Code-driven Law NO, Normware SI!

3 November 2022, CRCL conference “Computational Law on Edge”, Brussels

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Socially Intelligent Artificial Systems (SIAS),
Informatics Institute, University of Amsterdam

Part I:
types of “law”,
and a more nuanced distinction

text-driven law **data-driven law** **code-driven law**

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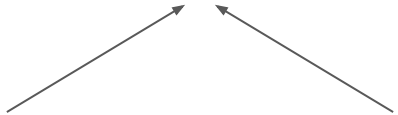

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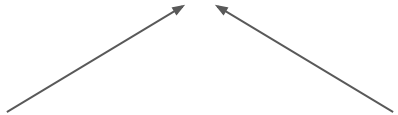

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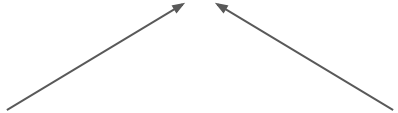

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in so far humans are involved

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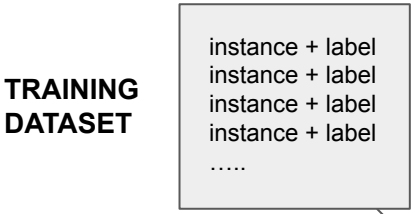

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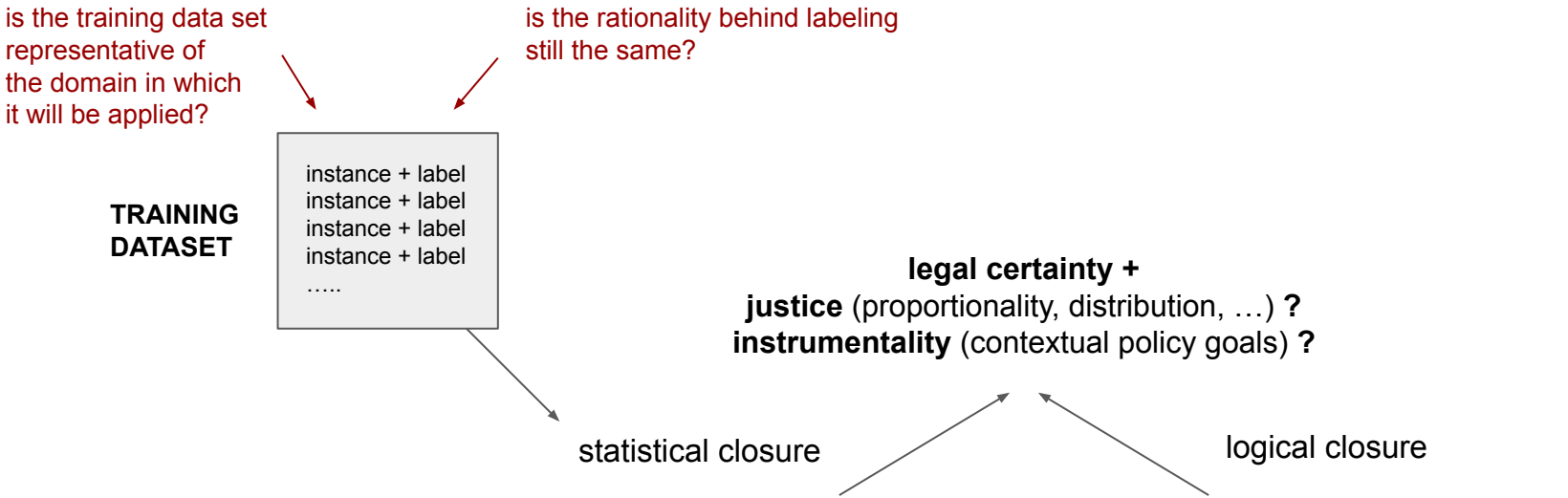

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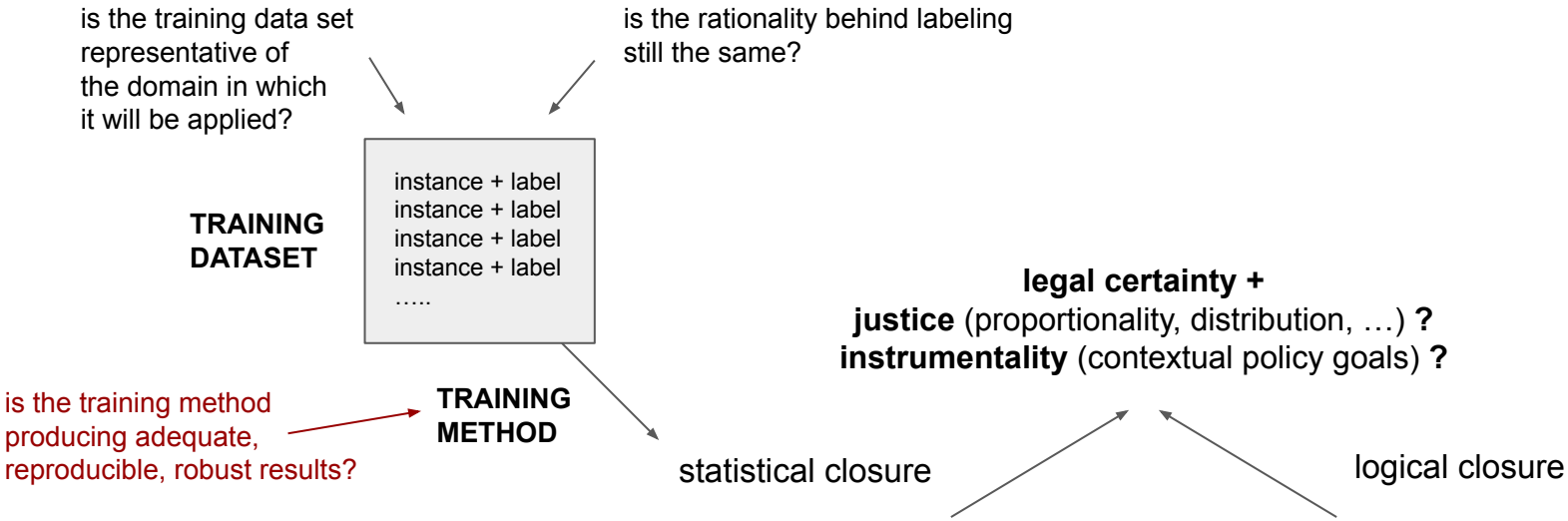

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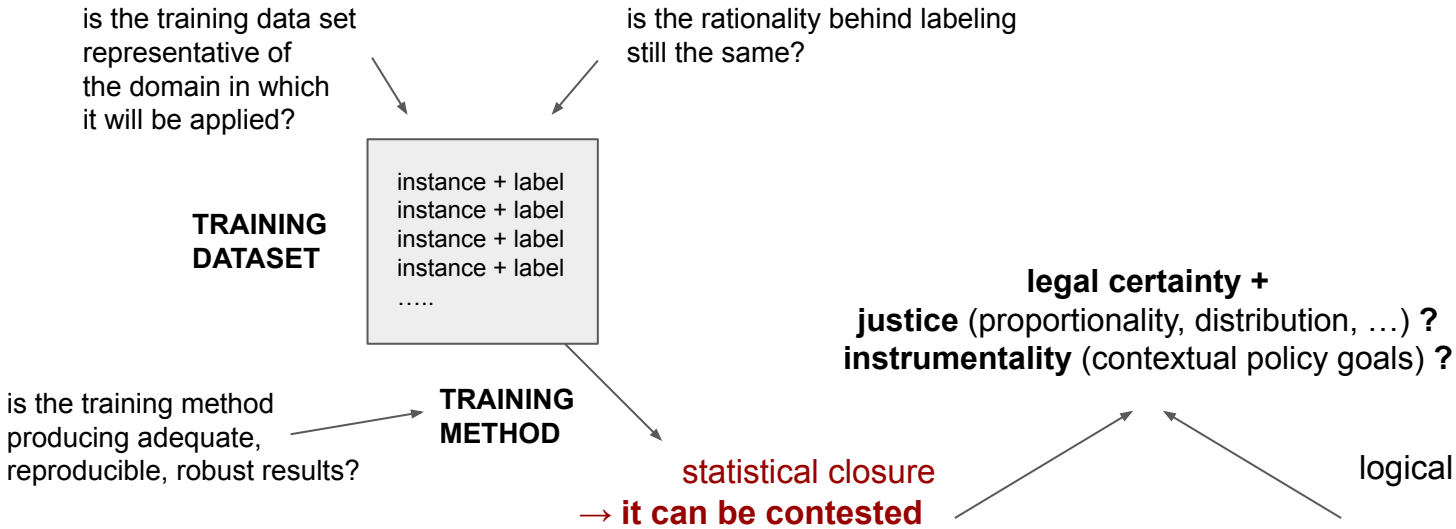
is the training data set representative of the domain in which it will be applied?
is the rationality behind labeling still the same?
TRAINING DATASET
instance + label
instance + label
instance + label
instance + label
…..
is the training method producing adequate, reproducible, robust results?
TRAINING METHOD
legal certainty +
justice (proportionality, distribution, …) ?
instrumentality (contextual policy goals) ?
statistical closure
→ it can be contested
logical closure
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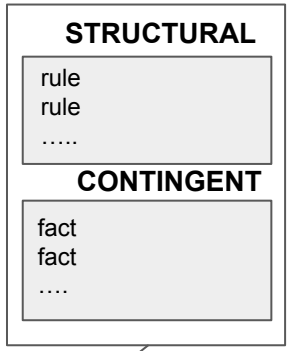

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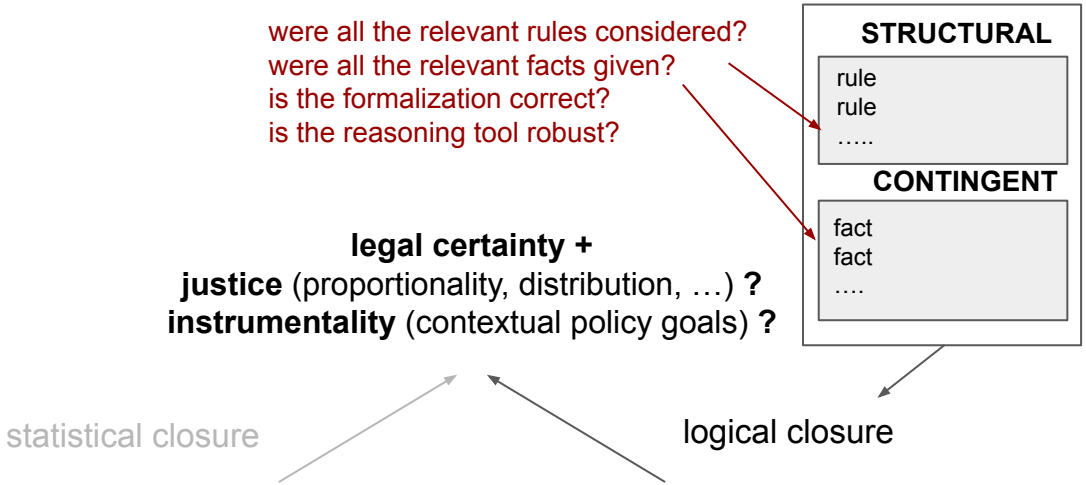

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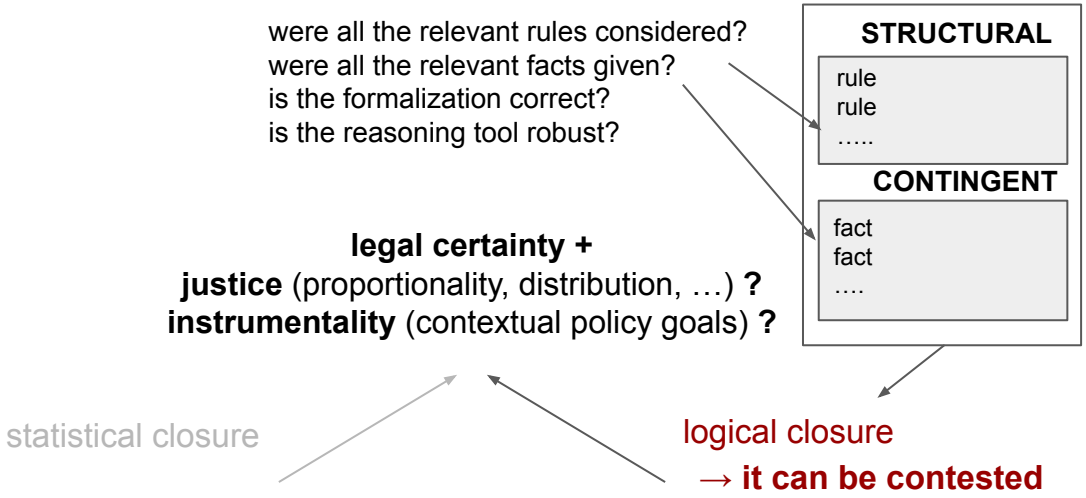

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is this all?

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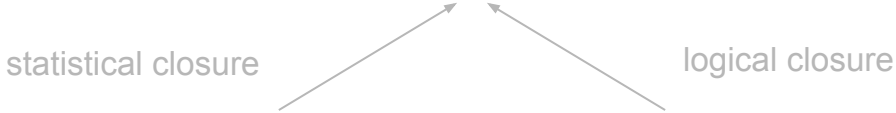

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these principles could be to some extent formalized as meta-rules

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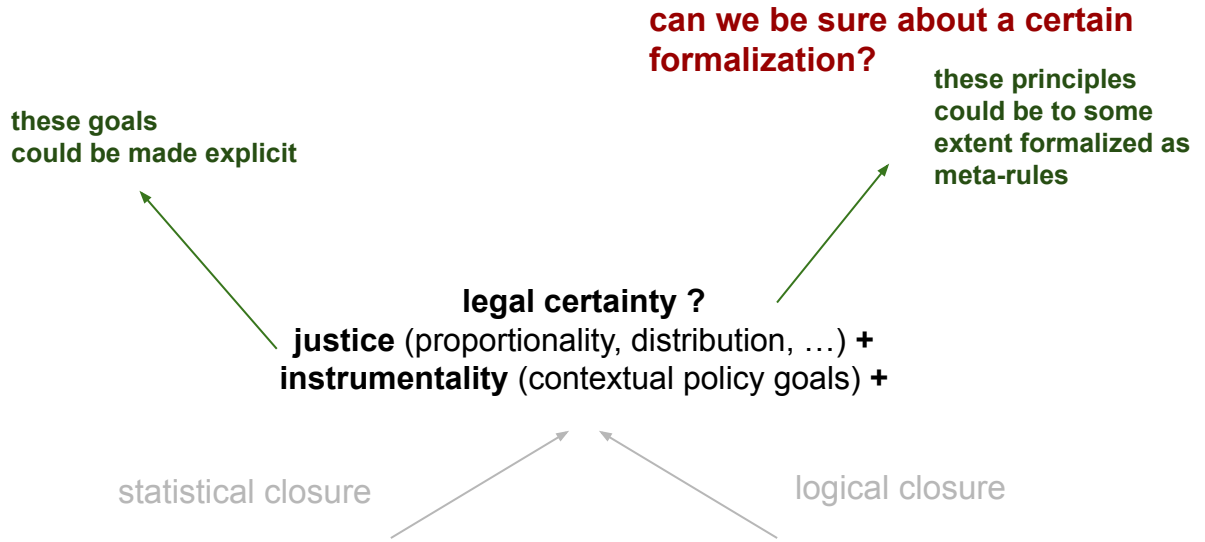

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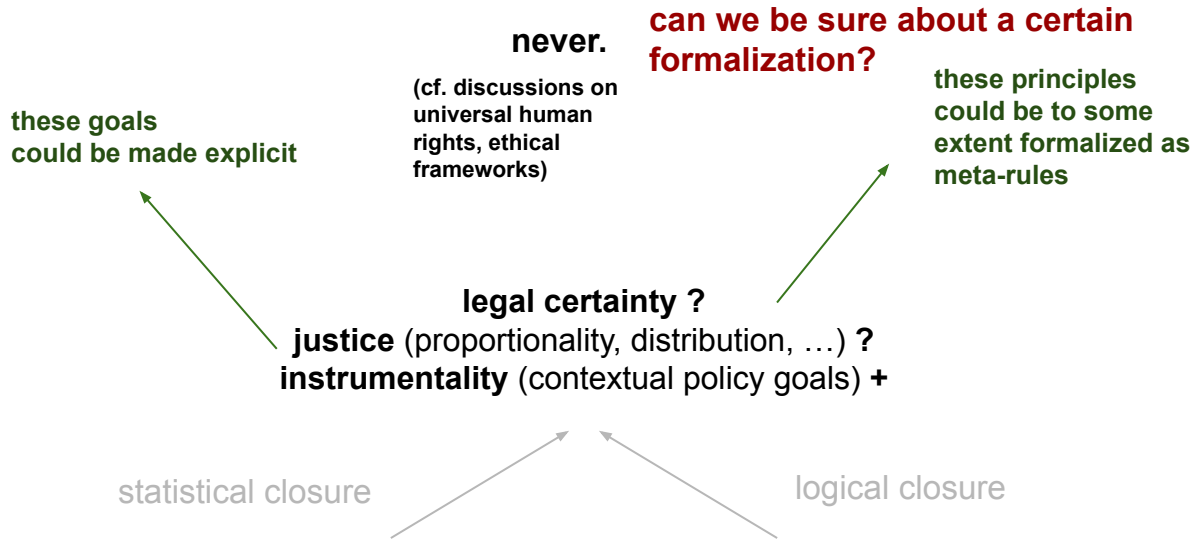

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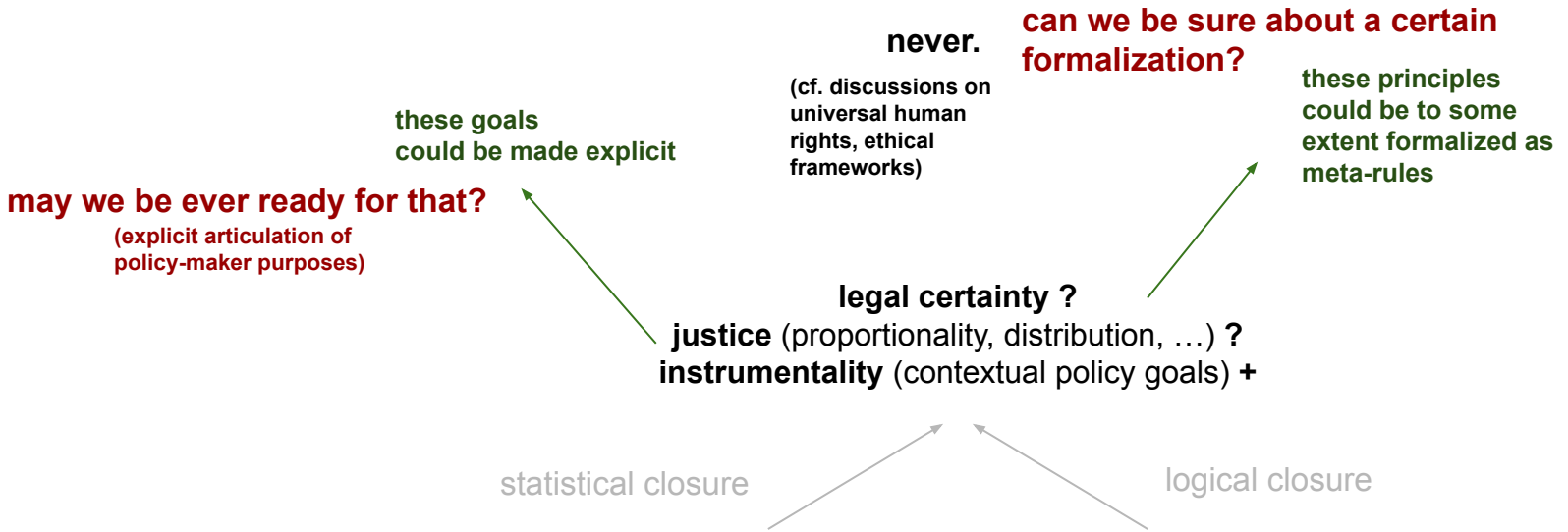

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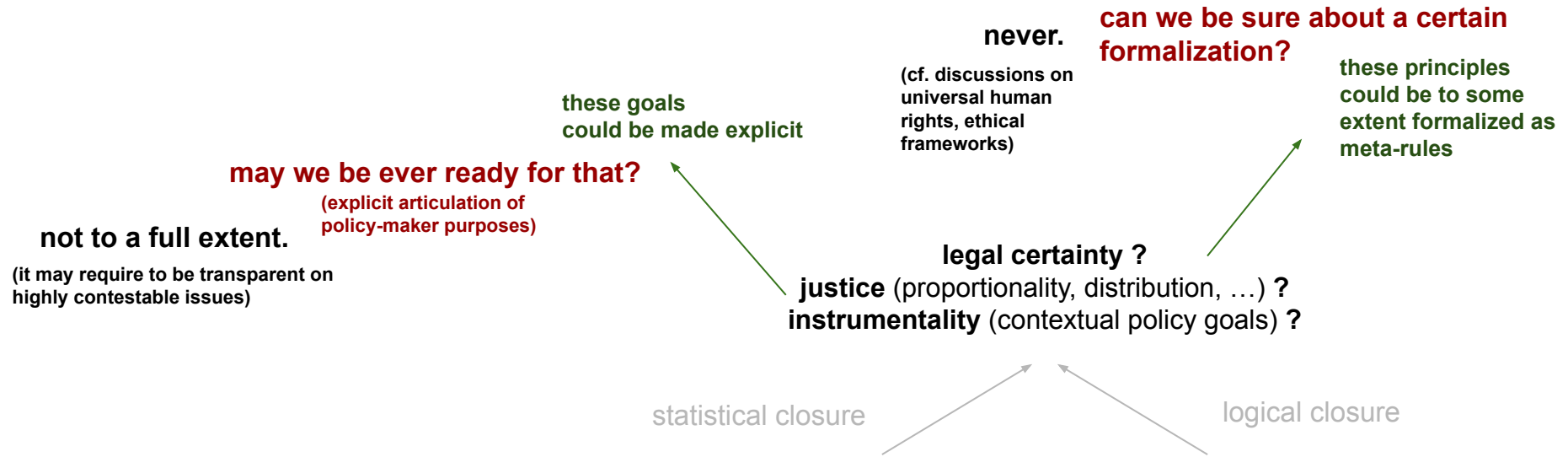

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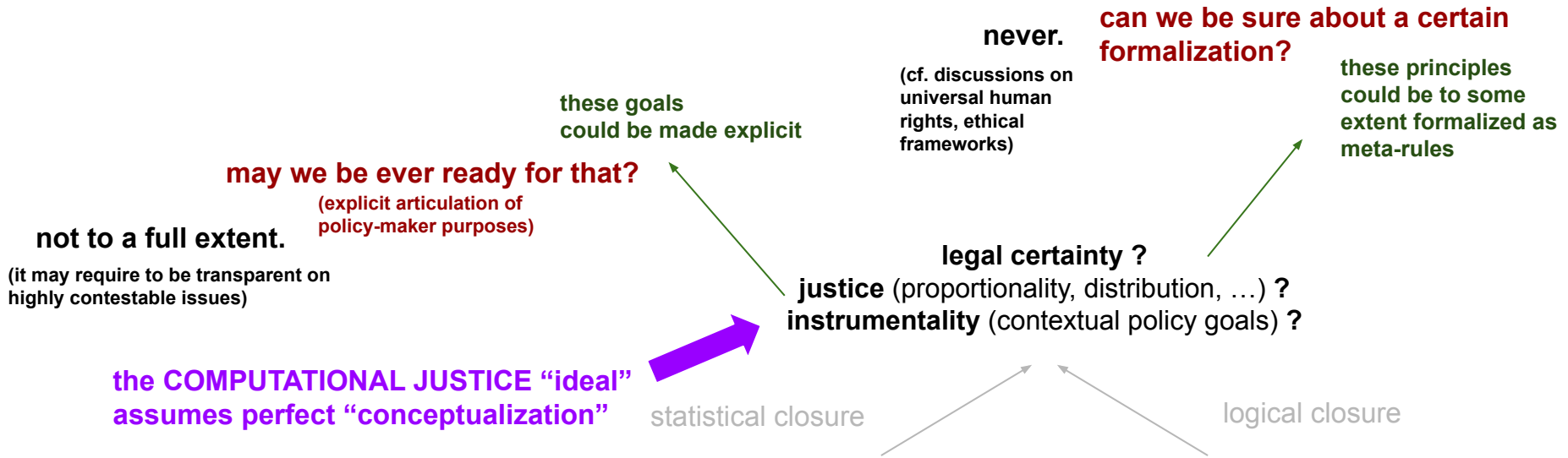

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possibility of **continuous, automated testing/verification**

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ecological system including interfaces with humans

derived from legal norms or policies that have been articulated in computer code (or from other methods)
lower authority w.r.t. human authorities!!!

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lower authority w.r.t. human authorities!!!

a serious technological gap exists today...

Part II:
what is normware?

A tentative ontology

HARDWARE

- **physical device**
- when running
  ⇒ physical process
- situated in a
  physical environment

SOFTWARE

- **symbolic device**
- when running
  ⇒ symbolic process
- relies on
  physical processes

A tentative ontology

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SOFTWARE

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NORMWARE

- **?**
- when running
  ⇒ ?
- relies on **?**

A tentative ontology

?

HARDWARE	SOFTWARE	NORMWARE	
• **physical device**	• **symbolic device**	• **?**	**ARTIFACT dimension**
• when running **⇒ physical process**	• when running **⇒ symbolic process**	• when running **⇒ ?**	**PROCESS dimension**
• situated in a **physical environment**	• relies on **physical processes**	• relies on **?**	

Normware as artifacts: directives concerning regulation

the cookie jar must be full

you are prohibited to eat cookies

you can not eat cookies

Normware as artifacts: directives concerning regulation

aiming to regulate situations in the world

the cookie jar must be full

aiming to regulate behaviour

you are prohibited to eat cookies

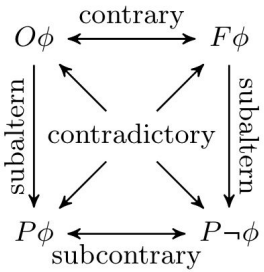
you can not eat cookies

Normware as artifacts: directives concerning regulation

we can have explicit normative specifications…

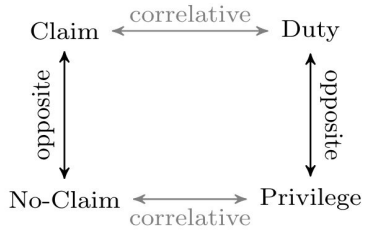
```
Order Deny,Allow
Deny from all
Allow from example.org
```

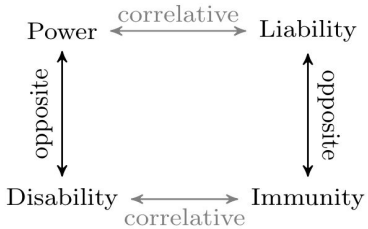
access-control policies



languages based on deontic logic

languages based on Hohfeld's primitives





Normware as artifacts: directives concerning regulation

but programs in themselves
are already mandatory in nature!

`a := 2 + 2`	system ***has*** to perform 2 + 2…
`?mother(maggie, bart)`	system ***has*** to prove that…
`animal :- dog.`	system ***has*** to make animal true if dog is true

Normware as artifacts: directives concerning terminology

what is a cookie?

what is a jar?

the cookie jar must be full

what does it mean to be full?

who is you?

what is eating?

you are prohibited to eat cookies

you can not eat cookies

Normware as artifacts: directives concerning expectations

eating cookies → cookies are destroyed → the jar is not full

the cookie jar must be full

practical **normative reasoning always require some world knowledge**

you are prohibited to eat cookies

you can not eat cookies

Normware as artifacts: devices intended to regulate

doors regulate entrances

semaphores regulate traffic

Normware as artifacts: devices intended to regulate

doors regulate entrances

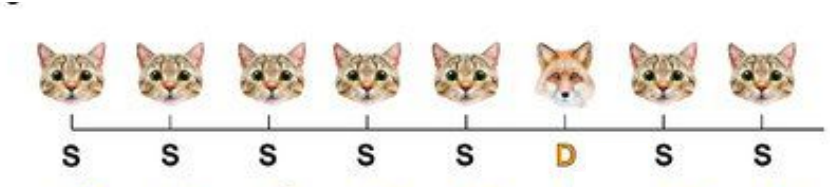
semaphores regulate traffic

we do not have access to the inner decision-making mechanism that brings to the current output state!

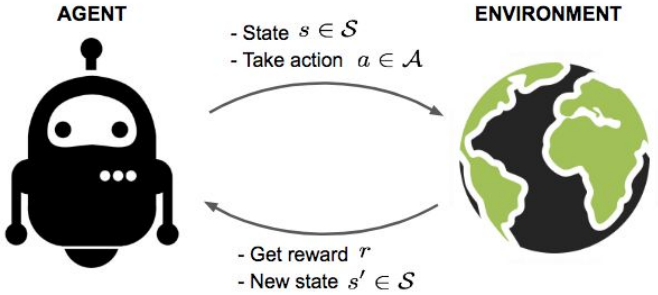
Normware as artifacts: devices intended to regulate

black-boxes (eg. ML models) are also artifacts expressing some form of normativity/normality

"is this a cat?"



"how to (best) behave in certain conditions?"



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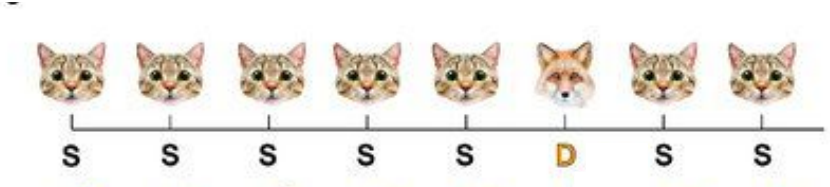

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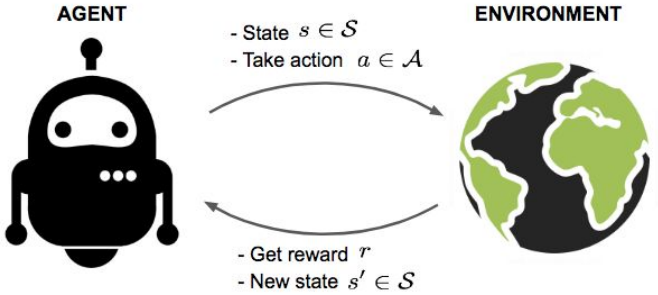


from a functional point of view, they also count as normware!

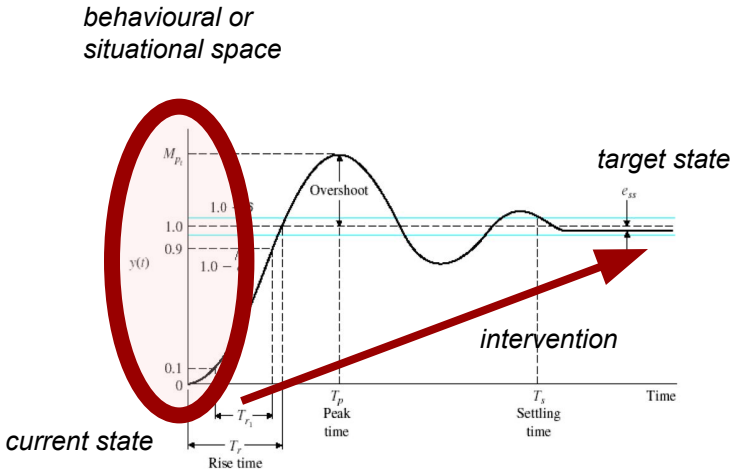
Normware as processes: regulation as control

Whether artificial or natural, designed or emergent,

what counts in control is

- the existence of some ***reference*** (the **target** of control),
- which the entity is set to either *approach* or *avoid* (the **direction** of control).

Normware as processes: regulation as control



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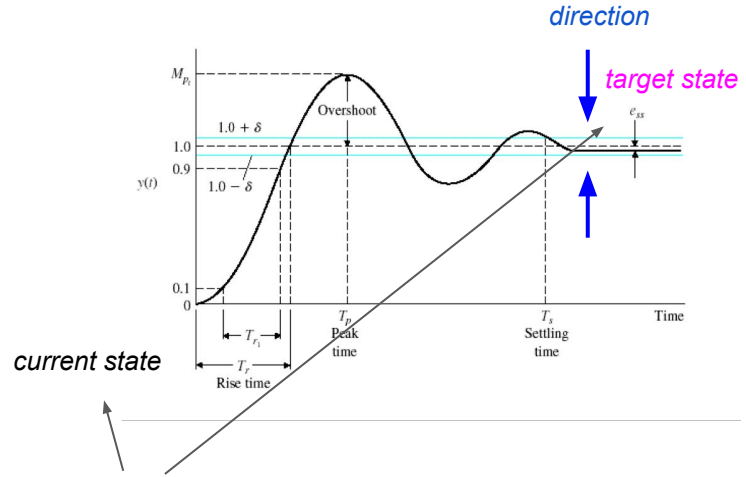
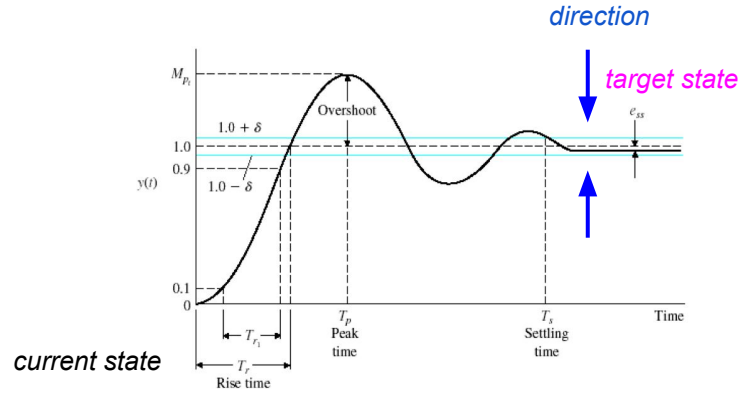


what defines the references though?

Normware as processes: regulation as control



Whether artificial or natural, designed or emergent,

what counts in control is

- the existence of some ***reference*** (the **target** of control),
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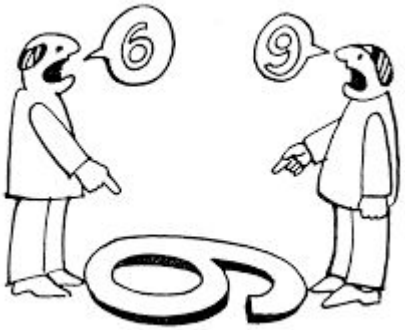
by defining directives by this control signature (target, direction), any regulative mechanisms can be abstracted from its implementation.

Normware as processes: higher-order indetermination

indeterminacy of references



Normware as processes: higher-order indetermination

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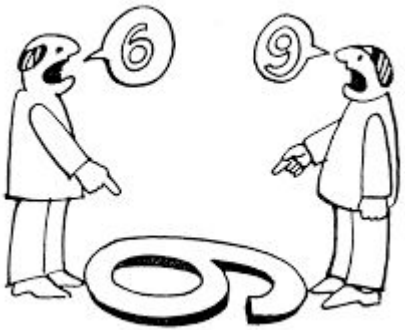
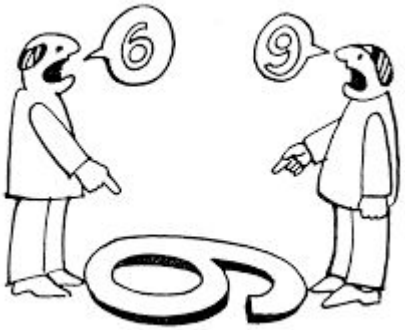


indeterminacy of directives

Normware as processes: higher-order indetermination

indeterminacy of references

antinomies



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Normware as processes: higher-order indetermination

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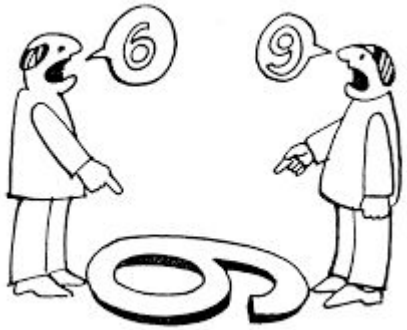
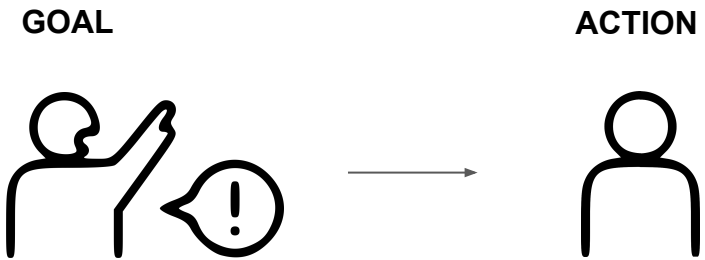


indeterminacy of directives

mechanisms of conflict resolution
are needed at systematic level!

Normware: first-order control



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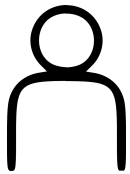
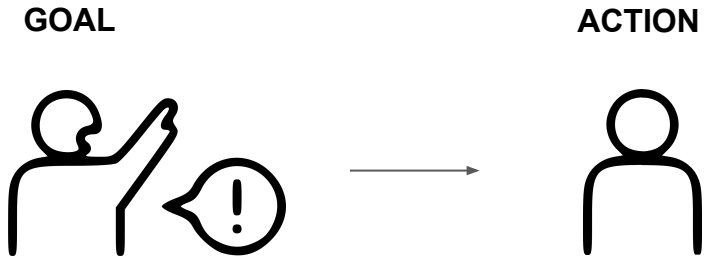


	GOAL	ACTION
code-driven	instruction	operation
data-driven	labelled dataset	ML black box

Normware: first-order control

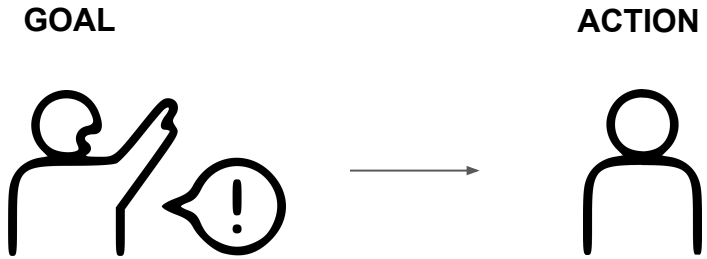
In both cases, some method has been used to select the action from a pool of actions…



code-driven	instruction	operation
data-driven	labelled dataset	ML black box

Normware: first-order control

But then, where the goal comes from?



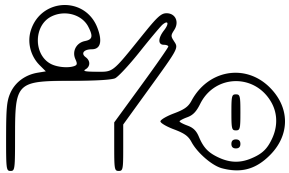
code-driven	instruction	operation
data-driven	labelled dataset	ML black box

Normware: second-order control

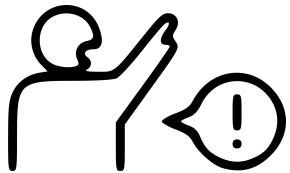
Adding depth!

pool of actions

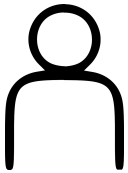
STRATEGIC GOAL



TACTICAL GOAL



ACTION



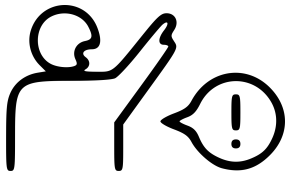
Normware: second-order control

Adding depth!

pool of goals

pool of actions

STRATEGIC GOAL



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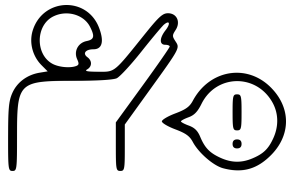

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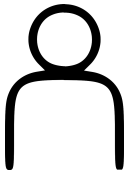

Normware: second-order control

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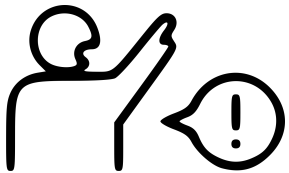

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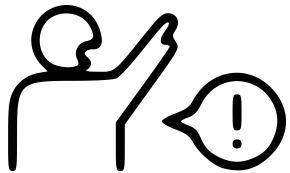

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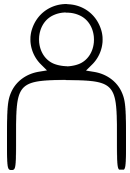


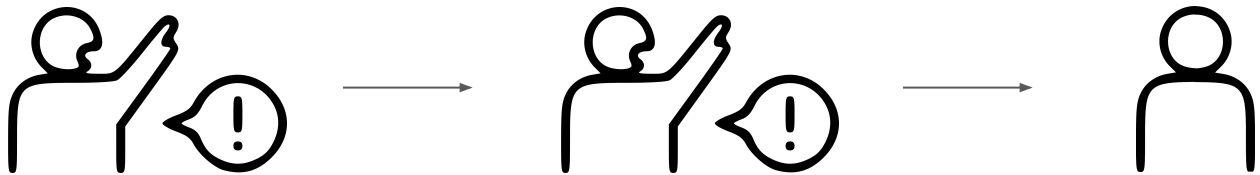
Sileno, G., Boer, A. and van Engers, T., The Role of Normware in Trustworthy and Explainable AI, Proceedings of XAILA workshop: Explainable AI and Law, in conjunction with JURIX 2018

trustworthy AI *and* ***explainable AI*** *issues in ML due to lack of the strategic component*

Normware: second-order control

cybernetic view on systems: ***policy***, ***intelligence***, ***operations***

STRATEGIC GOAL **TACTICAL GOAL** **ACTION**



Normware: second-order control

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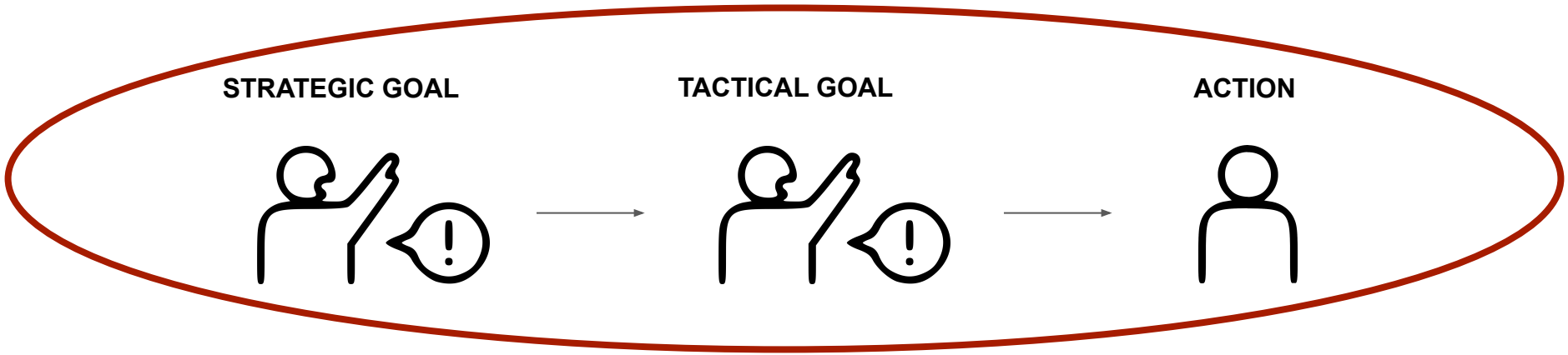
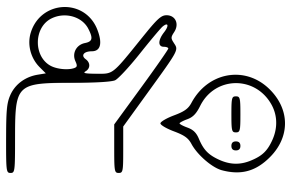


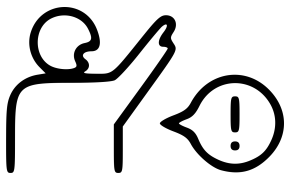
…yet it is about a single “organism”, not an “ecology”

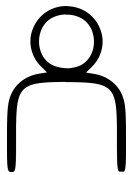
“TOTALITARIAN” architecture

Normware: plural second-order control

*we need to acknowledge the presence of several **autonomous entities**,*







Normware: plural second-order control

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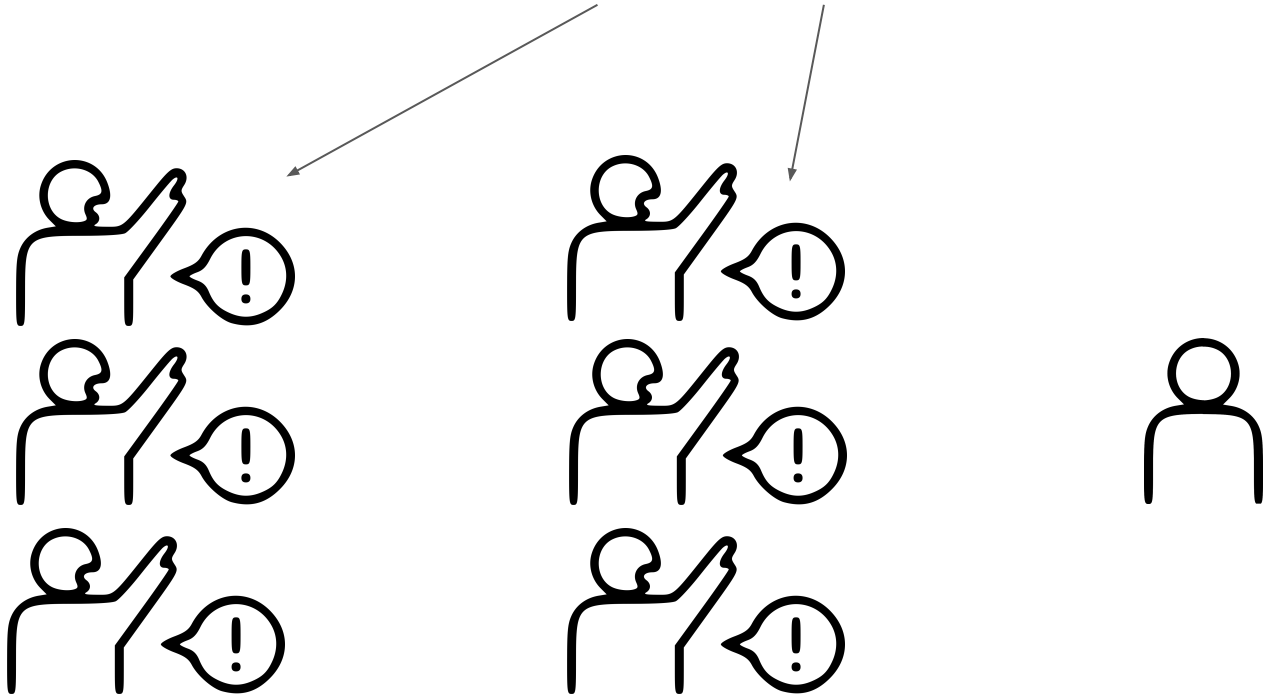
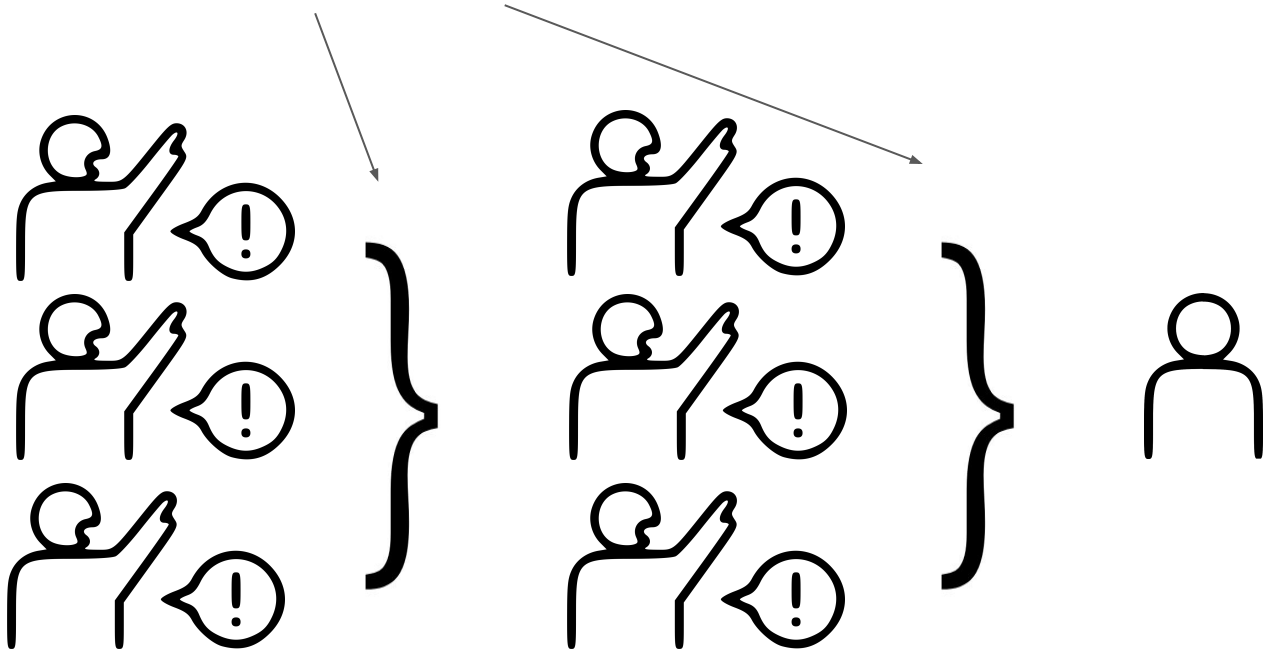


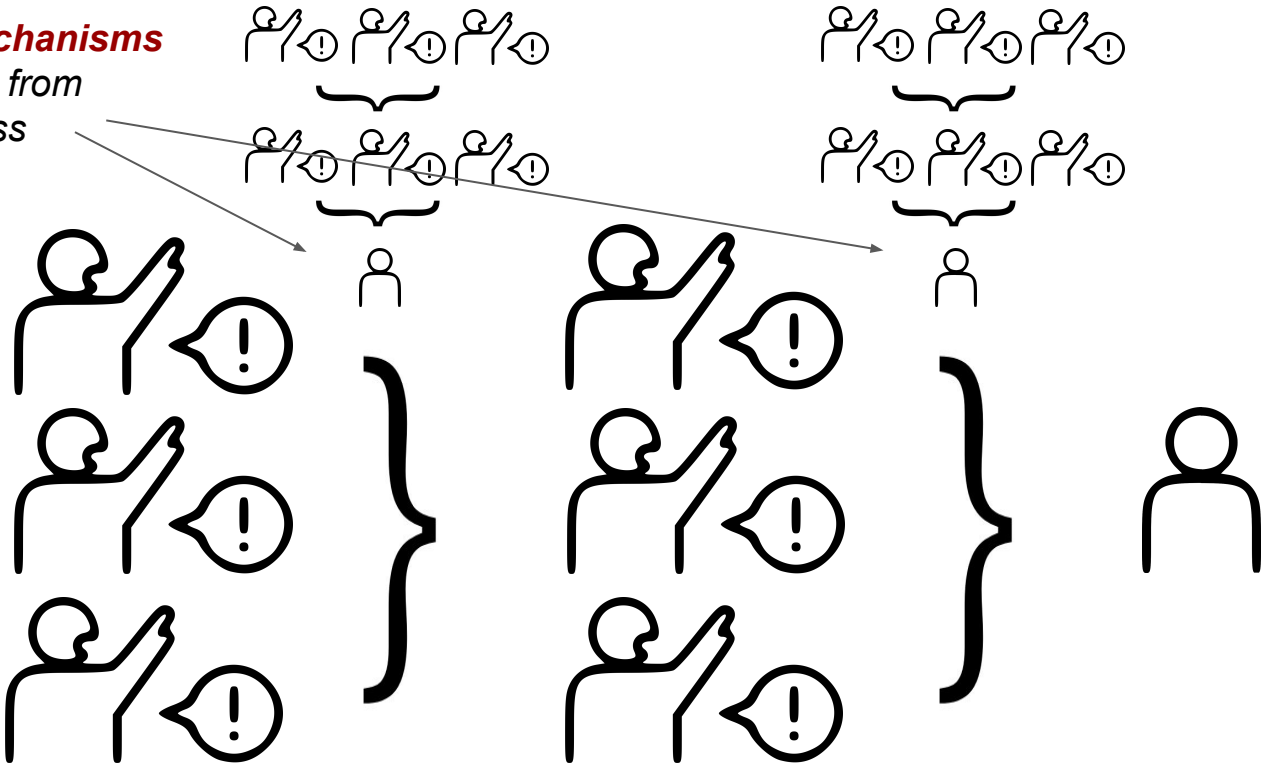
Normware: plural second-order control

*we need to acknowledge the presence of several **autonomous entities**,*
*and adequate conflict **resolution mechanisms***



Normware: plural second-order control

resolution mechanisms
may also result from
a similar process



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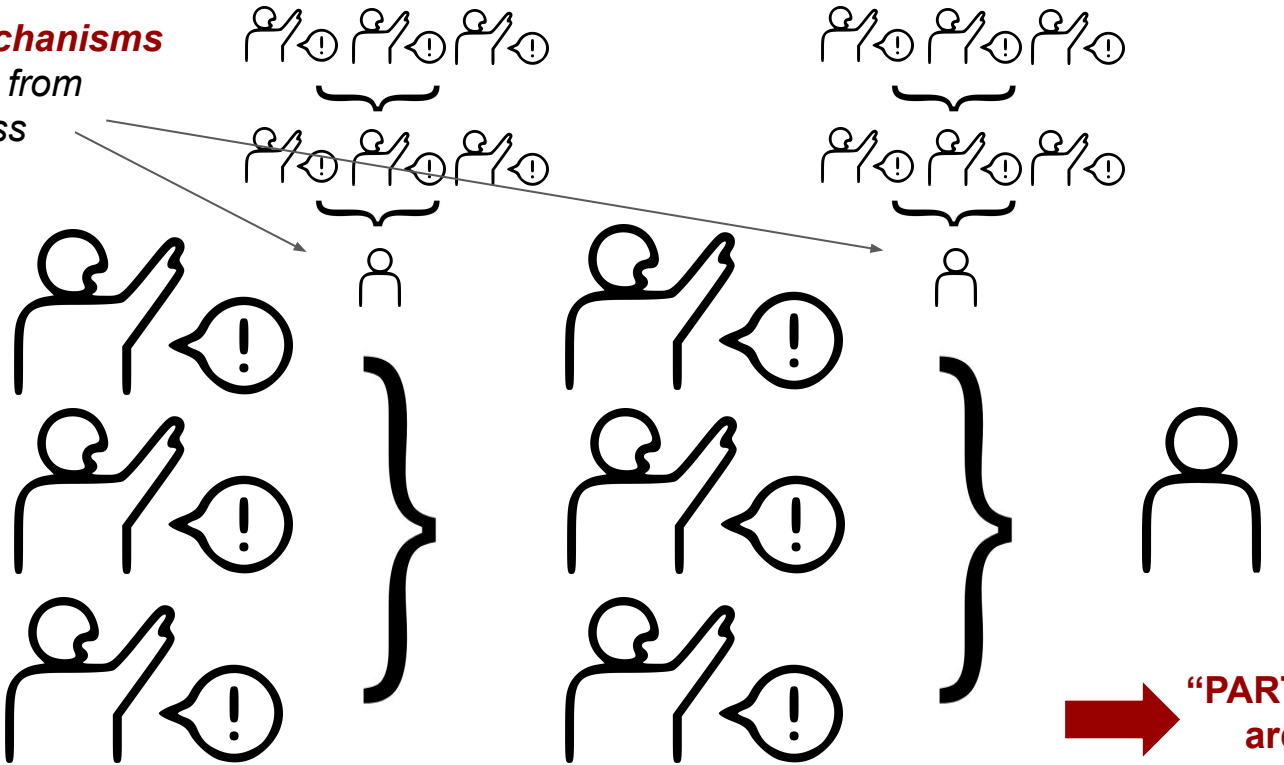

“PARTICIPATORY” architecture

Normware: plural second-order control

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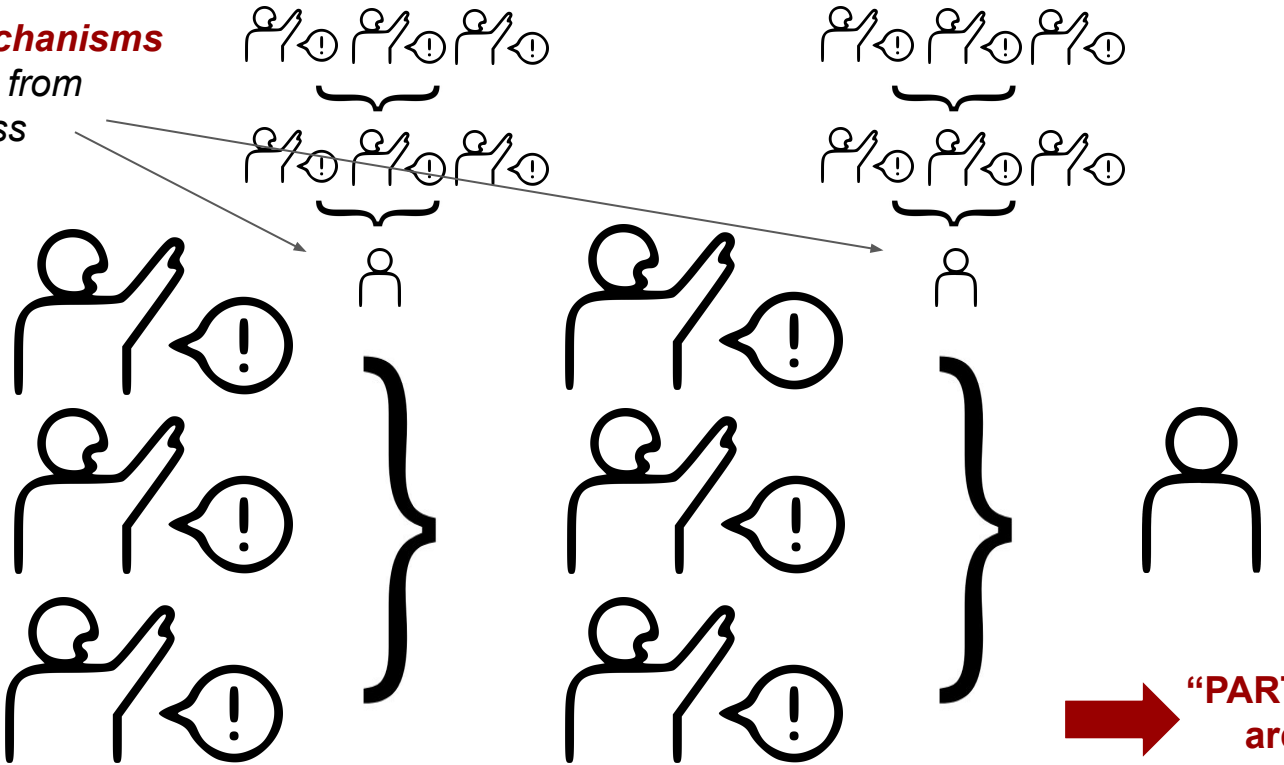


“PARTICIPATORY” architecture

Sileno, G., Grosso, P., Accounting Value Effects for Responsible Networking. Proceedings of ACM SIGCOMM 2021 Workshop on Technologies, Applications, and Uses of a Responsible Internet (TAURIN2021).

A less tentative ontology

?

HARDWARE	SOFTWARE	NORMWARE
physical device	**symbolic device**	**coordination device**
when running ⇒ **physical process**	when running ⇒ **symbolic process**	when running ⇒ **coordination process**
situated in a **physical environment**	relies on **physical processes**	relies on **symbolic** (possibly hard-coded) **processes**

Key points

- There is continuity between institutional and computational activities.
- We don’t need institutions to become more mechanical, institutional constructs need to be brought into the computational realm.
- As we have a plurality of normative sources, we need a plurality of computational normative sources.

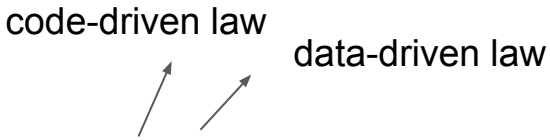
→ **normware**

Contemporary socio-technical challenge:

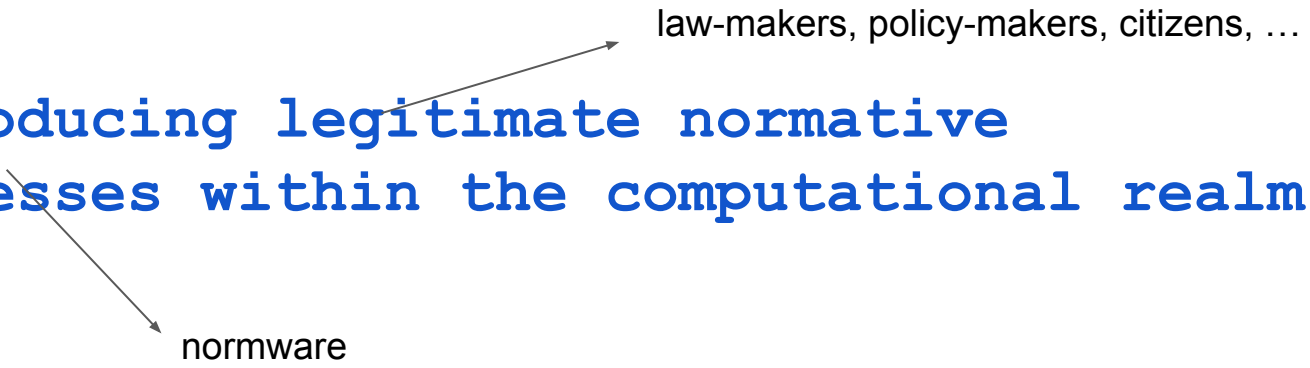
NO mechanizing law

SI! introducing legitimate normative processes within the computational realm

Contemporary socio-technical challenge:



NO **mechanizing law**



SI! **introducing legitimate normative processes within the computational realm**

Code-driven Law NO, Normware SI!

3 November 2022, CRCL conference “Computational Law on Edge”, Brussels

Giovanni Sileno, g.sileno@uva.nl
Socially Intelligent Artificial Systems (SIAS),
Informatics Institute, University of Amsterdam