Relevance of Qualia Relations in Coercive Contexts

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Abstract

In this paper we explore how nouns are interpreted in context. Our main goal is to stress the role played by Qualia in semantic compositional processes involved in argument selection, and to provide the motivation for integrating the annotation of the Qualia acted on by coercive verbs in predicate-argument constructions, in the context of the GLML annotation effort. After a brief introduction of the notion of coercion (section 3), we describe the first steps taken in the preparation of the data set for an experiment of annotation of coercions in Italian texts (section 4), illustrate the different types of coercions that we encountered in a preliminary analysis of the data (sections 5 and 6) and discuss how a task for Qualia annotation in coercive contexts may be conceived (section 7).

1 Credits

This paper is the result of collaboration initiated between the co-authors in occasion of the meeting with the members of the GLML working group held at ILC-CNR in Pisa on Sept. 23-24, 2008.

2 Introduction

In this paper we explore how nouns are interpreted in context and how Qualia relations play a pervasive role in semantic compositional processes involved in argument selection. This analysis goes in the direction of reinforcing the idea of a "unitary" view of meaning with an intrinsic potential for context-dependent meaning modulations. Different meaning dimensions are differently highlighted in various contexts, thus giving rise to alternative contextual interpretations. We focus here on operations of type adjustment induced by predicates over their arguments when they do not match their selectional requirements, usually referred to as *type coercion* in the literature (cf. Pustejovsky, 1993 and 1995; Copestake and Briscoe, 1995; Egg, 2003 inter alia).

The observations reported in this study originate from a preliminary corpus investigation of predicate-argument constructions, carried out in order to build the data set, to prepare the annotation framework and the guidelines for a first experiment of annotation of coercion phenomena in Italian texts[1]. Our theoretical framework of reference is the theory of selection outlined in Pustejovsky (2006). Our goal is to provide feedback for annotation schemes designed to capture metonymies in text, as those described in Markert and Nissim (2002) and Pustejovsky et al. (2009). More specifically, we intend to highlight the broad relevance of Qualia relations in coercion, which motivates the usefulness of Qualia relation annotation, and contribute to enhance a GL-based annotation framework for a comprehensive annotation of type coercions.

In this view, our work constitutes a preliminary study that may be helpful to develop a more fine-grained annotation of coercion types within the GLML annotation effort (Generative Lexicon Markup Language, Pustejovsky et al. 2009). This annotation scheme currently allows the marking of type shifting (e.g. EVENT→LOCATION "he left the *concert* early", PHYS.OBJ→SOUND "listen to the *radio*"), but does not foresee annotation of the Qualia role associated with the noun that is acted on by the verb in a coercive context. Therefore, the annotation scheme currently annotates the effect but not the trigger of the coercion operation. For example it does not allow the marking of the constraint to Telic role of the noun

[1] Although the data discussed is Italian, the proposed generalizations may easily expand to other languages.

radio in "listen to the radio" (e.g. *produce_*(SOUND)). However, we argue that it is precisely the availability of this Quale that licenses the coercion (cf. *listen to the table).
Considering the extensive role played by Qualia in coercion, we argue that they should be recognized and therefore annotated. Only by recognizing/annotating the Quale targeted in a coercion (in addition to the type shifting), the compositional history of the argument selection can be fully reconstructed.

3 Coercion is not (simply) metonymy

The basic current idea behind *coercion* is that some of the senses that nouns take on in context are not lexically specified (or non in a trivial/direct way), but are built compositionally through a process of meaning modulation induced by the semantic requirements of the selecting verbs[2].

Following Pustejovsky (2006), the syntagmatic processes that trigger coercion come in two main sorts: those that exploit a subportion of the noun's type (*coercion as exploitation*) and those that introduce new conceptual material which is not part of the noun's original meaning (*coercion as introduction*). For example, in "the author will discuss her book", *discuss* exploits the informational content of *book*, while in "I have read his speech" *read* introduces a physical manifestation which is absent in the inherent meaning of *speech*.

The distinction between *coercion as exploitation* and *coercion as introduction* does not overlap with the traditional distinction between *conventionalized* vs. *unconventionalized metonymy*, nor does it correspond to the opposition between *lexicalized* vs. *non lexicalized sense*[3]. Instead, it strives to capture the genesis of the metonymic reconstruction, that is, what licences a coercion in a specific context. In this view, "Mary opened the *wine*" is a conventional metonymy, but it is not lexicalized (CONTAINER is not an established sense of the word *wine*), and can be interpreted as an *introduction* if one assumes that liquids or beverages need not encode information about their possible container in their constitutive or telic roles *per se*[4].

From a theoretical perspective, Exploitation and Introduction constitute better means for the representation of type shifting phenomena than the generic notion of metonymic displacement.

In this paper, we support the view that this distinction may be relevant not only for theoretical considerations but also for annotation schemes designed for the automatic recognition and resolution of coercions in text, such as GLML.

Practically speaking, we are aware that it is difficult and somewhat risky to distinguish between the two mechanisms, since this brings into play the interplay between lexical meaning and world knowledge in the construction of interpretations for linguistic utterances, and the varieties of different approaches to it.
However, given that both types of coercion involve the meaning dimensions captured by Qualia, for the time being it would be a great advantage both for systems and for theoretical investigations to annotate explicitly the Qualia relations involved; information which could be used in a second stage to investigate the distinction.

4 Methodology and data preparation

As we mentioned above, our study constitutes the basis for a first annotation experiment of coercion on Italian, which follows the methodology proposed in Pustejovsky et al. (2009), based on previous work conducted within the Corpus Pattern Analysis (CPA) project (cf. Hanks, 2009 and references therein).

Briefly, the methodology proposed for a GLML annotation of coercion phenomena consists in two main blocks: 1) the construction of the dataset to be annotated, 2) the actual human annotation. The construction of the data set involves three main steps: a) selection of a sample of verbs, b) for each verb, definition of the sense inventory and the type template(s) associated to

[2] Coercion may also be induced by other factors, such as constructional requirements. However, only coercions induced by verb selectional preferences (intended as semantic type requirements) will be discussed in the remainder of this paper.

[3] For an account of metonymy in terms of pragmatic function, cf. Fauconnier (1986) and Nunberg (1995) inter alia.

[4] Viceversa, the CONTAINEE sense is inherently latent in the Qualia structure of words denoting a CONTAINER (*glass*, *bottle* etc.). Note, however, that the assumption that the container is not part of the meaning of *wine* is controversial, since it depends on the amount of world or common-sense knowledge which is attributed to the lexicon. We will come back on this in section 7.

each sense[5] and c) extraction of the contexts to annotate from the corpus.

The first annotation experiment data set will consist of about 20 Italian verbs that in their basic sense select for arguments associated to a different semantic type (LOCATION, EVENT, SOUND, DOCUMENT, CONTAINER etc.): *abitare* 'inhabit', *accelerare* 'accelerate', *accusare* 'accuse', *afferrare* 'grasp', *annunciare* 'announce', *aprire* 'open', *arrestare* 'arrest, stop', *arrivare* 'arrive', *ascoltare* 'listen to', *aspettare* 'wait for', *atterrare* 'land', *attraversare* 'cross', *curare* 'heal, treat', *divorare* 'devour', *finire* 'finish', *lanciare* 'throw, launch', *leggere* 'read', *riempire* 'fill', *visitare* 'visit', *volare* 'fly. For example, wrt. the direct object position:

(1) *abitare* 'inhabit'prep selects for LOCATION
ascoltare 'listen to' selects for SOUND
divorare 'devour' selects for FOOD
leggere 'read' selects for DOCUMENT
riempire 'fill' selects for CONTAINER

This first dataset includes a) *coercive verbs*, i.e., verbs which tend to keep their basic sense in composition and coerce the sense of their argument(s) (e.g. *finire* 'finish' *la birra* 'the beer'| *la sigaretta* 'the cigarette'| *il gelato* 'the icecream', *il panino* 'the sandwich'), and b) verbs which tend to undergo meaning modulations or licence new senses in co-composition (*aprire* 'open' *la porta* 'the door'| *la bottiglia* 'the bottle'| *un negozio* 'a shop'| *il dibattito* 'the debate'; *divorare* 'devour' *la torta* 'the cake'| *il libro* the book'; *leggere* 'read' *un libro* 'a book'| *una radiografia* 'an X-ray'| *i caratteri cinesi* 'chinese ideograms')[6]. Note, however, that single verbs frequently exhibit both characteristics. For example, *finire* is coercive in its 'bring to and end' sense and licences a different sense ('run out of, consume') in composition with *pane* 'bread', *benzina* 'petrol', *soldi* 'money', *rullino* 'photographic film' etc..

For each verb of the sample, we define the sense inventory by checking existing lexical resources (ItalWordNet, SIMPLE-PAROLE-CLIPS) and traditional dictionaries (DISC, GRADIT) and by examining corpus data extensively. As a general rule, we focus on primary senses and avoid unnecessary sense splitting. Given that lexical resources (in particular, traditional dictionaries) usually present fairly refined but partially arbitrary sense inventories, for most verbs we end up either simplifying sense distinctions or identifying sense inventories which overlap only partially with our references. *Senses are basically identified through association with a type template*. We extract type templates directly from corpus evidence with the help of the Sketch Engine (cf. Kilgarriff et al., 2004), where a large reference corpus for Italian is uploaded (cf. Baroni and Kilgarriff, 2006), using a CPA-like methodology. The procedure used to extract type templates and associate them to verb senses is similar to the technique used to define the context patterns in the Italian Pattern Dictionary (part of the current CPA project), and can be described as follows: we select a sample of concordances from the corpus for each target verb (about 200); we examine the types associated with the nouns that fill the different argument slots; we identify type selectional preferences for the different argument positions; finally, we map the type templates onto the different senses.

This procedure raises a series of problems, such as the presence of regular type alternations in a specific argument position, that cannot always be dealth with in terms of coercion and therefore need careful investigation (e.g. *l'aereo* | *il pilota* | *il turista* | *il volo* è atterrato 'the plane | the pilot | the turist | the flight landed', *Luca* | *la macchina* accelera 'Luca | the car accelerates', *Luca* | *il treno* è arrivato', 'Luca | the train arrived' etc.)[7].

For now, we have examined about two thirds of the sample following the methodology sketched above. The analysis so far allows us to identify the major problems that emerge in the construction of the data set. Also, it highlights the presence of different types of coercions in the data, suggesting that the notion of Quale plays a central role in coercion processes. Finally, it gives us insight in the difficulties that the annotator is likely to encounter in the actual annotation task, as well as hints on how a task on Qualia annotation in coercive contexts may be conceived. These aspects will be discussed in some detail in the remainder of this paper.

[5] A Type Template is defined as an argument structure with specification of the expected semantic type for the argument fillers (e.g. [HUMAN] attend [EVENT], [HUMAN] listen to [SOUND] etc.).

[6] The reason for including verbs which are not highly coercive in our sample is mainly theoretical. We are interested to gain insight in what makes a verb more coercive than another.

[7] Semantic-type alternations are discussed in detail in Hanks, forthcoming.

5 General Observations

If we take a restrictive view according to which coercion only applies when a novel, creative, non lexicalized sense for a word is licensed in context, coercion is not a frequent phenomenon. If, instead, we conceive words as having a potential for meaning modulation instead of a set of predefined senses, and share the view that polysemy proceeds from an abstract core meaning through sense generation rather than sense selection (cf. Recanati, 2004: 134, 2009), the analysis conducted so far suggests that the phenomenon is ubiquitous.

A selection of examples of different coercion types drawn from the corpus, in particular those which are most relevant from the perspective of Qualia annotation, will be discussed in the next section.

6 Types of Coercion

In order to illustrate the differences in coercion types found in the data and show that the type shifting is only the surface of a deeper phenomenon where Qualia relations are involved, let us consider the verb *ascoltare*, and assume it selects for SOUND[8]:

ascoltare 'listen', v.
Template
"[HUMAN] ascolta [SOUND]"
Sense
"make conscious effort to hear a sound"

Corpus data show that argument fillers greatly differ for their *source type*[9]. In other words, *ascoltare* combines with an extremely wide variety of arguments, only a subpart of which are SOUNDS or SOUND-related types:

(2) *ascoltare* 'listen' (SOUND)

Object[10]

a. *pure sounds* (rumore 'noise', eco 'echo')
b. *informational sounds* (musica 'music', *canzone* 'song', *sinfonia* 'symphony')
c. *media artifacts* (radio, stereo)
d. *music artifacts* (cd, album, cassetta 'tape')
e. *sound makers artifacts* (campana 'bell')
f. *events involving sound production* (grido 'scream', pianto 'cry', respiro 'breath'),
g. *speech acts* (annuncio 'announcement', conversazione 'conversation')
h. *natural forces* (vento 'wind')
i. *humans* (collega 'colleague', gente 'people', coro 'choir', Mozart)
j. *body parts* (cuore 'hearth', polmoni 'lungs')…

Whatever their source type is, all the nouns are somehow re-interpreted as SOUNDs when selected by *ascoltare*: media artifacts (*radio*), music artifacts (*disc*), sound makers artifacts (*bell*), events involving sound production (*cry*), speech acts (*announcement*), humans (*people*, *Mozart*, *colleague*), body parts (*lungs*) and so on. But the operations at play in the various contexts are different. Although they all entail re-computing (except for type matching or pure selections, as in (2a)), they do not all involve the same amount of computation. For example, (2b) involves a fairly inexpensive operation (a light form of coercion), that is, the exploitation of a component of a complex type. This operation is close to pure selection and may be characterized as a kind of subselection; (2c) involves a more internal (and computationally more expensive) operation, that is, the exploitation of a piece of information coded in the Telic Quale. Finally, (2j) involves the introduction of new conceptual material which is not part of the original meaning of the noun.

Yet another example which highlights the role played by Qualia in coercion is offered by constructions in which a verb induces the interpretation of CONTAINEE in an artefact which lexically denotes a CONTAINER (e.g. *bere un bicchiere* 'drink a glass').

(3) *bicchiere* 'glass'(PHYS.OBJ⊗$_{Telic}$*hold*(*liquid*))

Selecting Verbs[11]

a. PHYS.OBJ: posare 'put down', porgere 'give', alzare 'lift', lavare 'wash', rompere 'break', afferrare 'grasp', sollevare 'lift'
b. PHYS.OBJ⊗$_{Telic}$hold: riempire 'fill', vuotare 'empty', svuotare 'empty', colmare 'fill'

[8] It is still somewhat unclear whether the type selected by *ascoltare* is SOUND or SOUND●INFO. However, we will simplify for the present discussion.

[9] We define the *source type* of a noun as the type associated with it outside the coercive context.

[10] Following a proposal in Rumshisky et al. (2007), under the label *Object* we list the nouns filling the direct object slot wrt. the target verb, clustered per semantic type.

[11] In (3) selectors are grouped according to the type of coercion at play (indicated by Q-E, E-I) instead of their semantic type, as in (2) above.

c. Q-E, where $\otimes_{Telic}$hold(liquid): bere 'drink', sorseggiare 'sip', versare 'pour', tracannare 'gulp down', scolarsi 'down'
d. E-I, Q-E where $\otimes_{Telic}$hold(liquid): finire 'finish'

Ex. torna al tavolo, si *versa* un altro bicchiere, e lo *beve* alla stessa maniera del primo.
'he returns to the table, pours another glass and drinks it just as he drank the first one'.

Ex. non faccio in tempo a *finire* il mio bicchiere che viene un mio amico.
'before I can even finish my glass, a friend arrives.'

The examples in (3) are interesting because they actually show different compositional mechanisms induced on the same object. In particular, (3a) may be accounted for as an *accommodation*, where only the head of the type associated with the noun (PHYS.OBJ) is exploited in composition[12]; (3b) represents a case of *pure selection*, where there is perfect matching between selecting and selected type (CONTAINER in both cases); (3c) may be considered a *Qualia Exploitation*, in which the Telic role of the noun is acted on by the verb. Finally, (3d) represents a more complex case of coercion, where exploitation of the Telic Quale of the noun occurs as a response to the introduction of an event (E-I) typically related to the Quale, by the predicate *finish*.

In contexts where selecting and selected type do not match (i.e. under coercive contexts), the type call of the verb must be satisfied in some way for a coercion to be successful. For example, in the case of *ascoltare*, there must be a SOUND meaning component in the semantics of the co-occurring noun for the operation not to fail. If this is the case, Qualia exploitation may occur as a response to the type call of V (*ascoltare la radio*). If SOUND is missing, the exploitation of Qualia cannot take place and the compositional operation fails (*listen to the table) or results in an introduction ("listen to the clock").
All this suggests that selectional restrictions apply not only to semantic types, as in an ontology based on ISA links (as selectional restrictions are usually interpreted) but also to more granular dimensions of meaning, such as Qualia. This goes in the direction of highlighting the relevance of these other meaning dimensions captured by Qualia in compositional processes of meaning modulation.

7 Annotating Qualia in coercive predicate-argument selection

As we have mentioned above, in its current version, the GLML annotation scheme groups together under the label "coercion" phenomena of different kind: Exploitation of dot objects: *listen to music* (an operation close to Pure Selection); Exploitation of Qualia: *listen to the wind*; Introduction: *open the wine*.

In the following we discuss how GL annotation of coercion phenomena can be improved by integrating Qualia annotation inside predicate-argument constructions, which can help in capturing the different types of coercions. It is not the goal of this proposal to explicitly annotate the different coercion mechanisms, but to provide means to identify them, also for further investigation. The underlying assumption here, in line with the theory, is that lexical knowledge is more complex than a representation of semantic type and other "classical" lexical relations (e.g. synonymy, antonymy, hyperonymy,…). Lexical knowledge integrates at least part of our world knowledge, or metaphysics (cfr. Asher and Pustejovsky, 2006), and the Qualia Structure is a useful representational means for capturing this.
Additionally, the resulting annotated corpus could be of great use not only for training and testing automatic methods for metonymy recognition, but also for the extraction of semantic relations (cf. Yamada et al., 2007; Cimiano et al., 2005; Bouillon et al., 2002).

7.1 A Generative Lexicon annotation of coercion phenomena

An effort has been done at Brandeis to "translate" (a part of) the theoretical apparatus of the GL theory into the GLML annotation framework (Pustejovsky et al., 2009), which tries to establish not only a mark-up language, but also an annotation methodology for type shifts and Qualia roles. Here we briefly introduce the annotation steps currently foreseen for the 2010 SEMEVAL-2 "Argument Selection and Coercion" Task.

Once the dataset is constructed, as explained in 4 above, the annotation of coercions is currently organised into three main steps:

[12] According to Pustejovsky 2006, artifactuals may be analyzed as types with an asymmetric internal structure consisting of a *head* that defines the nature of the entity and a *tail* that defines the various generic explanatory causes of that entity (i.e., a Quale). For instance *beer* = LIQUID$\otimes_{Telic}$*drink*.

1) sense disambiguation of the verb in each context/sentence,
2) identification of a possible mismatch between the usual sense type of the noun w.r.t. the type required by the verb;
3) specification of the typical sense type of the noun in case of mismatch.

As the task is conceived now, cases where the noun type satisfies the verb requirements are (automatically) annotated as instances of SELECTION, whereas cases where the noun does not would be annotated as COERCIONS.

7.2 Integrating Qualia annotation in coercive predicate-argument constructions

As mentioned in section 2, the annotation of Coercion proposed so far in GLML (Pustejovsky et al. 2008) captures the type shifting (more specifically, the *source-target* shifts) but does not explain why coercion may take place in certain contexts and not in others, as in (4) below.

(4)
ascoltare la radio
**ascoltare il tavolo*
PHYS.OBJ →SOUND

What we propose here is to enhance this task by including the annotation of the Quale involved in the coercion, which would allow for a better understanding of the sense modulations taking place in coercions. Furthermore, we would like to annotate, where relevant, the licensor(s) for that mechanism (typically in Qualia Exploitation), and mark not only the Qualia type involved in the coercion and but also, if possible, the Qualia value, or relation:

PHYS.OBJ$\otimes_{\text{Telic}}$*produce_sound* →SOUND

With this task in mind, we have explored the possibility of making use of information encoded in existing lexical resources or dictionaries, taking them as "simulations" or "approximation" of human lexical knowledge. This approach may have some limitations imposed by the choices/approaches taken for the construction of the resource, by the "imperfection" of manually built resources (missing entries, incomplete information, possible arbitrary sense assignment…).

The general principle governing generative operations would not be theoretically damaged by following such an approach: whatever the lexical representation in the resource/mental lexicon, the mechanisms would work. In the case of *wine* for example, if our lexical entry specifies in its constitutive role that it is typically contained in glass, bottle, barrel, then the coercion operation according to GL would be identified as an exploitation; whereas, if our lexical entry encodes only inherent properties of the entities denoted and therefore does not specify any container, then the operation would be an introduction[13]. In either case, a coercion operation would be successfully recognized.

Thus, we considered the opportunity to use the SIMPLE-PAROLE-CLIPS [14] lexicon (Lenci et al., 2000) as a possible background resource for Qualia annotation in type coercions. The analysis conducted so far, however, bring about some problematic issues, as exemplified below.

Using SIMPLE semantic entries
As an example, we report some cases with the verb *ascoltare* 'listen to' above (assuming its semantic template is "[HUMAN] *ascolta* [SOUND]" as found through a CPA-like analysis of the corpus). Looking at the Lexical Representation of the senses of the nouns in direct object position, we find that, although rich in semantic information given, this is difficult to be directly exploited in annotation, beyond the obvious problems of sense disambiguation.

Below, we briefly discuss some examples, concentrating on the lexical representation of the nouns involved. Note that here we give an extremely simplified version of the sense representation, displaying only the information that would be relevant for our annotation task. (QS stands for Qualia Structure).

(5) *Ascoltare le campane* 'listen to the bells'

Campana 'bell'
Semantic Type: INSTRUMENT
QS
Formal = Isa.strumento 'instrument'
Telic = Usedfor.suonare 'to sound/ring'

[13] These issues bring into the discussions theoretical questions of the nature of lexical meaning vs. world knowledge and of the boundaries between the two, which go beyond the scope of this paper. What is important here is that type coercions involve deeper meaning dimensions captured by the Qualia Structure.
[14] The SIMPLE-PAROLE-CLIPS is a manually constructed semantic lexical database initiated within the EU SIMPLE project covering 12 languages and integrates features of the Generative Lexicon theory, in particular the Qualia Structure.

(5) is a good example in that the Qualia Structure of the noun has a somewhat direct reference to the sound production in the Telic Quale, *suonare* 'to sound/ring'. In such a case, an exploitation operation would be easily and successfully recognized.

(6) *Ascoltare la radio* 'listen to the radio'
Radio 'radio'
Semantic Type = INSTRUMENT
QS
Formal = Isa.apparecchio 'tool'
Telic = Usedfor.ascoltare 'listen to'

In order for the coercion of INSTRUMENT (or OBJECT) to SOUND to be licensed in (6), the Qualia structure should contain some meaning dimension related to a sound event. Intuitively, the Telic role should refer to the fact that a radio typically produces, or emits, sounds. This is not the case for this particular SIMPLE entry, which however specifies another Telic relation still related to sounds and directly related to the verb meaning.

In such an example therefore, using the resource to prompt and guide the human annotator would correctly lead to the identification of the Quale acted on by the verb, and thus indirectly of a case of exploitation.

(7) *Ascoltare un collega* 'listen to a colleague'

collega 'colleague'
Semantic Type: kinship > human
QS
Formal = Isa.persona 'person'
Constitutive = Ismemberof.società 'society/company'

This is a more critical example. The Qualia structure of the entry (7) does not contain any reference to a sound emission event nor even specify a Telic role. In this case, in the annotation a new Qualia relation would have to be introduced, thus indirectly signaling this as a case of Introduction. However, it could be argued that a typical activity (that is, a telic relation) of humans is talking/speaking, clearly related to sound emission. Therefore, if such a meaning dimension was encoded in the entry of the hyperonym *persona* 'person', this could be inherited by *collega*. Again, this is not the case in SIMPLE. Moreover, it is questionable whether to encode such information, being the notion of intrinsic lexical meaning not so clear-cut.

Additional complications of using the SIMPLE resource, at least at this stage, are related to the granularity of the semantic type system, and on the possible arbitrary assignment of senses to semantic types.

In conclusion, although the model is well equipped with the useful representation devices for capturing and motivating coercion operations, the actual, human-made, resource can not be fully trusted for the purpose of this first annotation phase. However, part of the information contained in the lexicon could be exploited as a potential source of information: we think here at the taxonomy of Qualia relations worked out in SIMPLE (also known as the Extended Qualia Structure (EQS, cfr. Lenci et al. 2000)). On the reverse, the annotation effort could serve the purpose of improving the resource providing the encoding of missing Qualia relations useful for coercion.

An operational proposal for annotation

An alternative methodology for the annotation of Qualia in coercive predicate-argument constructions, which requires minimal pre-existing knowledge and therefore minimal effort in the preparation of the dataset as well as minimization of inconsistencies, is to prompt the user to indicate the meaning dimension activated by the verb on the basis of the semantic type of the noun previously indicated in step 3 (see section 7.1 above)[15]. After the annotator has decided whether the semantic type of the noun corresponds to the verb semantic restriction, s/he will have to choose the Quale acted upon and possibly the specific relation, or meaning dimension.

For this task, the annotator should be proposed a set of relations that are compatible with the Qualia "active" for its semantic type (see Pustejovsky, 2001, for the distinction into Natural Types, Artifactual Types and Complex types).
Here, we can use some of the information encoded in the SIMPLE lexicon to prepare the prompts as addition/specification of the relevant

[15] In Pustejovsky et al. 2008 (section 5.2) a similar procedure is used to identify Qualia relations between nouns and their governing predicates, with the focus on the noun. Our proposal, however, differs insofar as we focus on the coercive contexts with the goal of identifying the Qualia dimension exploited or introduced by the coercive predicate, in order to fully reconstruct the compositional operations at play.

Qualia for the three main types above, both by accessing to the Qualia defined for the noun Semantic Type[16]. However, the possibility to select for other Qualia should also be left open. Furthermore, because we are interested also in identifying the specific relation that is activated by the coercion, the specific Qualia relations defined in the EQS (or a subset of them) could be proposed to the annotator, who will choose from them, or add a new one if necessary.

This first annotation experiment will be useful for further refinement of the annotation methodology and will give us more insights on how to use existing lexical knowledge to assist the annotation. On the other hand, Semantic Type and Qualia annotation in coercive contexts will help us improve the existing lexical resource with information details relevant for a task of coercion or metonymy identification.

8 Conclusions

Our main goal in this paper was to provide the motivation for integrating the annotation of the Qualia acted on by coercive verbs in predicate-argument constructions.

Despite the theoretical and practical problematic issues underlying coercions and semantic annotation in general, we hopefully have shown the robustness of the generative coercive operations and the importance of an annotation task aiming at making them explicit to enhance automatic recognition and interpretation.

What is important at this stage, however, is that different meaning dimensions, captured as Qualia, play a fundamental role in guiding the compositional operations that allow for sense modulation in language use, and that these dimensions underlie different types of coercions in different but similar ways. The annotation not only of the type shift, but also of the meaning dimensions at play in them is crucial especially for further investigation of such different mechanisms, and for systems to have more predictive power in identifying coercions. The outcome of such an annotation exercise moreover will also lead to improvements of the existing resources with meaningful information relevant for interpretation purposes.

This paper, however, also aimed at raising critical issues regarding this type of annotation and at stimulating a reflexion on how to better refine/construct a good annotation methodology.

[16] Semantic Types in SIMPLE are represented as templates, which define among, other things, their Prototypical Qualia.

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