Abstract
The paper is devoted to a legal framework of a three-dimensional virtual world. Here visualization and symbolization precede formalization on the way to construction and legal knowledge representation. Thus the visualization of virtual world issues can have a favourable effect on modelling, formal representation and implementation. The paper also identifies a legal informatics approach which is worded “From rules in law to rules in artefact”. The rules are divided into classes, such as legal, technical, professional, reputation, etc. The modes of effect of rules are distinguished, too. The differences of the technical rules and the legal rules are in the focus. The development tackles a virtual world platform within the FP7 VirtualLife project, which pursues the goal to create a secure and legally ruled collaboration environment.

Keywords: virtual world, norm, virtual law, ought-to-be in-world reality, visualization, conceptualization

1. Introduction

The paper presents a view to a virtual world as a whole. This view is depicted by a metaphor of stage. Thus, a kind of visualization1 is obtained. It is a model, a symbolization of the conceptual framework of the virtual world. It is called “spatialization”.

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1 Eppler and Burkhard (2006) emphasize the role of visual cognition and perception and note that a majority of our brain’s activity deals with processing and analyzing visual images: “If visualization is applied correctly, it dramatically increases our ability to think and communicate” [4, p. 553].
The paper aims at a classification of rules and distinguishing between the modes of effect. Further the terms “rule” and “norm” are synonyms; discussing the difference is out of scope of the paper.

The paper also tackles operational implementation of rules in software. The issues arose while developing a virtual world platform within the FP7 VirtualLife\(^2\) project. Legally ruled collaboration is among the novelties of the project.

2. The Frame of a Virtual World

The frame – reality – of a virtual world is constitutive. The entities are avatars, objects (primarily 3D objects), then inventories of the avatars, etc. The frame is established from the outset; it is not a subject for discussion in this paper. The metaphor of stage is used to visualize the “theatre” of a virtual world (see Fig. 2).

The entities of major importance are avatars, actions and rules. The avatars can engage in joint actions. They communicate in such a way.

The rules establish the regimes (paradigms) of a virtual world. The rules can be divided into different classes such as technical (technological) rules, legal rules, energy rules, etc.

**Technical rules.** They establish factual limitations. Real world examples are to fence the grass, to close the door in order to forbid entering, to refuse money by a cash machine if you do not provide the PIN code. The technical rules cannot be violated.

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Legal rules. Their nature is that they can be violated. For example, you can step the grass or take a train without a ticket. But you risk to be punished. A procedure is enforced by a certain authority such as police, peacekeepers in a virtual world, etc.

[Diagram: A conceptualization – the elements of a virtual world]

The structural elements of a legal rule are the same as in real world norm. The subject is a natural person, a juridical person, etc. The modus is a deontic notion: obligatory, permitted, prohibited, veto, etc.

The legal rules are of two kinds. The primary rules come first. Sanctions are determined by secondary rules. They are associated with certain authorities which enforce the rules. A (virtual) procedure can be raised for a violation of a rule. For instance, online dispute resolution is a kind of a procedure.

The modes of effect can be very different. A sanction can be raised randomly with a certain probability p%. An example is a road rule which forbids crossing a street against traffic lights. You can go through a red light, but if you are lucky and a policeman does not punish you.

Energy rules. They can be illustrated by security/trust rules, reputation rules and the avatar identity card in VirtualLife. Each avatar has an ID card, which contains information about both his virtual and real life identities [1] (see Fig. 3). The ID card includes simple indicators of trust. A red bar means that the avatar is a guest and has not proved his identity; a yellow bar – the avatar has an identity, but it has not been verified by any certification authority; and a green bar – the avatar’s identity has been verified by a certification authority. Each avatar also has an economical, social and civic reputation, whose indicators are handled by a sophisticated reputation system, depending on the avatar’s behavior.
Professional rules. Other kinds of rules are moral rules, professional rules, Virtual Nation rules, etc. Examples can be provided from the VirtualLife project. Here the users can engage in a trusted community called Virtual Nation.

A standard collection of laws and the Virtual Constitution, finalized to the creation and regulation of a secure and trusted environment (Virtual Nation), form the VirtualLife’s legal framework. Part of the framework is implemented as a shrink-wrap End User License Agreement. The EULA binds the user on a contractual level. The legal system takes into account both real life values and real world laws [1]. It should be noted that the user cannot escape from the real world law, too [8]. At present VirtualLife is targeted at learning support scenarios, such as a university virtual campus [3].

Virtual Nation scenarios. A number of examples of setting up the nation/zone tables for allowing different scenarios can be proposed. Different values are concerned by NoCopy, CopyRight and CopyLeft nations. Computer code in the form of permission language tables serves to represent distinguished rights. Thus the permissions are represented explicitly.

In a NoCopy nation, no one is allowed to make copies. In a strict copyright nation, only the author of the object can make copies. The receiver of the copied object cannot make copies.

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3 The descriptions are provided and implementation in the virtual reality engine of VirtualLife software is designed mainly by Kevin Glass, TAVAE, France.
In a non-strict copyright nation, the original author of an object can decide if the new owner can copy the object or not. By default, an author or owner can copy. In a CopyLeft nation, the creator’s information is preserved. Each user can change and copy its own objects. In a Second Life model nation, you can sell objects controlling whether they are editable, copyable or sellable. The creator cannot modify a sold object. Of course, you can always move your own objects. For example, the seller can decide to sell non-copyable objects. This object cannot be duplicated by the new owner. Therefore if she puts them in her inventory they disappear from the world.

**Fig. 4. Principles of construction of a virtual world legal framework**

### 3. Principles of Construction of a Virtual World Legal Framework

Rules can form different normative systems. Virtual world rules have different modes of effect or relevance, too. The modes of effect can be identified as “barrier”, “occasional”, “step-by-step”, etc. (see Fig. 4).

A door is an example of a barrier type technical rule. An occasional type rule sanctions you with a certain probability. An example is an obligation to buy a ticket when you take a train. You can succeed to travel without the ticket if a conductor does not fine you. A step-by-step effect is characteristic to reputation and energy rules. For example, each time you violate a rule, your energy points are decreased by 10%.

A core ontology is immanent within the whole set of rules. A special (material) domain ontology is present within each kind of rules.

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A technical filter can be set in order to make rules valid. For instance, in the context of e-law, the text of legal documents can go through an XML filter. A document cannot be put on the “transport belt” of legislative workflow in case of flawed XML structure, e.g. marked-up with errors. Such a filter is an example of a technical rule. The ruling is of the type “Entering without stop is refused”.

4. Terminology of Technical Rules

The technical rules are treated as factual ones. They establish factual hindrances. For instance, a closed door is a hindrance to enter the room; a request from the cash machine for the PIN number is a hindrance to take money by unauthorized persons.

These “natural” rules have to be distinguished from natural laws such as gravitation – a physical law. The natural image or the essence of a human being is examined when behavior is regarded in natural law (Naturrecht). Thus the factual rules can be divided into two classes – technical rules and natural rules (see Fig. 5).

![Fig. 5: A classification of factual rules comprises physical laws such as gravitation](image)

5. Three Legal Stages

Three legal stages can be distinguished: (1) the legislative stage, (2) the negotiation stage – the stage of the game, and (3) the judicial stage. This metaphor is depicted in Fig. 6. The functions of the stages accord with the functions of law which are distinguished in legal theory.

![Fig. 6: Three legal stages of a virtual world: (1) a legislative stage, (2) a negotiations stage – the stage of the game, and (3) a judicial stage](image)
The legislative stage serves to produce rules. Here the whole in-world community can be involved. Next, the negotiation stage serves for the everyday life. Social games including contracts are performed here. The judicial stage serves for judgments. This stage is not entered in each case. Distinguished modes of (virtual) legal proceedings are already identified above. Here activities such as story-telling, adjudication dialogs and legal disputes can be invoked.

The legislative stage consists of two sub-stages. On the first one, 1a in Fig. 7, legislative (general) rules are produced. It is compared with parliamentary activities, but performed by the community. On the second sub-stage, 1b, contract (individual) rules are produced.

A sub-stage of access can be distinguished within the stage of the game. It can be compared with an entering scenario. For example, in an airport a citizen with a valid ticket has to pass a certain procedure in order to become a passenger.

![Fig. 7: Two legislative sub-stages serve to produce general rules and individual rules](image)

The people think in roles, not rules. People on the streets think in the terms of roles. The people even do not know the rules and the paragraphs of the law. The first attempt to model the concept of the role is to put the role’s label.

6. Formalizing the Rules

The concept of technical rule is formalized causal relationship. Legal rule is formalized as a formula in deontic logic; see, among others, [6, 2]. Energy rule prohibits a certain behavior; if violated then subject’s “energy points” are decreased.

A sketch, a kind of symbolization, is below. Formalizing normative systems, modeling legal argument and operational implementation of rules attracted a broad research; see e.g. [7, 9].
6.1. Technical Rules

Technical rules are based on natural causation. They are formalized with the *modus ponens* rule:

If \( P \), then \( Q \).

\( P \).

Therefore \( Q \).

In the sequent notation, \( P \to Q \). An example is the cash machine’s rule that is worded:

‘if PIN code is provided then cash machine gives money’

Formally:

\[ \text{Rule}(\text{pin} \to \text{money}) \land \text{Fact}(\neg\text{pin}) \implies \text{Fact}(\neg\text{money}) \]

Or:

\[ \text{Rule}(\text{pin} \to \text{money}), \text{Fact}(\neg\text{pin}) \mid \text{Fact}(\neg\text{money}) \]

It can be discussed whether the idea of technical rule is “if and only if” (iff, \( \iff \)):

‘if PIN is provided then cash machine gives money, and if PIN is not provided then cash machine does not give money’

Formally:

\[ \text{Rule}(\text{pin} \iff \text{money}), \text{Fact}(\neg\text{pin}) \mid \text{Fact}(\neg\text{money}) \]

The technical rules do not have *modus* structural element. Therefore ‘ought’ (obligatory) or ‘may’ (permitted) is not included even in the grammatical formulation of a rule.

6.2. Legal Rules

Deontic status (obligatory, permitted, forbidden, etc.) is a structural element of legal rules. The nature of the legal rules is that a prescribed behaviour, \( Q \), can be violated. For instance,

\[ \text{Obligation}(P \to Q) \quad – \text{rule.} \]
\[ \text{Fact}(\neg P) \quad – \text{fact.} \]

\[ \text{Fact}(Q) \quad – \text{observed fact.} \]

For example, the traffic lights rule permits you to cross if and only if the lights are green: ‘Permitted to cross iff green’. However, you can cross against the lights:

\[ \text{Permission}(P \leftrightarrow Q) \quad – \text{green iff cross.} \]
\[ \text{Fact}(\neg P) \quad – \text{red is on.} \]

\[ \text{Fact}(Q) \quad – \text{you cross the street.} \]

The interpretation of the observed behavior is that you are simply a bad guy. Nobody can stop you crossing. However, you risk to be punished; a procedure can be enforced by a policeman.

6.3. Energy Rules

Energy (reputation, etc.) rule prohibits a certain behavior. Consider you violate a rule. Therefore, your energy points are reduced. An example is as follows:

\[ \text{Norm}(\neg A) \quad – A \text{ is prohibited.} \]
\[ \text{Fact}(A) \quad – \text{you violate the rule} \]

Points of \( A \) are reduced – e.g., \( A := 0.9 \times A \)

Everyday interpretation is that your energy points are reduced to \( A_1 \), then \( A_2 \) and so on to \( A_n \). At last a state \( \neg A \) is reached, which denotes no energy at all (see Fig. 8).
Fig. 8: Energy points are reduced upon the violations of a rule

The shark fish illustrates an energy rule in the nature. If a shark swallows too much it drowns.

7. A synthesizer of normative status

A problem of synthesizing the normative status of a given subject is faced. A specification of a synthesizer of the normative status can be considered very simple. Input is a list of rules $r_1, r_2, \ldots, r_n$. Output is the normative resultant $O(X)_{r_1 \ldots r_n}$; see [5, p. 88-92]. This input/output specification is depicted in Fig. 9.

Fig. 9: The input and output of a synthesizer of the normative status. The rules $r_1, r_2, \ldots, r_n$ serve as input

Implementation of the machinery is not an easy task. The synthesis of both duties and permissions is in the scope. In reality, the task requires human intelligence. A reason is that legal rules are formulated very abstractly. In case of a big number of rules, artificial intelligence techniques meet complexity problems. Therefore, an attempt of identifying the resulting normative status is to assign a role, such as “passenger”, “professor”, etc.

8. Conclusions

The paper elaborates on an approach which is worded “From rules in law to rules in artefact”. Thus a kind of a trend in legal informatics is identified. The approach aims to build a bridge between an Ought-to-Be reality and Is reality in the domain of virtual worlds. Modeling a virtual world and an implementation of rules is a challenging task; not only for software developers. Therefore, the people think in roles, not rules. The names of roles, such as
an author, an owner, a NoCopy nation, serve to describe a situation. Therefore the metaphor of stage can be successfully used for the visualization of virtual world issues. A formalization and operational implementation require further efforts.

The research is devoted to two activities which are implied by a legal framework. The first is the compliance with the law by software users. This is a classical function of law. The second activity is the transformation of rules into computer code. The latter activity is attributed to informatics. A human translator has to distinguish the methods of law and informatics. Some differences to mention are abstractness of legal norms, open texture problem in law, heuristics to identify lower level concepts, legal methods of interpretation and the teleology of the law.

The proposed approach accords with the conception “[Computer] code is law” [5].

Acknowledgments. The work is stipulated by the whole VirtualLife consortium of 9 partners.

References


