Multi-, trans- and inter-disciplinarity, essential conditions for the sustainable development of human habitat

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Abstract. While the hierarchy of inter-, trans- and multi-disciplinarity is not commonly agreed upon, the vast majority of authors emphasize the utility of integrating to more or lesser extent different disciplines in research. The paper analyzes the particular case of the disciplines dealing with the design of human habitat, in order to prove that a supra-disciplinary approach is an essential condition for a sustainable output. The results indicate that, in addition to the need for crossing disciplinary borders, a multi-scale approach is also required.

Key words: spatial planning, territorial planning, urban planning, systemic

1. Introduction

Modern research implies the transfer of concepts and methods among different disciplines. While the exchanges were initially occasional, in time they tended to be sought for and were performed into an organized fashion. The new trend gave birth to new concepts and methods, such as Haken’s synergetics. However, most authors commonly agree that the exchanges between sciences form a hierarchy consisting of several concepts, though the understating of levels varies.

At the bottom of it, when only one discipline is involved, the term used is ‘disciplinarity’ (Nicolescu, 2001), ‘single disciplinarity’ (Iordache, p. 265), or ‘mono-disciplinarity’ (Antrop, 2003). These terms are seen as different from ‘unidisciplinarity’, meaning that some disciplines cannot be separated, as they form a whole (Wallerstein, 2004, p. 98), or identical to it (O’Campo et al., 2011).

The next stage involves several disciplines. According to Salmons and Wilson (2007), when concepts and/or methods from more disciplines are used together, the approach is ‘multidisciplinary’. When in addition to it concepts and/or methods are coordinated, it becomes ‘cross-disciplinary’. If the borders of disciplines are also crossed, the approach is called ‘transdisciplinary’ and, if crossing the borders leads to combining disciplines, it becomes ‘interdisciplinary’.

However, François (2006) considers that inter-disciplinarity consists of a “specific more or less integrative interrelation between two disciplines” (e.g., biochemistry), multi-disciplinarity involves the harmonization
of differences between more sciences coming together, and the final stage is trans-disciplinarity, when a global theory is finally derived. O’Campo et al. (2011) distinguish a scale starting from one discipline (called ‘uni-disciplinarity’), continuing with ‘multi-disciplinarity’, and ending with ‘inter-disciplinarity’.

On a finer-tuned scale, Kötter and Balsiger (1999) distinguish a ‘spectrum’ starting with co-disciplinarity (strong collaboration of two disciplines), continuing with cross-disciplinarity (as a first supra-disciplinary stage), con-disciplinarity (goal-oriented supra-disciplinary effort), infra-disciplinarity (cooperation which finds comparable kinds of problems in different disciplines), infra-disciplinarity (collaboration of disciplines with the same theoretical level of integration), pluri-disciplinarity (first step of unregulated collaboration among various disciplines), multi-disciplinary (unspecific collaboration), and inter-disciplinarity (supra-disciplinary collaboration where different disciplines keep their autonomy when solving a given problem), to end with trans-disciplinarity (joint collaboration between scientists and practitioners in the resolution of a problem raised from outside of the scientific context).

Last but not least, Bruun et al. (2005) consider that multi-disciplinary juxtapose disciplinary perspectives speaking as separate voices; they are united in inter-disciplinarity, while the term ‘trans-disciplinarity’ is used to coin an “overarching and unifying synthesis”. The same scale is used by Lattanzi (1998, pp. 18), Besselaar and Heimeriks (2001), Choi and Pak (2006, 2007, 2008), Zaman and Goschin (2010), and also by Nicolescu (2005), who adds ‘disciplinarity’ as a first step preceding multi-disciplinarity.

The model presented in this paper combines all the above, starting with single-disciplinarity, followed by multi-, cross- and trans-disciplinarity to end with inter-disciplinarity (Fig. 1). The model is used to test the hypothesis according to which all fields dealing with the design of human habitat, starting with the spatial planning of larger territories, continuing with urban and rural planning of human settlements, architectural design and construction details are essentially multi-, inter-, or trans-disciplinary, and this is an essential condition of sustainable development.

![Fig. 1. Most commonly agreed view on single, multi-, cross-, trans- and inter-disciplinarity](image)

### 2. Case study: constructions, architecture and spatial planning

The theoretical disciplines dealing with the human habitat – spatial planning, urbanism, architecture and constructions, but also their applicative sides – territorial and urban planning (particularizing spatial planning at different spatial scales in some EU countries, such as Romania of France – Petrișor, 2010), architectural and construction design have tight, indissoluble connections making them act as a whole.
2.1. The interdisciplinary character of spatial planning and urbanism

The Charter of Torremolinos (1983) defines spatial planning as “geographical expression to the economic, social, cultural and ecological policies of society”, and state that “it is at the same time a scientific discipline, an administrative technique and a policy developed as an interdisciplinary and comprehensive approach directed towards a balanced regional development and the physical organization of space according to an overall strategy” (Déjeant-Pons, 2010, p. 22).

Different definitions regard urbanism as an activity or its product, a science or an art, or a system of regulations (Petrişor, 2010). Occasionally, the planning side is coined by ‘urban planning’. Choay’s definition (1965) is in place when describing the final product: civil engineering works, plans of cities, and urban forms. According to other definitions, urbanism is the science and theory of human settlements, a discipline derived from arts, but different through its reflexive and critical character, making it a science (Péchoin, 1995). Legislative definitions place urbanism among regulations – set of rules governing the birth, development and management of urban areas or activities – operational, integrative and normative activity aimed at stimulating the complex evolution of settlements through short, medium, and long term strategies of development (Petrişor, 2010). The methods used in urbanism include strategic planning, urban composition, participatory, management and communication urbanism (Lacaze, 1990).

If the definitions of urbanism and spatial planning reveal their inter-disciplinary character in theory and methodology, only few definitions of architecture do the same: “making of a place by the ordering and definition of meaningful space, as developed in response to a need or program” (Ching, 1979, p. 10) does not necessarily imply inter-disciplinarity, “expression of culture, of public interest” (AERES, 2012, p. 2) does it to some extent, but “expression of society or culture in spatial, experiential form” (Campbell, 1996) suggests at least a link between social sciences, cultural studies and arts. The science of constructions – or civil engineering – includes “several distinct specializations, such as structures, construction, foundation, transportation, sanitation, and hydraulics”, and, more recently, “planning and management, remote sensing, landscape, environment, energy facilities, water management, and infrastructure systems, including national and regional planning, urban planning, telecommunication systems, and disaster prevention systems” (Horikawa, 2009).

2.2. Planning for the human habitat – a multi-scale approach

The connections between the disciplines result into inter-conditions expressed during the planning process. In order to raise a house, a building permit and an architectural project are required. Projects must be integrated in the context specific to the zone, defined by urban plans (conditioning also the issuance of a building permit), subordinated in their turn to the spatial plans of the broader area. However, projects must embed constructive details, specifying civil engineering details. Such particularities can be dictated by the specific local conditions or aim for better fitting to the ambient.

The separation between spatial and urban planning is not based only on the scale difference, but also on their scope. Urban plans set very specific, operational rules, while spatial plans provide general guidelines, offering a framework that
directs the elaboration of urban plans. Both plans are elaborated by teams consisting of specialists with different backgrounds, such as architectural or urban planning, sociology, ecology, economy, geography, engineering etc. (Petrișor, 2010) – Fig. 2.

These statements can be illustrated by:

1. **Buildings in earthquake-prone areas.** Analyzing the destructive effects of Romanian earthquakes, Georgescu (2010) shows that the separation between civil engineering, architectural and urban planning leads to a “critical and unwanted situation” and pleads for a close collaboration between civil engineers, architects and urban planners, resulting into safe architecture, multi-criteria urban planning, multi-hazard structural engineering focused on seismic issues.

2. **Building in protected areas containing natural and cultural heritage sites.** Sustainable development of large areas, such as biosphere reserves, involves not only preserving species and habitats, but also cultural values. The cultural heritage is reflected by traditional architecture based on using construction materials specific to the area (Meiță, 2010), but also other details, such as their placement, color, height etc. Preservation the requirements of traditional architecture can be ensured by their inclusion in urban regulations applicable to the area, so that the restrictions are uniformly observed.

3. **Buildings from vulnerable areas.** Coastal zones are vulnerable not only because in some cases they are classified as ecologically fragile (e.g., the European Union), or due to their high biodiversity, but also due to some geological processes affecting them, such as the erosion. The erosion is amplified by the increased urban pressure (EEA, 2006), and even more when their volume grows due to the height and density of buildings. The solution consists again of urban planning restrictions based on civil engineering studies aimed at identifying the conditions required to reduce the crushing risk or diminish the intense corrosion due to the marine environment etc.

**Fig. 2. Planning for the human habitat at different scales**
4. Mitigation of climate change. Recent studies have proven that during the warm seasons, particularly during the heat episodes, extreme temperatures are amplified by built-up zones, which become ‘heat islands’ (Cheval et al., 2009). In the particular case of specific buildings, the choice of construction materials, orientation and other engineering details can amplify the effect. At the same time, certain urban planning restrictions, such as the presence of green spaces, water, design of roads and trees along their sides can reduce the heat stress. At a different scale, territorial planning can regulate and optimize land use, related in its turn to the energy balance and climate changes (Dale et al., 2011). Only integrated studies can substantiate an integrated regulation system aimed at better adapting the built environment to climate changes and increasing the quality of human life.

2.3. Inter-disciplinary planning for sustainable development

When dr. Brundtland (1988) coined sustainability as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs”, she actually meant balancing three traditional pillars – economic, social and environmental (Bugge and Watters, 2003), to which a fourth cultural one was added later (Déjeant-Pons, 2010, p. 15). The definition emphasizes the inter-disciplinary character of sustainability, tying it to the Torremolinos definition of spatial planning. In fact, inter-disciplinary sustainability can be achieved in a spatial context only through inter-disciplinary spatial planning, or, in brief, sustainable spatial development is the spatial expression of sustainability.

On a similar line, the Leipzig Charter or Toledo Declaration, among other European documents, emphasize the need for integrated planning – involving inter-disciplinarity – in order to develop sustainable urban planning approaches.

Landscape is, by itself, an inter-disciplinary concept. Introduced by a geographer, Zonneveld (Wu and Hobbs, 2007), it is currently used by ecologists, botanists, soil scientists, climatologists, economists, agriculture and forestry scientists, geologists, artists, architects, engineers, and many other professionals in addition to geographers, each discipline defining it in a different way. There is no surprise that landscape issues cross not only the borders of close disciplines, but also bridge natural and human sciences, especially when the aim is to manage landscapes (Tress et al., 2001a, b; Stokols, 2011).

Similarly, urban studies require a trans-disciplinary approach, especially if planning needs to “be effective, looking for coherence versus paradoxes” (Ramadier, 2004). Specific urban issues, situated at the interference with other fields, require trans-disciplinarity even more, especially when Principle One of the Rio Declaration states that “human beings are at the centre of concerns for sustainable development” (UNEP, 2012); this is the case of urban health, for example (O’Campo, 2011), particularly provided that health sciences require trans-disciplinarity as well (Choi et al., 2006, 2007, 2008). Acknowledging that urban planning is trans-disciplinary, Després et al. (2011) suggest that the trans-disciplinarity expands to architecture as well, especially when narrowing the gap between research and practice or working
on specific issues, such as the ecological architecture.

2.4. The need for a holistic approach
The investigation of trans-disciplinarity within the disciplines dealing with the human habitat reveals their trans-disciplinary character, and intrinsic connections among them. If all details are assembled, human habitat can be seen as a complex system (geographical, ecological, social etc.), and only a holistic, trans-disciplinary approach can understand it in full or manage its sustainable development. Such an approach is consistent with Gaia Theory (Lovelock, 1979), stating that actually the entire planet is organized and works as a whole – Fig. 3.

3. Conclusions
The paper examined disciplines dealing with the human habitat in theory – spatial planning, urbanism, architecture and civil engineering, and practice – territorial and urban planning, architectural design, and the design of constructions, in an attempt to prove their trans-disciplinary character. For the disciplines acting at a smaller spatial scale, covering larger territories, this character is revealed by their definition and difficulty to place them in a clear category (art, science, regulation, etc.); for the others, trans-disciplinary is required when working on specific issues. However, when sustainability is accounted for, the different disciplines, acting at different scales, must come together in a trans-disciplinary effort to improving the living conditions for humans. This effort must be made in research as well as in practice.

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Urbanism


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