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JURICYBERNETICS: GENESIS AND STRUCTURE OF A DISCIPLINE

I. THE ORIGINS OF JURICYBERNETICS

The discussion about the use of computers in the legal world began the year the cybernetics of Norbert Wiener was born. His fundamental work, *Cybernetics, or Control and Communication in the Animal and in the Machine*, was in fact first published in 1948. His suggestion there of legal problems as cybernetic problems probably influenced the article published the following year by Lee Loevinger, in which one found jurimetrics, i.e., the use of computers in the field of law,[1] spoken of for the first time.

It is thus possible to assign a precise date of origin to the articles dealing with this development: 1949. Thereafter, the number of interested scholars has increased rapidly; the discipline has spanned the oceans and spread throughout Europe and Asia; and the writers on this subject have become so numerous that the most recent international bibliography on the use of

Translated by Elias Crim.

[1] Lee Loevinger, *Jurimetrics, The Next Step Forward*, "Minnesota Law Review," XXXIII, 1949, pp. 455 ff.

computers in the field of law comprises approximately 6,000 titles of books and special articles.[2]

The extraordinary diffusion of these studies has generated research extending to areas not foreseen by Loevinger and, consequently, not traceable to the original definition of jurimetrics. This crisis of growth had repercussions even in the arguments over the discipline's name. The term "jurimetrics" was justly criticized because it evoked notions of measuring or quantifying law. In 1963, Paul S. Hoffman proposed "lawtomation," an unfortunate term, since the activities performed with the aid of computers do not necessarily imply the automation of trials (and legal actions) as the object of study. In 1968, I proposed using the term "juricybernetics" to designate the heterogeneous complex of international research-in-progress.[3]

At least three reasons compelled me to propose a new system of arrangement for the material. First, since the confusion over the various terms was due to the ambiguity of the word "law" (diversely interpreted as "positive law," "legal application," and "legal theory") a usable category was needed, sufficiently general to contain studies apparently quite diverse. Cybernetics was precisely the science to furnish theoretical models, no less for restructuring of law in the abstract sense than for constructing electronic devices and programs designed for applied use in "positive law." Second, the term "juricybernetics" had never been in previous use, which meant its meaning could be stabilized conventionally, keeping in mind the research already done or possible at a future date. Third, the term "juricybernetics" is clear to the legal profession—who, for example, make frequent use of "jurinaturalism" and of "jurisconsult"—and is translatable into the major languages. Even if the term is not pleasing, it still offers the advantage of unequivocally indicating the boundaries of a discipline which were previously unsure.

Before illustrating the content of juricybernetics, I would like to make it clear that I do not see it as a new science; rather, a new method probably bearing fruitful innovations in traditional

[2] This bibliography, edited by the University of Ratisbon and submitted to the Deutscher Juristentag, 1970, is still in press.

[3] Mario G. Losano, *Giuscibernetica*, in *Nuovi sviluppi di sociologia del diritto*, Comunità, Milano 1968, pp. 307-325. Two bibliographies on juricybernetics are appended to the volume.

juridical science. In fact, I think that one ought to accept the invitation of Herbert Lüthy to a careful examination of the dialectic between object and method of a science and to a consequent *askesis* in the use of the word "science." Today in fact there is the tendency to present as an autonomous science every methodological innovation from traditional science.[4] For this reason, I speak of juricybernetics as a new discipline, not as a new science.

II. THE OBJECT OF JURICYBERNETICS

Within the field of juricybernetics we can distinguish three distinct areas of research: jurimetrics in the strict sense, information retrieval of legal data, and juricybernetic theory of models. Studies belonging to one of these areas differ profoundly from the others but are traceable to a common problem area: whatever results from cybernetic principles is applied directly in law (that is, with a view toward the theoretical reorganization of law) or else indirectly, from the computer (with a view toward practical application in law). The point will become clearer when we examine analytically the three branches of cybernetics. In the course of this examination, information will also be presented on the genesis of the guiding principles of research—one will thus obtain a succinct overview of the brief but intense history of this discipline.

a) *Jurimetrics in the strict sense* was born and developed in a typically North American climate. The excess of data to be evaluated and the resulting crisis in information was increasingly harrying Anglo-American jurists. Their legal system is well known to be founded on the principle of the binding precedent: the judge is bound to a verdict submitted in the same way in which precedent cases have been decided. This juridical technique calls for a precise understanding of the precedent sentences. Therefore a crisis occurs when the bulk of past sentences takes on such proportions as to render useless all manual research. The data on this avalanche of information are astounding. Precedents of jurisprudence used in the U.S. in the inclusive period between 1789 and 1916 are collected in 11,650 volumes. For the period

[4] Herbert Lüthy, *Die Mathematisierung der Sozialwissenschaften*, Arche, Zürich 1970, p. 10 ff.

prior to this date, state and federal publications exist to make a total of about 10,400 volumes. The overall number of volumes of precedents that a North American jurist would have to manage in exercising his profession thus surpasses 22,000 units. But the rate of increase in juridical information is even more disturbing than its enormity in absolute terms. The most famous classical indices of English legal decisions are those of Edward Coke and William Blackstone. While Coke (*ca.* mid-17th century) listed 5000 cases and Blackstone (*ca.* mid-18th century) listed 10,000, a North American judge, Vanderbilt, maintained that in 1953 alone the state and federal sentences of U.S. tribunals (published in the *American Reporter*) had surpassed two million.

In the face of this looming crisis, the evolution of North American society pointed to a seductive solution: a recourse to the computer. The sentences were to have been conveniently cataloged in the memory banks; at a specific demand of the jurist, the computer would have furnished all the sentences relating to the problem. Nevertheless, while theoretically excellent, the project ran aground upon almost insurmountable practical difficulties: memorization techniques vary and impose different practical solutions, as will be made clear at § 3; costs are high; as the quantity of material for computerization is enormous; and the economically preferable solution of a limited experiment appears to be unsuitable for an experiment on a vast scale. Besides these practical difficulties, the negative results of a doubful theoretical definition soon were felt.

A blind faith in the capacity of computers and modern mathematics produced roughly this line of reason: if a judge must decide present and future cases in accord with solutions accepted in past sentences and if we have stored many of these sentences (as a limit, all of them), it must be possible to predict a future judge's action in regard to a specific case. The calculation of probabilities and other modern mathematics would have furnished the theoretical instruments for this prediction. The computer, with its gigantic memory and rapid calculation, would have been the practical instrument.

This ambitious project quickly proved to be unrealizable. The likely origin of the problem was the plan of transferring methods and procedures properly belonging to econometrics to the field

of law. Beyond this explanation of the original bases (which must suffice here), numerous factors were not correctly foreseen. For example, the number of stored cases did not reach such proportions as to render mathematical computations reliable; judges shirked the rule of binding precedent, choosing to view the case under examination as differing from precedents. This last criticism put in question the entire theoretical foundation of the predictability of any judicial decision. An actual case is in fact different from all others and, consequently, an Anglo-American judge can always shrug off the principle of *stare decisis*.

Besides the various possible explanations, a decisive factor was the gap between the jurimetric predictions and plain reality. This type of research was dropped and now constitutes the historical branch of juricybernetics. According to my information at the moment, no one in fact is any longer pursuing this line of research, although that does not exclude the possibility of pursuing it again once new technical or theoretical means render some positive, obtainable results.

The term "jurimetrics" is correct for this branch of research, as it consists of a series of computations and quantitative surveys of juridical data. It is only one of two parts of the jurimetrics proposed by Loevinger; actually, the other, whose object is the input and retrieval of judicial rulings, is not a kind of "measuring of law" but a different activity which will now concern us.

b) *Information retrieval of legal data* comprises the branch of juricybernetics that collects all studies directly concerned with the storing and retrieving of legal data. A part of the Loevingerian jurimetrics, it crossed the Atlantic to come to the attention of European jurists. The legal system of continental Europe in fact molds a point of view in the jurist of these countries rarely open to the typical jurimetrical problem, the prediction of a judge's future actions. In continental Europe, the judge compares the actual case with an abstract and general statute and decides if the case conforms to that norm without obligation to take into consideration legal precedents. Of course, in actuality, he will mentally weigh what other courts have decided, especially the Court of Cassation. Nonetheless, he may ignore these without prejudicing the validity of his action. Decisions of this sort are quite frequent in continental Europe.

While American computers were penetrating European industry, the American use of computers was winning over many Europeans. Along with the machines, certain programs came into acceptance as well. But all this offers a solution only for the precise needs of a particular society. Today, in the changing social context, the same means may not satisfy the same needs. For example, the information crisis existed in European legal circles as well[5] and the solution proposed by the Americans thus received the fullest consideration. Likewise, in Europe, between the late '50s and early '60s, the process of computerizing legal decisions began to be realized. It should quickly be noted here that the decisions alone were not sufficient to furnish a jurist of continental Europe with all the information necessary to decide a case. First, he had to note the legal statutes on the topic; then, the sentences of various court levels; and finally the scholarly works which, though not binding in character, could help determine the applicability of a particular statute to a particular case.

At this point, information retrieval of legal data takes on a much more complex aspect than ever before. Statutary hierarchies exist in every governmental organization, further complicated by the existence of supernational legislation such as that of the European Economic Community. Structural characteristics of legal information differ from level to level, and are to be differentiated also in the techniques of retrieval (as will be seen at § 3, it is inadvisable to use the same storing and retrieving technique, for example, with a statute and a scholarly opinion). Furthermore, there are problems of cost, operation, and even legal and political supervision of the computerized data.

In the first place, there are two kinds of difficulty in the field of retrieval of legal data. The first is information retrieval in general—that is, the problems involved in storing and retrieving of any kind of data. The second difficulty concerns this specific branch of juricybernetics, consisting of details characteristic of juridical data and the legal profession which condition the choice of the techniques for storing and retrieving legal information.

[5] Spiros Simitis, *Informationskrise des Rechts und Datenverarbeitung*, Müller, Karlsruhe 1970, pp. 161.

c) *Juricybernetic theory of models* is a typically European transplant on the American tree stock, as examined to this point. The original information retrieval of legal data, as received in continental Europe, was contained *in nuce* within jurimetrics and was extended to legislative texts different from single decisions; though more complex and problematic, their basic nature remained the same. But the legal system finally reacts to the methodology applied to it. The American one generated jurimetrics in the strict sense; the continental European version generates juricybernetic theory of models.

The discipline involves the formalization of the entire legal structure (or of one of its parts) on the basis of results obtained from cybernetic research. The concept of "formalization" will be defined in § 4; let it suffice here to say that the third and last branch of jurycibernetics aims at the construction of theoretical models of the legal system considered as one of the systems existing in actual fact. But within it must be distinguished the abstract construction of models and constructions toward specific results.

To understand the genesis of this theory of models, one must pause to consider a typical assumption of continental European thought: the tendency to construct systems.[6] I shall limit myself to some evidence of the importance of the notion of a system in law. Under the impulse of the idealistic nineteenth-century German philosophy, it conditions, even today, legal thought on the continent of Europe. In my research on the notion of the system in law, two distinct conceptions of the systematic are documented. The first is typical of legal philosophy and consists in the creation of a system so as to unify harmoniously the entire legal structure. The second is typical of legal praxis and consists in systems limited to specific sectors of law—for example, contracts, the family, crimes against property, etc. The first

[6] Mario G. Losano, *Sistema e struttura nel diritto*. Vol. 1: Dalle origini alla Scuola Storica, Giappichelli, Torino 1968, pp. 302. I have summarized the arguments relating to the transition from legal philosophy to juricybernetics in two articles: *The Legal System from Theology to Technology,* "Archiv für Rechts- und Sozialphilosophie," still in press; *L'informatique et la tradition juridique*, in *Law, the Computer and Government.* Paper from the Bangkok World Conference (September 7th-12th, 1969). Edited by Mario G. Losano, CLUT, Turin 1970, pp. 25-30. [Centro di Giuscibernetica dell'Università di Torino, Booklet no. 1].

conception of the systematic satisfies the philosophic demands put forth most thoroughly by the German idealists. The second satisfies practical demands for an understanding of law with a view toward its application. It follows that the first conception spread only to modern jurisprudence in continental Europe, while the second is found in all legal structures.

The diffusion of theories and cybernetic machinery in continental Europe was influenced by this tendency of jurists toward thinking in systems. The titles of the many articles and books pouring forth promised a discussion of cybernetics and law. But these terms signified cybernetic reformulation of traditional legal theories to some, problems purely of information retrieval techniques to others, questions of legal logic to others, cybernetic theories of society to others, and so on. In an atmosphere of confusion and enthusiasm, all were speaking at the same time about different subjects. After some time, it seemed to me that two evolutionary lines might be distinguished along which the theoretical contributions of continental European jurists can be followed. The first is juricybernetic theory of models, linked to the notion of practical systemization of a certain sector of law. This connection between systematic and modellistic thought was not specifically stated by individual authors. The following ought to be convincing proof of the exactness of the reconstruction attempted here.

Returning to the definition of juricybernetic theory of models given at the beginning of the subparagraph, I suggest distinguishing theory of models as formalization in the abstract from theory of models as formalization for concrete ends.

Theory of models as abstract formalization proposes to translate into cybernetic terms the traditional explanations of the systematic nature of the legal structure. The supporters of this type of modellization, continuing in the attitude characteristic of the continental European philosophy of law, tend to construct a cybernetic system of the entire legal field. The purpose of this model is entirely cognitive. The assertion of Ottmar Ballweg has a typical aim: the construction of a "technomorphic legal model" through use of "feed-back" and the "black box," the writer declares that the "structural model" thus built interests him solely from a theoretical point of view. The possibility that

the "structural model" might be transformed into a "functional model" cannot be excluded: indeed, it may be desirable but Ballweg does not pursue any such transformation because he sees in the technical applications only an "intellectual horizon" of the contemporary world, not a goal toward which to direct the proper research.

This verbal innovation tends to clarify things by its very nature since cybernetic notions express with precision the dynamic structure of certain legal and social processes. In this limited innovative process, the computer functions not as an instrument but as a metaphor. The nineteenth-century philosophy of law tried to dress itself in scientific garb, making use of terms borrowed from biology. Today, another step is being taken: from the moment when an organism can be explained cybernetically, one can consider the more modern expression of a legal theory to reside no longer in organic but in cybernetic terms. Finally, theory of models as formalization in the abstract often translates itself into a re-examination of traditional legal doctrines.

Theory of models as formalization toward concrete aims tends to make a clean break with the traditional theories and to create theories which make possible the substitution of the computer for the human in the course of legal activity. Various levels of formalization toward concrete ends are possible with the same problem. For example, the model designed for a teaching machine represents a specific sector of the legal structure in a less precise and detailed way than formalization in view of the computerization of the same legal sector.

In this part of juricybernetic theory of models, the computer is no longer a metaphor to explain law in new terminology but an instrument to make use of law in a new way. While legal information techniques are an aid for the jurist's work, and theory of models in the abstract aids his theoretical efforts, theory of models for concrete purposes is partly or wholly a substitute for the jurist's activity itself. The following much-discussed problem crops up in the latter context: to what degree is it possible or lawful to substitute the computer for the jurist,

[7] Ottmar Ballweg, *Quelque progrès des recherches dans le domaine: science, prudence et philosophie du droit*, "Archiv für Rechts- und Sozialphilosphie," LII, 1966, no. 2, p. 223.

particularly for that jurist holding a key position in our social structure—the judge? The following will show that, in the present state of technological development, this substitution is impossible except in very limited sectors (cf. § 4).

This concludes the examination of the three component branches of juricybernetics. In the following pages, neither jurimetrics in the strict sense nor the theory of models in the abstract will be examined but information retrieval of legal data and the juricybernetic theory of models for concrete ends. The techniques characteristic of each illustrate more clearly their natures

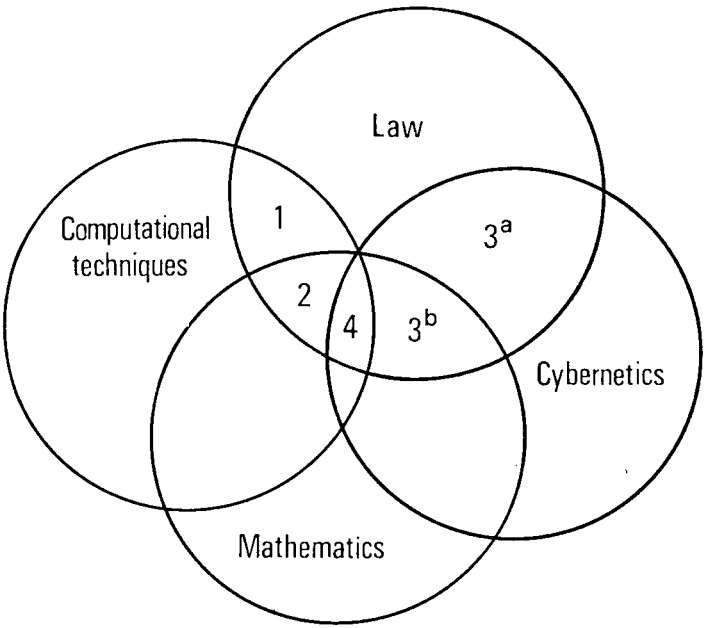

Fig. 1

Euler's Diagram

1: *retrieval of legal data* (law and computational techniques);
2: *jurimetrics in the strict sense* (law, mathematics, and computational techniques);
3: *theory of models in the abstract* (two possible variants: 3a, cybernetics and law; 3b, cybernetics, law, and mathematics);
4: *theory of models for practical ends* (law, computational techniques, cybernetics, and mathematics).

and differences. At the end of this general discussion of juricybernetics, it may be useful to synthesize these characteristics of the individual branches with a graph from the theory of wholes. The four circles composing Euler's diagram (fig. 1) represent respectively computational techniques, mathematics, cybernetics, and law. The intersection of one or more circles individuates one of the branches of juricybernetics illustrated in the text and briefly summarized in the drawing captions.

III. TECHNICAL PROBLEMS IN THE INFORMATION RETRIEVAL OF LEGAL DATA

Information retrieval techniques are divided into sectors of research other than law. Timely information on results obtained by other researchers became increasingly difficult, especially in the chemical, physical, and biological sciences because of too many articles scattered throughout too many journals. Under these conditions, research was inevitably duplicated, resulting in the double economic loss of useless expenditures and time wasted for further research. Furthermore, the perusal of journals by the usual methods could not be taken beyond certain limits. It was remarked that less expense was involved in duplicating laboratory research, even when known to have been completed by others, than in attempting to locate reports in the ocean of scientific publications.

The first experiments with information retrieval undertook to remedy this situation. The technique was therefore conceived to deal with bibliographic-scientific information, with special regard for the experimental sciences. But the other sciences were likewise drowned in the flood of publications. Thus, information retrieval techniques entered the ambience of the social sciences as well. The transition from bibliographic information to legal information was simplified by the fact that law is expressed in propositions which are not linguistically different from a summary of a medical or a sociological article. American jurimetricians in the 1950's, making use of this external resemblance, began to computerize federal and state court decisions. As already noted, these data sufficed for them. However, the debates over the validity of the programs used by American jurimetrists began

when they first came to be applied to continental European law.

Thus, like every self-respecting discipline, juricybernetics, too, has by now its classical debate: the polemic between those who favor the full text and those who favor abstracts—both versions supplied with key words. The terms of this polemic will become clear in an examination of the two techniques.

The *key-word technique* consists in designating those words in a specific text which outline its argument. One of the synonyms for "key-words" is "describers." The texts for computerization are furnished with these key-words by the manual action of specialists. Sheets thus prepared pass to those in charge of punching the computer cards. The latter transfer the original data into the memory of the computer. Now let us suppose that a scholar wishes to know how much has been computerized on a certain subject. He will indicate this subject by one or more key-words which will be perforated on a question card. The computer will search out all the texts in its memory that contain the key-word requested and will immediately print them in readable form, that is, in normal language. Therefore, the contact between the man and the machine occurs only through key-words. The computerized text is singled out during the machine's search and is furnished to the user only if it has been supplied with the required key-word. If the key-word does not occur in the title but only in the body of the text, the program may not be adequate to locate that text. The assigning of key-words is therefore a delicate and complex task on which depends the greater or lesser utility of the computerized information.

This activity, also called "indexation," is common to information techniques whether using abstracts or full texts. The polemic concerns the type of raw information retrieved by means of the key-word. The possibilities here are various, all previously experimented within the field of general information techniques. Given a specific text for computerization, the machine should extract the key-words in every case. After these may come either the single bibliographical entry of the article (which the user will then have to locate manually in a library) or an abstract of the full text of the article. Here the polemic begins. Its resolution ought to be researched instance by instance, keeping in mind the special demands of the material to be computerized.

For example, the single bibliographical notation of texts found under a key-word offers the most economical solution, one whose validity depends on the accessibility of a library containing all the computerized texts. Therefore, the use of terminals at a great distance from the central computer appears excluded from the start.

The *technique of the abstract* supplied with key-words is the most widespread and was accepted in the first experiments with legal information. Often, in fact, individual rulings are summarized by the same courts from which they emanated. Yet this technique revealed its inadequacy when the creation of information systems designed for specific European needs was undertaken in continental Europe. Since the nature of continental European law required the computerization not only of court decisions but also, and above all, of general and abstract norms, what sense would there be in an abstract of the latter? For the continental European jurist, the literal content of a legal statute is fundamental. Every word, every comma has a specific weight —thus the need for the full text to follow the key-words. Yet this theoretically unquestionable assertion arouses serious practical problems: to computerize an entire text means punching many cards and spending much machine-time, i.e., raised costs for the information system. The first experiments with legal information systems had to fall back, precisely for financial reasons, on more economical techniques which were not always suitable for optimum retrieval of data.

In conclusion, the supporters of abstracts and those of the full text are both correct but in different areas. Today, legal information retrieval means the computerization—as much in Common Law countries as in Civil Law countries—of general and abstract statutes, of judgements, and of scholarly texts. For the first of these, the full text is indispensable; for the second, an abstract is acceptable; for the third, a bibliographical notation suffices. The demands of cost compression are thus reconciled with the characteristic needs of computerized legal information. Therefore, the polemic over the abstracts versus the full text, viewed from the historical perspective sketched out above, seems to be founded on a misunderstanding due to the divergence between Anglo-American and continental European law.

In my opinion, however, the real problem in information retrieval lies in the key-words, hitherto accepted as an inevitable impasse of information retrieval. The defect in the key-word technique is in the loss of information: the text arrives instantly but only in the form of a few key-words. This is especially dangerous in law because laws generally have a much longer life than a scientific article. Through a longer period, the terminology can undergo variations (which make irrecoverable certain information indexed under a key-word fallen into disuse) or else the laws may come to be interpreted in a manner different from that understood by the specialist who assigns the key-words.

In attempting to eliminate this drawback and to create a more adequate information system for the needs of law, I have completed an experiment in which the legal text does not have to be indexed prior to computerization. According to this program, every word of the computerized text becomes a key-word. To obtain the pertinent text, it is sufficient to request one of its component words. Two advantages are thus obtained: the enormous manual labor of preparing texts is reduced to a minimum and, consequently, information depending on the human factor is not lost or distorted.[8]

IV. TECHNICAL PROBLEMS IN JURICYBERNETIC THEORY OF MODELS

Only the juricybernetic theory of models for practical ends shall concern us in the following pages. Here is the heart of the relations between the legal system and computerization, since a fundamental question is raised: what form must legal activity assume to be carried out by a computer?

In order that a series of actions for a specific end be carried out by computer, they must necessarily be formalizable and, in particular, translatable into algorithms. Here a clarification of what is meant by the terms "formalizable" and "algorithm" is needed.

Jurists tend to confuse the notions of formalization, mathe-

[8] This project uses a standard IBM program and has been carried out in collaboration with the Centro Studi IBM at Pisa. An early report on the program's structure is contained in my article *Introduzione all'informatica giuridica*, "Civiltà delle Macchine," XVII, 1970, n. 6, pp. 22-28.

matization, and quantification. Certainly, the original experience with jurimetrics is not alien to this conclusion. This empirical discipline, as it happens, did not take care to delimit reciprocally its two diverse component activities, namely, information retrieval of legal data and probability calculations from computerized data. The failure of the latter also involved the former and even if afterwards information retrieval gained a steadier footing, many opponents of the new methodologies continue to criticize it, indifferently lumping it in with the application of mathematics to law. Yet formalization is a different matter. First, it is as typical of information retrieval as of juricybernetic theory of models. Still, in the same way that many view computers only as calculating machines, likewise many see in formalization a dangerous *furor mathematicus* for the social sciences. Formalizing reality immediately indicates translating it into terms of formal logic and, at the most, of algorithms. For this reason, the formalization of law is only partly identical with its "mathematization, while it does not concern the quantification of the legal phenomenon.

This formalization aims to translate a completed series of actions into an algorithm. This term, derived from mathematical parlance, has assumed an ever wider significance. It can be precisely defined when put in relation to Turing's machines,[9] but here an intuitive definition will suffice: an algorithm is a system of transformation from input data (or problem) to output data (or solution). The algorithm must present various characteristics, of which the principle ones are the following: it must lead to a solution in a finite number of steps; and each single step toward the solution must be univocal, i.e., interpretable in only one way.

The algorithmization of either numerical or non-numerical problems is an extremely complex task. Yet the matter need not occupy us here, as it suffices to have clarified what is meant when the term "formalization" is used in juricybernetics: the transformation of a problem into an algorithm. In fact, the algorithm is the means through which the computer "understands" a specific problem.

[9] T. E. Hull, *Introduction to Computing*, Prentice-Hall, Englewood Cliffs (N.J.) 1966, pp. 170 ff.

The introduction of the notion of the algorithm clarifies the subdivision of juricybernetics proposed at § 2. The juricybernetics theory of models in the abstract creates theoretical models that do not necessarily present the characteristics of an algorithm (and, in fact, by definition are not destined for computers). Jurimetrics in the strict sense has constructed algorithms to solve by computation mathematical problems linked to probability calculations. Legal information retrieval formalize the process through which someone traces out the legal data dealing with a particular concrete situation. This algorithm thus makes reference to a process outside legal data. Indeed, it has been shown that this formalization was not originally applied to law but to other subjects. The juricybernetic theory of models for practical ends formalizes a series of actions regulated by a sector of the legal system. With this algorithm, formalization penetrates the interior of the legal system.

The definition of an algorithm, to this point, allows the indication of the limits of the theory of models. Not all social problems are in fact reducible to algorithms, nor can all algorithms be committed usefully to computers, which indicates that many problems either do not present a solution expressible in a finite number of steps, or else demand so many steps as to go beyond the capacity of today's computers.

The applications of theory of models so far realized refer especially to public administration. It has been noted that to algorithmize certain parts of the system (for example, taxation or pension payments) the pre-existing legislation had to be modified. This modification has always produced rebellion at the notion of reducing the discretionary decisions of a civil servant performing the task to be automated. Such decisions are not, in fact, predictable and therefore they obstruct the formalization of the problem. The progressively extended use of computers in public administration will in the end profoundly influence techniques of legislation. The State of Bavaria, for example, has already passed a law fixing the formal criteria of future legislative proposals. In this way, the criteria, once approved, ought not obstruct the use of computers in the sector of public administration regulated by them.

From all the above, one thing is certain: in order that the

present legal codes and laws remain in force, the machine cannot replace the penal and civil judge. This fear, which is often evident in the writings of jurists, is not so much groundless as premature, in my opinion. The dehumanizing of justice is still a long way off. Instead, there are other disquieting doubts, even closer and perhaps more serious, which we must take up at this point.

V. FROM TECHNICAL PROBLEMS TO SOCIAL AND POLITICAL PROBLEMS

Every tecnological innovation raises social and political problems because it involves a reorganization of the social structure caught up by it. Between the group about to lose seemingly intangible powers and the group coming out of the shadows to acquire an unforeseen influence, a struggle takes place, the result of which hangs on the application or the rejection of the innovation itself. This holds true throughout the entire history of scientific discoveries and it is also pointedly verified by the introduction of the computer into this century's industrial world. The symptoms of these problems of "changing the guard," also in the field of law, already exist, while the introduction of the computer appears to be coming sooner and more inevitably. For brevity's sake, we shall now take into consideration only three aspects of the problems raised by the computer's entrance in the legal world. The first concerns the *resistance* of the old structures in the face of innovation. The second concerns the tendency towards *centralization* on the part of supporters of innovation. (The first and second attitudes condition themselves reciprocally to the point that it becomes impossible to distinguish cause and effect). The third concerns the greater *efficiency* of the attempt to persuade the citizenry to accept the innovation, in order to bend the resistence of the old structures and to justify the centralization introduced with the new techniques.

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The *resistance* of the old administration and judicial structures in the information retrieval of legal data finds its expression in the polemical question: who does the computerizing? Today the

judge searches out the laws and decisions on a specific case on his own. Tomorrow he will request them from his terminal of the central computer. The sense of dependency in this arrangement leads him to invoke principles of judicial independence and interpretative liberty against the use of the computer. The polemic may become even more heated if the magistrature is divided into opposing camps and one of these succeeds in assuming control of the central bank of legal data. It has been noted that information techniques cannot avoid information losses. Accusations of tampering with data (especially if damaging to the camp which controls the computer) might ensue.

The introduction of theory of models results in a definite loss of power in the peripheral areas. Today a decentralized fiscal office decides by its own discretion specific tax problems. Tomorrow they will be solved by a program forwarded from the central office, or else the solution adopted in the outlying area might be checked by the central office. Obviously, the secondary employee will oppose this loss of position. In the heart of the system, the computer becomes a symbol of power: whoever controls it has complete control of all its functions. Hence the phenomenon, already noticeable, of the proliferation of calculation centers in different capitals. Often different centers computerize the same data but refuse to cooperate because each administration wishes to be autonomous in respect to the others.

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Centralization, as an aim of the new administrative and judicial structures, raises another polemical question in legal information techniques, complementary to the preceding one: what is to be computerized? That is, what are the guarantees that the computerized legal data is of the kind to interest every point of view within the magistracy?—the equivalent to a demand for a check on the basis of the computerizing, i.e., decentralizing. Yet this is difficult to effect in practice. Moreover, whoever controls the computer will urge that this decentralization aim not at better management of the innovation but at a more effective resistance to it. On this ground, he will try to exclude every control over the center by the periphery.

In the area of the theory of models, there is no lack of gloomy

predictions on the computerized society of the future. A central system without controls would direct a periphery completely deprived of the possibility of knowing its own will. In reality, the computer offers great possibilities of decentralization as well, because the development of terminals at the present allows the most distant cities immediate access to information formerly usable only at the central authority. Yet these possible technical uses of the computer depend on a political decision: does the central authority wish to allow the periphery access to this information or not?

The automation of public administration probably demands a revision of the concepts of centralism and decentralism. For now, it remains only to record the fact that, in actuality, automation tends to translate itself into a rigid centralism very likely due to the resistance it encounters, as well.

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The introduction of computers in law comes under the heading of *efficiency*. A faster and less bureaucratic administration is always a good argument in the eyes of the voters. However, efficiency is not the unique value to follow up in legal information techniques. When a more precise rhythm of work is placed on the judge and judicial material is preliminarily selected, more rulings will be obtained, though with no guarantee of "good" sentences. By analogy, automated procedure in the theory of models is not necessarily improved with speed. As was remarked in regard to centralization, there are dangers of blind enthusiasm and excessive pessimism here, too. In particular, it must be remembered that the myth of computer efficiency derives from the field of economics, where it has its justification. But in the fields of law and public administration, it must be asked if efficiency is the value these social structures ought to seek. In my opinion, the answer must be no. That does not imply a refusal of efficiency but its precise limitation. Where a true conflict arises, as between efficiency and "grass roots" control, efficiency will have to be sacrificed.

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In the examination of these three social and political problems concerned with the introduction of computers in law, I have indicated only general questions, not solutions. In my opinion, these must be studied case by case and put next to specific examples of information retrieval of legal data or juricybernetic theory of models existing in actual social structures. The theoretical assertions in the preceding pages are only a contribution toward differentiating the possible problems—not a negligible premise, I hope, if solutions are the result.

VI. THE FUTURE OF JURICYBERNETICS

The history of juricybernetics, as set out here, has allowed us to examine its principal theoretical aspects. This might be the proper place to attempt an estimate of existing projects but the undertaking would demand a lengthy exposition. In practice, every country to some degree industrialized has done some juricybernetic experiments. In North American and in Europe, numerous centers for the study of legal information retrieval exist, linked to lawyers' or notaries' groups or else undertaken privately.[10] The teaching of juricybernetics has penetrated North American and European universities, even if the teaching in the latter cases is imparted from teaching posts whose official designation does not yet mention juricybernetics or legal information retrieval.[11]

The juricybernetic theory of models has made practical

[10] For an overview of juricybernetic activity up to 1969, v. my *Giuscibernetica, op. cit.*, pp. 52-86 and the readings indicated there. A complete picture of Italian activities now underway is found in "Bulletin no. 4" of the Centro di Giuscibernetica of the University of Turin, 84 pp. On North American activities, ample information is found in the review "Jurimetrics" which replaces the former "Modern Uses of Logic in Law" (MULL), and in "Law and Computer Technology," especially III, 1970, nos. 7-8 (dealing with all continents).

[11] Special institutes have appeared in three universities of the German Federal Republic: Frankfurt, Bonn, and Ratisbon. The National Councils of Research in Italy and France are even undertaking teaching projects on juricybernetics. The North American and Canadian situations have not yet been specially researched but many universities offer courses in this material.

[12] In Russian the term *kibernetika* is coming to be used in a different sense than that current in Western European languages. Often, it is synonymous with the English "computational." On cybernetic management of society, cf. several summaries presented and developed at a meeting dedicated to this

progress, especially in the area of local administration, but the automation of limited sectors of central administration is also on the rise. Entire institutes now exist in Eastern Europe whose concern is high-level study of computer management problems in society.[12]

In this feverish research and enterprise, there have been praiseworthy attempts at coordination on the part of the C.E.E. Commission and the Council of Europe. Even if all the individual differences have not been overcome these exchanges have generated promising international initiatives.[13]

However, looking ahead, my enthusiasm is much less ardent than that I see around me. International efforts undertaken up to this point will continue to exercise their functions in parallel with professional lawyers' organizations: for example, CREDOC in Brussels and the French CRIDON. Many other organizations seem to me to have discharged their function, which was to pioneer in the computerization of legal data or modellization of legal proceedings, demonstrating to the unbelievers that such tasks were possible. These experiments took place among widespread incomprehension, technical difficulties and financial restraints: such conditions allowed only limited objects and inexpensive techniques, as in the case of the Italian Operational School and the Prague group. Now that the practical possibilities of juricybernetics are evident, it may be necessary to make a qualitative leap in applying techniques already tested to the enormous sectors of public administration and justice. I doubt that the time is ripe. What I know of the European situation seems to indicate a rekindling, rather than an extinguishing, of social and political problems connected with cybernetic innovation. Under these condtions, one can predict even numerous accomplishments in various sectors but hardly coordinated between themselves. Coordination will probably come with more advanced automation and calmer times, as a part of all the problems that a vast social restructuring implies. In conclusion, I share the optimism of many over the present and future services

subject in East Berlin, November 24-26, 1970. These are contained in the review "Staat und Recht," XX, 1971, no. 2, pp. 181-237.

[13] For example, an international organization has been founded at Brussels which brings together groups interested in legal information techniques: INTERDOC. The publication of its bulletin has been announced.

of the computer in the field of law. Yet the facts in our problem include not only machines and programs but also social structures in operation for decades. From this perspective, optimism over the future of juricybernetics perhaps ought to be tempered by a realistic evaluation of the social difficulties to be encountered. Taking into consideration not only technical but social factors, juricybernetic techniques can be foreseeably and logically affirmed in socialist or developing countries.

The socialist states are already structured according to centralist criteria that allow both vertical and horizontal integration of single sectors of the political apparatus. Moreover, they are provided with greater governmental stability than Western Europe which allows them to undertake and complete the great legislative changes necessary, as has been noted, to the automation of vast legal processes.

The developing states, on the other hand, do not have great quantities of legal data to be computerized nor too many unadaptable statutes. Very often they must create their own organizational structures from nothing. The need to economize with financial resources and specialized personnel constitute an impartial brake on the proliferation of computers, as it thus favors the integration of various governmental activities.[14] Juricybernetics may perhaps furnish an unhoped-for aid toward their development.