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Article

Understanding Cultural Geography as a Pseudo-Diffusion Process: The Case of the Veneto Region

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Abstract: In this paper, we study the cultural geography of the Veneto Region on the basis of a pseudo-diffusion approach to the analysis of the inherent semantic spatial data. We find somewhat surprising results, and, in particular, that Venice, indisputably the Region's cultural hub in terms of concentration of activities and facilities, global visibility and attraction of resources, plays a marginal role in determining the momentum of cultural initiative at the regional level as of 2007 data. The areas with the greater momentum are relatively marginal ones but characterized by a strong presence of design-oriented companies that are actively engaging in culture-driven innovation in a context of gradually horizontally-integrated clusters. Our findings call for a revision of the traditional policy approaches that identify centralities in terms of concentration of activities and facilities based on past dynamics, and to design policies accordingly. We argue in favour of a more forward-looking, evidence-based approach.

Keywords: cultural geography; cultural activities and facilities; culture-led local development; *pseudo-diffusion* process; topological weighted centroid

JEL Classifications: C38, C45, R12, Z10

1. Introduction: Beyond the Common Sense of Cultural Policy-Making

There is an increasing awareness that culture can be a powerful lever of local development in terms of urban regeneration processes (Miles and Paddison, 2005 [1]), of economic value added (Andres and Chapain, 2013 [2]), and of comparative advantage driven agglomeration (Mommaas, 2004 [3]; Stern and Seifert, 2010 [4]), among others. The mounting tide of interest toward these topics is drawing increasing attention to the geographic dimension of cultural activities. The related literature is expanding at accelerated rates and appeals to a highly diverse range of experts, from scholarly journals such as the *Journal of Cultural Geography*, to thematic issues in less specialized journals such as the *Journal of Economic Geography* (8:5, September 2008) to name but one, while the global sensation generated by cleverly told success stories (e.g., *The Economist*, 2013 [5]) has made culture-led development a very interesting matter not only for geography, economics, urban studies and regional science scholars but also for ambitious local administrators (Ponzini and Rossi, 2010 [6]). This is not only true for territories with a deeply rooted capacity for local development, which are now looking for a post-industrial reframing of their specialization patterns (Landry, 2000 [7]), but also for up-and-coming ones aiming at new forms of leadership, which regard culture as a powerful tool to establish themselves more firmly on the global map of investment and tourist attraction, entrepreneurship, and innovation (e.g., McClellan, 2012 [8]).

In terms of policy making, the focus on culture as a development driver often tends to be accompanied by clear-cut, common sense recipes: imitate success (Florida, 2002 [9]), ride the buzz and conquer social influence (Currid, 2008 [10]), boost positive visibility and notoriety (Trueman *et al.*, 2008 [11]), and so on. In practice, however, general recipes seldom work in all kind of circumstances. Targeting successful models (be they real or marketed as such) is often accompanied by feeble critical awareness of their actual limitations (e.g., Degen and Garcia, 2012 [12]; Charnock *et al.*, 2014 [13]), or by failures in appropriately translating them into the local context (e.g., Zimmerman, 2008 [14]). The contribution of culture to local development processes, despite its promising potential, is neither straightforward nor mechanic, and is subject to complex nonlinear effects (Comunian, 2011 [15]), which are often elusive and difficult to appreciate and anticipate. For this reason, appropriate policy design calls for relatively sophisticated approaches and tools that enable capturing complexity and coping with it adequately, so as to avoid getting stuck into intuitively appealing but ineffective solutions.

In this paper, we provide an example of counterintuitive culture-driven local development effects for a specific case study, and introduce novel techniques as a basis for an evidence-based approach to cultural policy design. We have chosen in particular the case of the Veneto Region, a world-renowned example of a territory that lives on culture-related economic turnover—Venice and its surroundings—and which naturally qualifies as the cultural hub that absorbs most of the public and private resources, attracts the highest attention, and plays the role of the main developmental catalyst. However, the interest of the case study stems from the increasing perception that Venice's culture-led development model, which rests upon an unmatched power of attraction of global tourism flows and on a special status of one-of-a-kind display for world-class culture, has many shortcomings, in terms of the gradual destruction of the city's social fabric and the consequent transformation into a tourist theme park, and of the city's declining capacity to stay on the global map of cultural production and not merely serve as

a glamorous, seasonal stage of mega-events such as the Arts or Architecture Biennials and the Cinema Festival (Sacco, 2012 [16]).

There seems to be something wrong in this developmental trajectory, but what exactly? How does Venice's special situation fit into the wider territorial organization of the cultural system of production of the Veneto Region? What are the consequences in terms of the Region's overall innovation momentum and competitive advantage profile? In this paper, we develop a methodology and tools that allow us to dig into the deep layers of the regional geography of cultural production and to explore their relationships with medium/long-term local developmental trajectories, providing useful insights for territorial policy issues related to innovation and competitive advantage. The paper is organized as follows. Section 2 reviews some conceptual issues linked to the modelling and analysis of spatial social processes. Section 3 provides a short introduction to the methods and techniques employed in the paper. Section 4 introduces the case study. Section 5 presents and discusses the main results. Section 6 concludes the paper.

2. Social Spatial Processes: Levels of Complexity

Analyzing the spatial geography of a social system is in principle more difficult than analyzing a spatial process of a physical or even biological nature. The reason is simple: In physical or biological phenomena, there is no feedback between the disclosure of a theory of a spatial process and the structure of the process itself. For example, if we develop a theory to create a model of the infectious dynamics of a certain viral agent, the behavior of the virus is not affected by the model's predictions. Therefore, the dynamics under study may exhibit any sort of behavior, however dynamically exotic, but it will *not* co-evolve *with* the theory. When studying social phenomena, instead, the agents under study can learn about the theoretical speculations upon their own behavior and can purposefully adjust it on the basis of their own understanding of the micro and macro effects that such speculations imply, possibly to exploit them at their own advantage. Consequently, the macro dynamics of the process might be affected by the theories that try to describe and explain it. This phenomenon, first pointed out by Oskar Morgenstern (1972) [17] in a seminal paper (but the original contributions were published in German in the 30s; see Schotter, 1976 [18]), is known as "theory absorption". Morgenstern's idea has received relatively little attention in the literature (for an exception, see Dacey, 1976 [19], 1979 [20]; see also Sandri, 2010 [21]), but it can be clearly seen as a pioneering anticipation of the so-called Lucas critique (1976) [22], which is one of the cornerstones of micro-founded dynamic macroeconomic theory (see also Kydland and Prescott, 1977 [23]).

Morgenstern points out that if a social phenomenon is described by a certain law, and if the knowledge of such a law is going to alter systematically the behavior of the agents involved, then the law itself will not be invariant to the knowledge of the theory, and there will be a dynamic coupling between the social process described by the law, and the process of theory deployment, communication and revision. New theories provide impulses to the social dynamics, modifying the dynamics, prompting theory revision, and so on. The process may only stop once the social dynamics become invariant to the announcement of the related theory. This is the idea behind the notion of a rational expectations equilibrium (Muth, 1961 [24], Lucas, 1972 [25]), the natural complement to the Lucas critique—which, in turn, may be simply rephrased by saying that policy makers cannot design

their policies without taking into account how the agents will react to policies once they learn the rules on which they are based, and optimally adjust their choices accordingly. Therefore, in equilibrium, we will only observe dynamics that are invariant to policy rules—demonstrating the irrelevance of policy making in a world of rational decision makers. Theory absorption proves a useful concept also in the analysis of strategic behavior, and especially so once it is acknowledged that decision makers are generally boundedly rational (see e.g., Güth and Kliemt, 2004 [26], Morone *et al.*, 2009 [27]). It presents us with a new layer of complexity, where the coupled dynamics—the social dynamics and the dynamics of theories—might in the limit converge to an invariant equilibrium such that the social dynamics travel along a theory-invariant path, or where bounded rationality causes persisting waves of complex out-of-equilibrium dynamic adjustments to the shocks provided by disclosures of the theory.

The analysis of cultural phenomena, however, introduces a further layer of complexity. Culture is, itself, one of the main human processes of production of meanings, conceptualizations, and theories. Therefore, in this field, it is the social process itself that deals with the production of theories, so that the dynamic coupling with meta-theories describing its unfolding is practically unavoidable—and this poses an absorption problem of higher order with respect to ordinary social processes (as clearly shown by the difficulties in predicting the future performance of a new Hollywood movie or of a new videogame), also because of the strategic interaction that it causes between the makers of meaning and their allies and competitors (see e.g., Sharda and Delen, 2006 [28]; Zhang *et al.*, 2009 [29]). The purpose of culture, and in particular its long-term evolutionary rationale, is that of stimulating cognitive play that enables humans to expand their experience base and to enhance their adaptive flexibility to unprecedented situations (Boyd, 2009 [30]). We can thus view culture as a major platform of pre-innovation that provides a (still much overlooked) behavioral backbone to all forms of creativity (Root-Bernstein, 1984 [31]), and in particular drives innovation by familiarizing people with disruptive framing and reframing of problems leading to new, surprising solutions (Root-Bernstein, 2003 [32]). Therefore, culture should be regarded as a key component of a local innovation system, and a major source of *creative destruction* (see also Schumpeter, 1942 [33]; Hayek, 1944 [34])—the discovery of new forms of social and economic value through the purposeful dismantling of the pre-existing status quo, and of the attitudes, habits and behaviors connected to it (for a specific reflection on territorial dynamics, see Batty, 2007 [35]). Not incidentally, Schumpeterian economics has been one of the most vital and fertile breeding grounds of a new generation of nonlinear models and techniques—see e.g., Lavoie (1990) [36], Tesfatsion (2001) [37], Bruun (2003) [38], Pyka and Fagiolo (2007) [39]; see also the critical remarks in O'Sullivan and Haklay (2000) [40], and, as advanced examples of geo-spatial applications, Torrens and Nara (2007) [41], Crooks *et al.*, (2008) [42], Zellner *et al.*, (2008) [43].

In analyzing the dynamics of culture-led development, therefore, we need a particularly sophisticated battery of methods and tools that allows us to deal with such complex dynamic effects, and, in particular, that allows us to fully tackle far-from-equilibrium processes where invariance with respect to the (meta-)theory is normally very unlikely. On the other hand, culture-led development processes and cultural policy design call for reliable forecasts of the dynamic trajectories of cultural systems, due to the sector's traditional lack of resources and the refractory attitude of cultural players toward evidence-based decision making and evaluation. In a phase of tightening public and private budgets for cultural initiatives, it becomes increasingly important to appreciate what the critical factors in the dynamic evolution of regional cultural systems are, and their relationships with other sources of

economic and social value creation. It would be myopic, however, to conclude that this kind of evidence-based reasoning should have the main purpose of singling out and rewarding all and only those areas and activities of cultural production that prove to be most profitable and most directly beneficial to local development targets. The highly nonlinear nature of cultural systems, and the deeply entangled structure of cultural value chains, is such that sometimes apparently minor areas and activities, with a negligible direct impact (such as, for example, the most experimental, exotic areas of cultural experimentation in all fields), turn out to be fundamental for the sustainability and the effective functioning of the cultural (eco)systems as a whole (as it happens e.g., when experimental art and culture generate, a couple of decades later, highly popular and successful forms of mainstream culture). For this reason, the methods and tools that we need must be able to analyze and extrapolate the behavior of the regional cultural system taking into account as much as possible these aspects of organizational, dynamic complexity and their relationship with the spatial dimension.

There has long been a widespread awareness that an effective analysis of spatial dynamics of human activity calls for a massive and sophisticated use of quantitative techniques (see Johnston, 2008 [44], for a recent reassessment and Golledge, 2008 [45], Berry *et al.*, 2008 [46], for a historical perspective) and of complex systems tools in particular (see Batty, 2000 [47], for an early statement), and with an increasing ability to handle large and diversified databases (see LeGates *et al.*, 2009 [48]), while at the same time keeping the focus on policy-relevant issues and developments (Batty, 2004 [49]). Especially in the past few years, however, such awareness seems to have turned into a real urge to find adequate models to deal with an increased demand of understanding and control of spatial phenomena (see Crawford *et al.*, 2005 [50,51], O'Sullivan *et al.*, 2006 [52], Evans and Manson, 2007 [53], Batty, 2008 [54], 2009 [55]). At the same time, there are reasons to believe that applications of complexity science to the analysis of spatial phenomena may provide important drivers for development of new, powerful tools of more general relevance (Manson and O'Sullivan, 2006 [56]; Manson, 2007 [57]). On the one side, it is relatively natural to characterize the spatial choices of micro-agents in terms of self-organized, more or less optimal patterns (see e.g., Daffertshofer *et al.*, 2001 [58], Crawford, 2005 [50,51], Chen and Zhou, 2006 [59]). Moreover, it is equally natural to think of the modeling of spatial diffusion phenomena in terms of cellular automata, and indeed we witness the emergence of a rich and expanding related literature (see e.g., Vancheri *et al.*, 2008 [60,61], van Vliet *et al.*, 2009 [62], Moreno *et al.*, 2009 [63]; Besussi *et al.*, 1998 [64]). A reverse, and complementary, approach is that of starting from observed spatial distributions (GIS databases) and building models that provide an optimal fit or, more generally, finding out methods for optimal information extraction (e.g., Dietzel *et al.*, 2005 [65], Norman *et al.*, 2009 [66], Mennis and Guo, 2009 [67]) and for optimal policy design (e.g., Ribeiro and Antunes, 2002 [68], Pettit and Pullar, 2004 [69]; see also the critical remarks of Briassoulis, 2008 [70]). It is also possible to develop sophisticated, participatory GIS-based approaches to urban modeling and policy design by fostering massive collaboration among scientists or local community involvement (e.g., MacEachren *et al.*, 2006 [71], Rinner and Bird, 2009 [72]), or by suitably exploiting rich and under-utilized sources of spatial data (Ratti *et al.*, 2006 [73], Reades *et al.*, 2009 [74]).

All of this literature, however, builds upon an idea of complexity that does not explicitly take theory absorption issues into account—there is no feedback between the law of motion of the socio-spatial systems and the behavior of agents who follow simple adaptive rules. Such analytical methods often

replicate, from a methodological point of view, physically or biologically motivated research. However, appropriately tackling issues such as social sustainability and resilience—that inevitably involve the elaboration, interiorization, and cultural transmission of views about the structure and viability of local systems (see e.g., Theis *et al.*, 2009 [75])—calls for a more thorough account of superior layers of complexity. Another stream of literature tries to capture the cognitive dimension and to bring it into the modeling and policy design cycle, dealing with the perceptual mechanisms of city experience and the representational structures and patterns that go with them. Guhathakurta (2002) [76], for instance, analyzes simulation models as narratives that may be used to encourage local communities to adopt a pro-active, transformational approach toward urban change. Portugali (2004) [77] sets a far-reaching research agenda for this approach. Claramunt and Winter (2007) [78] and Tomko *et al.*, (2008) [79] develop a cognitively oriented approach to structural representations of the city. The encoding of rich and complex cognitive structures into formal models calls for a suitable set of tools that are able to take into account the dynamics and adaptive skills of human perception and reasoning.

In this paper, we tackle this challenging task by means of a *pseudo-diffusion* approach to the spatial complexity of cultural systems at the regional level, to be regarded as a dynamics in *semantic* space, that incorporates ex post all of the complexity and strategic interaction between agents, for all theory absorption layers, that shaped the cultural geography of both cultural activity and facilities. Looking at the *mere* geography of cultural production, and in particular to the spatial semantics that it encodes, we can track some aspects that are not conventionally thought to be accessible through a kind of analysis like the one we propose here. By looking at the geography of cultural production in terms of a *pseudo-diffusion* process, such as the effect of the action of a viral agent, we interpret the spatial distribution of the GIS coordinates of cultural facilities and activities *as if* they were the outcome of a diffusion process. This approach bears intriguing conceptual similarities with research and methodologies developed in geographic profiling, that is, estimating the probability of the location of a certain criminal agent base from the geographical distribution of its known crimes (Brantingham and Brantingham 1981 [80], 1984 [81]). In geographical profiling, it is natural to look for a centroid for the spatial pattern, that is, its most likely pointwise source, as well as for gradients that describe what are the most likely currently active zones on the basis of the available observations, *i.e.*, the ones where one can expect to observe new crimes by the same perpetrator. Moreover, as in diffusion processes, each single crime location influences the future local activity of the criminal, e.g., as each visit to a place reveals details and characteristics that may encourage or inhibit further initiatives in same or nearby locations. There is today an established corpus of mathematical techniques for geographic profiling (Rossmo, 2000 [82]; O'Leary, 2006 [83]), and it has been clarified that the problems of identifying outbreak sources for infective processes and finding out the location of criminals on the basis of their crimes present interesting analogies—and can therefore be both tackled through hybridization and selective improvement of existing techniques (Buscema *et al.*, 2009 [84]; 2013 [85]). One could however object that, whereas epidemic outbreaks are not apparently subject to theory absorption phenomena, geographic profiling clearly is: the decision of the criminal agent as to where to commit new crimes is clearly influenced by the theories on its actual location, and there is a very high degree of strategic interaction around this—which also explains why such theories are usually kept confidential as soon as the chase for the criminal is still ongoing. Although, in fact, if it is true that viruses and bacteria are not sensitive to theories, humans carrying them are, and again announcement

of theories about the possible nature of the epidemic disease and of the possible location of the outbreak source may strongly influence the behaviour of the human carriers and therefore the *social* component of the diffusion process of the epidemics. It is also interesting to point out that the very methods of space representation are subject to psychological biases that are sensitive to social dynamics of influence (Canter and Tagg, 1975 [86]).

In this paper, we extend the analogy from the social dynamics of epidemics and geographic profiling to the social dynamics of cultural initiative. The cultural geography of initiatives can be taken as the basis for the estimation of the gradient field describing the dynamics of cultural activation of each area, and a centroid can be identified as the most likely pointwise source of this spatial pattern, whose physical meaning is less literal than in the case of an outbreak source or of a criminal base, but certainly useful as an as-if cognitive heuristic. The strategic dimension of space in determining the location of cultural initiatives presents many conceptual analogies to both epidemics and criminal activity. The pattern of cultural initiative is the product of many different decisions and actions in time and space, bringing about a number of cultural activities and facilities whose relative position has been the outcome of a complex series of strategic interactions and negotiations in time. The presence of certain cultural facilities and activities will have stimulated further initiatives, or inhibited them, according to social diffusion forces such as social influence, learning, imitation, positional competition, and so on, which replicate at the social scale the logic of epidemic transmission (Rosen, 2009 [87]; Berger, 2013 [88]). However, not all initiatives in space have the same diffusion potential: some of them are more "infectious" than others in terms of their scale, importance, visibility, and so on, and therefore such asymmetries must be taken into account when characterizing the spatial pattern and its future evolution. We then summarize such complex dynamics, which in theory absorption terms has certainly been deeply influenced by existing conceptualizations of the role of culture as a source of entertainment, well-being, learning, civic progress *etc.*, while in turn feeding back on these conceptualizations on the basis of the success/failure of the cultural initiatives adopted, by means of the centroid and of the gradient dynamics which provide us with a ready, and cognitively parsimonious picture of the dynamic tensions at work in the observed spatial pattern, and of their foci.

In our case study of the Veneto Region, there seems to be a natural, indisputable candidate for the centroid of the pseudo-diffusion dynamics of cultural activity: Venice. Other major foci of vitality are expected around the other main cultural cities of the Region, such us Padua, Vicenza and Verona, which host world-class heritage and cultural institutions. Yet are such intuitions confirmed by the analysis? If not, what kind of insight can we draw from the intrinsic semantics of the spatial distribution of cultural activities? Can we make use of such insights to better understand the logic of cultural initiative, and to design better local policies? These are the questions that we address in the remainder of the paper.

3. Topological Weighted Centroid—TWC

In this section, we provide a short qualitative introduction to the pseudo-diffusion approach that we adopt, and in particular to the Topological Weighted Centroid (TWC) concept that represents its fundamental analytical tool. We refer the technically interested reader to Buscema *et al.*, (2009) [84,89], Buscema *et al.*, (2014) [90]. See Grossi *et al.*, (2009) [91] for a survey of applications.

A multidimensional scaling is the projection of the records of a dataset from a source high dimensional space to a target, lower dimensional (typically 2 or 3) space. The mathematical power of any specific scaling algorithm is its capability to minimize the alteration of the hyper-points distances when passing from the source space to the target space. If the distortion error is small enough, the target space is a new semantic space where the reciprocal distances of points still retain most of the meaning of the source spatial distribution: the closer any two points, the more similar they are, and, conversely, the farther away they are, the more their global diversity in the space of characteristics.

If a bi-dimensional map of real entities of the physical space is given from the beginning, the nature of the problem does not change: the spatial location of all the entities in this representation of the physical space should have its specific semantic. If such entities represent, say, a set of towns, then according to the classic gravitational models, the probability of mutual exchanges and influences among close-by towns will be higher than that of far-away ones, *etc.* (Capello, 2007 [92]). To fix ideas, consider a bi-dimensional target space. We will say that the space has a specific semantic if and only if the distribution of entities departs to any degree from the equi-probabilistic distribution. We define the Topological Weighted Centroid (TWC) of N entities in a D-dimensional space as the point where the entropy distances among the other points are minimized (see Buscema *et al.*, 2013 [85]). We may also say that the TWC is the centre of mass of such entities, weighted by their geometrical distribution. The TWC may be interpreted as a probabilistic modification of the classical Arithmetical Centroid (AC). The more meaningful the semantic of the space (*i.e.*, the more the distribution of entities will violate equi-probability), the more the TWC will tend to depart from the AC. The deformation parameter that measures the departure of the spatial pattern from equi-probability, and that therefore characterizes the intensity of the semantic of point spaces is denoted by α. We then have an entire TWC(α) *curve* depending on the value of α, with the TWC(α) collapsing into AC for $\alpha = 0$. As α varies, the relative distance of entities in the target space varies accordingly, and thus we can optimize over α from the point of view of the mean probability of finding more or less entities in a given space. $\alpha = 0$ corresponds to the case of absence of space semantic, and this can happen in two limit cases: when the distances among the entities are always constant and when the sum of the distances from one entity to the others is again constant. These are two cases of complete symmetry.

Now, if we also include into the distance formula the distance of each entity from itself, the dynamics of the whole process change dramatically, and we consequently index the probability distribution by a different parameter β. In addition to TWC(α), we now have an additional meaningful point, the Self Topological Centroid, STWC(β). Under the metric defined by STWC(β), the target space is transformed into a scalar field for a given spatial distribution of the entities. Specifically, to transform the discrete plan into a scalar field, we assign to each point a value that represents the probability to find an entity in that point. Once the scalar field is generated, we can calculate the gradient of this field, to transform it again into a vector field and to define a dynamics over it. The gradient intensity and its local direction will give us the variation of the probability to find an entity in each given point of the plan, and therefore a picture of the dynamic forces at work.

Moreover, we can calculate the trajectories of the (S)TWC(β) from the equi-probable centre of mass AC to each given entity, by suitably modulating the β parameter. Any such trajectory will appear as a straight line when entities carry the same probability, but will be curved when probabilities differ, as a reflex of the space semantic. The TWC(β) represents the maximum probability path along which we

can meet other entities when connecting the centre of mass AC with each given entity. We thus obtain a complete, regular, un-directional graph whose vertices are the entities and whose arcs might (and will likely) be curvilinear. The Minimum Spanning Tree (MST) of this graph will be a good probabilistic representation of the trajectories connecting all the entities.

The concept of centrality put forward by the TWC re-maps the space in such a way to consistently maximize the semantic distance with respect to the "context-neutral" (*i.e.*, arithmetic) idea of centrality. At the same time, the TWC family of measures of centrality is reflexive, in that centrality itself is the result of the negotiation of the reciprocal positions of the observed points as observable traces of the pseudo-diffusion dynamics. The *semantic* of a target space could be regarded as the potential energy of information of that space, that acts upon the state of any newly added observed point according to its inertia, which could be seen in turn as the own information content of that observation. The TWC approach then allows us to exploit fully the semantic of space as a repository of the effects of all those dynamic forces that have determined a certain spatial pattern, including ones that are "invisible" on the basis of the available database. For example, in the case of a diffusion process not subject to theory absorption, these could include the presence of physical barriers or infrastructures which, although not coded in the database, have a clear tweaking impact on the spatial pattern; or, in the case of social processes subject to theory absorption of some order, this can be the complex strategic interactions the drive the negotiation of the relative positions of the observations.

Just like the outbreak point and the criminal agent base are the locations which, once found and chosen as the vantage point, best extol the meaning of the observed pattern, the TWC of a certain cultural geography corresponds to the vantage point whose characteristics best reflect the driving forces behind the cultural dynamics of the territory that also incorporate the social dynamics of perception of the (socially constructed) role and meaning of cultural activities and facilities in a certain location in (cultural, social, economic, geographical) space. Consequently, the position of the TWC may substantially diverge from non-semantic averages of the spatial pattern, and the extent of this divergence is precisely the measure of the informational value added that the spatial semantic provides. Our case study offers us a clear illustration of this point.

4. The Cultural Geography of the Veneto Region

Most of the existing models of culture-led local development refer to some version of the notion of the cultural cluster, focusing in particular on the idea that the spatial concentration of cultural assets, by taking advantage of significant economies of agglomeration, scale and scope, is the key feature to be exploited. This conception of culture-led development borrows its basic tenets from traditional models of clustering of productive activities, and, in particular, underlines the parallel between the classical mechanisms of decentralized vertical integration taking place in traditional industrial clusters, and the analogous dynamics that occurs within cultural and creative value chains in the cultural context (Sacco *et al.*, 2008 [93]). However, taking a deeper view of the role of clustering in bringing about local development dynamics, it is almost inevitable that the transition from mature, stable phases to innovative, tie-breaking ones call for clustering patterns based on a horizontal rather than vertical integration, giving to culture a system-wide rather than sector-specific role (see e.g., Sacco *et al.*, 2013 [94,95]). This different, wider developmental scope of culture is, in turn, tightly related to

culture's role as a pre-innovation platform in a heterogeneous productive cluster, where the main location advantage is not linked to complementary roles in a given value chain but to common aspirations toward innovation through exchange, hybridization, reciprocal contamination, and so on. In such a context, the action of culture as a cognitive developer and accelerator becomes fundamental to the various players of the cluster, in order to shape and consolidate a common learning space and to maximize fruitful interactions.

The Veneto Region case is particularly interesting to test the effectiveness of culture in this respect, as it represents a situation of transition from traditional, sector-focused clusters to innovative, innovation-focused ones. In the initial decades of the twenty-first century, the local agents' attempts to regain a competitive edge have become mandatory once the classical, sector-specific cluster model has been put under pressure due to its poor ability to foster radical innovations rather than small incremental ones. On the other hand, this region is a major example of both an industrial territory and a cultural territory, extremely rich in cultural facilities and activities, so that testing the functional interaction between the two dimensions becomes of special interest, to check whether an innovative, culturally-oriented transformation of an extensive, highly clustered industrial economy rooted mainly in non-cultural fields actually takes place as the theory predicts.

Can we gain some insight in this respect by looking at the cultural geography of the region according to the approach outlined in the previous sections? To reconstruct the cultural geography of the region, data collection has been designed as follows. Both the activities and the facilities mapped are those with a permanent, and not occasional, character. A team of interviewers has been selected and trained through several sessions started in Spring 2006 to explain the methodology and collectively discuss and share all the details of the collection process, from the basic criteria down to the most technical issues and controversial examples and cases. Each interviewer has been assigned to a well defined territory of the region; whenever possible, interviewers have been assigned to a territory where they lived and/or worked on a regular basis, in order to take advantage of their familiarity with the milieu, their personal relationships with local cultural operators, and so on. The interviewers had to provide a complete list of the activities and facilities matching the selection criteria, together with a pre-determined list of items, including geographical coordinates. Once the first wave of data collection was completed, an official letter was sent to all of the region's local administrations (town halls and specifically, whenever applicable, their cultural offices), asking them to review the data pertaining to their jurisdiction, to check their correctness and, whenever necessary, to correct or integrate them. Further checks were carried out with a sample of expert cultural operators, fairly representative of local cultural scenes, that provided comments and feedback in the context of a mixed top/down-bottom/up framework, contrary to what is claimed in Ponzini *et al.*, (2014) [96]. At the end of the second round, in the early months of 2007, we thus ended up with a database including 2042 facilities and 2507 activities, for a total of 4549 observations, which has been repeatedly presented and discussed in various public and private occasions with selected representatives of local stakeholders from the whole region. Facilities have been classified into 14 distinct typologies and further labelled as "empty" or "full", depending on whether they were actually occupied by some kind of (permanent, non-occasional) cultural activity or not. Activities have been classified into 18 typologies. The typologies for facilities are: Design-oriented factories, Museums, Educational and Training Centers (excluding Universities), Universities, Cultural Institutes, Libraries and Archives, Theaters and Cinemas, (Non-industrial) Heritage

Buildings, Industrial Archaeology Buildings, Archaeological Sites, Research Centers, Cultural Centers, Art Galleries, Non-commercial Exhibition Spaces. As to the typologies for activities, we have the following: Visual Arts, Arts & Crafts, Performing Arts and Live Shows, Television and Radio, Multimedia Design, Product Design, Fashion Design, Architectural Design, Advertisement, Video Games, Other Creative Industry Activities, Film and Video, Publishing, Music (Production, Recording), Heritage and museums, Festivals and Events of Religious and Secular Tradition, Other Events, Educational Services in the Cultural Field.

On this basis, we have been able to draw a map of the emergent cultural geography of the region (Figure 1). The actual distribution seems to show relatively little sensitivity toward the administrative borders between provinces (reported in the map) and draws out a complex array of local patterns (polycentric, center-periphery, a-centric and scattered, etcetera) for the various sub-regions.

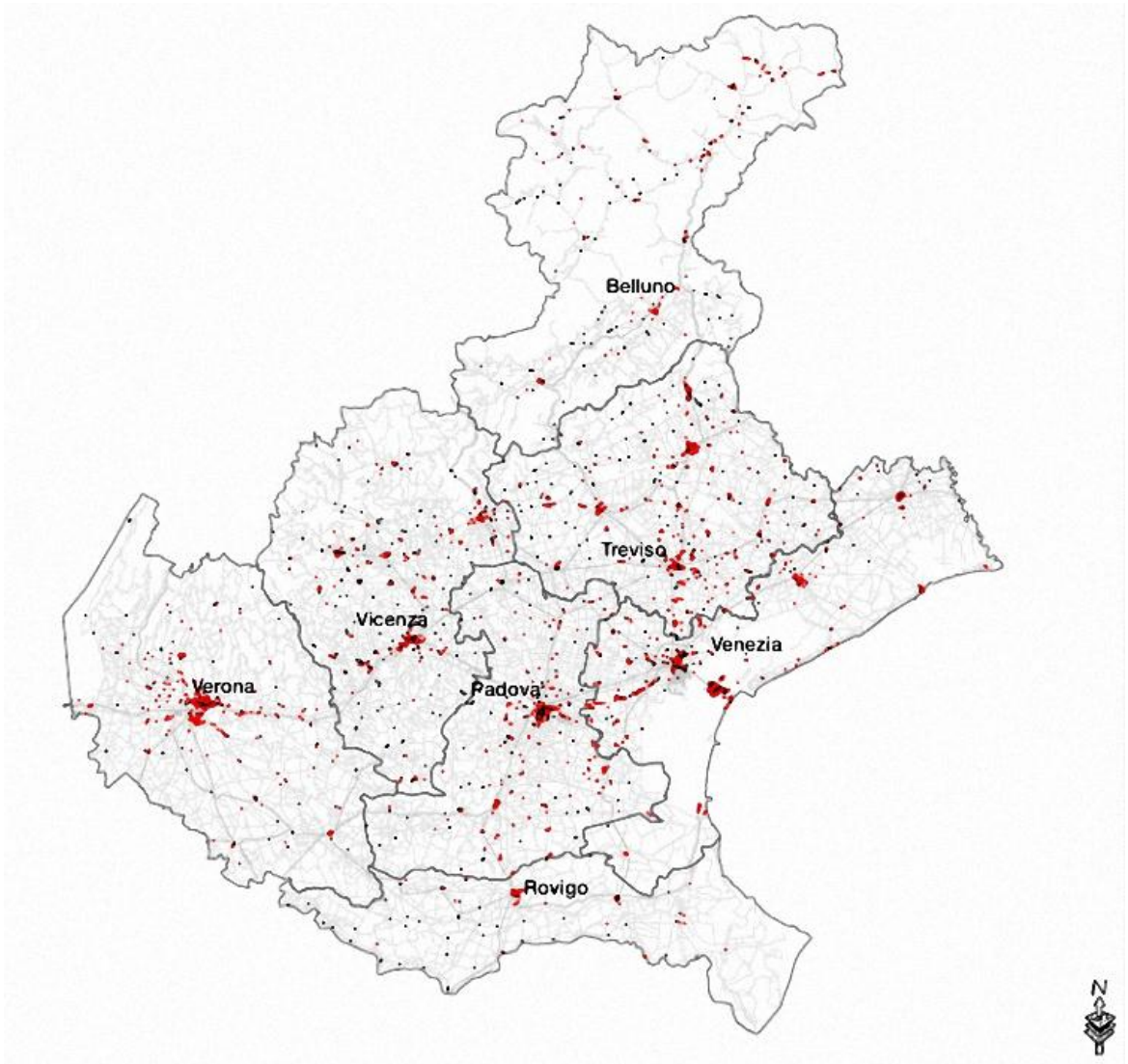

Figure 1. The Cultural Geography of the Veneto Region. Spatial distribution of activities (red points) and facilities (black points).

A few interesting stylized facts easily emerge even from the visual inspection of the map. There are three main cultural poles, corresponding to the three main cities: Venice, Padua, and Verona. However,

the local patterns differ quite sharply. Verona (at the far left of the map) clearly shows a dual territorial logic: A strong concentration of cultural life in the city, and a very low level of initiative elsewhere in the province. A more complex—though still somewhat dual—logic seems to prevail for the Venice province (at the far right in the map). Venice clearly takes the lion's share of initiative, but one can also witness a strong concentration of cultural life around the "mainland hub" of Mestre (that, administratively, is part of Venice city), which, in addition, seems to be connected by a sort of "umbilical cord" (*i.e.*, a rather continuous strip of activity) to Padua. Moreover, there are also a couple of minor cultural hubs in the Eastern part of the province, corresponding to the towns of San Don à di Piave and Portogruaro. As to the province of Padua, we find a relatively more even distribution of cultural initiative across the whole province, although there is a significant concentration in the city—so that, also in this case, a substantially mono-centric organization prevails. Two provinces that, instead, display a strong polycentric organization are Treviso and Vicenza, where we find a multiplicity of cultural poles and no clear prevalence of the capital city. Finally, in the provinces of Belluno and Rovigo, we find a relatively low and dispersed level of activity, with no evidence of major cultural poles, not even in the capital cities. To make the patterns more readable, we present in Figure 2 a density map for cultural activities, where darker brown colours denote relatively higher concentration. This new map reinforces the perception of Venice, Padua and Verona as the three main cultural hubs of the Region and the ancillary rank of Vicenza and Treviso; moreover, in the Treviso province, one can notice another hub whose rank is close to that of Vicenza and Treviso, namely, Conegliano. Moreover, several third-rank poles can be found throughout the region, and most notably in the polycentric provinces of Vicenza and Treviso. Through a suitable, sector-specific cluster analysis one can moreover infer different typologies of clusters from the distribution of activities: wide spectrum clusters with a rich and varied profile of activities and facilities, which intersect a large number of sectors and typologies; specialized clusters, mainly focused on specific sectors and lacking of significant presence in others, and non-clusters with a very limited and sparse range of activities and facilities, that do not identify proper territorial concentrations.

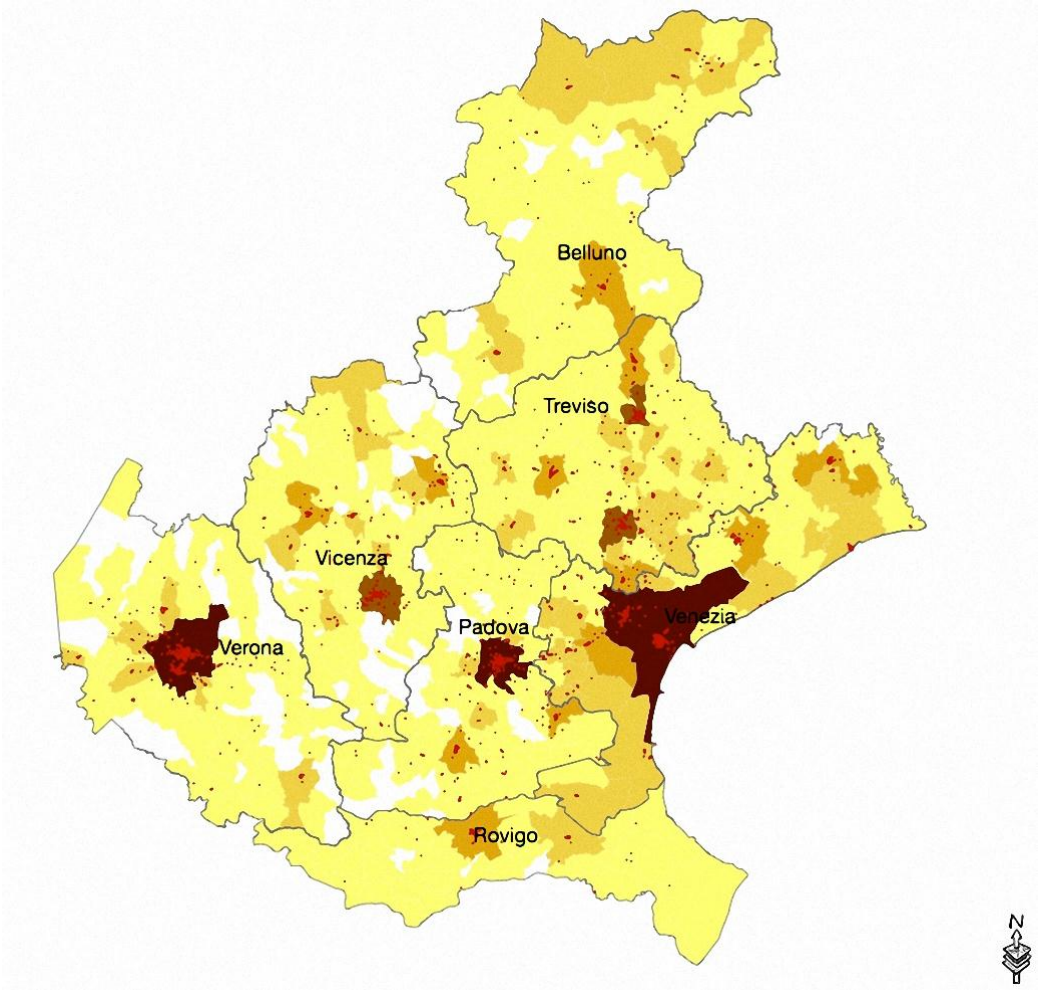

Figure 2. Spatial concentration of the activities: white corresponds to lower densities, brown to higher ones.

The actual sector concentrations for some examples are shown in the figures below.

Figure 3 shows, for instance, the spatial density pattern for museums, from which, as it could be expected, the predominance of Venice clearly emerges, as does the second-rank order of Padua and (somewhat surprisingly) Conegliano, whereas Verona belongs to third rank (keep in mind that here we are only considering the number of items, not their cultural importance). Likewise, Figure 4 shows the analogous distribution for libraries and archives, where it is Venice again that appears as the absolute leader, with Vicenza as the closest follower.

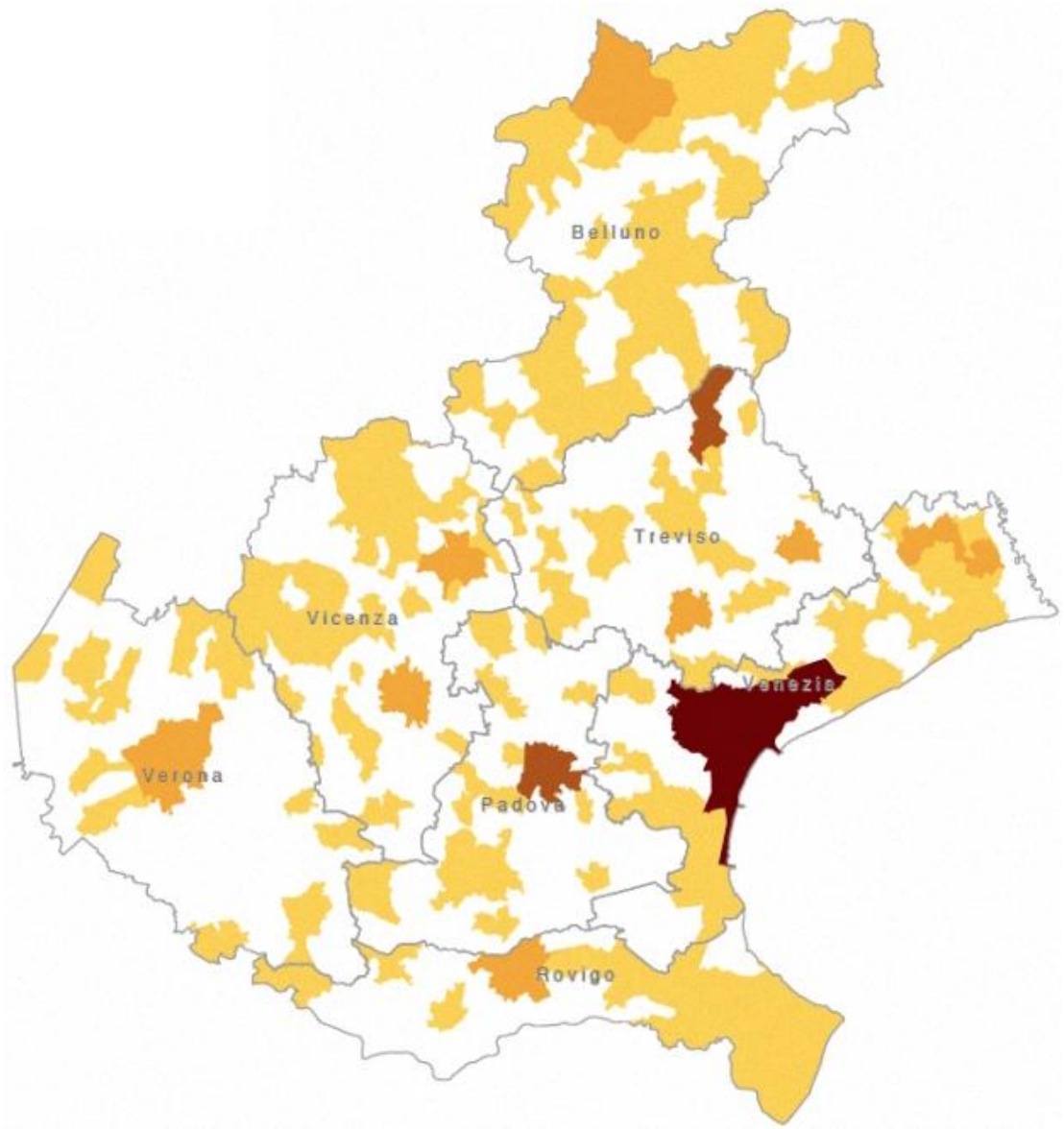

Figure 3. Facilities: Spatial density pattern for Museums.

To a considerable extent, the spatial distribution of facilities reflects a long-term tendency to host cultural activities on a permanent basis, and therefore it is not surprising that the bigger and most important cities of the region from the economic and historical point of view are also those that present the highest density of appropriate spaces. The comparison with the spatial pattern for activities may therefore provide a possibly more faithful picture of the current trends.

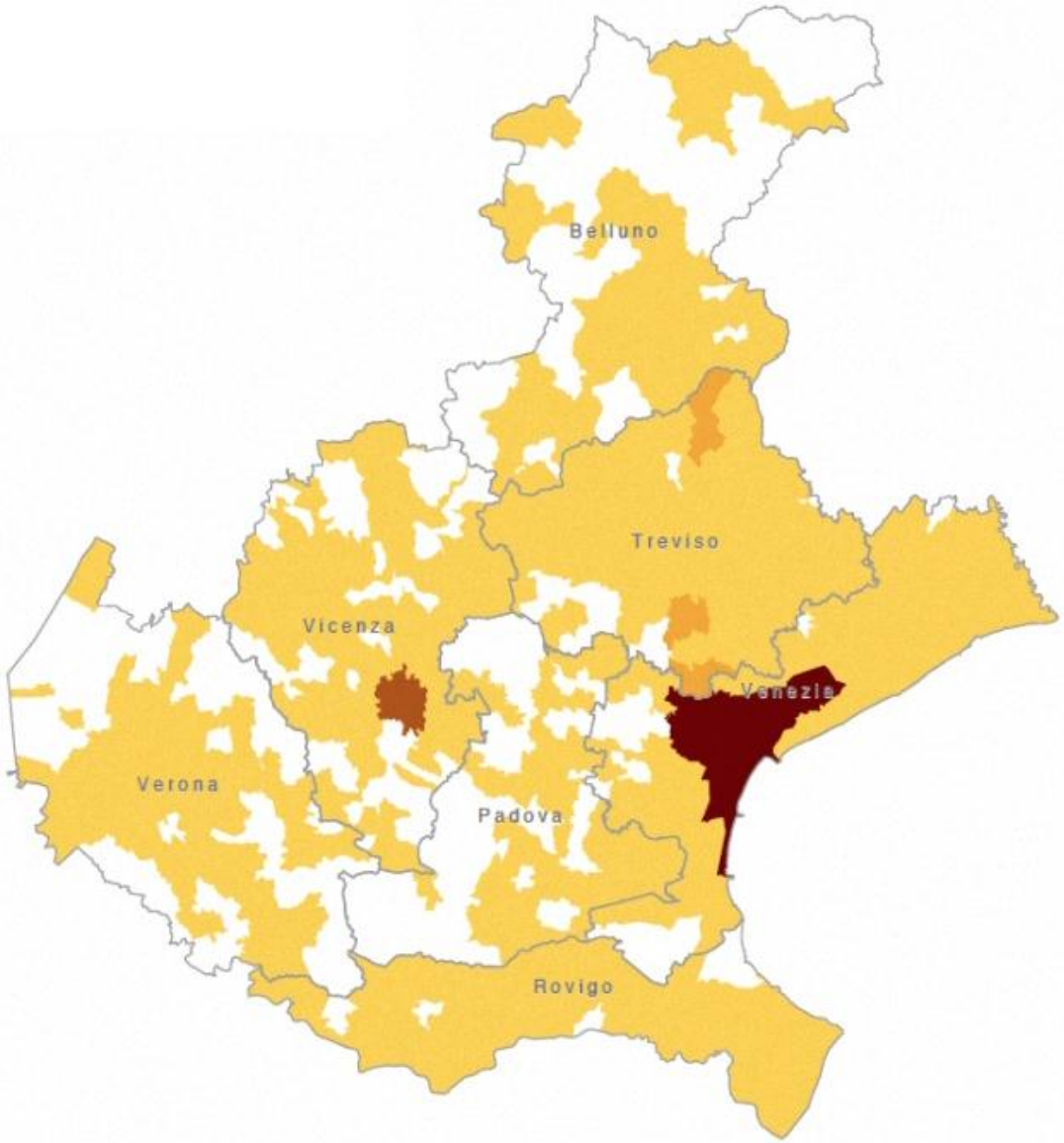

Figure 4. Facilities: Spatial density pattern for Libraries and Archives.

In fact, in addition, as shown in Figures 5 and 6 that compare Educational Services in the Cultural Field, Performing Arts and Live Shows, and Other Events, we find that, on the side of activities, there are more complex forms of polycentrism than in the cases of facilities, although also here, and again not so surprisingly, the predominant role of Venice is almost always confirmed, with the notable exception of the Performing Arts, where clearly the logistic peculiarity of the city poses nontrivial problems that reflect in a relative lack of suitable spaces; in this case, the regional leadership goes to Verona and Padua, whereas Vicenza sits with Venice at the second rank.

In its main traits, the cultural geography of the Region seems therefore rather clear: On the one side, Venice plays a primary role and is the undisputed cultural hub at the regional level. Moreover, there are a couple of other major cities such as Verona and Padua that are the second-rank hubs, and a bunch of other ones, such as Vicenza, Treviso and even Conegliano (which is not a province capital city) that sit on the third rank. Depending on the kinds of facilities and the sectors of activity, the local hierarchies may vary to some degree, reflecting the different characteristics of the various territories, but within a clearly settled overall rank.

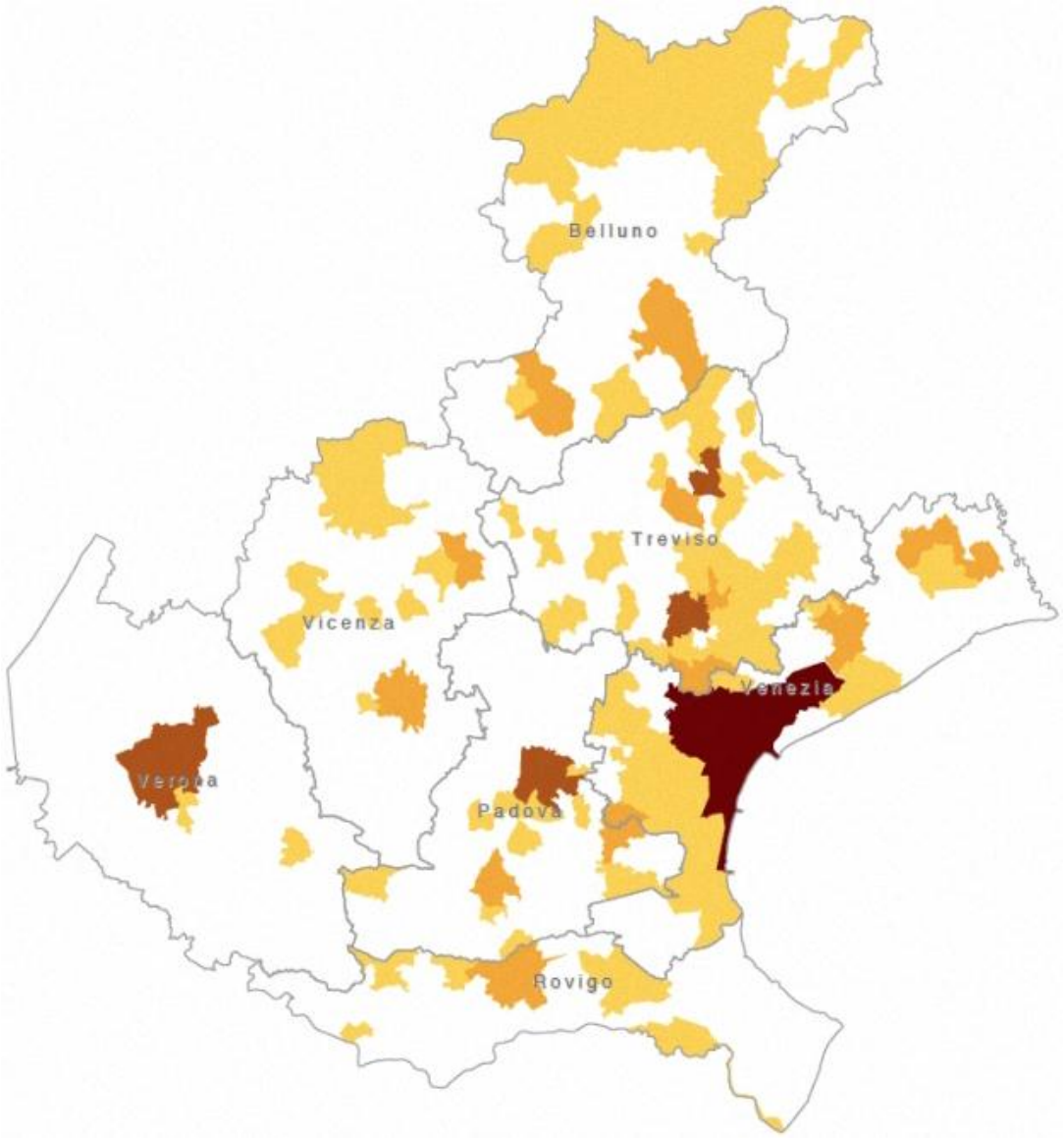

Figure 5. Activities: Spatial density patterns for Educational Services in the Cultural Field.

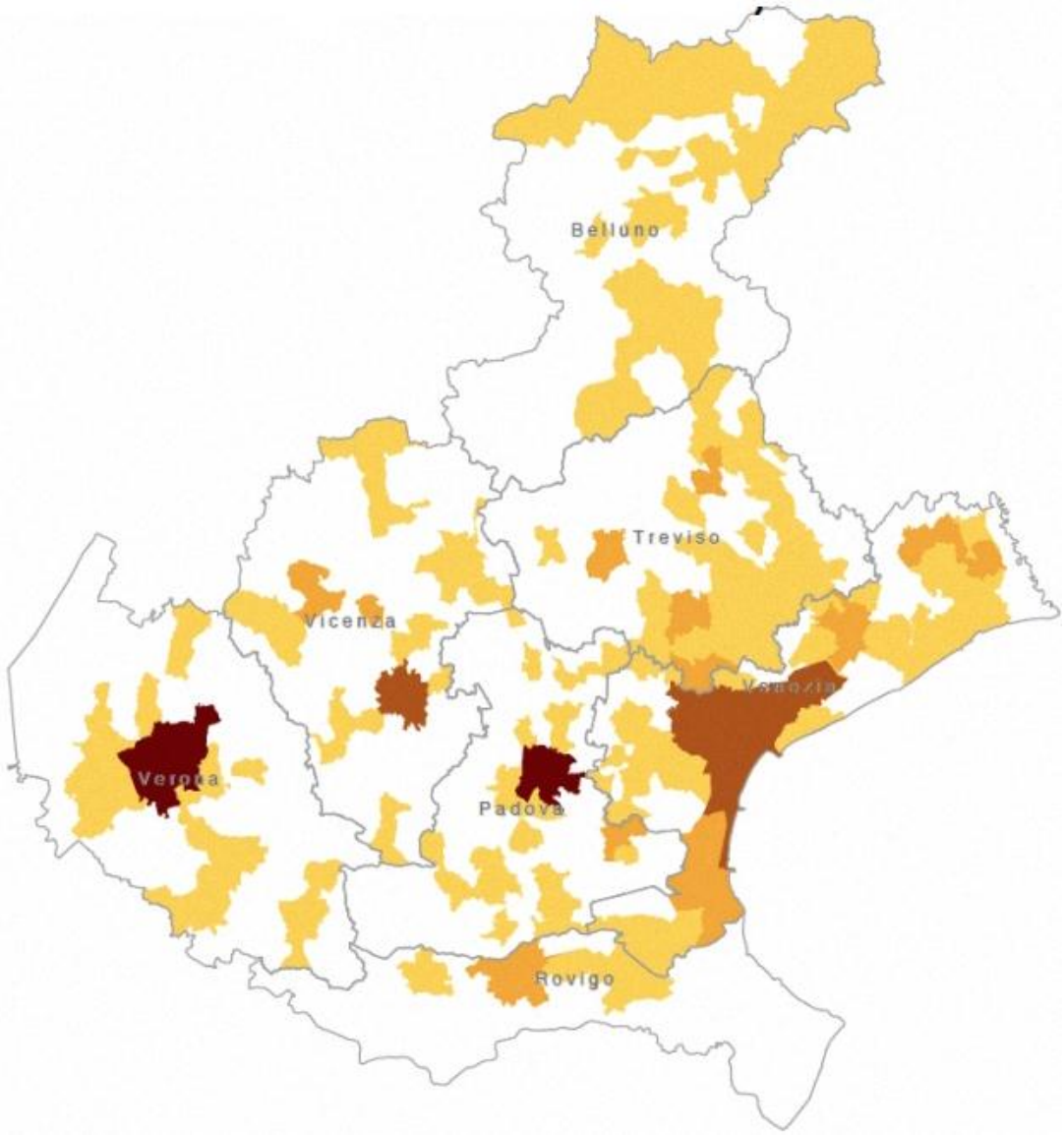

Figure 6. Activities: Spatial density pattern for Performing Arts (Live Shows).

This is, therefore, the cultural geography of the Veneto Region as of 2007. In applying the pseudo-diffusion approach presented above, we therefore have all the reasons to expect that the Region's TWC is to be found anywhere near Venice, with some high gradients corresponding to the second-tier cities, as a consequence of the strong concentration patterns that are found in the spatial distribution of cultural initiatives. This also makes intuitive appeal, as it is legitimate and reasonable to expect that the cities with a richer cultural supply are also those likely to present the stronger dynamism in initiative. In terms of the inherent spatial semantic, our maps show that the semantic is quite meaningful, as the spatial distribution of initiative is far from equi-probable and presents clear concentration patterns which could also indicate the presence of culturally specialized clusters. Are these intuitions reflected in the data? This is what we explore in the next section.

5. Culture as a Pre-Innovation Platform: The Inherent Semantic of Cultural Geography

The positioning of the TWC in the regional space as a consequence of the probabilistically weighted relative proximity of the observations describes the outbreak point of the pseudo-diffusion process. By comparing its position with that of the AC, we may determine how the inherent spatial semantic of cultural initiative tweaks the local geography, and in particular, by detecting the direction toward which the TWC moves with respect to the AC, we have a clear indication as to where the main momentum in cultural initiative actually lies. In Figure 7, we report the actual spatial distribution of observations and the curve describing the movement from the AC (large circle) to the (self-)TWC.

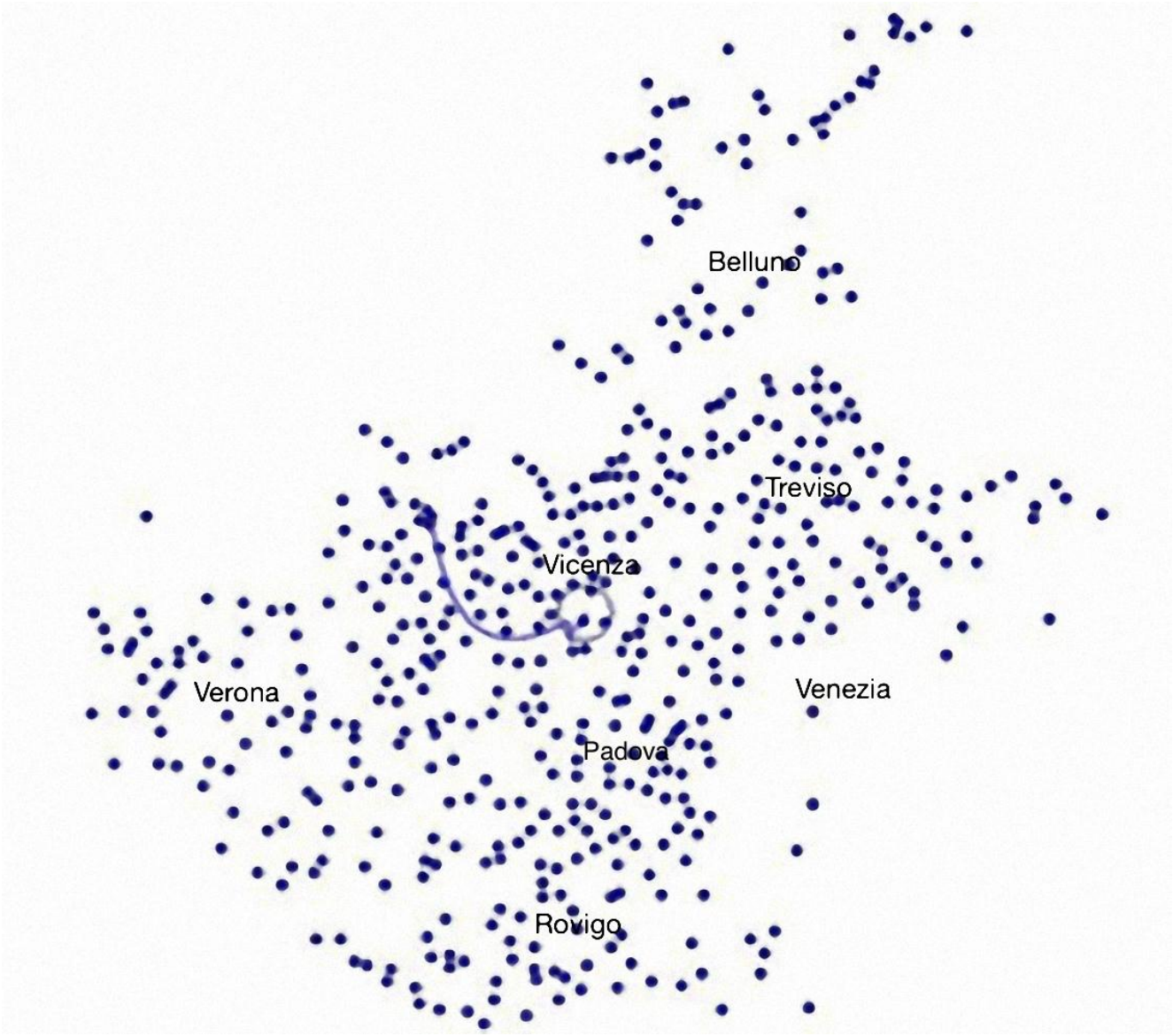

Figure 7. Arithmetic centroid and TWC(α).

The result is, indeed, quite surprising. Whereas the AC lies, intuitively, close to the geographical center of the region, in the proximity of Vicenza, and close to the intersection of the provinces of Vicenza, Padua, and Treviso, the path toward the TWC moves exactly in the opposite direction with respect to Venice, to land in the middle of the so called Pedemontana area, corresponding to the border

between the Northern province of Vicenza and the North-Western province of Treviso, in a mountainous territory which hardly anybody would assume as the cultural hub of the Veneto Region. How is that possible, and what does it mean?

A more articulate picture emerges by drawing out the proximity field gradient, that describes the whole hierarchy of hubs and sub-hubs as determined by the global relative proximity of the observations (Figure 8).

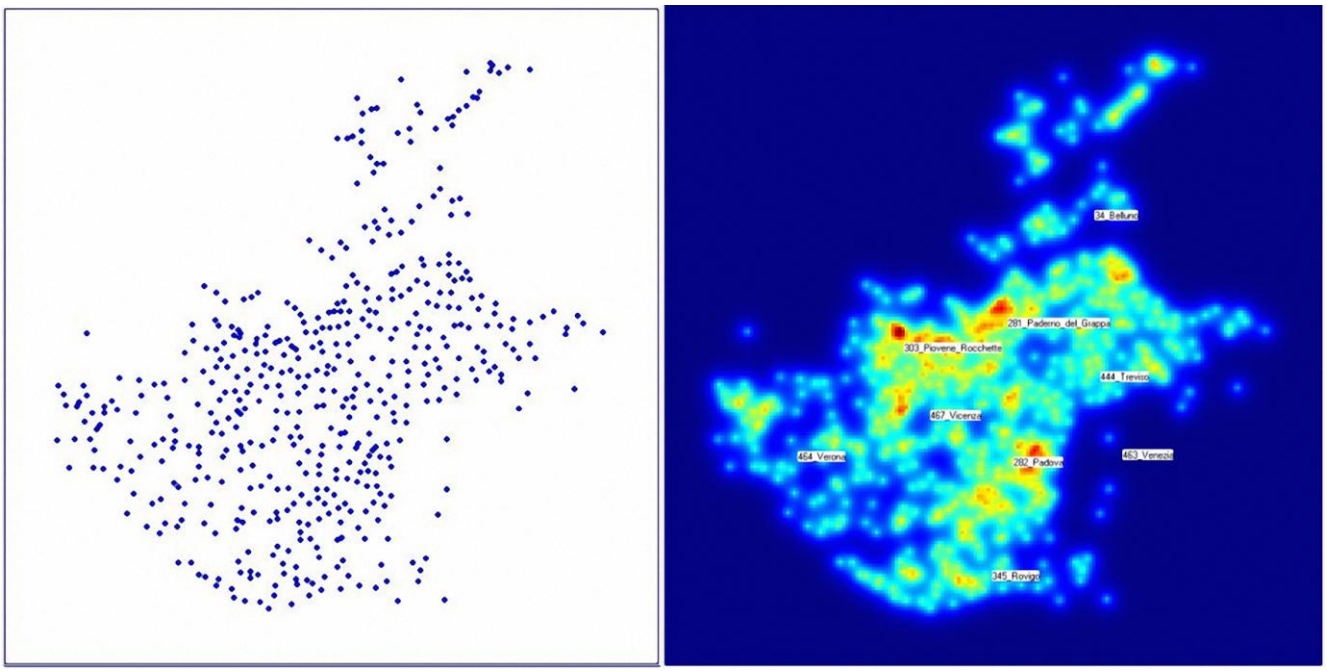

Figure 8. The proximity gradient field of TWC(β).

The gradient field identifies three main foci of cultural dynamism, two of which are located around the "Pedemontana corridor", and in particular at the two extreme ends of the corridor: One centered around Piovene Rocchette, in the upper province of Vicenza, and the other around Paderno del Grappa, in the North-Western province of Treviso. A third, slightly less active, pole is located in the proximity of Padua, which turns out to be the only major city of the Region that shows significant levels of activation. Interestingly, neither Verona nor Venice even vaguely compare. Venice, in particular, seems to be totally "turned off", *i.e.*, it does not display any significant amount of "cultural virulence". This result is totally at odds with the conclusions coming from the concentration analysis of the previous section, and looks quite counter-intuitive. After all, not only is Venice certainly the most widely known cultural city of Veneto (and actually, one of the most widely known in the world), but it is also, from ancient times, a real "outbreak point" for the diffusion of cultural activity, both at the local and at the international level. Not incidentally, many important cultural artefacts that are part of the Region's heritage are a more or less direct result of the Venetian cultural influence. As we have already explained, however, our analysis only takes into account the spatial pattern that emerges from the semantic of space. However important the role of Venice has been in determining historically the regional pattern of cultural initiatives, the regional picture as of 2007 shows that the contribution of Venice to the current cultural dynamism of the Veneto territory is almost non-existent, a result that reflects the already mentioned gradual transformation of Venice into a glossy stage for productions and activities

that have been developed elsewhere, rather than as a vital hub of cultural production (e.g., Sacco, Tavano Blessi and Vergani, 2007 [97]). This is also true to a large extent of Verona, which is also increasingly profiling itself as a global tourist city implicitly following the Venetian model, although with much less dramatic effects in terms of transformation of the urban fabric in a mono-culture of tourist-oriented facilities. Venice thus badly underperforms in terms of its meaningfulness in the semantic of the cultural geography of the Region, in spite of the huge concentration of cultural activities and facilities that it boasts. Such a conclusion reflects into the increasingly frequent complaints voiced by local stakeholders with reference to the decline of the city, which is most often attributed, among other causes, to its "cultural death" and its gradual transformation into a tourism theme park (see e.g., Kay, 2008 [98]). With respect to the 2007 status quo as represented in our data, the current situation eight years later seems, if possible, further deteriorated (Settis, 2014 [99]).

However, what is, on the contrary, the reason why the TWC moves toward the Pedemontana area, of all possibilities? Quite interestingly, the Pedemontana area represented in 2007 (and even more clearly represents today) the area of higher concentration of design-oriented companies which are more actively engaged in culture-driven innovation, and which at the time were already re-configuring as horizontally integrated clusters focusing on radical innovation rather than on strategic complementarities within a given value chain. This is, in other words, the area that has been clearly identifying itself as the most vital part of Veneto in terms of adoption of innovative creative practices among companies in a mixed, wide-spectrum range of manufacturing sectors, as pointed out by the specific survey of Fuoribiennale (2008) [100]. Some of these companies are also actually engaging in cultural activities of various kinds themselves, such as Bonotto (a global leader in the top quality segment of textile materials for fashion), Bisazza (a global leader in high-end bathroom tiles), Dainese (a global leader in extreme sporting equipment), Diesel (a global leader in stylish young fashion apparel), Benetton (a global leader in young casual fashion) etcetera. The TWC fully captures this momentum, and turns upside down the commonsense logic of concentration of cultural initiative by singling out where culture is making the difference as a platform of pre-innovation, and as an element of structural coherence in the innovative transformation of clusters from vertically integrated to horizontally integrated forms. Our results, therefore, not only show that the analysis of the inherent spatial semantic of cultural geography can provide surprising insights, but also confirms the link between the momentum of cultural initiative and that of certain forms of radical innovation. Interestingly, the third focus of the gradient field, located close to Padua, identifies a third area with similar characteristics, although relatively less pronounced than the two major ones.

Remembering that the TWC functions as the vantage point from which the cultural geography best extols its meaning, one sees that, by identifying the Pedemontana area as the centroid of such geography, namely an area which is not characterized by high cultural status but by a very profound interaction between cultural and creative production and design-oriented entrepreneurial culture, one truly captures the "soul" of the socio-cultural atmosphere of the Veneto Region, which, in most of its territories, reflects into a practical, pro-active, hands-on attitude where culture is not meaningful as a source of highbrow stigma, but as part of a dynamic, performance-oriented creative process. This is also the reason why Venice, in spite of the impressive concentration of cultural activities and facilities that would make of it the obvious candidate for the TWC, is on the contrary totally de-activated: Venice is an absolute outlier in the cultural geography of Veneto, and, in particular, it embodies a

social model of culture that, with its concentration on status and visibility, is totally disconnected from the one that characterizes the mainland territory. On the other hand, such alternative model is not vital enough to make of Venice an active focus from the *regional* point of view: what is in Venice, "stays" in Venice and has little "epidemic" impact on the cultural dynamics of the mainland territory, and thus, however impressive the concentration of cultural resources of the city, it does not generate significant enough non-local interactions at the regional scale. This is where, and how, the spatial semantic makes the difference.

These results appear even more meaningful when the analysis moves for the general distribution of cultural initiative across all sectors, to the gradient fields for single sectors. Here, it appears very clearly how, at least for certain sectors like music studios and private galleries (Figure 9), the hubs are found in main cities such as Verona and Padua—a further confirmation that the previous result depends not on a (linear) sum of the performances of territories across various sectors, but by the *overall* spatial semantic of the whole spectrum of activity. Once focusing on a specific sector, the spatial semantic changes completely and confirms intuitive results: where the most facilities are concentrated, there we often find the main hubs. There is a deeper layer of spatial semantic, however, arising from the negotiation of those various sectors, which follows a totally different logic and that identifies culture-driven innovation as the main dynamic force at work.

For art galleries, the regional hub is Verona, due to the presence of a relatively large number of art galleries and of an emergent art fair. In spite of the presence of the Venice Biennial and of a significant concentration of galleries in Venice and Padua, the Eastern quadrant of the region did not seem to be strong enough to generate an alternative hub for the private market as of 2007, while still maintaining a significant level of potential activity. As for music, we find instead a dual situation, where the Padua-Venice axis is dominant but the Western Verona hub represents a viable alternative.

It is interesting to remark how, from the theory absorption point of view, the easy prophecy of the centrality of Venice in the regional geography of cultural production is far from self-fulfilling. The main local corporate players of the Pedemontana area actively use Venice as a showcase for their projects and events, but this has never inhibited them from carrying out their main lines of cultural and creative activity in their original milieu. The most dynamic Veneto players seem to be able to filter effectively the visibility-prestige component associated to Venice as a global stage, and the dynamism-experimentation component that is more linked to the robustness of the local social fabric, and behave accordingly. At the level of specific sectors, however, the higher visibility of certain cities and territories in certain sectors influences the location dynamics and becomes more self-fulfilling.

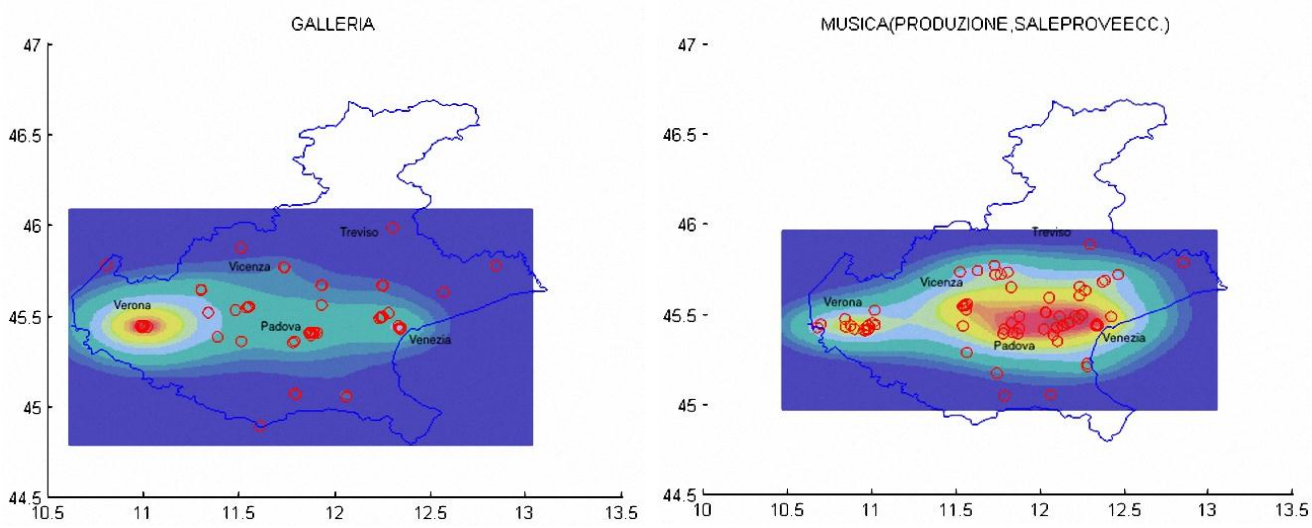

Figure 9. Proximity fields for Art Galleries (**left**); Music Production (**right**) sectors.

Although further research is still needed to dig deeper into the above results and in drawing out comparisons with the current situation, this is an encouraging piece of preliminary evidence that the semantic of cultural geography may be highly significant in understanding the complex dynamics of cultural activation and its relationship with local innovative processes.

6. Conclusions

In this paper, we have found a huge gap between the intuitions provided by a traditional analysis of concentration patterns of cultural activities/facilities, and those arising from a more sophisticated analysis that exploits the implicit spatial semantics that emerges when the cultural geography at the regional level is interpreted in terms of a pseudo-diffusion process. Not only does this alternative approach lead to a very different notion of "centrality", but it also seems to cast new light on the deep relationship between cultural activity and innovation-based socio-spatial dynamics. On the other hand, it provides an interesting confirmation to the mounting intuition that, as in the case of Venice, exasperating the tourist orientation at the expense of the vitality of the cultural production field may seriously endanger the social sustainability of local cultural systems. Our results leave, of course, many questions open for further research and analysis. A more detailed understanding of the meaning and implications of TWC positioning in the regional space and of the geometry of the gradient field of pseudo-diffusion processes are called for. Moreover, it is important to test this method in different geographical, analytical and even disciplinary contexts to evaluate its consistency and robustness.

Before closing, it may be interesting to give a final thought to the policy implications of our analysis. The financial support for our research has come from an INTERREG IIIA Italy-Slovenia Project, and, therefore, our focus has been orientated from the very beginning to providing useful information for policy design at the regional level. However, after several years from the completion of the project, we have to remark that, following an initial interest from the regional administrative bodies, little of our results have passed into public decision making, and in particular none of the non-trivial insights that we were providing with our analysis has been the basis for specific cultural

policies at the local level. As already remarked, the situation of Venice, for instance, has further deteriorated, and the local fabric of small cultural players and associations that ensured the city's cultural vitality off the main tourist season is gradually waning. One could wonder whether a timely policy response could have at least partly contrasted such a trend, or at least slowed it down. On the other hand, for the Pedemontana area whose scenario of opportunity was so surprisingly promising, a similar dynamics has occurred: after a momentary surge of interest and commitment from some local administrations, nothing has really passed into policy decision-making and action in the medium-long term. The issue seems therefore not to be one of denial of negative evidence, but rather difficulty in translating evidence of any kind into timely, coherent policy interventions, and in stimulating local private players to coordinate accordingly—a weakness that seems to have characterized not only the Veneto Region, but the Italian country as a whole in the last few years (as reflected in the poor performance of the Italian public sector according to most performance indicators; see e.g., Afonso *et al.*, 2005 [101]; 2010 [102]).

One could somewhat sadly conclude that, at least for the moment, the Italian case theory absorption phenomena are less of a main concern, as the interested players, in the first place, do not seem to react very much to the available evidence and to the theories that explain it—which, in principle, should be an incentive for public sector pioneers and innovators to develop cutting edge cultural policies whose short-medium term impact would be relatively easy to appreciate from a vantage point of relative strategic leadership, but which, in practice, still remains a largely untapped opportunity.

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Author Contributions

Discussed and elaborated the paper's main conceptual background: MB, GF, PLS, GTB. Developed the pseudo-diffusion approach: MB, PLS, GF. Developed the software: MB. Elaborated the data: MB, GF. Developed the methodology, data collection and interpretation: GF, PLS, MB. Developed the policy implications: PLS, GTB, GF. Discussed the literature: PLS. Wrote the paper: GF, PLS, MB, GTB.

Conflicts of Interest

The authors declare no conflict of interest.

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