Conceptual Modeling of Legal Relations

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Abstract. Legal relations abound in conceptual modeling. Despite that, the representation of these relations in the area has not yet received sufficient theoretical support. We address this by establishing a basis for the well-founded representation of legal relations. We capture a comprehensive set of legal relations (and legal positions within these legal relations) that arise from widely accepted legal theories into a legal core ontology called UFO-L, which is grounded on the Unified Foundational Ontology (UFO). We rely on the Theory of Constitutional Rights proposed by the philosopher of law Robert Alexy. This theory extends the system of legal positions proposed by the jurist Wesley Hohfeld, which has been used as a theoretical basis for several works in the conceptual modeling literature. The result is a modeling strategy for legal relations that incorporates patterns from the legal core ontology. We present here a synthesis of empirical studies conducted to evaluate the aforementioned results. The studies show that the approach based on UFO-L produces models that are more comprehensible and clear for the representation of legal contracts.

Keywords: Legal Relations, Conceptual Modeling, Legal Ontology, UFO-L

1 Introduction

The Law permeates our social lives. It is not surprising thus that legal phenomena have made their way into our information systems and have become a frequent subject in conceptual modeling [1],[2]. In the last decades, several approaches have been proposed to address the conceptualization and representation of legal phenomena [3],[4], addressing normative notions, e.g., rights, prohibitions, duties, claims, etc.

Despite these advances, we have observed that existing approaches fail to capture some important aspects of the legal phenomena. For example, many of the existing approaches lack support for *legal relations* between parties, given their root in monadic (standard) deontic logics. As a consequence, they are unable to make explicit the *legal positions* of the various parties in a legal relation and to capture the *roles* they play in the scope of a relation. This poses a challenge to the adequate representation of a number of real-life settings involving legal relations, such as legal contracts in general, and service contracts in particular [5]. Moreover, much of the existing work in the

conceptual modeling of legal aspects has emerged from the disciplines of computer science (and logics) and has failed to incorporate the state-of-the-art in legal theories. As a consequence, they often leave out key concepts underlying complex legal phenomena (such as *power* and *legal liberty*).

We address these gaps in this paper with a principled approach. We establish a basis for the well-founded representation of legal relations by capturing a comprehensive set of legal relations (and legal positions within these legal relations) into a legal core ontology called UFO-L. UFO-L is based on Hohfeld's seminal theory of fundamental legal concepts and Alexy's relational theory of constitutional rights [6]. As a result, UFO-L accounts for legal notions that include: *rights* and *duties*, *no-rights* and *permissions*, *powers* and *liabilities*, *disabilities* and *immunities*, as well as *liberties*.

A key aspect of the approach is the representation of legal relations based on the notion of *relator* from the UFO foundational ontology [7], [8]. At first sight, relators can be seen simply as a well-founded relationship objectification. However, as discussed in depth in [8] they are genuine ontological entities that bundle relational properties and serve as truthmakers of material relations. As such, they can account for essential and accidental properties as well as change and modality in the scope of same relationship. Moreover, they can account for the roles that entities play in a relationship and capture the subtle ways in which they are related. The applicability of the approach is illustrated here with the representation of the legal aspects of a real-world cloud service contract (Amazon Web Service Contracts). Furthermore, we report on empirical studies that show that the approach based on UFO-L produces conceptual models that are more comprehensible and clear for the representation of legal contracts.

This paper is further structured as follows: section 2 discusses the kinds of legal relations and legal positions that ought to be represented in conceptual models of legal aspects; section 3 discusses an overall approach for the representation of relations based on the *relator pattern* [9]; section 4 presents the UFO-L fragment employed here with a taxonomy of legal relator types; section 5 shows how UFO-L and the relator pattern are applied to the modeling of contracts; section 6 presents the results of the experiment that was conducted to assess models built following UFO-L, section 7 discusses related work and section 8 presents concluding remarks.

2 Legal Relations

In a seminal work in the legal literature, Hohfeld examined legal positions between subjects in legal relations [10]. He observed that key legal terms such as "right" were often misunderstood because of semantic overload. For instance, in the expression "right to smoke", the term "right" has the meaning of *permission*; in the expression "right to charge taxes" it takes on the meaning of *power*; in the expression "right to receives salary at the end of the month" it takes on the meaning of an *entitlement*.

After an analysis of legal concepts, he identified eight fundamental legal concepts (right, duty, no-right, privilege, power, liability, disability, and immunity), and established relations between them. Table 1 shows these concepts, grouping them in pairs of correlative legal positions. Correlative positions are those with a counterpart in the

same legal relation. For instance, the correlative of "John's duty to pay his debt to Mary" is "Mary's right that John pay his debt to her". A right in this precise or 'narrow' sense is a legal position in which one may demand from another the performance of a certain conduct. Likewise, "John's permission to use Mary's car" correlates to "Mary's no-right that John refrain from using her car". Hohfeld observed further that the various legal positions are classified into two main categories: (i) those that arise from norms of conduct, namely: right, duty, permission, and no-right (at the left-hand side of Table 1); and (ii) those that arise from norms of power, namely: power, liability, disability, and immunity (at the right-hand side of Table 1). While norms of conduct have mainly a coordinative nature, norms of power presuppose a subordinate nature [6], and concern the creation and change of other legal positions through institutional action (e.g., voting, marrying, hiring an employee).

Table 1. Fundamental Legal Concepts According to Hohfeld

CORRELATIVES			
Right	Privilege (Permission)	Power	Disability
Duty	No-Right	Liability	Immunity

Alexy [6] proposed a system of legal positions embedding Hohfeldian legal positions in *triadic legal relations* and considering also the possibility of denying the legal relation's object (thereby augmenting Hohfeld's theory). As a result, for each legal concept *right, duty, privilege,* and *no-right* to an action, there exists a concept of *right, duty, privilege,* and *no-right* to an *omission*. These legal positions are relevant because they define duties to negative actions (effectively prohibitions). For instance, in e-mail service contracts, the customer often has a duty to omit sending the same message indiscriminately to large numbers of recipients on the Internet (unsolicited e-mail or spam). The following categories are proposed by Alexy combining the legal positions of Hohfeld's theory with the new legal positions.

Right to Positive Action. Subject *a* has the right *R*, against subject *s,* to an act ϕ: R*as*(ϕ). In this case, the addressee (*s*) has the *duty to perform* action ϕ. For instance, in a service contract with warranty, the *service customer* has the right that the *service provider* fixes the service in case of defect or failure.

Right to Negative Action. Subject *a* has the *right R,* against subject *s,* to an omission ϕ: R*as* (¬ϕ). In this case, the addressee (*s*) has the *duty to omit* to perform action ϕ. For instance, a *service provider* must not disclose a customer's private information.

Permission to Act. Subject *a* has permission *P* towards subject *s* to perform action ϕ: P*as*(ϕ). In this case, the addressee (*s*) has *no-right* to demand that the permission holder (*a*) omit action ϕ. For instance, in a messaging service, a *service customer* has the permission to send messages using the provider's infrastructure.

Permission to Omit. Subject *a* has permission *P* to refrain from acting (abstain to perform action ϕ) towards subject *s:* P*as*(¬ ϕ). In a relational sense, the addressee (*s*) has *no-right* to demand that the permission holder (*a*) perform action ϕ. For instance, a *service customer* has the permission to abstain from paying contractual interest established by a *service provider* if it exceeds permitted by law in delayed payments.

Unprotected liberty. Subject *a* has liberty *L* in face of subject *s* with respect to an action ϕ if *a* has the permission to perform ϕ and the permission to abstain from performing ϕ, i.e.: L*as*(ϕ) ≡ $_{\text{def}}$ P*as*(ϕ) ∧ P*as*(¬ ϕ). The idea of liberty is related with an *alternative of action* and is defined in terms of the fundamental legal concept of *permission.* Because of the relational nature of permissions, if *a* has a liberty against *s*, then *s* has no-right to demand that *a* perform or abstain from performing ϕ. For instance, airline customers usually have the liberty to use in-seat entertainment.

Power. Subject *a* has the legal power *K* in face of subject *b* to create, change or extinguish a legal position X for subject *b* by means of institutional actions: K*ab*(*Xb*). *Power* is created by a *competence norm.* The exercise of a legal power is an institutional action, which gives ability to act to a power holder. Since *power* has a converse position*,* it means that subject *b* is in a *subjection* position toward subject *a* (*subjection* is also called *liability*). For instance, often a *service provider* has the power to cancel the service agreement unilaterally in the case of contract violations.

Disability. A subject *a* has, in face of subject *b,* no power to create, change or extinguish a legal position X for subject *b* by means of institutional actions: ¬K*ab*(*Xb*). The converse position of a disability is *immunity,* and the subject *b* is immune to changes in his/her legal position. For instance, often a *service provider* is immune to cancellation of a service agreement unilaterally in the cases of *force majeure.*

3 Ontology-Driven Conceptual Modeling of Relations

The Unified Foundational Ontology (UFO) [11],[12],[13] is an axiomatic theory that has been developed based on a number of contributions from Formal Ontology, Philosophical Logics, Philosophy of Language, Linguistics and Cognitive Psychology. For an in-depth discussion, empirical support and formalization see [11],[12].

At the core of UFO, we have four fundamental categories forming what is termed an *Aristotelean Square*, namely, *Substantials* (or Objects) and *Moments* (also termed tropes, aspects, particularized properties). Substantials are entities that exist on their own. Examples include a car, a dog, the moon and Mick Jagger; Moments, in contrast, are parasitic entities that can only exist by *inhering* in other individuals (inherence is a type of existential dependence relation). Example of moments include (a) John's headache or John's capacity of speaking Greek (which can only exist insofar John exists) as well as the (b) marriage between John and Mary (which can only exist insofar both John and Mary exist). Moments of type (a) are termed *intrinsic moments*, including *qualities* (e.g., the charge in this conductor) as well as *modes*/*dispositions* (e.g., the disposition of a magnet to attract metallic material; John's capacity of speaking Greek). Within the category of modes, we have *relational modes* (or externally dependent modes). These are entities that, while inhering in an individual A, are still existentially dependent on another individuals B disjoint from A. An example is John's commitment to meet Mary tomorrow (or Paul's love for Clara). Although this commitment inheres in John (it is a commitment *of* John), it is still existentially dependent on Mary (it is a commitment *towards* Mary). Moments of type (b) are termed

relators. Relators and their constituting externally dependent modes are fundamental for the purposes of this article and are discussed in the sequel.

As discussed in depth in [8], relators are the real *truthmakers* of relations. At least for the so-called *material relations*, which are the vast majority of the relations we are interested in not only in conceptual modeling and information systems engineering but also in social and legal reality. So, for instance, it is true that "John is married to Mary" because there is a relator (a particular *marriage*) binding them; likewise, it is true that "Paul works for the United Nations" because there is a relator of another type (an employment) connecting them. As a result, many of the fundamental tasks in enterprise and information systems management requires a proper understanding of the nature and lifecycle of relators such as employments, enrollments, marriages, contracts, presidential mandates [8]. In UFO, a relation of *mediation* is defined to connect relators to their relata. Mediation is, like inherence, a type of existential dependence.

Moreover, as also elaborated there, relators are full-fledged endurants, i.e., proper object-like entities as opposed to just n-uples of relata. They are entities that can bear their own individualized properties and can have their own complex mereological structures, i.e., they can have their own parts, some of which are essential (i.e., which they must have necessarily) and, conversely, they can be part of other complex relators. For example, a marriage has as an essential part a number of mutual commitments and claims and as an inseparable part a *conjugal society* [14]. Thus, if John and Mary are married, there is an individual relator *m* of type "Marriage" that mediates John and Mary. This relator consists of all properties that John and Mary have in the scope of the marriage. For instance, John has a fidelity commitment towards Mary and, *mutatis mutandis*, the same for Mary.

In Fig.1, we illustrate the general *Relator Pattern* the marriage example discussed above. We use the OntoUML profile [11], which comprises modeling primitives that represent the ontological distinctions put forth by UFO (captured as stereotypes in the profile) and *ontology design patterns* that represent micro-theories in UFO [9]. In the relator pattern, entities in a relation instantiate types that are termed "roles" (here "Husband" and "Wife"). Roles classify, in a contingent and relationally dependent way, instances of the same kind, in this case persons classified as husbands and wives. The model reveals the roles played in a marriage and the relational modes that are part of it (e.g., mutual commitments and claims).

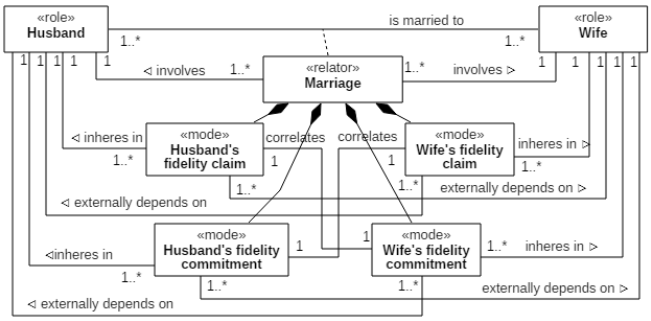

Fig. 1. Marriage modeled with the UFO relator pattern

4 Legal Relations in UFO-L

Based on Alexy's legal concepts, we have built a legal core ontology called UFO-L [15]. This core ontology uses the *Unified Foundational Ontology* (UFO) [11] as basis specializing ontological categories from UFO (both its UFO-A *upper* fragment and its UFO-C *social fragment*) [13]. A key notion in UFO-L is that of a legal relator, which is a relator that is composed of externally dependent legal moments, each of which represents a legal position following Alexy. A Legal Relator specializes *Social Relator* (UFO-C) which in turn specializes the basic notion of *Relator* (UFO-A).

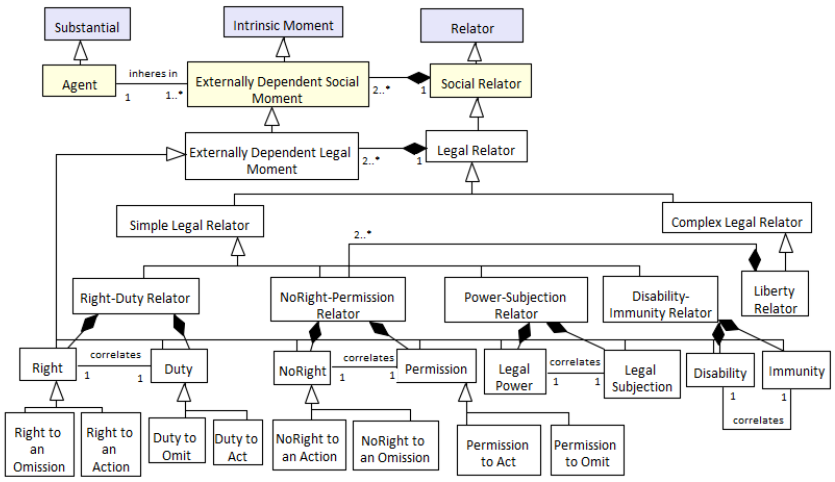

Fig. 2. UFO-L fragment

Legal relators can be simple or complex. A Simple Legal Relator is composed simply by a pair of legal positions (categorized in UFO-L as legal moments), such as: Right/Duty, NoRight/Permission, Power/Subjection, and Disability/Immunity. In contrast, a Complex Legal Relator is composed of other legal relators (thus more than one pair of legal moments). For instance, a Liberty Relator is composed of NoRight to an Action–Permission to Omit Relator and NoRight to an Omission–Permission to Act Relator. Legal moments are related to each other by a correlation association and are essential and inseparable parts of the legal relator which they form. A fragment of UFO-L is shown in Fig. 2 with the existing legal positions, the taxonomy of legal relators and its connection with UFO. UFO-L has a catalog of modeling patterns composed of eight patterns based on the taxonomy of legal relators (Fig. 2) and the *relator* pattern [7],[9] (Fig. 1). A modeling pattern was created for each pair of legal moments and consists of the pattern name/code, the rationale, competence questions, restrictions, usage guidelines, questions to check the chosen pattern, and the model [14]. In [16], for instance, we applied two of these patterns in an ontological analysis of the universal notion of *right to life*. For the sake of space, we restrict our presentation to five of the UFO-L patterns in the next section and applied them to the modeling of service contracts.

5 Modeling Amazon Web Service Contracts

The combination of the taxonomy of legal relations with the relator modeling pattern leads to a number of more specialized patterns for the modeling of legal relations. In this section, we discuss the application of some of these patterns in the modeling of Amazon Web Services (AWS) contract clauses (AWS Terms [17] and AWS Customer Agreement [18]). These legal documents were also used earlier in [5] in which we model service contracts based on the ArchiMate language. Here, we return to the study but focus only on some of the clauses for the sake of illustration. Table 2 shows the text of the clauses as obtained directly from the legal documents.

Table 2. Amazon Web Service contract clauses

CLAUSES
1.2. You must comply with the current technical documentation applicable to the Services (including the applicable developer guides) as posted by us and updated by us from time to time on the AWS Site. (…)
5.1. You may use Alexa® Web Services to create or enhance applications or websites, to create search websites or search services, to retrieve information about websites, and to research or analyze data about the traffic and structure of the web.
5.3 You may not resell or redistribute the Alexa® Web Services or data you access via the Alexa® Web Services.
7.2 Termination. (a) Termination for Convenience. You may terminate this Agreement for any reason by providing us notice and closing your account for all Services for which we provide an account closing mechanism. We may terminate this Agreement for any reason by providing you at least 30 days' advance notice.
13.3 Force Majeure. We and our affiliates will not be liable for any delay or failure to perform any obligation under this Agreement where the delay or failure results from any cause beyond our reasonable control, including acts of God, labor disputes or other industrial disturbances, electrical or power outages, utilities or other telecommunications failures, earthquake, storms or other elements of nature, blockages, embargoes, riots, acts or orders of government, (…).

Fig. 3 shows the model that was produced to account for the legal relations in clauses 1.2 and 5.3. It reveals the mereological structure of the Right-Duty to an Action relator ("Compliance with the technical documentation") with a pair of correlated modes, one of which is a Right to an Action ("Right that customer follows technical documentation") and the other of which is a Duty to Act ("Duty to follow technical documentation"). These modes inhere in the legal agents involved in this relation, each of which plays a particular role. Also, if a mode inheres in a Legal Role, then this mode is externally dependent on the counterpart Legal Role and *vice versa*. Also, Fig. 3 shows a legal relation that contains a pair of legal moments categorized as Right to an Omission and Duty to Omit (Clause 5.3). In this case, the Right Holder has a right (in a narrow technical sense) against to Duty Holder in such a way that the Duty Holder must abstain from performing a specific act. In the case of Clause 5.3, the duty is imposed on the customer not to resell or redistribute the AWS. Both legal relations in Fig. 3 are represented by *Simple Legal Relators*.

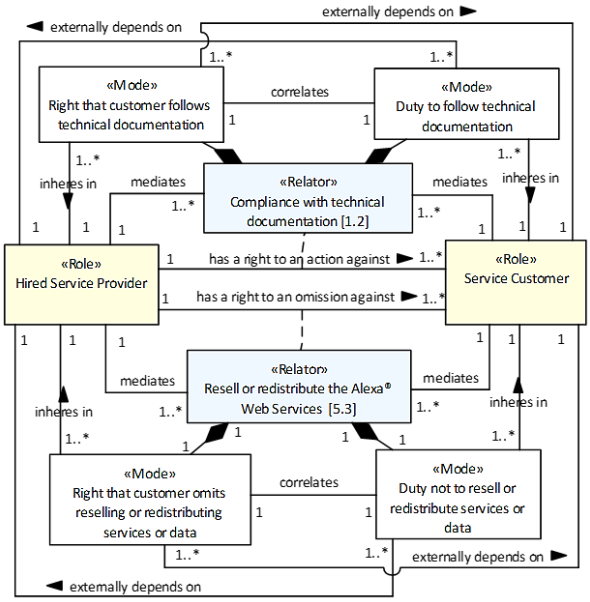

Fig. 3. Clauses 1.2 and 5.3 modeled on UFO-L

Fig. 4 captures Clause 5.1 with a *Liberty Relator*. As discussed in the previous section, the liberty relator is a *complex legal relator*, composed of two *NoRight-Permission Relators*. The *Service Customer* and the *Hired Service Provider* have two legal positions at the same time in the scope of the relation: *Service Customer* holds both *Permission to use AWS* and *Permission not to use AWS*. In its turn, *Hired Service Provider* holds both *NoRight that customer omits using AWS* and *NoRight to demand customer use AWS*.

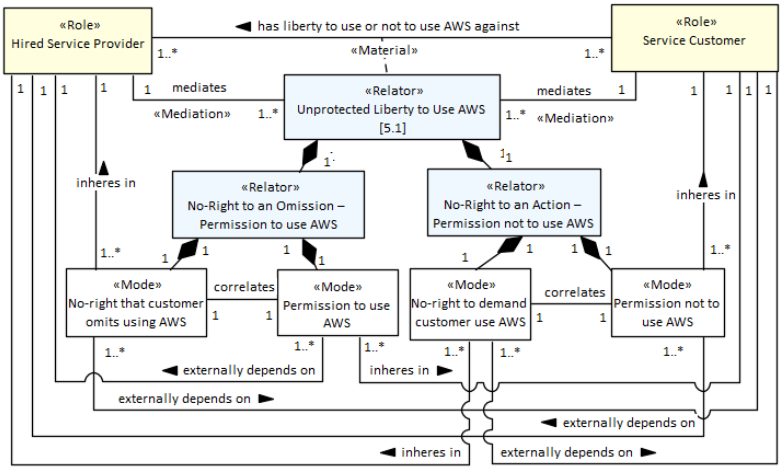

Fig. 4. Clause 5.1 modeled on UFO-L

Some legal positions empower the bearer to create, modify or extinguish other legal positions. This is the case of the legal position of *power*. For example, Clause 7.2(a) gives the *Service Customer* the power to terminate the contract when certain requirements are filled. This clause is modeled in the upper part of Fig. 5 with a *Power-Subjection* relation. The *Hired Service Provider* is in the legal position of *subjection,* and the *Service Customer* in the legal position of *power.*

It is also possible for contractual clauses to rule out the creation, modification or extinction of a legal relation. An agent affected by such a clause holds a *disability*. Consequently, the other player is in an *immunity legal position*, i.e., he/she is not submitted to an act (or an omission) from the *Disability Holder* that aims to create, modify or terminate a legal relation. The type of legal relation is called *disability-immunity*. Fig. 5 shows (in the lower part) the modeling of Clause 13.3 that removes any responsibility from the *Service Provider* in case of service failure due to force majeure. In this case, the *Service Customer* has no power to hold *Service Provider* responsible (and thus the *Hired Service Provider* is immune in case of force majeure).

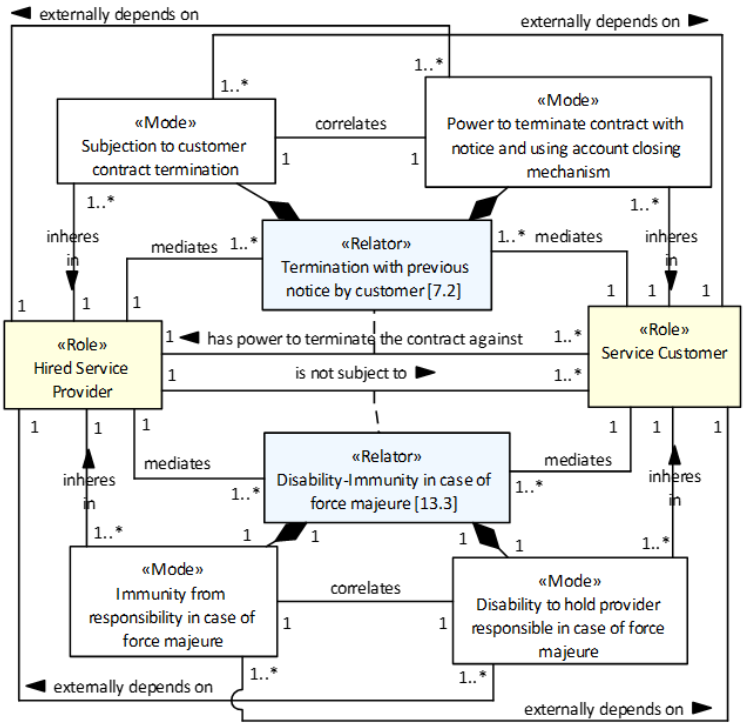

Fig. 5. Clauses 7.2 and 13.3 modeled on UFO-L

6 Empirical Results

We have performed an empirical study to investigate the quality of models built with the UFO-L patterns for legal relations. In particular, we have tested whether models built with UFO-L facilitate the correct interpretation of contract text, improving question answering performance and perceived clarity. In total, 37 subjects participated in the experiment (students and professionals in computer science and law, 92% of which indicated some experience in conceptual modeling, and 65% of which indicated no experience in legal aspects). First, they were given Amazon Web Service (AWS) contract clauses solely in text and were prompted to answer a number of questions concerning the content of these clauses. After answering these questions, 20 participants were given UFO-L-based models to represent the AWS contract relations. They were again prompted to answer questions on the legal aspects of the services.

When answering solely based on the textual representations, they were able to provide in total 215 correct answers (72.6% out of 296 total answers of all subjects). 36 answers were incorrect, and 45 answers were left blank (subjects indicated they were unable to answer). After participants were given access to UFO-L-based models, they managed to provide 233 correct answers (83.2% out of 280 total answers of all subjects), with 39 incorrect answers and 8 no answers. The McNemar test was applied to verify if the introduction of UFO-L diagrams resulted in improved correctness of the participants' responses. We selected five questions on the text treatment and related them to five questions on UFO-L treatment. Then, we related the answers given to these questions in order to form pairs of answers (200 pairs). A chi-squared (χ^2) test was applied with the discordant pairs of the 200 responses. The McNemar test statistic was calculated and χ^2 found to be 6.26 (degree of freedom 1). The p-value was found to be lower than 0.0125. Hence, we consider there is significant statistical difference between the number of correct answers in the text and the UFO-L treatment, with the UFO-L-based models improving average question answering performance.

In addition to performance in question answering, we have also considered the subjects' perception of clarity. They were asked whether specific legal relations and positions were clearly expressed in the text (or diagram). In case of a positive answer, the representation scheme was awarded one point. In total, the textual representation obtained 45 out of 111 points (40.5%) and the UFO-L-based diagrams, 97 out of 140 points (69.3%). A chi-squared (χ^2) test was applied to the clarity points and χ^2 found to be 12.19 (degree of freedom 1). The p-value was found to be lower than 0.0005. With this result, we concluded there is a relation between the increase of clarity and the introduction of UFO-L-based-models. In addition to the objective clarity point questions, we have also provided the opportunity for subjects to provide free feedback concerning clarity. After introducing the diagrams in the second part of the experiment, the participants were able to perceive concepts in the diagrams that went undetected in the textual representation, as well as relations (associations) that were not expressed in the *text* (there was an open question that allowed participants to provide any feedback they might see fit). To cite one example, three participants explicitly reported that they perceived, after the introduction of the diagrams, the concepts of *immunity*, *power*, and *liberty*.

An additional experiment was conducted with 10 participants that were exposed solely to the UFO-L based models (and not to the text). Our goal was to assess the threat that the first experiment was biased towards UFO-L because of the order of treatment (text first) and a possible learning effect. In this additional experiment, the percentage of correct answers was 79.3%, which, when contrasted to 83.2% in the first experiment, suggests that the learning effect, if any, had minor influence.

Considering the quantitative results of the experiment described above, we can conclude that the UFO-L-based models added greater clarity and comprehensibility to the representation of service contract clauses. The full dataset is available in [14] (published in Portuguese; a translation of the chapter concerning the experiment can be found at http://purl.org/nemo/griffoch7). Further, from a qualitative analysis of the questions that have had most incorrect answers, we are led to believe that UFO-L may benefit from more support for inferences concerning legal situations, especially in the case of violation of legal positions. This is a topic for further investigation.

7 Related Work

Several efforts that address the representation of legal aspects are reported in the literature, notably in the context of enterprise information systems.

A number of approaches, under the umbrella term "contract languages" [20], [21], are devoted to the formal representation of the contents of contracts, specifying rigorously the ways in which parties ought to act in the scope of (service) contracts. For example, in [20], a formal system for reasoning is proposed based on a Business Contract Language (BCL). The authors raised some issues for further investigation, such as an improved separation of subject and target roles in a policy expression and the expressiveness of BCL with respect to other legal concepts (right, authorization and delegation). About the first issue, we have suggested in our work that roles are explicitly represented and as well as their legal positions [16]. In this case, not only one party is modeled but two parties in the legal relation, each of which plays a different role in the scope of the legal relation.

In [22], a Contract Language (CL) was defined based on deontic logic. The authors stumble on a case of *semantic overload* when they do not distinguish right from permission. For instance, in the example cited to instantiate Postulate 3.8 ("Obligation to an action implies that the action is permitted") it is not correct to state that "the client has the right to pay". The correct assertion is that "the client has permission to pay". This is an instructive example of how the reduction of legal positions to a unique form of right-duty position results in loss of meaning and misunderstanding as discussed in [10]. In [23], the authors propose a Formal Language for Writing Contracts (FCL) that is based on monadic deontic logic operators of obligations and prohibitions. In the aforementioned languages, we observe the use of monadic operators: obligation, prohibition and permission as the unique way to represent legal positions. There is no representation of *power norms* and other relevant legal concepts (particularly missed is the notion of *right* in a narrow sense discussed here). Further, while these approaches have proven useful, e.g., in the analysis of business process compliance and

in the verification of formal properties of contracts [4], [24], they do not aim to include legal aspects in the overall practice of structural conceptual modeling. Here, we have opted to instead, propose an approach that enables the integration of legal positions and legal relations into structural conceptual models.

In addition to contract languages, there has been some efforts on contract ontology in the literature, for example: the ontology for international contract law [25]; the Uniform Commercial Code Ontology, on legal contract formation [26]; the MPEG Media Contract Ontology (MCO) [27] to deal with rights concerning multimedia assets and intellectual property content; and, the contract ontology based on the SweetDeal rule-based approach [28]. All these approaches employ the monadic operators of deontic logics, hence, not being able to fully capture the relational aspect that is at the core of our service contract ontology. With the exception of [25], none of the approaches employ Hohfeld's legal concepts, failing thus to account for rights in a narrow sense. Additionally, none of these explicitly address *powers*. Also, we observed cases of semantic overload concerning the concept of *right* in some ontologies of contracts (e.g., [29]). Thus, we conclude that all these efforts could have benefited from an ontological foundation such as UFO-L.

Concerning legal core ontologies covering broad aspects of the legal domain such as UFO-L, we have observed in a systematic mapping of the literature [14], [19] that most extant legal core ontologies, including LKIF core, CLO and FOLaw, focus on the representation of *norms* or on the representation of isolated legal positions. Differently from these other core ontologies, UFO-L emphasizes the relational perspective, revealing explicitly the roles and positions in (simple and complex) legal relations. Because of this, UFO-L has provided us with a basis for the conceptual modeling of legal relations which we could not obtain directly in the existing legal core ontologies.

In order to model legal aspects in the scope of enterprises and information systems, a number of dedicated representation schemes have been proposed including, *e.g.*, Rule*ML* [30], LegalRule*ML* [31], and Nòmos 3 [4]. LegalRule*ML* builds up on Rule*ML* and uses notions of defeasible logics to treat violation of obligations; in the treatment of violations (something that we still need to address systematically in our approach). With respect to the legal positions that can be represented, it does not cover powers or rights in a narrow sense (capturing only the corresponding obligations). Note that the notion of "Right" adopted in LegalRule*ML* corresponds to the notion of protected liberty, which can be accounted for in our ontology with a complex relator composing an unprotected liberty with obligations, following Alexy [6]. In its turn, Nòmos 3 is a framework for representing laws and regulations that uses the conception of *goals* and Hohfeld's theory to reason about compliance of requirements. Consequently, its concept of liberty as synonym of privilege does not cover all the existing permissions (negative and positive permissions).

8 Conclusions and Future Work

This work presents an approach for the conceptual modeling of legal relations taking as theoretical basis Alexy's Theory of Constitutional Rights [6], the Unified Founda-

tional Ontology (UFO) [11], and the legal core ontology termed UFO-L [14]. To illustrate this approach, the *relator* pattern proposed in [7], [9] and its specializations in terms of the UFO-L modeling patterns were employed here to model clauses of Amazon Web Service contracts. With UFO-L, both the model creator and its users are led to understand the differences between the notions of *right* in a narrow sense, *permission*, *liberty*, and *power*. Thus, the UFO-L-based-models expose nuances of each legal position and, therefore, of each legal relation. Understanding and representing the subtleties of these relations is of fundamental importance to the proper conceptual modeling and information systems engineering in complex domains.

The modeling patterns proposed here were evaluated in an empirical experiment aimed to assessed whether a representation scheme including these patterns brings some benefit to stakeholders. Participants reported that, after being exposed to these diagrams, they were able to perceive concepts that they were not able to identify in contractual texts. We attribute this to the fact that all correlative legal positions are made explicit in the UFO-L based representation, which is not the case in legal texts. In fact, it is common for service contracts to be written from the provider's perspective. This means that the provider's advantageous positions are emphasized along with customer burden positions. On the other hand, customer vantage positions and provider burden positions are (sometimes deliberately) "hidden" [5].

Regarding future work, we intend to investigate the modeling of the lifecycle of legal relations, the detailed representation of power positions and the exercise of power, issues involving compliance and non-compliance, as well as specialized visual syntaxes for the legal domain (also experimenting with areas other than contracting).

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