Grounding Conceptual Modelling Templates on Existing Ontologies
A Delicate Balance

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Abstract: Using templates for conceptual modelling is becoming a fashionable way to guide and facilitate Domain Experts in providing rich and good quality knowledge. A possibility to build templates without starting from scratch is grounding them on existing foundational and core ontologies. In this paper we investigate *how* these ontologies can be effectively used for the construction of templates able to guarantee a balance between usability and rigorousness. We report findings and lesson learned from a survey carried out for the evaluation of templates built from existing foundational and core ontologies in the enterprise domain.

1 INTRODUCTION

Effectively involving domain experts in the process of *authoring* OWL ontologies, making them able not only to provide domain knowledge to knowledge engineers but also to directly write ontologies on their own or together with knowledge engineers, is increasingly recognised in a number of works (see e.g., (Dimitrova et al., 2008; Tudorache et al., 2010)) as a crucial and challenging step to make the construction of ontologies more agile and apt to the needs of organisations and business enterprises.

A popular way of involving domain experts in authoring conceptual models is to provide them with graphical languages (diagrammatic representations). Nevertheless, as argued in (Kop and Mayr, 2011) and briefly summarised in Section 2, diagrammatic representations are often adequate to represent only part of the knowledge that needs to be contained in a conceptual model, but are not used to render more complex knowledge such as axioms and properties of relations. *Templates*, usually constituted by tables, forms, controlled language sentence patterns or any other kind of structured textual information, have been proposed in literature as an effective way of "encapsulating knowledge and modelling recurrent sets of axioms" in ontology engineering (Parreiras et al., 2010) and have been used in existing tools such as MoKi (Di Francescomarino et al., 2012), COE (Hayes et al., 2005) and Populous (Jupp et al., 2012) to complement graphical languages and guide domain experts to describe ontology elements in a structured textual fashion. Templates, however, are difficult to build. They have to balance the needs of both domain experts and knowledge engineers, i.e., being usable but also rigorous enough. Moreover, methodologies for the definition of usable and rigorous templates need to be put in place, in order to facilitate their adoption and the customisation of tools that make use of them to specific scenarios.

In this paper we propose our approach along with a concrete method to build templates based on a mixture of foundational, mid-level and domain specific ontologies, and we evaluate it through a survey conducted with domain experts and knowledge engineers. More in detail we investigate the ease of understanding, usefulness, completeness and correctness of templates for modelling key entities of an enterprise ontology based on 23 foundational, mid-level and domain-specific ontologies. The main findings of our analysis are the following: (i) grounding templates on existing ontologies allows the construction of templates usable and rigorous enough; (ii) grounding templates on foundational or mid-level ontologies and characterising them with specialised domain ontologies allows us to reach the right level of granularity of templates, thus making them more usable and precisely characterised; (iii) domain experts perceive template usability more positively than knowledge engineers, thus validating the key role of templates in supporting domain experts.

To the best of our knowledge, the evaluation performed in this paper provides a first empirically rigorous evaluation of the support provided by a wide

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range of existing ontologies to the definition of structured forms that can guide domain experts in ontology modelling and therefore highlight, in a comprehensive manner, the potential and criticality of using existing ontologies as a base for template-based approaches.

2 TEMPLATE-BASED CONCEPTUAL MODELLING

As extensively described in (Kop and Mayr, 2011), template-based approaches have been used as an effective method to elicit knowledge in the area of software engineering and database in the last 40 years. By *templates*, we refer here to any kind of structured textual information (such as tables, forms, controlled language sentence patterns) were the meaning of the textual information contained in the template can be determined according to its position within the structure. The first examples were tabular representations for the description of software functions (Janicki et al., 1997), and glossaries for a structured description of terms relevant for a domain used in database design methodologies such as DATAID (Albano et al., 1985) and more recently in the KCPM (Klagenfurt Conceptual Predesign Model) template-based modelling language (Vöhringer and Mayr, 2006). With the advent of object-oriented analysis and design, and of popular graphical modelling languages for the representation of use cases such as UML (Unified modelling language), templates remain an effective way of complementing the graphical use case description with detailed information (Cockburn, 2000), which usually constitutes the biggest portion of knowledge of a conceptual model[1].

In the last few years several works have started to propose templates also to support Ontology Engineering activities in order to encapsulate complexity and to better involve domain experts in the activity of ontology authoring (Parreiras et al., 2010; Di Francescomarino et al., 2012; Hayes et al., 2005; Jupp et al., 2012). Among the main advantages of introducing templates in Ontology Engineering listed in literature are: (i) a *decrease in complexity*, as templates hide the complexity of the axioms and expose only the required parameters to be filled in; (ii) an *increase in efficiency* of modelling, as templates can be reused in the modelling of several ontologies; and (iii) an *increase in reliability*, as templates comprise set of axioms developed by domain experts who, therefore place domain knowledge at the heart of the modelling process.

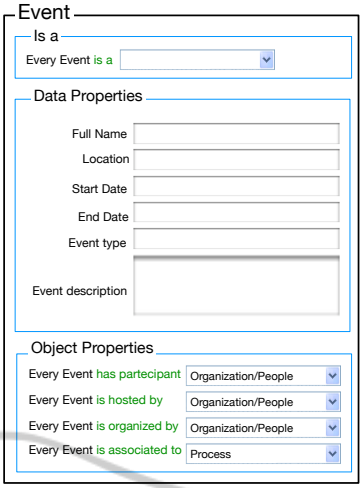

Figure 1: A template for "Event".

Templates in MoKi. MoKi[2] is a collaborative MediaWiki-based[3] tool where teams of knowledge engineers and domain experts, with different knowledge engineering skills, can actively collaborate to author ontologies. To foster collaboration MoKi provides two different modes to access the formal content of an ontology: a *fully-structured* access mode, where knowledge engineers can edit the ontology content by means of OWL axioms, and a *lightly-structured access mode*, where domain experts can edit the ontology content by means of a simplified, template-based, view on the (same) formal description. As argued in (Di Francescomarino et al., 2012), the ability of easily customising interfaces to create ad hoc templates such as the one in Figure 1 is one of the advantages of MoKi, and of MediaWiki-based tools in general.

However, defining ad hoc templates such as the one drafted in Figure 1 that can be used by domain experts to: (i) refine / adapt the characterisation of the concept to the specific domain; (ii) model more specific concepts (e.g., a concept "Product launch event"); and (iii) populate the ontology with specific instances of the concept (e.g., the instance "Fiat 500 UK launch event") is a difficult and time consuming task, as templates need to be produced by balancing usability and rigorousness aspects.

To address this problem we have investigated an

[1] In (Kop and Mayr, 2011), Kop and Mayr portray the information contained in a conceptual model as an iceberg, whose visible part is constituted by the graphical representation, and whose hidden (biggest) part is contained in additional textual descriptions such as templates.

[2] A comprehensive description of MoKi is omitted for lack of space. The interested reader can refer to (Di Francescomarino et al., 2012) and http://moki.fbk.eu

[3] http://www.mediawiki.org

approach which builds templates which we present and evaluate in Sections 3 and 4. Note that while the work presented here is motivated by the work on MoKi, the approach and the evaluation do not depend upon MoKi. Therefore they can provide an insight on the potential and problems of using existing ontologies to structure templates for ontology engineering.

3 BUILDING TEMPLATES FOR ENTERPRISE ONTOLOGIES

In this section we provide an overview of the approach we followed to construct templates for the domain of Enterprise Ontologies. We selected this domain as this provides an important use case where domain experts are usually involved, but the suggested method can provide suitable guidelines for the definition of templates to support the task of ontology engineering in a wide range of specific domains.

The Approach. The approach relies on building the templates based on a model extracted from a range of ontologies, which include foundational, mid-level and domain-specific ontologies. The reason to ground templates on existing ontologies, instead of building them from scratch, is that of exploiting the ontological analysis performed and modelling patterns already encapsulated in well crafted ontologies, and of making them available to domain experts to reuse and adapt. The reason to exploit a number of existing ontologies, ranging from foundational to mid-level, to specific ones is to evaluate the appropriateness of the different resources to the specific task.

The Realisation. The method we have followed is composed of four macro steps.

As a first step, we focus on selecting entities relevant to our problem domain (together with their related axioms) from foundational ontologies. The reason to start from foundational ontologies is that they contain a well founded characterisation of the foundational ontological categories, and therefore provide a good a starting point for building good quality ontologies. In our study we decided to use the DOLCE ontology (Masolo et al., 2003), which, we believe, provides a good reference ontology on a wide range of domains which encompass the one investigated in our experiment.

The second step concerns the complementation / specification of the entities selected from the DOLCE ontology with entities selected from core (mid-level) ontologies. In fact, while grounding the templates on DOLCE helps us to start from a rigorous characterisation of the entities they have to describe, we need to produce templates for entities that are usually more specific than the categories contained in a foundational ontology. Mid-level ontologies provide the best candidate for this task as they usually describe specific (yet general) concepts for a particular domain. Since we started from DOLCE we decided to first review mid-level ontologies that are produced either as extensions of DOLCE (see e.g., the Ontology of Social roles presented in (Masolo et al., 2004)) or grounded on DOLCE (see e.g., (Boella and van der Torre, 2006)) and to select entities relevant to our domain together with their characterisation.

The third step concerns thebuilding of taxonomy by using the *is-A axioms* (among entities) selected in the first two steps. In our case this resulted in a taxonomy of 20 entities, whose relevant part is illustrated in Figure 2. The leaves of this taxonomy constitute the entities to be characterised in the templates (7 in our case). Note that while reviewing the mid-level ontologies we found out that some of the entities we were interested in are contained both in foundational and mid-level ontologies. In our experiment that was the case for "event" and "process". In Figure 2 we have decided to depict the entities in the most abstract type of ontology in which they were found. Thus "event" and "process" are listed among the entities coming from foundational ontologies. We also found out that several entities are contained in more than one mid-level ontology. In these cases we decided to merge the characterisation of the entities contained in the different ontologies to produce a more comprehensive one, and possibly to solve some conflicting issues, which were nevertheless extremely limited in our experience.

The final step concerns the complementation of the characterisation of the different entities with knowledge coming from domain-specific ontologies. In our scenario we looked at domain-specific ontologies such as The Enterprise Ontology (Uschold et al., 1998) and Schema.org[4].

By applying the method above we built an ontology of 20 concepts, 86 relations and 159 axioms which has provided the basis for the construction of the templates for Organization, Actor, Role, Process, Event, Task, and Artefact. In detail, the ontology Description Logic axioms have been used for the automatic construction of the templates. A description of the ontology and of the resulting templates is omitted for lack of space and can be found in (Ghidini et al., 2012).

[4]http://schema.org

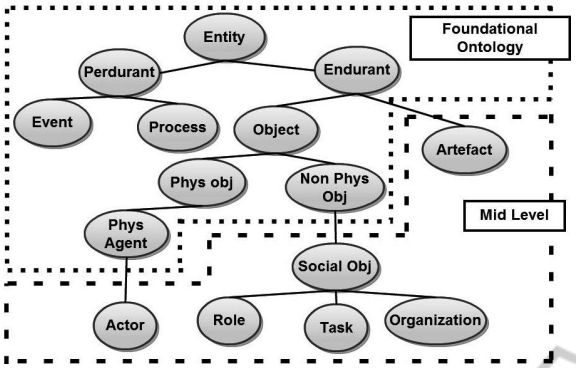

Figure 2: A case for Enterprise Model.

4 EVALUATION

We are interested in investigating whether templates built starting from existing ontologies can be used to support domain experts in ontology modelling while preserving the rigorousness and the accuracy characterising the good principles of knowledge engineering. These templates should indeed be able to fill the gap between Domain Experts and Knowledge Engineers while balancing usability and rigorousness. In order to evaluate whether they can suit the different requirements they are supposed to satisfy, we built (Section 3) a set of templates grounded on different existing ontologies ranging from foundational to specific domain ontologies and we asked experts to evaluate them.

4.1 Description

The *goal* of the evaluation is investigating (i) the usability (in terms of ease of understanding and usefulness) of templates built starting from existing ontologies and (ii) their capability to completely and precisely capture the modelling needs of the specific domain, as perceived by both Domain Experts and Knowledge Engineers. The research questions we are interested to evaluate are:

RQ1. Are templates built from existing ontologies perceived as *easy to understand* and *useful* by Domain Experts and Knowledge Engineers?

RQ2. Are templates built from existing ontologies able to *completely* and *precisely* satisfy the modelling needs of a specific domain according to Domain Experts and Knowledge Engineers?

In order to answer the above research questions, we provided the seven templates described in Section 3 and we asked a group of Domain Experts and Knowledge Engineers to answer a questionnaire investigating four main factors: (i) ease of understanding; (ii) usefulness for ontology modelling tasks; (iii) characterisation completeness, i.e., how good is the proposed characterisation to include relevant and necessary properties and (iv) characterisation precision, i.e., how good is the proposed characterisation to omit redundant and useless properties for each template. We used the subjective perception expressed by subjects about the first two factors for investigating whether templates built using well known existing ontologies are actually easy to understand and useful (**RQ1**) and the last two factors for a subjective evaluation on the feasibility of the usage of ontological resources for addressing domain modelling issues (**RQ2**).

The subjects involved in the evaluation were 43: 19 Domain Experts (mainly enterprise workers) and 24 Knowledge Engineers (both modelling experts and ontologists). We asked each of them to evaluate a set of three (*Role*, *Artefact* and *Actor*) or four (*Organization*, *Task*, *Event* and *Process*) templates.

Each template has been evaluated by means of a set of questions belonging to two categories: (i) closed-ended questions, where answers were selected from a 5 point Likert-scale, (ii) open-ended questions, where participants were allowed to provide suggestions for improving the templates. In detail, we used closed-ended questions and 5 point scales for asking experts their subjective perception about template ease of understanding (0=immediate, ..., 2=reasonable, ..., 4=complex), usefulness (0=absolutely useful, ..., 2=neither useful nor useless, ..., 4=absolutely useless) and completeness (0=totally complete, ..., 2=neither complete nor incomplete, ..., 4=totally incomplete). For the precision, instead, subjects were asked to evaluate, for each template characterisation, whether they would keep or discard it (yes/no answer). For each template, we used the collected answers to compute the *subjective precision* of each expert. According to the classic information retrieval precision metrics, we computed the *subjective precision* as the ratio between the number of characterisation properties provided and evaluated as correct by the expert and the total number of characterisation properties provided. We then classified the values of each subjective precision in three categories: *high* (100% precision, i.e., the subject agreed on all the provided template characterisations), *reasonable* (the precision is between 66% and 100%, i.e., more than $2/3$ of the characterizations have been judged correct), and *low* (less than 66% of precision).

4.2 Results

Here we report the results of our observations and the statistical analyses we applied to strengthen these results. In detail, to assess the positivity of the experts' evaluations, since values are derived from an ordinal scale, we test medians using a one-tailed Mann-Whitney test (Wohlin et al., 2000), verifying the hypothesis that $\tilde{F} \leq 2$, where F can be each of the four factors under investigation, $\tilde{F}$ is its median and 2 the intermediate value of the scale. All the analyses are realized with a level of confidence of 95% (p-value < 0.05), i.e., there is only a 5% of probability that the results are obtained by chance.

Table 1 reports the percentage distribution related to the answers provided by subjects for **RQ1** and **RQ2**. For the sake of readability, in reporting the percentage distribution, we group together the two positive and the two negative values of the three 5 point scales, thus reporting the percentages on 3 point scales, the same used for the subjective precision (*high*, *reasonable* and *low*). For each of the factors, the *median value* of the provided evaluations is 1.

Considering the above results, it comes out that subjects perceived the templates as overall easy to understand (the median value is 1, i.e., *easy* on the 5 point scale). Such a overall positive evaluation is also confirmed at statistical level (p-value < 0.05). Indeed, by looking at the distribution of the provided answers, more than half of them state the easy understanding of templates, while in only 11% of the cases the templates have been evaluated difficult to comprehend. Nevertheless, the number of answers that are not clearly positive or negative is not trivial (about 33%). Considering the distribution of these "answers in the middle" per template, we found that the high number of *reasonable* answers, can be partially connected to the *Role* template. Indeed by looking at Figure 3 (left), showing the subjective evaluation related to ease of understanding for each template, the criticality of the *Role* template is quite evident: 62.5% of the subjects expressed a borderline answer for this template.

Subjects provided an overall positive evaluation also with respect to template usefulness. The median value of the evaluation on the 5 point scale is indeed 1, i.e., *useful*. The result is also statistically confirmed with a level of confidence of 95% (p-value < 0.05) by the Mann-Whitney test. Templates have been judged overall *useful* in almost 65% of the cases versus the 15% of *useless* evaluations. In this case, the borderline answers were about 20% and, one of the reasons for these uncertain answers, could be the lack of usage of the templates in a real setting. Indeed, most of the uncertain (*neither useful nor useless*) answers (96% of the uncertain answers) has been provided by Knowledge Engineers who have a less deep knowledge of the specific domain, i.e., the enterprise one.

Table 1: Statistical measure of the survey results

RQ	Factor	Rate	Percentage
RQ1	Ease of Understanding	easy	55.3%
		reasonable	33.3%
		difficult	11.4%
	Usefulness	useful	64.9%
		neither useful nor useless	20.2%
		useless	14.9%
RQ2	Completeness	complete	56.1%
		neither complete nor incomplete	25.4%
		incomplete	18.4%
	Precision	high	82.5%
		reasonable	14.9%
		low	2.6%

We can hence conclude that overall *easy to understand* and *useful* templates can be built starting from existing ontologies and hence positively answer **RQ1**.

The third row of Table 1, reports the distribution of the survey answers related to the characterisation completeness. Experts evaluated the characterisations as overall complete: the median value is 1, i.e., *complete* in the 5 point scale, with $\tilde{Compl} < 2$ (p-value < 0.05). In this case, although more than half of the evaluations were positive, the percentage of the negative ones is slightly more than for the other factors (18%). Similarly to the usefulness evaluation, most of the 25% of uncertain answers (79.3%) was provided by Knowledge Engineers, who are overall more rigorous about what a complete characterisation is.

Finally, the fourth row of Table 1 reports the values related to the precision of the template characterisation. Overall the precision is high: the median is 1, i.e., the highest value and $\tilde{P} \leq 2$ (with p-value ≤ 0.05). Indeed, most of the evaluations (82%) are high, while only a small percentage (2.6%) is negative.

Considering the results related to characterisation completeness and precision we can hence positively answer **RQ2**: ontology-based template characterisations are perceived as overall complete and precise.

4.3 Findings and Discussion

The analyses of the data carried out for answering the above research questions suggest that differences exist in the perception of Domain Experts and Knowledge Engineers, as well as in their evaluation of the different templates.

Surprisingly, it seems that, on average, Domain Experts judged template ease of understanding, use-

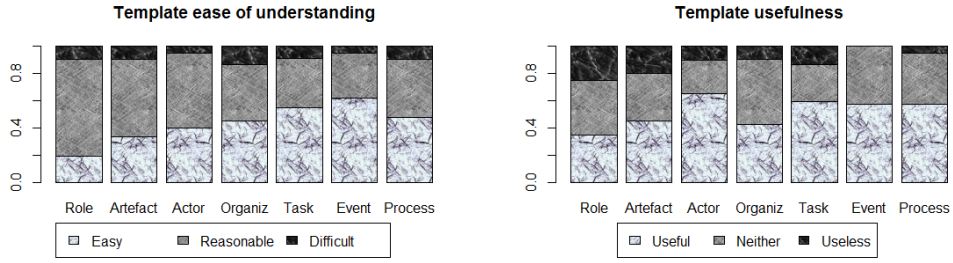

Figure 3: Template usability subjective evaluation.

fulness and characterisation precision slightly more positively than Knowledge Engineers. Indeed, the average evaluations of Domain Experts for the ease of understanding, usefulness and characterisation precision (1.67, 1.61 and 1.24, respectively) are slightly higher than those provided by Knowledge Engineers (1.64, 1.58 and 1.17). On the contrary, the completeness of the template characterisation has been evaluated slightly more positively by Knowledge Engineers (1.68 for Domain Experts versus 1.73 for Knowledge Engineers). This result, that confirms the validity of ontology-based templates in supporting Domain Experts, can be partially explained by considering the different competencies and objectives guiding the two roles. Domain Experts, indeed, are interested in the practical issues related to the modelling of the domain. They want templates that are useful to describe the entities of the domain without caring whether terms used for/in the template could also convey other meanings in other contexts. On the contrary, Knowledge Engineers are more focused on the formal part: from their perspective, a term is easy to understand if it is enough detailed and formal so that its semantics cannot be confused; similar criteria also apply for usability and precision of template characterisation.

Differences among templates, instead, clearly come out by looking at the distribution of the users evaluations about the four investigated factors across the templates (Figure 3 and Figure 4). Figure 3 shows that the evaluations related to ease of understanding and usefulness of the *Role* template are the worst ones. On the contrary, the *Event* and the *Task* templates seem the easiest to understand and the *Event*, *Task*, *Process* and *Actor* templates the most useful. Slightly different is the completeness case in which (Figure 4, left) the most problematic template is the *Organization* one, that is the template characterised by the highest number of properties. Finally, looking at the evaluations for the characterisation precision (Figure 4, right), we found again that the *Event* and the *Process* templates outperform the others, while the *Role* and *Actor* characterisations are less precise.

With the aim of investigating the reasons behind the criticality of some of the templates (e.g., the *Role* template) and the positive perception of others (e.g., the *Event* template), we looked more in detail at how they have been built and at the ontologies they have been grounded on. Overall, two (including the outperforming *Event* template) out of the seven templates are defined in foundational ontologies (other than in mid-level and domain-specific ontologies). Table 2 reports for each template, the most abstract category of ontology in which the entity is defined, as well as the percentage of characterisation attributes and properties belonging to foundational, mid-level or domain-specific ontologies, respectively. Finally, it also reports the percentage of attributes and properties used to complete the characterisation, as well as the percentage of properties common to more than two ontologies.

The table reveals that differences exist in the template composition (in terms of ontology categories used for their construction). Crossing these data with the users' evaluations we found that the largest part of the characterisation of the templates that has been perceived easier to understand and more precisely defined than the others (i.e., the *Event* and the *Task* templates), comes from domain-specific ontologies. This result is also confirmed at statistical level. Indeed, we found a strong positive correlation [5] between the percentage of characterisations deriving from domain-specific ontologies and the average evaluation of both ease of understanding and characterisation precision. In other terms, the percentage of specific properties is directly proportional to the template ease of understanding and precision. On the contrary, a negative correlation exists between the percentage of attributes and properties from mid-level ontologies and the average perception of ease of understanding, usefulness and characterisation precision. A second factor that seems influencing the perception of both ease of understanding and usefulness is the number of different source ontologies sharing the same property or attribute. Surprisingly, characterisations shared by more than two ontologies seem to negatively affect

[5] We performed a correlation analysis applying the Pearson's coefficient at 95% confidence level.

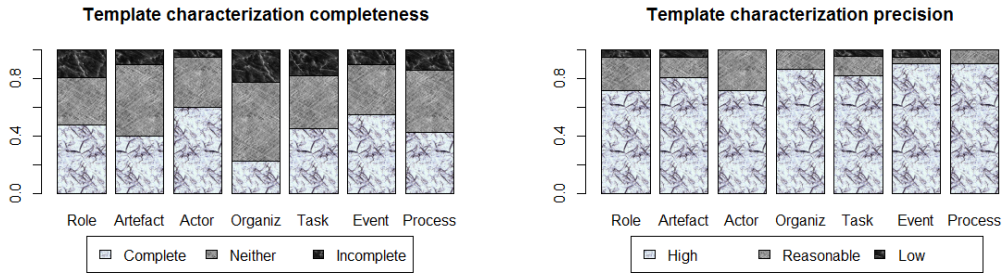

Figure 4: Subjective evaluation of the template characterisation completeness and precision.

Table 2: Source ontologies used for building templates.

Template	Most abstract ontology category	Foundational	Mid-level	Domain-specific	Other	Shared by > 2 ontologies
Role	mid-level	0	93.8%	0	6.3%	37.5%
Artefact	mid-level	0	75%	8.3 %	16.7%	14.3%
Actor	mid-level	23.5%	58.8%	5.9%	11.8%	0
Organization	mid-level	10 %	40%	30%	20%	0
Task	mid-level	0	40%	40%	20%	0
Event	foundational	7.7%	15.4%	46.2%	30.8%	0
Process	foundational	8.3%	50%	33%	8.3%	0

the overall perception of the ease of understanding and usefulness of the template. This result can also be connected to the negative correlation between too generic characterisations and their usability.

Summarizing, hence, (i) we found that grounding templates on foundational and core ontologies, allows the construction of templates usable (6 out of 7 templates were perceived as easy to understand and useful by more than 50% of the subjects) and rigorous (the characterisation of 6/7 of the 7 templates has been judged complete/precise by more than 50% of the evaluators). Moreover, (ii) we observed that to improve the (perceived) usability of the templates, the right level of granularity has to be devised by opportunely grounding templates on foundational or mid-level ontologies and characterising them also with specialized domain ontologies. Finally (iii) we validated the usability of ontology-based templates by Domain Experts.

Threats to Validity. Despite the rigorousness and the care used for conducting the survey and for analyzing the results some threats can hinder the result validity. A first threat is related to the lack of usage of the templates in real-life tasks. Nevertheless, the templates were accompanied with a description of a possible scenario, thus helping the subjects to figure out a possible practical use case for the template usage. A second threat is the subjectivity that has been used for building the templates. The impact of this threat, however, is partially limited by the definition and the use of method for the construction of the templates. Finally, the specificity of the domain considered is a further threat to the validity of the study. On the other hand, the enterprise domain is a quite general domain in which Domain Experts are often involved.

5 RELATED WORK

Works dealing with templates based approaches in the ontology engineering field can be mainly classified in two categories: those focused on the ontology structure and those oriented to both structural and domain knowledge.

In (Parreiras et al., 2010), authors presents a approach to support ontology engineers in modelling of ontology templates. They have demonstrated their approach with templates for ontology design patterns. This work is different from our approach as it is more focused toward knowledge engineers and it needs to be extended, the usability aspect have not been studied and it has not been used for top level ontologies. Also in MoKi (Di Francescomarino et al., 2012) templates are mainly used for providing structural support to the ontology authoring. The lightly-structured view, indeed, provide a semi-formal rendering of the OWL content in a predefined template to support domain experts access to the content of the ontology. The work of this paper will extend a tool like MoKi with a set of templates grounded on existing foundational ontology and core ontologies instead of starting from scratch.

A slightly different approach is the one of Popu-

lous (Jupp et al., 2012), a template based approach designed for domain experts to gather knowledge that can be used to build ontologies. In Populous the authors advocate the use of spreadsheets as templates to gather and organise information about concepts and their relationships as it provides a simple and intuitive form fill-in style of user interface. However, the main purpose of this approach is knowledge gathering, the *population* of the templates at the point of data entry, and not ontology building. In this paper, instead, we focus on the complexity of building usable and rigorous templates. Another approach that uses templates to capture experts knowledge is presented in (Hayes et al., 2005). In order to acquire knowledge from experts this approach allows users to structure their knowledge by using concepts maps or the formalised knowledge structures defined as templates. The templates in this approach corresponds to commonly used owl structures (e.g., subclass, instance, owl restrictions), they do not help very much in the overall structure of the ontology.

6 CONCLUSIONS

The paper shows, through a rigorous evaluation, that templates based on existing foundational and core ontologies are able to reconcile usability and formality dimensions, ensuring ease of understanding and usefulness while guaranteeing completeness and precision. As a side effect of our evaluation we provide some insights about the relation between the different types of ontologies used for building templates and their resulting perception by users. Future work includes the investigation of the impact of different categories of ontologies on template characteristics, thus (i) refining the proposed approach for the construction of ontology-based templates; and (ii) devising measures and criteria of their appropriateness to define templates that meet certain requirements.

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