DISTRIBUTIVE MULTIMEDIA AND MULTISENSORY LEGAL MACHINES

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Abstract: Since Aristotle, legal philosophy explores and develops its concept of the iustitia distributiva. Currently, a trend in legal informatics both transforms and adopts long-established traditional cognitive patterns of (legal) philosophy. For example, it reveals the antique and medieval roots of (legal) ontologies. Similarly, new concepts of societal distribution can be elaborated in the context of multimedia and therefore multisensory legal machines. By reference to automats performing legal transactions, traffic lights, and ticket machines, we will explain new concepts of legal procedures. These concepts base on algorithms governing these procedures. Such distributive multimedia and hence multisensory legal machines are not only applications of legal informatics and e-government, but they can also be adequately analysed within the theoretical and practical framework of multisensory law. This new legal discipline in the making particularly focuses on the uni- and multisensory aspects and implications of the new ICT to which the machines at issue belong.

1. Human beings and machines

This paper addresses human beings and machines in the role of legal actors. A transition from factual acts (or facts) to legal acts is explored. Factual acts are in the Is world whereas legal acts are in the Ought-to-Be world [Kelsen 2000]. Hence the point of departure is that an actor makes an action with an effect and this is under a condition. Examples are “Alice puts a coin in a piggybank”, “Bob takes his shoes off and drops them in the room” (though this makes him rude), etc. Hence we assume the factual act model that is depicted in Fig. 1.

A notation for the factual act type is a tuple:

\[ \text{factualActType} = \langle \text{condition}, \text{actor}, \text{action}, \text{effect} \rangle \]
Following is an instance, \( \text{factualAct}_1 \):

\[
\text{factualAct}_1 = \langle \text{condition} = \text{undefined}, \\
\text{actor} = 'Alice', \\
\text{action} = 'drops a coin in a piggybank', \\
\text{effect} = 'making savings' \rangle
\]

The actor can be of different types: a human being, a machine, goodness, a text, or something \( x \).

The meaning of factual acts above is pure facts which have no legal importance. Legal importance is observed, for instance, in conduct implying an intent (\textit{konkludentes Verhalten}), such as Chris putting coins in a ticket machine to buy a train ticket, a policeman raising a hand, etc. These are treated as \textit{legal acts}. You commit a fraud when dropping fake coins in a vending machine whereas a child may put old coins in his piggybank, etc.; cf. [McCormick & Weinberger 1992]. The importance of legal acts is different from factual acts but the structure is the same – a tuple – though worded differently (Fig. 2):

\[
\text{legalActType} = \langle \text{legalCondition}, \text{legalActor}, \text{legalAction}, \text{legalEffect} \rangle
\]

Visualizations in this paper form a step to formalisation. They are influenced by Florian Holzer (2010) and his situational legal visualization.

\[
\text{Legal condition} \quad \text{Legal actor} \quad \text{Legal act} \quad \text{Legal effect}
\]

\[
\begin{align*}
\text{Condition} & \quad \text{Actor} & \quad \text{Act} & \quad \text{Effect} \\
\text{Human} & \quad & \text{Machine}
\end{align*}
\]

\[\text{Fig. 2: From factual acts to legal acts}\]

Factual acts can be lifted to the legal acts category by the actor’s role. For example, you are obliged to stand up when the judge enters a courtroom, though you sit when ordinary people come in.

Both factual and legal acts can be represented in propositional logic in the form of statements which are true or false, for example:

\[
\begin{align*}
\text{factualAct}_2 &= \text{listener_John_enters_the_courtroom} \\
\text{legalAct}_2 &= \text{judge_Ken_enters_the_courtroom} \\
\text{factualAct}_3 &= \text{pedestrian_Mike_raises_a_hand} \\
\text{legalAct}_3 &= \text{policeman_Steve_raises_a_hand}
\end{align*}
\]

The difference is that legal acts have legal consequences. For instance, \( \text{factualAct}_3 \) above has no legal consequences, whereas \( \text{legalAct}_3 \) implies, that the drivers are obliged to stop. This can be expressed in deontic logic:

\[
\text{legalAct}_3 \Rightarrow \forall x \in \text{drivers} \quad \text{Obligatio}(\text{stop}(x))
\]

Important are legal effects of legal acts. The types of legal acts – speech acts or implications – are not so important. As an example assume a vending machine. Persons putting coins into it engage in
sales contracts. In this sense we view the vending machine as a legal machine. Another example is a traffic lights. It distributes rights to cross the road. The third example is FinanzOnline\(^1\) form proceedings in the e-Government domain in Austria that serves in tax law issues.

The condition can have legal importance, too. For example, road radars make photos when the vehicle’s speed exceeds a certain value. Thus each element – the legal condition, the legal actor, the legal action and the legal effect – are qualified to have legal importance.

**Organisations, legal acts and legal machines.** Organisations are essential in discussing legal acts (Fig. 3). An organisation is viewed on three levels. The first is a legal entity (*juristische Person*) as a whole, such as a company with limited liability, a university, etc. The second level is an organ of the organisation, and the third, an administrator of the organ, which can be an official or a machine, too. For example, when you buy a train ticket, the contract is established with the railway company, not the cashier. The company (with recourse the official, too) is held liable. Here the cashier can be replaced by a ticket machine.

![Organisation](image)

**Fig. 3: Organisation**

In this respect differences between legal machines and human beings are not so large (Fig. 4). Of course, they have to be considered when speaking about rights, duties and liability. This leads to legal analyses of human and electronic agents which were already accomplished decades ago; cf. [Schweighofer 2001; Sartor 2002; Wettig & Zehendner 2004; Sorge 2006], the whole Issue 1-2 of Artificial Intelligence and Law, Vol. 12 (2004), etc. The concept of electronic person (e-Person) [Schweighofer 2007] regarding e-Government has to be taken into consideration, too.

![Replacing human beings with machines in a legal person’s organ](image)

**Fig. 4: Replacing human beings with machines in a legal person’s organ**

**Horizontal and vertical effect.** In the contract example above, the relationships condition-actor-action-effect have horizontal – individual – effect as they concern private law (Fig. 2 and 4). Traffic lights have vertical – general – effect as regulated by administrative law (Fig. 5). Traffic lights serve as a legal machine: you are prohibited to go on a red light, \( F(go) \), and permitted on green, \( P(go) \), though you can wait on the pavement, too. The traffic lights algorithm in terms of a finite state

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\(^1\) [https://finanzonline.bmf.gv.at/](https://finanzonline.bmf.gv.at/) accessed 15-01-2011
automaton is shown in Fig. 5. Its states are turned from red to green or vice versa. The algorithm changes permissions and obligations and distributes legal time and space between pedestrians and drivers. The regulation of pedestrian traffic lights can be expressed by the following formula:

\[ O(\neg A) \lor T[O(\neg A) \rightarrow P(A)] \lor T[P(A) \rightarrow O(\neg A)] \lor P(A) \]

where \( O = \text{obligation}, \ T = \text{transition}, \ P = \text{permission}, \ A = \text{go-action}. \) Prohibition to do \( A, \ F(A), \) is interpreted as obligation not to do \( A, \ O(\neg A). \)

Fig. 5: Vertical effect of administrative law regulation by traffic lights. Thus legal time and space is distributed. The algorithm is represented in the form of state machine. On a pedestrian red light they are obliged not to go, \( O(\neg A), \) and drivers are obliged to go. On a pedestrian green light they are permitted to go, \( P(A) \)

The algorithms, which are embedded in legal machines, are out of scope of this paper. Operational implementations of norms are dealt by software engineers. Different approaches are explored; cf. [Vázquez-Salceda et al. 2008]. Mathematical formalisations and computational models are investigated by JURIX, DEON and Normative Multi-Agent Systems communities.

Traffic lights colours are legally indifferent substratum, cf. [Kelsen 2000]. The same colours are exhibited, for example, by discotheque lights machines. However, the latter act in the Is world contrary to the traffic lights that act in the Ought-to-Be world.

Fig. 6: Human/machine in a workflow. Decisions can be made by machines, too.

\[ \text{\textsuperscript{2}} \text{ See a whole Issue 1 of Artificial Intelligence and Law, Vol. 16 (2008) which is devoted to agents and AI & Law.} \]
**Workflow and legal machines.** Example 3 is about form proceedings workflows, such as FinanzOnline in Austria. Data input to a workflow is a legally binding act. Declaring your income and other data has legal qualification and you are obliged to input truthful data. Decision making actors in the workflow are comprised of both humans and machines (Fig. 6). You are not allowed to excuse machines saying that you were joking with false data. Before making decisions machines also check for your input correctness. Hence, apart human-machine also machine-machine communication of legal importance is observed. The workflow enables you to skip tax advisers.

In communication, as the workflow above shows, all the relationship combinations are observed: human → human, human → machine, machine → human, and machine → machine.

**Machines replace organisation officials.** Example 4 is about machines in the role of official. In this case, a machine is not a legal entity and also not e-Person, shortly:

\[
\text{machine} \neq \text{legal person} \quad \text{(Not yet.)}
\]

As noted above, legal persons can be viewed on three layers: (1) a legal person as a whole, (2) an office within it, and (3) an official within the office. An example is an official selling tickets. Assume officials being replaced by ticket-machines (Fig. 7). Similar examples include airport check-in machines, car parking payments via mobile phone, etc. Here you communicate with machines and skip humans.

![Diagram of three layers within an organisation](image)

*Fig. 7: (a) Three layers within an organisation (legal person). An example illustrates a machine which is auxiliary to officials and is not a legal person yet. Here machine \(\neq\) legal person. (b) Communication relationships.*

**Boundaries: machines as e-Persons.** In summary, we have identified four cases which involve legal machines:

- **Case 1.** Vending machines, such as slot machines, used for selling drinks
- **Case 2.** Traffic lights
- **Case 3.** Form proceedings, such as FinanzOnline
- **Case 4.** Machines auxiliary to officials. Here machines are not legal persons.

In Case 4, machines replace physical persons – officials. Thus machines can have the aura of physical persons but still do not reach the level of legal persons. They are treated as things, tools. They lack characteristics of legal subjects, such as legal capacity (Rechtsfähigkeit) and contractual capacity (Geschäftsfähigkeit).

Case 4 draws a boundary of today. Imagine a situation (in future) in which a machine replaces the whole organisation. Assume national register organisations such as immobility register, register of
personal data handlers, etc. Today registers operate as legal persons according to the Case 4 model depicted in Fig. 7. However, imagine a register which is operated by a legal machine (Fig. 8). Thus the machine becomes a kind of e-Person. This is not reality yet.

**Fig. 8: A situation in the future: a machine replaces an organisation and becomes a kind of e-Person**

A paradigm shift for the future can be expressed as follows. Today’s paradigm is that legal actors are comprised of physical persons and legal persons. In the set theory notation, the legal actor category is the union: $\text{legal_actor} = \text{physical_person} \cup \text{legal_person}$.

or in predicate logic:

\[
\begin{align*}
(a) & \quad \text{is-a}(\text{physical_person, legal_actor}) \\
(b) & \quad \text{is-a}(\text{legal_person, legal_actor})
\end{align*}
\]

Future paradigms should complement legal actors with legal machines:

\[
(c) \quad \text{is-a}(\text{legal_machine, legal_actor})
\]

or shortly: $\text{legal_actor} = \text{physical_person} \cup \text{legal_person} \cup \text{legal_machine}$.

In summary, the context of legal machines is comprised by the four cases above.

2. Two stages: real life and its representation

We distinguish between the real life stage (real space) and representation stages (virtual space). Machines can serve as representation stages. Examples are three-dimensional online virtual worlds such as Second Life. Avatars in a virtual world are representations of and are manipulated by physical persons. However, misbehaviour in virtual space is qualified differently than in real life.

It makes sense to regulate avatars’ behaviour by the so called “virtual law”. Regulation would prevent two kinds of misbehaviour. First come acts (criminal, civil, etc.) which are qualified as illegal in the real world, such as copyright infringements, indecent content, etc. Second, come acts on the representation stage. An example of so called virtual crime is an avatar making virtual harm to other avatars, e.g. hitting them. Virtual space regulation is aimed by two ways, cf. the VirtualLife project and Čyras & Lachmayer 2010. The first way is regulation through virtual

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3 A virtual world developed by Linden Lab, [http://secondlife.com/](http://secondlife.com/).

4 “… there is a difference between writing about rape and raping” [Lessig 2006, p. 20]. Examples concern sexual violence against avatars in textual and 3D MMORPGs (massively multiplayer online role-playing game). This appeared in the rise of cyberspace [p. 17-20, 98-99].

world’s software that implements the method “[Computer] code is law”; cf. Lessig 2006. The second way is regulation through norms – making the virtual law part of end user license agreement (EULA) and enforcing it on the contractual level. The virtual law in EULA as being an ordinary contract can be implemented by way of click-wrap agreements. In result, computers which run the virtual world become legal machines. They distribute (1) real time/space for human users, and (2) virtual space for avatars.

3. Legal machines in multisensory jurisprudence

Machines are able to issue commands which are perceived by all of our senses (sight, hearing, smell, taste and touch). As advocated by Colette R. Brunschwig (2003; 2009), multisensory jurisprudence is about multimodal (visual, audiovisual, etc.) representation and communication of valid legal content (geltendrechtliche Inhalt6). Traditionally legal actors are comprised of lawyers, judges, administration officials, parliament members, etc. [2003, p. 411]. In this paper we explore on supplementing the concept of legal actors with legal machines – at least in certain tasks.

Machines can also serve for multimodal representation and communication. In this way, normativity is transmitted to be perceived by all senses – by both humans and machines. The traffic lights illustrate perception by sight. Road and airport radars are examples of visual and radio communication between machines with machine vision producing legal effects. Traffic lights which are intended to blind people are equipped with sound devices and touch panels. A voice example is when you hear commands in your phone “In case of ... press 1, in case of ... press 2, etc.” A thermostat is a machine perceiving temperature changes and turning the heating system on. Prescriptive and prohibitive gestures can be performed by machines, too. Examples are automatic barriers in parking places.

Multisensory production and perception are distinguished. A variety of modes is shown in Fig. 9.

Fig. 9: A variety of modes in the production and perception of legal content

The reasons for the lack of pictures in law and the reluctance of jurists to admit multimodal forms of law (“Law is text”) were seriously explored; see Brunschwig 2003; Röhl & Ulbrich 2007.

6 The valid legal content denotes the content of valid law and also the content, which is significant for it (“Mit „geltendrechtlichen Inhalten“ meine ich Inhalte des geltenden rechts, aber auch Inhalte, die für das geltende Recht bedeutsam sind” [Brunschwig 2003, p. 413]).
Representation and communication of legal contents can be viewed from different perspectives. In our research we focus on the production of legal acts by machines. We aim to identify machine-aided production tasks within the phenomenon of law that has several functions and is rich of tasks.

4. Conclusions

This paper reflects on legal machines. Patterns to produce legal acts are sketched out. Further research is required to develop a complete classification of the patterns and a stricter notation. Semantic networks form the first attempt to formalise the visualizations above. Legal issues tackle the concept of e-Person. Construction issues such as operational implementation tackle software agents.

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5. References


