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A Knowledge-Based Approach to Warrant Induction

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Abstract. This contribution outlines the diversity of warrants which can connect a claim and a justification. Opposite justifications can support a claim and vice versa: two opposite claims can be supported by the same justification. Since warrants are seldom explicit, this contribution introduces a conceptual model, based on telicity, to automatically induce the content of warrants. This model is evaluated on a corpus of user generated content on various topics. The grammatical and conceptual subtleties of warrants, depending on the argument they support, is also analyzed.

Keywords. Argument mining, Natural language processing, Knowledge representation.

1. Multiple Warrants and Toulmin's Model

Warrants, and to a certain extend Backings which support Warrants in Toulmin's model, refer to categories of perceptions, evaluations, appreciations, value systems and beliefs that help humans to construct regulatory mechanisms that underly the construction of well-formed arguments. Claims or debates about an event or a fact activate certain types of beliefs, evaluations and knowledge in the different protagonists' minds. These beliefs and evaluations are in general at the basis of warrants and backings.

Toulmin's model (Toulmin 1958) describes the structure of an argument. The model, which is well-known and which has received a few extensions, was initially based on six components which play a different role in the argument: the Claim (C), the Evidence (E) or justifications, the Warrant (W), supported by the Backing (B), the Qualifier (Q) and finally the Rebuttal (R). Toulmin underlines the domain-dependence of warrants and backings used to deploy an argument. Warrants in different fields may be backed differently. While the overall model is widely accepted, the notion of domain associated with warrants is too vague to precisely characterize a warrant. It may prevent a correct evaluation of the role of backings and warrants when they connect a claim and a justification.

To circumvent the vagueness or inadequacy of the notion of domain, Freeman (Freeman 2005b) proposes to replace this notion of domain by a functional categorization of warrants based on four foundational types: a priori, empirical, institutional and evaluative. Roughly, an *a priori* warrant is based on a definition, a law, a regulation, a physical property, a principle, an *institutional warrant* reflects the practices of an institution, a group of people, or a tradition, an *empirical warrant* is based on the observation of facts

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or relates personal experiences, and an *evaluative warrant* is based on a personal value system, a belief or an evaluation of a situation. These types may be further elaborated depending on the situations being dealt with. They allow to integrate social, cultural, domain and psychological factors in warrants and backings. This analysis although promising remains somewhat vague. In this article, we propose to go one step further by introducing more precise knowledge sources that contribute to warrant content induction. In particular, we show that the telic aspects of the main terms in a justification allow to induce more precise conceptual characteristics of warrants. By main term, we mean those terms which are syntactic heads or which have a heavy conceptual content.

It is important to note that, within the context of argument mining, warrants are rarely explicitly realized in language. They must therefore be induced within the context of the interaction initiated by the claim. Warrants can sometimes be made explicit in discourse constructions adjoined to arguments, in particular in elaborations, reformulations or possibly in illustrations. This observation will serve to test the analysis proposed in this article.

Freeman (Freeman 2005a) shows that several warrants can be used in an argument to connect a claim and a justification. These warrants may be associated with epistemological constraints. The diversity of possible warrants which can play a role in the construction of an argument explains why most arguments involve so many controversies. As suggested by (Kock 2003), the structure of an argument is often multidimensional. Each warrant or group of related warrants reveals a facet of the argument. While some warrants may be related, others are independent: they are not reducible to others. In that case, defining priorities among unrelated and incomparable warrants is a matter of personal evaluation and value system. The multidimensionality of warrants reveals, according to philosophers, their *incommensurability*. Two warrants are said to be incommensurate in priority or strength if it is not possible to determine which one should be followed (Raz 2000). Therefore, two (or more) warrants introduce options, based on different beliefs and values (grounds), that argue for different positions or actions. Weighting warrants is possible, but does not guarantee to lead to a preferred choice since weighting may introduce partial orders.

When an argument is based on several warrants, these reflect different perspectives on the claim and its justifications. In a multi-layered system of warrants, it is not always possible to establish priorities, a hierarchy or weights so that the argument looks well-founded. The option approach advocated above constitutes a form of practical rationality settled within the context of an interaction, taking into account the protagonists' profiles. This approach induces the need to consider essential features such as scope, strength, priority, equity and possibly moral values to evaluate the importance of a warrant. (Kock 2003) shows that the principles developed by the early Greek tradition in rhetoric constitute an accurate inventory of warrant types which can be used to elaborate priorities or weights. These principles include considerations such as: warrants must be just, lawful, honorable, pleasant, easy to realize, feasible and necessary. These can be considered as parameters of a decision making process. At this stage, rhetoric is certainly a necessary process to debate warrant priorities, adequacy and efficiency in the context of a claim. Argument schemes should also play a similar role by implementing and emphasizing similarities, analogies or the importance of previous cases, etc.

There are several theoretical works which develop the problem of the multiplicity of warrants and their organization. In (Rotstein et al. 2008), argumentation is considered

as a mechanism for reasoning about beliefs, for filtering desires considering the agent current environment, and for selecting proper intentions. This analysis entails the taking into account of sets of 'warranting beliefs'. The approach allows to define different types of agents which impact the way in which desires are modeled. In (Garcia et al. 2007), a formal account is provided of the construction of warrants. Within a formal approach of explanation, an argument is regarded as an explanation as well as a form of support for a claim. This argument is then evaluated to decide if the claim is accepted. This form of dialectical analysis offers a model to structure warrants. None of these two approaches provide e.g. a decision model to select appropriate warrants in a given context, nor do they show how warrants can be induced from arguments However, the explanation approach proposed in (Garcia et al. 2007) is further developed on a concrete basis in this article. Finally, our analysis is relatively orthogonal to the emerging research in probabilistic argumentation (e.g. (Gabbay et al. 2015)), in particular when epistemic models are considered. Beliefs on justifications are not addressed in our approach.

The considerations developed in this article emerged from a relatively extensive argument mining task and attempts to analyze argument conceptual elaboration. These revealed a number of problems raised by the diversity and the incommensurability of warrants. In this article, we show in section 2 that, for a given pair claim-justification, a number of warrants can be advocated. We show that it is possible for a given justification to be shared in a perfectly acceptable way by a claim and its negation. From these observations, a hypothesis is proposed on the way a number of conceptual characteristics of warrants can be induced. These hypothesis are based on the notion of telicity. Telicity is related to action, it characterizes purposes and functions of objects, goals and aims of humans. In section 3, a corpus is elaborated in order to further explore and validate this hypothesis. Typical language patterns allow the extraction of warrants in this corpus when they are made explicit via discourse structures. Based on these results, section 4 develops preliminary elements of a model for warrant induction based on linguistic analysis and knowledge associated with the claim conceptual domain. In terms of prerequisites, section 2.5 introduces the notion of telicity and the Qualia structure of the Generative Lexicon. Corpus construction and pattern technology are introduced in section 3.

2. Incoherent Claims and Justifications

Argument mining reflects the complexity of human thinking, as shown in e.g. (Feng et al. 2011) where the use of argument schemes in concrete situations is explored, and in e.g. (Fiedler et al 2007) and (Walton 2015) for reasoning aspects associated with the elaboration of arguments. It is possible for a given justification to be shared and perfectly acceptable by a claim and its opposite (i.e. the two standpoints involved by the claim). Conversely, contradictory justifications can be mined to support a given claim. Claims or justifications can have different levels of strength while preserving the validity of the argument.

2.1. The case of justifications supporting opposite claims

Let us first consider the case of a justification which supports two opposite claims. In opinion analysis, which is an area where argumentation is highly developed, the two

following arguments have been mined in the hotel domain:
A1: This hotel is very nice because it is close to bars and cinemas,
A2: This hotel is horrible because it is close to bars and cinemas.
The claim C_2 *this hotel is horrible* is not coherent with the claim C_1 *this hotel is very nice* because the adjectives 'very nice' and 'terrible' are antonyms in this domain. These two arguments are perfectly acceptable with the same justification *close to bars and cinemas*.

In Toulmin's model, this apparent contradiction can be justified by the use of two different warrant and backing systems. Argument A1 is based, for example, on the following informal warrant W_1 and backing B_1 (although it is quite difficult to estimate the level of abstraction these statements require):
W_1: *it is pleasant to stay close to social and cultural activities*
B_1: *humans generally want to live in a dense social context where they have a high feeling of satisfaction and fulfillment*.
A possible rebuttal R_1 can be formulated as follows:
unless the environment generates too many problems (noise, insecurity).
A number of other warrants and backings may be invoked to connect the claim and the justification, e.g.: B'_1 *Humans need to live together to survive.*

Argument A2 is based, for example, on the following informally formulated warrant W_2 and backing B_2 and possibly B_3 since several backings can be advocated for a given warrant:
W_2: *public places with bars and cinemas are very noisy and unsafe*
B_2: *humans generally prefer safe places*
B_3: *large human concentrations usually generate trouble and danger*.
A rebuttal can be: R_2: *unless there is a very strict police control over the area*.

The divergences between A1 and A2 can be explained in terms of value systems or preferences where some warrants may have higher weights than others for specific categories of persons. Rebuttal R_1 shows restrictions which are in fact close to W_2 and B_2. It is important to note that the warrants and backing given here are not inconsistent: they simply relate two different facets of the situation advocated in A1 and A2.

2.2. The case of opposite justifications applied the same claim

Two opposite justifications can support the same claim. Consider, for example:
A3: A number of participants liked this film because it is politically correct.
A4: A number of participants liked this film because its is politically incorrect.
For example for A3 we may have, informally:
W_3: *only politically correct ideas are appreciated and must be developed in public*
B_3: *the public must be educated according to moral principles*.
A rebuttal can be:
R_3: *unless the goal is to educate people by means of counter-examples.*

For A4, we have, informally:
W_4: *it is good to criticize standard education to promote the evolution of minds*
B_4: *in education it is crucial to develop critical thinking*
R_4: *unless some historical aspect is developed and must be presented impartially.*

Similarly to the previous section, the warrants and backings produced for A3 and A4 develop different facets which are not incompatible. They correspond to different views of a complex situation. A justification and its opposite may therefore support the same claim with the same strength.

2.3. Graded claims and justifications

It is frequent in argument mining to find justifications for a claim with various levels of strength. The opposite has also been observed where a justification is associated with claims that have different strengths and orientations. Consider the following arguments where premises have different strengths while the claim remains unchanged:
A1(a):*I like this hotel because it is settled in the very heart of the bar and night-life area.*
A1(b): I like this hotel because it is within a walking distance to restaurants and bars.
A1(c): I like this hotel because it has a few nice restaurants nearby.
A1(d): I like this hotel because it is far from the night-life area.

and, conversely, different claims with similar premises:
A5(a): *Brexit is good for the UK because citizens want a healthy economy.*
A5(b): Brexit should be implemented with great care because citizens want a healthy economy.
A5(c): Brexit should be given up because citizens want a healthy economy.

Same remark with an argument on a concrete domain::
A6(a): *vaccination against Ebola is necessary to protect elderly persons.*
A6(b): vaccination against Ebola is useless to protect elderly persons.

Probably more considerations could be expected for A6(b) to understand the argument (e.g. the vaccine does not work for seniors). The justifications or claims which show variable levels of strength, or where the statement is uttered with great care, indicates that there are probably several underlying warrants with different strengths.

2.4. Complex claims with multiple warrants

When the argument deals with an abstract or a general purpose topic, warrants and their associated backings may be quite numerous. This is, for example, the case for argument A5: *Brexit is good for the UK because the citizens want a healthy economy.* where the motivations of the citizens for Brexit may be quite diverse. Here is a sample of the justifications found in our corpus (Section 3), which are sentence extracts from longer statements. These statements w can induce warrants W as partly illustrated below:
w5(a): *It will allow the UK government to make better decisions for the country.*
w5(b) It will contribute to enhancing incomes. $\Rightarrow$ *W5(b) citizens want high salaries.*
w5(c) It will certainly create new jobs. $\Rightarrow$ *W5(c) citizens want full employment.*
w5(d) The population feels uncertain about EU decisions. $\Rightarrow$ *W5(d) citizens want to control political decisions.*
w5(e) Most citizens disapprove EU immigration policy.
w5(f) The UK EU contribution can now be used to support the local industry.
w5(g) Commercial relations will be developed only if they can benefit to the UK. etc.

These statements can partly overlap. Argument A5, for a given utterer, can be based on several warrants W derived from these statements, with different levels of priorities. The analysis of several arguments shows that (1) a given justification (support) can be shared and be perfectly acceptable by a claim and its opposite, (2) contradictory justifications can be mined for a given claim, and (3) various forms of strength have been observed for claims and justifications. Our observations can be summarized as follows:

- a given argument may be supported by several warrants W_i, ranging over several different conceptual considerations, and with variable strength and scope,

- these warrants do not need to be totally coherent,
- they may partly overlap,
- for a given utterer, these warrants may be partially ordered to outline preferences,
- these preferences, when generalized, define the utterer's value system. Therefore, a claim may be justified by opposite justifications or vice-versa, depending on the utterer's value system.

Finally, although observations remain informal and sparse, it seems that the relations between warrants and backings are of type many to many: a backing may support several distinct warrants and vice-versa, a warrant may be supported by several distinct backings.

2.5. Inducing warrants from Telic knowledge

Warrants are rarely explicit in argumentative texts. When they are accessible, they may, in some cases, take the form of explanation, elaborations or illustrations. When they are not linguistically realized, the contents of warrants are largely unpredictable and highly domain dependent. However, our corpus observations (section 3) show that a number of warrant conceptual and lexical elements can be induced from the head concepts of the argument justification via functional relations. These relations are in fact recurrent in argument production (Saint-Dizier 2016). Our hypothesis is that these functional relations can be characterized by the two following paradigms:
(1) **the telicity:** which characterizes the functions, uses, purposes and goals of the concepts which are considered, and
(2) **the agentivity:** which characterizes the development, construction or creation of the entities represented by the concepts at stake.
The concepts involved in these relations are relatively straightforward for issues which are concrete, such as vaccination (argument A6), but they are much more complex to specify for more abstract topics, such as the Brexit arguments (A5).

Models for telic and agentive functions are particularly well developed in the Generative lexicon (Pustejovsky 1995). For example, the telicity of *economy* includes, informally: *enhance incomes, create jobs, support industry, get more taxes for the government, make more investments,* etc.

The Generative Lexicon (GL) (Pustejovsky, 1995) emerged from a series of research efforts inspired by Aristotle's notion of modes of explanation. The GL is an attempt to structure lexical semantics knowledge in conjunction with domain knowledge. It allows to explain a number of language phenomena such as various types of metonymies via a decompositional view of lexical meaning. The GL also develops of a specific argument structure with semantic types, lexical paradigms, an event structure and the Qualia structure, which is the structure that is considered in our investigations.

The Qualia structure of an entity is a kind of lexical and knowledge repository composed of four fields called roles:
- **the constitutive role** describes the various parts of the entity and its physical properties, it may include subfields such as material, parts, shape, and components,
- **the formal role** describes what distinguishes the entity from other objects, i.e. the entity in its environment, in particular the entities which are more generic.
- **the telic role** describes the entity functions, uses, goals, roles and purposes,
- **the agentive role** describes the origin of the entity, how it was created or produced.

Informally, a fragment of a Qualia structure for *economy* is:

$$\text{economy(X):} \begin{bmatrix} \text{CONSTITUTIVE: } [\text{FUNDS, STRATEGIES, TESTS}], \\ \text{TELIC: } \begin{bmatrix} \text{ENHANCE(X,INCOME\_OF(Y))}, \text{ CREATE(X,JOB(Z))}, \\ \text{INDUCE(X,TAX\_FOR(G))}, \text{ DEVELOP(X, ACTIVITY)} \end{bmatrix}, \\ \text{FORMAL: } [\text{HUMAN\_ACTIVITY}], \\ \text{AGENTIVE : } [\text{DEVELOP(X,COUNTRY)}] \end{bmatrix}$$

For a concrete argument such as A6, the Qualia structure of vaccine is:

$$\text{vaccine(X):} \begin{bmatrix} \text{CONSTITUTIVE: } [\text{ACTIVE\_PRINCIPLE, ADJUVANT}], \\ \text{TELIC: } \begin{bmatrix} \text{MAIN: PROTECT\_FROM(X,Y,D)}, \text{ AVOID(X,DISSEMINATION(D))}, \\ \text{MEANS: INJECT(Z,X,Y)} \end{bmatrix}, \\ \text{FORMAL: } [\text{MEDICINE, ARTEFACT}], \\ \text{AGENTIVE : } [\text{DEVELOP(T,X)}, \text{ TEST(T,X)}, \text{ SELL(T,X)}] \end{bmatrix}$$

where X is the variable that represents the vaccine, Y is the person that is vaccinated, T is the biologist or company that develops the vaccine, Z is the doctor that makes the injection, and D is the disease associated with the vaccine (Ebola in our example). The telic role of this structure specifies possible conceptual elements, leading to reasons (warrants) for argument A6: *avoid dissemination, protect populations,* etc.

Describing Qualias raises several feasibility problems since there is little data available. The problem of an automatic or semi-automatic acquisition of Qualias is addressed in e.g. (Claveau et al 2013), and to a lesser extent in (Saint-Dizier 2016). While it is possible to encode Qualias manually, we feel that a bootstrapping method from corpora should enhance the process by providing a lot of data, which, however, needs to be organized by hand in a second stage. An interesting point is that, for a given claim domain (e.g. Brexit, vaccination, hotel evaluation), the knowledge that is required is not so large, therefore the number of Qualias is relatively limited.

Before developing the analysis of warrant induction based on telicity, let us concentrate in the next section on the corpus constitution. This corpus is aimed at identifying warrants so that the hypothesis and analysis presented here can be supported and partly evaluated.

3. Elaboration of a Corpus of Incoherent Arguments

A corpus analysis is a necessary step to observe how argument warrants, or some of their lexical and conceptual components, are formulated. A similar approach is used in e.g. (Nguyen et al 2015) to identify lexical elements typical of recurrent argument schemes.

The goal of this section is to have empirical data to identify the resources and the means required to elaborate the method advocated above to induce warrants or some of their parts. The corpus construction process is partly automatic and partly manual. Arguments A1, A2, A5 and A6 and their variants are used to illustrate this construction.

In a first step, we concentrate on user-generated content. In a next stage of this research, it will be necessary to consider other genres, such as juridical decisions or journal articles or debates on economic, social, political and scientific issues.

3.1. Collecting data

The first step is to collect texts which contain relevant data. Arguments of the A1 and A2 type and found in consumer reports on various consumer sites. Given a resource such as a hotel or a restaurant, it is frequent to find divergent opinions. For this category of arguments, evaluations related to 4 hotels, 5 restaurants and 4 cell telephone products have been collected manually. They all contain divergent claims or justifications. Most arguments also contain a number of restrictions or concessions which need to be considered. These latter elements may be interpreted as instantiated forms of rebuttals, and could be mined as such, but this is outside the scope of this paper.

A second corpus, dedicated to arguments A5 and A6 which are not related to consumer opinions, has been constructed from Web resources. 8 short claims such as A6 and slightly longer ones such as A5 have been defined and are used as seeds for a bootstrapping technique on the Web. A relatively large number of texts have been collected. Web results being somewhat unpredictable, it was necessary to manually inspect these texts in order to only keep those which are relevant. Only about 35% of the initial texts have been kept. From bootstrapping, it is also frequent to get questions such as for A5:
Q5(a-d): *Was Brexit a bad idea for the UK economy? Is the UK leaving the EU a bad thing? Was it a good or bad idea in the economy for Britain to leave the EU? Is it bad for EU economy that UK is delaying to leave after Brexit? How did Brexit campaigners give UK such a bad deal?*
which in turn can be used to get more relevant data. These questions may contain underlying or explicit warrants. For each of the 8 claims, a set of texts of an average size of 6000 words is selected. This is not very large, but sufficient for the analysis being carried out whose goal is to explore the phenomena, not to design a warrant mining system.

3.2. Argument selection

To allow for simpler automatic analysis, the above collections of texts are transformed into standard ASCII texts, skipping items of no present interest such as XML tags or icons. The next step is to extract from these texts arguments which may potentially be incoherent or show gradations in justifications. This should provide us with arguments supported by different forms of warrants, and therefore various warrant conceptual elements. For that purpose, for each of the 8 claims, a small set of patterns are manually defined that reflect various ways of expressing incoherence. The arguments given in the previous section are short and simple, they are canonical forms or 'skeletons' from which inducing warrants is of much interest. In texts, arguments are in general more developed and less easy to identify. They may contain in a more or less explicit and comprehensive way the warrants that connect the claim-justification pair. The hypothesis explored in this analysis is that some (probably not all) warrant lexical and conceptual elements can be found in the discourse structures associated with arguments.

To detect those arguments in the corpus, patterns are implemented in <TextCoop> (Saint-Dizier 2012), a platform designed for discourse analysis, which allows to specify flexible enough patterns.

For arguments of the form of A5(a), the following patterns have been defined:
P5(a): `['Brexit', gap(X), adj(syn_ant([good,useful,...])), gap(Y), 'because', gap(Y ,not(neg)), adj(syn_ant([good, healthy, ...])), 'economy', gap(Z), discourse([illustration, elaboration, consequence, purpose])].`
This simple pattern recognizes A5(d), where the terms explicitly stated in the pattern are given in bold, including the purpose clause from which a warrant is induced (4.1):
A5(d) **Brexit** *will be unequivocally* **good** *in both the short and long term* **because** *it is in favor of the UK* **economy : employment, investments and finance will be boosted**.
P5(b): `['Brexit', gap(X), modal, verb(action), gap(Y), 'because', gap(Y ,not(neg)), adj(syn_ant([good, healthy, ...])),èconomy', gap(Z), discourse([illustration, elaboration, consequence, purpose])].`
where:
- terms between quotes are words which must be found in the utterance,
- gaps stand for finite sequences of words of no present interest, possibly with a constraint (not(neg) which means that no negation must be skipped),
- adj(syn_ant([a,b,c]) refers to adjectives a, b, or c or their synonyms or antonyms as defined in TextCoop associated lexicons, verb(action) denotes an action verb,
- discourse([illustration, elaboration, justification, purpose]) is a non-terminal symbol that represents a discourse structure mainly of type illustration, elaboration, justification or purpose. These are processed via our TextCoop discourse processing platform.

The last step is to manually inspect the results and to keep only those sentences which are relevant for the present investigation, i.e. those which contain relatively explicit conceptual elements, such as those found in telic roles, which could originate warrants. Making decisions is challenging: it is difficult to estimate the level of abstraction of a warrant in a given context. After manual inspection, 43% of the selected sentences are kept, including very similar ones. An average of 16 sentences per argument has been kept.

Sentences such as the following are kept, as being developments of A5(a) which contain elements of warrants:
A5(e) The overall impact of the Brexit on the UK economy will be small, I think it will be positive overall, because the UK has a diversity of local healthy companies which could get some financial aid.
A5(f) Brexit will herald a major growth-boosting period, as the UK breaks free of the over-mighty EU with its protectionist mindset and establishes free trade and intelligent regulation aimed at UK economic interests.
A5(g) The Brexit process should be stopped because it has a severe impact on the economy: the UK government proposed lowering corporate tax rate to 15 percent to encourage business to invest in the British economy.

4. A Preliminary Model for Warrant Induction

Based on the corpus developed above, this section develops the hypothesis suggested in Section 2.5. Sentences selected in the corpus are first annotated using an XML-frame representation. Results are compared with the contents of Qualia telic roles.

4.1. Corpus annotation

The first step is to annotate the corpus described in Section 3 where claims, justifications and warrant elements are identified. Since these notions may overlap in an utterance and since the text spans to annotate may be discontinuous, we developed an annotation system based on the traditional notion of *frames*, implemented in XML. This procedure no longer follows the sentence reading order used in text annotations, but it allows to account for the claim - justification - warrant triad in a much more efficient way.

In a first stage, only claims, justifications (or attacks) and warrants are identified in the frame by means of lists of words or sentence fragments. The identification of warrant elements is driven by the argument A5(a) considered in the corpus construction, viewed as the seed. For example, A5(d), which is representative of the corpus results, is annotated as follows, where word and sentence extracts are represented between square brackets:

```
<argument> <claim > [[brexit will be unequivocally good]] </claim>
<justification> [[favor UK economy]] </justification]
<warrant> [[boost employment], [boost investments], [boost finance]]
</warrant> </argument>
```

In this simple example, elements identified as potential warrants are developed in the discourse structure 'consequence' that ends the statement.

4.2. Identification of concepts in the corpus of warrants

Warrants are in general short statements, as illustrated by the examples B1 to B4 in section 2. They may include negation and modals. It is not possible in this experiment to fully construct such warrants. Nevertheless, it is possible to isolate the main concepts which are involved. These concepts are of two types: predicates, essentially verbs, e.g. *boost* or relational nouns, and entities, which are nouns which are either grammatical objects or subjects. These latter identify specific, topic-oriented components of the warrant such as *finance, employment*.

To reach a relatively generic formulation of warrants, the predicative concepts, which identify events, states or processes, can be generalized. This generalization is based on a number of publicly available lexical resources which have been imported into TextCoop, following the linguistic principles developed in (Cruse 1986) and in WordNet. In particular, lexicons of antonyms and taxonyms have been included into TextCoop resources. *Boost* is then generalized to *enhance / develop*. Entities are not generalized since they specify a precise domain or topic. Determiners are added wherever relevant. The statements which could be warrants or parts of warrants are rather straightforward in this example: W'5(d): *enhance / develop employment, W"5(d): enhance / develop investments, W"'5(d): enhance / develop finance*.

4.3. The telic role of the Qualia structure: uses and limits

Let us now consider the Qualia structure of the head terms of the justification of A5(a), in particular the telic role, given in section 2.5. This telic role contains the following formula, given in natural language for readability: *enhance the economy, create jobs, induce taxes for the government, develop activity*. These expressions include W5(a)-(c),

Topic of main claim	nb. of arguments considered	nb. of manually identified warrants from arguments	Rate of Qualia telic data contributing to warrant definition
Vaccination	12	25	74%
Nuclear Plants	12	18	62%
Women situation in India	8	17	57%
Brexit	15	33	69%

Table 1. Preliminary evaluation: Role of Qualia telic roles in warrant identification.

which is just an extract of the corpus. Considering A5(e) to A5(g) and others leads to the conclusion of the adequacy of the telic role to account for the main concepts found in a number of warrants.

The same conclusions can be drawn from argument A6, *vaccination against Ebola is necessary to protect elderly persons*. The telic of vaccine (Section 2.5) says that: *vaccine protects people from the disease, vaccine allows to avoid the disease dissemination*.

An experimental protocol is ongoing where the conceptual and linguistic needs in terms of warrant identification and the possibilities offered by the generative lexicon are compared and evaluated. This task is delicate because it is necessary to define Qualia telic roles independently of any argument annotation task. The bootstrapping method evoked in Section 2.5 seems neutral in this respect. Preliminary results are given in Table 1, where concrete and more abstract argument topics are considered. These preliminary results show the major role played by telicity in warrants, which is not very surprising since a number of attacks or supports concern functions, goals or purposes of the main concepts of a claim, as shown in (Saint-Dizier 2016).

The Qualia telic role essentially offers the main concepts that should appear in warrants. Besides these concepts, this telic role, as defined in the Generative lexicon formalism is unable to account for a number of constructions in warrants, among which:
- negation, although negative orientations could be detected in claims or in justifications, this indication is not sufficient to add a negation in the warrant being generated.
- forms of quantification: in the telic, variables are a priori universally quantified, but in a warrant some variables may receive more natural quantifications such as *most, an average*,
- adverbs, such as temporal adverbs, which confer to warrants a form of 'universality' or, conversely, various types of restrictions (modals, manner adverbs),
- various forms of restrictions or domain adaptations which are proper to the claim,
- elaborated syntactic constructions with e.g. focus, passives, and various alternations.

To account for these limitations, extensions to the Qualia formalism, restricted to predicates, is ongoing to include forms of quantification, modals and more comprehensive formula. The introduction of negation is not possible since it raises additional coverage problems. Besides the above restrictions, we feel that the Qualia telic role is a useful component of a system that induces warrants from justifications in arguments.

5. Perspectives

This contribution has outlined the diversity of warrants which can connect a claim with its justification(s). We have shown that opposite justifications can be the support of a

claim and vice versa. This contribution proposes a preliminary model, based on telicity and the Qualia structure, to induce concepts which could be found in warrants. However, this is not a sufficient resource to fully generate warrants, in particular their grammatical structure and the complex elements such as negation or quantification they may include.

We have introduced a specific way to mine and annotate warrants in corpora via XML-frames which now needs to be evaluated on a larger scale. Ongoing work include (1) the validation of the approach, including considering other genres (news, juridical decisions, debates, etc.), (2) going deeper in the conceptual analysis of warrants content and their relations with other elements of argumentation (backings, argument schemes, exceptions and rebuttals) and, ultimately, (3) the generation in natural language of comprehensive sets of warrants for a given argument.

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