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The Vocabulary of *Prometheus Bound* in the Context of Aeschylean Poetics

οὐδ᾽ ἔστιν ἄθλου τέρμα σοι προκείμενον;
οὐκ ἄλλο γ᾽ οὐδέν, πλὴν ὅταν κείνῳ δοκῇ.

The words above, from the text of *Prometheus Bound*,[1] are indicative of the infinity of Prometheus's suffering. These words, meant to serve the dramatization of the content, could be also subject to different interpretation, while the salience of the text reflected in its ability to inspire many generations of researchers, demonstrated the long-lasting effects of this classical drama with a 'boundless' epilogue.

It is important to consider the extent of historical research that ensued in the analysis of the text of *Prometheus Bound*. Of note is generated scholarship throughout the centuries around a scientific-like desire to validate its authorship from academics in the field of philology. Resembling a detective-style investigation by philologists, one can assume that this level of philological "peril" or suffering as that found in *Prometheus Bound* by scholars seeking to identify the text's authorship, has rarely received approval in the history of world literature. While many researchers have attempted to find a resolution to this conundrum, none of them appear to have the Olympic strength that is necessary to arrive at the finish line of reconciliation.[2] In actuality, *Prometheus'*s authorship

[1] *PV*, 257-258.

[2] Beginning from the doubts of R. Westphal (1856) about Aeschylean authorship, to the hypothesis of M. L. West (1990) suggesting Euphorion as an author of the play, the question of Prometheus' authenticity has passed through many stages of theories:

enigma is one of the most intriguing problems in the history of literature – as Winnington-Ingram defined it[3] – and still remains unresolved.

Despite the fact that this paper will underline several times the authorship puzzle of *Prometheus Bound*, it does not seek to imply that its goal is to approve or disprove the Aeschylean authorship of the text. The modest goal of this paper is to demonstrate methodological possibilities of the Digital Humanities when tasked with the analysis of an author's use of vocabulary. I will try to demonstrate the above goal with an example that aims to compare the frequency of vocabulary analysis in relation to the text of *Prometheus Bound* with extracted Aeschylean, Sophoclean and Euripidean Corpora data.[4]

Researching vocabulary patterns is not a "novel" idea in philology. However, methodologies found in the Digital Humanities (particularly within Corpus Linguistics), allows us to sort and extract data from diverse texts with added accuracy in short timespans. This offers us an opportunity to study selected vocabulary from various perspectives and within them - from the perspective of the authorship attribution of a text.[5]

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exceptional theological and mythological background of the play became first argumentum for negotiation of Aeschylean authorship by W. Schmid (1927) and a "solid pillar" for the following researchers, such as M. Griffith, O. Taplin, A. F. Garvie, B. Marzullo and others to refuse Aeschylean authorship on the basis of dramatic, lexical, metrical, philosophical and structural patterns of the play. For panoramic discussion of the bibliography see Pattoni M. P., L' Autenticità del Prometeo Incatenato di Eschilo, Pisa 1987, 2-32.

3 Winnington-Ingram R., Towards an interpretation of *Prometheus Bound*, in Studies in Aeschylus, Cambridge, Literary Collections 1983, 197.

4 Corpus based analysis is not a new method for the text philology in general and for the *Promethean Question* in particularly. In actuality, it was Mark Griffith, who attempted for the first time to investigate methodically the vocabulary of the text in the context of the authorship problem on the basis of the principles of Corpus Linguistics (see Griffith M., The Authenticity of Prometheus Bound, Oxford 1977, 147-207). Though due to the methodological inaccuracies, analysis made by Griffith lacks cogency (see observations of Peretti and Pattoni about the issue in: Peretti A., Osservazioni sulla lingua del *Prometeo* eschileo, SIFC, N. S. V, 1927, 165-231 and Pattoni M. P., L' Autenticità del Prometeo Incatenato di Eschilo, Pisa 1987, 221-250).

5 About the types of computer based analysis and about the authorship attribution methods see Stamatathos E., A Survey of Modern Authorship Attribution Methods, in Journal of the American Society for Information Science and Technology, Volume 60, Issue 3, 2009, 538-556.

The scope of this paper will not allow for a full review of all the methods and approaches that the Digital Humanities has to offer. Rather, it will address several specific aspects of one method found in the digital humanities, the quantitative research of vocabulary. This method is demonstrably employed most frequently to attest for semantically significant words found in ancient Greek tragedy as well as forming semantic maps, as voiced by three tragedians.

As such, I will highlight the software. Entitled *Antconc*, this textual analyzer is regarded as one of the more fruitful programs for philologists. At present, it is not relevant to speak of the advantages or disadvantages of the program. Nevertheless, it should be mentioned that Antconc provides researchers with the option to define precise frequencies of reoccurring word forms, including corpus compounding in one or more texts. It further allows one to evaluate collocations, co-occurrences, groupings of words, etc., within one or more corpora.[6]

The lexical analysis, presented below, is a product of Antconc functions. It will be employed as an experimental tool; showcasing generated results via tallying of vocabulary frequencies of various corpora. These frequencies will be compared, and semantic planes identifying high word frequency will be recorded. Results will be chronicled as an index, referencing the breadth of one author's poetic rationale. The goal of this paper is to approbate this method with an aim to closely situate *Prometheus Bound* to one of three tragedians' corpus.[7]

Before beginning our analysis, it seems necessary some technical details to be underlined: Selection of material for analysis includes 4 corpora of which *Prometheus Bound* functions as the *central corpus*. This text was consciously selected due to its problematic features concerning doubts of Aeschylean authorship. The additional 3 corpora include texts written by Aeschylus, Sophocles and Euripides and are used as reference corpora. Within the *Aeschylean corpus* there are 6 undisputed plays of

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[6] See Anthony L., AntConc (Version 3.4.3) [Computer Software], Tokyo, Japan: Waseda University 2014. Available from http://www.laurenceanthony.net/.

[7] Our way of comparison is the same as Griffith's and others, who have made a comparative lexical analysis between more than one text, but in our opinion, it doesn't seem serious the results of any statistical data to be regarded as argumentum (as many scholars do), but it could be aiding materials that may become an argumentum if it will be strengthen by other (not only statistical) data.

Aeschylus, whose authorship is doubtless. Under the *Sophoclean corpus* there are 7 tragedies of Sophocles (the entire literary heritage of the dramatist). In the *Euripidean Corpus*, 18 plays of Euripides are included. In this case, *Resus* is excluded due to its contested authorship.[8]

It is important to acknowledge the fact that the authorship of *Prometheus Bound* remains unresolved and an ongoing challenge in classical scholarship. This further illustrated the need for its centrality and selection as main corpus in the following research. Such classification of this corpus gives us the chance to explore the proximity of the central corpus (in this case, *Prometheus Bound*) to other corpora. This also allows for a comparative analysis of vocabulary, style and/or metrics. To complete the above, a topic-based comparative analysis is required. This allows for scrutiny of vocabulary frequency accounting for comparison of semantics and repetition of word occurrence indicating likelihood of salience between various corpora.[9]

In the first phase of the research, vocabulary classification of each corpus was completed using the Antconc text analysis program. This function generated wordlists accounting for vocabulary frequency for the Aeschylean, Euripidean and Sophoclean corpora, as well as for the corpus of *Prometheus Bound*. Once the selection of vocabulary frequency takes place, semantically significant words are extracted using a "stop-list."[10] After the elimination of semantically non-significant words, lists of the most frequently employed words for each corpus may be retrieved creating grounds for wordlist comparisons. In the next phase, top five words have been extracted for each corpus. In addition to comparing the

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8 See Ritchie W., The Authenticity of the *Rhesus* of Euripides, CUP, Cambridge 1964, 7.

9 About the differences between topic-based text classification and style-based text classification, see: Stamatathos E., op. cit., 542-543.

10 This facilitates the removal of "function" words such as articles, prepositions, pronouns etc. It also helps to isolate words presumably dictated by context such as vocative case forms from παῖς, τέκνον, πάτηρ etc. in the passages describing the dialogue of father and son etc. Words which may have a high frequency of use in several subcorpora but is not reflective in at least one subcorpus are also eliminated. For example, while the word βασιλεύς appears in Agamemnon 12 times, it does not appear a single time in Eumenides. This results in its exclusion of significant words from the *Aeschylean Corpus.* Subsequently, one of the prevalent preconditions for the process of selecting semantically significant words is considering its frequency within all subcorpora of the corpus.

frequency of these first five words emanating from one corpus to another, the hierarchical ranking of words enabled to assess the importance of the words from one author to another. In the last phase of the research semantic maps have been designed for Aeschylean, Sophoclean, Euripidean and *Prometheus Bound's* Corpora. The results of such an approach are demonstrated bellow.

The analysis begins with *Prometheus Bound*, previously identified as the central corpus. In this text, the most re-occurring word appears to be θεός (god) with 33 notations. The second most frequently employed word is λόγος (word, reason, etc.), which appears 29 times in the corpus in several forms. The term "mortal" (βροτός, θνητός) ranks third with 25 uses. This is followed by the term τύχη with 21 occurrences, and the word φρήν, employed 13 times.

After eliminating the non-significant words in the Aeschylean Corpus, the first five words that emerge appear to resemble those of *Prometheus Bound* in terms of semantic category. For instance, as seen in *Prometheus* here also the word θεός ranks first with 242 occurrences. The second most occurring word is λέγω identified 177 times. In third, fourth and fifth place the words ἀνήρ (164 times), δίκη (117 times), and φρήν (63 times) follow suite. This ranking illustrates an identifiable sequence which semantically coincides with the vocabulary hierarchy of word frequency in *Prometheus Bound*. This does not signify however that we should make any premature conclusions until vocabulary frequencies of other corpora are considered. Studying the statistical frequencies of vocabulary ranking in Euripidean and Sophoclean Corpora must also be taken into account.

Mimicking the vocabulary hierarchies of Aeschylus and *Prometheus*, the *Sophoclean Corpus's* most frequently employed word is θεός, occurring 355 times in various forms. This is followed by the word ἀνήρ with 284 occurrences in the corpus, λέγω with 254 occurrences, the verb θνήσκω with 191 occurrences, and finally the word πόλις, which appears 111 times in the *Sophoclean Corpus.*

Regarding the *Euripidean Corpus*, the adjective κακός is employed the most frequently used word (510 times in total). In second place is the word θνήσκω with 463 occurrences, followed by the word δόμος (456 occurrences). In the third position is the word γυναῖκα, which occurs 378 times in the corpus and lastly the word φίλος with 362 occurrences.

Looking at the hard statistics regarding the correlation between words

and frequency in each corpus, the comparison of this data offers us interesting results. Using intercorporal comparison allows one to compare word and frequency statistics; determining specificity of each word occurrence and aggregate sum of use. It also enables one to define average rates of words' frequency. It is here where the experimental results will be important for our analysis. Shown below are average frequencies of word occurrences that took place. Note the distinction from one corpus to another.

Euripidean Corpus consists of 37 460 word types, which correspond to 182 093 word occurrences. This means that the average frequency for one word is approximately 4.8 (i.e. each word within the corpus is repeated close to 5 times and occur in several forms). In order to ensure the validity of this statistical data and to confirm that this mean is not "contaminated" by the volume length of *Euripidean Corpus*, six Euripedean plays were selected at random and tested, revealing the same mean range as that of the *Euripedean corpus*. The validity of this technique was further tested by an additional method. When assessed, the average frequency of each Euripidean subcorpus revealed an index of 4.4. This means that in Eurpidean subcorpora each word could be repeated up to at least 4.4 times; indicating that the occurrence of frequency in Euripides is considerably higher than in Sophocles and Aeschylus, as shown below.

In *Sophoclean Corpus* we find 16 462 words with 62 458 occurrences. This reveals that the average rate of frequency for each word could be 3.7 (i.e. each word cited in the *Sophoclean corpus* could be appeared just under 4 times in the text). In this case, the average frequency of vocabulary use in the *Sophoclean Corpus* is significantly lower than that of the *Euripidean Corpus*.

Regarding the *Aeschylean Corpus*, 14 330 word forms are noted, revealing 35 492 occurrences. Subsequently, the average frequency of a single word is 2.4; considerably lower than the average word occurrences in the Sophoclean and Euripidean texts.

In the Corpus of *Prometheus Bound*, 3 187 word forms are found, with a total of 35 492 occurrences; (i.e. the average frequency of word occurrences in the corpus is potentially 1.9). This illustrates that the statistics of *Prometheus Bound* are much closer to the statistics of *Aeschylean Corpus*, rather than the Sophoclean and Euripidean texts. This is further supported by the fact that during the calculation of the average frequencies for each Aeschylean tragedy several subcorpora mimicked the average frequency

of *Prometheus Bound*. The average frequency index in Aeschylean subcorpora is fluctuated from 1.9 to 2.5, which once again situates *Prometheus Bound* closer to the statistics of the *Aeschylean Corpus*.

We will now return to the top five most frequently used words mentioned above. It is evident that a continuation of categorization for further ranking of vocabulary hierarchies is permissible by the software. As such, the list could be stretched to a ranking of 10 words for each corpus, 20 words, etc. Nevertheless, for the purpose of this paper attention will be devoted to the analysis of the first five words, representative of the highest frequency index. It is important to note that there is a significant quantitative difference between the frequency indexes of the words found in this top five index. The most frequently employed five words or "keywords" for each author or corpus, sheds light on the potentiality for developing semantic fields and provides insight on the dimensional thinking of the authors. These keywords lend us the ability to design semantic maps for Aeschylean, Euripidean and Sophoclean Corpora, and *Prometheus Corpus* as well as increasing opportunity for comparison. In the analysis below, an experiment is provided that can be used to situate the poetic mindset of an author within any semantic plane by assessing frequently used vocabulary.

Commencing with *Prometheus* Bound, this corpus revealed the following words as keywords: 1. God; 2. Logos (having the semantic connected with word, result, etc.); 3. Mortal; 4. Destiny; and 5. Fren (having metaphoric understanding of heart, as the place of human passions). The semantic map of these keywords would be situated in the plane of the opposition; portraying an interrelation of the divine and human worlds (see: Figure 1).

In the same plane as *Prometheus Bound* the semantic map of Aeschylean *Corpus* would be situated. The only difference between the words' semantics is the difference between τύχη and δίκη – the words which hold fourth position in top-five words of *Prometheus* and Aeschylean Corpora. Notwithstanding the semantics of these words are not opposite, still the fact could be explained easily: While the acting area of *Prometheus Bound* is the God's world, in opposition of 6 undisputed tragedies of Aeschylus, existence of τύχη instead of δίκη is logical because of the τύχη's privilege in the world of Gods. Otherwise, the whole tragedy of *Prometheus* is nothing more than the lack of δίκη from the Gods' world.

Figure 1

Figure 2

In order to provide a more relatable interpretation, let us consider the semantic maps reflecting the vocabulary frequency for the Sophoclean and Euripidean Corpora:

Identifiably, the semantic map of Sophocles finds itself in an intermediate place between the Aeschylean and Euripidean semantic planes. For Aeschylus, words belonging to the elevated, metaphysical dimension populate the semantic field. It characterizes "whole" creation – portraying a tendency of centering the human world within that of the divine one. Looking at the semantic map of Sophocles leads us to think that the author is more aligned with the human plane; particularly with word frequency such as θνήσκω (dying) and πόλις (polis). These words literary characterize the human world, and rank amongst the first top five most frequently re-occurring words in Sophocles (see: Figure 3). Once assessing the semantics of the other words identified in the Sophoclean top five most re-occurring vocabulary list, it does reveal that the poetic thinking of Sophocles is placed both within the planes of human and divine spheres. Nevertheless, when comparing Sophocles to Aeschylus and/or *Prometheus Bound* it is more physical or "human".

As for Euripides, the semantic map of the author's keywords reflects the connection between his poetic thinking and that of the human, physical dimension (see: Figure 4). To support this claim, it is possible to draw upon many other data sources extracted from the corpora using the above mentioned software. For instance, the word θεός fell outside of Euripides's top ten keywords list. Additionally, words such as πόλις and θνήσκω also remained outside of Aeschylus's top ten keywords. With regards to the word γυναῖκα, which is typical in the *Euripidean Corpus*, is not found within the top ten keywords of the other three corpora. Moreover, τύχη, popularly employed in the *Aeschylean Corpus* falls outside the top ten keywords of both *Euripidean* and *Sophoclean Corpora.*

Figure 3

Figure 4

Now, if we count the words with similar semantics in each corpus, we shall see that *Prometheus Bound* and the *Aeschylean Corpus* correspond to one another. *Sophoclean Corpus* identifies more closely to Aeschylus than Euripides, while the *Euripidean Corpus* bears patterns which differ completely from patterns identified in Aeschylus and *Prometheus Bound* (although it does share common traits with the *Sophoclean Corpus*). To express more clearly the interrelation of semantic planes of the keywords of our corpora, let us refer to the figure 5, which demonstrates the proximity of each corpus to either the human and divine dimensions. These two dimensions are regarded as the main "action spaces" for ancient Greek tragedy.

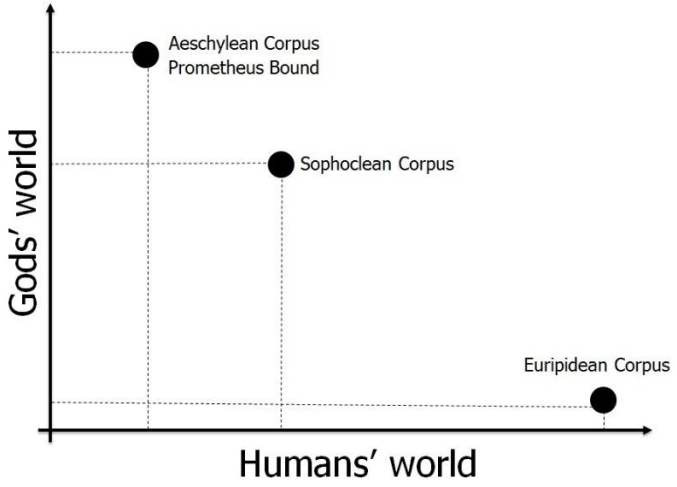

Figure 5

As mentioned in the beginning, the goal of this paper was not to approve the authenticity of *Prometheus Bound*. I do realize that to set such a goal in a single paper, using only some of the extracted statistical data, frankly speaking, is fantastical. Evidently, the results generated from our analysis are considered controversial in the eyes of many scholars such as Schmid, Griffith, Taplin, West, etc.; scholars who place *Prometheus Bound* closer to the epoch of Euripides and regard the play as a work from the epoch of Euripides.[11] Due to the paper format, we cannot discuss the claims of such viewpoints. It should however be underlined that the arguments against Aeschylean authorship give impression that they are conditioned by preconceived notions dependent on building argumentation against Aeschylean authorship. In our case, the limited dimension of the above analysis does not allow us to assert the authorship of Aeschylus or vice versa. Nevertheless, it allows us to conclude that according to the frequency of its vocabulary, average rates of word use and results of keyword semantic analysis, *Prometheus Bound* is comparable to *Aeschylean Corpus*, and it is dissimilar from the *Sophoclean Corpus* and does not coincide semantically with the *Euripidean Corpus*.

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[11] See West M., The Prometheus Trilogy, in Journal of Hellenic Studies 99, 1979, 130-148.

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Abstract

Resembling a detective-style investigation by philologists, one can assume that this level of philological 'peril' or suffering as that found in *Prometheus Bound* by scholars seeking to identify the text's authorship, has rarely received approval in the history of world literature. While many researchers have attempted to find a resolution to this conundrum, none of them appear to have the Olympic strength that is necessary to arrive at the finish line of reconciliation. In actuality, *Prometheus*'s authorship enigma is "one of the most intriguing problems in the history of literature" and still remains unresolved.

Despite the fact that the paper underlines several times the authorship puzzle of *Prometheus Bound*, it does not seek to imply that its goal is to approve or disprove the Aeschylean authorship of the text. The modest goal of this paper is to demonstrate methodological possibilities of the Digital Humanities when tasked with the analysis of an author's use of vocabulary. The paper demonstrates the above goal with an example that aims to compare the frequency of vocabulary analysis in relation to the text of *Prometheus Bound* with extracted Aeschylean, Sophoclean and Euripidean Corpora data and to closely situate *Prometheus Bound* to one of three tragedians' corpus.

The comparative frequency analysis of most used words in four corpora, comparison of average rates between Aeschylean, Sophoclean, Euripidean and *Prometheus Bound's* Corpora and the semantic maps designed by top five words of each corpus showed that the *Prometheus Bound* is comparable to *Aeschylean Corpus,* it is dissimilar from the *Sophoclean Corpus* and does not coincide semantically with the *Euripidean Corpus* – the fact that could be aiding forth in creating an argumentum for supporting the Aeschylean authorship of the play.