# TheOn Documentation

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# Domain and scope of the ontology

The creation of TheOn is targeted towards a formal representation of divine interventions relating to humans in literary texts. In general, the aim was to try to define the concept of human and divine entities, since many times there is a blurred line separating the two, and understand better the types of relationships between them.

Our competency questions are:

- In which moments and contexts men turn to divine entities in Greek tragedies?
- In which forms do they do it?
- What kind of divine interventions is it possible to classify?
- Is man impotent when he has to face divine entities?
- In which cases human will and actions coincide with those of divine entities?
- In which cases is it possible to recognize a similarity between a man and a divine entity?

# Bibliographical sources

In order to give some answers to the competency questions we asked ourselves, we turned to Prof. Camillo Neri, who teaches Ancient Greek language and literature. He helped us shed light on what to focus on in our analysis, and which bibliographical comments and editions of the literary texts were better to take into account for the research to be carried out. Our choice of tragedies was: *Prometheus Bound* and *Trojan Women* by Aeschylus, *Agamemnon* and *Medea* by Euripides, based on the criteria of linguistic and content variety and presence in our bibliographic sources. For more information about the sources we used, see the section at the end of the report.

# Quantitative text analysis

A close reading of the literary texts and their commentaries was not enough to have a complete understanding of the text itself. Therefore, we decided to combine this approach

with a statistical one, performing some NLP analysis on a small group of tragedies. In order to do that, we decided to use a wide variety of methods. In particular, we chose to exploit a combination of algorithms created in R and Python, along with the tool "VoyantTools" (voyant-tools.org).

The first study we did was a gender analysis starting from lists of relevant words, in order to assess gender predominance in each tragedy. The results allow us to have an idea of which are the most active characters, regardless of the actual protagonists of each tragedy.

Then, we proceeded to collect the most common five words in the tragedies, after having deleted stopwords and recurrent words relevant to our context. In the *Prometheus Bound*, for instance, the most common five words were Prometheus (94), shall (89), Zeus (55), chorus (36), gods (32). Such terms are nothing but expected, but it is interesting to point out how "shall" is the second most frequent word: something expressing a sense of duty and coercion. In fact, the dynamic between Zeus and Prometheus is a dynamic of contrast, with the latter resulting in being tortured. The condition in which the main character is subjected does assimilate him to a human being. Actually, even performing a topic extraction it is clear to the terms associated to the tragedy. They are Prometheus, shall, Zeus, suffer, herm, earth. The last one is particularly important, since it relates to the human word, even though the whole tragedy is set in Scythia, not accessible by humans.

The sentiment analysis performed on the tragedy confirms this thesis. The most negative sentences detected by an algorithm in R (i.e. "You will often scream in pain and sorrow, for Zeus' heart is pitilessly harsh, and everyone whose ruling power is new is cruel and ruthless"; "I may be miserable, but my distress does not make me desire to see such pain imposed on everyone—no, not at all").
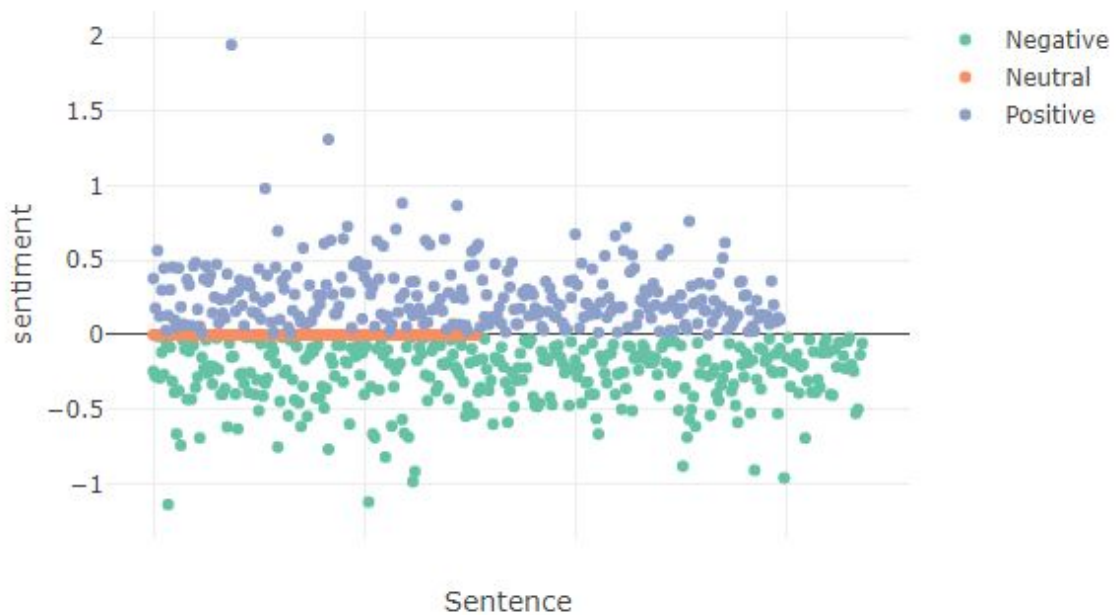
Fig. 1: Sentiment analysis on *Prometheus Bound*.

As it clear from the sentiment graph, at the end a negative sentiment prevails: the main reason is that Prometeo refuses to obey to Zeus' orders and he ends up thrown down a cliff. This confirms the dynamic of contrast between gods that have different powers: Zeus can choose the destiny of Prometheus as if he was a man, and Prometheus can't do anything but resign to his fate. Aeschylus clearly tried to create empathy between Prometheus and the spectators of the tragedy without actually involving any man in it. In fact, the plot dispersion analysis shows the prevalence of the "forecasting god" on the other divine entities in the text.
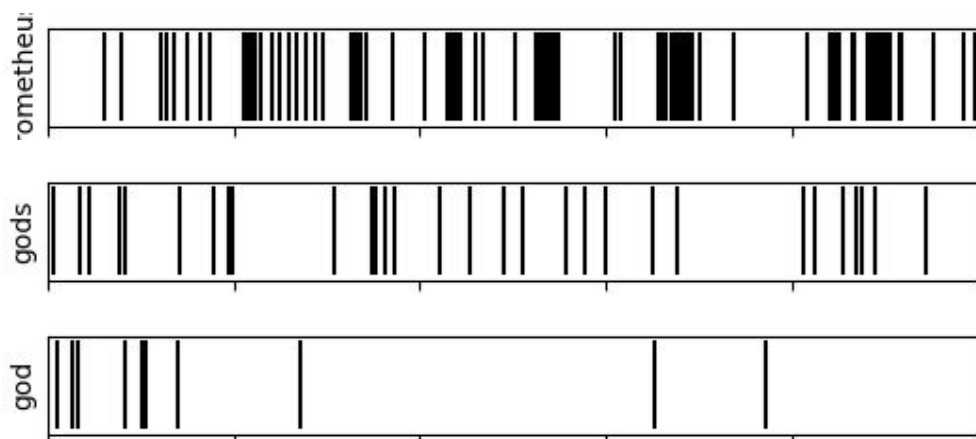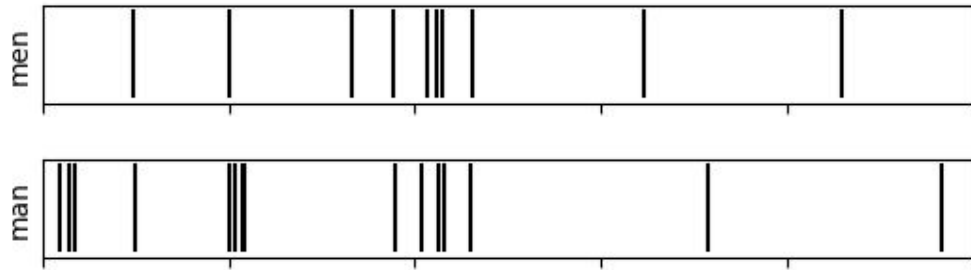
Fig. 2: Plot dispersion in *Prometheus Bound*.

To sum up, the textual analysis we carried out shows that Prometheus is characterized as a human being rather than a divine entity, thus making the author's choice to portray a god as a man, impotent towards his destiny.

We carried out the same analysis on all of the tragedies we decided to study. Some interesting results came out from the *Agamemnon* of Euripides, too.

The linguistic analysis performed on the tragedy revealed one of the main themes of the whole trilogy: the term "woe" is the most common, with 39 occurrences (the others are "leader", 38, "home", 35, "Clytemnestra", 32, and "lord", 31) and it is a common feeling for the human characters, who are all, in a sense, victims of a higher will like puppets in the hands of the gods. This human condition is also evident from the fact that the terms god and gods are more frequent with respect to the name Agamemnon, even if he should be the main character. An explanation for this phenomenon comes from the fact that because gods are heavily present in the plot, mainly with their indirect influence on the characters' actions.
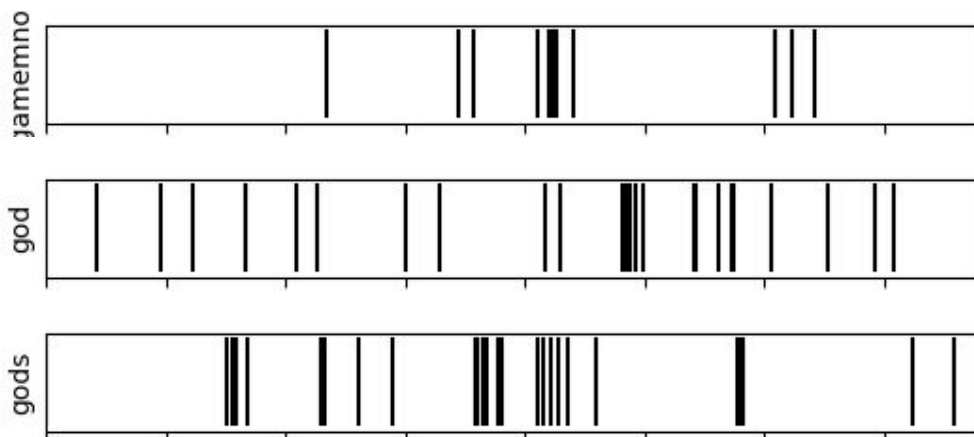


Fig. 3: Sentiment analysis on *Agamemnon*.

The sentiment analysis highlights a strong predominance of negative sentences, as Fig. 4 shows, since they are mainly connected to this conflictual relationship with gods.
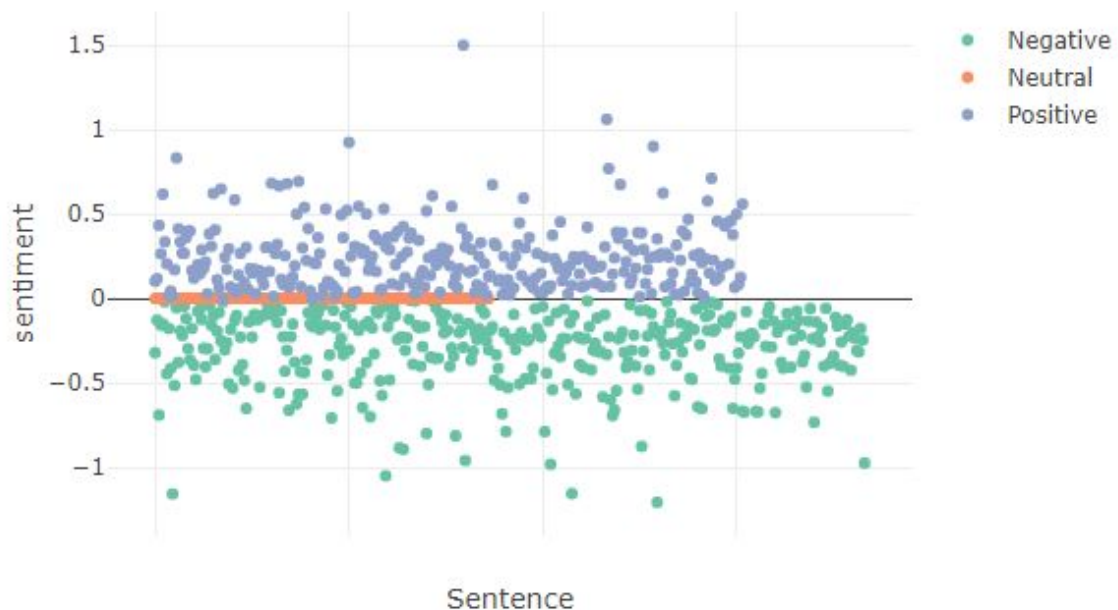


Fig. 4: Sentiment analysis of *Agamemnon*.

Finally, in the case of *Medea* of Euripides, as opposed to the *Agamemnon*, there is a strong predominance of divine entities throughout the plot.



Fig. 5: Plot dispersion of *Medea*.

What does this tell us? From this diagram, it is clear Medea is the predominant character, while the frequency of "God" and "gods" is relatively low. This is why, thanks to a close reading of the text itself, in which Medea is associated to a sorceress and figures like Circe,

we deduced that **she actually has some characteristics of a goddess**. In addiction, the "genderize" algorithm confirms that there is **a female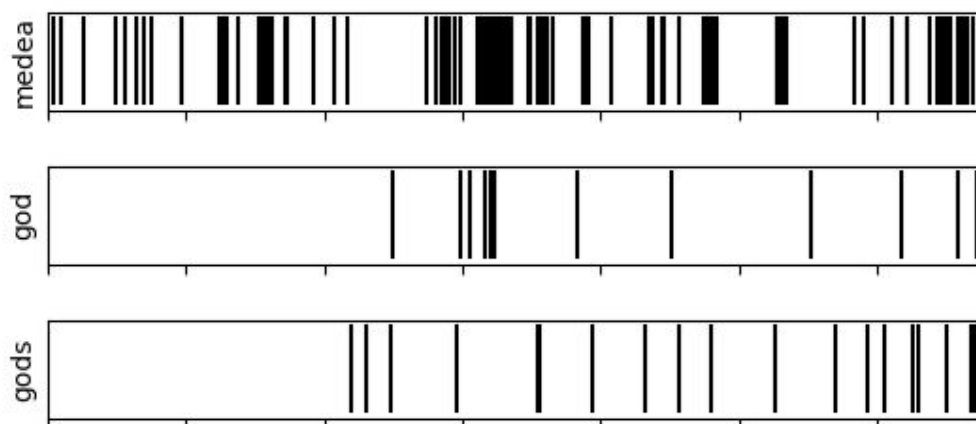 dominance in the sentences of the tragedy** despite the fact that everyone, besides Medea and the nurse, is a male character. This result comes from the fact that the main character itself turns to female gods, creating an empathic relationship with them.

The association between Medea and a female divine entity is also clear from her actions, since **no god ever intervenes in her decisions.** This is confirmed by the **final *deus ex machina*** that ends the tragedy and allows the story to reach a conclusive resolution, but also from one of the most positive sentences detected by the algorithm:"lives like mine achieve the greatest glory".

Finally, our observations can be summed up by this clustering graph that involves the choice of a tragedy with a very "classic" structure like *Ajax* by Sophocles. It is possible to notice that *Agamemnon* and *Prometheus* are closer to the destiny of *Ajax*, a hero subjected to the gods' will, while *Medea*, since she makes her own decisions, is more characterized by freedom of thought and will.
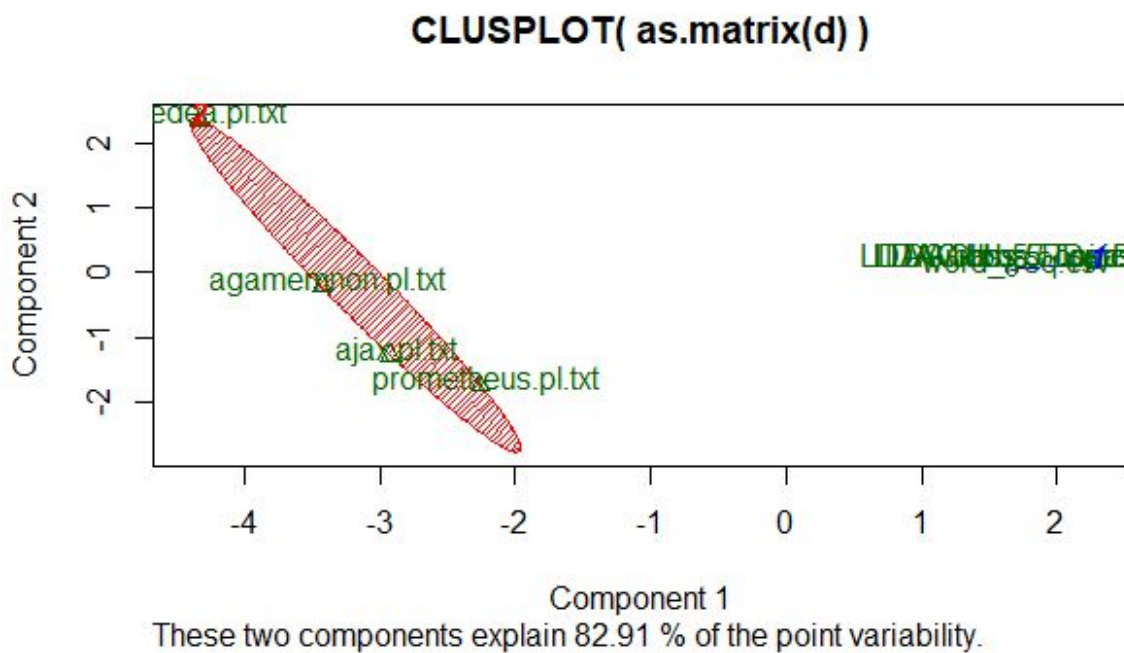


Fig. 6: Cluster analysis of *Prometheus*, *Agamemnon*, *Medea*, *Ajax*.

# Reuse of existing ontologies

We chose to reuse three ontologies: Semiotic, Drammar and INTRO. For the first one, we decided to develop the class "information entity", exploiting the pre-established concept that a meaning is interpretant of any information entity. In our ontology, this implies that the mental concept the meaning refers to can be both an agent and a process. The "has interpretant" object property proved to be useful to relate an information entity with its formal expression as well. In fact, that kind of entity, especially when it comes to a text, has a formal way of interpretation that includes many kinds of literary features. The two interpretative sides are disjoint?. The second one means to describe the dramatic feature in fiction, in particular from an action point of view. Because we needed to represent the content of the literary texts by means of agents involved in actions, we found some Drammar classes useful, starting from "drama entity" and its division into "drama endurant" and "process". The process itself is then divided into "action" and "unintentional process" both referring to a boolean datatype "isIntentional". This last part of the taxonomy was fundamental to define which divine interventions took over humans' will, and which human actions were, instead, fully intentional. In fact, from this point on TheOn developed further the knowledge representation for ancient theater, specifying whether the unintentional processes an agent took part in were induced by a divine entity or not, if they affected some other agent or if they had some correspondence on the formal expression point of view, other than the "meaning one". Speaking of formal features, that class and its subclasses was reused from INTRO, which means to model the intertextual relationships within texts, and further specified.

# Developing the ontology

The approach that was chosen to develop our ontology was a top-bottom one, starting from the most general classes and reaching the most specific instances. For the full documentation of our classes, see [here](#).

## Typical Use Cases

We chose some instances in order to have concrete examples on how our ontology should be used.


### Examples


Agamemnon takes part in unintentional specific mental process caused_by divine entity.

Divine entity takes_part_in action, punishment, that affects human entity Agamemnon


Prometheus takes part in generic action, hybris, that has topos hybris, that affects Prometheus.

Zeus takes part in action punishment that affects Prometheus and human entities.


Medea takes part in generic action that has textual concretization dramatic mechanism deus ex machina, which has subject divine entity and affects Medea.


Deus ex machina has textual concretization formal feature metrical verses pentameter.

Zeus has epithet epithet action "Xenios", that means "protector of foreign people".


## Knowledge extraction


We chose to represent the knowledge extraction by reporting **some representative verses** of the abovementioned tragedies. In addition, we decided to include a verse from the Bible in order to show how the categories we outlined can be used also for texts other than the tragic ones. Users can explore **key concepts** and **topos** of this knowledge domain **through highlighted words** that will appear simply **hovering on the text.**

Class: Deus_ex_machina
*"Medea **appears aloft in a winged chariot upon the mechane**, which rises from behind the skene."*

*"Whistles and shrills with rapid beat of wings./ There cometh nought but to my spirit brings/ Horror and fear./ **The DAUGHTERS OF OCEANUS draw near in mid-air in their winged chariot**."*

Class: Mental_UnintentionalProcess
"Clitaemnestra: *Do not imagine that I am Agamemnon's spouse. A phantom resembling that corpse's wife, **the ancient bitter evil spirit of Atreus**, that grim banqueter, **has offered him in payment**, sacrificing a full-grown victim in vengeance for those slain babes.*"

"Chorus:*Frenzied in soul you are, **by some god possessed** *"

*"But when he **had donned the yoke of Necessity**, with veering of mind, impious, unholy, unsanctified, **from that moment he changed his intention** and began to conceive that deed of uttermost audacity. For wretched delusion, counsellor of ill, primal source of woe, makes mortals bold. So then he hardened his heart to sacrifice his daughter"*

*"Così arrivarono **al luogo che Dio gli aveva indicato**; qui Abramo costruì l'altare, collocò la legna, legò suo figlio Isacco e lo depose sull'altare, sopra la legna. 10Poi **Abramo stese la mano e prese il coltello per immolare suo figlio**."*

Class:INT_Motif
*"Ah me! Ah me! what wafture nigh at hand,/ **As of great birds of prey**, is this I hear?/ The bright air fanned/ Whistles and shrills **with rapid beat of wings**."*

Class:INT7_Interpretament
**La differenza tra l'eroe tragico (Agamennone che sacrifica la figlia Ifigenia) e Abramo balza agli occhi facilmente.** L'eroe tragico rimane tutto dentro la sfera etica… Diversa la situazione di Abramo Egli ha cancellato con la sua azione tutta l'etica ottenendo il suo telos superiore fuori di essa, rispetto al quale ha sospeso l'etica. (…)"

Class: Punishment
"Io:*Tell me **who has bound you** fast in this ravine. /*Prometheus:
***Zeus by his will***."

Class: Revenge

*"For, in her pity, holy **Artemis is angry at the winged hounds of her father**, for they sacrifice a wretched timorous thing, together with her young, before she has brought them forth. An abomination to her is the eagles' feast.*"

# Sparql queries

## QUERY 1:

The results that emerge from this query allow us to classify individuals according to the categories of human and divine entities. In particular, according to the abovementioned theory, individuals taking part in Unintentional processes can be considered as Human Entity for they are somehow subjected to an external will.

**Answered competency question:** What kind of divine interventions is it possible to classify?

PREFIX The: <http://www.TheOn.org#>
prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>
prefix owl: <http://www.w3.org/2002/07/owl#>
SELECT ?subject ?object
WHERE {
  ?subject The:**takes_part_in** ?object
}

LIMIT 25

| | subject | object |
|---|---|---|
| 1 | The:Zeus | The:Punishment1 |
| 2 | The:Apollo | The:Possessed_by_god |
| 3 | The:Cassandra | The:Possessed_by_god |
| 4 | The:Clitemnestra | The:Killing_of_Agamemnon |
| 5 | The:Arthemis | The:Revenge1 |
| 6 | The:Prometheus | The:Stolen_fire |
| 7 | The:Medea | The:Invocation1 |
| 8 | The:Agamemnon | The:Sacrifice_Of_Iphigenia |
| 9 | The:Prometheus | The:Bound_to_the_cliff |

## QUERY 2:

Obtaining all the triples linked to each character could be useful for users as a starting point to develop new literary theories inserting the character in a narrative context composed by

its intentional or unintentional process, its feature (e.g. epithets) or its involvement in a dramatic mechanism (e.g. deus_ex_machina).

**Answered competency questions:**
- In which moments and contexts men turn to divine entities in Greek tragedies?
- In which forms do they do it?
- Is man impotent when he has to face divine entities?
- In which cases human will and actions coincide with those of divine entities?

PREFIX The: <http://www.TheOn.org#>
PREFIX : <undefined>
PREFIX dr: <http://purl.org/swan/2.0/discourse-relationships/>
PREFIX drammar: <http://www.purl.org/drammar>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT ?subject ?predicate
WHERE {
  The:**Prometheus** ?subject ?predicate  .
}
LIMIT 100

| | subject | predicate |
|---|---|---|
| 1 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | <http://www.w3.org/2002/07/owl#NamedIndividual> |
| 2 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | The:Divine_Entity |
| 3 | The:takes_part_in | The:Stolen_fire |
| 4 | The:takes_part_in | The:Bound_to_the_cliff |
| 5 | The:is_affected_by | The:Punishment1 |

PREFIX The: <http://www.TheOn.org#>
PREFIX : <undefined>
PREFIX dr: <http://purl.org/swan/2.0/discourse-relationships/>
PREFIX drammar: <http://www.purl.org/drammar>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT ?subject ?predicate
WHERE {
  The:**Zeus** ?subject ?predicate  .
}
LIMIT 100

| | subject | | predicate | |
|---|---|---|---|---|
| 1 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | | <http://www.w3.org/2002/07/owl#NamedIndividual> | |
| 2 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | | The:Divine_Entity | |
| 3 | The:has_epithet | | ""Xènios"" | |
| 4 | The:takes_part_in | | The:Punishment1 | |

Showing 1 to 4 of 4 entries

PREFIX The: <http://www.TheOn.org#>
PREFIX : <undefined>
PREFIX dr: <http://purl.org/swan/2.0/discourse-relationships/>
PREFIX drammar: <http://www.purl.org/drammar>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT ?subject ?predicate
WHERE {
  The:**Arthemis** ?subject ?predicate  .
}
LIMIT 100

| | subject | | predicate | |
|---|---|---|---|---|
| 1 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | | <http://www.w3.org/2002/07/owl#NamedIndividual> | |
| 2 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | | The:Divine_Entity | |
| 3 | The:has_epithet | | ""Agrótera"" | |
| 4 | The:takes_part_in | | The:Revenge1 | |

PREFIX The: <http://www.TheOn.org#>
PREFIX : <undefined>
PREFIX dr: <http://purl.org/swan/2.0/discourse-relationships/>
PREFIX drammar: <http://www.purl.org/drammar>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT ?subject ?predicate
WHERE {
  The:**Ocean** ?subject ?predicate  .
}
LIMIT 100

| | subject | | predicate | |
|---|---|---|---|---|
| 1 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | | <http://www.w3.org/2002/07/owl#NamedIndividual> | |
| 2 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | | The:Divine_Entity | |
| 3 | The:is_subject_of | | The:Deus_ex_machina2 | |

**QUERY 3:**

This query could enable users to discover some specific **linguistic patterns** which identify the use of this mechanism in that section of the tragedy.

**Answered competency question:** In which cases is it possible to recognize a similarity between a man and a divine entity?

SELECT ?subject ?predicate
WHERE {
  The:**Deus_ex_machina2** ?subject ?predicate  .
}
LIMIT 100

| | subject | predicate |
|---|---|---|
| 1 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | <http://www.w3.org/2002/07/owl#NamedIndividual> |
| 2 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | The:Deus_Ex_Machina |
| 3 | <https://w3id.org/lso/intro/beta201901#R44_has_wording> | ""Whistles and shrills with rapid beat of wings. There cometh nought but to my spirit brings Horror and fear. The DAUGHTERS OF OCEANUS draw near in mid-air in their winged chariot."" |
| 4 | The:has_textual_concretization | The:motif1 |

## QUERY 4:

The result of this query could enable users to classify a specific process getting the agent who caused it or the affected entity in case of an action.

**Answered competency question:** What kind of divine interventions is it possible to classify?

PREFIX The: <http://www.TheOn.org#>
PREFIX : <undefined>
PREFIX dr: <http://purl.org/swan/2.0/discourse-relationships/>
PREFIX drammar: <http://www.purl.org/drammar>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>

SELECT ?subject ?predicate
WHERE {
  The:**Sacrifice_Of_Iphigenia**?subject ?predicate  .
}
LIMIT 100

| | subject | predicate |
|---|---|---|
| 1 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | The:Mental_UnintentionalProcess |
| 2 | <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> | <http://www.w3.org/2002/07/owl#NamedIndividual> |
| 3 | <https://w3id.org/lso/intro/beta201901#R44_has_wording> | ""But when he had donned the yoke of Necessity, with veering of mind, impious, unholy, unsanctified, from that moment he changed his intention and began to conceive that deed of uttermost audacity. For wretched delusion, counsellor of ill, primal source of woe, makes mortals bold. So then he hardened his heart to sacrifice his daughter"" |
| 4 | The:is_caused_by | The:Arthemis |

## QUERY 5:

The results of this query allow users to define which characters could be considered divine entities as they are subject of a dramatic mechanism used as prerogative of gods in ancient tragedy.

**Answered competency question:** In which cases is it possible to recognize a similarity between a man and a divine entity?

PREFIX The: <http://www.TheOn.org#>
PREFIX : <undefined>
PREFIX dr: <http://purl.org/swan/2.0/discourse-relationships/>
PREFIX drammar: <http://www.purl.org/drammar>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX beta201901: <http://w3id.org/lso/intro/beta201901>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>

SELECT ?subject ?predicate
WHERE {
  ?subject **The:is_subject_of** ?predicate  .
}
LIMIT 100

| | subject | object |
|---|---|---|
| 1 | The:Ocean | The:Deus_ex_machina2 |
| 2 | The:Medea | The:Deus_ex_machina1 |

# Further development

Starting from the richness of possible interpretations that Greek tragedies still offer us today, the purpose of this ontology is to create a mode applicable to any kind of literary text involving some kind of divine and human entities. Our main aim is to provide an innovative tool that serves as a starting point for new critical interpretations of literary texts. Indeed, a formal model allows a scientific approach to the study of the text to be adopted, providing greater objectivity to an interpretative theory.

Our ontology also wants to work alongside other works that aim to provide an even deeper understanding of Greek literature and culture, such as the ontology for the

study of the ritual in ancient greek tragedy developed for the project *Euporia, Rituals in ancient Greek tragedy*, carried on by the Laboratorio di Antropologia del Mondo Antico (University of Pisa) and the CoPhiLab of the Institute of Computational Linguistics at the CNR in Pisa, and the ontology for the heroes of the ancient Greek mythology and religion.

## Sources

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3. P. Hitzler, A. Gangemi, K. Janowicz, A. Krishnadi, V. Presutti (eds.) (2016). *Ontology Engineering with Ontology Design Patterns: Foundations and Applications*, IOS Press, Amsterdam.

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6. Simoni, S. (2017) "*La Medea di Euripide e il femminino sacro: elogio della vendetta",* La Rosa di Paracelso OJS.