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**Knowledge Structuring in Scientific Discourse**

We are proposing a five-part structure of scientific argumentation:

**„Five-Finger-Model“ (FFM)**

**1. Thesis**

**2.**. **Vs** Counterpositions (“versus”)

**3.** **Def** (Idiosyncratic) Definitions – deviating terminology – debatable groupings of objects

**4.** **Example**: different level of speech, e.g. speech of non-existent objects – presents the subject

**5.** **Camp**: a standpoint that is shared by some researchers and disputed by others

However, all five components are not always present.

This structure brings with it a peculiar network of networks in which not all of the components necessarily have to be linked. This is the case because some definitions are idiosyncratic or contrarian or are only implicit and realisable through further examination. It is precisely this further examination which is conducted in the Lexicon of Arguments. For the Semantic Search in Sciences the main problem will be non-mentioned concepts as we will see below.

**Knowledge – implicit, explicit, concealed**

One might think that knowledge is concentrated in the nodes of a network, not in the edges, but this is not quite true. When getting familiar with a scientific field a student gets the feeling that he or she gains a better understanding of the arguments contained within this field making them more convincing. Later on, as the learning processes moves forward, the student will learn that there are also counterpositions to these arguments. However, this realisation is not always evident at the beginning because authors sometimes conceal competing theories when elaborating their own work.

 Therefore, we can state that the edges of the network (i.e. what happens in dispute: the counterpositions ) deserve examination.

**The main problem**

Competing theories and authors often do not mention each other. Therefore, in order to get into the ropes of the controversies one will need

**A.** Explicit indications (rare)

**B.** Treatment of sources

 - by the authors themselves by arranging their abstracts according to a template e.g. the FFM (see above).

 - by the recipients (arranging according to the FFM)

**Knowledge Structure – Structuring of Knowledge**

Supplementary to the distinction between theses, examples, definitions, commentaries and assignment to scientific camps there are also different forms of arguments in a particular discourse.

**Forms of Arguments - Forms of Dispute**

Even authors who belong to one and the same scientific camp may contradict each other. Therefore, there are different forms these arguments take e.g.:

**a**) Same camp, equal demarcation of the scientific field (ontology) – different terminology for objects - this may lead to a different formation of groups – otherwise it would be only a so called “notational variant”.

**b**) Same camp, divergent demarcation of scientific fields – recess or integration of debated objects and the names of them – these theories are not so much competing for truth but for explanatory strength.

**c**) Same camp, equal demarcation of scientific field (ontology) – same terminology for objects - but logical divergences. In most cases you will find a flaw here.

**d**) Camps differ mostly in their use (or definitions) of concepts and the acceptance of premises. Key words from more traditional theories sometimes are willingly concealed. All contributions are bound by the same logic anyway.

**e**) Differing kinds of logic (e.g. Dialetheism, the view that statements can be both true and false at the same time). It is often criticised then that the meaning of the sentential connectives “and”. “or”, “if…then…” is not preserved. Theories like this are not in the continuity of a discussion that presupposes a common logical basis.

**f**) Differing ontologies: in this case it is not always possible to put the finger to the dissent.

**Problems for the Semantic Web**

“Semantic Web” is the expression for efforts to search the web automatically for questions that are more explicitly put than simply in one word.

**Example**: “Is there a product available similar to product X, but not X itself and with the diverging properties A and B in the environment of city Z for a price below $ 500,-?”

Today, agents (programs) are able to resolve this automatic Semantic Search.

In contrast to this, scientific controversies lead to questions in the form of

**Example**: “Do the concepts used by author 1 refer to the same objects as those used by author 2?” - “Is author X segmenting the objects in his field of research in the same manner as author Y?” - “Do both authors accept the same conceptual discrimination?”

**Example**: The System Theory replaces the distinction content/form by the distinction inside/outside.

Here we can already see the problem that the concepts of one camp are not used by the other.

These questions stretch beyond the Example of the product mentioned above. That example was limited to covering a prefixed ontology even when not all of the elements were present at all times.

Now, in the sciences it may be sufficient to call on scientists to prepare their abstracts according to something like the FFM (see above), i.e. set marks like “Vs” (AuthorAVsAuthorB) to enable an automatic Semantic Search. The encouragement to do this is one of the root reasons of this article.

**Possibilities and Solutions for the Semantic Search in Scientific Discourse**

We have noticed above the differences between scientific Semantic Search and the search for a product e.g. a camera. Nevertheless, indeed there are some similarities between the two. Even in scientific discourse there are “standardized parts” which can be present or not. Therefore, these “standardized parts” may fit the description of a “type of product” (type of argumentation) or they may not.

 **Example**: The Theory of Possible Worlds (PoWo) in philosophy. Here the question is whether certain elements are adopted by an author or not, e.g.:

 Similarity metrics for PoWo yes/no

 Individuals in more than one world yes/no

 Real existence of PoWo yes/no

 Emerging and passing off of individuals between PoWo yes/no

 Accessibility between PoWo transitive yes/no

 Etc.

Using these elements we can characterise the profile of an author and identify his affiliation to a scientific camp.

**The Five-Finger-Model (FFM) – For which Scientific Field is this appropriate?**

The FFM seems to be appropriate for an array of competing theories such as

 Philosophy

 Psychology

 Economic Sciences

 Sociology

 Historical Sciences

 Law

 Art Theory

 However, it seems less at home in the Natural Sciences like

 Physics

 Chemistry

 Biology

 These are sciences that are not necessarily fields of competing theories in which dispute emerges more so around methods and systematics. Having said this, in this meta-dimension the FFM, of course, may still be a useful tool to navigate through the discourse.

 **Example**: (from physics): Lee Smolin**Vs**Stringtheory (analogously): you should not deploy a theory that is untestable in principle.

**Non-mentioning of a Concept – A Problem for the automatic and non-automatic Semantic Search**

Sometimes a source may not mention a concept even when it is relevant to the discussion around a particular question. Therefore, this source should still be taken into account for the inquiry of the problem at hand.

 **Example**: (from philosophy): **Vs**representation: a purveyor of the speech act theory might purport that we don’t need to assume representations because when assuming that speaking is an act we don’t ask primarily about the relationship between the way of displaying an object and the object displayed. This author might assume that the depicted object is in flux instead of being fixed.

 The author`s text, perhaps, will not even mention or use the concept of representation. The problem therefore introduced is that someone at the beginning of their studies in this field will be left obscured from a possible counterposition in the discussion.

 Just because a concept is not used we cannot draw the conclusion that it is unimportant.

 By the way of the definition of an “advanced student” - she or he will realise that a concept is not mentioned, be it important or not. An advanced student will detect counterpositions.

Back to Semantic Search: if we want to get a grip on the situation where a concept is missing we have to be astute and pay attention to words like “whereas”. This might reveal the counterposition in phrases such as “whereas we have to pay attention not to…”, “whereas we may not…” etc.

 Other deceptive expressions include “while”, “on the other hand”, “not at all”, “one might think”

 And more directly: “traditional”, “widespread”, “handed down”, “well established”, “minority”, “majority”, “some authors”, “steer clear of” etc.

**Knowledge Structuring between Fidelity to the Text and Creativity – Introducing Material concealed by the Author**

For our above mentioned example we now can set a mark:

Speech Act theory**Vs**Correspondence theory

Problem: correspondence theory again might not be mentioned at all in the source! Therefore, we will have to make clear that the source is edited. Knowledge structuring revises a text, as does secondary literature. Solution: we set a mark for the editor e.g. (**s**):

Speech Act theory**Vs**Correspondence theory/(**s**):…

This makes it clear that our resulting text is not directly quoted. In our example we also add the concept in question which was not found in the original text:

representation/Speechact theory**Vs**Correspondence theory/(**s**):…

Our problem initially was that the Semantic Search will likely not find the important points in a text because the searched concepts are concealed or only present in paraphrased forms. We were bringing in concepts out of a thesaurus of related concepts to ease the Semantic Search.

An author may protest here and say that he did not use the concept because according to him the object the concept refers to does not exist at all!

Our defence is that we only wanted get better search results, alternatively perhaps this author would not have been found at all.

By the way, our intervention in a text does not obscure the source but rather makes such demarcations itself.

Traditional secondary literature normally embeds texts in even longer texts. What we do is reduce the text by setting marks:

**Thesis:**

**Def/Concept:**

**Example:**

**Vs:**

**Camp:**

Through this we show the different dimensions of a dispute.

This will not make the original literature unnecessary. For scientific quotations the original source with the literal wording is needed, i.e. added or paraphrased concepts will have to be eliminated or marked. The additional concepts that were inserted are there to ease the search and to make it possible to find certain sources which would not be found by standard search engines.

**The problem of paraphrased keywords**

Another problem for the Semantic Search is the deviating use of relevant words according to the individual taste of an author. An example can be taken from philosophy. While talking about non-existent objects - a problem for logic - some authors prefer the Pegasus as an example. Others like unicorns. Apart from Pegasus being a singular term and unicorn being a general term there is not much difference. While processing the text for the Semantic Search we should nevertheless put both words at the beginning of our excerpt in order to make it possible for the user pull up more results when searching for information about non-existent objects – our original aim. So this is our job while editing texts and preparing a lexicon that goes beyond simply copying texts that come up in a discussion.

**Vs, versus., Counterpositions**

Indeed, even today you will find a lot of results by typing “vs” on Twitter or Google – and be whacked by results from sports teams!

 “Brutus vs Caesar” might be illuminating for a historian or be related to a fancy-dress ball which will be over in case of doubt.

 The main problem here is that the result of your search will consist one more time in a long text that will have to be examined once more, though. And at last you will not find in it the answer to your original question about Caesar!

 The Lexicon of Arguments by contrast puts a single statement after the “Vs” plus the indication of the source. These statements can then be compared:

 BrutusVsCaesar/source1:…

 BrutusVsCaesar/source2:…

 BrutusVsCaesar/source3:…

Generally: Author1VsAuthor2. Possible searches are then:

“VsAuthor1”: all arguments against this author

“Author2Vs” everything this author is against.

Thereby, we automatically establish a whole network of networks:

 AuthorAVsAuthorB

 \_\_\_VsAuthorC

 \_\_\_VsAuthorC

 \_\_\_VsAuthorD……..AuthorDVsAuthorB

 \_\_\_VsAuthorC

 \_\_\_VsAuthorE…….AuthorEVsAuthorA

 \_\_\_VsAuthorB

 \_\_\_VsAuthorF

Etc.

Or

AuthorAVs…

 Vs….

 Vs…

 …VsAuthorB

 …VsAuthorB

 …VsAuthorB

 …VsAuthorC

 …VsAuthorC

 Etc.

According to the same device we will get

(Scientific) Camp1VsCamp2 A-IsmVsB-Ism TheoryXVsTheoryY.

You can see it in our table “Versus!” . Help us make it contain more results! This is only the beginning.

**Scientific Camps**

There are different ways of camp-forming in the sciences and humanities:

A. Theoretically

 Agreements

 a) on a common *subsidiary* branch

 b) against diverging definitions of commonly used concepts

 c) against integration of new concepts or objects under examination

 d) against eliminations of commonly used concepts or objects under examination

B. Practically

 Forming of groups by mutual strengthening (mutual quoting)

Scientific camps emerge only within subsidiary branches of a greater scientific field because useful distinctions are only made in a sphere of common research. Unrelated fields do not form scientific camps.

Strategies of demarcation of scientific camps are:

 Claiming

 a) that two objects fall under one concept instead of two

 b) that a conceptual discrimination has to be made between two objects

 c) that a traditional concept is not apt to or makes a wrong discrimination between objects under examination

 d) that a new concept is not apt to or makes a wrong discrimination between objects under examination

 e) that an object belongs to an outside array

 f) that an object of an alleged outside array belongs to the own field and should be integrated

 g) like e) but for concepts instead of objects

 h) like f) but for concepts instead of objects

There is a tendency that an author will count himself to an established scientific field while some of his readers may want to push him “out of the family”.

It would be helpful while working on structuring knowledge and scientific fields that authors write their abstracts in form of the FFM (Five-Finger-Model) in the future. The authors even may hope for more quotations by that!

**Cross-author Index**

Up to now there is no cross-author index available. This is astonishing in a way but also quite understandable if one takes into account the considerable amount of efforts associated with creating such an index. We have started to prepare this in German for the field of Analytic Philosophy and it is the core of the Lexicon of Arguments.

 Titles and authors are indicated by roman numerals – pages by Arabic. Additional to this there are very short commentaries e.g.

**Lambda‑Operator**  LW III210,211,212(i.Grammat:Verknüpf.("binder"),x^: "ist ein x, so daß "(something x such that) ‑‑ Q IX 52f(Funktabstr.,"x"/erzeugt Terme aus Termen (bei Frege/Church auch von Auss./"x(x²)"Quadr.v.","x(...x...): "{<x,y>: y = ...x...}"),54("xx" (= D)/Ident/"xz(={z} X J)),98,126(bei Rekurs),127(alltagssprchl:y(x\*y) = x‑mal‑Funkt." v(x + x):"x + Funkt,y(xy):"x‑hoch‑Funkt),129(y(x + y):Folge a deren y‑ter Wert a**'**y für jed.y = x + y ist) ‑‑ EMD 292(Rel.d.Ident/ Wigg:(x)(y)(x = y)),296,297,298(Äqui.zw.Formeln m+ o.LO),300(äuß.Negat:"nicht(xi)Sokrat. i.kahl)()" wobei irgendein fix.Term, weil xi n.frei/inn.Neg:"(xi)(xi ist kahl)(Sokrat)"/einheitl. Interpretat.+Funktor v.Präd.>Präd), 305(dient d.Aufnahme belieb.kompl.wffs zw.d.Klamm), 311(falsch:(notw(x)(y)(x ist Teil v.Tisch)(Bein)/falsch:(notw(x)(y)(x ist Teil v.y)(Bein,Tisch) ‑richtig:"(notw(y)(Bein Teil v.y)(Tisch)"/Chi pro,KriVs) ‑‑ Mei I 90(Name d.d.off.Stllen bindet,Name f.präd.Univ), 91(Selbstident:zweideut:a=a,a=b),92(Prädikation, allgem.:"A(b) ist wahr gdw.b. exemplifiz":01[A(01)]")

There are lists of abbreviations and logical symbols as well.

Having this Index on your smartphone in the library, or while ordering books on the internet, you can easily assess by the commentaries if a book will be helpful for you.

**The Lexicon of Arguments – Controversies in Sciences**

In the Lexicon of Arguments (www.philosophy-science-humanities-controversies.com) the structure of the FFM was applied for the first time for scientific excerpts. The Lexicon of Arguments has done this for the field of Analytic Philosophy which leads the user to the Tables “Versus”, “Concepts”, “Scientific Camps” as well as the Glossary and the Index which are available on our website. This organisational structure shows the dimensions of fields of competing theories that are always present but normally not explicit.

 The Lexicon of Arguments enables you to stay in the field of your inquiry and to “walk along” the horizontal and vertical lines in order to confront the positions of the different authors.

While using Google you will have to start a new inquiry which makes you having to read a longer text all over again.

We hope that Psychologists, Historians, Economic Scientist, Sociologists, Art Theoreticians and many others will join us. Our model can also be used for navigating the discussion of methodology in the natural sciences

This little text and the Lexicon of Arguments as a whole is an appeal to scientist to use the FFM for the sake of better results of Semantic Search. The FFM is neutral in its relationship to technical realisation.

Please visit the “Semantic Search” on our website to learn more about the Lexicon of Arguments and how to take part in this project in the future.