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SMART LEARNING ECO-SYSTEMS: "FASHION" OR "BEEF"?

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This article proposes to identify the smartness of a learning eco-system - physical and/or virtual - with its attractiveness that, in a *people in place centered* perspective, can be put in relation with the ability of the eco-system to meet needs and expectations of all categories of actors taking part in a given learning process and, finally, with the achievement of their state of "*flow*".
To follow, as an example of application of the concept of smart learning ecosystem, we present a brief description of salient aspects and features that characterize one of the most promising domain of investigation emerged recently - *the smart city learning* - together with a list of challenges and possible directions of research.

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1 Introduction

The adjective "smart" - excluding the use made by a well known car manufacturer to identify a model of city car - began to gain a increasingly notoriety between 2005 and 2007, when it started to be used to denote a sort of dream-city, i.e. a complex and optimized environment, or eco-system, where it could be desirable to live. It appeared immediately clear that the adjective smart was intended to go well beyond the meaning *intelligent* and/or to emphasize the use of IC and digital technologies. In fact it has been used in an extensive way to include also the human component (Glaeser & Berry, 2006). This latter, however, was taken in consideration as *intellectual capital*, that is an asset decisive to sustain the urban competitiveness, measured according to a well known model of regional and urban development based on six soft factors, also known as pillars (Giffinger *et al.*, 2007): *smart economy, smart mobility, smart environment, smart people, smart living, smart governance*.

It is not unexpected, therefore, that the potential development of a *smart eco-system*, was found to be strongly related to the high-skill level of its inhabitants and, as well, to the possibility to attract and/or locally produce high-skilled people, thanks to one of the components of the eco-system: its universities. In the case study discussed by (Glaeser & Berry, *op. cit.*) the presence of a high density of high-skilled people in a given area - although a purely quantitative indicator whose effectiveness should be verifies also on qualitative bases - turned out to be the driving factor of the economic development of that area. It is also interesting to note how such area to become attractive should integrate the "production" of high-skilled people with the ability of the local context to meet the individual needs (housing, security, adequate wages, etc.; or, in other words the basic levels of the Maslow's pyramid of needs (Maslow, 1943)).

The picture that one gets from (Glaeser & Berry, *op. cit.*) is not very different from what in all historical periods marked the refulgence of specific geographical areas. Let's consider, for example, the Renaissance in Tuscany. It was characterized by the concentration of high-skilled people: among them artists, artisans, traders, bankers and administrators. Knowledge and skills were acquired in a very diffuse and active manner: for example into workshops, by observing and helping day-by-day "the master" at work. At that time, the needs of artists were met by the practice of *mecenatismo*, although the most renowned artists were attracted not only by the highest reward but also by prestige and visibility of the proposed commitments i.e. by level and hypothetical outcomes of the *challenges*. In other words high skilled people were attracted also by the ability to meet the needs of achieving a higher consideration and visibility in the society and, thus, by the *personal fulfilment*.

It is important, however, to underline how also the most attractive situa-

tion may hidden problems: even in periods of great splendour the well-being accumulated in certain areas, or for the benefit of certain classes, implied, in obedience to a sort of conservation law, the deprivations of other areas and other classes (Glaeser & Berry, *op. cit.*).

More recently we have assisted to a shift of the meaning ascribed to the adjective *smart* that, going beyond top-down functional and infrastructural aspects, has incorporated a greater consideration for the centrality of the individuals, their personal characteristics and their expectations, the quality of their experience and well-being and, as well, for the characteristics of the contexts in which they work and live to include also the preservation of the environment (PiPC, 2008; HSC, 2013). In other words we have assisted to the development of a greater consideration for the highest levels of the Maslow's pyramid of needs.

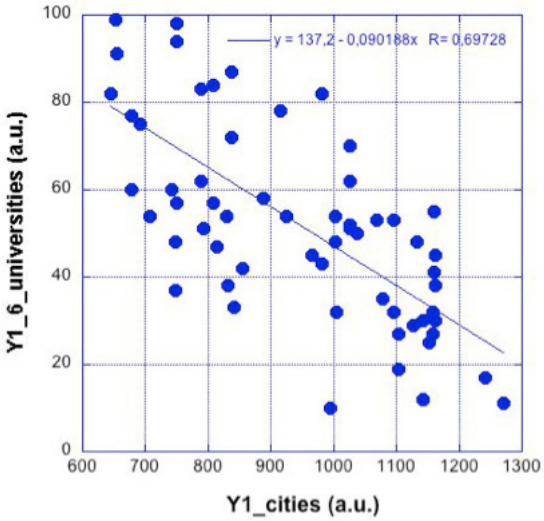

Fig. 1: First principal component coordinates derived from a PCA (Giovannella *et al.*, 2014) applied to the city ranking of (iCity rate, 2012) vs. First principal component coordinates derived from a PCA (Giovannella, 2014b) applied to the university ranking of (Il Sole 24ore, 2014)

This shift in the meaning of the adjective *smart* triggered also a critical revision of the smart-city ranking approaches based on the use of top-down models, like those referring to the six soft factors (Giffinger *et al.*, 2007; Fast Company, 2013; iCity rate, 2012). The outcome has been the identification of several limits (Giovannella, 2013a), like the relevant correlation among the soft factors' indices, with the exception of smart-environment, to indicate

the leading role of the smart economy (and/or smart mobility). Zooming into cities and territories and focusing on the entities responsible for the training of high-skilled people, it came out that also the benchmarking procedures used to formulate the universities ranking (Il Sole 24ore, 2014) show limitations similar to those detected in the determination of the smart cities rankings. Nevertheless, after the application of appropriate filters, aimed at taking into account the strong correlations among the indices, and the use of a Principal Component Analysis (PCA), it was possible (Giovannella, 2014b) to highlight the close relationship between cities/territories and the corresponding educational systems (see fig. 1). The linear correlation between the two variables is very noticeable: R = 0,7.

This result represents a partial confirmation of what reported in (Glaeser & Berry, *op. cit.*) although the case study considered here and, as well, the methodologies used are quite different.

The limitations of the benchmarking methods, described above, led us also to explore new bottom-up and partly qualitative approaches, with the aim to take into greater account individual perceptions and expectations on what a smart city/territory should be (Giovannella, 2014a; Giovannella *et al.*, 2014). The overall picture that was derived from our investigations is one in which the smarter economy, although considered the engine on which one can build opportunities, does not seem to represent a primary goal. Beside the satisfaction of needs such the optimization of mobility and personal time, the circulation of information and a better support to culture and education, the interviewed perceive the environment and the economic activities related to its preservation, together with a careful consumption of resources, as the leading key-factors of a potential growth of the territorial "smartness". In addition territorial development and technology penetration are expected to be harbinger of a positive tension, perceived not only as an enabling factor but also as a driving force to foster creativity and innovation. All this support the idea that the attractiveness of an eco-systems, included a learning one, is determined by its *state of flow* (Czisikszentmihalyi, 2009). By transliterating from a person to a context (university, city, territory), we can state that *a smart context is a context where the human capital* (and more in general each individual) *owns not only a high level of skills, but is also strongly motivated by continuous and adequate challenges, while its primary needs are reasonably satisfied*. The state of flow of a context, of course, should be maintained by cooperative and convergent actions carried on by all main stakeholders belonging to a given community.

This long introduction, apart from pointing toward the need of novel monitoring approaches to detect the state of flow of all categories operating in an

ecosystems and thus to fully uncover the smartness of territories and learning, put us in a much stronger position to better define the meaning of the adjective *smart* when referred to learning eco-systems and environments. The aim is to go beyond either the misuse of the adjective to indicate something more fashionable and the diffuse attitude to consider "smart environments" as containers ready to welcome and recycle any sort of subject and/or proposal.

2 Smart Learning Ecosystems

First of all, it should be noticed that a learning eco-system can be composed by both physical and virtual environments, possibly interlinked.

For sure being smart does not mean being simply "intelligent" or exclusively "digital" and does not mean either going back to retrace the conceptual path already explored without particular success by the research on Artificial Intelligence and on the Intelligent Tutoring Systems.

According to an intelligent systems' perspective, the machines (or rather the ICT infrastructural backbone as a whole) are expected to replace the tutor. Looking further away, the entire ecosystem should aim at producing more effectively and efficiently the human capital (high skilled people of any sort) needed by the territory for its continuous development and growth.

In a different perspective, a *people in place centered* one (PiPC, 2008), technologies are expected to act as enablers. What matters is that technology enhanced environments - i.e. environments characterized by an evident mediating action of the technology - will be able to support the implementation of no- or low-barriers learning processes capable to meet all experiential needs and expectations of individuals and communities about the development of their learning trajectories. It is also important that such technology enhanced and mediated learning processes, will be designed and managed to support the establishment and the maintenance of the individual *state of flow*. It implies an implicit and continuous support to motivation, the offer of an adequate level of challenge and the possibility for the learners to progress in the acquisition of progressively higher skill levels. It is worth noting that satisfaction of needs, and maintenance of the state of flow can not and should not be confined to the pure performance. The attractiveness, and as well the spontaneous adhesion, must go beyond the need: you could be attracted by a given place because it may provide you nice job opportunities and even desirable career progression but, nevertheless, you still do not recognize it as your place, and as soon as you can you go somewhere else to spend your life. Far from suggesting that smart eco-systems should be totalizing ones, nevertheless, they should be able to generate the "*here I feel at home*" effect and foster a sense of belonging. The smart ecosystems, thus, should be able to monitor not just what one learner knows or

how s/he performs but the state of the flow of all actors of the learning process.

To resume and stress the difference, one may tentatively state that the automatic, efficient and effective acquisition of knowledge and skills is the goal of an *intelligent* learning environment, while the support to learning processes that allow to develop skills by achieving a state of flow (both of individuals and of the whole ecosystem) is the goal of the *smart* learning ecosystems.

An interesting corollary to be associated with the definition of the smartness of a learning ecosystem concerns the ability to maintain and continuously increase over the time its level of attractiveness, also when the boundary conditions - e.g. characteristics of the learning settings or unexpected progressions of the state of flow of the actors taking part in the learning processes - change and would require path modifications.

An accurate analysis may help in identifying how much the system will be able to resist to the changes and continue to support the evolutionary path of the learning processes and/or to adopt mitigation and, eventually, re-adaption strategies to proceed on. In other words, this corresponds to identify the level of *resilience* (Folke *et al.*, 2008; Tuvendal & Elmqvist, 2012) of the learning ecosystems. The resilience, thus, has not simply to do with the ability of the system to return to its initial state after a perturbation but has intrinsically a more dynamical nature.

Unavoidably, the technological evolution will continue to change modes and levels of the technological mediation and, as well, habits and behaviours of the society. Accordingly also modes and levels of the support offered by the learning eco-systems will change together with their architecture. However what will probably not change is the definition of smart learning eco-systems given here above, that appears to possess an inner robustness.

3 Smart City Learning

At present one of the most interesting domain influenced by the technological evolution, involving also learning, is that of smart cities and territories from which the introduction of this paper moved on. The gradual transformation of urban spaces into sentient and responsive places (MIT, 2011) and, by this time, the almost complete penetration of personal devices (smart phones and tablets) have started to produce relevant changes in all aspects of learning: spaces, contents, processes, monitoring methods and, of course, skills (Giovannella, 2013b).

The unavoidability of such changes led a group of researchers to launch an International Observatory (I-SCLO, 2013) and to promote opportunities for

reflection and design. This initiative was also intended to ensure that, despite of the top-down approaches to smart cities/territories and changes in social habits, education will be increasingly perceived as related to expectations and requirements of individuals and less as a necessary evil.

The recent in-depth reflections conducted by the members of the observatory (EC-TEL, 2014) have made emerge a set of themes that are contributing to better focus the challenges proposed by the smart city learning domain. Here below an advanced summary that improves that contained in (Giovannella *et al.*, 2013a):

- multi-dimensional continuity - temporal, technological, of learning approaches - of the elements composing the smart ecosystem (physical and virtual) and that characterize the processes taking place in there, especially in mobility (e.g. LLL, open-education, etc.); exploitation of the potentiality offered by the physical space; social role and mediation of the technologies used to support learning processes;
- contents continuity and structural-functional redefinition due to additional dimensions (e.g. geolocation and additional sensing dimensions); organizations of contents and experiential spaces, both at individual and collective level (e.g. based on narrative approaches)
- strategies (e.g. gamification, "local money" circulation, stimulation of sense of belonging, etc. (Giovannella *et al.*, 2013b) to sustain a high level of motivation in all kind of learning settings (formal, informal, non-formal, LLL, etc.) by respecting the individual experiential propensities;
- redefinition of roles and skills with particular attention to the interplay between skills needed to be active actors of the transformed learning processes and those characterizing active citizens;
- development of new approaches and methodologies to monitor and benchmark the state of flow of individuals/communities/learning ecosystems; tools and approaches for the multidimensional monitoring, analytics and visualization of the learning experience to foster awareness of emergent behaviours (with particular reference to critical situations) and an adequate level of "resilience" at individual, process and ecosystem level.

Summary

Resuming, in this paper, following the evolution of the meaning of the adjective *smart* attached to cities and territories - ecosystems by far larger and more complex than the learning ecosystem to which they are closely related (see fig. 1) - we have identified a set of features that make learning ecosystems smart. These latter differ from intelligent learning environments, among others,

because of: the people in place centered perspective, purposes and strategic approaches to the development and management of the technology enhanced learning processes, the indicators considered relevant to monitor and benchmark the "smartness" of the processes (included the state of flow).

Finally, we have briefly introduced the reader to an emerging area of great interest in the field of the smart learning ecosystems: the Smart City Learning.

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