# Argumentation Mapping for the History of Philosophical and Scientific Ideas: The *TheSu* Annotation Scheme and Its Application to Plutarch's *Aquane an ignis*

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## Abstract

**English.** This paper presents the *TheSu* XML annotation scheme, which is intended to be an indexing and mapping tool for intellectual historians. Its sheets contain "theses" extracted from written works, representing the stance of their authors or of the individuals quoted in the text, classified by themes and other peculiarities. These theses, linked between them in argumentative and expository "supports", compose a network identifiable with the "scientific discourse" that the work they are included in means to convey. Being it representative of an author's scientific or philosophical thought, it is always important for the historian researching on that author's ideas to give proper and articulate consideration to all its elements and their relations. *TheSu* is designed to aid in this operation, by providing the possibility of generating organized lists and maps of the "Argumentative-Expository Systems" of interest to the historian. In this presentation, examples are provided from an exhaustive case annotation of Plutarch's *Aquane an ignis utilior sit*. *TheSu* is also briefly compared to apparently similar annotation schemes in Argumentation Mining to better show its individual features and aims.

**Italiano.** Questo articolo presenta lo schema di annotazione XML *TheSu*, pensato come uno strumento di indicizzazione e mappatura per storici delle idee. Un foglio *TheSu* contiene "tesi" estratte da un testo scritto, rappresentanti il punto di vista del suo autore o degli individui da esso citati, classificate secondo temi e altre caratteristiche. Queste tesi, collegate tra loro all'interno di "supporti" argomentativi ed espositivi, compongono una rete identificabile con il "discorso scientifico" trasmesso dal testo in cui sono inserite. Poiché esso può essere rappresentativo del pensiero scientifico o filosofico di un autore, è sempre importante che gli storici che ne studiano le idee prestino la giusta attenzione all'intera articolazione di tale discorso, ai suoi elementi e alle loro relazioni. *TheSu* serve a semplificare quest'operazione, dando la possibilità di generare liste organizzate e mappe dei "Sistemi Argomentativo-Espositivi" d'interesse per gli storici. In questa presentazione sono mostrati esempi tratti da un'annotazione esaustiva dell'opera di Plutarco *Aquane an ignis utilior sit*. *TheSu* viene inoltre confrontato brevemente con altri schemi d'annotazione apparentemente simili nel campo dell'*Argumentation Mining*, per mostrare al meglio i suoi scopi e le sue caratteristiche individuali.

## 1 Introduction

The field of "computational history of philosophy" (Betti et al., 2019) is rather new but promising, as it can provide historians with powerful research tools to work with large amounts of data in an organized fashion, giving them the possibility of finding patterns, similarities and links. History of philosophy and History of science can be regarded as subfields of History of ideas – meant in the broadest possible sense – and although digital methods seem to have only recently been introduced in this latter (Betti and van den Berg, 2016)[1], History of science has been benefiting from them for a long time already, under the influence of Computational linguistics (Dibattista, 2009). By presenting the novel XML annotation scheme *TheSu*, this paper aims to contribute to the general trend of digitalizing the research methods in these fields, focusing on "ideas" in the sense of judgements about states of things and giving relevance to the way these judgements are presented and promoted by their authors.

Plutarch's short conference (D'Ippolito and Nuzzo, 2012, pp. 180–191) *Aquane an ignis utilior sit* (*Aq.*) — "Whether fire or water is more useful"— has been annotated according to the *TheSu* scheme to give some examples of this latter's possible applications and capabilities. The digital XML/TEI edition (TEI Consortium, 2019) of the original Greek text chosen as a base for the annotation has been downloaded from PerseusDL/canonical-greekLit (Cerrato et al., 2019), and corresponds to Bernardakis's critical edition of the work (1895, pp. 1–10).

[1] Betti and Van den Berg do not seem to consider the activity of the ILIESI (Istituto per il Lessico Intellettuale Europeo e Storia delle Idee) in Rome, which has long been working on History of ideas in the frame of Digital Humanities. See http://www.iliesi.cnr.it/.

## 2 *TheSu* and related work in Argumentation Mining

The aim of the *TheSu* (*Thesis-Support*) annotation scheme is to provide the possibility of easily navigating through enunciates (*Theses*) contained in written texts and all their linked explanations, justifications and refutations (*Supports*), each indexed as a node in an abstract network defined as "Argumentative-Expository System" (AE System), which is stored in a database. Focusing on argumentative relations of whatever rhetorical nature, *TheSu* can be likened to the various annotation schemes that are being proposed in the field of Argumentation Mining (Lippi and Torroni, 2016; Stede and Schneider, 2019), even if it doesn't share their common objective of digitally automatizing argument extraction from texts. *TheSu*, although similar to these approaches, is different from them for two main reasons:

(1) It builds its system on theses abstracted from the texts by human interpreters, which can then be linked to their possible textual supports (if there are any). Argumentation mining approaches influenced by Toulmin (2003 [1958]) and Walton (1998; Id. et al., 2008) tend to directly search the texts for premise-conclusion enunciative pairs to tag them under schemes such as Walton's "argumentation schemes" (see *e.g.* Lauscher et al., 2018; Mochales Palau and Moens, 2009; Rocha et al., 2016; Green, 2018a); approaches based on Rhetorical Structure Theory (RST) instead (see Mann and Thompson, 1987; Taboada and Mann, 2006, secs. 2.4, A.2) select their elements through objective textual markers (see the definitions of EDUs —Elementary Discourse Units— in *e.g.* Carlson et al., 2001; Marcu et al., 1999), and as a consequence segment the text into discrete —albeit interconnected— non-overlapping units (on the undesirable aspects of these approaches see Green, 2018b; Peldszus and Stede, 2013, pp. 15–19). In contrast, *TheSu* focuses first on the indexing of individual theses, *i.e.* treating every single declarative sentence as a "claim", and then on their connection with supportive spans of text: the latter can be contiguous to their targeted theses or very far away in the text, as well as in other works from the same author or from different authors too (as will become clearer below).

(2) While Argumentation Mining methods are generally concerned with *textual* cohesion and natural argumentation patterns, *TheSu* is interested in the coherence and justification of an author's ideas in her *thought*, inasmuch as it is exhibited in her textual production. This also differentiates *TheSu* from annotation

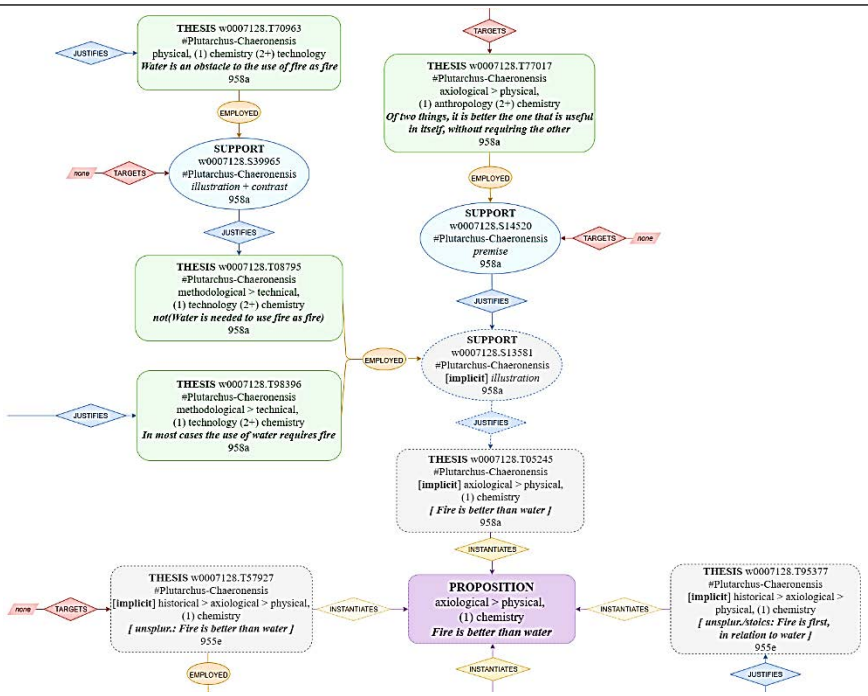


Figure 1. Fragment of a concept visualization of a *TheSu* map: Argumentative-Expository contexts linked to the theses in *Aquane an ignis utilior sit* instantiating the proposition 'Fire is better than water'. Every THESIS and SUPPORT that doesn't receive justifications or explanations is highlighted by "*none* –targets→": it's desirable to be able to notice them at a glance because it can be proof that their speaker considered them clear and non-controversial enough not to spend more (supportive) words on their presentation, thus being the ideological 'building-blocks' of the whole argumentative discourse.

schemes in Argumentation Mining that seem to be more independent from Walton's and RST's influence (*e.g.* Peldszus and Stede, 2013). An intellectual historian, while researching on an author's thought, usually tries to reach a comprehensive view of it in order to identify trends and elements of cohesion, incompatibility, and evolution. When the historian extends the scope of her research to include texts from different authors, her

aim is usually to be able to discover traces of historical influences or innovations based on independent reasoning. Sometimes she tries to elucidate the author's texts by putting them in relation to others pertaining to the same culture or current of thought: when certain ideas are presented synthetically and without explanation, she can always look at works from different authors —culturally and philosophically close to the first— to find their plausible sense and justifications (on current research practices in History of ideas cf. *e.g.* van den Berg et al., 2014, sec. 3). *TheSu* is intended as a tool to help the historian reach these aims, by providing databases for generating maps of the networks of ideas conveyed by texts, and arrange and filter them according to her interests (see Figure 1).

*TheSu* is thus distinguished from the other annotation schemes in a way that can be summarized as follows: although it always starts from a text containing natural argumentation, it only uses it as a proof for the existence of a *scientific discourse* that the text's author intends to convey. The "discourse" is composed of both explicitly stated enunciates and their implicit assumptions and alluded consequences, as well as all the explicit and implicit argumentative links between them. These are only "scientific" in the sense that they are to be 'taken seriously' by the interpreter, who must always start by assuming the hypothesis that the author has legitimate reasons to believe in and present all of them: to test her hypothesis, the interpreter must thus do her best to find in the text all the supports that might qualify the claims as *well founded* and *adopted critically* by the author, and so "scientifically" legit (in the context of their existence). In so doing, the interpreter cannot but be guided by a strong principle of charity[2], and in this way detach the scientific discourse from the text up above a certain degree of 'charitable' arbitrariness. The structure of the scientific discourse, then, can not always correspond to the structure of the text, and the latter is only used as grounding for the reconstruction of the former.

*TheSu* annotations, in addition, can serve the purpose of gathering organized data as a basis for logical and epistemological evaluations of an author's style of reasoning. To make these further analyses possible, the interpreter must be as non-judgemental as possible in the annotation phase: weird and weak as they may seem, every extra-logical "argumentation" practice deserves the same space as the actual "demonstrations"— adopting Perleman and Olbrecht-Tyteca's distinction (2013)— in the network of ideas. This also distinguishes *TheSu* from more 'normative', logically rigid, approaches in Argumentation Mining (*e.g.* Green, 2018a), and from the CRM*inf* Argumentation Model, an extension to the CIDOC CRM that complements CRM*sci*, a model for the structuring of metadata about contents and practices of current empirical sciences (Stead et al., 2019). In CRM*inf*, the epistemological evaluation of the arguments is embedded in the annotation itself (*e.g.* its class "I3 Inference Logic" can only include «anything that is scientifically or academically acceptable as a method for drawing conclusions», *ib.* p. 11), and much of the discourses' rhetorical contexts is thus ignored.

Plutarch's *Aq.* has been chosen as a case study because of its short length and its elaborate, though very clear, argumentative structure. It is a rhetorical exercise where both the superiority of water and the superiority of fire are argued for in persuasive speeches that are symmetrical in extension as well as in cogency, and wherein no final solution is provided to the controversy. It contains way more "argumentation" than "demonstration", and its interesting rhetorical features have already been analysed by Milazzo (1991), although with a different approach. In this paper, its theses will only be quoted by their annotated paraphrases in English, which is the standard language for the *TheSu* sheets: considering that all the theses have been extracted from the original Greek text, in this case every paraphrasis is also a translation, original to this annotation and sometimes diverging from the previous ones —including Helmbold's in Cherniss and Helmbold (1957)— to improve on clarity and faithfulness. The original (pre-annotated) text will be quoted in translation as well.

## 3 Encoding the Argumentative-Expository Systems

Every *TheSu* XML sheet corresponds to at least one work to be annotated. Considering the general need for historians to keep track of the textual *locus* of every passage that they analyse and quote, it's better for the annotator to work on already-existing XML/TEI editions of the texts, if suitably provided with `milestone` elements with IDs corresponding to the desired reference system. This has been the case with the adopted digital edition of *Aq.* Often *TheSu* elements need to include non-contiguous spans of text. These, in turn, can often be interpreted as composing multiple theses or supports (explicit or implicit) cumulatively, sometimes leading to the problem of overlapping hierarchies. For these two reasons stand-off markup has been chosen as the annotation method for *TheSu*: each of its elements has to refer to a span of text in another document, linked through xLink and xPointer.

[2] See Davidson's "Principle of Coherence" (Davidson, 1991).

Every *TheSu* sheet contains an Argumentative-Espository System (AE System), that is theoretically defined as a set containing theses, their argumentative and expository supports, and the functional relations between the two. As will be shown below, this also needs to include a few more elements in its digital implementation.

A "**thesis**" is an instantiation of a declarative proposition at a certain point of the text representing the stance of its speaker. It can be explicit in the form of an enunciate (*e.g.* 'Putrefaction is the decay of liquids in the flesh', *Aq.* 957[e]) or implicit, *e.g.* in the form of a rhetorical question (*e.g.* '[ Water is more useful to humans than fire ]' in «how, then, should water not be more useful… ?», 957[b]).

A "**support**" is a segment of text that is presented by its speaker *in function of* a part of the scientific discourse conveyed by the same text. A "support" can:

[1] provide justifications for the acceptance or refusal of a thesis or of another support (*argumentative support*): *e.g.* «In most cases, it's not possible to use water without fire: in fact, it's more useful when it's heated, otherwise it's harmful», 958[a].

[2] explain more clearly, stylistically, or in depth the meaning of another segment of text containing theses and/or supports (*expository support*): *e.g.* «Isn't it more helpful what we always and continuously stand in need of, like a tool and an instrument, …?», 955[f];

[3] expand on an information conveyed by a thesis, favouring a more complete knowledge and understanding of it (*expansive support* or *excursus*): «… and (don't you see) that every sense partakes of fire, as it fabricates the vital principle, and especially sight, which is the keenest of the bodily senses, being an ignition of fire… ?», 958[e];

[4] contextualize the interpretation and reception of another segment of text containing theses and/or supports (*contextualizing support*): «In fact, (about) the saying that sometimes humans exist without fire: humans can't at all exist (without it)», 958[b].

The reader here may notice that in *TheSu*'s annotation scheme the "support" elements, having four distinct functions, include rhetorical uses that do not correspond directly to argumentative and expository aims. One can still speak of "Argumentative-Expository Systems", though, because careful consideration of both the expansive and contextualizing supports is needed for a complete understanding of the argumentative and expository roles of the theses surrounding them, and of their linked segments of text.

"Theses" and "supports" are encoded as `THESIS` and `SUPPORT` XML elements, both children of an `AEsystem`, which is in turn child of a `work`. *Aq.*'s AE System, in its current version, contains 259 manually annotated `THESIS` elements (corresponding to 334 theses, 56 of which are implicit) and 216 `SUPPORT` elements (121 implicit). These numbers are striking if the very short nature of the text is considered (1627 words in total). It's clear that a high amount of information on an author's thought and on her cultural context can always be extracted from even relatively small bits of text: mapping it in detail can be crucial to avoiding misinterpretations and misattributions.

Every `THESIS` and `SUPPORT` must have its own ID, so that each can be targeted by `SUPPORT` elements through xPointer. `THESIS` elements' IDs are also necessary for the most original feature of the *TheSu* annotation scheme. Absent, to the best of my knowledge, from current Argumentation Mining techniques is the possibility of linking together unrelated argumentative-expository chains when converging towards the same idea. It is a need for the historian, when studying the thought of a certain author, to have a clear view of how the same theses are presented and argued for in different contexts, even when unrelated. For example, if the author does not provide supports for a judgement in a certain work or paragraph, it does not necessarily mean that she does not argue for it, or better explains it, elsewhere. To have a map where all its occurrences in different *loci*, with all their corresponding argumentative-expository apparatuses, are linked together, would naturally be helpful to the researcher. This is made possible, in *TheSu*, through the creation of a "propositions" sheet containing only `PROPOSITION` elements (a modified version of `THESIS` for the annotation of non-textual declarative sentences), and by linking to their IDs all the textual `THESIS` elements instantiating them. In *Aq.*, the proposition *e.g.* '{ Water is more useful than fire }' is repeatedly argued for in different manners, and implicitly conveyed by the words in [a] 955[f]-956[a], [b] 956[c] and [c] 957[b]. The thesis at [a] is the target of 5 supports, the one at [b] of 5 more, and the one at [c] of only 2. It is undesirable to keep these 12 supports fragmented in their respective rhetorical chains, as they all converge towards the same idea. Indeed, it is interesting to see how this proposition is argued for in *all* of its enunciative occurrences. Accordingly, it is preferable to connect each of the textual theses to their common abstract proposition within the same network. The usefulness of such a connection becomes even clearer if one imagines its extension to the whole textual production of an author, as well as to works from different authors.

What follows is a non-exhaustive presentation of some of the required or optional attributes and sub-elements of the [i] `THESIS` and [ii] `SUPPORT` elements.

[i] Every **THESIS** has an @id, a @value (affirmative or negative) and a @quantity. It can sometimes be @implicit (boolean), as has been explained above. Every non-propositional THESIS can have one or more child elements instanceOf, each with a @propRef pointing to the corresponding PROPOSITION. A required child element is the speakersGroup, containing at least one speaker, corresponding to the person, group or entity the thesis is interpreted to be 'pronounced' by, with a @ref pointing to its name in an authority sheet. The THESIS's child element assent is used to specify whether the thesis is shared, unaccepted or actively attacked by its speaker (sub-element assentSpeaker with its @assentValue), or by the author of the work (assentAuthor). The child element thesisType mainly serves indexing purposes, as it classifies the THESIS through its sub-elements: value (epistemic — to specify with @valueTag whether the thesis is offered as the speaker's real stance, as a hypothesis, or fictitiously), macroThemesGroup (to specify the 'macroscopic' theme(s) of the thesis, *e.g.* "physical", "historical", "axiological"), microThemesGroup (for the 'microscopic' theme(s) of the thesis, *e.g.* "physiology", "cosmology", "dialectic"), and keywordsGroup (to point through keywordRef elements to the textual or implicit keyword(s) corresponding to the object(s) of the thesis).

Note that each keywordRef's @ref links to the ID of a **keyword** that is a child of AEsystem. Separating the keywords from the theses becomes necessary due to the possibility of different theses including the same keywords: in 957$^{c}$ («but, in general, water (τὸ ὕδωρ) is so far away from being self-sufficient for self-preservation or the bringing-forth of other things that lack of fire, for it, is even destruction») the theses 'not(Water is self-sufficient for self-preservation)', 'not(Water is self-sufficient for the bringing-forth of other things)' and 'Without fire, water is destroyed' all share the textual keyword τὸ ὕδωρ. Each keyword can point to a segment of the annotated text or be 'implicit', and must always be tagged semantically through an attribute @namely, pointing to a class in a vocabulary sheet (*e.g.* "water"). Although the choice of the controlled vocabulary can be left to the interpreter, all new exhaustive *TheSu* annotations should consider the keyword classes already used in the previous ones, to facilitate the linking of the novel theses to all the corresponding previous propositions. It is better not to refer to an ontology of real-world entities, both to free the classification from the need of specifying vague or untranslatable terms, and to avoid projecting alien categories of thought to different cultural and scientific contexts. More freedom can be granted in the choice of the classes for the "macro-" and "micro-themes", as coherent keywords give sufficient help for the discovery and aggregation of (quasi-)equivalent theses. Each of the microTheme and keywordRef elements also has an attribute @focus to specify, by order of rank, their relative prominence in the thesis: the one just quoted, 'Without fire, water is destroyed', is about "water" and "fire" and includes both as its keywords, but it's more relevant to an understanding of Plutarch's ideas on water than those on fire. The keywordRef linked to it has thus been given @focus = 1, and the other @focus = 2. keywordRef can be used as grounding for visualizable analyses such as the one in Figure 2, where fire- and water-related keywords are assigned a score ("Epistemic relevance") based on the quantity of THESIS elements containing them at different points of the text, weighted on the basis of their @focus. One can learn from such a graph that a comparative style is maintained (almost) throughout the text, instead of it featuring two 'separate' speeches on the individual excellence of each element: such an analysis can lead to interesting findings if compared to similar analyses of other works of the same genre.

Other child elements of THESIS are recap and text. The former contains a short paraphrase in English of the thesis as interpreted and annotated: no logical formalization is required, as the annotation process must remain accessible to interpreters untrained in logic. The same goes for the PROPOSITION elements' recap: avoiding a strict logical formalization of the propositions allows the interpreter to consider as their instances theses that are not quite logically equivalent, but that can count as *synonymous enough* for the History of ideas, as is the

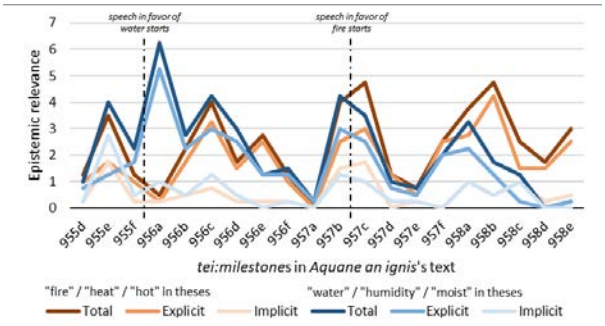


Figure 2. Relevance of fire- and water-related keywords to the theses conveyed by different contiguous spans of *Aquane an ignis*'s text.

| | Use in SUPPORTS | Form of SUPPORT | Justified? | THESIS quantity | Total | Justified / Total |
|---|---|---|---|---|---|---|
| THESES | Employed in justifications | as premises | yes | 36 | 74 | 49% |
| | | | no | 38 | | |
| | | as illustrations | yes | 65 | 140 | 46% |
| | | | no | 75 | | |
| | | in other forms | yes | 9 | 50 | 18% |
| | | | no | 41 | | |
| | Employed in explanations | | yes | 9 | 30 | 30% |
| | | | no | 21 | | |
| | Employed in jstf./expl.? | as examples | yes | 0 | 1 | 0% |
| | | | no | 1 | | |
| | Unused | | yes | 19 | 83 | 23% |
| | | | no | 64 | | |
| | All THESES | | yes | 208 | 334 | 62% |
| | | | no | 126 | | |

Table 1. Theses in *Aquane an ignis* in relation to supports: by how many and in which forms they are employed, and by how many they are targeted.

case with the thesis in the bottom-right corner of Figure 1 (quoting 'Fire is first, in relation to water') in respect to 'Fire is better than water'. Finally, the `text` points through its sub-element `textRef` (containing at least one `segment` with `@from` and `@to`) to the textual proof of the existence of the thesis at a certain point of the discourse.

[ii] `SUPPORT` elements share with `THESIS` the attributes `@id` and `@implicit`. The sub-elements `speakersGroup`, `assent`, `recap` and `text` are present here as well. The first unique child element of the `SUPPORT` is `targetsGroup`, containing at least one `target` pointing through `@ref` to the ID of a supported element. Very useful is `empolyedTheses`, including one or more `thesisRef` (with `@ref`) to link to the theses in the `SUPPORT`'s textual span that are actually presented to support the targeted element(s), discriminating between them and other non-relevant theses possibly annotated in the same text, thus solving ambiguities.

For mainly indexing purposes, as with `thesisType`, each `SUPPORT` element contains a `supportType`, also necessary for the analysis of the reasoning styles of the discourses they are part of. While their child element `value` is identical to the one in `thesisType`, they also include their own `function` and `form`. The `function`'s sub-elements are `justification`, `explanation`, `expansion` and `contextualization`, each with a `@rank` (default = 4) representing their relative centrality to the support (most central = 1). The idea is that every support, as everything else in a cohesive discourse, is always at the same time justifying, expository, expansive and contextualizing of its surroundings to a certain degree (cf. Perelman, Olbrechts-Tyteca, 2013 [1958], p. 203), and that its speaker, in order to achieve different rhetorical effects, simply choses to make one or another of these functions more prominent than the others. The possibility of ranking the functions solves the problems that would come from having to choose *only one* of them even in cases where there is enough ambiguity to make it seem impossible. For the annotation of whether the support, when "justifying", serves the purpose of arguing *for* or *against* its target(s), `justification` has been given the attribute `@for` ( = "acceptance", "refutation" or "mix"). Finally, using the element `form` the interpreter can classify the support by its rhetorical type, referring through `@formTag` to any class in a typology contained in an authority sheet. The *TheSu* standard typology of supportive forms is meant to be very simple and intuitive for intellectual historians: among the "justifying" forms, the "logical premise" is a sentence from which the supported target can be inferred by deduction, the "illustration" is a particular case from which the conclusion can be derived by induction, the "authority" is an appeal to an authoritative figure that adheres to the targeted idea, etc. Table 1 illustrates a quantitative analysis strictly dependent on the elements `SUPPORT`, `function` and `form`: it is not surprising that in a rhetorical work such as *Aquane an ignis* a very high amount of theses are given argumentative support (62%), but it is not necessarily expected that "illustrative" supports are twice the deductive "premises" (140 to 74), characterizing the speech as scarcely "logical" in tone and much more "exemplary". It is also interesting that theses employed in supports tend here to attract further argumentation, especially the "premises" (49% justified) and "illustrations" (46%), in contrast with the theses not used in supports (23%). This breakdown is only a small tile of the mosaic that is Plutarch's personal argumentation style, waiting for further analyses to be combined with and compared to.

## Conclusion

The previous sections have described the essential features of the *TheSu* annotation scheme, its theoretical framework, and some of the potential uses of a *TheSu* sheet. This exposition has focused on the methodological usefulness of this kind of argumentation and exposition mapping for an historian working on a text, but *TheSu* can also be helpful for an optimal, *transparent* and *reusable*, exposition of the basis and results of her research: a historian's 'secondary' interpretation of a certain text —*e.g.* its ideas' dependency from the ones in a contemporary philosophical current, or their ideological or popular nature— always depend on a 'primary' interpretation of the argumentative and expository chains it is composed of. Storing these primary interpretations in easily-accessible *TheSu* databases would help with the evaluation of the secondary interpretations proposed by the historian, and would facilitate the work of future researchers who wish to build upon her research and generate new interpretations from the argumentative-expository material. This is only possible thanks to digital interfaces and database interrogation techniques, and would otherwise be too difficult and/or time consuming using traditional, non-digital methods.

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