

What being « smart » means ? The case of smart cities as sense making complex system

Searching for the momentum



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Middle age cities were smart: organic development, common good, synergies between economic activities

Common good

Vivere politico

Pivate goo

Economic welfare



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Direct democracy was at the root of the city life and its organic evolution

A russian born institution

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Novogorod veche: Rule by popular assembly

Новгоро́дская респу́блика вече



Claude Rochet --



From organic growth to top-down planning

- Екатеринбург was founded top down in 1723 to be a mono industry city.
- Modern cities (from XVI° onward) were designed through detailed plans.
 - The political associated ideal was autocracy (Vasily Tatishchev).

The opposite of the organic grown-up middle-age city!



Middle Age cities grew on an organic planning basis

Coherence without the need of a detailed plan!

« Organic planning does not begin with a preconceived goal; it moves from need to need, from opportunity to opportunity, in a series of adaptations that themselves become increasingly coherent and purposeful, so that they generate a complex final design, hardly less unified than a pre-formed geometric pattern. »

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Autopeoletic system integration works bottom-up based on "ordinary actions of the people"

The TimelessWay of Building



Christopher Alexander

This quality in buildings and in towns cannot be made, but only generated, indirectly, by the ordinary actions of the people, just as a flower cannot be made, but only generated from the seed.

In this case, the "chemical fields" are replaced merely by people's consciousness of the larger scale patterns, which provide the rules of growth. If people have agreements about these larger scale patterns, then they can use their knowledge of the patterns, and the degree to which these patterns have been attained, or not, to guide the growth and the assembly of the smaller patterns.

Slowly, under the impact of this guidance, the sequence of small-scale transformations will, of its own accord, create the larger patterns, piece by piece: without any individual person necessarily knowing just exactly how or where these larger patterns will be in the finished town. Integration process is bottom-up...

- ... based on ordinary interactions
- ⇒ We must understand how ordinary people behave
- ⇒ Q: Is there an architect with a master plan?

NO! An evolutionary process

Combining cities' growth laws:

create Clustering medium size The more problems we solve cities The more complex becomes Connections x wealth the system... ... and the more instable New town When cities lost their self social benefits regulating properties - costs New town Y*-W*, city exists Gmax G* G_{min} G city unstable Size x Number of cities

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The more connectivity we

Good and bad complexity

At a certain point growing complexity produces more negative than positive externalities and become turbulent

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E. g. Detroit (USA), Russian monocities...

May we monitor the growth of complexity?



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- Emergent self-organizing behaviour are driven by co-evolutionary interactions, and an adaptive capacity that enables them to rearrange their internal structure spontaneously.
- Modelling complexity can take the form of taking into account these interdependencies to understand economic phenomena and predict outcomes.
- The evolutionary process may be predictable since technology is **history** and create history
- The more an evolutionary process is grounded in local history, the more predictable, desirable and sustainable is the outcome.



A (really) smart city is an **emerging** ecosystem

- Smart city framework = A great number of interactions between people x connected objects whose quantity and speed are in dramatic increase at date.
- The behavior of a system is predictable when the sequence of transitions from one state to another can be described thanks to history, culture and instituons
- Emergence takes place when the space of possible states or rules of transitions changes: the city can't be described by the model that described it until then. (Heylighen & Joslyn 1991) : The behavior is no longer predictable

Modeling emergence implies:

- . Carrying on a watch of all kinds of as well **exogenous** (e.g. human behavior) as **endogenous** (e.g. disruptive technology) **changes**.
- 2. Mapping the properties, **desirable an undesirable**, the system can take.
- 3. The **values** attached to theses properties in a precise context.
- 4. Defining a **meta system** which variety could monitor the growth of complexity.



- An autopoeitic system is "a network of processes of production (transformation and destruction) of components which: (i) through their interactions and transformations continuously regenerate and realize the network of processes that produced them; and (ii) constitute it as a concrete unity in space in which they (the components) exist by specifying the topological domain of its realization as such a network." H. Maturana
- Autopoeisis is a property of human dissipative system: strong entropy and correlative capabilities to reproduce itself permanently thanks to its internal interactions



Why do we need strong citizen based interactions within a system? (1)

Economy:

- An economic structure based on synergies of economics activities is the condition to wealth creation which reinforces itself through interaction of a political power based on the Common Good (Reinert, 2006, Rochet, 2012)
- FFF (Failed, Fragile and Failing states) : The missing link is related to the lack of increasing returns based on « coopetitive » diffusion of means (...) productive governance often enforces the development sustainable productive structures based usually on a participatory system.
- "The more the participatory system is closed to democracy and shared economic growth with special focus on health, education and communication infrastructure building, more quickly the divergence between countries narrows down.» (Reinert &Kattel, 2009)



"Smart" means continuous learning



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- The more the city as a system is confronted to as well endogenous as exogenous changes, the more it accumulates this « people conscientiousness » that allows new patterns to emerge.
- The smartness of the city consists of this continuous learning process that relies on interactions between basic cells and actors of the city. If the lessons of the middle-age city is an archetype of organic development that produced the smart city of that time, its failure has been it was conceived as a closed system locked in behind the wall.
- We may think of the city as an adaptive system which have the same internal coherence as the medieval city, but being opened to the turbulences of the external world, an archetype of a quasi-smart city of today being Singapore.



Why do we need strong citizen based interactions within a system? (2)



Resilience:

- A smart city is a highly internally connected facing with a turbulent environment, that challenges its resilience.
- Strong social capabilities enforces the autopoeitic properties of the system, and consequently its resilience.
- E.g. Christchurch (NZ)

The city's newly installed mayor, Lianne Dalziel, hopes to usher in a new era of governance that focuses on empowering community organisations to do things for themselves. "Building a resilient city starts at the grassroots, so that bottom-up meets top-down halfway," she wrote recently.

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Why do we need strong citizen based interactions within a system? (3)

- Citizen is at the interface of technological devices which consume and produce data (e.g. The smart phone)
- The frontier between production and consumption is blurred more than in other cases of information economy (McLuhan): the prosumer.
- In a rapid innovative system the citizen is a lead user of the innovation process (Von Hippel).
- The power of these technical systems requires strong political control to be both fully efficient and not becoming the level of a totalitarian system.
 (Simondon).



Direct democracy has a strong record in the management of cities and human communities as complex systems

- Schumpeterian economics correlates synergies between activities, political freedom and common weal.
- Traditional decision making system may help modeling a resilient human system e.g.: ongoing research project of modeling an eco-efficient drinking water network in Angola with the palaver tree.







New paradigms in public decision making

- Polycentric governance (Ostrom): deciding in small units on a large scale
- Bottom up decision processes : e.g. Michael Batty modeling decision process as a Markov chains to bring back the city in a ergodic state
- Large deliberative upfront processes reduce uncertainty e.g. The Parable of the Hare and the Tortoise: Small Worlds, Diversity, and System Performance (Lazer & Friedman 2005)
- « In short, cities are more like biological than mechanical systems. The rise of the sciences of complexity, which have changed the direction of system theory from top down to the bottom-up is one that treats such systems as open, based more on the product of an evolutionary process than a grand design » Michael Batty « A new Science of Cities » 2015





Which drivers of Social Emergence?

BOX 2.1 DRIVERS OF SOCIAL EMERGENCE (FROM SAWYER, 2005)

- Individual: Intention, agency, memory, personality, cognition
- Interaction level: Discourse patterns, symbolic interaction, collaboration, negotiation
- Ephemeral emergents (i.e., conversation theory): Topic, context, inter-3. actional frame, participation structure, relative role and status
- Stable emergents: Group subcultures, group slang and catch phrases, 4. conversational routines, shared social practices, collective memory
- Social structure: Laws, regulations and institutions; material systems 5. and infrastructure



For which Prototypes of Emergence?

Table 2.1 DRIVERS OF EMERGENCE ACROSS THE EIGHT PROTOTYPES

Prototype Name	Drivers Described	Initial Conditions
I: Relational properties	Large N of interacting agents	
	Relationships \rightarrow Properties	
II: Exo-organization	High energy driven into system	Far-from-equilibrium state
	Closed (constrained) container	Amplification
III: Computational order	Large N of interacting agents	Ongoing stream of interactions
	A few rules guide agent behavior	Interdependence of agents
IV: Autocatalysis	A reaction chain produces its own	Far-from-equilibrium state
	catalyst	Amplification
		Interdependence of agents
V: Symbiogenesis	Symbiosis through envelopment or association	
VI: Collaborative emergence	Large N of interacting agents	Ongoing stream of interactions
	Emergent rules guide agent	Aggregation \rightarrow amplification
	behavior	Interdependence of agents
	Preferential action	
VII: Generative emergence	Intent to create value	Far-from-equilibrium state
	Method for producing value	Collaborative emergence
		Amplification
		Interdependence of agents
VIII: Collective action	Intent to create value	Collaborative emergence
	Large N of interacting agents	Rules (local + institutional) guide
	Ongoing stream of interactions	agent behavior
	Symbiosis through association	Preferential action
		Interdependence of agents



Dynamic state in social systems & Generative Emergence

Opportunity Tension as the Key Driver of Generative Emergence



Figure 8.2: Elements of a Dynamic State

Table 8.2. CONNECTIONS BETWEEN GENERATIVE EMERGENCE AND DYNAMIC STATES

Conditions for Generative Emergence

Elements of a Dynamic State

Container is shared vision + focused action Boundaries co-evolve with emergent entity Agents are diverse Agents are self-directed

Process is started from within

Inputs are endogenous, through social ecology

Outputs become inputs; sustainability is essential Opportunity tension provides focus for vision and action
Boundaries and concept evolve through interactions
Agents in the social ecology are diverse
Founder and members of the organizing team are self-directed
Opportunity tension is generated by founder/organizer within the social ecology
Resources, information, and energy for venture are accessed through social networks and social ecology of the organizer
Value creation outputs become the inputs for costs, resources, and sustainability of the venture

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Generative Emergence of Social Systems occurs through 5 major Phases



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Generative Emergence occurs in Cycles (not linear!)



Questions

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Can we move deliberately from one phase to the other?



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Lichtenstein, 2014



Can We Enact (Deliberately) Emergence of Social Systems?







Can We Enact (Deliberately) Emergence of Social

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Systems?



A Social Ecological Systems Answer

Social Ecological Transformation Process



Triggers or Pretransformation

Characterized by major social or ecological disruptions, which in turn, create windows of opportunity Opportunity contexts change throughout the process of

transformation but typically become transparent enough at certain points for agents to navigate to another phase

Preparing for change

Sensemaking - analysis of the structures that are most problematic for current trajectory

Envisioning - generating new innovations and visions for the future Gathering momentum - self-organization around new ideas, networks of support are often created and mobilized, experimentation in protected "niches"

Navigating the transition

Selecting - choosing which innovation or change process in which to invest social, intellectual, and financial capital

Learning - evaluating the results of earlier experiments and developing shared understandings or new forms of knowledge

Adoption - widespread uptake or replication of innovative change that was successful in experimental stage, tipping point

Institutionalizing the new trajectory

Routinization - managing dynamic stability to embed new trajectory and establish or strengthen new feedbacks

Strengthening cross-scale relationships - involves scaling up the change, which often involves a different type of innovation than was created originally in niche (needs to suit different contexts),

Stabilization - transformed system reaches new "attractor" but active resistance from powerful actors at different scales is likely, and actors need to deal with next, unanticipated perturbations





How sense emerges within the sense making process?



Complexity based concepts	Sensemaking based concepts	
Unknowability	partial connections that produce multiple realities	
uncertainty as an issue of ontology	Uncertainty as an issue of epistemology.	
Partial connections	distributed sensemaking, semi-independent agents, reciprocal reference, identities that hold agents together, loosely coupled systems	
Chaos	ambivalence, equivocality, ambiguity, and the unexpected.	
Emergence	becoming, organizing, and juxtapositions that force novel meaning	
Dynamic	fluid, impermanent, process, ongoing, updating, exploration	
Co-evolution	reciprocal enactment of both the organization and the environment	
Self-organizing	organization that emerges IN communication	
Simple rules applied locally	micro states that are central in organizing	
Non-linear	deviation amplifying feedback and small actions that can have large consequences	
Entropy	normalizing, codification, shareability constraints, labeling	
Diversity	requisite variety, conflict, multiple drafts	



How sense emerges within the sense making process?

Individuals respond to cues that disrupt the ordinary, predictable flow of experience and suggest a gap between the reality as it seems to be and how they expected it to be.

- These cues trigger conscious attempts to bring order into ambiguous realities open to multiple interpretations.
- Collective sensemaking emerges out of a combination of practices. Team members use physical artifacts, such as images, cards, sketches, maps, lego bricks, to build, articulate, and elaborate their understandings of the city they are designing.



Weick's view of the relationship among enactment, organizing and sensemaking Source: Adapted from Luisi (2003) Source: Adapted from Weick (1979: 132)







Research fields underway

1. **Rehamna**, an integrated Social Entrepreneurship Ecosystem to transform the territory through and with its actors

2. Saidia, a classical beach resort seeking to integrate with broader territory through Multilevel governance

3. Euromediterranean University of Fes about to initiate an innovation Ecosystem around Sust. Energy & Agritech at the regional level, in codesign with the key stakeholder

Merci!

Спасибо

Muchas gracias!

Thank you!



