Adpositional Argumentation
How Logic Originates In Natural Argumentative Discourse

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What is Adpositional Argumentation
AdArg = PTA + CxAdGrams

A new formal method that enables the analyst of argumentative discourse to represent linguistic and pragmatic information in a highly detailed and yet flexible way.

Source: Gobbo & Wagemans (Actes JIAF 2019)

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2. Constructive Adpositional Grammars (CxAdGrams, by Gobbo & Benini)
Epistemological and applicative aims of AdArg

Epistemologically, bridges the gap between:

1. Computational Argumentation (argument mining and mapping)
2. Argumentation Theory and Rhetoric (insights from tradition)
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Source: Gobbo, Benini & Wagemans (*Intelligenza Artificiale* 2019), here
The Periodic Table of Arguments (PTA) is a formal linguistic categorisation of argument types (Wagemans 2016)

Argument types are grouped along four quadrants of canonized forms, such as:

<table>
<thead>
<tr>
<th>quadrant</th>
<th>conclusion</th>
<th>premise</th>
<th>retrogressive argument (progressive variant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\alpha$</td>
<td>a is X</td>
<td>a is Y</td>
<td>a is X, because a is Y (a is Y, so a is X)</td>
</tr>
<tr>
<td>$\beta$</td>
<td>a is X</td>
<td>b is X</td>
<td>a is X, because b is X (b is X, so a is X)</td>
</tr>
</tbody>
</table>

**Table 1:** Overview of first-order argument forms

Source: Gobbo, Benini & Wagemans (Intelligenza Artificiale 2019)
Conclusions and premises are expressed by statements

- **F** is statement of Fact
- **V** is statement of Value
- **P** is statement of Policy

Colors indicate the combination of statement types

<table>
<thead>
<tr>
<th>Values ($\sigma\pi$)</th>
<th>Conventional color</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP</td>
<td>red</td>
</tr>
<tr>
<td>VV</td>
<td>yellow</td>
</tr>
<tr>
<td>FF</td>
<td>blue</td>
</tr>
<tr>
<td>PV, VP</td>
<td>orange</td>
</tr>
<tr>
<td>PF, FP</td>
<td>purple</td>
</tr>
<tr>
<td>VF, FV</td>
<td>green</td>
</tr>
</tbody>
</table>

**Table 2**: Conventional colors of the argument types

Source: Gobbo, Benini & Wagemans (*Intelligenza Artificiale* 2019)
For more info please visit https://periodic-table-of-arguments.org/
Constructive Adpositional Grammars (CxAdGrams)

• The theoretical framework results from the application of constructive mathematics to the adpositional paradigm in linguistics
• CxAdGrams specifically are based on topos-theory
• It thus permits to use Grothendieck’s topologies to formalize natural languages, making information completely explicit.

What does ‘adpositional’ mean, in this context?

The adpositional paradigm in linguistics follows the idea that relations between linguistic elements can be described as hierarchical in that the one element ‘governs’ the other (which then ‘depends’ on the former).

Source: Gobbo & Wagemans (with Benini, Ai³, AIXIA 2018)
Abstract adpositional trees

- *gov* is ‘governor’, conventionally on the rightside leaf
- *dep* is ‘dependent’, conventionally on the leftside leaf
- *adp* is ‘adposition’, under the hook, including information prominence ($\leftrightarrow$)
- *gc* is ‘grammar character’, the function of the whole tree in the syntax
- $\triangle$ indicates a hidden adtree, i.e., recursion is possible

**Figure 1:** The abstract adtree structure

Source: Gobbo, Benini, Wagemans (AI$^3$, AIXIA 2021)
Argumentative adpositional trees
Basic abstract trees of minimal argument forms: $\alpha, \beta, \gamma$

- $(\sigma \rightarrow \pi)$ the form is retrogressive (conclusion because premise)
- $\text{Pta}$ indicates the argument type (e.g., $\text{Cr}$ is argument from criterion)

Source: Gobbo, Benini, Wagemans (AI$^3$, AIXIA 2021)
Basic abstract trees of minimal argument forms: $\delta$

The premise of Delta arguments has a predicate ($Z$) attributed to the conclusion, which appears in the arg-adtree as quoted ($q$) conclusion.

Source: Gobbo, Benini, Wagemans (AI$^3$, AI$XIA$ 2021)
Convergent (left) and serial (right) arguments

- $Q$ is Quadrant $(\alpha, \beta, \gamma, \delta)$
- $\Omega$ signals the serial argument, where $\text{txt}$ holds a double function
- $\omega$ graphically represents the two halves of a chain ring $\omega(\pi_1, \sigma_2)$

Source: Gobbo, Benini, Wagemans (AI 3, AIXIA 2021)
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$\omega(\pi_1, \sigma_2)$ is an implication whose nature (classical, intuitionistic, relevant, linear, ...) is not specified.

Source: Gobbo, Benini, Wagemans (AI$^3$, AIXIA 2021)
To annotate a natural language text we need the voice (\(\varphi\)).

\(\varphi_y\) is a report by \(\varphi_y\) whereas \(\xi_y\) introduces arguments (...) put by \(\varphi_x\).

Figure 2: Adtrees showing voice (left), viewpoint (middle), and reported speech (right)

Adapted from: Gobbo, Benini, Wagemans (More than Relata Refero, *Languages* 2021)
Annotating an Argumentative Text
In his article “Plagiarism: A rich tradition in science,” editor John Lowell argues, referring to an article by dr. P. Smith, that Copernicus was also guilty of plagiarism: it appears that he “forgot” to mention that Aristarchos of Samos (310-230 BC) had already arrived at a heliocentric theory. It is, however, doubtful that Copernicus knew of this.

Kant spoke of heliocentricity as a Copernican revolution: it is directly contrary to “common sense” (after all, we can see that the sun rises in the east and sets in the west), and more importantly, to a centuries-old geocentric, Christian-scientific tradition. Copernicus needed all the support he could muster for his theory, and cited a great many classical writers to that end.

Source: Gobbo, Benini, Wagemans (More than Relata Refero, Languages 2021)
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Source: Gobbo, Benini, Wagemans (More than Relata Refero, Languages 2021)
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2.1.a. II spoke of
2.1.a. III heliocentricity as a Copernican revolution:
2.1.b it is directly contrary to “common sense”
2.1.c (after all, we can see that the sun rises in the east and sets in the west)
2.1.d and more importantly, to a centuries old geocentric, Christian scientific tradition.
2.2.a Copernicus needed all the support he could muster for his theory,
2.2.b. I and [Copernicus] cited a great many classical writers
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Source: Gobbo, Benini, Wagemans (More than Relata Refero, Languages 2021)
Figure 3: Arg-adtree of § 1-2 of Copernicus and Aristarchos
Conclusion
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- The annotated text reveals argumentation structures and patterns
- Annotation is *pre-logical*: it shows exactly where the logic comes in
- It makes evident the points of attack of the way of reasoning
Thank You for Your Kind Attention! Any Questions?

💬💬💬 FOR MORE RESEARCH ON AdArg 💬💬💬
https://lancar.org/research-projects/constructive-adpositional-argumentation-cxadarg/

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