Stanislaw Lem

Metafuturology*

Translated by Istvan Csicsery-Ronay, Jr.

Futurology, the youngest and most fashionable science, has not even established itself, but it is already more interested in its institutional status than in the systematic examination of its own possibilities. It is a characteristic of our age that every problem whatsoever is quickly passed on to a collective body created to deal with it—a commission, if it is a short-range matter; an institution, if it is longer-range. All problems must be referred to the appropriate expert. And so futurology also strives to become one more science among the others. In their own view, the futurologists co-opt specialists for their project; and in turn these—the physicists, sociologists, city planners, economists—transmit the data which the futurologists correlate to construct their predictions. The futurologists thus aspire to be universalist-"complexologists," the polymaths of civilization, since they must integrate facts and theories above the specialties. They are served by the specialties, but they are not bound in their work by any sort of feedback.

The trouble with this division of labor is not that the futurologists elevate themselves above all other specialists when they co-opt them. Rather, it is that the resulting standpoint is insufficiently neutral with regard to the futurologists' prophecies. Even if they wished to, futurologists could not become—within the institutional structure—the highest authorities of synthesis, harmonizing the humanistic, anthropological tasks of culture with the instrumental ones. They are like the passengers of a gigantic vehicle moving without any guidance or direction. Now they want to discover, on the one hand, all the possible roads that the vehicle might travel, and, on the other, which of the vehicle's component parts can be used to guide it successfully. But civilization is not like a ship or a car. It has no single, clearly differentiated guidance mechanism. The elements that might be used to direct its movement are oddly "dispersed" or "flow into one another" throughout the whole construct. It is nonetheless true that they are especially

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concentrated in the scientific-technological base, and this is why futurologists consider it their most important task to reveal the laws of motion of this base.

And yet, the fact that those who control technology can direct the vehicle with the least difficulty does not mean that they have discovered the perfect guidance-mechanism. In the first place, the effectiveness of the vehicle's guidance is not necessarily congruent with the passengers' comfort. In fact, exactly the reverse holds true: the wide dispersion of human beings' individual behavior patterns makes the prediction of their collective futures more difficult, and so it would be more comfortable for the futurologists if the objects of their observation were human collectives that are subject to constraints which determine their behavior. (Of course, it is not quite so comfortable for the people under observation.)

Secondly, the futurologist constantly oscillates between the role of an observer of the ship (the "pure" ideograph) and that of an advisor to the ship's officers (mainly politicians and managers). The observer is as disinterested as an astronomer predicting an eclipse. The advisor, by contrast, must assume the existence of a value-system, and therefore he proves to be a creator of norms. Thus the range of futurology's fluctuations extends between scientific objectivity and the axiological creation of norms. Conducting advisory-normative activities openly is not as harmful as keeping them secret. A fairly dangerous situation develops when advice that has inextricably intertwined with a value system is presented as an *objective* prediction. It may slowly transform the whole vehicle in subtle ways. That is, it may change the character of the vehicle's laws of motion. When we direct civilization by controlling technology, we are masters of the immediate effects of our actions. At the same time, we ignore all non-technological, and hence non-instrumental, means of guidance. At first we ignore them because it's easier to do so; later, as a consequence of this process of selection, the structure of intracivilizational connections proves to be ever more dependent on purely instrumental interventions. While we are creating the illusion that we are transmitting objective data to the navigators, we are transforming the vehicle itself. The navigators do not do whatever has the most perfect consequences, but rather whatever can be done most effectively. Objective prophecies thus become self-fulfilling.

We can already observe this process in the work of the Americans. Their futurologists facilely thumb their noses at the imponderables, not necessarily because they disregard them, but because the imponderables are the least susceptible to measurement and therefore the most difficult to grasp exactly. Hence they cannot be easily subjected to manipulations that would conserve them. And yet, it is the imponderables—i.e., whatever cannot be recalculated in terms of national wealth, or the frequency of scientific-technological discoveries, or population statistics—that are the solid foundation of human civilization. The initial premises of the instrumentalists lead them to consider the imponderables, in their social manifestations, as "noise," uncertain obstacles that hinder truly optimal action. The futurologists therefore treat the consequences (for example, an "anti-rationalist rebellion" or an "anti-scientific uprising" characteristic of

subcultural youth movements) as undesirable phenomena, not as the symptoms of a complex social situation. They will console themselves with the fact that only three or four per cent of the young generation joins the hippies. They believe, though they are not the least bit sure, that it is permissible to evaluate such collective reactions through the instrumental model of culture: those who rebel against it are simply bad, disturbances that must be quelled or calmed.

It is true that the imponderables do not form the material-energetic base of civilization without which civilization could not function at all. This is why the "anti-rationalist rebels'" programs—those limited to the "destruction of technology"—are unrealizable. Even so, the imponderables are the bases of the meaning of a civilization's existence. A civilization that is perfectly stable in the mechanical, institutional, thermodynamic sense is one in which people live increasingly more uncomfortably; it is not a "perfect" civilization at all. Furthermore, there is no necessary positive correlation of any kind between civilization considered as the fittest nest for human life and the predictability of progress. The structures of socially optimal conditions may be hidden precisely in whatever is most difficult to predict. In regard to the methods and spirit of their work, futurologists are pragmatists rather than scientists. They do not raise these questions at all.

To the degree that the imponderables are completely internalized, they are the values and norms that motivate authentic human action. Their parametrical immeasurability is a fact that the scientist must investigate, instead of trying to "cover" and neutralize it with completely other kinds of instrumental practices. These problems of futurology—its imbalance, the undesirable direction of its organization, its lack of theory—cannot make us feel easy. Futurology encourages extreme positions. It has its enthusiastic defenders and diehard enemies. It has few reasonable, objective arbiters, and these are what it needs most.

As in all fields of knowledge, it is important to assess the existing store of data about the object under study. But it is even more important to assess periodically what constitutes our ignorance. The greatest errors and injuries originate from the belief that we already know practically everything.

For this reason, in my opinion, each of the existing branches of science should devote some of its effort to futurology. Just as there is no "universal history of everything that has ever happened," but rather the history of nations, of living organisms, of mathematics, of law, of art, of physics, of literature, etc., so there should be an analogous branch of the individual sciences, dealing with the future. At the moment, there is no humanistic "counterweight" to the instrumental pragmatism of futurology. There is not one specialist in axiology or ethics studying the future development of ethical-moral phenomena or evaluative behavior.

It is futile to expect literature, whether it is fantastic or non-fantastic, to right the existing imbalance. That task is certainly beyond its powers, and indeed, the powers of all the arts combined. At the same time, it is extremely important for literature to participate in this reorientation of thought and action. Since "conventional" literature keeps its distance from such tasks, so-called "science fiction" has an even greater responsibility. If futurology

has an "instrumental bias," literature must be true to its traditions by challenging it. After all, it has been literature's task from time immemorial to integrate the values and concepts that make up the horizon of human life.

Let this suffice for the futurologist as diagnostician and prognostician of history's dynamics, and for the fact that it is undesirable to centralize the predictive assignments in the hands of institutional futurologists alienated from the sciences.

Metafuturology does not exist, and it would be reckless, even ridiculous, to try to supply this lack in these few pages. But I feel I should at least signal what I mean by *metafuturology*—as the complement of prediction, the study of its greatest possibilities and its most painful limits.

The future is made indeterminate by at least two sets of factors: on the one hand, by all the factors that constitute the real freedom of choice for the larger social groupings on our Earth (the collective efforts along a certain path; for example, the guidance toward space travel often depends on the free choice of appropriate officials); on the other hand, by all the factors completely independent of us, the as yet unrecognized qualities of the universe. If it should turn out, for example, that the Second Law of Thermodynamics does not have universal validity, or that the speed of light is not an unsurpassable boundary, or that beyond that boundary another spectrum of conditions exists (as implied by the new hypothesis of "tachyons"), then the world of the future would acquire different qualities from those we can attribute to it now. But even if we are certain that some presently hypothetical ideas will be realized, we still can not intuit what the material and human aspects of these realizations will be. It is possible, for instance, that we may achieve the "reversal of death" by hibernating organisms, but that out of every 100 of the hibernated, only 87 can be revived. A civilization that can resurrect 100 people out of 100 will use the technology very differently from another civilization in which one in ten hibernated individuals cannot be revived. In the former, cryogenic sleep might even be treated as a form of entertainment ("a trip into the future"). In the latter, it will be only the last refuge of the incurably ill and the very aged; for only someone who is certain of losing his or her life will be willing to risk regaining it even when there's a chance of failure. Therefore, the same purely biophysical characteristics of technology in these two cases will make that technology a completely different civilizational formation. The uncertainty of economic costs increases this variation even more. If the perfectly reversible hibernation requires 30 times the investment of the slightly less certain mode of resurrection, it will influence the dissemination of the technology and its place in the whole cultural apparatus.

But let us look at another technology, one already realized. It is precisely the easy separation of the sexual act from conception that has created the well-known dilemmas associated with the birth-control pill. If it would have proved impossible to render women temporarily infertile with simple chemical substances without simultaneously disturbing vital body-processes because of the strong interconnection of copulation and the biological parameters of conception, then the typical dilemma of the pill would not have taken shape. One could have condemned the pill with an easy conscience because

it was definitely harmful to one's health. (By the way, it does in fact appear to be harmful, because among those women who have decided to bear children after taking the pill for several years, there are more instances of birth problems than among those who never took contraceptives; at least some statistics indicate this.) If the condition of weightlessness were to harm even a single one of the life-sustaining functions of the body—for instance, if the heart could not ensure the brain's blood supply without gravity—then there would be only unmanned space flights for a while.

Thus the structure of future civilization is relativized in two ways: by freedom of choice and by the internal parametric interconnections of matter that are still unknown values for us. These are very different universes, in that the not-yet-made decisions simply do not exist, while the parametric values of matter that we do not know are already determined at this moment. An established prognosis may influence today's or tomorrow's choices, but it cannot influence the qualities of matter. This has practical consequences. Within futurology, "internal" specialization has already begun with regard to the range of prognoses: short-range, medium-range, and long-range predictions. (The "long range" means investigations no further than the first quarter of the next century.) But outside this institutional futurology, a "second futurology" is already emerging, particularly among astrophysicists studying the question of cosmic civilizations. Since such civilizations can't be discovered until their activities have reached the astronomical level, the "cosmic futurologists" focus their attention on the questions surrounding so-called astrotechnics. A side-product of these studies has been the determination that if the rate of earthly energy-production continues at its present, annual four per cent increase, disturbances will occur in our planetary thermodynamic balance in only 125 years; more energy will be produced on the Earth than can be released into space through thermal radiation. This means the Earth will begin to heat up (i.e., the planet's average annual temperature will rise). Now, the maintenance of the energy-balance is a life-and-death matter for the entire biosphere, including humanity. This raises the question: Shouldn't we already be thinking of ways to avoid the crisis? The predicted crisis is to occur beyond the furthest date reached by the "first futurologists"—and therefore decisions may be postponed. Let subsequent generations deal with it.

The energy-limit isn't the only discovery. We have foreseen demographic limits (the "population bomb") and informational limits (the "megabyte bomb"). Are we permitted to deal with all these questions so nonchalantly, leaving them to the next generation? Isn't it true that the faster the vehicle travels, the sooner we must step on the brake or begin evasive maneuvers? May the "first futurology" ignore what is to be expected in the 21st century merely because it isn't accustomed to preparing prognoses of such "depth"?

Even if we do not need to make decisions immediately about these problems, it's worthwhile not only to keep the case of the "second futurology" in mind, but to apply it to the work of the "first futurology." Only with the synthesis of the two can certain programs be formulated. I don't think an objective futurology can be realized, as if it were some form of physics, and we

must reveal the latent normative character of present futurology. A precondition for this is that we consider certain questions that do not relate to any concrete short- or medium-range prognostication.

Perhaps the most important question we can ask of science and technology is the following: Can we imagine discoveries, inventions, or technological transformations that will enable humanity to "leap out" of its antecedent history? The unpredictability of historical development is a hard nut to crack: it is the main obstacle to all futurological aspirations. We have no idea what difficulties and dilemmas await us in the course of autoevolution. The variants enthusiastically sketched nowadays by popular magazines (and even knowledgeable, although not very wise, individuals) are worthless, just like the first idea in the field: the "cyborgization" of man. These ideas are always limited to improvements that will "mechanize" the organism. Their goal is to surprise and astonish us, but in fact they contain nothing that goes beyond quantitative optimization (the more rapid conduction of nerve impulses, better functioning circulation of blood, etc.). They do not offend the principles of biological construction; they only select subunits that can be perfected technologically.

Let us examine the matter from another point of view. It is well known that the chromosome code containing the prescription for producing the organism is separated by an inviolable barrier from the other parts of the organism. Phenotypically acquired experiences—i.e., experiences acquired in the course of an individual's life—cannot be inherited. Culture is certainly an exceptional characteristic of human beings and plays a leading role in determining the totality of their behaviors, but it is also phenotypic; it plays no role in the human being's genotype. In the human organism, this genotype contains only the capability of culture-production. It is theoretically entirely possible to "scrape off" the individual's cultural impregnation —naturally, not by erasing cultural experiences from an adult personality, but in the form of the well-known fact that human progeny torn from their cultural group at an early age are unable by themselves to create culture, losing instead their ability to speak and suffering a certain bestial degradation. The human being therefore still belongs biologically to the realm of biologically evolved organisms, at least in the sense that there is no feedback between the brain and the gene-plasm. Every future generation must begin acculturation "from zero," and the form the cultural phenotype will take depends on the social environment, which no one can choose for him or herself when he or she is born.

It is precisely in our age that humanity is being led to the threshold of establishing feedback between culture and heredity. This is what "autoevolution" means: breaking through the "somatogenetic boundary" that has separated the phenotype from the genotype since the beginning of life on Earth. A historian of the year 4000 might then conclude that 500 centuries of anthropogenesis—as a theoretically reversible process of socialization and culturalization—was a transitional period, followed by the period of the irreversibility of human culture. Such a historian would argue along these lines: culturalization as an irreversible condition, as the inscription of the "categorical imperative" into the chromosomes or the importation of "humanistic

data" into the organic genotype, was an evolutionary impossibility. At most, evolution was capable of leading the mass of organisms to the threshold of becoming human, in accord with its own particular mechanism, in which the somatogenetic boundary plays a leading role. Natural evolution could not create conditions in which the organisms developed through its processes could dispose of the genetic transference of cultural traits. Because of this, there was always a possibility that certain currents and movements directed against the foundations of a culture could emerge in that culture, threatening, for example, to destroy or otherwise harm certain groups of the species. But after the transition period there came an age when science became the collection of phenotypic information, of "artificial" knowledge, because it is transmitted biologically. This led to the next threshold, beyond which *culture is inherited* (through auto-evolutionary direction).

The notion has a shock effect on familiar cultural traditions. That is evident in the powerful antagonism produced by the idea of reconstructing the species in this way. The enlightened conservatives will emphasize that the non-biologically inherited character of culture is more a strength than a weakness. It guarantees "democratic identity" for the human being, since she or he is always the same, whether born in a cave, in pharaoh's palace, or on the deck of a spaceship. Further, though it is impossible to get free of genotypically established characteristics, it is also difficult to perfect them. Therefore the above-mentioned program would put a halt to the natural process by which successive cultures are constructed. The model of culture would be as inheritable as walking on two legs or erect posture.

There are quite good objections to this argument, beginning with the following. Hereditary culturalization would put a halt to future development in a certain sense, i.e., of developing the genetic predetermination of a human being "specialized" in a certain way, "prepared" according to the matrix of a certain actual formation. But the goal might be the "generalization" of a new prototype of *Homo sapiens*. We might construct it to be a "culture-creator" that can continue to develop "forward," but no longer "backward." It might reach higher physically and intellectually, but the possibility of so-called "bestialization" would no longer exist in it. For the moment, we do not have the experiences necessary to resolve this debate unconditionally in favor of the partisans of the "genotypicization" of culture. But if a crossing of the auto-evolutionary threshold is possible, it would certainly mean the end of the history in which the species endangers itself. In this sense, auto-evolution would be the next act of human liberation, and it would promise a psycho-biological emancipation corresponding to the socio-economic emancipation that Marx was the first to plan. After the passing of the somatogenetic threshold, perhaps the characteristic demoralizing dilemmas of our age would cease.

Those practices that are technically feasible, economical, and desirable from a social-economic point of view will be the first to be realized. Hence, the question of which combination of parameters should be realized first is really of central importance. Technologically-oriented civilization shows an extremely strong tendency to realize whatever is immediately possible instrumentally. Whether bio-constructive or socio-constructive modelling will be

realized first will depend on which of the two it is easier to accomplish. We do not know which sort of research will be begun first. But in any case, whichever is first will decisively influence what will be accomplished later. In this sense, for a civilization as internally contradictory as ours, the material world is a sort of puzzle or labyrinth, concealing unknown—positive or negative—values in the depths of its unexplored corridors. Will its treasures be easier to abuse than to use for the common good, or vice-versa?

With this line of thought we have been personifying the world as if it were prodding humanity to action. In fact, it is neutral and accidental. But the fate of a divided civilization, especially one dominated by science and technology, depends on the qualities of the world's totality of parameters.

How does all this relate to our postulated metafuturology? It shows that, at this high level, reflection must allow space for such normative directives, since social forecasting cannot (in regard to its methods) be placed under the same hat as physical or astronomical predicting. In practice, futurology works according to completely different rules: "the machine works somehow; let's do whatever is necessary to make it work better." But the tactics of the successive stages of technological movement cannot compensate for the lack of strategy in the totality of phenomena. So people write books assigning a myriad of great distant goals for humanity (for example, in the framework of a 100-year program of space exploration). The authors of these books believe that we should not use the established values as our compass, but rather that humanity should be "attracted" by a group of goals set in the distant future, and the movement towards them alone will be sufficient to unify us to strive for these goals. But exactly why should we strive for any goals at all, if they are not dictated by the cultural values to which we adhere? The authors of these so-called "Prometheus Programs" naïvely transpose the principle that leads a parent worrying about a lazy child to say: "Move already! Do something! Don't just sit there!" This is not sufficient for the civilizational work of the next few centuries. The caution we must show might also be called wisdom. But who knows whether this particular quality might not be in need of careful re-examination? In ancient culture, stabilized by the succession of generations and as unchangeable in its dynamics as a perfectly regulated clock, respect was given to sages like Chuang-tzu, who placed inaction above all action. In the only slightly more mobile Middle Ages, which hardly transformed the disposition of human works at all, the skeptical agnostic could be just as much a master of thought as his extreme opponent, the dogmatic enthusiast who first framed the doctrines of activism. Both these models of wisdom are anachronistic in our world. Since the futurologists no longer hold a brief for this responsibility, the vacated space has been filled by thinkers who have grown disgusted with civilization and are angry with its creators. They condemn it lock, stock, and barrel, and they consider the destruction of every form of the so-called "establishment" emancipation from the slavery to objects. But however dubious the value of the machinery of civilization—especially when it wants to determine life-principles—today we can only discuss certain different ways it might be transformed, and not its complete demolition, which is the new sage's favorite idea. Therefore, parallel to the changes reconstructing the main rela-

tions of civilization, we must change the idea of personally incarnated wisdom. Can the writer become such a sage? It's doubtful. But even if he or she can not be the judge, let the writer at least be a critical observer. To be one, she or he must see every lack and flaw in the world, even those that are on their way to being corrected.

The petty prophets of our age have often sinned against scientific method. The first response of scholars or scientists is to admit the mistakes they have made. In futurology, however, they have shrewdly introduced the principle of the unverifiability of prognoses. When I predict that an eclipse will occur at such and such a time, at such and such a place, my prediction can be verified. But if I give a 100,000 different places and times where and when an eclipse *might* occur, I have made my position so flexible that anything I say will evade verification. A futurology that multiplies its "scenarios" of possible events does not articulate the space of real possibilities latent in the future. Instead, it builds a sort of "exercise machine," an apparatus that will help the holders of power to learn how to optimize decision-making. This may be a valuable thing to study, but it has only a very indirect relation to predicting what is actually to come.

Another sin of the futurologists is that instead of objective prognoses, they prepare self-fulfilling programs (first I predict that a certain woman won't find a husband, then I announce everywhere that she is so homely that she surely can't appeal to anyone; thus I scare off every potential suitor and ensure that the poor woman will indeed remain a spinster).

The third sin is the rule of "searching for the key in the lamp-light." The protagonist of the anecdote doesn't look for the key where he lost it, but where the lamp sheds its light. The futurologist often considers the most important factor determining the future to be the one most easily measured, and not that which may have enormous significance but can't be squeezed into an exact schema. The other side of this principle is "the dust must be swept under the rug." Unfamiliar with the theory of certain phenomena (for instance in the realm of imponderables), the futurologists will sweep the factors most difficult to calculate from the center of their work to its periphery. Thus they replace the objective probability of events with subjective probabilities determined by the method and education of a given futurologist.

Finally, the "blind spots" of prognoses—and even of futurology as a whole—are caused by the specialists' political opportunism. The eye does not see itself, one cannot taste one's own tongue, and the American futurologists do not see phenomena that could prove uncomfortable for them. We find the most cunning horrors in chapter 21 of H. Kahn and J. Wiesner's voluminous *The Year 2000*, entitled "Other 21st Century Nightmares." But there's not one word about the problem that the press has put this way: "The US is endangered by its own national defense," or rather by the "military-industrial complex" built around the Pentagon (cf. *Le Monde*, June 18-19, 1979.)

Opportunism, eclecticism, pragmatism—these are not causes of the "futurologists' disease," but symptoms. They are evidence that we lack a general theory of prediction, which I have called *metafuturology*. Of course, no one can build the whole methodology and theory of predicting the future

of very large and complex systems all by her or himself. But we must point out the need for them—and emphasize that it would be inappropriate for practicing futurologists to be the ones to construct them.

RÉSUMÉ

Stanislaw Lem. ***La «méta-prospective».****—Les pronostiqueurs voudraient que leur expertise soit «au-dessus des spécialités» quand ils élaborent leurs prédictions en mettant en corrélation l'information fournie par les autres sciences. Mais la prospective contemporaine, particulièrement aux États-Unis, se trouve sérieusement compromise par trois points faibles apparentés. En premier, les pronostiqueurs ne sont pas neutres en ce qui a trait à leurs prophéties; ils confondent leur rôle d'indicateurs des tendances objectives avec celui de conseillers du pouvoir. Ainsi leur opportunisme politique se manifeste et ils dressent des prophéties qui s'accomplissent sans peine. Deuxièmement, les pronostiqueurs s'occupent principalement des bases matérielles et technologiques de la civilisation. Ils en ignorent les «impondérables», les valeurs et les normes qui rendent compte des actes humains authentiques ayant pour résultat que l'influence de leurs prédictions conduit à l'instrumentalisme des normes culturelles. Troisièmement, les pronostiqueurs n'ont pas suffisamment développé une théorie rigoureuse qui contrôlerait leur penchant pragmatique à évaluer uniquement ce qui peut être facilement mesuré.*

Nous avons grand besoin d'une méta-prospective *qui étudierait les limites et les possibilités de l'extrapolation scientifique. Chaque science devrait avoir une section qui traiterait de son avenir et qui contrerait le pragmatisme instrumental de la prospective par un contrepoids humaniste. Dans son ensemble, la méta-prospective devrait se soucier de deux facteurs qui teintent l'avenir d'incertitude, c'est-à-dire la liberté des groupements humains et les qualités méconnues de l'univers. Elle devrait allier le travail effectué par la prospective conventionnelle avec celui des «seconds pronostiqueurs» principalement les astrophysiciens qui se penchent sur l'existence possible des civilisations astrotechniques. La méta-prospective doit aussi prévoir d'une manière effective les découvertes qui pourraient aider l'humanité à «bondir» hors de son histoire, par exemple, la disparition de la «frontière somatogène» entre le génotype et le phénotype culturel. Enfin, la méta-prospective doit tenir compte de l'impact des normes existantes sur le développement de la civilisation.* (IC-R)

Abstract.—*Futurologists aspire to be experts "above the specialties," constructing their predictions by correlating the information provided by other disciplines. But contemporary futurology, especially in the US, is seriously compromised by three related flaws. First, futurologists are insufficiently neutral with regard to their prophecies; they confuse their role as describers of objective tendencies with their role as advisers to agents of power. As a result, they are often politically opportunistic and they construct self-fulfilling prophecies. Secondly, futurologists generally concentrate only on the material-technological base of civilization, ignoring the "imponderables," the values and norms that motivate authentic human action. As a result, the influence of futurologists' predictions contributes to the instrumentalization of cultural norms. Thirdly, futurologists have not developed a sufficiently rigorous theory to control their pragmatic tendency to value only what can be most easily measured.*

There is a great need for a metafuturology*—which will study the limits and possibilities of scientific prediction. Each discipline should have a branch to deal with*

its future, to counteract the instrumental-pragmatism of futurology with a humanistic counterweight. As a whole, metafuturology should deal with the two sets of factors that make the future indeterminate: the freedom of human collectives and the as yet unrecognized qualities of the universe. It should combine the work of conventional futurology with the work of the "second futurologists"—primarily astrophysicists studying the possibility of astrotechnical civilizations. Metafuturology must also actively imagine discoveries that might enable humanity to "leap out" of its antecedent history—as for example the breakdown of the "somatogenetic boundary" between the genotype and the cultural phenotype. Finally, metafuturology must consider the effect of actually existing norms on the development of material civilization. (IC-R)