DISCONTINUITIES AND SPATIAL MUTATIONS AS A MARK OF URBAN RESILIENCE IN BACAU MUNICIPALITY (ROMANIA)

1Alexandru BÂNICĂ, 2Lucian ŞERBAN

1Romanian Academy, Iaşi Branch, Romania, alexandrubanic@yahoo.com
2National College „Gheorghe Vrânceanu” Bacău, luciansherban@yahoo.com

Abstract: The paper tries to identify the spatial structure and dynamics of Bacau city by reconsidering the concept of geographical discontinuity as a tool within the general framework of urban resilience. Based on the native heterogeneity of urban environment, the discontinuities are fractures that divide the city’s tissues, but also lines of convergence where different morphological and social (micro) identities join and complete each other. The existing (geographical) literature identifies axialisation, heterogeneity and deficient spatial management as inherited features of Bacau municipality, all creating visible and “sustainable” discontinuities. The purpose of our study is to identify different types of urban discontinuities that shape the urban habitat. We assess and try to integrate natural and human induced, linear and areal, elementary, structural and functional, morphological and social discontinuities, also by analysing their historical evolution and effect upon the city’s functionality. The final outcomes of the paper refer to drawing some general lines in overcoming the drawbacks of discontinuities in Bacau in order to have a resilient and liveable urban space.

Keywords: spatial discontinuities, urban crisis, resilience, post-communist dynamics, Bacău

I. INTRODUCTION

A central concept in geosciences, the geographic discontinuity is grounded on the intrinsic heterogeneity of space, on its diversity and contrasts, representing, in systemic approach, a rupture between two systems (Brunet, 1967). Therefore one can define urban discontinuity within the framework of the spatial crisis of towns (Francois, 1995). In broad sense, discontinuity is the equivalent of a spatial catastrophe produced in the presence of certain catalysts as a consequence of divergent forces whether attractive or repulsive (Rosser, 2011). The emerging
urban fractures can create or maintain lack of urban functionality, social tensions or even conflicts which are able to decrease the resilience capacity of the system. The concept of resilience – defined as the ability of an entity to stand perturbations, to recover, cope and adapt to different challenges that might affect it – gives a good framework of is good opportunity to study the evolution of urban functional patterns.

The meaning is not always negative: these places of contact are also sometimes spaces of complementarity, communication and promotion of urban change, of modernizing the structure and the functionality of a city (François, 1995). Therefore the attempts of urban ecology and urban morphology to measure the degree of homogeneity/heterogeneity starting from the general references of the studied urban organism become legitimate. This approach emphasises the cross-scale analysis from local level – the urban neighbourhoods – to other broader spatial levels in order to assess the structural and functional units whose dynamics could give an ascendant path to the analyses area. The main purpose of this attempt is to contribute to understanding the way urban functions induce/are induced by such turning points/lines/areas. Therefore, we indirectly assess the relative resilience of the urban system based on the dynamic equilibrium/disequilibrium that establishes between functionality and urban division.

By the other hand discontinuities can only be studied in relation to the opposite notions of similarity or spatial homogeneity. The proximity creates neighbourhood effects both likeness between individuals and urban structures and sizing the urban flows (François, 2002).

II. THE THEORETICAL BACKGROUND OF THE CASE STUDY

Understanding structural attributes is important in order to assess resilience. Nevertheless one should acknowledge that resilience is always a dynamic process that implies continuous adjustments and adaptation. Moreover a static vision on development may transform in a “bad resilience” that keep cities stocked in dysfunctional states (for e.g. the former communist industrial or residential urban structures resist and block the modernisation of cities). On the contrary an efficient planning does not exclude change, diversification and even redundancy i.e. a certain heterogeneity that creates a different kind of discontinuities.

Actually there are two different approaches of spatial discontinuities. One is based on the assumption that heterogeneity creates discontinuity. Therefore every geographic area is structurally heterogeneous as discontinuity is a fundamental element induced by the geographic disposition of the phenomena themselves, by
the intuition of heterogeneity and also by the perception of the environmental diversity. In this framework it is impossible to evaluate the relation between two places without suggesting the discontinuities that separates them (Hubert, 1993). The second approach highlights that discontinuities are marked by steep ruptures at a very short distance (Grasland, 1997). If differences operate gradually in a specific area they correspond to transitions. In this second signification of the term one can acknowledge heterogeneity only when negative exception occur in the case of an indicator in the global context of a positive spatial autocorrelation. If heterogeneity is maximum but not spatially organised (spatial autocorrelation zero), one can consider that there is no perceivable discontinuity. Rather closer to this second approach is François’ classification of discontinuities (1995) delineating eight types of discontinuities by taking into account certain criteria including the type of appropriation, the configuration as a barrier, the legal recognition and the dynamic features of linear and areal structures (Fig. 1).

Referring to the Romanian urban system and having an approach much similar to Grasland’ and Francois’, Ianoș (2004) assimilates discontinuities with functional ruptures that have a spatial measure in contrasting landscapes and functionalities between different urban areas. In this sense, they also represent sudden disturbances that manifested within the fundamental relations between the main structural components.
In the case of Romanian cities that evolved, for a long time, under the communist regime that have radically put its mark upon them, the causes for the appearance of these fractures are considered to be the change in property ownership from the end of the 1940’s and the 1950’s and the state’s centralized and standardized management of the urban structures. One could add the high degree of ruralisation of the country when aggressive policy measure of collectivisation and industrialisation were taken, but also the dependency on foreign resources of many rapidly industrialised cities and towns.

Broadly, this is the case of Bacău city that was included by Ianoș (2004) among the urban entities with fundamental ruptures clearly altering the former functions and physiognomy by creating new internal structures.

During six centuries of urban evolution, due to many political and administrative pressures that the city had to adapt to, Bacau suffered profound mutations of the elements composing the urban structure. More than other Moldavian cities, Bacau was marked by the evolving report between continuity and discontinuity which actually created its present urban landscape. The analysis of the dynamic background and the complex relations created by these discontinuities could be a good opportunity when analysing urban resilience to challenges that are presently faced by the Romanian city.

Bacău city extended very much in the south after the new industrial platform was put into place and added to the two pre-existing industrial area i.e. the central one near Bistrița Valley and the North-Western towards Mărgineni. The municipality faced brutal and almost complete change of the interwar structure by the applying an intensive programme of industrialisation and collective housing. At urban scale these transformations are equivalent to a catastrophe that resulted in losing its own identity in favour of a more obvious similarity with other regional cities that have undergone similar changes.

III. OBJECTIVES AND METHODOLOGY

The purpose of present paper is to identify the main features of Bacău urban space evolution in relation to major lines/areas of discontinuity – either natural or human induced and their choreatic representation. In achieving this goal we extracted both from the available topographic plans or maps - 1: 5000 (1975), 1: 25000 (1961-1962, 1983-1985), and 1:50000 (1894) and from the ortophotoplans (2003, 2008 and 2010) the „sustainable” baselines and the recent structural changes. Complementary the field work and many representative pictures of interest areas of our approach have increased the authors’ degree of comprehension on the subject and made easier the elaboration of a clear typology
of urban discontinuities able to stop (barriers) or to promote change (transition and front areas etc.). In order to roughly identify thresholds in accessing certain urban services (educational, sanitary, public transportation) there were established certain buffer areas of first 400 and then 500 meters around the service points. It is a basic and rather arbitrary manner to visualize the fractures that are less visible in the urban landscape, but it gives a background on areas with less accessibility to urban like facilities. Nevertheless the present approach is intended to be a qualitative and visual assessment and not a quantitative evaluation of urban discontinuities (that will be the subject of our feature studies).

IV. PAST AND PRESENT DISCONTINUITIES IN BACAU MUNICIPALITY

Cities have inscribed on their walls all virtues and sins of those who built them.

(George Cantacuzino, 1932)

The evolution of Bacau was highly influenced by certain natural and human-made elements both morphologic or hydrologic elements (the presence and disposition of Bistrița’s lower terraces and riverbed, the path of its affluents) and the situation of the main communication ways (fig. 2). They managed to behave as structuring axes stressing urban evolution (Ungureanu, 1980) but they created long-time discontinuities within the urban landscape (the large roads concentrating important flows and, to a greater extent, the railroad crossing the city longitudinally).

**Fig. 2** Bacău city – major nuclei and axes of urban evolution
During the long history of the city there were some decisive landmarks for the built-up area, but little by little they were integrated within the urban functionality. Therefore most of them are no longer obstacle but links within the urban environment a fact shown in previous studies (Bănică, Picioruș, 2012).

Taking into account François’s classification of discontinuities one could identify the main discontinuities that presently shape and are shaped by urban functions. There were envisaged three categories differentiating the ones directly visible within the landscape (areal and linear) from the less observable, but sometimes more important discontinuities related to access to urban services. The last are more or less indirectly suggested in this study by applying buffers to areas served by a few urban services, but their detailed quantitative analysis is subject for a different future paper.

IV.1. Area discontinuities

The type of urban discontinuities which is the most obvious in urban physiognomy is represented by areal barriers that have the largest surface and therefore create major functional hiatuses. They have a decisive role in the urban evolution (see the role of Bistrița Valley and of the industrial platforms in the urban genesis), they were sometimes nuclei of territorial expansion or former convergence areas for employees and raw materials, but today some of them behave as devolving peripheries. Therefore, after 1990, their evolution was highly contradictory as they simultaneously included deconstructed areas with unclear legal status, degraded brown areas, but also some newly built residential or commercial areas. Nevertheless, in future some might become drivers of urban innovation or green areas with recreational and sanogenic function.

The main axis of the urban emergence and evolution, Bistrița Valley is a defining and standing discontinuity for the city. Its functionality within the territory changed very much, sometimes in a contradictory way, during different periods, shaped by political or edilitary decisions of the municipal authorities: the building of Iron Bridge (1886-1890 contributed to the decay of two important fords – Lecca and Beizadea Costache, as well as the neighbourhoods they served), the arrangement of the hydroelectric power plants (in the 6th decade of the last century) or the emergence of a linear industrial district. The tentacular evolution of the city towards south and the occurrence of some functional ruptures within the urban profile drastically limited the urban role of Bistrița Valley, therefore nowadays the local architects are discussing the needed „comeback of the city towards the water” in order to functionally integrate in an effective manner the large neighbourhood of Serbânești.
As a consequence of massive industrialisation, the industrial districts occupy almost 20% of the built-up area. They concentrate in the southern and northern fringe of the city and, after 1990 they had very contradictory evolutions: destructured landscapes degraded brown areas, uncertain legal status, some transforming in residential or extended commercial areas. The areas that are related to utility services and the cemeteries occupy over 5% of the built-up area (178 hectares). The features of territorial evolution reflect upon their location: they are present both in pericentral areas (e.g. the old Jewish cemetery) and in the peripheral quasi-rural areas - the former villages agglomerated to the city in the modern period (Gherăești, Izvoare, Șerbânești).

The transition areas are dynamic places par excellence, favouring contact, functional “contamination” and creating opportunities to capitalise the complementarities of different and often contrasting areas. They sometimes overlap the last sites that still preserve cultural heritage that has a priceless identity value (Oituz, VasileAlecsandri, Cuza Voda, George Bacovia areas). There are three main identifiable categories of transition areas. The most diverse are pericentral areas of crossing from the complex functionality of the centre to residential (for example individual houses and collective dwellings in George Bacovia neighbourhoods) or service functions (sometimes by restraining the green areas as in the case of the former Sports Park). Secondly, the peripheral areas complete some hiatuses/gaps between collective residential districts and the new areas of expansion for urban housing at the urban fringe. Thirdly the green areas mark also the transition from residential to different service areas (education, health, sports and recreation) as it is the case of Cancicov Park and of the more recently inaugurated Cathedral Park.

The “no man’s land” type of discontinuities is usually consisting in vacant undeveloped areas, with (more or less) free access, but they are often subject to whether natural hazards (such as floods or landslides) or human induced degradation (uncontrolled waste landfill). Nevertheless these abandoned, sometimes interstitial places may sometimes become important/valuable reserves for urban planning projects. In Bacau, they include significant areas in the northern and southern extremities, sometimes with outright construction bans, including protected wetlands, the drinking water reserve protection area from Gherăești. Some are highly modified by industrial or housing activities that created human made landforms (for e.g. phosphogypsum dump from the fertilizers factory lying on 16 hectares in the South-Eastern part of the city) or substrate contamination (former landfill of the city near Nicolae Bălcescu) inducing long-term problems. The others could be easily turned to green areas or can be used to extend the built-up area (for e.g. in Șerbânești neighbourhood) (fig. 3).
Fig. 3 The visual impact of urban discontinuities in Bacău city
The last analysed types of areal discontinuities are the **front areas** usually related to the process of suburbanization and periurbanisation of residential and service function. Some of these sectors are former industrial places presently degraded: for example residential complexes from Mărgineni Platform, the former “Partizanu” shoes manufacture area near Stefan cel Mare Boulevard, the former “POBAC” clothes factory or the service area that replaces the former industrial district near Bistrița Valley. Other functional changes are taking place in former restricted areas (military for example) which are transformed in small industry and service areas a fact highly encouraged by the building of a the underground tunnel crossing the railways not far from the main station (Oituz Passage inaugurated in May 2012). The western and south-western spreading of service area envisaged by the recently approved General Urban Plan (GUP, 2011) is impeded by construction interdictions and the distress induced by the presence of the local airport and the restricted areas owned by the army. La last but not the least important identified category is related to urban sprawl on former green fields (“Magnolia gardens” in Gherăiești neighborhood or “Small Town” in Șerbânești).

### IV.2. Linear discontinuities

The linear barriers are inducing faults within urban functionality and esthetic contrasts, sometimes diminishing the role of spatial proximity within the city. Some natural barriers were gradually integrated within the city: the top of Bistrița terrace of 10-15 meters worked as a effective barrier a century ago, but was later obscured by the construction and expansion of the city within the riverside of Bistrița. By the other hand the Negel and Bârnat rivers had created repulsive areas (floodable) that permited the urban expansion only after utility measures of rectification and regulation were put into place (1951-1961). Anyhow, some riverbeds are still obvious functional barriers (including the flow channel of Bistrița downstream the hydroelectric power plant).

The railway was decisive for the westward expansion of the urban area (1880-1900) but afterwards if functioned as a true barrier that divided the city because of the small number of crossing points. One can add the industrial railways – built in order to supply large production units (Rombet, FNC, Letea) are not in use today after the industrial decay but remain an obstacle for the road traffic and people’s circulation and sometimes have a repulsive visual impact. The road circulation axes themselves have an essential role in the tentacular enlargement of urban area. It is a fact that the main road network showed a great stability from XIXth century to present days. Nevertheless the boulevards represent major lines of
discontinuity for peoples’ flows, especially when pedestrian crossings are very much spaced out (Calea Mărășești, Calea Republicii).

![Diagram](image-url)

**Fig.4.** Bacau city – the discontinuities within the urban environment

The urban “border” discontinuities have to be given a major importance when assessing Bacau’s urban evolution. Their legal recognition and the consequent restrictions in terms of access and use (depending on the type of property) can induce long term (dis)functional inertia or stagnation, or, by contrary they can become vectors of urban change.

From Mediaeval Age to Modern Period, the status of reign borough obscured the possibilities of extending an inhabited area that was surrounded on three
sides by monastic and manorial estates (Letea, Leiteni, Mărgineni, Călugăra). The later recognition of property rights led to a modest spatial dynamics that during the nineteenth century was limited to the gradual occupation of the headland of 10-15 meters terrace in front of Bistrița’s ford.

These administrative and territorial constraints were mitigated in the interwar period by agglutinating neighboring villages (in Gherăești, Șerbănești, Domnița Maria) or imposed allotments (in CFR district) totally eliminated in the second half of the twentieth century. As former studies acknowledged "The medieval customs and mentalities were so striking that only after the communist regime in Romania was installed, Bacau could expand in the South, trampling on traditions related to field property "(Popa A., 2010).

The communist unsustainable development was rapid and expansive, so that presently the built-up area holds 92 % of the administrative area therefore highly limiting the possibilities of urban growth. The Territorial Reference Units prom GUP, but also the delineated neighborhoods have an artificial character and are not regulated by taking into account morphological or functional criteria. Moreover the form and the dimension of urban plots give a self-evident picture of “the sustainable background” of small scale specific spatial discontinuities in Bacău (fig. 5).

IV.3. Urban discontinuities and accessibility to services

There are also discontinuities less marked within the landscape and that are related to social, economic and infrastructural issues. For example the access to the main urban transportation routes (bus or minibus) or to important proximity services whether sanitary (pharmacies, family physicians’ offices) or educational (kindergartens, primary and secondary schools) shows that services are concentrated in the central and pericentral area but sometimes the peripheries lack proper accessibilities to urban facilities (fig. 4). It means that most of urban expansion and/or sprawl processes were not sustained by proper proximity services. The fact should be taken into account when assessing urban growth in order to make it more sustainable by transforming the new neighbourhoods in really functional areas not added to but included in the urban organism.

Beyond the above mentioned city suburban assault, systematic drawings for Bacău, as for most of the communist industrial cities, provided concentration in the central area not only of institutions but of all urban services and facilities, while in the new working-class districts they were highly limited. As a normal consequence deindustrialization and tertiarisation marked the 20 years of post-communist evolution and transition to market economy, services improved in the pericentral area and in the collective residential sectors. On the other hand they are still insufficient
and hardly accessible in the former villages added to the city (Șerbănesti, Gherăiești, Izvoare) and also in the new areas of urban sprawl. They are few pharmacies, family physician offices, kindergartens and schools in the northern and north-western urban expansion areas, while in the south-western and western the completely miss. The fact increases the necessity for the population to use personal cars (resulting long yearly cumulated distances) in order to access services that should have been in the proximity. Meanwhile the access to public transportation, although recently modernized and expanded still does not assure a good cover for all city – not only in peripheral areas, but also in highly inhabited neighbourhoods (for. e.g. there is no direct connection between the northern quarters and the railway station).

Fig. 5 Bacău city – discontinuities create by the (lack of) access to services
As one could understand from the above analysis – discontinuities are sometimes lines and areas that are impeding urban flows with both beneficial and negative effects. In order to increase urban resilience it is necessary to better integrate these ruptures within urban functionality by an efficient planning. Some measures were already taken into account: the construction of an underground road passage crossing the railway and the repairing of some already existing bridges, the new landscaping of parks (Cancicov Park, Cathedral Park). Nevertheless, as fig. 4 shows, there are still many abandoned, grey or brown areas that should be clean, depolluted and taken into consideration when development projects are put into work. The maintaining of the paradoxical presence of the “extensively” used/unused areas, together with convergent overcrowded spaces and shortcomings of the urban infrastructure (Bânică and Picioreanu, 2012) are still issues highly affecting urban sustainability – a fact which is more visible when analyzing urban discontinuities. The balance between maintaining important urban functions and structures and promoting change by diversification and densification is needed in order to create a more resilient city.

V. CONCLUSIONS

When studying urban resilience one should first draw the major lines sustaining the city’s landscape and try to find historical and functional explanations of their distribution and persistence. Therefore the discontinuities are marks of urban resilience in a positive i.e. the capacity to withstand difficulties and to resist by adapting and integrating old and new in a functional organism, or in a negative sense i.e. the proliferation of ineffective, dysfunctional structures and habits that block urban modernisation.

The present heterogeneity of the urban mosaic and the functional thresholds marked the chrono-spatial evolution of Bacau city. This is closely linked to the formation of contrasting urban micro-identities despite their proximity. Although not immutable, as they can appear or disappear depending on short term circumstances and evolutions, the spatial discontinuities are constructed as gaps or barriers that trace sustainable patterns of inner urban evolution, but also axes or dynamic zones which a favourable to urban modernization. The analysed urban space is highly fractured by major barriers both areas (water storage lakes and Bistriţa Valley, disaffected industrial areas etc.) or linear discontinuities (major axes of circulation, rivers), fact that affect its coherence mostly because of the insufficiency of connection points, the recent edilitary intervention being limited to modernising the existing ones. Meanwhile the border discontinuities have deep and sustainable implications by their insertion within the landscape.
The degree of heterogeneity, the size and fragmentation of properties and hence of the built environment have long-term implications regarding the structuring and operation of territorial reference units. Some less visible discontinuities within the urban landscape, social discontinuities, sometimes linked to the access to services and transport must also be taken into account when planning a more sustainable and resilient city.

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