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

Searching for the momentum

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What a smart city can’t be

- A collection of « smarties »
- A techno centric city
- A city without past

= EU ideology!

On the contrary
Smart city = Integrated complex system
Middle age cities were smart: organic development, common good, synergies between economic activities

- Common good
- Vivere politico
- Economic welfare
- Private good

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

A russian born institution

Novgorod veche: Rule by popular assembly

Новгородская республика вече
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. »
Autopeoietic system integration works bottom-up based on “ordinary actions of the people”

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:

Clustering medium size cities

Connections x wealth

Size x Number of cities

New town

The more connectivity we create
The more problems we solve
The more complex becomes the system...
... and the more unstable

When cities lost their self regulating properties
At a certain point growing complexity produces more negative than positive externalities and become turbulent.

E. g. Detroit (USA), Russian monocities…
May we monitor the growth of complexity?

- 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 institutions.

- **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:
  1. 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 those properties in a precise context.
  4. Defining a **meta system** which variety could monitor the growth of complexity.
Autopoeisis: Why and How?

- An autopoeitc 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

- 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.
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 smartphone).
- 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
The key research question:

- How to conceive the government of a city that should not need a government? (since it should be a self-regulating autopoietic system)
Which drivers of Social Emergence?

Box 2.1 Drivers of Social Emergence (from Sawyer, 2005)

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

For which Prototypes of Emergence?

<table>
<thead>
<tr>
<th>Prototype Name</th>
<th>Drivers Described</th>
<th>Initial Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>I: Relational properties</td>
<td>Large N of interacting agents</td>
<td>Far-from-equilibrium state</td>
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<tr>
<td>II: Exo-organization</td>
<td>High energy driven into system</td>
<td>Amplification</td>
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<tr>
<td>III: Computational order</td>
<td>Large N of interacting agents</td>
<td>Ongoing stream of interactions</td>
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<tr>
<td>IV: Autocatalysis</td>
<td>A few rules guide agent behavior</td>
<td>Interdependence of agents</td>
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<tr>
<td>V: Symbiogenesis</td>
<td>Symbiosis through envelopment or association</td>
<td></td>
</tr>
<tr>
<td>VI: Collaborative emergence</td>
<td>Ongoing stream of interactions</td>
<td>Aggregation → amplification</td>
</tr>
<tr>
<td>VII: Generative emergence</td>
<td>Emergent rules guide agent behavior</td>
<td>Interdependence of agents</td>
</tr>
<tr>
<td>VIII: Collective action</td>
<td>Intent to create value</td>
<td>Far-from-equilibrium state</td>
</tr>
<tr>
<td></td>
<td>Large N of interacting agents</td>
<td>Collaborative emergence</td>
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Lichtenstein, 2014
Dynamic state in social systems & Generative Emergence

Opportunity Tension as the Key Driver of Generative Emergence

Table 8.2. CONNECTIONS BETWEEN GENERATIVE EMERGENCE AND DYNAMIC STATES

<table>
<thead>
<tr>
<th>Conditions for Generative Emergence</th>
<th>Elements of a Dynamic State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Container is shared vision + focused action</td>
<td>Opportunity tension provides focus for vision and action</td>
</tr>
<tr>
<td>Boundaries co-evolve with emergent entity</td>
<td>Boundaries and concept evolve through interactions</td>
</tr>
<tr>
<td>Agents are diverse</td>
<td>Agents in the social ecology are diverse</td>
</tr>
<tr>
<td>Agents are self-directed</td>
<td>Founder and members of the organizing team are self-directed</td>
</tr>
<tr>
<td>Process is started from within</td>
<td>Opportunity tension is generated by founder/organizer within the social ecology</td>
</tr>
<tr>
<td>Inputs are endogenous, through social ecology</td>
<td>Resources, information, and energy for venture are accessed through social networks and social ecology of the organizer</td>
</tr>
<tr>
<td>Outputs become inputs; sustainability is essential</td>
<td>Value creation outputs become the inputs for costs, resources, and sustainability of the venture</td>
</tr>
</tbody>
</table>
Generative Emergence of Social Systems occurs through 5 major Phases

1. Sequence 1: Disequilibrium Organizing Opportunity Tension
2. Sequence 2: Stress and Experiments
3. Sequence 3: Amplification to a Critical Threshold/Event
4. Sequence 4: New Order through Recombination
5. Sequence 5: Stabilizing Feedback

Outcomes: Emergence or Dissolution

--- Outcome IS the next substrate/ecology ---
Generative Emergence occurs in Cycles (not linear!)

Questions

- Can we move deliberately from one phase to the other?

......

- HOW?
Can We Enact (Deliberately) Emergence of Social Systems?

A Complex Systems based Answer: The Generative Emergence Model

Sensemaking & Sensegiving is key, throughout the journey!!
Can We Enact (Deliberately) Emergence of Social Systems?

A Social Ecological Systems Answer

Social Ecological Transformation Process

Sensemaking here again is Key
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.
Distributed Sensemaking viewed as an emerging pattern of “organizing” through an ongoing flux of Enactment / Selection / Retention processes (see next slide).

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

Source: Adapted from Weick (1979: 132)
Multi-actor system as a “Loosely coupled system”
» Collection of actors with loose tights & interconnections
» e.g. companies located in a business district or belonging to the same professional branch
- Low levels of interdependency, coordination
- Irregular communication flows

Complex project generating ambiguity and equivocality
- Multiple, conflicting interpretations (“what the problem is” unclear)
- Different value orientations
- Leaders as Sensemakers

Distributed Sensemaking viewed as an emerging pattern of “Organizing”
Relational spaces
Experiments, Trial & Error
Scale up / out successful tests
Leaders as Enacters & Catalyzers of change

Multi-actor system evolving into a “Tightly coupled distributed and Autopoietic Loosely coupled system at the same time”
» Manage
- Cognitive interdependence
- Stabilize new order through New rules and patterns
- Integrate constraints & interate

Claude Rochet

Source: Adapted from Luisi (2003)
New techniques arise

THE DESIGN THINKING PROCESS

Design thinking
(Stanford, Ecole des Ponts)
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 co-design with the key stakeholder
Merci!

Спасибо

Muchas gracias!

Thank you!

Obrigado!