

TEAnO, an Organization for the Application of Computers to Art Production

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ABSTRACT: this paper describes the baselines and the aims of TEAnO (the acronym of: Telematics, Electronics, Analysis in the Opificium), a non profit association established in Italy in 1991 and currently based in Milano.

The aim of TEAnO is collecting and focusing the expertise and the specific interests of a group of persons working in the information science world since a number of years, in order to discuss, study and experiment the application of computers and computer-based techniques to the production of art.

Furthermore, the present paper summarises the main activities carried out by TEAnO in the field of computer generated and computer aided literature and music.

KEYWORDS: palindrome sonnets, definitional literature, logic of novels, telenovelas, antonymic music, musical workstation

1. TEAnO

TEAnO was founded in Florence, on May 7th 1991, during the conference "Beware of the potential - the game of literature", organised by Università di Firenze and Institut Française de Florence. Those two key words ("potential" and "game") were able to win its bashfulness to be born and its first dawnings were let out in the arms of OPLEPO (OPificio di LETteratura POTenziale).

It has two mentors, OULIPO (OUvroid de LITTérature POTentielle) e OUPEINPO (OUvroid de PEINTure POTentielle), e an elder brother, ALAMO (Atelier de Littérature Assistée per la Mathématique et les Ordinateurs), born in 1982.

2. The Nature of the beast

The interaction between humans and computers can be thought as divided into two different (but equally interesting) classes of activities: the productive interactions and the experiential interaction [2].

During the productive interaction, the computer is used as a tool for producing an outcome in the real world (for example the interaction with the word processor for writing this paper) that

is considered more important than the experience of the interaction itself. On the other hand, experiential interaction essentially consists of the use of the computer as a medium for being engaged in a sensorial (aesthetic) experience which is the real goal of the interaction (for example the interaction with a computer game or the plotting of fractal coloured diagrams of the Mandelbrot set).

Both such classes of interaction are based on the exploitation of the complementary characteristic of human thinking and computer processing capabilities in order to try to create something "new" and "aesthetically worthwhile".

All the activities of the members of TEAnO are intended to explore this twofold potential of the human-computer interaction.

3. Mice and Mazes

The members of Oulipo and Oplepo defined themselves as [3]: "mice that have to build the maze form which they try to escape". One of the aims of TEAnO is to use computers as tools by means of which you can, from one side, build more and more sophisticated and complex mazes and, on the other side, develop and experiment the (sophisticated and complex) techniques for escaping from them¹.

The programs described briefly in the following are some examples of computer based interactive tools for the production of texts (either prose or poetry) based of some of the canonical constraints proposed by Oulipo and Oplepo.

Most of the programs described in the following are prototypes developed by students of the Computer Science Department of the University of Milano.

3.1. An editor for palindrome sonnets²

The sonnet is a very complex maze based on a well known and very successful set of constraints since a number of centuries. In the specific case of the palindrome sonnet a new constraint has been added to the usual ones: the same text must be readable starting from the first character of the first verse as well as starting from the last character of the last verse.

The palindrome constraint sets up a complex grid of correspondences and reflections that have to be satisfied in order to accomplish the required rhymes and metrics.

The following is an example of the templates (generated by the editor) for a palindrome sonnet accomplishing two different rhyme structures³, obtained just by enter the first verse, which can give an idea of the complexity of the composition:

¹As explained in [4] by William of Baskerville: "To find the way out of a labyrinth, [...] there is only one means. At every new junction, never seen before, the path we have taken will be marked with three signs. If, because of previous signs on some of the paths of the junction, you see that the junction has already been visited, you will make only one mark on the path you have taken. If all the apertures have already been marked, then you must retrace your steps. But if one or two apertures of the junction are still without signs, you will choose anyone, making two signs on it. Proceeding through an aperture that bears only one sign, you will make two more, so that now the aperture bears three. All the parts of the labyrinth must have been visited if, arriving at a junction, you never take a passage with three signs, unless none of the other passage is now without signs". William of Baskerville also adds that, as far as he knows, this techniques works almost never.

²This work has been carried out as examination task for the course of Theory and Applications of Computing Machines by G. Zambelli and D. Zuccante

³For evaluating rhymes, only the last three characters of each verse are taken into account

ABBA - ABBA - CDC - DCD

ABAC - ABAD - ABE - ABE

was alone in the sun

*4

was*

*sun

was*sun

*

nus*

*sun

*

nus*saw

nus*

*saw

*

nusehtnienolasaw

was alone in the sun

*

nus*sun

was*

*sun

nus*

*sun

nus*

*sun

nus*

*saw

nus*saw

*

nusehtnienolasaw

After that, the user can proceed by adding spaces for separating words (e. g. in the last verse) and entering the missing part of the sonnet: any entered character will be reflected by the program in the appropriate positions (depending on the specific rhyme structure) to ensure the validity of all constraints. During the sonnet composition, the "*" characters indicates to the user where it is possible to add new characters without violating the constraints.

Furthermore, the editor provides a number of functionalities for helping the writer to select the desired rhyme structure from a dozen of pre-defined schemes (e.g. ABAB-BABA-CDC-DCD or ABBA-ABAB-CDE-CDE or ABAB-ABBA-CDE-DEC), to define new rhyme structures and to choose the number of characters taken into account for each rhyme,

3.2. An anagram editor⁵

Following in the footsteps of G. Perec (who published in France the work "Ulcérations" composed exclusively of anagrams of the French word *ulcérations*) and R. Campagnoli (who published in Italy the work "Edulcoranti" composed exclusively of anagrams of the Italian word *edulcoranti*), this editor helps the user in writing poetry or prose consisting exclusively of various anagrams of a selected word. It allows to:

- a) define the selected word to anagram;
- b) to define a fixed section within the word that will not be changed during the anagram generation
- c) generate the complete list of all existing anagram (taking into account the constraint due to the fixed part of the word)
- d) browse and select the desired anagram and edit it on the screen by adding blank spaces

⁴The "*" character stands for any sequence of character still missing in the structure

⁵This work has been carried out as examination task for the course of Theory and Applications of Computing Machines by A. Dellavadova

This is a really a suitable subject for the exploitation of the combinatorial power of computers as a powerful help for the humans in the creation of original works. The English word "loutishness" can generate up to 39916800 anagrams but, keeping the part "theloss" fixed and generating all the possible anagrams, we can obtain the response: "the loss in us".

3.3 A tool for the production of definitional literature⁶

A piece of definitional literature can be generated from a given text by substituting each "meaningful" word (such as nouns, adjectives and some adverbs) with its definition contained in a given dictionary and iterating this procedure for a number of times [3].

Using this technique, it is possible, after three steps, to generate a text of approximately 180 words starting from a sentence of six words. For example [3]:

STEP 0: The cat drinks the milk.

STEP1: The carnivorous, domestic and digitigrade mammal drinks the white sweet liquid produced by the females of the Mammalian.

STEP2: The meat eating, living in places populated by humans, and walking on fingers mammal ...

This interactive tool helps the user in defining one or more (specialised or general purpose) dictionaries to be used in the step by step process, allows to define the words to be substituted and the number of steps to apply.

4. From Folktales to Telenovelas

4.1 A step beyond Propp: the logic of novels

Many works regarding the generation of folktales using the Propp's approach have been performed within TEAnO since 1983. Such works range from simple generation programs, strictly adopting the syntax proposed by Propp to generate Russian folktales, to more sophisticated ones trying to tune this mechanism for generating folktales belonging to the Italian folklore and the latter was used to create scripts for some performances of traditional wooden puppet theatre. The most interesting results are described in [7].

Nevertheless, some activities have been carried out in order to try to find a more sophisticated and general purpose "novel generation engine", which led to the work of Claude Bremond.

As known, the analysis developed by Propp is based on four axioms [1]:

- a) The constant, stable elements of a folktale are the actions (Propp call them "functions") performed by the characters, regardless who is actually performing the action and how. They are the basic building blocks of the folktale.
- b) The number of such functions in a folktale is limited to 24.

⁶This work has been carried out as examination task for the course of Theory and Applications of Computing Machines by D. Salamina, C. Tediosi and M. Xodo

- c) The sequence in which the functions follow each other is always the same (that is each function is independent from the other)
- d) All the folktales have the same structure.

In [1], Claude Bremond tries to make a step further in the work done by Propp by contradicting the basic axioms and generalising the morphology proposed by Propp to any kind of novels and not only folktales. According to Bremond, the new four axioms for the morphology of a novel are:

- a) The basic building block is still the function as in Propp's work, but such functions are not limited and are grouped into sequences to generate the whole novel.
- b) A novel is a sequence of "elementary sequences". Each elementary function (process) consists of three functions corresponding to the three mandatory components of the elementary sequence:
 - 1) a first function (an event to be foreseen or a behaviour to be taken) that "opens" the process related to the elementary sequence and provides its rationale;
 - 2) a second function that implements the process in terms of actual events and/or behaviours
 - 3) a third function that "closes" the process related to the elementary sequence under the form of a result that has been (or has not been achieved)
- c) With an elementary sequence, a function does not necessarily force the subsequent one (contradicting Propp) and each elementary action is described by a "virtuality graph":

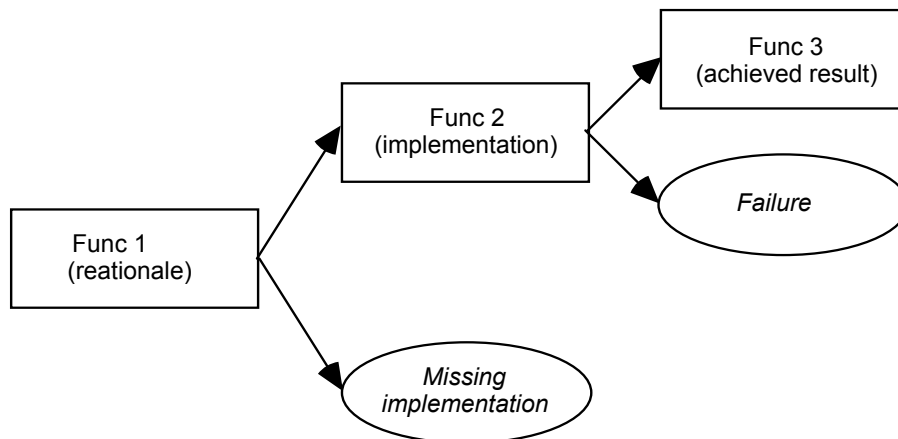


Fig 1: the virtual graph for the development of elementary sequences

- d) Elementary sequences can be combined in different ways to form "complex sequences". Two examples of links between elementary sequences are the following:
 - "bout à bout": the third function (the closure) of an elementary sequence implements the first function (the opening) of the subsequent elementary sequence;

in "enclave": the functions which an elementary sequence consists of are exploded in nested elementary sequences which functions can be in turn exploded in other elementary sequences and so on.

Following the approach of C. Bremond seems to be possible to synthesise novels having a structure that is much more sophisticated if compared with the folktales originating from Propp's axioms.

A work group is evaluating the generation of really interactive novels (or interacting scripts) using the logic proposed by Bremond to be performed on a multimedial computer workstations or on the (future) interactive TV. The interaction between the user and the generation program would be possible by means of an "emotional joystick", that is a sort of "crystal sphere" changing colour depending on the evolution of the interactive novel. A first rough prototype of such emotional joystick is currently being developed.

4.2 An algebraic approach to telenovelas⁷

As well known, telenovelas present a very established and peculiar structure that can be described by means of few simple rules:

- a) A fixed set of characters
- b) A fixed set of closed places in which all the actions are developed
- c) A number of related (but independent) narrative processes which evolve in parallel

This consideration can lead to the definition of an algebraic structure and a set of operation based on it, to be used for generating "canonical" telenovelas:

$$T = \{\tau, \Pi, \Sigma\}$$

where τ represents the time, Π is the set of all involved characters and Σ is the set of all possible closed places.

This first description provides only a static view of the set of telenovelas; to describe the development of all actions, a structure called "script" has been defined:

$$\xi = \langle T, \Lambda, \Phi \rangle$$

where the first item, T , is a static description of telenovelas, the second, Λ , is a function (functions are typically the elements describing transformations of other elements) having specific properties and called "placement"; the third component, Φ , is another function, called "focus".

During the development of the script, the various parallel stories evolve in parallel, characters interact each other and move from one place to another. At any time, the placement function has the goal of describing the distribution of characters over the different places and their transitions from place to place; on the basis of the so determined distribution, it is possible to apply the focus function in order to find out the most interesting place (that is the place in

⁷A paper on this subject has been presented by P. Ferrara at the Congress "Beware of the potential!" held in Florencia, 7-9 May 1991

which the performed actions have the highest narrative tension) in order to focus the script on the actions happening in such place.

One of the most interesting implications of a so defined structure, describing an abstract telenovela, is that it allows the definition of a sort of telenovela engine, consisting of "elementary telenovelas" that can be composed in order to obtain a whole family of "canonical telenovelas".

5. One record for a hundred thousand billions of record-players

5.1 Antonymic Music

The "antonymic poetry" is another canonical constraint proposed by Oulipo[3]: it consists of the substitution of all the "meaningful" words in a given poetry with words having exactly the opposite meaning. Typically, since it is not possible to define an "absolute antonym" of a specific word⁸, a context dependent substitution is performed and, in general, many different results can be achieved from the same text to manipulate.

For example, the following short passage from T. S. Eliot:

After the torchlight red on sweaty faces
After the frosty silence in the gardens
After the agony in stony places
The shouting and the crying

.....

can be turned in:

Before the darkness black under dry feet
Before the burning shouts in the rooms
Before the birth in grassy places
The silence and the laughter

.....

TEAnO has applied this techniques to texts (both prose and poetry) and to music as well, so to obtain the so called "antonymic music".

The generation of antonymic music is based on the following mechanism, which in some sense resemble the one adopted for antonymic poetry [8]: after having drawn a given melody on the pentagram, the "average value", a sort of "musical centre of gravity" of such melody is determine as a specific position on the pentagram and, then, all the notes of the melody are reflected above and under the average position. Finally, the antonymic melody is "normalised" (shifting of all the notes by a fixed number of position on the pentagram) in order to bring all the antonymised phrases to the same tonality.

The following is an example of an antonymic transformation [8] (Fig 2)

⁸What could be, for example, the "absolute antonym" of white? Black? Coloured? Non white?



Fig 2: An antonymic transformation on a musical phrase (the centre of gravity is F)

This is essentially a mathematical/statistical approach, based on some statistical assumptions:

- a) a note appear more frequently in a musical phrase is considered more important for the melody than another that is repeated less frequently and has the same intensity and duration;
- b) a note having a longer duration is considered more important for the melody than another with less duration but same intensity and frequency
- c) a note with a higher intensity is more important for the melody than another having the same frequency and duration but a lower intensity.

With the help of commercially available computer programs, a number of experimentations have been realised⁹ on some well known songs, using the antonymic techniques for processing both music and lyrics: for example, "Le feuilles mortes" by J. Prevert and J. Kosma has been transformed into "Le racines vives" and "Blowin' in the wind" by B. Dylan into "Breathin' in the lull".

5.2 A musical workstation¹⁰

The work performed on antonymic music led to the idea of the design of a "musical workstation" for standard PC's, a sort of "virtual juke-box" able to play the same record in a hundred thousand billions of different ways [8]: for example, different and interesting results can be obtained by varying the parameters for the determination of the musical centre of gravity and/or changing completely the transformation algorithm.

This musical workstation allows to enter a melody and to apply to it one ore more pre-defined transformations; it is then possible to listen to the achieved results and to print the related scores.

One of the most promising evolution of these techniques for music manipulation could consist in thinking of such transformations as algebraic operations on a an "algebraic musical structure" (e. g. a group or a linear space) and deriving from it the basic properties of different classes of melodies.

A feasibility study is currently being carried out on this subject on the basis of the overall structure [8] described in the figure 3:

⁹ By E. Fagnoni and A. Di Carlo

¹⁰ Many prototypal works related to this subject have been carried out as an examination task for the course of Theory and Applications of Computing Machines.

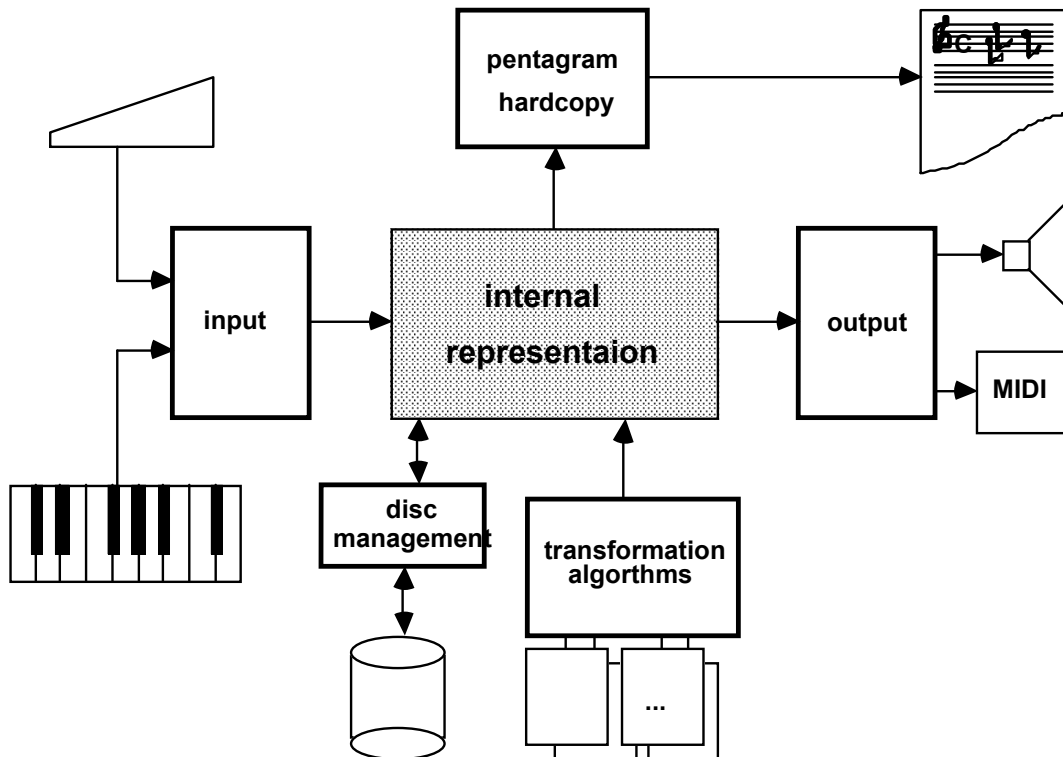


Fig 3: an overall architecture for the musical workstation

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