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Constructing a *Periodic Table of Arguments*

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Abstract: The existing classifications of arguments are unsatisfying in a number of ways. This paper proposes an alternative in the form of a *Periodic Table of Arguments*. The newly developed table can be used as a systematic and comprehensive point of reference for the analysis, evaluation and production of argumentative discourse as well as for various kinds of empirical and computational research in the field of argumentation theory.

Keywords: argument scheme, argumentation scheme, classification of arguments, dialectic, locus, *Periodic Table of Arguments*, rhetoric, topoi, typology of arguments

1. Introduction

In present-day argumentation theory, several classifications of arguments have been developed.¹ Among them are the new-rhetorical classification of Perelman and Olbrechts-Tyteca (1969), the classifications of Hastings (1962), Schellens (1985) and Kienpointner (1992), the pragma-dialectical classification of van Eemeren and Grootendorst (1992) and the new-dialectical classification of Walton, Reed and Macagno (2008).² These classifications of arguments typically take the form of a list of ‘argument(ation) schemes’.

Scholars do not agree as to the exact number and nature of these schemes. The new-dialectical list, for example, mentions more than sixty different argument schemes, each of which consist of a varying number of premises and a conclusion. The schemes are categorized in three main classes: ‘reasoning’, ‘source-based arguments’ and ‘arguments that apply rules to particular cases’ (Walton et al., 2008, pp. 348-351). On the other end of the scale, the pragma-dialectical list only mentions three types of argument schemes, which consist of an abstract representation of the way in which the argument relates to the standpoint it supports. The types ‘causal argumentation’, ‘symptomatic argumentation’, and ‘argumentation based on a comparison’ are then further divided into a relatively small number of variants and sub-types (van Eemeren & Grootendorst, 1992, pp. 94-102; Garssen, 1997, pp. 7-25; van Eemeren & Snoeck Henkemans, 2006, pp. 75-87; van Eemeren, Houtlosser, & Snoeck Henkemans, 2007, pp. 171-239).

The existence of such a wide variety of accounts of argument(ation) schemes is not without consequences. The fact that there are different views regarding the nature and number of argument schemes poses for instance a problem for researchers who want to use a classification of schemes as a starting point for their research. More than a decade ago, Katzav and Reed (2004), who are interested in computational applications of argumentation theory, observed that the existing classifications of argument types or schemes are unsuitable for use in research in the field of artificial intelligence:

¹ The description of the problematic aspects of the state-of-the-art in argument classification in this section is an amended translation of Wagemans (2014).

² For an overview of different theories on argument schemes see e.g., Garssen (1997, pp. 27-121; 2001).

The rich diversity of these argument types or schemes therefore needs to be tamed and ordered to provide a basis that is not only sufficiently formal and well-defined to be employed in AI system building, but is at the same time sufficiently rich and diverse to support the flexibility and breath that makes the schemes attractive to AI in the first place. (pp. 240-239)

More recently, Hornikx (2013), who is interested in the development of standards for the quality of arguments, asks himself which way of classifying argument schemes is the best:

If the aim is a single, normative framework for argument quality, then the first obstacle is that researchers have proposed different classifications of argument schemes [...] An important question is which classification is wide enough to distinguish different schemes and compact enough to avoid overlap [...] What rationale of schemes is the best? [my translation] (pp. 132-135)

One of the reasons why it is difficult to use the classifications developed so far is that they are not based on a formal ordering principle. The new-dialectical method of classification, for example, does not rest on a theoretical but on an empirical starting point. The argument schemes that are distinguished in this approach have been observed in argumentative reality and have subsequently been subsumed under one of the three main categories. No theoretical rationale is given for the number nor the name of the categories in this classification. This lack of theoretical rigor is explained by referring to the practical origins of the list of schemes:

The list of presumptive argumentation schemes given by Walton (1996) is not complete, but it identifies many of the most common forms of defeasible argumentation that should be the focus of research. [...] The existing formulations of the argumentation schemes are not very precise or systematic, perhaps because they have arisen out of practical concerns in dealing with real cases. (Walton et al., 2008, pp. 12-13)

Unlike the new-dialectical method of classification, the pragma-dialectical method of classification is premised on a theoretical starting point. The three main types of argument schemes distinguished within this approach differ from one another because they express a different relationship between (an element of) the argument and (an element of) the standpoint. But since this starting point is of an informal rather than a formal nature, it does not explain why there are exactly three different argument schemes to be distinguished (and not more or less schemes). Apart from this problem, the starting point is not consistently applied in the further subdivision of the main types into variants and subtypes. Argumentation from effect to cause, for example, is classified as a variant of causal argumentation, but it should be classified as a subtype of symptomatic argumentation. Pragmatic argumentation is classified as a subtype of causal argumentation, but it does not establish a causal relationship between an element of the argument and an element of the standpoint. Argumentation from example, finally, is classified as a subtype of symptomatic argumentation, but it should be classified as a subtype of argumentation based on a comparison (Hitchcock & Wagemans, 2011, pp. 190-197).

The absence or inconsistent application of an ordering principle for classifying arguments is not only unsatisfactory from a theoretical point of view but also leads to difficulties in applying

the associated critical questions for analyzing and evaluating arguments. The critical questions related to the new-dialectical argumentation schemes, for instance, are very diverse in nature. In addition to questions that can be answered with a 'yes' or a 'no', there are also questions that require a gradual response and questions about the process in which the argument plays a role. In some cases, it also remains unclear to which of the premises in the argument scheme a critical question relates (Hornikx, 2013, pp. 134-135; Wagemans, 2011b, p. 334; 2014).

The application of the critical questions associated with the pragma-dialectical argument schemes, to give another example, is not unproblematic either. The proposed critical questions are not always relevant for criticizing the argumentation expressing the scheme. Also, the critical questions listed for a main type of scheme are not always among those listed for its subtypes. And apart from these problems, the so-called 'preliminary' questions that are distinguished in relation to some of the subtypes can be regarded as a superfluous critical tool because they either relate to the propositional content of the argument or can be seen as a further specification of a critical question that is already related to the scheme (Hitchcock & Wagemans, 2011, pp. 193-197).

The problems listed above can be avoided by developing a classification of arguments that is based on a set of formal ordering principles. In previous publications, I have made a proposal to classify arguments on the basis of a formal analysis of the statements expressed in arguments and standpoints (Wagemans, 2008; 2011a). It has been shown that this classification solves some of the problems inherent in the pragma-dialectical account of argument schemes (Hitchcock & Wagemans, 2011). More recently, this new approach to argument characterization has been extended with the notion of 'second-order' arguments such as the argument from authority (Wagemans, 2014). The aim of the present paper is to show how these distinctions can be combined with the classification of propositions as developed within debate theory in order to construct a standardized account of the types of arguments in the form of a *Periodic Table of Arguments*.

The paper is structured as follows. First, I explain the formal-linguistic and pragmatic insights forming the basis of the three fundamental distinctions between argument types constituting the theoretical framework of the table. Then, I flesh out the table by translating in terms of this framework a number of descriptions and examples of several types of arguments distinguished in the literature. It is shown how traditional dialectical and rhetorical characterizations of arguments, fallacies and other means of persuasion take their systematic place within the table. Finally, I present the most recent version of the *Periodic Table of Arguments* and discuss some possibilities for adaptation, extension and use of the table.

2. Three fundamental distinctions for characterizing arguments

The theoretical framework of the proposed *Periodic Table of Arguments* consists of three fundamental distinctions between the types of argument. In this section, I explain in more detail what these distinctions entail.³

First, I make a distinction between subject arguments and predicate arguments. This distinction is derived from a formal-linguistic analysis of the constituents of the three main types of argument schemes as they are distinguished in the pragma-dialectical theory of argumentation. Then, I explain how a specific problem concerning the determination of the underlying

³ In expounding the theoretical framework of the table, I combine, translate and adapt earlier formulations and explanations of the three fundamental distinctions as they are described separately and / or in combination in Wagemans (2008; 2011a; 2011b; 2014; 2015) and in Hitchcock and Wagemans (2011).

mechanism governing argumentation from authority can be solved by making a distinction between first-order and second-order arguments. Finally, I propose to further characterize the types of argument by looking at the combinations of types of propositions they instantiate. This third way of characterizing arguments is based on a typology of propositions as developed within debate theory.

2.1. Subject arguments and predicate arguments

The construction of the *Periodic Table of Arguments* proposed in this paper takes as a starting point that the propositional content of standpoints and arguments can be expressed in the form of a categorical proposition. Such a proposition consists of two elements, namely that of which something is said – the 'subject' – and that what is said about the subject – the 'predicate'.

The subjects of the categorical propositions expressing the propositional content of the standpoint and that of the argument may either be different or identical, and the same applies for the predicates. So from a formal point of view, there are precisely four different combinations of categorical propositions expressing the propositional content of a standpoint and that of an argument. Figure 1 shows an overview of these combinations. A standpoint (1) may be supported by four different arguments, each of which consist of an element in the form of a categorical proposition expressing the propositional content of the argument (1.1) and an element in the form of a hypothetical proposition expressing the justificatory force of the argument (1.1').

	<i>same subject</i>	<i>different subject</i>
<i>different predicate</i>	1 S is P 1.1 S is Q 1.1' If S is Q, then S is P	1 S is P 1.1 T is Q 1.1' If T is Q, then S is P
<i>same predicate</i>	1 S is P 1.1 S is P 1.1' If S is P, then S is P	1 S is P 1.1 T is P 1.1' If T is P, then S is P

Figure 1 A formal-linguistic typology of arguments

In the first combination, upper left in the figure, in the argument a predicate is attributed to a subject to which a different predicate has been attributed in the standpoint (S is P, because S is Q). In this type of argument, which I call a 'predicate-argument', an attempt is to increase the acceptability of the standpoint by making use of a relationship between the predicates Q and P. This relationship is such that if the subject may be attributed the predicate Q, then it may also be attributed the predicate P.

In the second combination, upper right in the figure, the propositional content of the argument is completely different from that of the standpoint (S is P, because T is Q). Putting forward this type of argument does not lead to increasing the acceptability of the standpoint. By the lack of a common element, the acceptability of the standpoint is independent of that of the argument. In order to be able to speak of the 'justificatory force' of an argument in a meaningful way, its propositional content should at least have one element in common with that of the standpoint.

In the third combination, bottom left in the figure, the propositional content of the argument and that of the standpoint are completely identical (S is P, because S is P). Although this combination meets the condition just mentioned that the propositional content of the argument should have at least one element in common with that of the standpoint, a pragmatic inconsistency occurs. Putting forward an argument creates the commitment that the speaker or writer believes that the listener or reader accepts its propositional content, while putting forward a standpoint creates the commitment that the speaker or writer believes that the listener or reader does not immediately accept its propositional content. Since in this case, the propositional contents are the same, someone who argues in this way incurs two commitments that contradict each other.⁴

In the fourth and last combination that can be distinguished on this formal level, bottom right of the figure, to the subject the predicate attributed that is attributed to a different subject in the position (S is P, because T is P). In putting forward this type of argument, which I call a 'subject-argument', an attempt is made to increase the acceptability of the standpoint by making use of a relationship between the subjects T and S. This relationship is such that whenever predicate P can be attributed to subject T, it can also be attributed to subject S.

The discussion of these four combinations has revealed that the assumed aim of putting forward an argument—increasing the acceptability of the standpoint—can only be accomplished if the propositional content of the argument has at least one element in common with that of the standpoint without coinciding with it completely. It follows that from an abstract, formal-linguistic point of view, exactly two types of arguments can be distinguished: (1) predicate arguments and (2) subject arguments.

2.2. First-order and second-order arguments

In proposing a solution for the problems inherent in the pragma-dialectical account of argument schemes, Hitchcock and Wagemans (2011, pp. 197-199) characterize argumentation from authority as a sub-type of 'sign argumentation'. According to them, in all sign argumentation, a standpoint of the form 'Y is true of X' is supported by an argument of the form 'Z is true of X', while the unexpressed premise of the sub-type argumentation from authority can generally be formulated as 'being uttered by authority A (=Z) is generally an indication of being true or acceptable (=Y)'.

In my view, the formulation of this justificatory force is still adequate. At the same time, however, by characterizing argumentation from authority as a sub-type of sign argumentation, one of its important aspects remains hidden under the surface. In all types of sign argumentation, the propositional content of the standpoint is expressed by 'Y is true of X':

- 1 Y is true of X
- 1.1 Z is true of X

But in argumentation from authority, the propositional content of the standpoint that is originally defended by the speaker is expressed only by 'X':

- 1 Being true or acceptable (=Y) is true of X

⁴ For this reason, in pragma-dialectics putting forward such an argument is seen as constituting a violation of the so-called 'starting-point rule' (namely as the fallacy of the *petitio principii*) rather than as constituting a violation of the so-called 'obligation-to-defend rule' (see e.g., van Eemeren & Snoeck Henkemans, 2006, pp. 105-106).

1.1 Being uttered by authority A (=Z) is true of X

As a result, whereas in sign argumentation the predicate of the argument is related to the predicate of the standpoint, in argumentation from authority it is related to the acceptability of the standpoint as a whole.

In order to reflect this difference, I propose to interpret arguments such as argumentation from authority as ‘second-order’ predicate arguments (Wagemans, 2014, p. 23). This means that the standpoint originally defended by the speaker—which consists of a subject and a predicate—is interpreted as the subject of the reconstructed standpoint. In abstract terms, such a reconstruction has the following form (using the same variables as in the previous sub-section):

- 1 (S is P) is Q
- 1.1 (S is P) is R
- 1.1’ if (S is P) is R, then (S is P) is Q

In the case of authority argumentation, the predicate Q has the fixed meaning ‘true’ or ‘acceptable’ and the predicate R has the fixed meaning ‘being uttered by an authority’. One could imagine other types of second-order arguments in which these predicates have a different meaning.

As indicated above, a defining characteristic of second-order predicate arguments is that the predicate of the argument (R) does not relate directly to the predicate of the original standpoint (P) defended by the speaker. The absence of such a direct relation may explain why classical authors such as Cicero describe argumentation from authority as an ‘external’ topic, i.e., a topic that draws from outside the subject under discussion.⁵ It may also explain why some scholars think that arguments from authority are not real arguments or, at most, weak arguments. Mizrahi (2013), for example, states that an argument from expert opinion is a weak argument because the fact that a specific opinion is uttered by an expert does not contribute as such to the acceptability of that opinion. Connected to this rejection, so I believe, is the fact that some scholars consider any type of argumentation from authority to be fallacious by nature. Argumentation from quantitative authority may appear in lists of fallacies under the names of *argumentum ad populum*, mob appeal, or populist fallacy, while argumentation from qualitative authority may appear under the names of *argumentum ad verecundiam*, snob appeal, or appeal to inappropriate authority (Wagemans, 2015, p. 52).

From these observations it may be conjectured that the distinction between first-order and second-order arguments is reflected in the distinction made by classical scholars in dialectic and rhetoric between internal and external topics (*topoi*, *loci*) and is also reflected in the distinction made by present-day scholars in argumentation theory between reasonable and fallacious arguments.

⁵ Cicero (2006, *Topica* 24) states that ‘extrinsic arguments depend principally on authority’ and provides an example that can be reconstructed as argumentation from authority. For a further explanation of the distinction between internal and external topics as made by Cicero and Boethius, see e.g., van Eemeren et al. (2014, pp. 86-94).

2.3. The three types of propositions and their combinations

The third distinction that is constitutive of the theoretical framework of the *Periodic Table of Arguments* proposed in this paper is the one made in debate theory between three types of propositions (see e.g., Schut & Wagemans, 2014, pp. 25-39). These types are:

- (1) the proposition of policy (P);
- (2) the proposition of value (V);
- (3) the proposition of fact (F).

In order to use this distinction for the present purpose of constructing a *Periodic Table of Arguments*, it should be brought in line with the formal-linguistic characterization of arguments explained in the previous sections. This can be done by reconstructing the subject and predicate of these propositions in the following way (see also Wagemans, 2014, pp. 21-23).

Propositions of policy typically express that a specific act or policy should be carried out. Apart from this act or policy, the proposition may also contain an actor, an indication of time and an object. An example containing all these elements is ‘The Netherlands should leave the EU in 2020.’ Although there are some other reconstruction possibilities, I shall assume for the sake of simplicity that the subject of a proposition of policy is an ‘act’ (A) and that its predicate can be generally described as ‘should be carried out’.

The subject of a proposition of value and a proposition of fact may be any real or imagined ‘entity’ (E), be it a person, an event, a thing, an act, or a policy. The difference between the two types is located in the content of the predicate. While the predicate of a proposition of value can be generally described as ‘is judged as J’, the predicate of a proposition of fact can be generally described as ‘has empirical property P’.

For the three types of propositions, then, the subject and predicate involved can be formulated as displayed in Figure 2.

	<i>subject</i>	<i>predicate</i>
<i>proposition of policy</i>	act, policy (A)	should be carried out
<i>proposition of value</i>	person, event, thing, act, policy (E)	is judged as J
<i>proposition of fact</i>	person, event, thing, act, policy (E)	has empirical property P

Figure 2 Subjects and predicates of the three types of propositions

The distinction between the three types of propositions can be used for classificatory purposes by describing the types of propositions instantiated by the standpoint and the argument that supports it. This is especially helpful in distinguishing between types of argument that share other features. Pragmatic argumentation, for instance, resembles causal argumentation in that it employs a specific relation between cause and effect. This may be the reason why in pragma-dialectics, the former is viewed as a sub-type of the latter (see Hitchcock & Wagemans, 2011, pp. 188-189, 192). But on closer inspection, the underlying mechanisms of the two types of argument are quite different. In pragmatic argumentation, a proposition of policy (P) is supported by a proposition of fact (F) having the effect of the act mentioned in the standpoint as its predicate. In causal argumentation, however, a proposition of fact (F) having the effect as its predicate is supported by

another proposition of fact (F) having its cause as its predicate. While pragmatic argumentation instantiates the combination PF, causal argumentation thus instantiates the combination FF.

In principle, every type of argument distinguished in the literature can be characterized by identifying the specific combination of the types of propositions of the standpoint and the argument that supports it. This creates an extra dimension of argument characterization that indicates which of the possible combinations (PP, PV, PF, VP, VV, VF, FP, FV, FF) is instantiated in the specific type of argument.

3. Fleshing out the *Periodic Table of Arguments*

When taken together, the three distinctions explained in the previous section can be used to construct a theoretical framework for argument characterization. Within this framework, types of argument are described as (1) subject arguments or predicate arguments; (2) first-order or second-order arguments; and (3) instantiating the combination of propositions PP, PV, PF, VP, VV, VF, FP, FV, or FF. I will now turn to showing how a number of examples of argument types that are described in dialectical and rhetorical approaches to argumentation can be characterized along the lines of these distinctions.

In a type of argument that is commonly known as the ‘argument from sign’, a standpoint expressing a proposition of fact is supported by an argument also expressing a proposition of fact, thus instantiating the combination FF. An example is ‘The suspect was driving fast, because he left a long trace of rubber on the road’. Since the subjects of the expressed propositions are the same but the predicates are different, this type of argument can be further characterized as a first-order predicate argument:

- 1 The suspect was driving fast (F)
- 1.1 He left a long trace of rubber on the road (F)

Whenever a standpoint expressing a proposition of value is supported by an argument expressing a proposition of fact, the combination VF is instantiated. An example is ‘Unauthorized copying is not a form of theft, since it does not deprive the owner of use’. I propose to call this type of argument the ‘argument from criterion’. Like the previous example, this is a first-order predicate argument:

- 1 Unauthorized copying is not a form of theft (V)
- 1.1 It does not deprive the owner of use (F)

Along the same lines, the argument commonly known as ‘pragmatic argumentation’ can be characterized as a first-order predicate argument instantiating the combination PF. An example is ‘You should take his medicine, because it will prevent you from getting ill’ which can be reconstructed as follows:

- 1 You should take this medicine (P)
- 1.1 It will prevent you from getting ill (F)

A similar first-order predicate argument is the ‘argument from evaluation’. An example is ‘We should go out tonight, because it will be great fun’. But while pragmatic argumentation has a proposition of fact in the argument, the argument from evaluation has a proposition of value:

- 1 We should go out tonight (P)
- 1.1 It will be great fun (V)

An example of the ‘argument from authority’ is ‘The economy will grow in 2016, because the FED said so’. As explained in section 2.2, this type of arguments can be characterized as second-order arguments and are considered by some argumentation scholars as fallacious per definition. But in constructing a *Periodic Table of Arguments*, which is a purely descriptive endeavor, fallacies are conceptualized in the same way as arguments. From the following reconstruction it is clear that the argument from authority, or the *argumentum ad verecundiam* for that matter, is a predicate argument instantiating the combination VF:

- 1 The economy will grow in 2016 (is true) (V)
- 1.1 The economy will grow in 2016 is put forward by the FED (F)

Apart from being of qualitative nature, the authority involved may also be of quantitative nature.⁶ An example is ‘Paul McCartney is a great artist, because many people believe this is so’:

- 1 Paul McCartney is a great artist (is true) (V)
- 1.1 Paul McCartney is a great artist is believed by many people (F)

As indicated in the overview below, there are also some other fallacies that can be incorporated in the *Periodic Table of Arguments*. An *argumentum ad baculum*, generally formulated as ‘You should accept S, because otherwise you will experience negative consequences’, for example, can be characterized as a second-order predicate argument instantiating the combination PF. Likewise, the *argumentum ad hominem*, generally formulated as ‘You should accept S, because otherwise you as a person are negatively qualified’, can be characterized as a second-order predicate argument instantiating the combination PV, and several arguments that are usually subsumed under the pathetic means of persuasion in rhetoric, generally formulated as ‘You should accept S, because you should feel F’, e.g., the *argumentum ad misericordiam*, can be characterized as second-order predicate arguments instantiating the combination PP.

So far I have only discussed predicate arguments. But some of the argument types distinguished in the literature can be characterized as subject arguments. As explained in section 2.1, instead of a relation between the predicates of the propositions expressing the propositional content of the argument and the standpoint, the underlying mechanism of subject arguments is a specific relation between their subjects. Depending on the types of propositions involved, subject arguments can be named differently. Examples are the ‘argument from similarity’, which instantiates the combination FF, for instance in ‘All animals can experience pain, because humans can experience pain’ and the ‘argument from analogy’, which instantiates the combination VV, for instance in ‘Biking on the lawn is forbidden, because walking on the lawn is forbidden. In naming the latter type of argument an ‘argument from analogy’, although the term ‘analogy’ may also denote (factual) similarity, I have used the definition of analogy as it is current in the field of law,

⁶ For an overview of subtypes of the argument from authority and their fallacious counterparts see Wagemans (2015).

which involves a proposition of value rather than a proposition of fact. Finally, some first-order subject arguments distinguished in the literature may be called ‘argument from equality’. They instantiate the combination PF, for instance in ‘The EU should waive the debt of Greece, because it waived the debt of Portugal’.

Like with some predicate arguments, some subject arguments may be characterized as second-order arguments. Examples are the ‘argument from tradition’ or ‘historical fallacy’, which can generally be formulated as ‘S is acceptable (now), because it was acceptable (back then)’ and the ‘argument from commitment’, which can be generally formulated as ‘You should accept S (now), because you accepted S (in the past)’. The difference between the two is that the first one instantiates the combination VF, whereas the second one instantiates the combination PF.

4. Conclusion

In this paper I have suggested to standardize the existing dialectical and rhetorical accounts of arguments, fallacies and means of persuasion by using a theoretical framework based on three fundamental distinctions between arguments: (1) subject arguments or predicate arguments; (2) first-order or second-order arguments; and (3) instantiating the combination of propositions PP, PV, PF, VP, VV, VF, FP, FV, or FF. By reconstructing some well-known descriptions of argument types as they are distinguished within the literature, I have shown that it is in principle possible to construct a *Periodic Table of Arguments* on the basis of these three distinctions. In Figure 3, I depicted the most recent version of the table.

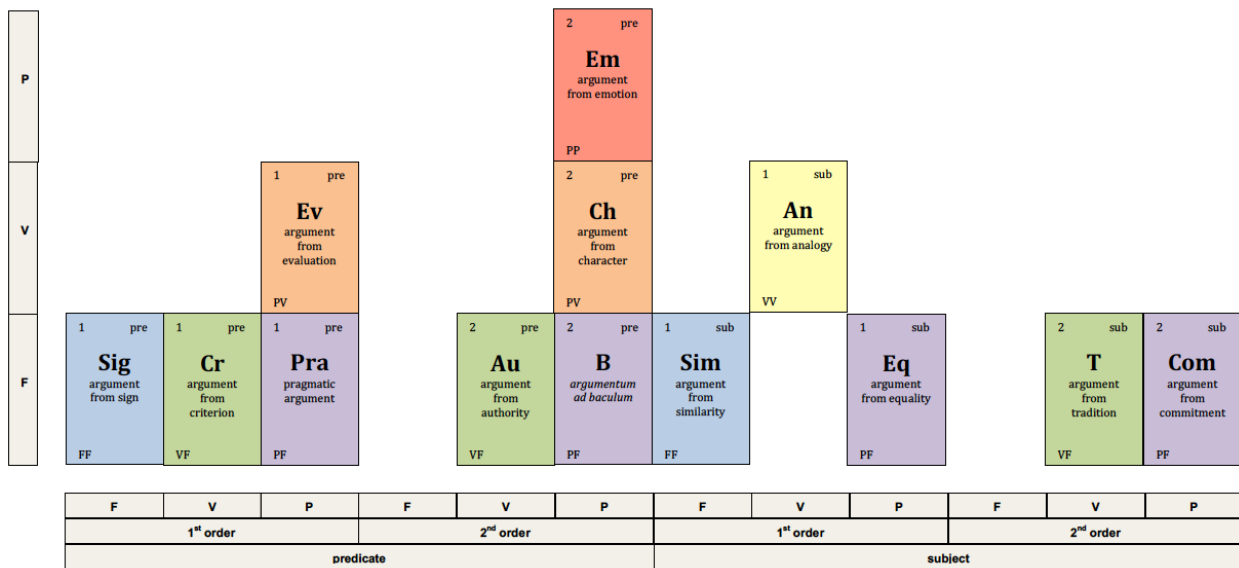


Figure 3 The *Periodic Table of Arguments*, 4th version, March 2016

The arguments, argument(ation) schemes or types of argument as described in the literature, so the analyses carried out in this paper suggest, can be characterized by making use of the three distinctions that constitute the theoretical framework of the table. It may further be conjectured that the distinction between first-order and second-order arguments is reflected in the distinction

made by classical scholars in dialectic and rhetoric between internal and external topics (*topoi, loci*) and is also reflected in the distinction made by present-day scholars who take a dialectical approach to argumentation between reasonable and fallacious arguments.

In future research, I shall concentrate on systematically incorporating dialectical and rhetorical accounts of the types of arguments and their classification into this newly developed *Periodic Table of Arguments*. I shall also pay attention to some remaining problems of characterizing arguments in this way, such as how to reconstruct the possible subjects and predicates of a proposition of policy.

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