Transdisciplinary research in theatrical literature through technological integration and interfacing information

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Abstract. This paper aims to address more confident mathematical laws to explain a literary phenomenon. For this we studied the play "O scrisoare pierduta (Lost Letter)" written by Ion Luca Caragiale, in order to establish some connection between the characters but also to show certain aspects hidden by the author under the personality of the characters. We use transdisciplinary research to get from measurements and calculations results who will demonstrate objective of the proposed research. The challenge is to find those favorite characters by the author. Information and communications technology is a tool for research that will integrate this knowledge for modeling and interfacing.

1. Introduction
In the moments of scientific creativity one uses, as source of inspiration, clearly defined laws and instruments, namely mathematics. Hard to define! This complex of laws logically and precisely structured resembles a queen of sciences rather than a standalone science. If you master these laws, you feel that you can explain almost anything. You feel surrounded by things and events that look normal only because you are able to find a reasonable explanation for them. In that moment you are capable of issuing realistic theories regarding the world around you. Therefore, you are the owner of a mathematical culture, explained in the purest and most logical language based on syllogisms. Did we say culture? But is Mathematics really a culture? Well, however affirmative the answer might seem, it is still "no"!

Mathematics is a sum of interlinked laws and syllogisms capable of explaining, through a specific language, manifestations and phenomena which man has come in contact with or which are yet to be discovered. The phenomena of the world around us have been happening even before having discovered their scientific explanation: gravitation, time, space-time, regressivity, recursivity, etc. It was enough to go from basic to complex in order to develop laws and principles which, not belonging to any of the other sciences, we called mathematics. Fortunately, these were the most abstract but, at the same time, the most generally true.

And nevertheless, they do not make up a culture, but only arguments which, if well placed in a fortunate perspective, could generate culture. Mathematics is not a culture in itself if we look at it the
way it is presented to us in schools or in the most extensive dissertations. However, it can generate a
culture in any field of knowledge through a precise and well integrated group.

The mathematician becomes a scholar, a man of culture, only when he transposes his knowledge
into the natural language specific to any phenomenon capable of being generated by the particular
laws that structure it. Only then can we say that Mathematics has generated a culture.

„The fluttering of a butterfly’s wings on one side of the Earth can cause a hurricane on the other
side”- the chaos theory. Here’s how fractals and the laws that govern the Brownian movements are the
base of the chaos theory, which generated a culture of the Universe and foreseeing of the phenomena.
Not to mention the countless artistic and literary creations that were inspired from this theory, or the
incentive it represented for discoveries related to both microcosm and macrocosm.

Mathematics has to be adapted to all forms of communication and expressivity in order to become
a culture. Learnt only through its own language it becomes merely a set of known of axioms, laws or
theorems. The mathematical problems we solve at school only help us gain knowledge of artifices or
solving algorithms that only make our dependence on notions and syllogisms stronger, without even
giving us the right to err. Error generates creativity even when it comes to Mathematics.

In conclusion, Mathematics is the queen of sciences only if it generates a culture inside each of
these sciences. A different perspective on Mathematics can generate interesting discovery in fields that
appear to have nothing to do with it in the first place.

2. The Mathematics of a lost letter
This paper attempts to boldly make use of mathematical laws as means of explaining a literary
phenomenon. To do this, we studied Caragiale’s play „A Lost Letter” [2] in order to establish some
connections between the characters, but also to highlight some aspects that the author concealed under
his characters’ personalities. We therefore used statistics and probabilities as means of analyzing the
literary text from a mathematical point of view. The main concern is to discover which characters the
author prefers and which he does not. It is well known that any writers, even a playwright, displays
more trust and preference for some characters to the disadvantage of the others.

The reasoning is quite simple. If one of the characters has a higher frequency of appearance in
comparison to the mathematical probability of appearance, then that particular character was favored
by the author, whereas, in the case of a lower frequency of appearance (compared to the mathematical
probability) another character was less favored.

In order to do this, we have to define the following notions, implemented in Microsoft Office
Excel.

3. The POISSON function
POISSON return the Poisson distribution [1] [3]

=POISSON (x, average, cumulative)

The Poisson distribution of probability is applied to experiments with random and independent
occurrence, related to a certain amount of time, space or volume. Using an average number of
occurrences for that particular interval, the Poisson function calculates the probability of a certain
number of occurrences in the interval x (Figure 1).

The arguments of the function have the following significances:
• x the number of occurrences inside the interval
• average the average number of occurrences (the expected number of occurrences)
• cumulative a logical value which determines the form in which the Poisson probability
distribution will be returned. If the value is TRUE, the cumulative probability is returned (the
probability that the number of occurrences be between 0 and the value x). If the values is FALSE, the
mass probability is returned (the probability that exactly x events occur).
## The Poisson Distribution of Probability

| CHARACTERS | NO. of APPEARANCES | Act I | Act II | Act III | Act IV | Act average | Occurrence Interval | Cumulative Poisson | Cumulative Poisson | Poisson |
|------------|-------------------|-------|--------|---------|---------|--------------|---------------------|--------------------|--------------------|---------|
| 1 Catavencu | 299               | 34    | 74.75  | 299     | TRUE    | 1 FALSE     | 5.46454E-85         | 0.006544185        | 0.049479119        |         |
| 2 Tipatescu | 291               | 31    | 72.75  | 56      | TRUE    | 0.0348073111| FALSE               | 0.014100743        |                    |         |
| 3 Zoe       | 239               | 12    | 59.75  | 57      | TRUE    | 0.068304804 | FALSE               | 0.014100743        |                    |         |
| 4 Trahanache| 201               | 22    | 50.25  | 62      | TRUE    | 0.054185603 | FALSE               | 0.014100743        |                    |         |
| 5 Farfuridi | 128               | 1     | 32     | 73      | TRUE    | 1 FALSE     | 2.12915E-10         |                    |                    |         |
| 6 Pristanda | 123               | 11    | 30.75  | 64      | TRUE    | 0.999999949 | FALSE               | 5.80919E-08        |                    |         |
| 7 Cetateanul turmentat | 93 | 16    | 23.25  | 56      | TRUE    | 0.999999997 | FALSE               | 3.7198E-09         |                    |         |
| 8 Branzenescu| 88                | 6     | 22     | 21      | TRUE    | 0.471641978 | FALSE               | 0.08733234         |                    |         |
| 9 Dandanache | 76                | 19    | 6.75   | 21      | TRUE    | 0.725496867 | FALSE               | 0.07882252         |                    |         |
| 10 Public   | 27                | 3     | 6.25   | 21      | TRUE    | 0.999998424 | FALSE               | 1.9534E-06         |                    |         |
| 11 Popescu  | 25                | 5     | 5.75   | 21      | TRUE    | 0.99999806  | FALSE               | 5.9098E-07         |                    |         |
| 12 Ionescu  | 23                | 5     | 5      | 21      | TRUE    | 0.99999982  | FALSE               | 6.2886E-08         |                    |         |
| 13 Alegatori| 20                | 3     | 3      | 21      | TRUE    | 1 FALSE     | 1.0193E-11          |                    |                    |         |
| 14 Cetateni | 12                | 1.5   | 1.5    | 21      | TRUE    | 1 FALSE     | 2.1783E-17          |                    |                    |         |
| 15 Un fecior| 6                 |       |        |         |         |             |                     |                    |                    |         |
| total average | 27.51667          |       |        |         |         |             |                     |                    |                    |         |

### Figure 1. The Poisson Distribution of probability

The correlation coefficient

| characters | no.appearances | line parameters | calculate appearances | corelation |
|------------|----------------|-----------------|-----------------------|------------|
| 1 Catavencu| 299            | 282.9238095     | 261.3166667           |            |
| 2 Tipatescu| 291            | 239.7095238     | 218.1023813           |            |
| 3 Zoe      | 239            | 218.1023813     | 218.1023813           |            |
| 4 Trahanache| 201            | 196.4952381     | 196.4952381           |            |
| 5 Farfuridi| 128            | -21.60714286    | 174.8880952           |            |
| 6 Pristanda| 123            | 153.2809524     | 153.2809524           |            |
| 7 Cetateanul turmentat | 93 | 131.6738095 | 131.6738095          |            |
| 8 Branzenescu| 88                | 110.0666667     | 88.45952381           |            |
| 9 Dandanache| 76                | 66.85238095     | 66.85238095           |            |
| 10 Public  | 27              | 45.2452381      | 45.2452381            |            |
| 11 Popescu | 25              | 23.6380952      | 23.6380952            |            |
| 12 Ionescu | 23              | 2.030952381     | 2.030952381           |            |
| 13 Alegatori| 20              | -19.57619048    | -19.57619048          |            |
| 14 Cetateni| 12              | -14.18333333    | -14.18333333          |            |
| 15 Un fecior| 6               | -41.13833333    | -41.13833333          | 0.946143266 |
| average    | 170.8888889     |                 |                       |            |

### Figure 2. The correlation coefficient between two sets of values
4. The Correlation Coefficient

**CORREL** (tablou_1, tablou_2) returns the correlation coefficient between two sets of values [1], [4]. The value of the correlation coefficient is set between -1 and 1. A correlation coefficient which is close to 1 indicates a positive correlation: when one of the variables increases, so does the other. A correlation coefficient which is close to -1 indicates a negative correlation: one of the variables decreases, while the other increases. A value close to 0 indicates that the degree of correlation between the variables is extremely low (even inexisten).

**INTERCEPT** (y_known, x_known) calculates the point in which a line will intersect the y axis, using known x and y values (the arguments of the function) [1], [5].

**SLOPE** (x_known, y_known) returns the gradient of the regression line using the given points y_known and x_known [1], [6].

We have obtained a correlation which is close to 1, therefore positive, which means that one of the characters has a larger number of appearances and thus the other characters will have a larger number as well (Figure 2). This proves that our data is accurate. In order to establish a mathematical connection we built, by using Excel functions, a linear mathematical function which can render the number of appearances.

It can be noticed that there are characters with a calculated number of appearances lower than the actual number of appearances: Cațavencu, Tipătescu, Zoe, Trahanache, Ionescu, Alegători, Cetățeni. We can therefore draw the conclusion that Caragiale had a preference for these characters, granting them a higher number of appearances compared to what results from the mathematical analysis.

5. The confidence and the Degree of Confidence

**CONFIDENCE** (alpha, st_dev, dimension) [1], [7] returns the degree of confidence for a population average, where:

- alfa is the level of importance used in order to determine the degree of confidence.
- The degree of confidence is the difference 1 – alpha (rendered as percentage). If alpha is 0.1, then the degree of confidence is 90%.
- st_dev is the standard deviation of the population calculated with the STDEV function
- dimension refers to the dimension of the population.

The degree of confidence is an area situated around and average value and it indicates the lowest and the highest figures. In order to find the limits of this interval, the result obtained through the CONFIDENCE function is subtracted from the average value to find the lowest figure, and added to the average value to find the highest limit.

**STDEV(number_1, number_2)** estimates the standard deviation based on a specific sample [1], [8]. The standard deviation is a means of measuring to what extent the values have dissipated compared to their mathematical average. If the values represent the entire population, the STDEVP function is used [1], [8].

The degree of confidence we have found proves the fact that only the characters whose appearance is outside this interval are the object of our research (Figure 3). In other words, only these characters could have been preferred or not by the author. A fact which we have demonstrated above.
CHARACTERS | no. appearances | standard deviation
1  Catavencu | 299 | 98.66743243
2  Tipatescu | 291 |
3   Zoe    | 239 |
4  Trahanache | 201 |
5     Farfuridi | 128 |
6    Pristanda | 123 |
7  Cetateanul turmer | 93 |
8  Branzovenescu | 88 |
9  Dandanache | 76 |
10   Public | 27 |
11 Popescu | 25 |
12 Ionescu | 23 |
13 Alegatori | 20 |
14 Cetateni | 12 |
15 Un fecior | 6 |
AVERAGE | 110.0666667 |

Calculation of confidence (for the confidence interval)

| Alfa | standard deviation | dimension | confidence |
|------|--------------------|-----------|------------|
| 0.05 | 98.66743243        | 15        | 49.93169263 |

The confidence interval

| average | inferior limit of confidence | superior limit of confidence |
|---------|-------------------------------|-------------------------------|
| 110.0666667 | 60.13497404 | 159.9983593 |

Figure 3. Calculation of confidence

6. Conclusion
This work is a promising perspective for literary research using information technology. Needs to study the relationship between author and characters in literary sciences through interference. Here's how a transdisciplinary approach can create scientific answers and solutions to the various problems facing the information society.

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