing images which seek to establish between images the same type of inter-relation and inter-connection as the man of science or the mathematician tries to establish between signs devoid of emotion. Literary invention lives by discharging and recharging symbolic signs.

In every case, of course, the Social intervenes with considerable force. Mathematical, literary, poetic, or aesthetic invention is situated in a wider framework: the entire universe of action. When the President of the United States or the President of France wishes to launch a new policy, he uses words. Men of action like men of the business world begin with words. But there is a great difference between the universe of action and the universe of literary or other works, in the sense that when a man of action or a businessman or a statesman wishes to succeed in an undertaking, he may begin with words, but he must nevertheless wait days, weeks, or months while a whole series of inter-relations is established, often through the use of words, of course. When these inter-relations have brought together in the appropriate conditions a sufficient number of human beings or interests or nations, as the case may be, the man of action has then provided himself with the power to bring about an *event*. But this event is not always—in fact, is rarely—the one which the hero who began it actually desired, since all the time that he was trying to bring it off he was being forced to modify his plan in order to accommodate all the other people essential to the success of this event. The same thing will be found—but at a purely abstract level—repeated in mathematical invention, which, in its own way, is an event. And between the pure sign of mathematics on the one hand and the largely social phenomenon of action on the other, the same thing will be found in the domain of the aesthetic and, more precisely, of the literary work. The same phenomenon is involved, the same way of creating an event. But the words of literature and the images which they evoke are, as Catherine the Great once said to

Diderot, much easier to manipulate than are human groups. The easiest of all to manipulate is probably the mathematical sign. All this is not to say that words and images are less "social" than human groups. But unlike the action whose event is not achieved in its initial utterance, but only after an extensive reference to the "real world" has modified the words themselves sufficiently for them to become part of a movement or policy in history, the literary work, once it is written, comes into existence all at once, whole and entire. The literary work needs no public in order to exist. The task of the public is to judge the work and although its first judgment may be inaccurate, as in the case of Stendhal, communication is eventually established between the work and the public, and at that moment, it is the feeling the public has toward it that indicates the quality of the work. In other words, one can find in the social processes of political action, as in literary history or mathematical judgment, the very same set of phases which I spoke of at the beginning of this paper: information, cogitation, and intellection.

It is these three broad evolutionary phases of the work of the mind which give it, whether in the order of action or of pure science, its force, color, and savor, in fact its whole content and supreme justification. We find ourselves facing either a refinement of effort (in science) or, on the other hand, a materialization of effort (in action), and the work of art is situated between these two poles. The artfully successful sentence is perhaps, after all—since man is also a physiological organism in action—the highest product of human genius. It is sustained by its own logic. But this logic, a totally abstract articulation, could not possibly satisfy the needs which our taste for life, our feeling for life, our hope of life instill in us. If, therefore, the syllogism reduces abstract articulation as much as possible in the rigorous work, it is nothing by itself. On the contrary, the work affords a certain means for men to situate themselves in the midst of society in such a way that society itself is located in the universe of things that it creates or that is offered to it by nature. Thus, in the reduction of the literary work, the creator or his hero (who represents either the creator himself or his antithesis) stands in relationship to other men, so creating logical articulations and, at the same time, lending to the political, scientific, or literary event its *mass*. The articulation is what makes the event comprehensible; the mass is what gives it its weight, its force of impact, its real power—or to use a vague but evocative word: its *beauty*. Thus, if we wish to sum up in an approximate word or two all that invention represents as integrated into larger structures—the object invented or discovered at the very end of the creative process: we

could say that the beautiful work is situated at the crossroads where what is accomplished comes forth from the possible and where certitude is offered as a reward for chances taken.

Discussion

JAMES EDIE: I want to ask a question; I would like to ask one that is very simple-minded. It struck me while listening to your very interesting discourse which attempted essentially to bring together, if not to identify, creativity, whether in mathematics, let's say, or in the realm of literary invention. Now, this is a very simple question and no doubt it hardly belongs here, but it might be interesting for us to have your reflections on it. It seems to me that in the realm of mathematics, for instance, in algebra or nearly any realm of mathematics, once the data of a problem are *set*, the structure, the *answer*, is also *set*; there's only one correct solution to a mathematical problem. Now, this may require a great deal of creativity, but there's really only one solution normally. This will not be true, I take it, in a problem that we can say is a work of literary invention. There seems to me to be a fundamental, essential difference.

CHARLES MORAZÉ: You say that there is only one reply to a mathematical question. It is very difficult to accept your assertion. I think that this is the ideal conception which we have of mathematics, but it is certain that the history of mathematics presents many crossroads; crossroads which suggest, at least for a particular period, which of several alternatives is the right or wrong answer.

The postulates go without saying. Men have made a whole mathematics, a whole Euclidian geometry, only to see, after all, that there were other possible off-shoots. Men thought there was only one solution while, in fact, the solutions were more numerous.

I would say that it is likely, it is very likely, but is not certain, that the invention of symbols—like the symbol “the root of minus one,” for example, which is completely irrational—would have been the only solution to problems which were [then] posed. But, let's admit it, we see nevertheless that mathematics cuts across itself, from time to time, with irrational periods; that is to say that mathematics is a flow of inventions much more restricted certainly (and there you are entirely right) than aesthetic invention; but it is not absolutely a straight and rigid line. So, your observation is entirely right, but we should not

push it to the point at which all comparison between mathematical invention and the invention of action, or aesthetic invention, is made impossible.

Let us say that mathematics is what is closest to a rational continuity, but that it is not identical with it. Mathematics goes through irrational periods, or zones, in which, suddenly, attitudes toward what might have been taken for certain before, change, and, consequently, there is that slight opening which is indispensable to mathematical invention; which means, once again, that one can discuss aesthetic and literary invention by following the same mental procedures and with the same models, which one must adapt (but which are really the same). I insist on this because you must not think that mathematics is entirely logical. That's not true; mathematics is full of illogical things which must be accepted as such.

Having said this, I think that it is clear that the mathematical universe in a given period, at a given moment, is more easily exhausted, and is enclosed by much more rigorous limits, than the poetic or aesthetic universe of which we never know if all the works of a period, all the authors of a period, have given a quarter, a third, or a thousandth of the possibilities offered.

RENÉ GIRARD: I will ask a question starting from the one just asked. If mathematical invention opens diverse possibilities, from another point of view, it seems to me that literary invention is perhaps *less* complex than is said; many great writers in fact (I am thinking particularly of novelists—of men like Proust) have said that the novel [has] absolutely no invention in it; and perhaps starting from certain personal and social contradictions, the possibilities of literary expression are I won't say only at one level, but perhaps very limited and not as vague and complex as the idea of imagination suggests.

MORAZÉ: I was trying to give some "spice" to the discussion, but it goes without saying that it is almost as difficult to invent a literature different from that which existed during a period, as to invent a mathematics different from the existing one at a certain time.

But I must simply say that there are, nevertheless, periods in the history of aesthetic production—you are going to say that I am straying a bit from the question, I confess, but I think it is important to draw attention to this—there are periods which lend themselves to many expressions; others, on the contrary, which are enclosed by unique expressions; and still others which cannot be expressed. They are *inexpressible*. There are *periods* in literature.

JEAN HYPPOLITE: Just a word; I wonder if great invention is not the invention of problems rather than the invention of solutions.

MORAZÉ: Certainly.

HYPPOLITE: According to Bachelard, we must reverse the question, "A problem well posed is always resolved"; we must say, "It is when it is three-quarters solved that the question is posed." The path of invention goes toward the "overture" of the field of problems and not toward the solutions. And it is this extraordinary opening which is, in retrospect, understandable, which is as profound in the mathematical domain as in the domain of the invention of literary structures; because the novel of Marcel Proust is entirely different from the novel of Balzac, and the "new novel" is something else again. There are, therefore, openings in history which are openings of a domain or of a problem. And consequently that is the invention of a problem. This said, I am not making anything clearer!

MORAZÉ: No, but I thank you for saying it because you emphasize what I was trying to say, too briefly and probably badly, in saying that the work itself emerges from the field of the possible and it's the exploration of the possible which is important, just as the work is, as I have already said, a recompense for risk. That's what Poincaré, I think, said: "The important thing, if you want to find the correct idea is to begin by thinking off-center [*penser à côté*]." (I'm not sure whether that's not a good symbol for this colloquium!)

LUCIEN GOLDMANN: M. Hyppolite has already touched on half of what I want to say, but I will just add a few words. I agree entirely with what M. Morazé has just said; well, I agree with almost all; but just one remark: cogitation (and information), cogitation, perception in the domain of science is found in the context of a posed question, as M. Hyppolite has just said. And this problem, the posing of the problem, is not an entirely intelligible phenomenon. It is obvious that the posing of a problem is closely allied to the state of scientific thought, to practical experience, to the social context, and it is within these contexts that the possibility of finding an answer is to be found; whether there be one or two, or a single correct answer depends on the precise institution. Now, I would like to ask the question, "What is the equivalent of this problem in the domain of artistic or literary imagination?", because it is not enough, perhaps, to say that the symbols are worn out; we must prove, first, that the symbols are *recognized* as worn out—and no one can tell us whether it is after ten years,

or twenty, or thirty or seventy years that symbols appear to be exhausted—and secondly, that one must say something new. And it's to say this that one legislates certain symbols, certain forms, and that invention is born. Literary invention also comes out of this setting, and I will say here—I am replying to Girard—that it is not true, it's clear, that, say in the seventeenth century in France, there were innumerable possibilities to create a worth-while, coherent literary work. There were innumerable attempts—the history of literature, with today's methods, preserves a few—but the *society* decided which were the valid solutions. I think that perhaps—I present this for discussion—the difference, for the moment, resides above all in the fact that the history of the sciences has already been, for quite a while, cumulative. There are certain problems in the history of science which arise—I would say for almost all the members of the scientific society of America or of France—for entire countries study the same physics today, and even if we put ourselves in the seventeenth or in the eighteenth century there would be a very large common ground; whereas the problems, or the equivalent of the problems, which arise in literary creation are plural to the degree that it is a question of the common life of men, and in which, let us say—to take a concrete example—in the seventeenth century one didn't have the same thing to say at the Court that one had to say in the environment of Rome or that one had to say among people or among the bourgeoisie. But this much said, the number of solutions is limited for the questions posed, or for the equivalent of the questions, and for the functions to be fulfilled in the social life; they are much more limited, and probably, except for this difference which exists also between the natural sciences and the sciences of man—because the natural sciences are already cumulative, while with the sciences of man we know to what an extent particular values and particular problems intervene—the situation is analogous and M. Morazé was entirely right about that.

ROGER KEMPF: I think, as Goldmann does, that it would be fascinating to do a history of literary wear-and-tear someday, or of the creation of symbols and also of their aesthetic disqualification—the history of the passage of a symbol from a creative symbol to a platitude, for example. But perhaps we must distinguish also between poetry and novel; that is, that a metaphor can be perfectly dead poetically and still be viable in a novel. For example, Proust is very critical of certain metaphors of Flaubert which he considers deplorable from the standpoint of poetry. He is very hard on them, he finds them unpoeti-

cal precisely because he refuses to accept the romantic style of Flaubert, just as he rejects the romantic system of Balzac. There, I think, it is necessary to distinguish.

MORAZÉ: We certainly must distinguish between poetic procedures and novelistic procedures, as between novelistic procedures and dramatic ones.

HYPPOLITE: That is why my question is not so different. I wonder if you haven't given us an enigma in choosing your examples; an enigma simpler, in a way, or more complicated in another, because you have chosen, as domains of invention, mathematics and poetry, and you have opposed "action" to them. I am simplifying your presentation, but you have not spoken to us about invention in physics, in the laboratory, or of invention in natural history. Between the poetic and the mathematical, it is enough to think of Mallarmé in order to imagine that there can be "rapports" in a field which is self-sufficient and that the contrast with "action" is just as strong because the man of action is using dialectical argument without knowing it, while the mathematician speculates and ends his speculation in himself, or ends his speculation in the history of mathematicians, and the poet does likewise. And perhaps if we had taken the problem of invention at the level of the laboratory and if we had taken the problem of literary invention on the level of the novel rather than on that of poetry, perhaps we would have entirely simplified, or complicated, the problem. I think that this is perhaps not too far from what you call the problem of symbols.

KEMPF: I am afraid today that in structuralist activity the novel is being sacrificed a bit. People will prefer Mallarmé and Lautréamont to Balzac or Flaubert.

RICHARD MACKSEY: Although Todorov and his colleagues, who are studying the calibrations of narrative structures, would seem to be redressing this balance. My aside, however, would simply be that your opposition of action and poetry may be too schematic, since the constitutive ambivalence of literature as against other modes of discourse seems to be that it is at once both a free, unmediated act itself and the interpretative process which follows on that act. I would contrast this former immediacy with the distance which you, as a historian, can maintain between your language and the collective acts which it records. Put another way, a poetic invention may have the

linguistic force of both a constatory, and, in some etiolated sense, a performative utterance—with all the consequences such an act implies.

MORAZÉ: I think that you are entirely right, and preferring discussions, which are always more enlightening than personal expositions, I passed very quickly over certain evocations of triangles and quadrangles . . . which were not of the clearest; but you have posed the problem, both of you [Goldmann and Hyppolite], in very clear terms. And you are thereby going to allow me to be more precise about something. . . .

I took mathematics because that is the simplest phenomenon. I evoked action because it is the most complex phenomenon, since it stretches over the greatest amount of time, and since it best brings into the question the way in which time can introduce variables at every stage of the process.

Literary invention is situated between the two. I evoked poetics because in the domain of the use of the word (it would have been painting in the use of colors), we are also at two extremes: the sign in mathematics and the sign in poetics. The invention of the physicist, like that of the biologist, is an invention which allies itself to action to the extent that it needs tools, it needs material, it begins an experiment, sometimes—and more and more these days—there are collaborators, the way a general of the army has soldiers. Anyway, it allies itself to the system of action. And as for the novel (Goldmann would not be satisfied to say that it has been sacrificed), it is found at the center of this triangle, in the ensemble of this figure, to the degree, I would say, that the figure is situated relative to positions that the line mathematics-poetry or the bond poetry-action or the bond action-invention describe. Each has its place and it tries to fill the voids which are effective between a certain way of using up words, and a certain way, on the contrary, of making them forceful, a certain way of representing an action or of denying it. But that is found, if you like, between the three poles. And surely this is a very schematic reduction.

I am not much clearer than I was a moment ago, but we have four days. It wouldn't do to exhaust all the obscurities at once!

JOSEPH DONNAY: My name is Donnay and I am professor of crystallography at this university. In following our distinguished visitor, I must admit, and we all admit it at Hopkins, that mathematics is a part of the humanities, so that you were not giving up your humanity in speaking of mathematics! As a teacher of the physical sciences, I would

MACKEY: I would like to clear up something which is still bothering me because it seems to me that there are at least two quite different sorts of invention, and that the distinction between these inventions is perhaps not terribly clear in the minds of some among us—including me. There is the invention which corresponds to the solution of a

—and I thank you for that confirmation. which arise from the ensemble or center of what you kindly confirmed just how difficult these genetic problems are to study; these [problems] thirty years later. But that doesn't prevent this process from showing did he write in his little notebooks)—was only appreciated twenty or times understood not only the importance, but the meaning (so badly attributed to an "invention of God" and of which people have some cases, strangely enough, his *Disquisitiones arithmeticae*—which he attributes for that problem, and there is a solution to the problem. In Gauss's depths—we say that at the certain moment a problem is posed, a public great deal—I should like at this point to evoke great perspectives and *arithmeticae* by Gauss came extraordinarily late. By simplifying a halism, "in some ways"; that is, that the success of *Disquisitiones* delicate problem (which is also the problem of Stendhal and "Stend-gift of God" . . . and it is striking because that poses a particularly and unto Gauss that which is Gauss's. It is Gauss who spoke of "the Moraze: First I want to render unto Caesar that which is Caesar's

three found in our work in the physical sciences. would like to confirm that the three phases, which you gave, are all presence." They also needed this long preparation. So, to sum up, I tries begin their prayer by saying: "Let us put ourselves in God's are the result of long work, and long, strict, hard discipline. In fact, tion, and we know of a lot of these "perfectly natural intuitions" which certainly Friedel was trying to underline the first phase of invention. He called "intuition" what you call "the gift of God," but later thousands of rectangular planes, as I have, it's a perfectly natural teristic modesty, replied: "But, my dear sir, after you have manipulated earth could you think of such a thing?" And Friedel, with characteristic ray diffraction. Someone asked Georges Friedel: "M. Friedel, how you; it concerns the "point symmetry" revealed by crystals under the Law of Mean Index. I won't inflict the explanation of this Law on who had discovered, among other things, a very intriguing law called savant, Georges Friedel. . . . Georges Friedel was a crystallographer like to confirm what you said by quoting the opinion of a great French

problem; as an example, you yourself used the invention of imaginary numbers: one day someone decided that the symbol "i" had to be invented, and that the symbol would be defined: " i^2 equals -1 " and that solved all kinds of problems. That is one kind of invention. The corresponding invention in literature might be the invention of bourgeois drama (at least in a vague and general sort of way), and I think that it is here that M. Goldmann's remarks take on all their meaning. On the other hand, there are inventions which are much more limited, like that, which you cited, of the mathematics professor who was posing a certain problem, it was a question of deciding the curve of a certain complicated equation, and there were certain tests which allowed him to say, "No, you were wrong, it's not that curve," and so on. To this might correspond the invention of certain tragedies, peculiar to the classical or the neo-classical period, which in turn correspond to particular tests, to certain social (and other) exigencies. And, within this second kind of invention, we must further distinguish, it seems to me, between the invention we all call "traditional"—for this reason I used the example of classical tragedies—and "contemporary," which perhaps takes in, a bit more, the idea of chance (which you put aside at the beginning [of this discussion]) and perhaps some other ideas too, because there are certainly ideas which are dead today, and [yet] certain concepts of invention seem to be based on them.

MORAZÉ: The essence of what you have said would be a kind of typology of invention which it would be interesting to make. I don't feel myself qualified to do this. I think that perhaps we could take up this theme in the colloquium, and we might see that, in fact, it is desirable to consider a sort of typology of inventions. Obviously, for my part, I would be very pleased if we could make some finds of the so-called rational kind correspond with some types of invention in the aesthetic realm. Well, I think we should consider this, but I cannot reply to the question, which is beyond me for the moment.

But, by the way, there are two details in what you said which caught my attention, and which I would like to correct. When I heard you say that someone one day decided that "i" should be the root of minus one . . . I said to myself "Goodness, what a simplification!" Just think what a drama that was, not only within the Italian who perhaps discovered it first, but it was the object of an exchange of letters, of disputes, of discussions, of obscure writings (voluntarily obscure!), of internal dramas and external dramas. Let's not discuss this rather complicated affair; but everyone knows, because I think it

is in all the classical courses of study, the disputes which envenomed the life of Newton and of Leibniz. It's not "one day" that one decides. . . . I said that it's extremely simple; it is *relatively* simple, but let's recognize that all this happened, after all, in a rather dramatic atmosphere; that all the myths, tensions, and personal circumstances come into it—Who is the inventor? Who is the inventor's father? Who is the son?—I mean, all kinds of dramas.

HYPPOLITE: And it might not even have turned out.

MORAZÉ: And it might not even have turned out, at any rate at that time.

HYPPOLITE: And it is because $(a + b)$ is susceptible to commutative, distributive, and applicative operations, because you can treat an imaginary number like any number; but if you go off into other dimensions it does not work anymore. It is because those who had this intuition succeeded in the course of history (a kind of rational happenstance), in opening a possible field—and all fields are not possible, as Leibniz said (the greatest theoretician of invention and of the "system-ness" of systems, is surely Leibniz). If you will allow me to add one more remark, namely that Einstein is perhaps the last "individual brain" (since you used the word brain) and perhaps today there will be only "collective brains."

MORAZÉ: That's what I wanted to say about this "chance" you were speaking of. We are not going to examine the axiomatic of chance, but I want to say that we must give a place to spontaneity in invention; precisely because, before the event, we cannot avoid leaving all that to what we *call* spontaneity (about which we will have much to say, and about what goes on inside the brain). During the classical period it is likely that [thought] took place only in a group; which means that what seemed to be chance for "Nicolle" is not chance for someone who would expect not a thinker (*savant*), but a scientific society. What I am trying to say is that it would not be a question of the same "chance," of the same opening of possibilities. We would be more at the center of the curve of certainties; this is itself a probability.

JACQUES LACAN: It is rare for a discussion to bring forward so quickly what could have remained unsettled after a presentation. Much of what there is [to discuss] has been put in its proper place. A minute ago, for example, when you were saying that as to the question of the

"imaginary root," things had been resolved very simply. You yourself brought the necessary corrective, *viz.*, that it was a terrible drama. What it seemed to me was the essence of your communication, what it centered about, what gave it its essential character, was that you touched on the question of invention, namely: Who invents? There would be no question of invention if *that* were not the question. You consider this question resolved. In any case, you were very anxious to be precise about the fact that whatever the constellation, the configuration, in which you place the phenomenon we call "invention" (and which you brought into the discussion in an admirably cogent and primary way): one invents to the degree that he puts a number of signs in relationship to each other. I do not advance this argument; it is you who have restated the problem in this way. (Parenthetically I am leaving aside here something that it seems useful to me to recall concerning the use of the term "symbol," which you seem to regret [coming from] the mouth of mathematicians, and which means only this: symbols are the relations between signs.)

But I want to keep to the heart of the matter, which is something you evidently took to be resolved from the beginning—that the man who invents is he whom you were speaking of when you spoke, a moment ago, of *savoir de vivre*, *goût de vivre*, *espoir de vivre* [zest for life, love of life, anticipation]. It is a question of the living being, it is the individual, the living individual. But there must still have been a question in the back of your mind, since throughout your exposé that point seemed so obvious that it was almost surprising to hear you emphasize it. You explained that, in spite of all you had said about the context of the invention, it was after all the inventor who invented, who was the author of the invention, and your phrases *savoir de vivre*, *goût de vivre*, *espoir de vivre*, actually implied the flesh-and-blood individual. The term "disincarnated" you used, not in connection with this inventor, but in connection with the *sign*, the mathematical sign; which goes to show that the question of incarnation was there present in your mind, although we don't, of course, both give it equal value. It is certain that in this domain of mathematics, which you have aptly chosen in introducing the question of invention, inventions are produced, we may say, at exactly the same time, or within a few months of each other, by *subjects* (I must pronounce the word sooner or later) who are at great distances (geographic or otherwise) from one another. The same phenomenon is no less observable in other fields of invention and especially in the field of literature, although here it does not evoke the same property of astonishment as in mathematics. So,

here is where the question lies. In proposing the term *subject* in this connection, and asking that we distinguish it from your living being with all his animation (your conception of which you have clearly expressed since it is a question of that *charge* which does or does not attach itself to the manipulation of the signs, and which you have presented to us on the whole as an emotional charge), you have shown us that this can go even further where the apprehension of signs is involved, for example pictorial signs, whose intuitive connotations you have rightly accepted: the picturesque element counts for something in the way in which they move us more than other signs.

But, leaving the elements in this sort of relationship in which you have left them, are we not ourselves losing something essential, an approach which we must adopt in posing the question? I mean the one which might appear if we focused on the most paradoxical points. I seemed to understand you to say that it was necessary for these mathematical signs to be *recharged* at times. But with what? You certainly emphasized what Russell had said, after all, that in mathematics one knows neither if what one is saying is true, nor precisely of what one is speaking. In this sense, of course, and only in this sense, one can talk of a certain *emptiness* of the sign. In any case, one thing seemed to me certain: that the sign is not recharged with this emotional quality. This I believe is the same thing you suggested when you talked of a purely "quantitative" energy. That must have been what you were thinking of—that it wasn't a—let's not call it "quantitative," which would be really awkward, but a, shall we say, "qualified," energy.

So, if it's not that which periodically presents us with a certain crisis in mathematics, if it is no re-charging of this kind, then the question comes up: What accounts for the passion of this mathematical crisis? What is this passion which is internal, in your admirable demonstration, to this crisis of the signs? To use your vocabulary (at least one I think you can accept, even if you are not the one who associated these exact words): What is the order of the passions around which this event will or will not occur, whatever it may be, this algorithm, invention of a new sign or of a new algorithm or a different organization of some logical system? Asked in this way the question seems to show a close connection with the question posed by the introduction of the term *subject* as [something] distinct from the function of individuality you introduced—and it is quite normal to have done so—as essential to the question of the inventor. Is the inventor the physical person that each of us is here, facing the other, being looked at, capturing and being captured, more or less, within a play of gestures? Is it some-

thing else? Or is it to the extent that we are both caught up in the system of signs which is creeping into our debate with a sort of effort at approximation, but in which all the same there is a necessary internal coherence, a logical necessity—as someone here recalled just a little while ago. It is after all true that a *collective agreement* does not bring about the triumph or the failure of a theory in formal mathematics. There is another sort of necessity which obtains. Only this other necessity transfers a certain charge which plays, may I say, the same role as that which we call roughly the “affective charge” [*charge affective*]. This seems to me very close to my immediate concern and what it seeks to elucidate: to know in what sense it is, properly speaking, concerned with the *status of the subject*, in so far as it is the same question as the question of the “passion of signs.” If one goes a little further in this line, one very quickly, it seems to me, comes to what could seem mysterious to M. Hyppolite in the announcement of the title of my own communication here. I am thinking of the word “inmixing” [*inmiction*]. I think that the first time I introduced this word was precisely in respect to subjects. Subjects (even the *Natural History* of Buffon was not so “natural” as that, may I add) are not as isolated as we think. But, on the other hand, they are not collective. They have a certain structural form, precisely “inmixing,” which is, properly speaking, that to which a discussion such as that today can introduce us, and I think uniquely in so far as we are not so sure that he who invents is exactly he who is designated by a certain proper name.

MORAZÉ: Yes, here is a very important problem which I will certainly not exhaust either, but here, too, I invoke the rest of the colloquium which, after all, goes on for several days. But I am grateful to you for several things, large and small. First, for having pronounced the name Russell; it is unthinkable that a discussion of invention should not pronounce this name, and you have done well to introduce it here. Then, for having evoked—this was not central to your remarks, but I note it—the possibility that an invention manifests itself in several places, almost in the same way, almost at the same instant. Let us note, however, that these places are not, after all, as random as one might think; it wouldn’t do that, in the minds of our listeners, these places should be considered as just any places. I freely admit that Leibniz and Newton, or a Venetian and a Florentine, were on the track of the same subject, or on the path of the same solution. But one does not imagine that the same solution appears on the banks of the Congo,

or even on the banks of the Yangtze Kiang, at these moments. There is consequently a certain fan of possibilities which makes the two inventions, the two phenomena of the same invention (the two manifestations of the invention) contemporary. But this fan does reach over the whole universe or to the whole of humanity.

(But I must say once again that we must always think in terms of what is more or less probable, and not think that invention can happen—that Newtonian or Leibnizian invention could have happened in India or with the Indians in America, that's obvious. But I think that this error is not in *your* minds.)

So, what does this mean? It means that, in fact, a certain number of problems—because in general, men had read the same authors, they were fascinated by the same problems—that roughly speaking, certain problems are, in themselves, ready for solution. This is not to say that the problems are living and that if humanity disappeared they would continue by themselves, it means simply that at a certain moment certain problems are so close to their maturation that perhaps one mind can seize them before another, but that several minds can (also) reach them together.

There is certainly, then, a phenomenon of the maturation of a problem which means, simply, that the problem having been considered before by a large number of minds has arrived at the point that a mind, or a group of minds together, can grasp it effectively. But since you are on the subject of mathematics, it is enough to read the first introductions of Newton to show how much he owes to a great number of contemporaries, or men who worked in earlier years, to see that it was a matter, there, of an “offering” which could have been seized just as easily by another as by himself. (But I think that this is not, either, what matters most to you.)

It remains to be seen, then, whether the “structuration” which appears at the heart of invention is a purely social phenomenon. I want to say: no, it is not a purely social phenomenon; I would say, however, that it is a phenomenon which takes place only to the degree that a human collectivity exists; but if it is purely social I don't quite see what meaning you could give it. . . . If ideas are brought together in the heart of a tragedy, if colors are brought together in a painting, if two ideas are brought together in a mathematical system, it is because they could be brought together, they had that quality in themselves.

I told you (I think, but perhaps I didn't insist on it enough) that that which is pure articulation is probably what the psycho-physiolo-

gists will have to study in the years ahead—this is to admit that I don't know what it is—[this pure articulation] can be traced to a cerebral phenomenon; that is to say that in this pure articulation the collective plays less of a part than the natural—I don't know how to say it—let's say, the biological.

I also said that I have a tendency to consider that the energy which was involved here was purely quantitative. But I didn't know if this energy was—not qualitative—but as you said yourself [Lacan], “qualified.” I don't know, it's possible. And I think that it's a question which I will leave open.

One last word: You said, “what is the [kind of] energy which draws one's interest? What is this energy, this re-charge of something which draws the interest?” I would say to you: “Define for me what you mean by ‘interest’ and you can immediately get from that my definition of energy! If you don't define for me your word, ‘interest,’ don't ask me to define my word, ‘energy!’” I say for the moment, let us keep our two ways of naming, [and] of considering a reality which are probably the same in both cases, but which we see differently. This is purely a working hypothesis, but I ask you to consider it as such.

As for this “energy charge” of ideas, I believe quite willingly—I have used a figure of speech here and I apologize because, in addition, this image is borrowed unhappily from what it is most modern to claim—that the sciences of man borrow from the exact sciences all their hypothetical images. First, one more nuance—there are the German linguistics, and on the other side, a spirit perhaps too French-Cartesian, concerned with what happens within the mathematical sign. (Is it with signs that one works? Hadamard formally says, “No, I work with something like vague ideas, which underlie signs.”) But this risks being a quarrel over words because these are the ideas which are the most immediately subjacent to any sign whatever. But it is not, after all, about signs that we are talking; it is something, it is the idea to which the sign clings as closely as it can. So that if one simplifies one should say, the sign. But still it must be known that it is not the sign itself, but an idea to which it clings very directly.

LACAN: As close as it may be. It is so difficult to . . .

MORAZÉ: [As close] as you wish; let's recognize this nuance. It won't do anything for us maybe, but I think it must be introduced. Now, what strikes me—I am going to speak in a very rough manner—in an invention (in other words in an event, since for me it's the same thing) is its transformation from a gross form to an articulated

one. When the event, or the need to invent, shows up in us, it is a kind of indistinct mass, and if it becomes charged with energy, or if (to use your expression) it attracts interest, it is probably because of numerous internal articulations that we don't know about and that we want to discover. And then, when the articulations are discovered, they fall into their places. And at that moment, occurs what I have called the "re-structuration" which gives us a feeling of liberty, of opening out.

I don't believe I have replied to all your questions, but I think I have made specific, in terms of my vocabulary—as one of my former masters, Nabert, used to say, naïve and rough—that which you said with the fineness of a razor blade. And I think that we should take up this question again in the days to come.

CARROLL C. PRATT: I should like to make a few comments on the historical background to the question of invention and the creative mind raised by M. Morazé. In recent years this topic has come to occupy a foremost position in the work of several groups of psychologists. The most intensive and extensive studies have been made by the psychologists at IPAR (Institute for Personality Assessment and Research) at Berkeley, California. Large groups of top-ranking writers, scientists, architects, and mathematicians were cajoled into spending a week or more at IPAR in close association with members of the staff who conducted interviews, administered all manner of tests of intellectual and creative ability, and then wrote up their reports regarding the salient characteristics of the creative mind.

Of outstanding significance are various lines of evidence to the effect that there is no real difference between scientific and artistic imagination. The mental processes of a Milton and a Newton are much alike, i.e., the IPAR inventories show that writers and scientists perceive and grasp new and unusual relationships in their respective materials in much the same manner and in such a way that the strange is made familiar and the familiar strange.

Creativity of all kinds involves aesthetic sensitivity. Artists and scientists, when tested in this respect, both score way above average and also show a preference for a complexity-asymmetry dimension as against a simplicity-symmetry dimension.

Various tests indicate that highly inventive persons are above average in a number of neurotic tendencies: hypochondria, depression, hysteria, paranoia, and schizophrenia. These results are at variance with Terman's findings many years ago, that brilliant children (those with very high

I.Q.s) are well above average in mental and physical health. But it may be reasonable to assume that in respect of emotional stability older people whose promise has already been fulfilled do not belong in the same category with children whose promise still lies in the future. In any event, it may well be asked how creative adults with all sorts of neurotic traits manage to achieve so much. The answer seems to be that they are markedly above average in ego-strength. They have what it takes to get things done, especially when those things involve putting their flights of imagination into some sort of permanent record. Their ego-strength may be related to W. H. Sheldon's evidence that great geniuses are more mesomorphic than ectomorphic in their constitutional make-up, i.e., they possess hard muscular strength combined with great ambition and drive. The ectomorphic introverts have vivid imaginations and are perpetually on the verge of important accomplishments, whereas the mesomorphic extroverts with creative minds are successful in their tireless search for ways of giving expression to their imagination.

RICHARD SCHECHNER: It seems to me that perhaps I ought to raise a basic question. In your paper, there seemed to be a confusion of projecting onto the artist the methods of the critic. In other words, you proposed that art—the creativity of the artist—and the creativity of the scientist were parallel. But I wonder if it isn't the creativity of the critic and the creativity of the scientist that are parallel; that what the scientist treats of nature and discovers from nature and develops as a methodology, and the critic treats of the work of art are in a parallel relationship; that criticism and scientific method are in a parallel relationship, and that when you try to suggest that the methods of the artist are parallel to the methods of the scientist there is perhaps a cross-transaction, and those methods really are not similar. Because it seems to me that the criticism of a scientific hypothesis is another hypothesis; while the criticism of a work of art is an analysis of that art work and if we try to figure out what a scientific hypothesis is, it is an analysis of nature and it seems to me that the parallel is between the scientific hypothesis and the critical analysis. And I'd like to know your feelings on this.

MORAZÉ: Ah, you mean that it is in criticism that the analogy . . . Well, I'll tell you, my perplexity with this question is that, first of all, the words "nature" and "art" bother me. What is Nature, for us who are closed in this room? It is the walls, the seats, the faces . . . , but after all many works of art are nature for us. You understand, we live,

for example, here in a whole set-up which is nature for us, in which we are, but which is a work of art. (My reference is very rough, but I stress the difficulty which I have in distinguishing clearly between nature and a work of art). . . . As for science, it is said that it works on nature. Ah, it is very difficult—What is the nature of mathematics? And what happens in a cyclotron? Is this “nature”? Is it not also a work of art?—in a way.

Thus science doesn't work only on nature, it works on a complex combination to which we attribute all the virtues of nature, but which is a complex melange of nature and art. When you say that criticism works on the work of art, you are no doubt right. What bothers me, is that while you have done well to say, that when science criticizes itself, it transforms one hypothesis by another, as I put the question to you, criticism of art does not create a work of art. But probably Barthes will give us an answer (rather, he will give us *his* answer to a question which perhaps has none). There are perhaps some forms of criticism which are works of art, but is this, then, criticism which can be validly compared to the criticism which is of a scientific hypothesis? In other words, to compare the criticism of art to a scientific hypothesis, is this not to condemn oneself not to know how art replaces art?—You see what I am trying to say?

In other words, I think that your distinction between “nature” and “art” should be considered with precaution and that it is really very difficult when one speaks, whether of a painting or of a poet, or of a play, or of a scientific object, to say exactly what “nature” and “art” are.

Second, I think that we must not limit to criticism only, the valid comparison with the *processus* of invention. Real invention in science is indeed what replaces one hypothesis by another, but true invention in art is, in fact, that which replaces one system of representation by another.

CHARLES SINGLETON: To break the English ice and to join Mr. Schnechner, I'll speak in English to say what I didn't know I was going to say a moment before. But if I understood M. Morazé just now, he suggested that there is little distinction between the work of art and nature. This troubles me very much and might, it seems to me, form a fundamental question. (Incidentally, just as he said, “What is nature? Here we are in this room . . .” I happened to see that it was just beginning to rain outside. And I think that the fact that, in this line of thought, we can suddenly see an analogy between nature and *this*

room and *these* walls, suggests a postulate or a focus of thought which perhaps we are not trying to analyze, or explore.) Now, predictably I'm going to speak about a certain Italian poet. I'm known to think of nothing else or read nothing else. I'm going to hold to my old habit, use Dante as a touchstone, and test some of the speculations and assertions made today, including collectivity, social classes, and possibly—though I still have to understand M. Lacan—in-mixing, and so forth. But as far as invention goes, it is in a sense safe to say that Dante invented nothing . . . in the sense of a problem. And yet he invented everything. What did he invent? An experience. An experience that the mathematical symbol does not offer. He says “*sensibile*,” “*sensibile-mente*.” It is a vivid, incarnate experience delivered through words. Why? Now, to test some of the hypotheses and to use Dante in this sense. *Why*, since he invents nothing in terms of doctrine, philosophy, ideas out of his social milieu, and so forth, why do we wait a thousand years to get the poet to invent, in the sense I've just said? What explains his coming at just that time? I hope someone will tell me that. When the dissolution or crumbling is threatening sense, there the poetic vision comes forth in its totality. I think that this question was excellently launched today in terms of invention. The experience is there to be had by all who can read the language and prepare themselves to have it. It is repeatable, and keeps on repeating itself. But in terms of “charge” and “recharge” it went a long time through Renaissance and Enlightenment “uncharged”—no battery was ever more so—and then in our time, perhaps we could explain that, it takes on a charge. So that a lecture on Dante by “*qui que ce soit*” attracted crowds. What's happening? What's happening to recharge this decharged battery of Dante? I don't know whether it's any good as a touchstone or not, but it certainly is a case. My colleague went further back in time to Oedipus, but it is a case of going back to a time in history when there was no confusion between nature and art. Dante knows nature is a work of art, God's work, and so forth. I grant you that. *But*, he makes a firm distinction between nature and man's work. Now this isn't coming close at all to “*signe*,” and “*invention de problème*,” it's just suggesting that we are already operating here in terms of *modern problems*, and just let a plodding medievalist suggest that there are other historical horizons in which it might be interesting to situate our thoughts occasionally, as René Girard did in terms of Oedipus.

MORAZÉ: I think that the problem of nature and of art, as you have just re-posed it, is going to be so important in all this discussion that

I won't say anything more about it at the moment; it is, really, a problem which for my part I find very delicate to define. I have not said that they should be mixed together or that they should be opposed to one another; it's just that I am very much perplexed before this difficult problem and words often fail me. On the other hand, I think that this will be the subject of the colloquium—to manage to arrive at this definition. Yet I am very grateful to you for having insisted on an aspect that I didn't discuss at all, which is that we are ourselves inventors, in a way, when we read of the inventions of others and when the admiration which we have for great authors or great poets of the past, in a way, resuscitates in us their invention. And I think—if this is, in fact, what you meant to say—that this is an essential aspect, because when we consider the work of art, or the invention of the work of art, we place ourselves always in the position of the one to whom we attribute it, by coupling it with a name while evoking those who give it a justification—that is, those who are the readers, those who are the admirers; in other words, in sum, the users and those who re-make something in themselves in this regard. For your having called this to our attention, I am very grateful. I think that this is going to give to our coming debates a breadth which perhaps my report alone had not envisaged.

JAN KOTT: I think that this drawing together of mathematical invention and poetic invention is fairly easy. We have, first, the *ensembles* which are limited and *elements* in the ensemble which are limited. And then, there is always the rule of transformation. But if we make some observations in another field; for instance, if a mouse finding itself in a closed circuit, finds the opening and gets out, is it possible to say that the mouse made an invention? Even in the domain of fictional invention in which there is no symbol, the novelistic invention [after all] is fairly difficult to treat at the level of sentences, at the level of words; we are always having to do something similar to what the mouse did—in other words, find the opening, but not in the sign.

If we take another example, for instance the invention of the director of a play. The director's invention consists in fixing a gesture among an innumerable number of gestures. Well, I think that perhaps the greatest division is between the invention in which the number of ensembles and the number of elements is limited (even if it is quite large), and the invention, where one can say the elements are infinite and where it is quite difficult to say what the definition of the ensemble may be, where the rule of the game, the rule of transformation, is not

defined. In other words, I think that if there is a large division between invention in the poetic domain and that in mathematics—I do not say an invention in the literary domain, which is much larger (let us say that the novelist doesn't invent with words, doesn't invent with sentences, but invents with the context or even the action)—well, here there is something which is quite perplexing to me, which really poses the problem of invention in which the greatest drawing together in the invention of action equals the invention in the domain of the sciences.

MORAZÉ: What you say interests me very much and reminds me first that I was wrong to suppress a paragraph of my paper which was a necessary definition of the distinction we must often make between invention [*invention*] and discovery [*discovery*]. The latter is the bringing to light or the lucky find [*trouvaille*] of something which already existed, like the exit for your mouse. While invention is the creation of something that did not formerly exist.

Your mouse does not make an invention. It does not create the exit. But it does make a discovery. It finds the exit.

The second point, for which I am grateful to you, is precisely to have evoked these mice, since they have done us such yeoman service in all our psychological laboratories. We torment and frustrate them; we slam doors in their faces. And then they work out the problem. Now, why do we do this? In order to find the basic constitutive elements in the operation of the intelligence. When we refer to the mouse in its labyrinth we are referring to attitudes which may help us to understand our own. If we refused to postulate that operational identity, we would have to do away with a great many laboratories [but we are still talking about the most basic kinds of problem solving and not of isolated cases of invention].

And finally, whereas the number of combinations in mathematical invention may be very limited, it is obviously very great in what the director of a play might do. You are quite right there, but I must set aside that awesome problem of almost innumerable variables in a sequence of solutions as beyond my competence and adhere to the model case of mathematical invention.

HYPPOLITE: Isn't an invention simply what is called in rhetoric an *ellipsis*. From the point of view of logic, one would examine one by one all possible combinations and eventually find the solution, but one can take a short cut. Invention is often the short cut.

MORAZÉ: I welcome the recovery of the principle of *economy*, the abandoning of sequential development for the shortest path.

MACKSEY: But must we not distinguish an inspired short-cut in the initial solution of a problem from economy in the demonstration of the solution? In other words, can't we distinguish psychological from logical processes? And then further distinguish those problems where there is a routine procedure of solution, an algorithm, from those where there is not. To take a simple mathematical case, differentiation answers to the former instance and integration to the latter. I assume that M. Kott's mouse should solve his labyrinth according to what the experimenter might call a "routine decision method" if he is an intelligent mouse (anthropomorphically conceived); but if the experimenter has been careless and left some extraneous clues or crumbs, the mouse may be able to short-circuit the decision method.

HYPPOLITE: I was finding in invention a sort of rhetorical figure, like ellipsis, because logicians must follow their logical steps; they won't skip anything. While the mathematician, who is often an imperfect logician, does skip, and he goes faster.

Apropos of Leibniz and Newton, it is not often enough pointed out that they did not discover *exactly* the same thing. If Newton alone had existed, we would have been headed toward a very different calculus out of his fluxions.

The community of invention is a community in a possible dialogue which takes on meaning only when a third man (such as Lagrange in the history of the calculus) comes along to rethink the dialogue and to see what had not been seen by either of the other two. And only then is there a recurrent history of invention—a fundamental, continuing problem which is, itself, an invention.

MACKSEY: You are certainly right to emphasize, in the case of the famous coincidence of the calculus, both the genuine divergence between the achievements of Newton and Leibniz and also the vital continuity of the *problem* in the next generation. But I am also struck by a number of other aspects of the example: the approximate coincidence of solution, given the diversity of the approach—Newton's being basically cinemetical and Leibniz's geometrical; the fact that the dialogue had some antecedents known to both men, such as the "characteristic triangle" (dx , dy , ds) of Pascal and Isaac Barrow; and, finally, the way in which certain more general assumptions and aims clearly predisposed each mathematician to his particular line of attack—thus, Leibniz was

led by his "scientia generalis" to his search for a "lingua universalis" and thereby to the special case of change and motion. I suppose that few minds have ever been so heroically "structuralist" as Leibniz's, but even Lagrange, to take the later instance, was led to his particular line of approach through his algebraic bias and his obvious distaste for Newton's theory of limits. Even though he could not finally sustain his algebraic foundation of the calculus, the abstract treatment of a function was certainly a great invention.

Pucci: I think that the problem which we posed just now—whether the replacement of one mathematical hypothesis by another can have some parallel with the work of art—might have some answer in the sense that each part in the literary invention tries to correspond to a story, to a truth, to a structure, which has already been *told*. I believe that from Homer to the tragedians to Dante, there is always this reflexive character. The invention of the poet turns toward the possibility of telling the truth in a manner different from the way in which it had been told before, of telling a story better, that is to say, of discovering something which had escaped the earlier poets. Dante actually criticizes some of his predecessors; Homer, in the case of Achilles, criticizes the poets who had told his story without the dimension of pity.

Now, in a sense, one could say that literary invention always leads to the *replacement* of a preceding invention; but there is here, I believe, a central problem: since a law of the structure of reality does not change because another is added, one could also see in the case of literary experience something parallel. Namely, a story. A literary invention preserves some truth if it has been able in some way to grasp the totality or a part of that totality of the society in which the work was conceived; and thus, in the historical process, this work preserves this validity precisely because it was able to apprehend this social totality in which resides the fundamental and essential determination of consciousness itself. But I believe that it is important to see in this case that the poet is more attentive to what we could call the *sub-structure*—the ideas, passions, feelings—than to the real structure of the concrete society. He relates a myth which he always intends to tell better than other poets; he intends to tell something which draws closer to the truth. Although we could find an analogue in this to the replacement of hypotheses, there is also a very great difference.

MORAZÉ: Your observation is certainly to the point and touches certain considerations, about the "renewal" of poetic inventions, which were noted by Professor Singleton. It is certainly true that a succession

of poets have sought historically to treat the same theme in order each time to "do it better," each in his own time. The question is then to know if there are not moments when they are exhausted or when, having been exhausted, they suddenly recover their value because there are readers who rediscover their beauties, their validity, after centuries of neglect.

MACKSEY: If there is an evolution of forms, and an evolution within forms, there is obviously an evolution of problems and of modes of inference or invention which they evoke. We are all grateful to M. Morazé for having advanced this evolution and for having thereby opened so many points of entry to the sessions which will follow this meeting.