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Simulations in Regional Science

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THE REGIONAL SCIENCE ASSOCIATION INTERNATIONAL



RSAI



1. Introduction

1.1 Welcome from the President: Jean-Claude Thill



Innovation! Today no issue of our flagship journals could be conceived without some articles making direct or implicit reference to innovation as a cornerstone of business success and survival, which in

turn is captured in a regional context in the form of spillovers and externalities that benefit other economic agents, as well as social and cultural organizations that call this region home. The successful region is a creative region. To remain relevant and competitive in an ever more connected world, regions, large and small, must assemble conditions favorable to encourage creative thinking, special combinations and recombinations of ideas that are novel and unique in some fashion to positively differentiate themselves from competing entities. This is the case in various spheres of considerations, including the scientific, the technical, the cultural and social, as well as business practices. Creativity is born out of questioning, skepticism; it is created out of competitive spirit and need. Knowledge creation finds fertile grounds in the juxtaposition of differences, complementarities, where cultures interface, where social networks of tightly knit and well integrated communities intersect. It is primarily a boundary effect.

As scholars of the knowledge world, Regional Scientists have studied and advocated the viewpoint expressed above. Interestingly, the same arguments also apply to our own

professional endeavors and to ourselves. Some years ago, Regional Science went through some rough patches. Several of our intellectual leaders initiated a soul searching process in the context of what starting to be seen on the outside as growing irrelevance. Some colleagues were already engraving the tombstone of Regional Science after having pronounced it dead! They were wrong!

Regional Science is well and alive. We have a renewed sense of purpose stimulated by the multiple challenges of the contemporary world, whether on the front of environmental and resources management, human and social capital disparities, or technological metamorphosis of our increasingly urban lifestyles. Our cutting edge research resonates well in the mind of young scholars, and we continue to build a solid basis for curriculum and educational programs. To maintain its relevance, a scientific discipline must also remain at the cutting-edge methodologically. Twenty years ago, this required embracing Geographic Information Systems (GIS), which have now become part of the toolbox of all Regional Scientists. Information and computing technologies have since opened the door to "Big Data", where data is increasingly disaggregated spatially and temporally, but also come to us in rather unorthodox ways. The terms "crowdsourcing" and "Volunteered Geographic Information" have permeated our discourse and Regional Scientists are adapting their research design to this new reality, from data storage, data dissemination and manipulation, to new urban and regional models, and to the very scientific questions we are now empowered to explore. The theme of this newsletter is in keeping with this opening to new methodological frontiers.

To conclude, I welcome you to the grand new and fascinating world of Regional

Science. I encourage you to stay tuned to new developments in our discipline and share your own creative work at one of our forthcoming conferences. I invite you to join us at the Tenth World Congress of RSAI in Bangkok, Thailand in May 2014. A Call for Papers is available under future events below, and on your association's web site: www.RegionalScience.org.

Finally, I want to salute Eveline Van Leeuwen and Graham Clarke for admirably editing this Newsletter. This is their last edition as they have decided to move on and let others step up to the plate. On behalf of the entire membership of RSAI, I give them both my deepest thanks for this job well done. RSAI is in the process of selecting a new editor whose responsibility will start with the 2014 newsletters.

As always, I welcome your comments and suggestions on all matters contributing to making RSAI a better community for us all. My inbox is waiting for you: Jean-Claude.Thill@uncc.edu.

1.2 Welcome from the Editors

Graham Clarke and Eveline van Leeuwen



Five years ago we were tasked with re-launching and re-vamping the RSAI newsletter. We have very much enjoyed working on the ten editions since that date. We wanted to bring more than just news – hence our features on some aspect of regional science application or methodology and the regular features

such as 'Meet the Fellows' and 'Centres of Regional science'. This is our last one as editors – democracy demands that we should pass the baton on now. We hope our successors will continue to develop the newsletter – we are sure they too will bring fresh ideas of their own. It has been a very enjoyable task and we thank our many colleagues for their contributions and time freely given.

The theme of this edition is simulation, especially in relation to the growing interest in agent-based models and modelling at the microscale. Again we have contributions from around the World. Dave Plane of Arizona provides a brief autobiography in 'Meet the Fellows'. Dave is a well-known figure at PRSCO, NARSC and the Western meetings. Charlie Karlsson tells us more about a major centre of regional science – Jonkoping Business School in Sweden, host of the 2010 ERSA meeting. Once again we hope you enjoy the newsletter and look out for more news on the RSAI website as to the new editorial team.



2. Simulations in Regional Science (1): The founder's take on agent-based models in regional science

Yuri Mansury, Cornell University



I had the chance to chat with Walter Isard one summer day back in 2006. Though Walter was not my formal advisor at the Cornell Regional Science program, he certainly influenced

the framing of my research on spatial modeling. On that day, I asked Walter what he thinks about the future of

agent-based modeling in regional science. I had taken notice that Walter had gone out of his way to work closely with one of my classmates on *The Use of Agent-Based Models in Regional Science* (Kimura, 2002). Naturally, I had expected an endorsement from Walter.

To me (and many of his fans), Walter is an iconoclast, maverick visionary who had tirelessly advocated a distinct mode of scientific inquiry where geography is a centerpiece. Here is a framework that promises to shed light on the mysteries of complex systems, and what is regional science if not the study of fascinating social phenomena that are intertwined with the complexity of spatial structures. Agent-based approach appeared poised to free research from the shackles of equation-based methods and, in so doing, expand the epistemology of regional science research. Walter's endorsement seemed to be a foregone conclusion.

I was surprised when Walter told me that he was wary of agent-based modeling approaches. Apparently, the agent-based models (ABMs) that Walter glimpsed at had "too many degrees of freedom." Here is a giant in the field, the founder of regional science, and he was telling me that to get results from an ABM we can just keep adding more and more ingredients until we get what we want. Instead of freeing us from the constraints of theorem proving, Walter was concerned that simulations had given us the illusion of freedom. He clearly understood that ABMs are much more flexible than the rigorous but restrictive axiom-theorem-proof approach. But Walter was worried they may encourage reckless practices, too, as agent-based models can be so easily tweaked to produce artifacts.

In the next section, I will outline features of ABMs that make them attractive to regional scientists. Following that, I will discuss emerging trends that challenge

the methodological orthodoxy. I will close with some thoughts on how ABMs can begin to attack some of today's challenges.

Agent-based models and regional science

Why should regional scientists use an agent-based approach? A short list of benefits may include the following:

- Agent based modeling thrives when heterogeneity is pervasive. There is no way to eliminate diversity completely, and models that use representative agent methods (where agents are aggregated into a few homogenous pools) thus run the risk of obtaining flawed results. By contrast, agent-based models build on micro units, like individuals, firms, or households with non-identical traits and behavioral rules. Aggregation errors are therefore minimized.
- ABMs are better able to study out-of-equilibrium adjustments and describe transient dynamics. This is of interest since it can take a very long time for a system to transit from off- equilibrium to steady states.
- Agent-based simulations are better able to handle local interactions and neighborhood effects. The "soup topology" is generally not the rule, as typically agents interact with neighbors in the local vicinity. Adaptation as a result of interactions with others is often assumed to be the byproduct that accompanies social contacts. Simulation is the only resort when agents adapt only imperfectly over discrete time intervals.
- ABMs visualize space more realistically. By contrast, equation-based approaches treat space in either very abstract or highly stylized manner. In a spatial ABM, every entity is defined by its place in a virtual but very realistic geometric space. The main advantage here is the notion of "local" becomes very well-defined.

Agent-based modeling has come of age in the social sciences. This is evident in the four-volume *de facto* handbook that Nigel Gilbert (2010) has collated. Regional science has a long history of engagement that goes all the way back to the first known incursions of computational methods into the social realm. Tom Schelling's (1972) model of neighborhood segregation is widely acknowledged as one of the earliest agent-based applications to an emerging phenomenon in a spatial setting. Schelling's work has influenced generations of regional scientists, and research that builds on his contributions has continued to remain active in regional science.

Agent-based modeling, however, has not gained significant tractions in regional science proper. The search by the keywords "agent-based", "individual-based", and "multi-agent" in the *Annals of Regional Science*, *Journal of Regional Science*, and *Regional Science and Urban Economics* returns a grand total of 8 original research articles. I am sure a wider net and more thorough content analysis will catch a few others, but it is safe to say that agent-based modeling has not kept pace with other "ways of doing science," in particular equilibrium approaches and econometrics. Walter himself mentioned ABM twice in his final opus, *History of Regional Science and the Regional Science Association International* (2003). The application he had in mind was rather limited, however, to "the problem of gaining further understanding of what the impacts of random elements may have been ..." (p. 191), while recommending other approaches to the studies of complex systems.

ABMs will continue to have wide appeals to geographers and the younger generations of regional scholars who grew up in the digital age. But I sensed that, to Walter, ABM is an interesting gadget that holds promises but had not

yet been tested enough to be given the same prominence as, say, regional input-output models. I will discuss next the rise of contemporary challenges that can serve as litmus tests for ABMs of spatial systems.

Challenges

A number of recent changes have radically changed the reality of regional development along multiple lines. Globalization, for example, has drawn closer buyers and suppliers previously separated by great distances. The space-time compression at the global scale is made possible by the emergence of new communication technologies. Although political borders are seemingly dissipating, there is plenty of evidence that certain activities have paradoxically become more localized, and that the new technologies themselves arise from the clustering of people and activities. The most intense feature of this "glocalization" process is the social interactions between individuals that are only minimally subject to top-down control. ABMs can help explore the evolution of spatial structures as entities move across increasingly porous borders.

A related but rather different development is the rising gap between the poor and the rich. The causes and consequences of economic inequality have been debated elsewhere. What I would like to point out here is the spatial dimension of this seemingly macro-phenomenon. The pattern among the developed economies is very uneven, with the Anglo-Saxon countries—Australia, Canada, the U.K., and the U.S.—showing the strongest surge in increasing disparities. While it is tempting to blame this on national policies, a closer look reveals equally uneven pattern across sub-regions. In the U.S. for example, the Gini coefficients varied significantly across states. There is something else here at

work at the regional level. ABMs seem to be particularly well suited to explain massive increases in inequality in some regions but not others.

There are other emerging trends, including climate change, the polarization of political views, the increasing volatility of the economy and rise of the financial sector, where the outcome depends not only on individual actions but also on interactions with those around. These changes have challenged regional scientists to rise to the occasion by providing more solid micro-foundations, implementing new ways to validate agent-based algorithms and, at the same time, maintaining discipline when there is no natural way to constraint degrees of freedom.

Going forward

I will contend that the vindication of agent-based models in regional science will come from an inference based on micro-behavioral foundations that provide the best explanation of the observed pattern at hand. To strengthen micro-foundations, regional scientists have begun to turn to new advances in behavioral sciences. The science part implies that regional scientists are tasked with the identification of the underlying causes that bring about spatial phenomena. The ABMs that Walter saw are so rich; it is difficult to pinpoint core causes. Of course, one can always argue whether a particular set of unobserved causes constitutes an adequate scientific explanation. But the early agent-based models that Walter was exposed to seemed to have the tendency of mixing too many ingredients.

New computational techniques provide for more robust design and programming. It is not clear, however, whether technical advances *alone* will increase our understanding of how complex spatial patterns emerge. To the contrary, I will argue, that the use of

ABMs in regional science can only be sustained through building blocks that govern the propensities for spatial events to occur. One example of such a building block is advances in behavioral research that suggest departures from the standard rational choice model are the norm rather than the exception. Applying new insights from psychology to regional questions I think is a very promising endeavor, as they allow us to attack today's topics using more behaviorally informed instruments.

What is clear is that to be able to explain and not just to rediscover breathlessly that emergence is wonderful (it is!), regional scientists need to do more. We need to integrate solid, empirically grounded micro-foundations that are able to *explain spatial patterns well*. This does not mean doing micro-foundations for the sake of rigor, for there are plenty of examples where "first principles" do not give a useful account of the thing they are supposed to explain. Instead, the objective here is to gain insight into how human behavior creates patterns. Such insights help us not only understand causal mechanisms better, but also hopefully identify policy responses more robustly than we have so far.

Despite the challenges, agent-based modeling continues to have the potential to transform regional science. Let me sketch an aspirational view of future ABMs that I think will help meet the need for a modeling framework along the line that Walter had suggested. Agent-based modeling encourages the grounding of our abstract analyses in everyday experiences. While retaining the role of an external observer, an agent-based developer brings artificial agents to life by introducing self-awareness and the discrete processes of learning. Towards the end of his life, Walter questioned our understanding of preferences and choice as approximated by standard models (Donaghy, 2012).

Indeed, we know now that our consumption habits are often incomplete, unstable, and vary widely across individuals. While remaining committed to rigor in the pursuit of replicable and verifiable evidence, ABM allows us to respect the relativist position; one that values the idiosyncrasies that make each of us unique and special. I think Walter would at least be supportive of that.

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Torben Dall Schmidt



Peter Sandholt Jensen

Based on the criteria a) originality of the topic b) theoretical foundations c) appropriate methodology and d) empirical relevance the jury concluded unanimously that this paper was the best paper. It examines the interesting and complex issue of social networks in regional recruitment and inflows of foreign labor. Using both cross-section analysis and panel data analysis in Denmark, the paper successfully shows the importance of regional social networks and spatial sorting in the recruitment and inflows of foreign labor. The paper is innovative in empirical study on a new and complex issue of international importance.

Many congratulations to Torben Dall Schmidt and Peter Sandholt Jensen.



3. News and Recent Events

3.1 Martin Beckman Prize

RSAI has the great pleasure to announce that the jury consisting of Masahisa Fujita, Jean Paelinck, Roberta Capello and Jouke van Dijk have chosen the article “Social networks and regional recruitment of foreign labour: Firm recruitment methods and spatial sorting in Denmark” by Torben Dall Schmidt and Peter Sandholt Jensen (published in Volume 91, Issue 4, November 2012, Pages: 795–821) as the winner of the Martin Beckmann Prize as the best paper published in Papers in Regional Science in 2012.

3.2 Dutch-Israeli workshop in Groningen

In the first week of October, the tradition of the Dutch-Israeli workshop was continued in Groningen. Hosted by Henk Folmer, 35 regional scientists from the Netherlands and Israel enjoyed each other's company for two days, followed by an excursion day. The theme was 'Regional impacts of global crisis'. However, at the end it was concluded that although the quality of the papers and presentations was very high, not many actually dealt with the crisis itself! It seems that regional scientists often stick to the same problems and methods. Instead, we should learn more

from other disciplines and be more responsive to (social) developments that take place today. Let's see how we manage when we meet again in Israel.



Amnon Frenkel, Daniel Czamanski, Marina Toger and Jacob Polak sitting in the front row



4. Meet the fellows: David Plane

Flower Child of the Quantitative Revolution and Second-Generation Regional Scientist

I was a flower child of geography's quantitative revolution, and I am a second-generation regional scientist. My concept for this article is to ponder the vagaries of how academic careers get launched, the ways regional science wended its way into mine, and why, subsequently, our multidisciplinary institutions came to consume a large portion of my intellectual energies. Various outstanding scholars were instrumental in mentoring me, and – through my spatial demographer's lens – I've come to view the intellectual enterprise of regional science as being fundamentally about passing the torch to future generations ("What about aging in regional science," *The Annals of Regional Science*, 2012).

I began my formal education in a one-room school, on the second floor of a WWII bombed-out manor house, in a small village in England. The year was 1961 (my dad, a Cornell University chemist, was at Oxford on a sabbatical leave). Our teacher, Miss Watson, was quite keen on math, but thought reading humdrum. She awakened in me an intuitive, conceptual approach to math that has served me in good stead throughout my academic career. I would grasp long division in that first year of school, but it would not be until third-grade that I would puzzle out how to read.

Growing up, I fancied pursuing a career as an architect; math and art were my favorite school subjects, with geometry a special passion. In 1972 I enrolled at Dartmouth College and began the pre-architecture curriculum. This involved vast swaths of studio art, but little actual architecture prior to senior year. So, in the meantime, I began taking geography classes. Dartmouth (which prides itself on doing whatever Harvard doesn't) had retained geography as a major subject and continues to this day a proud tradition of launching the careers of numerous academic geographers (WRSA Fellow, Richard Morrill of the University of Washington, among the most distinguished).



At Dartmouth, I was mentored by geography professor Jack Sommer (who would later become a stalwart member of WRSA). Jack got me hooked on spatial analysis, directing me to the works of D'Arcy Thompson, Peter Stevens, Michael Woldenburg, William Warntz, Bill Coffey, Peter Haggett, Richard Chorley, and others advancing morphological perspectives on natural and human systems. And I became drawn to regional planning, which during that radicalized era seemed more socially relevant career than architecture. Working during leave terms for the office of the St. Lawrence County (New York) Planning Board, I drafted Ian McHarg-style (*Design with Nature*) overlay maps: the precursor, in many ways, to modern GIS layer analysis.

When it came time to choose a graduate program, Professor Sommer gave me a list of what he considered the top North American geography departments and leading “quantifiers” (that quaint, somewhat pejorative label for those then spearheading Anglo-American geography’s spatial analysis revolution). Among the schools on his list was the University of Pennsylvania, and, among the scholars, Walter Isard. My dad was at that time the Provost of Cornell (according to long-time RSAI archivist, Barclay Jones, during his tenure he approved the creation of Cornell’s Regional Science doctoral program) and he, too, suggested I go down to Philadelphia to talk with Walter about graduate school possibilities. I remember sitting on a stack of papers in the Founder’s (perpetually overstuffed-with-research-detritus) office and asking: “Should I enroll at Cornell or Penn?” Thinking a moment, he replied: “For you, David, Penn.”

With a plan to ultimately become a transportation planner, during my Master’s year of 1976–1977 I studied with David Boyce and Bruce Allen. I

recall David chuckling when he informed us we shouldn’t plan on going anywhere for spring break, because Alan Wilson would be coming across the pond to give a week of seminars on entropy modeling. Those masterfully presented lectures, plus a later presentation by Folke Snickars on his work with Jürgen Weibull on a “Minimum Information Approach” to trip distribution modeling, along with Ron Miller’s elegantly presented courses on input-analysis, and Masa Fujita’s on location theory, laid the seedbed for my later dissertation work. Under the direction of Tony Smith, Dan Vining and Janet Madden, I investigated information-theoretic approaches to modeling temporal change in human migration patterns.



My academic career path was altered dramatically one day when Andrew Isserman popped into my grad student carrel at Penn. Andy informed me I was being hired – along with Larry Klein’s student, Paul Beaumont – to go to the U.S. Census Bureau as part of his American Statistical Association Fellow’s project to develop novel, combined economic/demographic population projection methodology. I naively told Andy: “No thanks; I think I want to continue working on transportation.” Alas, as others can readily attest, telling Professor Isserman, “No,” was virtually impossible. I soon found myself – sans any formal training in demography – the population specialist on the ECESIS Model development team. I owe a great debt of gratitude to John Long, Signe

Wetrogan and others in the Bureau's Population Division, as well as Andy, for providing on-the-job training in population analysis and for launching what was to become my primary career focus: the geographical analysis of population distribution and migration. During the second year of the project, Peter Rogerson (then ABD at the University of Buffalo) was hired onto the ECESIS team, and he and I began our long and productive research collaboration and friendship, including joint authorship of our text and practical handbook, *The Geographical Analysis of Population*.

My first regional science conference attended was in 1974, at the Philadelphia North American meetings. I presented my first paper at the 1980 North American Meetings in Milwaukee; Kingsley Hayes gave the discussant remarks (after re-presenting much of my paper, which I'd been too nervous to get across very coherently). Also in 1980, I entered the faculty job market. A long interview trip took me out west, including, among other stops, to my first Western Regional Science Association conference in Monterey, California, and to Tucson, where I instantly hit it off with the geographers and regional science crew at the University of Arizona. Arthur Silvers, Gordon Mulligan, Carol Taylor West, Alberta Charney, David Barkley, and others were then in that outstanding group. (As I recall, during my interview Lay Gibson was off traveling somewhere else in the world, but he rolled out the welcome mat for me at WRSA.)



David with his wife, Kathy Jacobs during the 50th Anniversary Dinner of the WRSA in Monterey, California 2011

As a mongrel geographer/demographer, my own research is not as economics-oriented as that of many regional scientists, yet regional science has always provided my primary intellectual home. As I argued in my short 2005 piece in the *Papers*, "On discipline and disciplines in regional science," I believe regional science offers "an almost perfect disciplinarily neutral . . . meeting ground." As in Walter's vision, it continues to attract top minds bringing technical prowess from many directions to important societal issues of space and location. And the plain and simple style of regional science – it's all about the scholarship and collegiality without the extraneous trappings of other disciplines and groups – has engendered remarkable loyalty among its adherents.

I've felt an almost missionary zeal in promoting regional science institutions and have devoted substantial energies over the decades to building regional science institutions. My first assignment came in 1984 at the Denver Meetings, when Walter Isard informed me that, henceforth, Peter Rogerson and I would become the North American Co-Editors of the *Papers of the Regional Science Association*. We proceeded to scramble to assemble some good papers for our first issue!

Prior to the 1988 North American Meetings in Toronto, David Boyce organized a (Quaker-meeting style!) workshop to discuss organizational structure of the Association, where it fell to me to draft the initial Constitution of the North American Regional Science Council (a document that took its inspiration, in part, from the Council of the Iroquois Indian confederation). Shortly thereafter I worked with Lay Gibson to put together the first version of the RSAI Constitution.

In 1990, at the behest of the RSAI Council, I was tasked with transforming the old-style *Papers*, which had consisted exclusively of papers presented at the three major, superregional conferences, into a regular, quarterly journal. I served a three-year term as the first Editor-in-Chief of what we retitled: *Papers in Regional Science: The Journal of the RSAI*. Geoff Hewings, long-time Secretary of the Association, was extremely supportive, contributing substantially to that transformation. (As part of the effort, I paid a University of Arizona undergraduate art student, whose name, alas, I do not remember, the munificent sum of \$50 to design the four-hexagon RSAI logo.)

In 1991, Lay Gibson handed me the reins as Executive Secretary of the WRSA, a post I would hold, with enthusiasm, through 2011.

In 1994 Ron Miller asked me to take over as Editor of the *Journal of Regional Science*. By then well into my first term as Head of the Department of Geography and Regional Development at the University of Arizona, I agreed, but only on the condition that I be allowed to co-edit with my more economics-oriented colleague, Gordon Mulligan.

I've had the immense pleasure of organizing a plethora of regional science

conferences: some nineteen WRSA Annual Meetings (in spectacular venues!) from 1992 to 2011; North American Meetings in Houston in 1993 (assisting Janet Kohlhase), Santa Fe in 1998 and San Francisco in 2006; and the Pacific Conference in Portland, Oregon, in 2001.

I'm deeply honored to have been tapped to serve as President of both PRSCO (2002–2003) and NARSC (2010), to have been selected as a recipient of the David E. Boyce Award for distinguished service, and to have been elected as a Fellow of both WRSA and RSAI.

Regional Science has been very very good to me. It has given me the opportunity to participate in the flowering and maturation of a significant, international scholarly movement; to help build a multidisciplinary professional enterprise; and to forge a plethora of academic friendships around the globe. I hope all of us in "Club Regional Science" (as our late Springer-Verlag editor, Marianne Bopp, so aptly dubbed our collegial network) will place top priority on nurturing the third and now fourth generations of regional scientists. We should entrust in their youthful enthusiasm and energies, much as the founding generation did during the formative period of my – and my cohort's – careers.



5. Simulations in Regional Science (2): Complexity Research Lab: experimenting with cities

Daniel Czamanski, *ComplexCity Research Lab, Technion – Israel Institute of Technology*



Urban landscapes and agents that populate them are heterogeneous and display non-uniform time-space dynamics. The presence of power laws at

various geographic scales suggests self organized criticality and possible phase transitions. Ideally, these urban features should result from models that start with a featureless space and homogeneous agents. And indeed, these are the assumptions of the traditional urban model. The welfare of homogeneous agents is assumed to increase with proximity to a single source of employment. The result is declining density and rent gradients in all directions (Alonso [1964], Mills [1967] and Muth [1969]) and a city that resemble a sand pile (see Figure 1). Although this approach has yielded many insights into the structure and evolution of modern cities, empirical tests that go beyond very crude spatial resolution are hard pressed to provide it with convincing validation.

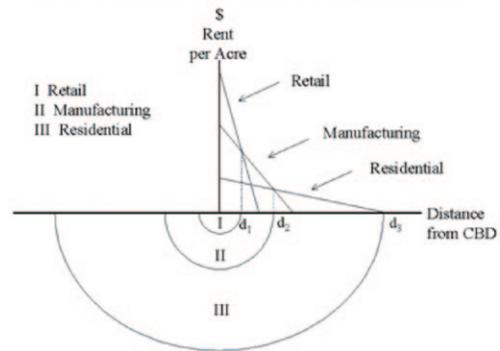


Figure 1. The traditional urban model

Furthermore, more than half a century ago it was recognized that economic systems are characterized by the presence of positive and negative feedbacks and fat tail distributions (Simon [1955] and Hayek [1967]). From the early days of regional science, following aspatial economics, it was recognized that urban evolution, powered by continuous flows, is characterized by abrupt and often striking changes in its organization, albeit the time frame required to observe these changes is long, typical of the characteristic time of cities and not of people. Yet, these facts were not quickly incorporated into urban models. Stabilizing negative feedback effects and de-stabilizing, self-augmenting, positive feedback effects lead to nonlinear dynamics that are difficult to sort out without computer simulation. To make

things manageable processes were linearized, constant returns were assumed and equilibria were obtained. Thus, despite the fact that traditional, equilibrium oriented, models are incapable of explaining nonlinear urban dynamics, the vast majority of regional science research is in this mold. Moreover, it is well known that cities are populated by agents and spatial structures with size distributions that make it impossible to represent them by a typical element. Thus for example, the size distribution of land developers is not Gaussian. Inclusion of developers in urban models requires the incorporation of industrial organization considerations in characterizing the interactions among urban players.

An outburst of new models aiming to explain the births of cities and the dynamic processes governing their evolution, and the uneven geographic distribution of economic activities in general, started in the early 1990s. While the idea of simulation as a means to understanding nonlinear dynamics was introduced in the middle of the 20th century, among others by von Neumann [1945], only in the 1990s has sufficient computational capacity made possible extensive modeling. Interest of physicists, including Kadanoff, Benguigui, Franhauser and others made the complexity approach to regional science respectable (see for example Benguigui et al, [2000], [2004a],[2004b]). Paul Krugman's 1991 paper and later the award of the Nobel Prize in economics in 2008 [Krugman, 1991, Fujita and Thisse, 2008] constituted a major stimulus. Mike Batty's books [1994] and [2005] made the approach known to all.

Until Krugman the neoclassical explanations for the location of cities and increasing spatial concentration of activities and people was anchored in local resource endowments, the so-called first-nature. Cities formed

where there were resources creating a competitive edge. Since Krugman, the emphasis shifted to explanations anchored in the relative locations of economic agents, the so-called second-nature. Recent approaches introduced heterogeneity in the characteristics of agents and in the nature of space. Caruso et al [2007] and Filatova et al [2009] among others introduced heterogeneous preferences, local amenities, externalities and market processes to generate heterogeneity. Nevertheless, much remains obscure. Can spatial heterogeneity be generated by models that start with homogeneous agents? What are the minimal conditions needed to create heterogeneous urban structures?

The challenge is being met by a nascent but growing literature that focuses on the role of heterogeneity of agents and on planning restrictions in generating polycentric urban structures (Czamanski and Roth [2011], Czamanski and Broitman [2012]). In these models a central driving force is the profit maximizing behavior of land developers. Their behavior reflects parsimoniously all the relevant information concerning urban markets. Development restrictions by planners create land price profiles that lead to leapfrogging and eventually to edge cities. The situation is particularly evident in models that include more than one planning authority and more than one type of developer. This approach is consistent with Henderson's view (Henderson and Venables [2008]) that planning decisions constitute constraints and not the engines of urban evolution.

To generate these results models must include at least one developer who is capable of and willing to purchase agricultural land for future development. The developer must possess savings and display some preference for risk-taking. As in the case of the non-spatial economy, innovation and growth are

associated with a particular size-distribution of firms. Growth is associated with idiosyncratic firm productivity improvements, selection of successful firms, and imitation by entrants (Luttmer [2007]). Zipf's law distribution of firms can be interpreted to mean that entry costs are high or that imitation is difficult, or both. The small size of entrants indicates that imitation must be difficult Gabaix [1999].

In the case of land developers, entry cost is related to the present value of the opportunity cost of purchasing agricultural land and holding it until realization, termed characteristic time.

There is a growing group of regional scientists inspired and challenged by the potential insights to be gained by agent based simulation. For some years now the ERSA meetings include special sessions entitled "complexity and regional science". There are several research groups concerned with urban complexity and there is a growing number of international workshops on this subject.

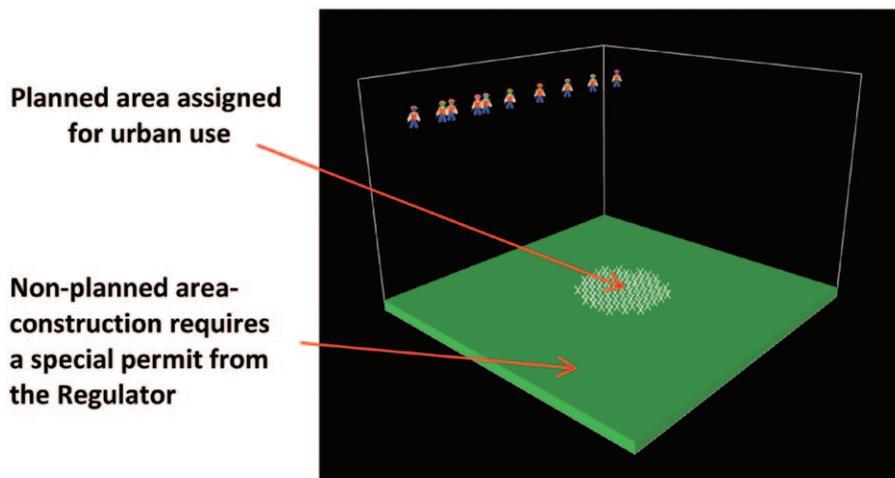


Figure 2. NetLogo based urban 3D simulation platform (Yoni Almagor)

Very few firms are not risk-averse and can withstand this entry cost. The equivalent of demand shock is population growth due to immigration at the urban level. In the model presented at the recent ERSA meeting in Palermo we start with developers who are homogeneous in terms of wealth. Some, however, are willing to take risks. The result is a size distribution of developers that is reminiscent of the size distribution of firms in growing economies. The behavior of these developers leads to a polycentric urban structure (Thanks to Yoni Almagor for Figure 2).

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6. Centres of Regional Science: The regional science research milieu at JIBS

Charlie Karlsson, research milieu at Jönköping International Business School



The regional science research milieu at Jönköping International Business School (JIBS) is a young one. The building of the research milieu started in 1994, when JIBS

started and Börje Johansson – an internationally recognized regional scientist – was hired as Professor of Economics. Two years later, in 1996, a PhD programme in Economics was launched and many of the PhD students in the coming years wrote dissertations in regional economics. In the early 2000s, another internationally recognized regional scientist – Åke E Andersson – was hired as Professor of Economics. A couple of years later Hans Westlund was hired as Professor of Entrepreneurship. It is interesting to note that Åke E. Andersson, Börje Johansson, Charlie Karlsson and Hans Westlund all have, or have had, leading positions in the international regional science community. Åke E. Andersson and Börje Johansson have both been awarded the EIB-ERSA Prize in regional

science. Since the recruitment of Åke E. Andersson, an informal team consisting of him, Börje Johansson and Charlie Karlsson, has led the research milieu. Another strategic recruitment was the hiring of Ghazi Shukur as Professor of Statistics/Econometrics. Later the group of regional science professors has been expanded by first Andreas Stephan and later Charlotta Mellander. Other critical faculty members are the two associate professors Johan Klaesson and Johan Eklund.

The regional science research at JIBS is today mainly taking place within the framework of two research centres: CESIS (Center of Excellence for Science and Innovation Studies¹, www.cesis.se) and CEnSE (Center for Entrepreneurship and Spatial Economics, www.cense.se)

Looking back at the research output it is obvious that the research has had a strong empirical orientation not least using the excellent databases provided by Statistics Sweden. The range of spatial units used ranges from neighbourhoods, via local planning areas, municipalities, labour market regions, to counties. However, most of the research has been devoted to analyses of functional economic regions approximated by labour market regions. A speciality of the regional research milieu at JIBS has been its focus on using an accessibility approach, where accessibilities have been defined at three levels – intra-municipal, intra-regional and inter-regional. More than 40 journal articles and book chapters using the JIBS accessibility approach have so far been published.

A focal point for the regional science research milieu at JIBS has been the

¹ This is a joint research centre between JIBS and the Royal Institute of Technology (KTH), Stockholm. According to the REPEC ranking, CESIS belongs to the top 2 % innovation research milieus in the world.

PhD programme. About 30 PhD students have defended their dissertation in Economics at JIBS and about 2/3 of them has focused on regional economics. Many of these PhDs have made an academic career. Pontus Braunerhjelm, Martin Andersson and Charlotta Mellander are today professors and Kristina Nyström, Johan Klaesson, Johan Eklund, and Olof Ejeremo associate professors. Others are today employed at the Swedish central bank – “Riksbanken” – and at the Ministry of Finance in Stockholm as well as chief health economist at AstraZeneca in Brussels. It has been a strong ambition in the regional science team at JIBS that the PhD theses should



hold a high international quality. To guarantee that the team has over the years invited many leading regional scientists from abroad to act as discussants and as members of the grading committee. Another major ambition of the PhD programme has been to secure that the PhD students build their own international research networks. Substantial resources have been devoted to make it possible for them to present their research at several international scientific meetings each year, as well as making it possible to do research abroad at foreign universities. One major cooperation hub during the years has been The School of Public Policy (SPP) at George Mason University (GMU) in Washington.

One major activity for the regional research team at JIBS has been the organisation of the yearly Uddevalla symposia in cooperation with University West, Trollhättan, Sweden and SPP at GMU. The first Uddevalla Symposia was held in 1998 in Uddevalla but has over the years become a “travelling symposia” that has also been held in Fiskebäckskil, Trollhättan, Vänersborg and Jönköping and outside Sweden in Fredrikstad, Norway, Fairfax, VA, USA, Kyoto, Japan, Bari and Bergamo, Italy, Faro, Portugal and Kansas City, MO, USA. The symposia have resulted in almost 15 books published by Edward Elgar, Routledge and Springer as well as Special Issues of Papers in Regional Science and Small Business Economics. Substantially more than 1000 regional and other scientists have participated in the Uddevalla symposia over the years. For further information, see www.symposium.hv.se .

The real high point for the regional science team at JIBS was the hosting of the 50th European Congress of the Regional Science Association International – the ERSA congress – in August 2010. Hans Westlund did a fantastic job as chair of the local organising committee as did the rest of his team. There is no doubt whatsoever that Hans Westlund set a new standard for ERSA congresses in terms of scientific quality, the social programme, and the number of participants. The top attraction during the congress was the round table discussion between Paul Krugman, Masahisa Fujita and Anthony Venables around “The Spatial Economy one decade later” led by J-F Thisse. In addition, everyone who participated in the congress dinner will always remember that event.

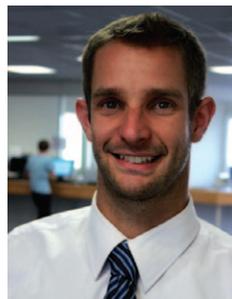
Even if research directed at international publication and PhD theses is the No.1 objective of the research team, the team has also carried out a great deal of contract research and consultancy for

municipalities, cities, counties and national public administration, such as the National Board for Agriculture, the National Road Authority, the National Agency for Growth Analysis, and The National Agency for Growth. Contract research has also included projects together with large companies, such as Astra-Zeneca and with industry organisations, such as the Swedish Ship-owners Association and the Confederation of Swedish Enterprise.



7. Simulations in Regional Science (3): GeoCells: modeling and simulation of Cohesion Policy funding and regional growth diffusion in an enlarged European Union

Sebastien Bourdin, Normandy Business School – Labo METIS, Bernard Elissalde and Patrice Langlois, University of Rouen – UMR IDEES (France)



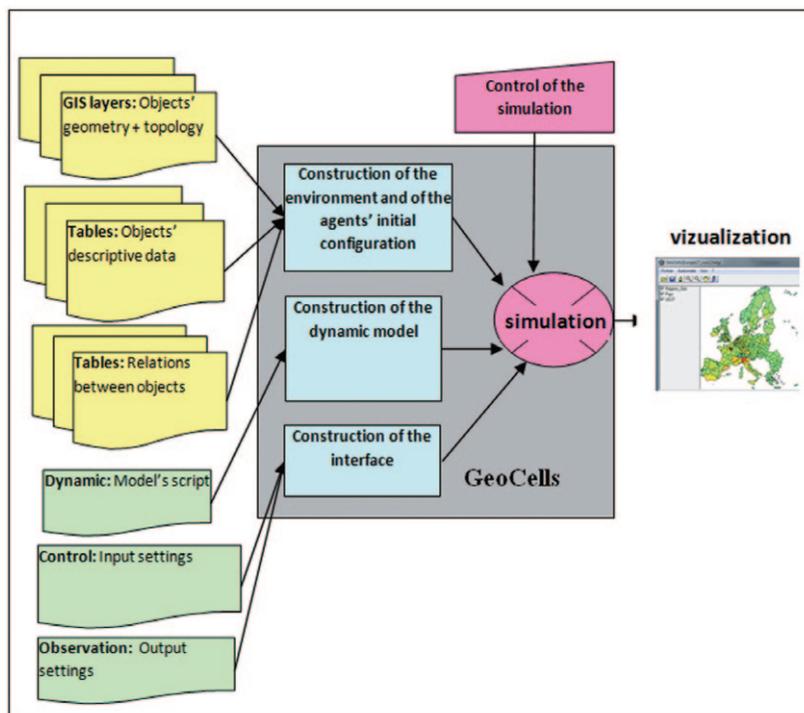
On May 1st, 2004, the most important extension of the European Union (EU) in history took place. Ten countries became full EU members: in the north, the three Baltic States (Estonia, Latvia and Lithuania), the four countries of

Central Europe (Hungary, Poland, the Czech Republic and Slovakia), a country of south-west area (Slovenia) and two islands (Cyprus and Malta). Two countries in South-East Europe (Bulgaria and Romania) joined the EU on January 1st, 2007. Consequently, the level of prosperity in the EU declined significantly.

But, numerous geographical issues arose from this policy of openness in the Central and Eastern European Countries (CEECs). A key question became, what territorialized management of the cohesion policy is required with the arrival of ten new countries? The community economic frame had been disrupted by the last two enlargements, which provoked an unprecedented increase in the economic gap between the developed regions and those lagging behind. This situation required the member states to revise the objectives regarding cohesion in order to prevent increasing economic, social and territorial fragmentation of the Union. The main question is in regard to the

ability of any Cohesion Policy to reduce disparities produced by the single market. How can we improve redistribution and territorial equity in a Union with low economic growth? In such an economic context, should we limit the solidarity efforts of wealthy countries or, on the contrary, increase it in order to accelerate the economic advancement of regions in an earlier stage of economic development?

The purpose of our research is to understand the process of convergence by using the simulation platform GeoCells coupled with spatial econometrics. GeoCells is based upon layers of geographic information. Its main engine is a meta-model based upon spatial agents or a topologic cellular agent (see the Figure below). GeoCells is used to model the evolution of GDP per capita in the EU-27, and the simultaneous influence of different types of aid under the cohesion policy, including the effects of growth diffusion by neighborhood.

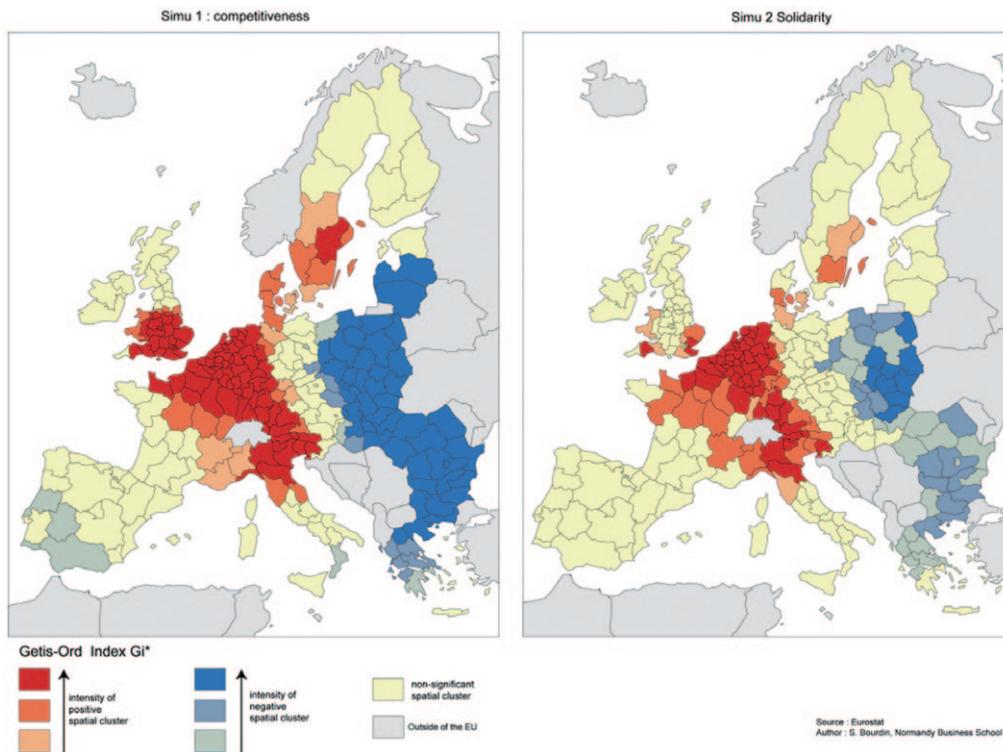


With the aim of investigating possible solutions for reducing the development gap – a gap which increased significantly with the progressive transition from 15 to 27 Member States in the European Union – we have developed a cellular automaton model. In this context, we consider that modeling by cellular automaton enables a clarification of the issues of convergence and European regional integration. The model that we have developed allows for the effects of neighborhood and diffusion of regional growth to be taken into account. In addition, modeling by simulation is useful in that it reveals the processes and mechanisms (i – see below) and serves as a decision support tool (ii – see below).

- (i) Cellular automaton simulation is constructive as it takes into account the complexity of the relationship between decision-making (budgetary stance, duration of European regional policy programming periods, eligibility thresholds), economic factors (growth and convergence) and spatial aspects (interaction between regions/Member States)
- (ii) Simulation is helpful when it is not a question of finding the optimal solution but of exploring a wide range of possible scenarios in order to identify the parameters that would significantly improve the efficiency of European cohesion policy.

Given the data available for the group of regions NUTS2 of the member States, the model retained, as the main indicator, the variation of the GDP per capita of each European region. The variation of this magnitude linked only to the variation of the GDP (we have made the choice of a constant population), is subjected within the platform to several influences, each adjustable for a different simulation:

- The **GDP variation rate** is, either specific to the region, or identical to the group of regions of a same country, or, by simple hypothesis, identical for the whole group of regions.
- The **terms of public intervention** include the mechanisms relating to contributions (Countries and EU) and to the aid linked to regional policy, such as eligibility thresholds (75%) for Structural Funds.
- The **European budget weight** was taken into account, stabilized around a threshold of 1% of the European total GDP over the last fifteen years (threshold reached since 1984). From this average budget, simulations were able to make the Community budget weight vary from 0,5% to 3% of the EU total GDP.
- The **principle of additionality** between the States and the European Union in the Structural Funds financing was also taken into account, as well as the variability of the relative importance of regional policy in the Community expenditures.
- Finally, the rule of 4% maximum **weight of European aid in the GDP** of a region or of a State was applied.
- To these principles officially ratified by the European Commission, we have added to our model a spatial dynamic parameter: a **growth-diffusion model**.



Europe 2025: Which scenario from which policy?

An application of this model demonstrates the economic performance of European regions according to the variation in aid granted by the European Union, as well as neighborhood effects. Taking into account the regional disparities, GeoCells analyzes European regions' relative positions from the angle of macroeconomic and budgetary indicators. The cellular automaton GeoCells allows an assessment of the overall effectiveness of regional policy and measures the influence of modification of granting rules.

To assess the weight of political cohesion in regional trajectories, simulations were performed with GeoCells. These simulations were based, on the one hand, on the settings of allocations Funds and, on the other hand, on neighborhood effects. The two

scenarios mapped below ask questions about the effectiveness of the cohesion policy and the dilemma between competitiveness and equity.

The introduction of simulation and forecasting methods in EU regional policy debates is not an attempt to find a single response to the problem of European regions' unequal development. Instead, it suggests a range of credible options as a decision support tool for territorial solidarity – as well as economic and social cohesion – in a European space which is in perpetual evolution. Even though European regions belong to an interdependent group, they each have their specific trajectories, in which reaction times and pace of change vary strongly from one to another. These various trajectories build a European regional mosaic, making it difficult for policy makers to override initially planned regional policies (Cohesion Policy,

Cohesion Funds, etc.) with budgetary adjustments. Overarching policies are enacted for these separate states/regions in their separate trajectories – but these policies may actually prevent, curtail, or disproportionately power certain trajectories, and in fact may disable newer “corrective” policy/fiscal mechanisms from actually helping.



8. Future Events

8.1 The 54th ERSA congress, St.Petersburg, August, 26–29 2014

Alexander Pelyasov, Chief scientific secretary of the 54th European RSAI Congress

The theme of the St.Petersburg Congress is exploring variations in policies and processes for regional policy and regional development. This Congress aims to provide a platform for formal and informal knowledge exchanges between Russian, European and world experts in the theory and practice of regional development.

Plenary speeches of prominent Regional Scholars from US, Europe and Russia (Michael Storper, Philip Cooke, Susan Christopherson, Kevin Stolarick, and Natalia Zabarevich) will be devoted to the intangible (including creative) factors around regional development; to the role of networks in regional development; to the contemporary development of global cities and metropolitan agglomerations; to the Russian school of regional science and its evolution over the last two centuries; to the past and contemporary development of St.Petersburg as a city.

We are planning to organize several round table discussions on the

interaction between Russian and world regional science, on the Arctic regions and on the regional policy of the resource corporations. We are planning to organize a presentation of the new Arctic Human Development Report prepared by the order of the Arctic Council. Another idea for the Congress is to organize a special session of the editors of the leading journals of Regional Science to inform the younger generation of Regional Scholars on the policy and rules of publication. We are thinking of creating a meeting between the Russian diaspora of regional scholars and Russian scholars in Russia during the Congress.

If we consider the logistics of the Congress it is worth noting that, for the first time in the last decade, the ERSA conference will be held in a country with a visa requirement. So please apply early if you intend to come. For Russians and non-Russians to participate fully we also intend to use synchronized translations for the plenary meeting, several round tables and the special sessions.

Dear Colleagues,

We would like to invite you to participate at the 54th ERSA Congress, which will be held in St. Petersburg, on August 26th – 29th, 2014.

We are sure that this large-scale event will unite representatives of all the institutions, involved in the process of regional development and policy: Russian and European scientific and business community as well as the federal, regional and municipal authorities of different countries.

The 54th ERSA Congress is devoted to the memory of Alexander Grunberg – Russian academician, outstanding scientist and the leader of the Russian regional science.

Organizers:
Council for the Study of Productive Forces
St. Petersburg State University

**Regional development & globalisation
BEST PRACTICES**

26 – 29 August 2014
Saint Petersburg

Local organizing committee co-chairs:
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Igor A. Gurlitskiy, First Vice Rector of St. Petersburg State University, St. Petersburg
General scientific secretary: professor Alexander N. Pilyasov
Congress web page: www.ersa.org/ersa-congress

ARONIA
Momonov PCO is an official of ERSA Congress 2014
Conference manager Anya Gilmanova
phone: +7 (812) 333-20-25 ext. 201
e-mail: ersa2014@online.org

With the support of
The Ministry of Regional Development of the Russian Federation
The St. Petersburg City Government

Technical excursions will include visits to the St.Petersburg Maritime museum, an excursion to a shipbuilding factory; a visit to Petersburg's Metro system, which is the deepest in the world. Post-Congress tours will include visits to the city of Lomonosov and its porcelain factory; to Pavlovsk and Paul's Palace; to Catherine's Palace and Pushkin's Lyceum.

Please come to beautiful St. Petersburg and the first Russian Congress of ERSA since 1993!

8.2 Short Course on Interdisciplinary Analysis and Policies for Regional Sustainability in Armenia

The Regional Science Association International and the Yerevan State University of Architecture and Construction (www.yсуac.am/) organize a Short Course and Workshop, with the theme Interdisciplinary Analysis and Policies for Regional Sustainability, that will be held from the 5th till the 6th of December in Yerevan, Armenia.

Beyond the extension of Regional Science in Armenia the goal of the Short Course and Workshop is to provide PhD-students and young researchers with:

- Advanced training in policy analysis of complex territorial systems;
- An opportunity to present and discuss their research;
- A chance to obtain improved skills, knowledge and scientific social capital

to advance their careers as researchers.

The Short Course and Workshop will take place during two highly focused and intense days of advanced training, student presentations and discussion, and a discussion of career strategies.

The Short Course and Workshop will be divided into six parts:

- 5 Past and Future History of Regional Science;
- 6 Regional Science Methods – Tool kit for territorial development;
- 7 Policies for the future, the New Urban World;
- 8 Design and evaluation of environmental and territorial policies;
- 9 Presentations and discussion of students and researchers works;
- 10 Plenary Session on Globalization and Regional Development.

8.3 RSAI World Congress in Bangkok

The Regional Science Association International (RSAI) invites regional scientists, policy makers and researchers of related disciplines to participate in the 10th World Congress. The Congress will be hosted by the Faculty of Architecture and Planning, Thammasat University, Bangkok. It will be held at the Imperial Queen's Park Hotel in Bangkok, Thailand, May 26–30, 2014. Please see the invite below and check out more details on the RSAI website (www.regionalscience.org/).