Bridging Representations of Laws, of Implementations and of Behaviours

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Law in action

- Law is often expressed in general (addressing classes of persons) and referring to "abstract" normative notions.
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ex-post  ex-ante
Research objective: a (partial) realignment of representations of Law, Implementations of Law, and Social Behaviours.

- Legal system
- Legal–administrative infrastructure
- Social system
Research objective: a (partial) realignment of representations of

Legal norms as institutional mechanisms

Legal system

Legal-administrative infrastructure

Business processes

Social system

Intentional characterizations of behaviour
Generalization

• The core problem – of *normative, epistemic and ontological* frictions – is more general than the legal activity.
Generalization

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• Similar contextualization processes exist to a certain extent in any agency (individual or organization), as requirement to be embedded in the social world.
Generalization

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• Similar contextualization processes exist to a certain extent in any agency (individual or organization), as requirement to be embedded in the social world.

• *how to operationalize their alignment?*
Humans implement this function mostly via narratives.
### Views available in narratives

<table>
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<th>How</th>
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<td>occurrence description</td>
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- From occurrence to pattern: *generalization*
Views available in narratives

| How          | Why                    |  \hline
| agents have behaved | occurrence explanation |  \hline
| agents usually behave | pattern description |  \hline
| agents should behave | behavioural mechanism |  \hline

From pattern to occurrence: **instanciation**
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• A mechanism entails, via its execution path, an observable pattern → patterns are abstractions of mechanisms (cf. declarative vs procedural programming) .. but mechanisms are still patterns of primitive actions!
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- Similarly an explanation confirms, via its execution path, a description of an occurrence
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- Explanation of an occurrence is made in terms of behavioural mechanisms or normative mechanisms.
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- Norms **circumscribe** (with duties, prohibitions) or **enable** (with powers) certain behavioural mechanisms, defining what is correct/wrong, possible/impossible.
Some examples..
Occurrence description: a sale

- Occurrences can be seen as *event logs*.
Pattern description: a sale

- In respect to occurrences, patterns introduce abstractions of references, and *partial ordering*. 
Normative specification: a sale
Normative specification: a sale

- A sale contract is issued after a *double promise*.
A sale contract is issued after a **double promise** generating **duties**.
Normative specification: a sale

- Normative specifications accounting duties introduce satisfaction and violation branches.
Agent-role script: a buyer
Agent-role script: a buyer

commitment: driver for behaviour
Agent-role script: a buyer

affordance
enabler of behaviour

commitment
(buy(Good, Money))

ownsEnough
(Money)

affordance
(buy(Good, Money))

accepts(Buyer, Seller, Good, Money)

pays(Buyer, Money, Seller)

enforces(Buyer, delivers(Seller, Buyer, Good))

commitment
(waitFor(delivers(Seller, Buyer, Good)))

failures
(success action)

success

failure

timeout

offers(Seller, Buyer, Good, Money)

delivers(Seller, Buyer, Good)
Agent-role script: a buyer

actions
account also monitoring
Agent-role script: a buyer

monitoring introduces additional commitments and failures
Alignment problem

- How to check whether two models are compatible?
  
  - that a certain occurrence goes under a given pattern?
  
  - that a mechanism produces a certain pattern?
  
  - that a pattern complies with a normative specification?
  
  - that a mechanism complies with a normative specification?
Alignment?

- The transformations of physical or abstract entities preserving (part of) the original structure are called morphisms.
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- The most elementary form of morphism is **homomorphism**, which consists in embedding the source structure into the target one, in a way that all the relations holding in the source are present in the target as well. (~ **subsumption**
Alignment?

- The transformations of physical or abstract entities preserving (part of) the original structure are called morphisms.
- The most elementary form of morphism is homomorphism, which consists in embedding the source structure into the target one, in a way that all the relations holding in the source are present in the target as well. (~ subsumption)
- This is a too strong constraint when we can focus just on system behaviour.
Alignment?

- The literature presents intermediate notions, amongst which *simulation*, and then *bisimilarity*, trying to capture the notion of ‘behavioral sameness’.
Alignment?

• The literature presents intermediate notions, amongst which simulation, and then bisimilarity, trying to capture the notion of ‘behavioral sameness’.

• This notion does not fit our problem, as one model presents events which are not in the other.
Alignment?

A complementary approach is *log-based analysis*, highly tolerant of incomplete knowledge and visibility on the environment, based on e.g. *replay fitness*.
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- Recent works compute fitness in linear time, based on a hierarchy of single-entry-single-exit (SESE) components.
Preliminary solution

Hybrid approach

• extraction of all execution paths $\Sigma_S$, $\Sigma_G$
Preliminary solution

Hybrid approach

- extraction of all execution paths $\Sigma_S$, $\Sigma_G$
- $\forall story_S \in \Sigma_S, \exists story_G \in \Sigma_G / subsumes(story_G, story_S)$
Conclusion

• The paper can be seen as a preliminary attempt to investigate a general *alignment* in our field.
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  - *semantic ontology alignment* typically overlooks the mechanism perspective, focusing on static structures.
Conclusion

- The paper can be seen as a preliminary attempt to investigate a general *alignment* in our field.
- Today, this topic is tackled down differently according the discipline:
  - *semantic ontology alignment* typically overlooks the mechanism perspective, focusing on static structures.
  - *process alignment* neglects to deal with ontological commitments, and epistemic considerations.
Conclusion

• In practice, however, any ontology aiming to represent aspects of the real world will always require both.

• It is therefore crucial to find a diplomatic truce between the two views, at least for operational reasons.