Triply Articulated Modelling of the Anticipatory Enterprise
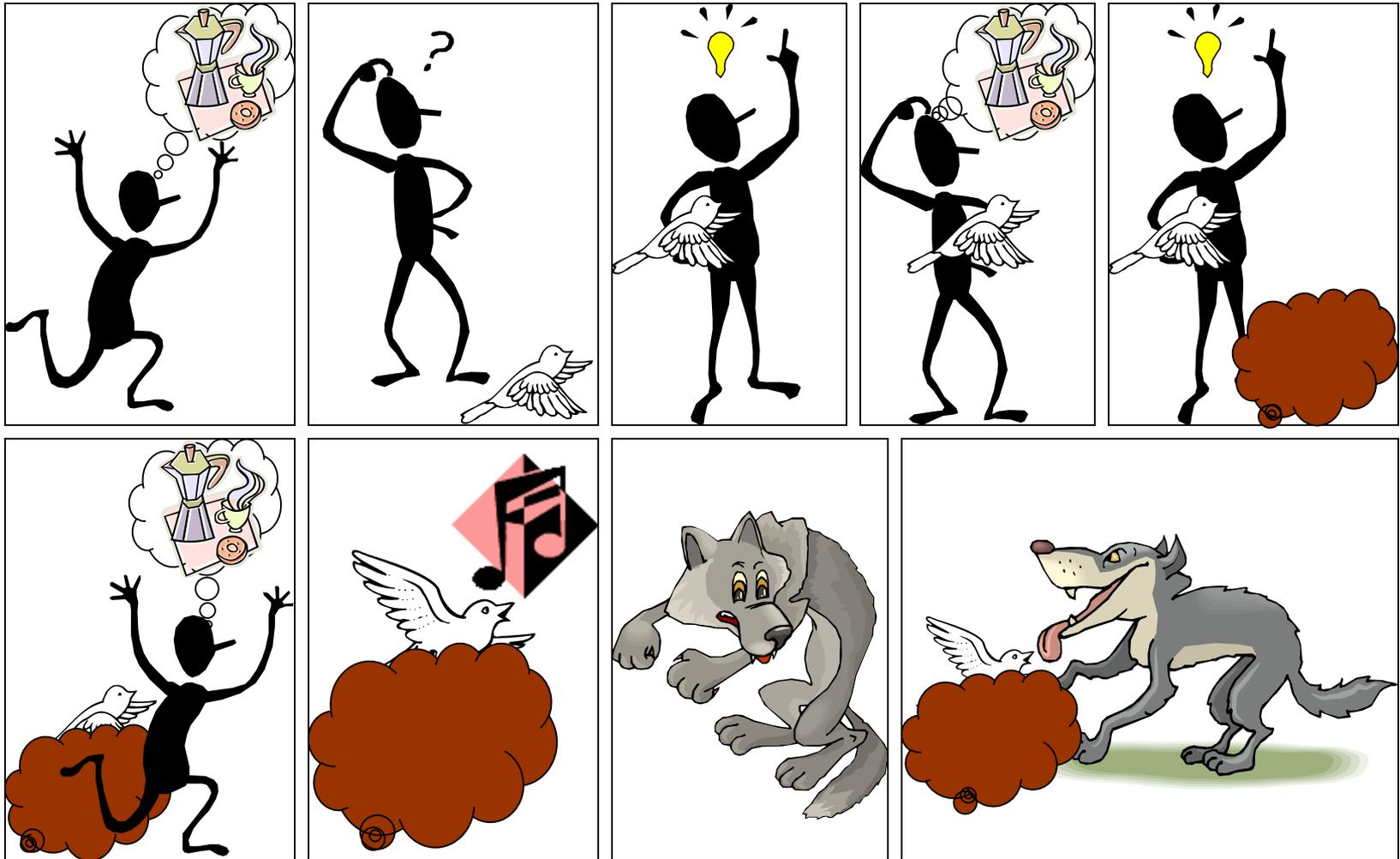
Philip Boxer, Boxer Research Ltd.
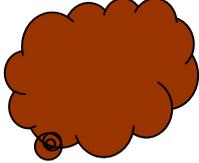
Professor Bernard Cohen, City U., London
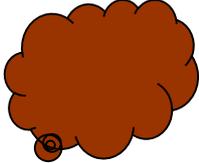
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1

The Parable of the Frozen Bird

The Morals of the Tale

The guy who gets you into the

is not necessarily your enemy.

The guy who gets you out of the

is not necessarily your friend.

When you're up to your neck in

don't sing about it.

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Flaws Generate Risks of Error

Error of execution   (Performance Risk)
    inability to sustain the performance of the capabilities
    one requires to provide the service.

Inadequate source
of heat to defrost
the bird in time

Error of planning   (Composition Risk)
    inability to ensure the validity of one's approach to
    composing capabilities in order to deliver the service.

Getting out of
the dung is left
up to the bird.

Error of intention   (Implementation Risk)
    inability to guarantee that the service will satisfy the
    client's need when deployed in her context-of-use.

The bird's
problem was
survival, not
defrosting.

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Asymmetric Demand

Symmetric demand

demand is defined in terms of what the supplier can provide

supplier assumes that demand is generalised and ***independent*** of clients' contexts-of-use.

strategic stance is ***positional***, power is held at the ***centre***, ***implementation risk*** is not the supplier's problem

Has successfully provided a vast variety of cheap, globally accessible, networked services, but its success leads clients to expect more: services ***specific*** to their context-of-use.
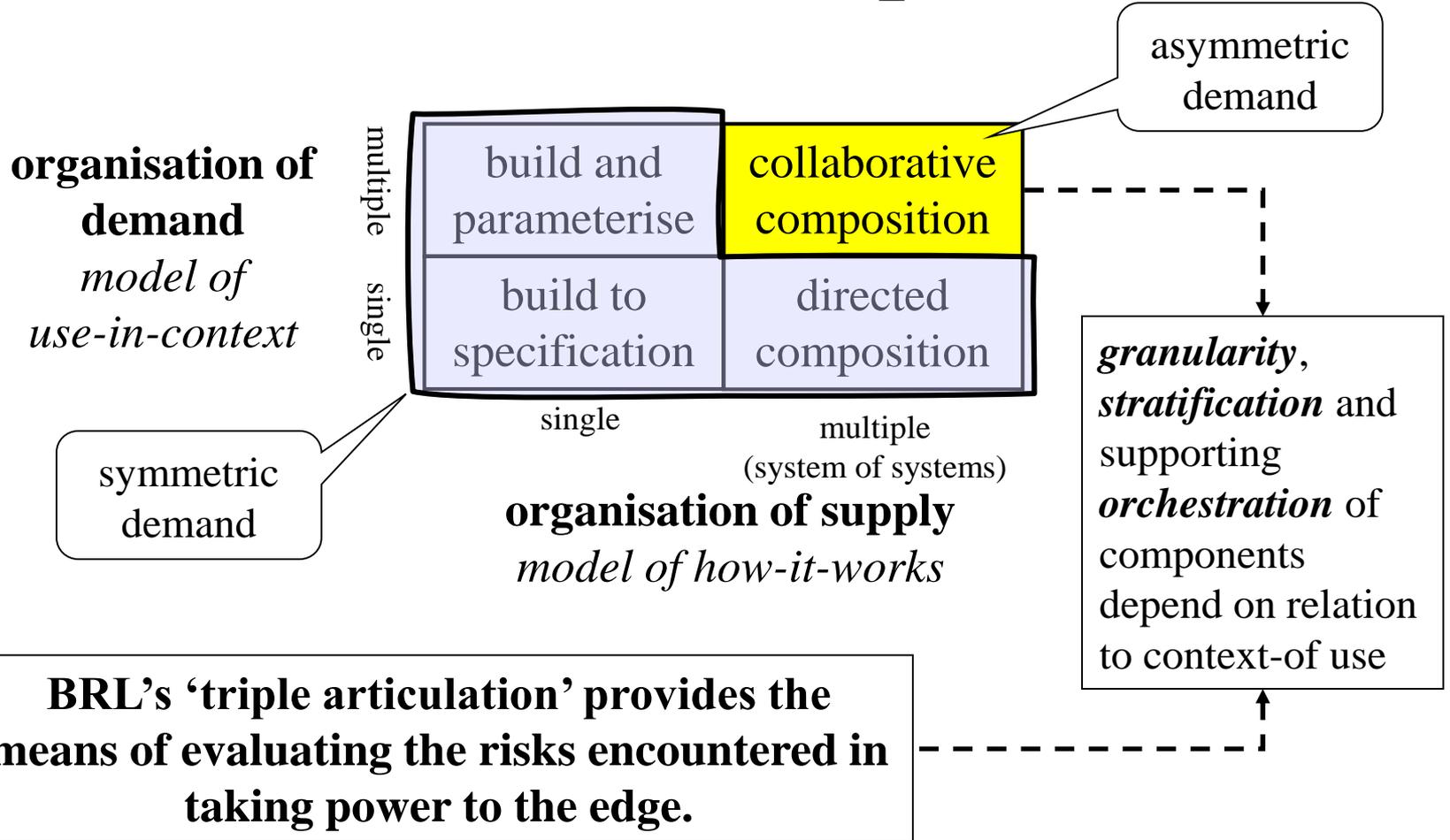
Asymmetric demand

demand is defined in terms of the supplier's relation to the client's context-of-use

competition requires the supplier to relate to the customer's experience

strategic stance is ***relational***, taking ***power to the edge***, ***implementation risk*** has to be managed

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Collaborative Composition

asymmetric demand

	single	multiple (system of systems)
multiple	build and parameterise	collaborative composition
single	build to specification	directed composition

organisation of demand
model of use-in-context

symmetric demand

organisation of supply
model of how-it-works

***granularity*, *stratification* and supporting *orchestration* of components depend on relation to context-of use**

BRL's 'triple articulation' provides the means of evaluating the risks encountered in taking power to the edge.

The Existential Articulation

ontology of supply

a relational model of the actor's knowledge of how her world ***behaves*** in terms of:

● *processes:* models of ***closed systems*** that, as ***formal causes***, change (public) states-of-affairs; and

● *events*: ***states-of-affairs*** that are prerequisite to, and/or observed to pertain after, a process;

together represented as a directed graph, the ***zero-level*** of the articulation; and
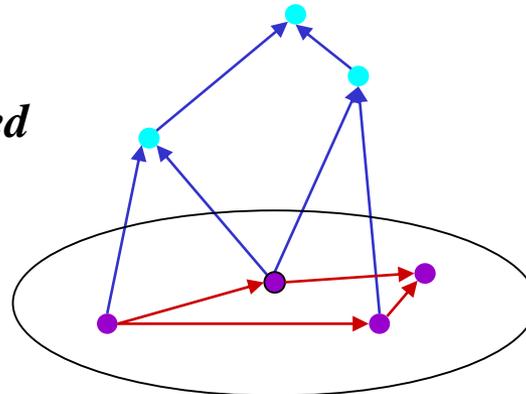
● *coordinations*: ***collections of processes*** (and/or coordinations, recursively) that can be made to occur together in some purposeful way,
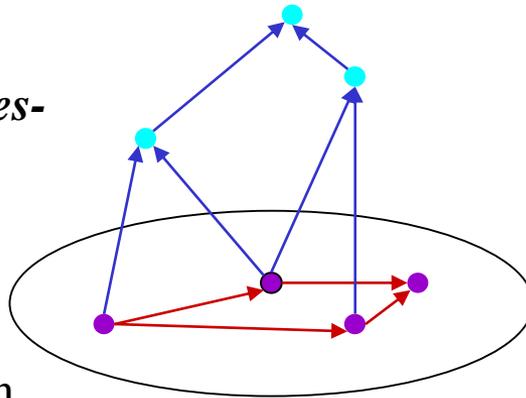
represented as a directed acyclic graph (***dag***) whose ***apices*** are subtended, transitively, by sets of zero-level vertices (processes).

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The Deontic Articulation

ontology of intent

a relational model of the actor's ontology of **controllability** in terms of

• *outcomes***:** observable ***states-of-affairs***; and

• *transformations*: ***changes*** that must take place in the pertaining states-of-affairs in order to bring about outcomes;

together represented as a directed graph, the ***zero-level*** of the articulation; and

• *synchronisations*: ***collections of outcomes*** (and/or synchronisations, recursively) that may be ***made to occur together***, represented as a directed acyclic graph (***dag***) whose ***apices*** are subtended, transitively, by sets of zero-level vertices (outcomes).

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Existential × Deontic

The existential and deontic articulations are ***composed*** by asserting mappings that implicate existential events in deontic outcomes, and deontic transformations in existential processes.

outcomes to events

processes to transformations
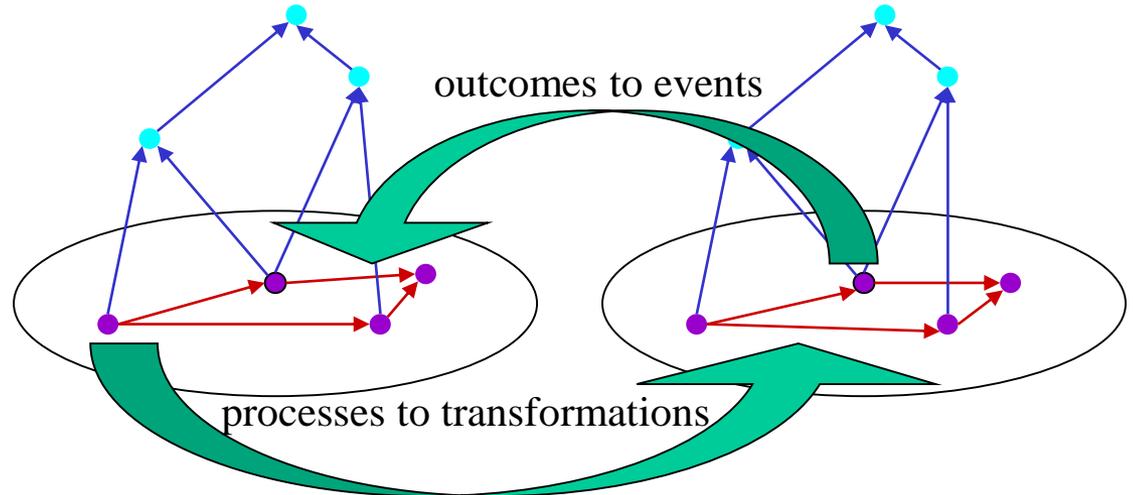
This composite articulation denotes
the repertoire of ***behaviour paths*** known to the actor —
the space in which she, as ***efficient cause***, can ***construct and execute plans***.

Which plans she ***chooses*** will depend on
how she ***values*** their implicated behaviour paths and outcomes.

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The Referential Articulation
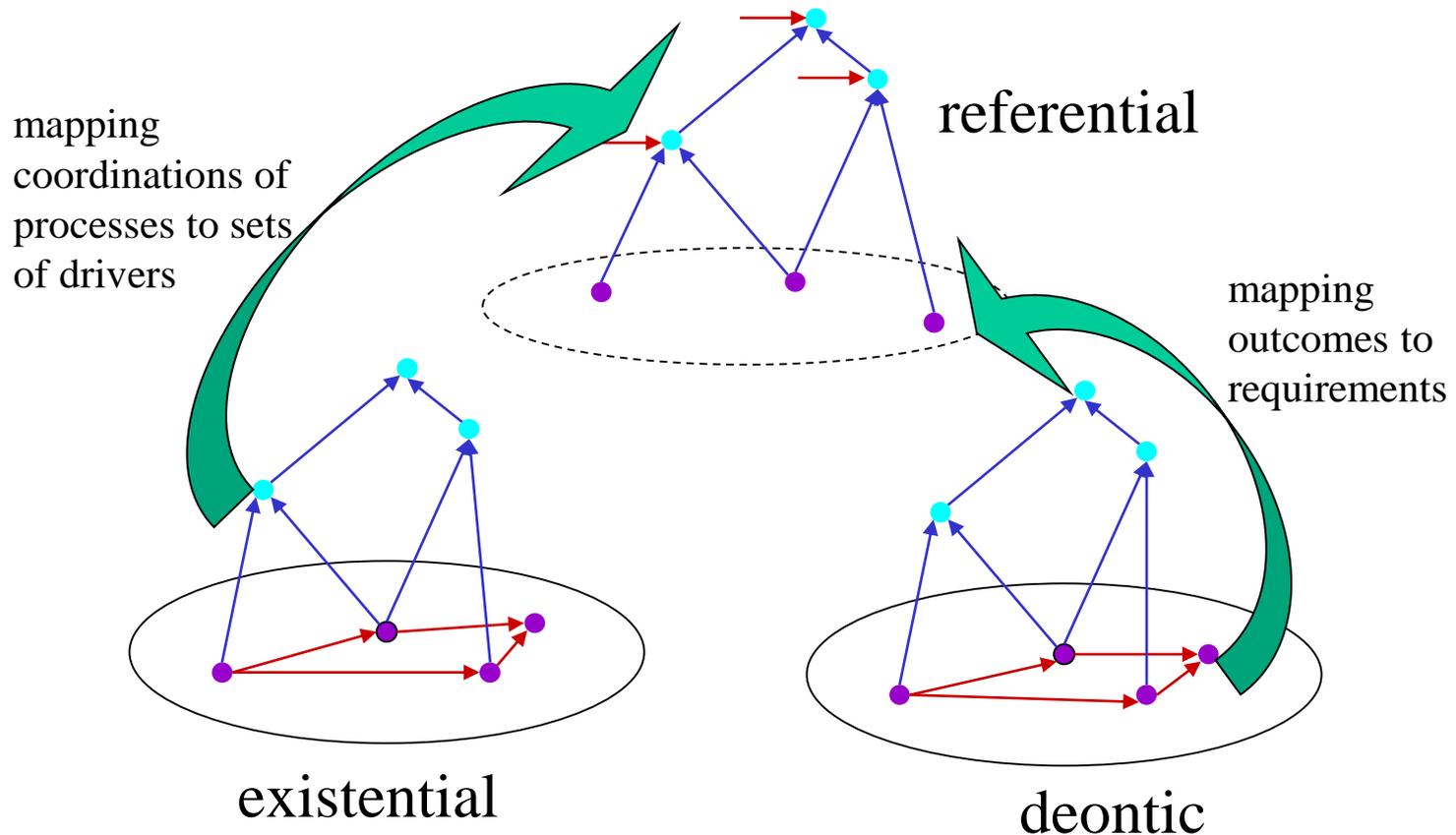
ontology of demand

a relational model of the actor's ontology of herself as an ***anticipatory system*** in terms of

• *drivers*, which attribute value to the actor's experience (by being, more or less, 'satisfied' by paths-of-behaviour);

• *requirements*, states-of-affairs that the actor anticipates to be of value in a way that she can define independently of drivers;

• *demand situations*, in which the actor anticipates that her experience of certain collections of requirements and/or demand situations (recursively) would be of value with respect to certain drivers;

together represented as a directed acyclic graph (**dag**); and
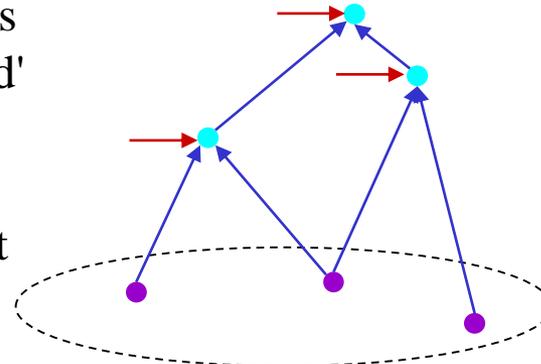
a directed graph, the ***zero-level*** of the articulation, which cannot be expressed directly by the actor but whose vertices may be induced by intersecting the sets of requirements that subtend common demand situations.

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Existential and Deontic x Referential

mapping
coordinations of
processes to sets
of drivers

referential

mapping
outcomes to
requirements

existential

deontic

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The Composite Triple Articulation

The result of these mappings is a ***composite triple articulation*** which may be processed by
- choosing one of the articulations as the basis,
- *pruning* from another articulation all vertices to which no basis apex is (transitively) mapped, then
- repeating this *pruning* operation with the third articulation.

Since the pruning operator is non-commutative, six different relational structures may be computed for any triply articulated model, three *clockwise* and three *anti-clockwise*.

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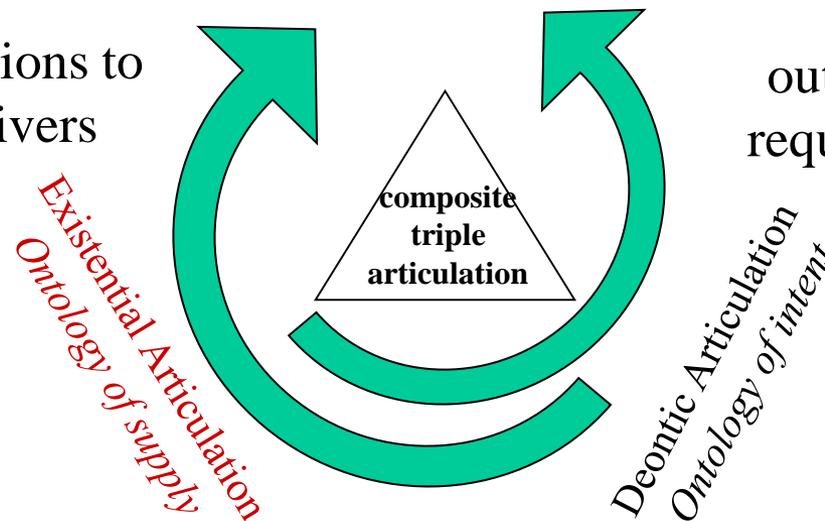Boxer Research Ltd

The Sequence of Pruning

Clockwise
composition
relating
coordinations to
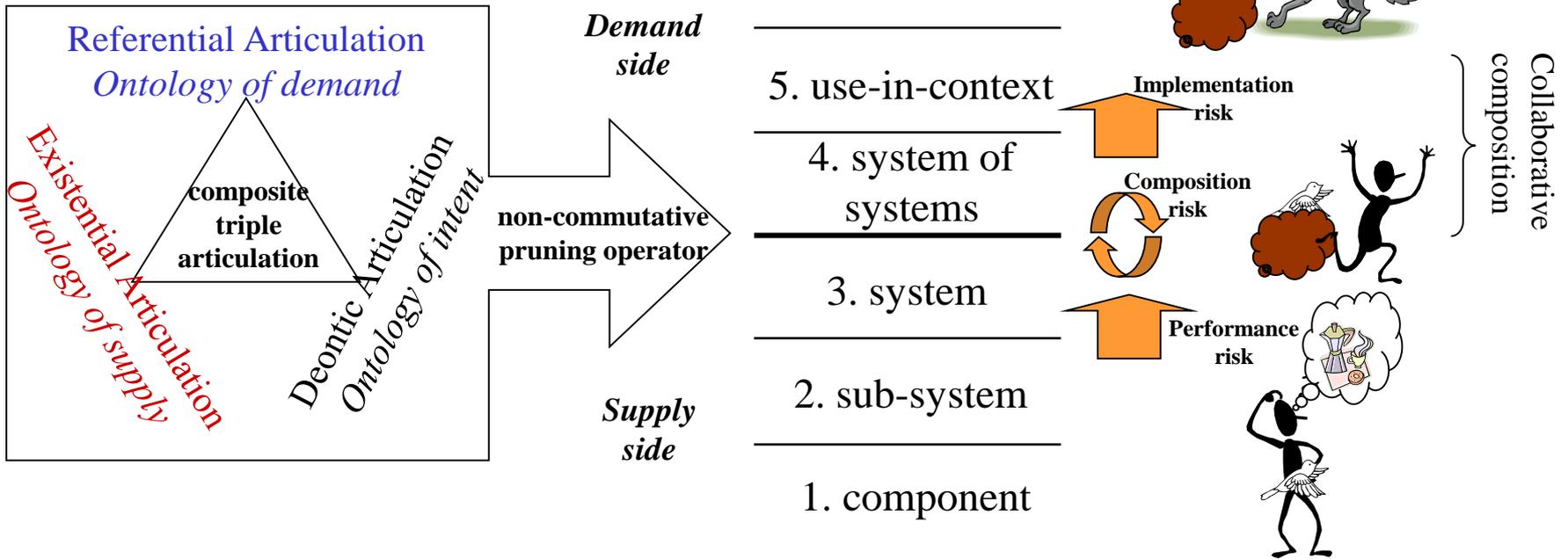sets of drivers

Referential Articulation
Ontology of demand

Anti-clockwise
composition
relating
outcomes to
requirements

composite
triple
articulation

Existential Articulation
Ontology of supply

Deontic Articulation
Ontology of intent

The relational structure generated by pruning ***projects*** naturally into six strata.

Defining Granularity and Stratification

Referential Articulation
Ontology of demand

Existential Articulation
Ontology of supply

composite triple articulation

Deontic Articulation
Ontology of intent

non-commutative pruning operator

Demand side

6. context-of-use

5. use-in-context

4. system of systems

3. system

2. sub-system

1. component

Supply side

Implementation risk

Composition risk

Performance risk
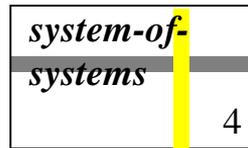
Collaborative composition

Each of the six strata is a binary relation, or *simplicial complex*, expressed at a level of granularity necessary to relate context-of-use to the underlying use of components
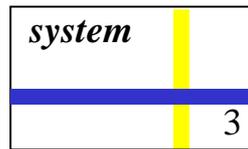
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Analysing Risks

any pair of adjacent simplicial complexes
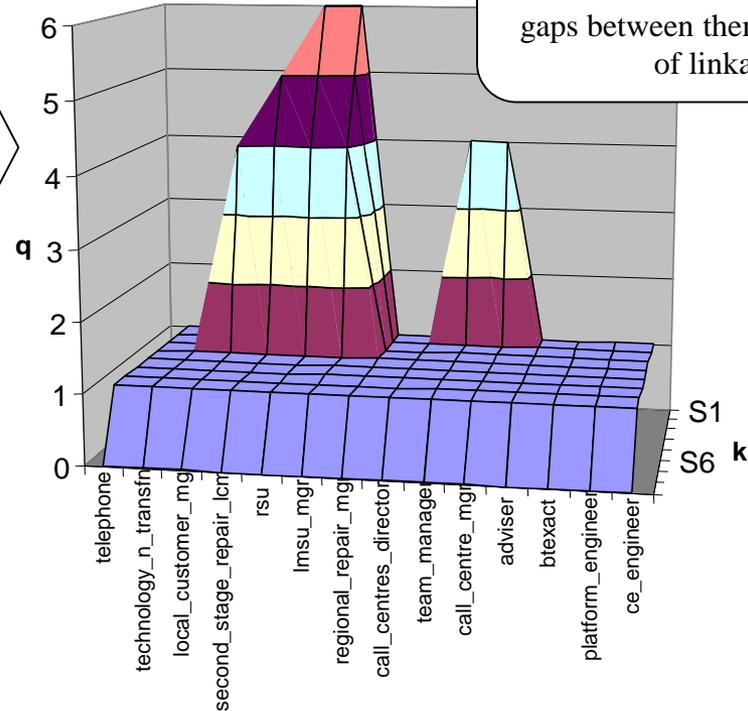
each subjected to

extended Q-analysis

produces a pair of *landscapes*

In this case a 'peak' represents linkages between constituent services, and gaps between them mean a lack of linkages

vertices

system-of-systems	
	4

strategies

services

system	
	3

outcomes

simplices

Absence of *congruence* between the landscapes indicates exposure to risk (in this case, composition)

q

6
5
4
3
2
1
0

telephone
technology_n_transfr
local_customer_mg
second_stage_repair_lcm
rsu
lmsu_mgr
regional_repair_mg
call_centres_director
team_manage
call_centre_mgr
adviser
btexact
platform_engineer
ce_engineer

S1
S6 k

simplices