

A Semiotic Procedural Approach to Dramatic Literature

Abstract: Ideal models of real phenomena lead to a deductive system of thinking that depends on the degree of the truth of our hypothesis. This type of dependency had been merely intuited until fuzzy procedures brought the problem into discussion. In respect to vagueness, generality, or ambiguity—the latter implicit in art and philosophy (not to say characteristic of them)—traditional logical deduction is no longer acceptable, neither from a gnoseological nor from an epistemological perspective. It seems that new types of inference should be considered and that the tendency towards overestimating the linguistic system of signs should finally be brought to an end.

1. On Fuzzy Inference

Contemporary semiotic theory has been extensively developed on a linguistic level, but the decisive step forward was taken only when it was finally understood that not only language is a system of signs and the sign itself was approached from a more general viewpoint. I believe that Peirce's most important contribution was to constitute his semiotic as a *logic*; and I would like to reiterate here (without going into detail) that his stated "logic of vagueness" is in fact the general semiotic he elaborated (Nadin, 1980). No matter what particular system of signs we consider, we can either concentrate on the system as such or on its environment (the generalized semiotic field), i.e., on its internal structure and the functions fulfilled (the environment viewed as background), or on the interaction between an entity with known properties and the constraints imposed from outside on this entity. In both cases, in order to be able to provide a consistent iteration, we must face the need to preserve the hierarchy of levels of study. Peirce (1903) suggested, with his *phaneroscopic categories*, the hierarchy Possible-Real-Necessary and derived a consistent sign typology (with ten classes of signs). This sign typology is semantically highly relevant, although in general not very well understood by his commentators and seen, by some contemporary semioticians (Eco, 1975), as rather a strange onomastic production of its author. The typology was perfected by Peirce himself (28 classes, then 66) after he improved the hierarchy of the study of sign (on the division of the object and interpretant, see Peirce, 1908). If we now re-elaborate the foundation of semiotics within the framework of algebraic categories (MacLane, 1972) and fuzzy categories (Goguen, 1968), we can prove Peirce's results and thus confirm their scientific value. This has already been done, and interested readers are invited to consult Nadin (1978) or Marty (1979).

What concerns us here is more a consequence of this sort of mathematical analysis, i.e., the need to adapt, in view of a semiotic approach, the means to the object approached. First a general sign theory and sign definition will be set forth; then particular sign systems will be defined and sign typologies constructed that are adapted to each semiotic system. This is the only procedure for making clear the type of dependency between the model used herein and the real phenomena, semantic in this case, to be explained. The fuzzy procedures to be applied in the second part of this study should be adapted to the semiotic system approached, the adaptation being connected to the specific sign typology.

The first condition to be fulfilled is the preservation of a given hierarchy by means of isotonic mappings between the set X of assumptions and the set Y of iterations. This can be expressed as follows: *Definition 1:* If X is ordered by a given order relation \leq , and likewise the set Y by a relation \leq , then a mapping of X into Y is said to be isotonic if it preserves the order. This can be formulated as

$$\begin{aligned} & (\forall x_i \in X, \forall x_j \in X: x_i < x_j) \leq \Rightarrow \\ & \Rightarrow (\forall y_k \in \lceil \{x_i\} \subset Y, \forall y_l \in \lceil \{x_j\} \subset Y: y_k \leq y_l) \end{aligned} \quad (1)$$

Definition 2: A mapping \lceil of an ordered set X into an ordered set Y that is isotonic is a morphism.

If it is possible to preserve the hierarchy, in fact to determine the morphisms, then there is reason enough to introduce the mathematical category. The simple, but nevertheless precise, intuitive representation of a category is that of a structure of object relations (the objects being the sets) called morphisms. In Peirce's case, the objects of a category are the *phaneroscopic categories* and the morphisms, the relations from the Possible to the Real and from the Real to the Necessary. Other fundamental sign categories can be also defined by giving other objects and suggesting a different

hierarchy (expressed, however, through the morphisms). From the fundamental sign category, we proceed to the classes of signs using categorical operations (in particular, defining the so-called diagram in a category (MacLane, 1972), but such an operation is beyond the aim of this article. The preservation of the hierarchy, identified by the isotonic series, guarantees the consistency of the system and makes possible a formal approach such as the logical, mathematical, or the like. Vagueness, implicit in the system, is taken into account from the definition of every particular type of sign. And iteration no longer takes place from an ideal model of the real phenomena but from a possibilistic model (in the sense Zadeh gave, 1977), which I myself associate to the representations in the logic of possible worlds (especially in the case of linguistic signs). As a matter of fact, statistical inference, so controversial, although greatly developed and applied through the aid of computer analysis, reaches a point of consistency (data-analysis-prediction), revealing a system of hierarchized relations and the structure of statistical inference, thus identifying its semiotic condition.

This article, based on the above-mentioned assumptions, examines the system of signs of a particular literary genre: a play. A method for the construction of a consistent model and iteration from it to theatrical praxis (theater being performance) is not only outlined and theoretically proved, but also applied to a given text. It should also be mentioned that the same text (in a context not given here) was analyzed through a rather classical procedural approach, the fuzzy procedure being not only a refinement, but also a definite change of perspective. The method of modeling to be given below has a certain generality, but I cannot claim that universal application is possible. The amount of mathematics to be used was minimized in view of the possible reader. Some definitions could not be avoided, but proofs of the theorems applied were omitted. Attention is drawn to arguments and discussions; statistical results are presented only in order to render such discussions possible and, finally, to clarify the mechanism of fuzzy inference. I am sure that the multiplicity of interpretations does not contradict the method but confirms it.

2. Communication/Signification

By focusing our attention on the play, we do not assume that the text is of primordial importance to the performance, neither that performances without a given text can take place. We center our attention on a particular case, out the whole domain of the performing arts, and insist that the sign system to be used should be adapted to the object analyzed. It can be said that a play is also literature, a viewpoint that should be emended by the observation that *performability*—a quality identifying the possibilities of a text, no matter what kind it is, to be performed—should be identifiable as an assumed aim. The contemporary evolution of art has confirmed that every text, and everything in general, is performable. But what makes a play able to bear the label *play* is its intrinsic tendency towards fulfilling its meaning through a performative form of art.

A play is the set of the words it is composed of. In any given dramatic structure, words represent the final and irreducible reality of drama. The interpretation through performance of a play independent of words is not possible even if performing a play actually means negating its linguistic (verbal) reality and translating it, extending it to a reality of another nature in which the word is sometimes made subordinate to image, movement, music, or silence. No matter what type of interpretation, it always starts out from the reality of the word and translates the word into the signs of systems of nonverbal communication and signification. Theater is ultimately the complex action of placing the word in a dramatic context, more vague than definite—one more reason to apply methods belonging to vague semantics.

The analogy between the definition of the sign and of abstract automata (Nadin, 1977a) can of course be extended to theater, but only after defining the sign in a performance or in the play. The latter's semiotic state stems not only from the fact that the play is an articulate system of signs, but also from the fact that its whole is constituted as a *supersign* (in Peirce's sense of the term). Its interpretation entails the unleashing of several sign processes through which its value is enhanced. In the terms of semiotic aesthetics (Bense, 1971), value reflects the degree of semioticity, hence the competence/performance relationship:

$$AV_{SEM} = f(\text{Supericonicity}). \quad (1)$$

If we now extend this analogy to the whole play, the model of the real phenomena we are researching will also be that of an *abstract automaton*, one which takes note of vagueness and guarantees, to a certain extent, that a new type of inference will subsequently take place. The analogy

between theater—performance first of all, but also such components as text, scenery, etc.—and an abstract automaton—in particular a fuzzy abstract automaton—points out the mechanism producing meaning that represents the actual finality of the act of theatrical interpretation, as well as our aim too. In order to take into account vagueness and ambiguity, the processes of theatrical semiosis should be considered as fuzzy. Since we shall utilize fuzzy functions in this study, let us here recall their basic definition.

Definition 3: A fuzzy function (or fuzzy relation) denoted by $f: X \rightsquigarrow Y$ from X in Y is the fuzzy subset of the product $X \times Y$.

For instance, we can consider the relation from the set of the words W in a play P to the set W_i represented by the lines of a given character c_i . According to *Definition 3*: $f: X \times Y \rightarrow [0,1]$ or $f \in F(X \times Y)$, where $f(x,y)$ is the degree of membership of y at the image x by f (or “the Intensity of the relation between x and y ”).

If an abstract automaton FA (Mealy) is given through a quintuplet such as:

$$A = A(X, Y, Q, \sigma, \lambda) \quad (2)$$

in which

X : the finite set of inputs;

Y : the finite set of outputs;

Q : the finite set of states;

$\sigma: Q \times X \rightarrow Q$ - the next-state function (transition function);

$\lambda: Q \times X \rightarrow Y$ - the next-output function (output function);

then a fuzzy abstract automaton (FAA) is characterized by the fact that the dynamics (σ) and the output map (λ) are fuzzy relations:

$$\sigma: X \times Q \times Q \rightarrow [0,1]; \quad \sigma: Q \times X \rightsquigarrow Q \quad (3)$$

$$\lambda: Q \times X \rightarrow [0,1]; \quad \lambda: Q \rightsquigarrow Y \quad (4)$$

Theorem 1: Theatrical performance, as well as dramatic texts, can be modeled by FAA.

The theatrical sign (at the level of the text or at any level of the performance) is determined by the object for which the sign stands (the object as input, for instance, the play as object of interpretation, in its relation to the reality or independent of it). It fulfills its meaning (sense, meaning, signification, cf. Peirce, 1904) as interpretation (“cognition produced in the mind”), i.e., output. No creative text leads to a one-meaning (univocal) production (as the medieval mystery plays intended). The ambiguous nature of any interpretation reflects the multiplicity of the interactions between component signs, i.e., between the words on which dramatic reality is based. The meaning embodied is revealed by an interpretant (director, actors, stage or set designer, composer, props, etc. or in theoretical interpretations, such as this one) for other interpretants (audience, readers). The mediate nature of theatrical interpretation—Signs₁ (in the text), Signs₂ (in the performance), Signs₃ (as received by the audience)—explains why research on drama focuses not on words, but on characters (Marcus, 1970; Brainerd and Neufeldt, 1974; Dinu, 1968) viewed as real persons who do not know what is going to happen, even if the play is a closed, determinate structure and significant as such. Similarities between life and performance are based on the false assumption that the characters on the stage communicate among themselves. In fact, on-stage dialog is not communication (in the strict definition of the term), but an act of signification (meaning instilment).

3. The Functioning of Signs

A sign algebra, although a necessity, is somehow impossible. Similar signs participate in sign processes that can be described and even formalized. But signs of a different kind also enter into semiosis, and in such cases new operations take place, in a variety practically beyond our imaginative capacity. In a given sign typology, operations can be determined. Moreover, if such a sign typology is expressed in categorical terms, like Dgram(ζ, ζ^{op}), then the operations are those typical of categories (pushout, pullback, projection, etc.). The sign of a play, although belonging to language, is not a simple linguistic sign. Its vagueness and its ambiguity is in direct relation to the quality that we called

performability, which tells us how words will “play” on the stage, or, recalling the proposed model of the automaton, how they will function.

The paradigm on which we shall base our model of drama is that a play represents the functioning of its words—linguistic signs converted into theatrical signs—with the aim of producing meaning, i.e., of carrying out an act of signification. We shall try to convey intuitions rather than to formulate axioms following a procedural knowledge of drama, that is, establishing those similarities between the processes of dramatic language and the processes of computer programming (logical procedures), which can be useful in any interpretive attempt (reading, performing, or analyzing). Some assertions will guide our approach, they themselves not being the aim of this study.

Assertion 1: The content of every theatrical utterance is made up of the words of the play. Even if drama is “made up of the words as a piece of literature,” it is not reducible to literature. “As literature creates a virtual past, drama creates a virtual future,” (Langer, 1953), i.e., its interpretations.

Assertion 2: The theatrical text is represented by the “sharp” set W of the words in the play (proper names of characters, parentheses, other instructions, lines attributed to the characters) put into action through the performance and by the fuzzy set M of meanings thus embodied.

Assertion 3: The functioning of the word/words is the reflex of the profound relation between mental and verbal structures. The characters of a play in performance do not introduce themselves by their names but by the words they utter. Every character is recognizable (and actually recognized) through the words he/she utters, the interaction between these and his/her nature (a psychological concept) being fuzzy. Costumes, gestures, and tone reflect his words as interpreted by the staging (or reading, analyzing, modeling, etc.).

Assertion 4: The study of the language of a play should be focused on the generation and reception of words/utterances in the aesthetic context in which their meaning is determined. This type of study can be applied also to other systems of signs.

Assertion 5: The author is the user of signs belonging to a language. His characteristic, aesthetics, and cognitive structures are stamped on the set of the signs (in particular words) he puts into function. Such structures as emotional, energetic, or logical, those from his memory, and his ability to process aesthetic algorithms (from words, each with a constellation of meanings to the meaning of the play) are reflected in the play-and in the performance.

Assertion 6: Each word participates in the signifying processes. The understanding process takes place in two phases: understanding the semiotic system of the text in view of a performance and understanding the text through the new semiotic system represented by the performance. During interpretation, the set W is intersected by the set of signs (words, music, scenery, movement, etc.) used in order to carry out an interpretive concept (W_{int}).

Assertion 7: The goals of the procedural knowledge of drama are the aesthetic mechanisms associated to the use of signs and the ways in which their functioning can produce, through the performance, an aesthetic state (which can be evaluated both qualitatively and quantitatively). The language used in drama is natural language structured by intrinsic (grammatical) and extrinsic (aesthetic) rules. A valid procedure should of course reveal the type of interactions between them and the influence of other factors (on the intrinsic and extrinsic level).

Assertion 8: The theatrical act involves the need for every participant (playwright, interpreters, audience) to use language in a broad, aesthetic process that includes the perception, interpretation, and evaluation of the human context as aesthetically significant. Each of them brings to the theatrical semiotic act his nature as a sign, a general aesthetic processing capacity (emotional and logical), the symbol system (repertory) and the necessary means of storing symbols and the knowledge thus obtained from the play. The strategies of the author, of the interpreter, and of the audience (in codifying/decodifying, codifying/decodifying) are expressed at the syntactic, semantic, and pragmatic levels. An actor’s utterance sets off an elaborate reaction, verbal or non-verbal, on the part of his companions. On the part of the audience, utterances build meaning and participate in a significative process. Inferences (logical or

aesthetic) and emotional reactions reflect the functioning of the words and the fact that some of them assume a central function (position). When we consider the following intersections of sets of words $W_i \cap W_j$, $W \cap W_{dir}$, $W \cap W_{dir} \cap W_{crit}$, it is obvious that they are significant for the play and for each of its possible interpretations. The intersections of the fuzzy meaning sets follow the rule of minimization.

Assertion 9: The structure of the utterances, as determined during the writing of the play, involves the aesthetically relevant process of feedback (linguistic or paralinguistic). Each utterance is part of the broader sequence defined as an *acteme*: the elementary dramatic unit consulting of an aesthetically significant decision (Nadin, 1977b).

Assertion 10: The procedural model to be developed takes into account the syntagmatic (inner) and the paradigmatic (outer) contexts.

These being the premises of our procedural analysis, we shall now present in turn the programs corresponding to the following objectives:

1. the exhaustive inventory of the words of a dramatic text, that is, the denumerable set $W = \{w_1, w_2, \dots, w_n\}$;
2. the inventory of words distributed per character (apart from the mute words in the text, such as instructions, descriptions, reflections, etc.), that is, for each character c_i of the set of characters $C = \{c_1, c_2, \dots, c_k\}$, the subset $W_i = \{w_{i_1}, w_{i_2}, \dots, w_{i_k}\}$, which forms part of set W and which can be superimposed over the subsets W_j, W_k, W_1, \dots of the words of characters $c_j, c_k, \dots, c_1, \dots$;
3. the inventory of the characters to whom the words of dramatic language correspond, that is, for each the set of characters who put them to use;
4. a statistical distribution of the words indicating those used most frequently, listed in order of rank (including the verification of statistical laws at the level of the text and of the characters);
5. the pyramidal distribution of words, that is, the determination of those words distributed in the vicinity of the word/words used most frequently.

The precursory operation of elaborating the program intended to execute these objectives is comprised of determining the inventory of information that will be automatically processed, such as:

- a. identification of characters from the words of the text (fuzzy inference);
- b. an exhaustive inventory of the words attributed to the characters (in particular the text of instructions);
- c. determination of the parts of speech (lexical and functional forms in particular);
- d. determination of the place of each word in the sentence and marking of the sentences.

The necessity of all these objectives stems from the model proposed and stands in relation to the need of an improved type of inference. Once this inventory is made, we can proceed to the analysis of the frequency of occurrence, global—at the macro-structural level of the text—as well as per character—the marked, micro-structural level. Therefore, in addition to objectives a, through d., which define the working file (WF), there will appear:

- e. determination of the word's frequency in the text (from component signs to the supersign, i.e., subsystems of the system);
- f. determination of the word's frequency per character. The combined objectives (from a. to f.) make up the vocabulary file (VF). The following file structure subsequently results:

	CHARACTER SENTENCE	WORD	PART OF SPEECH	PLACE OF WORD IN
	CHAR	WRD	F PS	PIS
	9 (18)	9 (18)	9	99

FIG. 1: FCARD1; FW

	CHARACTER FREQUENCY/	WORD	PARTS OF SPEECH	FREQUENCY/	
	CHAR	WRD	FV - PS	CHARACTER FV -HRC	TEXT FV - HRT
	9 (18)	9 (18)	9	9 (6)	9 (4)

Fig. 2: FVOC

In terms of computer science, we deal here with files and keys. Of course, a fuzzy semiotic procedure should define its concepts in fuzzy terms. Consequently, we should here introduce the basic elements will be used and show how fuzziness is taken into consideration.

Definition 4: A file F is a finite set of records.

Definition 5: A key is a property P of at least one record of the file F.

A file can hold a set of keys

$$K = \{P_1, P_2, \dots, P_n\}$$

in which case the pair (F, K) designs a file F having the set of keys. If

$$F_i \subset P(F)$$

denotes the subset having the property P_i , then

$$F = \{F_{i_1}, F_{i_2}, \dots, F_{i_r}\} = \{f(P_{i_1}), f(P_{i_2}), \dots, f(P_{i_r})\}$$

is the family nonempty subsets of F having the property

$$P_{i_1}, P_{i_2}, \dots,$$

which means that the pair (F, F) can represent the file F and the distribution of its properties more appropriately.

The fuzzy procedure is based on the assumption that the subsets F_i are fuzzy subsets of F. Let us take F as a subset of the fuzzy subsets

$$F^{(i)} \in L^F, L = [0, 1]; i = 1, 2, \dots, r.$$

These subsets can be defined on the following procedure:

Let $x \in F$; if x has the property P_i in a degree χ , then

$$\chi_{F^{(i)}}(x) = \chi, \chi \in [0, 1], \text{ which means } F^{(i)} = \underline{f}(P_i) \quad (1)$$

If we start from the properties P_i , we can build the subsets $F_{\lambda_i}^{(i)}$ as follows:

$$\chi_{\tilde{F}}^{(i)}(x) < \lambda_i \Rightarrow \chi_{F\lambda_i}^{(i)}(x) = 0; \quad \chi_{\tilde{F}}^{(i)}(x) \geq \lambda_i \Rightarrow \chi_{F\lambda_i}^{(i)}(x) = 1 \quad (2)$$

or:

$$\chi_{\tilde{F}}^{(i)}(x) \neq \lambda_i \Rightarrow \chi_{F\lambda_i}^{(i)}(x) = 0; \quad = \lambda_i \Rightarrow = 1 \quad (3)$$

In our files, we will have mainly word; the semiotic aspects of their specific functioning is not understood as the simple reflex of a syntactic structure but as the result of the interaction between the semiotic levels on which the sign is perceived and interpreted. That is why we determine the nature of the words in sentences and the change in meaning they go through. The properties to be determined are frequency, function in the sentence, meaning, and the change of meaning, neighborhood. Fuzziness is thus taken into account at every level of the functioning of the sign, in the drama (plot) or in that part of the text which usually is not considered in such attempts.

In addition to the list of characters, the analysis of the text adjacent to the play had been provided for since it participates in the sign processes of interpretation. "Moreover, modern playwrights sometimes write pages of instructions to the actors, even describing the heroine's figure and face, or the style of some character's motions and postures (Strindberg tells the leading actor in *Miss Julia* to look like a half-educated, man!" (Langer, 1953).

The proposed procedure, even though it concerns the automatic processing of data by computer, can be applied to individual analyses, indicating the optimal logical direction as well as the minimal operations of identification and marking. In order to carry out the objectives we assumed, we could have conceived distinct programs for each in particular or we could have referred to a so-called program stream. The latter has the chief advantage of approaching the problem in its generality as well a technical advantages (derived from the practical use of the computer). It was conceived from the perspective of the text's aesthetic reality as a distinct unit in a given repertory—part of the vocabulary of the natural language in which the play was written. Analysis of the text in its original language is taken into consideration since translations change not only the set of the words but also the rules of their functioning, according to the structures of the language the play is translated into (new sources of vagueness).

The conceived stream comprises four basic programs (whose detailed scheme and the discussion of their syntactic, semantic and pragmatic consequences are given below) and reflects the assertions (a_1 to a_{10}) assumed to guide the procedural knowledge of dramatic literature (and of literature in general). The example we shall submit to this fuzzy, refined and improved analysis is LeRoi Jones's one-act play *Dutchman*. The discussion of the results form part of the procedure and is significant only within its framework. Basically, in reference to the analogy proposed (Nadin, 1977) through the model of possible worlds, it seems clear that possible worlds are "populated" by the words of the possible individuals, so that the method proposed here improves the analysis of intensity, maintaining the relationship between *model* (as development in actemes) and interpretation.

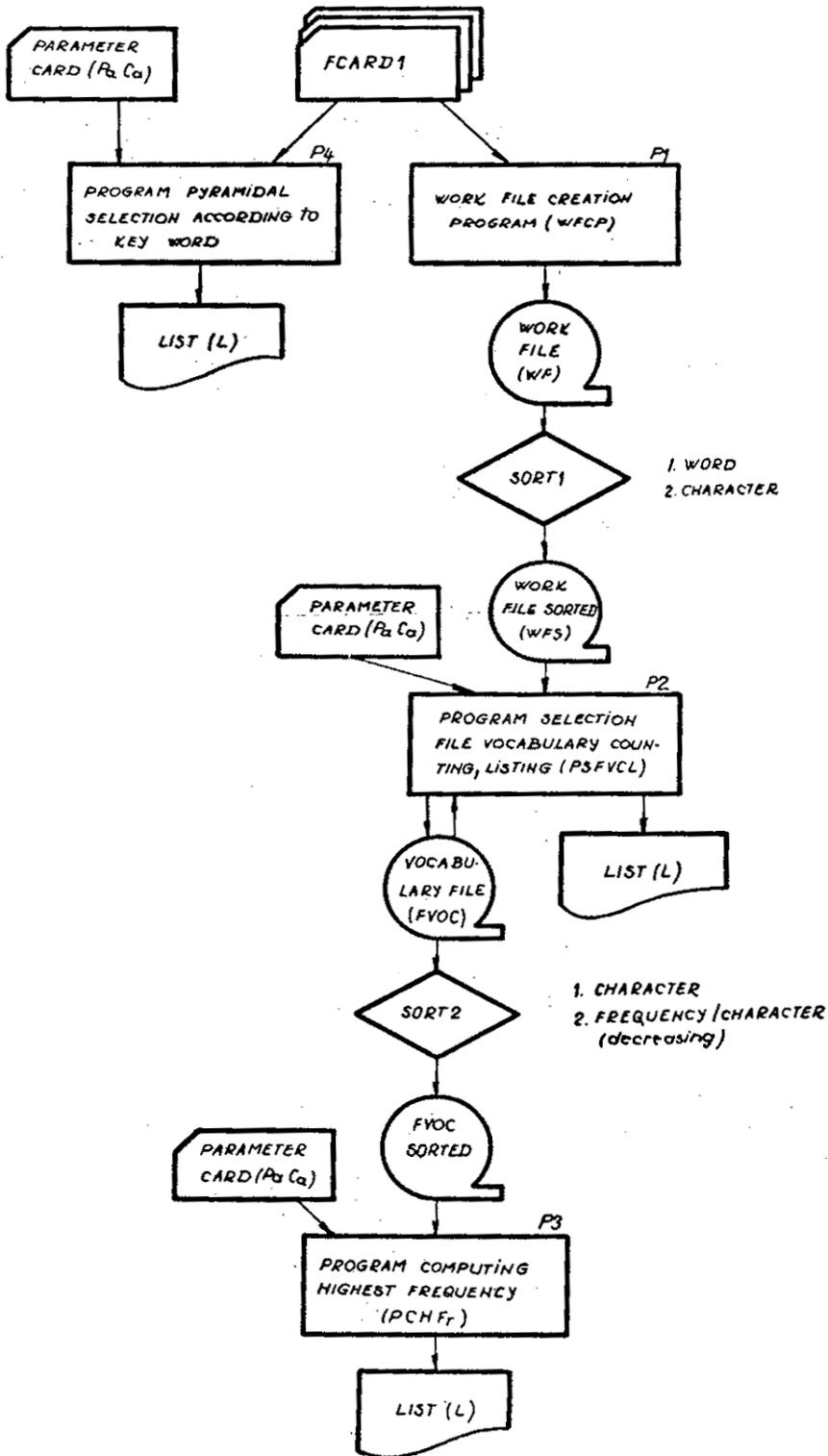


Fig. 3. Procedure stream of programs

4. On the Logical Structure of the Programs

Program P_1 assures the reading of the card file $FCARD_1$ with the structure α and the storing of information in a magnetic tape file (working file - WF) with the same α structure. Program P_2 assures the reading of the working file and sets up a vocabulary file (FVOC) with a β structure in which all occurrences of a word as attributed to a character (text) have been centralized, forming a single recording in FVOC:

word 1 character c_j ($j = 0, 1, 2, \dots, n$)

The same program assures the reading of a parameter card in which:
for PARAM = 1 the inventory of words is listed (reading of the file FVOC);
for PARAM = 2 the inventory of words per character is listed:

word 1	character 1	frequency n
	character 2	frequency m
.....		
word 2	character 2	frequency q
	character 1	frequency r
	character 2	frequency p
.....		

up to a degree $j > n$ relevant to the occurrence of a word. f

Program P_3 sets up the inventory ordered according to the frequency of words distributed per character:

character 1 (c_1)	word 1 (w_{1_1})	frequency n
	word 2 (w_{1_2})	frequency m
	word 3 (w_{1_3})	frequency l
.....		
character 2 (c_2)	word 1 (w_{2_1})	frequency o
	word 2 (w_{2_2})	frequency p
.....		

Only meaningful distribution (characters according to their importance in the play) and words up to a certain frequency are retained. The same program establishes the maximum frequency of the words in the text and lists them, up to a given rank, through a parameter card. Program P_4 assures pyramidal selection according to the words of maximum frequency listed through P_3 , keeping punctuation (vicinity within the sentence), but not the character, in mind since the functioning of the word in the dramatic context is independent of the character's word-name (cf. a_2 and a_7).

Definition 6: Pyramidal selection is a measure of the inner context sensitivity of a sign system. Distribution per character (subset W_i of the words in set W of the entire play) is relevant according to its definition as a distinct individual and through the intermediary of a certain structure (expressed by the relation between lexical and functional forms) of the dramatic discourse.

5. Application

LeRoi Jones's *Dutchman* was first presented at the Cherry Lane Theatre in New York City on March 24, 1964. The text for our study has been taken from the version appearing in the book *Black Theater* (Signet: New York, 1971) compiled with an Introduction by Lindsay Patterson. It is a one-act play in two scenes, essentially expressionistic. The scene is underground ("In the flying underbelly of the city. Steaming hot and summer on top, outside.") with impulsive action and a symbolic repertory. Two characters: Clay (Cl), a twenty-year-old Negro and Lula (Lu), a thirty-year-old white woman, plus extras (Riders of coach, white and black, Young Negro, Conductor), participate in a very tense dialogue. If we apply, as I have emphasized (Nadin, 1978) known semiotic and mathematical models (concerning the distribution of characters on the stage, the probability of their meeting, population density, etc., cf. Brainerd and Neufeldt, 1974; Dinu, 1968; Marcus, 1970; Revzina and Revzin, 1974), the results would not succeed in defining the play's nature or even its structure, not to mention its meaning and the way signs participate in generating the meaning. Not even parameters of domination (NADIN, 1977) are more useful for this purpose. Actually, the play is, as I already stated (NADIN, 1978) a violent image of structural differences concerning the history and the present of two symbolic types of civilization as expressed through *differences in language*. These differences are fuzzy expressed and can be made evident through a fuzzy procedure. Functional repetition is the most direct way the words function in this text; the action itself (a provocative stare, the dialog, provocative gestures, the dance, the murder) symbolic rather than naturalistic, takes place on a semiotic, not existential, level. The model (extensional analysis) of the play (Fig. 4) reflects its repetitive structure. The parallel actemes reflect the fact that both characters have a high degree of introspection, sign processes taking place not outside the person but inside it.

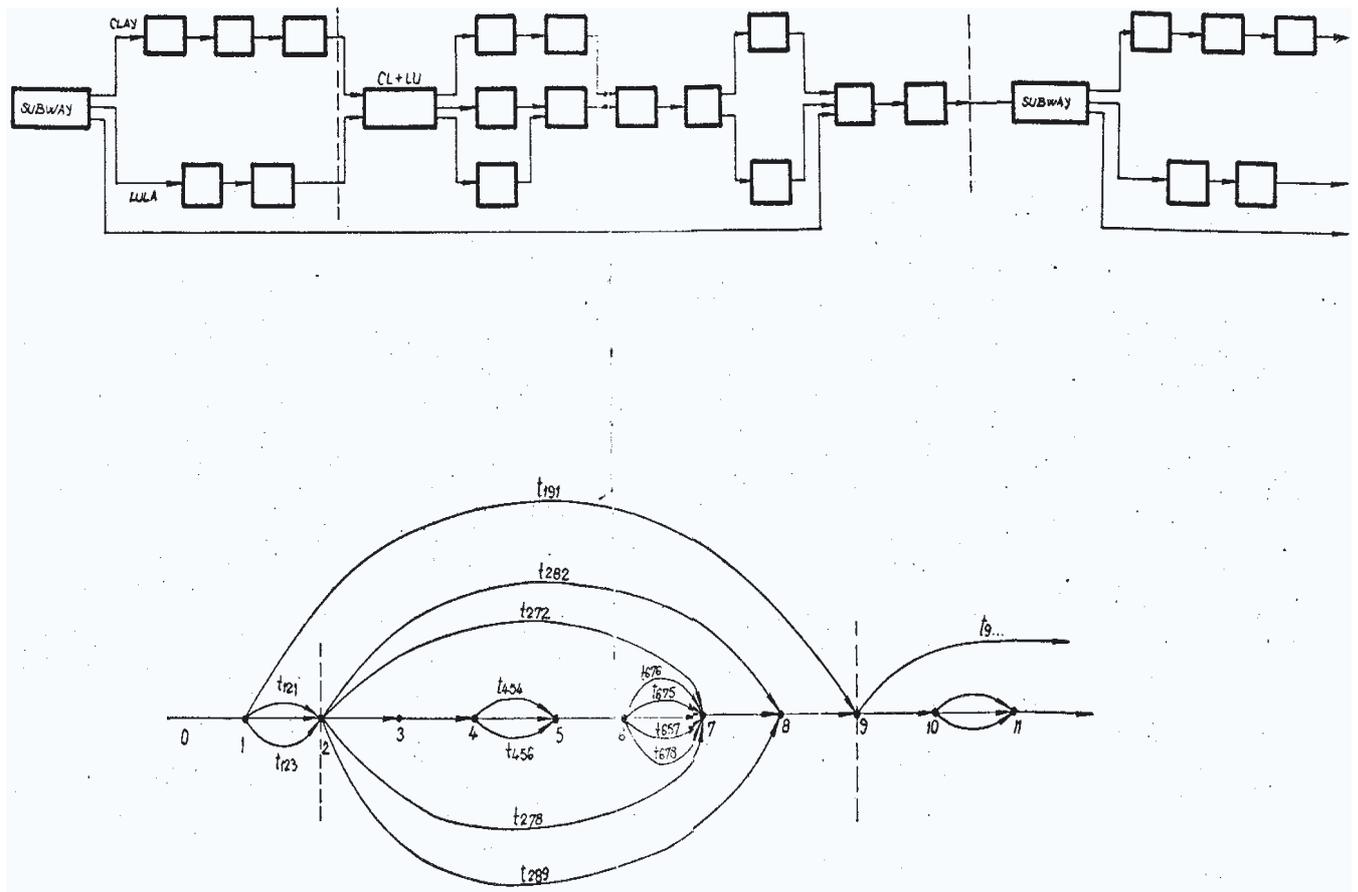


Fig. 4: Extensional model and transmittance

A final premise, also of a semiotic nature, is the definition of art expressed by the play (a line attributed to Clay): *substitute for murder, for violence*. Catharsis (Gr. "purification" or "purgation"), in Aristotle's spirit, represents an aspect of the action of the semiotic field in which this text is supposed to reveal its meaning. The ancient theme—also a given form of the semiotic field—the legend of the Flying Dutchman, works as a legato line. Calling himself a black Baudelaire, Clay defines his value system also in semiotic terms. He does not spurn a possible love affair with the woman who entices him, although he understands how dangerous it would be to his destiny. His murder is merely the logical consequence of the revelation (the monologue in the finale) he has expressed. The interaction between actemes is presented alongside the model of the text in order to explain the fuzzy type of inference we are using (and not as an aim as such).

The procedural analysis, following program P1, permits the determination of the set of words as well as of their distribution in lexical and functional forms. Writing:

I_T - total number of items (W);
 F_T - total number of forms taken by the items;
 I_L - number of lexical items;
 F_L - number of forms taken by the lexical items;
 I_F - number of functional items;
 F_F - number of forms taken by the functional item,

we can introduce several parameters which define the status of the play according to the structures of the words making it up, that is:

$$C_L = \frac{I_T}{I_L} \quad - \quad \text{coefficient of lexicality}$$

$$C_F = \frac{I_T}{I_F} \quad - \quad \text{coefficient of functionality}$$

$$R = \frac{I_T}{F_T} \quad - \quad \text{general redundancy of text}$$

$$R_L = \frac{I_L}{F_L} \quad - \quad \text{lexical redundancy of text}$$

$$R_F = \frac{I_F}{F_F} \quad - \quad \text{functional redundancy of text}$$

These parameters can be also defined in a fuzzy way and considered at the level of actemes, or can be determined for each character in part. Their significance will show up in the course of the analysis. Likewise, their value as an index (in the semiotic sense) for the interpretive act itself will be evidenced as part of the vague semantics of every performing activity. It is obvious that certain meanings will simply confirm intuition based on reading. In fact, reading literature is a form of progressive fuzzy iteration from the ideal model represented by what is written to the meaning of literature. Other meanings occurring will contradict appearances and explain the phenomena through which "in a natural language", as the language of this text is, "terms can change semantically in several ways. Some terms may simply drop a sense and take others," (Moravcsik, 1976). In cases of nonverbal aesthetic significative structures, coefficients similar to those listed above can be determined.

By thinking in words (language), a character produces an effect (aesthetic) on the thoughts of others. Selecting lexical and functional items, the procedural analysis reveals the creative process (of course, not in its generality but as seen from the perspective of a given text). The matching of words is resource limited (although modern poetry tries to ignore these limits). The creative process extends the limits and expands the multidimensionality of the sense of words, expressions, and of the play as a whole. The design of the dramatic mechanism, a form of the semiotic functioning of the signs, has several important and observable regularities, some of a fuzzy nature, which can be significant at the level of

semantics. The fuzzy coefficients C_L , C_F , R , R_L , R_F , computed on the basis of the relations (1) to (5) ($\chi = 0.8$), are lower in value than those obtained in a classical set perspective. The text as a whole displays a functioning based on a relatively low number of different verbal forms. The repetitions, as observed through reading, determine a relatively high value of overall redundancy.

$I_T = 5464;$	$F_T = 1909;$	$C_L = 1.299;$	$C_L = 1.286;$
$I_L = 4233;$	$F_L = 1706;$	$C_F = 4.40;$	$C_L = 4.16;$
$I_F = 1241;$	$F_F = 167;$	$R_L = 2.48;$	$C_L = 2.31;$

Although the functional redundancy R_F must be appreciated together with the lexical, we notice that R_F is quite high: $R_F = 6.14$, respectively $R_F = 6.09$. This expresses the fact that the types of relations specified in sentences are complex, imposing a great number of conjunctions, prepositions, and interjections. The placement of words in mutual relation is quite uncertain (loose, vague) resembling a sounding exploration process. The words intercondition themselves weakly. The verbal context is fuzzy. The characters embody rather autarchic ideologies (a conclusion derived from the semiotic functioning as revealed from the distributions given above).

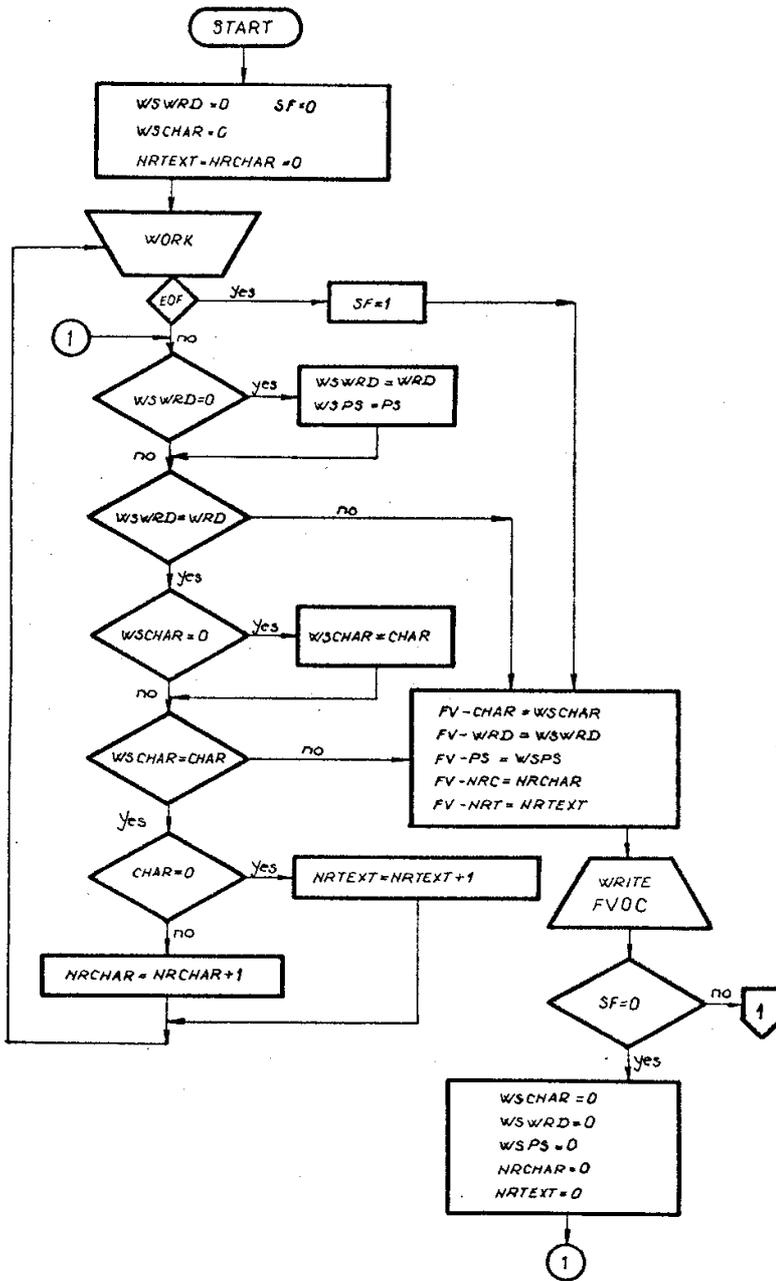
6. Fuzziness of Meaning Production

Returning to the analogy with fuzzy abstract automata (FAA), we can observe that the transition function a (cf. 2 (3)) assumes values in the upper part of the fuzzy interval $10,1]$ while the output function (cf. 2 (4)) does the contrary. The act of Clay's murder and the imposition as meaning of the irreconcilable nature of the civilizations symbolized by the two characters take place not unexpectedly but at an amplitude which the actemes, considered by themselves, do not anticipate. It is an example of fuzzy iteration, part of the text but significant also from the perspective we are using now. In the first case, the degree of membership χ can be considered from 0.5 to 0.9; in the second case, $\chi = 0.01 \div 0.1$. As the intensity of the relation between the words acting as the finite set of inputs and the finite set of outputs, is in a fuzzy connection with the finite set of states. It is no use to recall the results of calculations, but it should be observed that the text reaches a climax which can be precisely determined (and which should be identical to the climax of the performance, the latter rather intuited by the director and by the interpreters). The text is characterized by a relatively high semioticity, the constituting signs tending towards the level of interpretivity (necessary signs of the argument type).

Recalling now the model of the play (the extensional aspect), we can pose the question of how dramatic action develops. The influence of one acteme on another—and in the case of multi-act plays, of one act on another - is indicated not only through the model of logically and temporally ordered sequences, but also through the action transmitted (dramatic transmittance in this case; other types of transmittance can also be defined) through words, action represented also by a fuzzy function (cf. Fig. 4 and Definition 3).

Defintion 7: Semiotic transmittance (in particular, dramatic can be represented by a fuzzy function from the inner state Q_i to a next state Q_{i+1} of the FAA modeling an aesthetic system (in particular, a play).

In this sense, the introduction of procedures from programs P_2 , P_3 , and P_4 imposes itself.



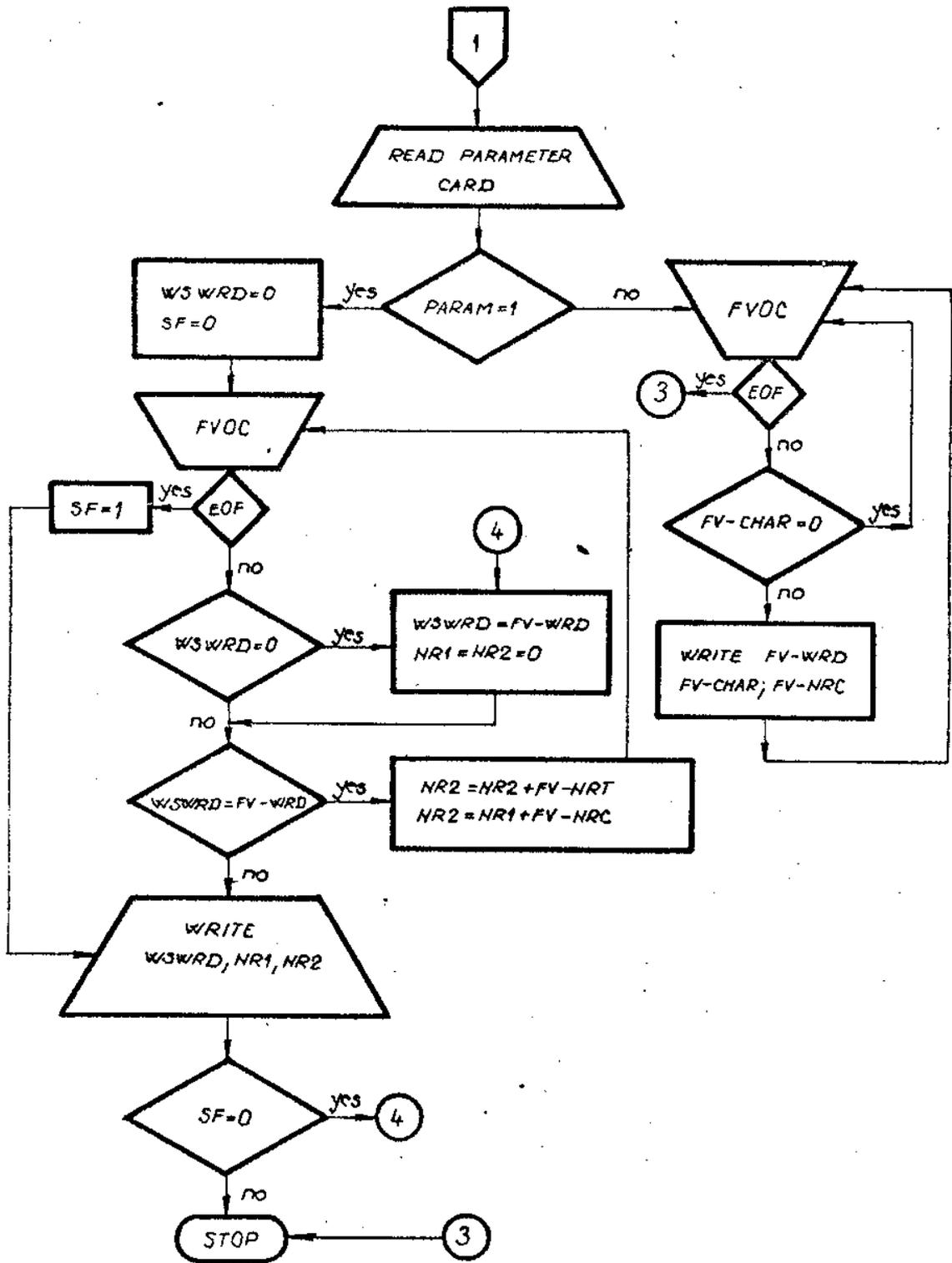


Fig. 5: Logical procedure program P₂

Following logical procedure P_2 , we have the possibility of observing in what manner the distribution of the set of the words of the text takes place as well as their double relation, from the word-name of the character to cues and from words of the cues to the character. Basically, this is a logically explicit model of the way in which the playwright himself conceives and conducts dramatic action. Obviously, the real working file is not identical to the one given in P_1 ; in particular, the set W_{real} of the words the playwright has at his disposal is greater than that actually used in the play (along with other signs belonging to non-verbal systems). Likewise, he does not list the character-words and the word-characters, but creates them through the word, their presence or absence taking place as a physical (alterable) reality only on the stage. On the written page, their presence/absence is given by the presence/absence of signs, in particular of words in typical grammatical forms. To synthesize the vocabulary file (FVOC) means not only to dispose of the set $W = \{w_1, w_2, \dots, w_n\}$ of the play (or, in a broader sense, of the author, including the dictionaries he refers to) but also to know what forms can be derived from a word in a language and what the lexical and functional forms are. Since the parts of speech are contextually determined, that is, through the actual functioning of the words in sentences and meaningful ensembles of words, this analysis is accompanied by a statistical analysis of frequency per character and frequency per text. It can be observed, following the procedure—evidently not the only one possible, a fact that corresponds to the implicit multidimensionality of the text—that any matrix of the characters' presence, as well as any probabilistic calculation of the co-presence of two, three, or more characters from the entire cast, can be rewritten as a matrix of presence of the words defining the subset W_1 of the words of a characters c_i . For a given text, we therefore have two distributions, which can be taken into consideration.

A. Given the set of all characters in the play as $C = \{c_1, c_2, \dots, c_k\}$ the configurations on actemes is given by:

$$\begin{array}{lcl} C_I = \{c_i / I \ I_k\} & \text{in which} & I_k = 1, 2, \dots, k & C_I \subset C \\ C_{II} = \{c_i / J \ I_k\} & & I_k = 1, 2, \dots, k & C_{II} \subset C \\ \hline C_Q = \{c_i / P \ I\} & & I_k = 1, 2, \dots, k & C_Q \subset C \end{array}$$

Q - number of actemes in the extensional model of the play.

Definition 8: The succession of sets C_1, C_{II}, \dots, C_Q represents a chain of stage configurations for the whole play. It is possible to determine the nature of interrelations between characters (individual, couples, trios, etc.) and to suggest various parameters expressing this relationship. The probability of one character's presence in an acteme and his real presence, determined by the author for reasons (mainly aesthetic) other than those expressed by the laws of probability, may give an idea of the "law" of the play and the direction in which the interpretation should be developed.

B. Given the set of all words in the play as $W = \{w_1, w_2, \dots, w_n\}$, the configuration in actemes is given by:

$$\begin{array}{lcl} W_I = \{w_i / i \in I_n\} & & I_n = 1, 2, \dots, n \\ W_{II} = \{w_i / i \in I_n\} & & \\ \hline W_Q = \{w_i / i \in I_n\} & & \end{array}$$

Definition 9: The succession of the sets W_1, W_2, \dots, W_Q represents, for the whole play, a chain of scenic word configurations. Such a configuration can occur several times. Such is the case with the repetitions in the play under discussion, or in plays written by Becket or Ionesco, which do not contain an apparent conflict but an inner one represented by the progressive emptying of sense from words. It should be noticed that this type of drama (and in general, this type of literature) is somehow opaque to the

abovementioned mathematical methods and also to applications of the game theory. Such plays display central terms—“rhinocerotization” (Ionesco’s *Rhinoceros*), waiting (Becket’s *Waiting for Godot*)—and word configurations, such as those stereotype phrases found in foreign language manuals (Ionesco’s *English Lesson* and *The Bald Soprano*).

The procedure under discussion is not only suited to such situations, but also reflects their structures through an appropriate chain of operations which permit the identification and marking of words or expressions. Such texts display a high ambiguity and pretend a fuzzy iteration of their meaning. The total number of occurrences of a word configuration W_i denotes the number of words having the property $W_i | W$. It is possible to determine the density of each configuration, i.e., how many times a given configuration W_i (lines attributed to a character c_i) from the set W occurs in the play. Considering also a probabilistic (theoretical) distribution, we can make a difference or we can consider the fuzzy intersection. This parameter reflects the degree of intentionality expressed by the words and their functioning in the dramatic context. In this way we can determine the rhetorical dimension of the text. In the case we deal with, rhetoricity $\gamma = 0.339$ (quite high).

8. Fuzzy Graphs

A matrix reduced to the first q words (in order of frequency) in the text would indicate their reciprocal relation. It has the form (1):

	w_1	w_2	w_3	...	w_q
w_1	1	a_{12}	a_{13}		a_{1q}
w_2	a_{21}	1	a_{23}		a_{2q}
w_3	a_{31}	a_{32}	1		a_{3q}
\vdots					
w_q	a_{q1}	a_{q2}	a_{q3}		1

The introductory dialogue, for instance, reveals *staring* as a central word (but synonyms, sometimes in the usual sense of the word, other times in a fuzzy manner given, should be also considered *looking*; or the line like “I guess you were just taking those idle potshots”). The functioning of the words points out, contrary to our first statements (Nadin, 1978), vague contexts (sex-myself, staring-myself, staring-sex). For the given example we have:

	staring	sex	myself	I
staring	1	0.47	0.23	0.70
sex	0.35	1	0.52	0.87
myself	0.12	0.55	1	0.66

The sum per line is an indication of centrality. Considering a fourth word (cf. 3, (1), (2), (3)), i.e. excites, the function of staring declines. Given the fuzzy nature of the relation between actemes or other consistent parts of the text, it would be necessary to introduce the fuzzy graph in order to associate it to the matrix we discuss. We shall spare the reader this aspect, but not without mentioning that the connectivity of the matrix attached to the fuzzy graph is a measure of its complexity.

The text is a configuration of words. Choosing from among all the words W only a particular configuration W_i , it is possible to determine the density of a word considering the evolution (functioning) of this word in the configuration of the play or of any of its components. If the analyzed configuration reveals

a decreasing series of densities $d_{w_a}, d_{w_b}, d_{w_c}, \dots$, then the interrelation between words (or signs in general) w_a, w_b, w_c, \dots from the n number of words (signs) as given by the set W is expressed by:

$$\Psi(w_a, w_b) = \frac{d_{w_a} \times d_{w_b}}{n}; \quad \Psi(w_a, w_c) = \frac{d_{w_a} \times d_{w_c}}{n}; \quad \dots \quad (2)$$

It should be added that the intersection $W \cap W_i$ defines the character's type (main or supporting) and that for every group of characters c_1, c_2, c_3, \dots , the intersection $W_1 \cap W_2 \cap W_3 \cap \dots$ denotes the intensity of their relation, the words in common reflecting closeness or distance. For a pair of characters c_a and c_b , if $W_a \cap W_b = W_{ab}$, a coefficient

$$\Omega = \frac{\text{number of words in } W_a \cap W_b}{\text{number of words in set } W} \quad (3)$$

can be introduced, as well

$$\theta_{ab} = \frac{\text{number of words in } W_a \cap W_b}{\text{number of words in } W_a \cap W_b} \quad (4)$$

In the case of the play analyzed, $\theta_{LuCl} = 0.37$ and $\Omega = 0.29$. These coefficients gain in relevancy in plays with more characters and indicate, at the microstructural level of the aesthetic work, the connection between them. All the parameters defined above permit the extension of mathematical analyses from the level of dramatic macrostructure (informational aspect) to that of dramatic microstructures (semiotic aspect). On the extensional model given (Fig. 1), we can also determine those interrelations at the level of each acteme. With the exception of the final (real) acteme (dialog between a *Young NEGRO* and an *old negro CONDUCTOR*), we deal with two speaking characters so that the interrelation of words expresses the character dominant. The chain of dominations is as follows:

Lu, Lu, Cl, Lu, Lu, Cl, Lu, Cl, Lu, Cl, Cl, Lu, Cl, Lu, Cl, Cl

and reflects the play's symmetrical structure.

Programs P_3 and P_4 (see figs. 6 and 7) permit this very refinement of the analysis through consideration of the frequency of words (at the level of the play, at the level of the characters in the component units, if need be) and of the contexts they produce or in which they are integrated. Each procedure in part is not only a model of analysis but also, read in inverse order of the logical chain, a model of synthesis, that is, an image of that which until now we have called the functioning of words.

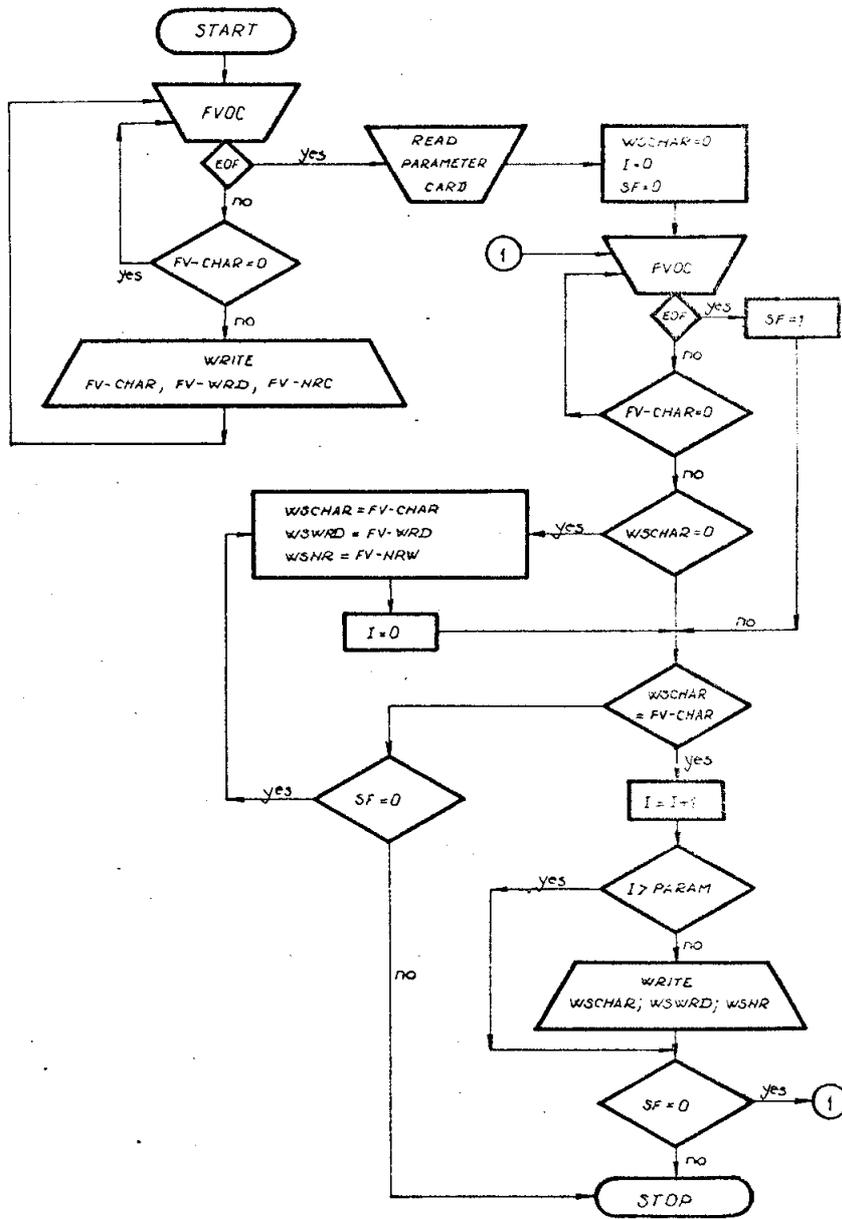


Fig. 6: Logical procedure program P₃

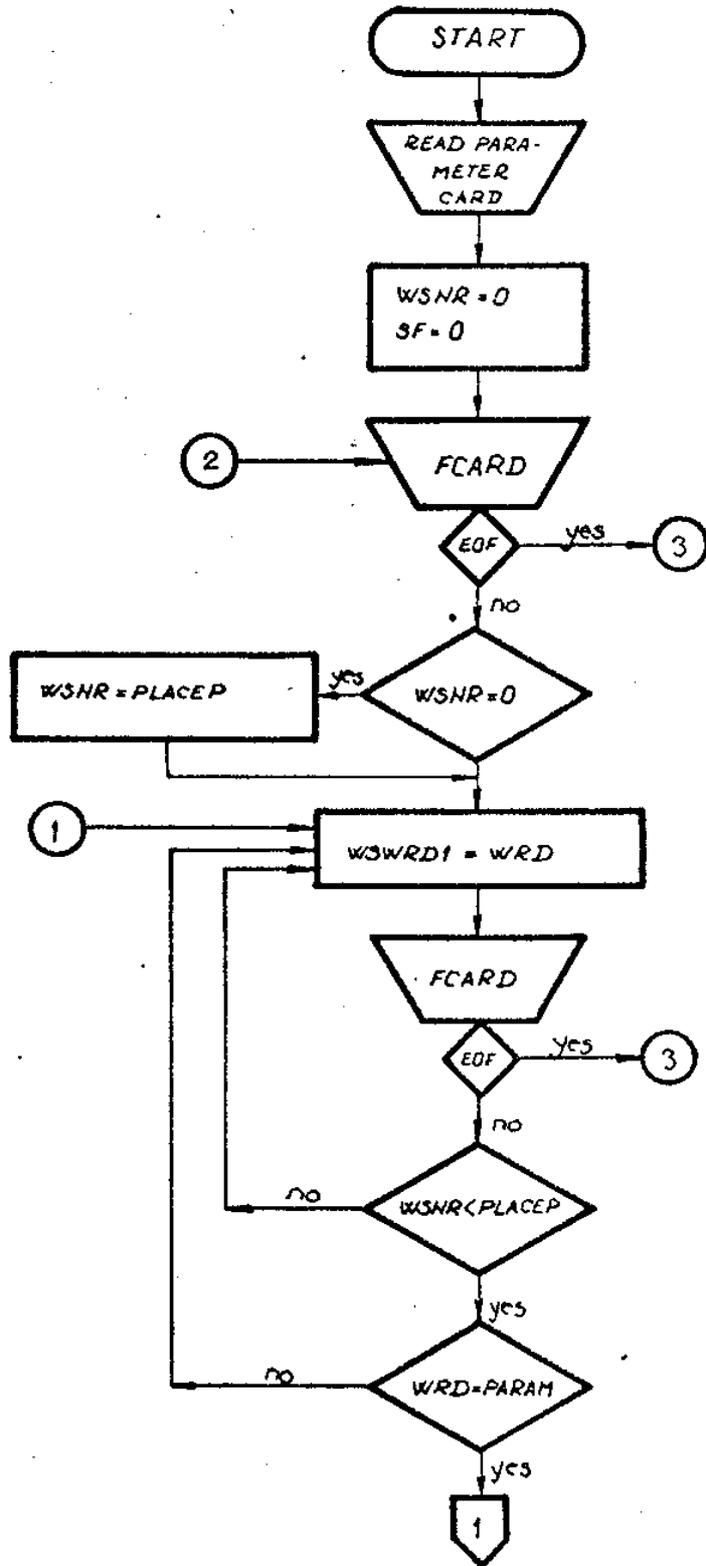
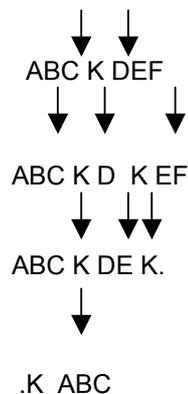


Fig. 7: Logical procedure program P₄

It is interesting to observe that the so-called informing temperature (cf. Mandelbrot) of LeRoi Jones's text is high (lexical variety, slang words, surprising expressions) although he uses the stereotype as a signifying *device*. Texts from the theater of the absurd that have been studied show much smaller values (in portions, they fall below the value 1). This procedure has subsequently not included the logical step (possible in practice through a simple instruction) of verifying the results through the abovementioned law due to Mandelbrot, because we are interested in a different kind of iteration than the one shown in this law. On the other hand, the statistical law of relations between the number of words n_m with a given meaning, that is, $n_m \cdot m^2 = K$, in which $K = f(\text{number of words in the dictionary, in particular from the set } W \text{ of the actual dictionary of the text})$ is a necessary key, especially since the functioning of words means the gain/loss of meaning contamination through the intermediary of the contexts produced. Other statistical laws or parameters connected to them can be tested (vocabulary richness R , as introduced by Guiraud, the law of relative growth of literary products, and Herdan's number, etc.); but it must be emphasized that statistical methods in themselves do not produce significant conclusions unless vagueness is implied from the beginning in the procedure. The analysis of the functioning of words proposes the integration of statistical data in the significant ensemble of the semiotic conception (vagueness involved) applied to aesthetic objects (in particular literary texts).

Several specifications must be made regarding Program P_4 , and the model of pyramidal distribution obtained through it. In a distribution of words w_a, w_b, w_c, w_d, w_e , one can be a central word (that is, having significant frequency). In this case, the words coming into contact with it, within the configuration of the text (no matter what type this text is), determine its meaning and bear its influence on their meaning. In the given case, if w_c were this central word, then a listing of type w_b, w_d becomes relevant. Extended over the entire play, the listing points out the frequency with which certain words appear in the vicinity of the central word/words, hence a pyramidal distribution (left and right). Extended to other semiotic systems, such a pyramidal distribution of signs remains effective. The procedure should assure contextual listing. Therefore, in the case of language we are attentive to sentences as syntactic meaningful units. If a central word is distributed at the end of a sentence, then the vicinity (after the period) is merely partially significant. The logically possible cases are:



(in which A, B, C, D, E, F ... words, K central word). It can be seen that the procedure "counts" to the left and right of the word utilizing data from FCARD1 concerning the word's place in the sentence. The parameter card assures the marking of central word/words. Again, in relation to the assertions stated (a_1 to a_{10}), the examination of the fuzzy procedure proves itself to be the expression of the generative type represented by the theatrical play or by any other type of texts. It can be also demonstrated that the semiotic procedural analysis prepares, down to detail, our ability to approach the text from the perspective of generative grammars, vagueness included, permitting the establishment of quintuplets that define this type of grammar (that is, $\langle V_T, V_N, A, Q \rangle$ in the sense derived from Chomsky (1975)). We shall present below the table of data, coefficients, and parameters (the text as a whole, the text of each character, and the text of parenthetical instructions) of the play in question with the intention of proposing, according to the fuzzy iteration procedure presented, several interpretations concerning them.

$$\begin{array}{llll}
 I_T = 5464; & F_T = 1909; & & R = 2.85 \\
 I_L = 4233; & F_L = 1707; & C_L = 1.29; & R_L = 2.48 \\
 I_F = 1241; & F_F = 202; & C_F = 4.40; & R_F = 6.14
 \end{array}$$

The fuzzy lexical redundancy is lower:

$$R = 2.17 \qquad R_L = 2.09 \qquad R_F = 4.89$$

The interpretation will take into account this matter of fact. The fuzzy lexical redundancy was given in parentheses. In short, Clay's dominant nature is revealed through the main determinate parameters (general, functional, and lexical redundancy). The character Lula's speculative way of thinking is reflected by the low coefficient of functionality as well as by a high level of functional redundancy. Clay has a very concrete type of thought. Functional forms are reduced to a minimum and verbs are frequently substantivized. His monolog, centered on the word *myself* (an endeavor at self-definition) groups individual words (*Money, Power, Luxury; or Act, Lies. Device; or Madness, Laugh, People*), constructing sentences elliptical of predicate.

$$\Pi_{ab} = \frac{\text{number of words of } W_{\text{cen}} \cap (W_a \cap W_b)}{\text{number of words of } W_{\text{cen}}} = \frac{\text{number of words of } W_{\text{cen}} \cap W_{ab}}{\text{number of words of } W_{\text{cen}}}$$

Interpretation of the results from a fuzzy iteration perspective should keep Lula's aggressive insecurity in mind as well as Clay's firm shyness (the signs defining these aspects are quite obvious in meaning). Passage from scene one to scene two, marked by the dilation of the pace presented to the audience (in the beginning, only the seats occupied by the two main characters are shown; afterwards, the subway car full of people who also constitute a contextual element, marked by the words defining their presence and, after the crime is committed, their complicity), changes the functioning of the words and of the other signs participating in the production of the meaning. Instead of an attempt at harmony, contrasts are presented as a reflex of strongly conflicting cultural and psychological structures as semiotically revealed in the semiotic field.

8. Similarity Relations

More intersections are also possible: $W_{\text{cen}} \cup W_{\text{Cl}}$, or $W_{\text{cen}} \cup W_{\text{Lu}}$, i.e. how many central words, with significative functioning in the text belong to the set $W_{\text{Cl}} \cup W_{\text{Lu}}$. Centrality being a fuzzy concept, the intersections should be considered according to the rule for fuzzy sets. In this case, not only do we have an index of interrelations between two or more characters, but also a determination of their relevancy to the play as a whole. The index (in the semiotic sense) Π defined as

$$\begin{array}{l}
I_T^{Lu} = 2397; \quad F_T^{Lu} = 683; \quad R^{Lu} = 3.50 \quad (3.12) \\
I_L^{Lu} = 1666; \quad F_L^{Lu} = 637; \quad C_L^{Lu} = 1.43; \quad R_L^{Lu} = 1.73 \quad (1.67) \quad \underline{\text{Lula}} \\
I_F^{Lu} = 731; \quad F_F^{Lu} = 46; \quad C_F^{Lu} = 3.27; \quad R_F^{Lu} = 15.9 \quad (15.08) \\
\hline
I_T^{Cl} = 2295; \quad F_T^{Cl} = 1097; \quad R^{Cl} = 2.09 \quad (1.98) \\
I_L^{Cl} = 1955; \quad F_L^{Cl} = 974; \quad C_L^{Cl} = 1.17; \quad R_L^{Cl} = 2.009 \quad (2.009) \quad \underline{\text{Clay}} \\
I_F^{Cl} = 340; \quad F_F^{Cl} = 123; \quad C_F^{Cl} = 6.75; \quad R_F^{Cl} = 2.76 \quad (2.61) \\
\hline
I_T^T = 772; \quad F_T^T = 129; \quad R^T = 5.98 \quad (5.01) \\
I_L^T = 612; \quad F_L^T = 96; \quad C_L^T = 1.26; \quad R_L^T = 6.37 \quad (5.87) \quad \underline{\text{Text}} \\
I_F^T = 170; \quad F_F^T = 33; \quad C_F^T = 4.54; \quad R_F^T = 5.15 \quad (5.05) \\
\hline
\end{array} \tag{1}$$

reflects the contribution of characters c_a, c_b (or of more characters) to the generation of the text's meaning. The closer the values are to 1, the more significant the configuration $C = \{c_a, c_b, \dots\}$ is.

In this respect, the possibility of developing the intensional fuzzy analysis of the text arises, considering the concept of similarity of characters from the perspective of the set W_i . It is obvious that since they are defined through the word/words, the characters are similar not to the extent to which they are present or not in a text's significant unit—an element taken into consideration at the level of the literary (dramatic) microstructure—but to the extent to which their words define a similarity (as an expression of fuzzy similar mental structures). Departing from the definition of the function of similarity α , which sets up an application of the type

$$\alpha: X \times Q \rightarrow R \tag{2}$$

so that

$$[\forall x \in X] (\alpha(x,q) = (q,x)) \text{ and } [\forall x \in X] (x = q(x,q) = 1) \tag{3}$$

that is, by determining a real number for each pair (x,q) of the sets $X \times Q$ for which the relations (3) take place, we can retain either the Parker-Rhodes-Needham function or the Maron-Kuhns function. The similarity between any two verbal items in a text (in particular a play) can, as was already mentioned above, be approached from the perspective of fuzzy relations corresponding to the nature of the signs used in a literary (aesthetic) structure, in our case to the words belonging to and defining the dramatic structure. In this case, the following conditions regarding the fuzzy relation of similarity R should be fulfilled:

$$\begin{array}{l}
[\forall x \in X] (R(x,x) = 1) \\
[\forall x \in X, \forall q \in Q] (R(x,q) = (q,x)) \\
[\forall x \in X, \forall q \in Q] (\bigvee_{x \in X} [R(x,z) \wedge R(z,q)] \leq R(x,q))
\end{array} \tag{4}$$

Likewise, a fuzzy extension of the Parker-Rhodes-Needham function or of the Jaccard similarity index, reflecting the intensity (fuzzy) of the relation between words—sometimes pointing out superimpositions of

meanings, other times, oppositions—remains to be carried out so that the corresponding function fulfill the following conditions:

$$\begin{aligned} \Delta x &\leq R \text{ (reflexivity)} \\ R^{-1} &= R \text{ (symmetry)} \\ R \bullet R &\leq R \text{ (transitive)} \end{aligned} \tag{5}$$

It is obvious that not only a semantic similarity is established between the two high frequency words w_i, w_j but also one reflecting their functioning in the dramatic mechanism (or in any other aesthetic structure) as represented by the fuzzy abstract automaton to which they belong in the finite set of inner states (cf. 2, (3) and (4)). Of course, in the case of a play with a complex structure (several acts, more characters, a larger set of words), the matrix that can be written becomes practically impossible to solve (even at the present level [1980] of computer technology) for a play as a whole, but the microstructures can be submitted to research acteme by acteme and the whole integrated according to a balanced average. Moreover, given the implicit fuzzy nature of the relations between words, the fuzzy separation of the matrix (Nadin, 1977a), actually an iteration, can be of aid in discovering the configuration W_i and the relations of interdependence among them. The fuzzy equivalent and fuzzy exclusive classes of configurations W_i, W_j, W_k , etc. reflect the proximity or isolation accomplished by the functioning of the word (or of any other type of signs). No less significant, although momentarily difficult to compute, is the calculation of the entropy according to the standardization of a word's (or sign's) frequency in a distinct unit (acteme, in the case of a play) through

$$H_i = \sum_{j=1}^2 P_{ij} \log_2 P_{ij} \tag{6}$$

with P_{ij} as the probability of the presence of a sign (word) from the repertory used (W) in the selected unit. The higher degree of the entropy calculated permits a hierarchization of the signs (words) according to a more nuanced criterion than that of frequency (in particular, its rank).

9. Closing Remarks

In applying the analogy between “the human language facility” and an “artifactual object,” (Winograd, 1976) intuitively confirms our concept concerning the functioning of words in language processes or the functioning of signs in semiotic complex processes not always reducible to language. The data resulting from the procedural method described reflect the interaction between very complex semiotic mechanisms. The structure (as revealed in categorical representations) approached is not purely linguistic, even though linguistically expressed. Through the words used, the author perceives the non-linguistic extensions of his play, i.e., its aesthetic multidimensionality. The word level of explanation given to a play does not reduce it to a purely linguistic reality. On the contrary, it is aimed at finding the relation between linguistic signs and other signs through the concept of semiotic functioning, i.e., the rules governing the transfer of meaning from the reality of verbal communication to complex (verbal and non-verbal) signification. The mathematical means applied convey intuitions and formulate test procedures rather than impose artificial formalization. The inferences we have suggested can in fact be improved. Vagueness can be considered even at the level of imprecision (word use, acting, performing, etc.) and ambiguity not as a by-product but as an aesthetic aim reached through a specific semiotic tactic. We are aware that some other aspects of the question approached deserve a more cautious analysis and that aspects we have ignored might deserve more attention. In the field of fuzzy inference, the validity of the rules to be used depends on the “fuzziness” of the quantifiers. The complexity of a broader approach to dramatic processes might prove still too high for the actual state of the art in fuzzy reasoning.

(This work was supported in part by a Research Grant awarded through the Alexander von Humboldt Stiftung.)

References

- Bense, M. (1971): *Zeichen und Design* (Semiotische Ästhetik). Baden-Baden: Agis Verlag.
- Bobrow, D.A., M. Collins, Eds. (1975): *Representation and Understanding: Studies in Cognitive Sciences*. New York: Academic Press.
- Brainerd, B., V. Neufeldt (1974): On Marcus' Method for the Analysis of the Strategy of a Play, *Poetics* 10, 31-74.
- Chomsky, N. (1975): *The Logical Structure of Linguistic Theory*. New York and London: Plenum Press.
- Dinu, M. (1968): Individualité et mobilité des personnages dramatiques, *Cahiers de linguistique théorique et appliquée*, 5, 29-46.
- Langer, S. (1953): *Feeling and Form (A Theory of Art)*. New York: Charles Scribner & Sons.
- MacLane, S. (1972): *Categories for the Working Mathematician*. Berlin, Heidelberg, New York: Springer Verlag.
- Marcus, S. (1970): *Poetica matematica* [Mathematical Poetics]. Bucharest: Ed. Academiei.
- Marty, R. (1979): *Formalisation et extension de la Sémiotique de Ch. S. Peirce. Application à la sémantique*. II Congress of the IASS, Vienna.
- Moravcsik, J.M. (1976): The Epistemology of Grammar and Semantics. Some Significant Differences, *Revue Internationale de Philosophie*, 117/118, Fasc. 34.
- Nadin, M. (1972): *Camasa lui Nessus* [Nessus' Shirt]. Bucharest: Editura Cartea Romaneasca.
- (1977a): Sign and Fuzzy Automata. *Semiosis* 5, Heft 1.
- (1977b): Text and Character. *Poetics* 6:3/4.
- (1979): On the Scientific Foundation of Semiotics (Manuscript).
- (1980): E. Freeman, Ed. The Logic of Vagueness and the Category of Synecism, *The Monist* 63:3, pp. 1-16.
- (1984): Functioning of Words. Procedural Knowledge of Drama, *Poetics* 13. Amsterdam: Elsevier Science Publishers, pp.17-46
- Peirce, Ch. S. (1903): *Collected Papers*, (2nd printing), 5.122 (volume/paragraph).
- Revzina, O. and I. Revzin (1974) On Marcus' descriptive model of theatre, *Cahiers de Linguistique Théorique et Appliquée*. Bucharest.
- Takeda, E. (1973) Connectivity in fuzzy graphs. Technology Department, Osaka University, Japan.
- Weizenbaum, Joseph (1976). *Computer Power and Human Reason*. San Francisco: Freeman.
- Winograd, Terry (1976). Towards procedural understanding of semantics, *Revue Internationale de Philosophie*, no. 117/118, fasc. 34.

