Towards runtime support for norm change from a monitoring perspective

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Outline

1. Introduction
2. Dynamic Normative Context
3. Conclusions and Future Work
Governance on Electronic institutions

- Apply social abstractions to distributed systems in order to tame their complexity.
  - **Requirement**: Assess, at **run-time** the state of the normative environment (norm violated, norm fulfilled, etc.)

Norms:
- **Regulative**

\[ \text{Win}_\text{Auction}(\text{isangi}, P) \rightarrow O_{\text{isangi}}(\text{Pay}_\text{Product}(P) < \text{leave}_\text{auction}(\text{isangi})) \]
\[ \text{In}_\text{progress}(P) \rightarrow F_{\text{attendee}}(\text{ask}_\text{question} < \neg \text{In}_\text{progress}(P)) \]

- **Constitutive**

\[ \text{Raise}_\text{hand} \Rightarrow Sotherby's \text{ Bid} \]
\[ \text{Raise}_\text{hand} \Rightarrow Osaka_Fish_Market \text{ Leave} \]

- **Other** (e.g., regimented, conventions)
Framework for Governance on EI
Basic Concepts:

- Language: $\mathcal{L}_O$
- Ontology: $O$
- Logic connectives $\{\neg, \lor, \land\}$
- Set of all possible well-formed formulas: $wff(\mathcal{L}_O)$ (DNF)
- A norm $n$ is a tuple $n = \langle f_A, f_M, f_D, f_w, w \rangle$
- A norm is considered fulfilled if, and only if:
  $$f_A \rightarrow [O_w(E_w f_w \leq \neg f_M) \cup f_D]$$
- Event: $\langle \alpha, t, p \rangle$
- Normative Monitor: $M_N = \langle N, S, IS, VS, FS, RS, E \rangle$
**Norm Life-Cycle**

activated\((ni)\) ⇔ ∃\(f ∈ F(s)\), Θ\(f_A\) ≡ \(f\)

deactivated\((ni)\) ⇔ ∃Θ', ∃\(f ∈ F(s)\), Θ'(\(f_D\)) ≡ \(f ∧ Θ' ⊆ Θ\)
Scenarios for Governance on EI
Outline

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Previous Work

- Jordi Campos et al. *Formalising situatedness and adaptation in electronic institutions*, 2009
- Tinnemeier et al. *Programming norm change*, 2010

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Our Approach

Objective: Real-time expansion and contraction of the normative context in the institution

- Without having to stop monitoring the state of the world
- Inferring new **consistent** information about the state of the world

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Retroactive Promulgation
Prospective Promulgation

Monitor M
Norms N
P PNorm
M.IS M.RS M.FS M.VS

Monitor M'
Norm P PNorm
M'.IS Ø Ø

Monitor M
Norms N
M.IS M.RS M.FS M.VS

Monitor M
Norms N U Norm P PNorm
M'.IS M.IS M.RS
M.FS M.VS
M.FS M.VS

= =
Abrogation

Outline
Introduction
Dynamic Normative Context
Conclusions and Future Work

Monitor M

Norms N U Norm ABNorm

-ABNorm

Monitor M

Norms N U Norm ABNorm

Monitor M

Norms N U Norm ABNorm

Monitor M

Norms N

-ABNorm

Monitor M

Norms N

-ABNorm

Monitor M

Norms N

-ABNorm
Annulment
Extended Norm Life-Cycle

Enabling new norm states
- In force (contains original norm life-cycle)
- In transition
- Deleted
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Conclusions

- Formal generic method for expanding and contracting institutions at run-time
- Formalisation of the four operations to be supported
- Norm life-cycle extension
- Algorithms
Future Work

The proposed framework has room for improvement:

- Interaction between the proposed framework and previously developed frameworks for:
  - Run-time change of constitutive rules\(^1\)
  - Framework scaling via distributed monitors\(^2\)
- Means to ensure normative-context modifications result in a consistent and non-redundant normative-context
- Statement of framework’s efficiency via tests on a prototype
- Development of adaptive normative contexts
  - Support for detecting when norm-change is required from an institutional point of view
  - Provide means for agents to autonomously perform norm change

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\(^1\) H. Aldewereld et al. *Making norms concrete*, 2010
Thanks

Thank you for your attention

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