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Bridging Morphological Studies and Parametric Approach to Design Hybrid Spaces

Michela Barosio, Hongye Wu

In recent decades, the hybrid models of living and working have been widely experienced, also, but not exclusively, in relation to of Covid-19 pandemic lockdown period. Consequently, spaces are increasingly conceived as hybrid spaces. The establishment of hybrid spaces is directly connected with the social and economic conditions of city development and the current intensification of globalisation processes[1]. The essence of hybrid spaces is to be flexible and changing. Parametric approach, in this regard, can help to grasp and study their dynamic evolution. Mark Burry suggests working parametrically, including sufficient inputs so that there are abundant opportunities to enrich spatial solutions[2]. Among the possible approaches, urban morphology studies can be a strategic input to describe the dynamic transformation of architectural and urban spaces. This contribution, bridging the studies of parametric design and urban morphology, questions firstly what a *hybrid space* is, and secondly, how the parametric approach helps to explore and design urban space.

Possible Definitions of Hybrid Space

Derived from Latin *hibrida*, initially the word *hybrid* was commonly used in biology, referring to the offspring of a mating between any two unlike animals or plants. At the end of the twentieth century, Brian Stross, a linguistic anthropologist, coined the concept of *cultural hybrid*, extending the term *hybrid* beyond the biological and racial context to embrace the cultural context. In a broad sense, a *cultural hybrid* can be a culture, or element of culture, derived from something heterogeneous in origin or composition[3]. Moreover, Stross pays essential attention to the importance of the context where the *hybrid* emerges[3]. It implies the possibility of applying the concept of hybrid in other fields, for instance, hybrid vehicle, hybrid battery, hybrid working, as well as hybrid space.

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During the last two decades, the concept of *hybrid space* has been widely explored in the studies of architecture[4, 5] and urban design[6, 7], as well as in many relevant studies in the field of sociology[8], networked mobility[9], and urban planning[1, 10, 11]. The definition of *hybrid space* is explored from various points of view in the interdisciplinary and cross-disciplinary fields, particularly in a strong relation with architectural and urban design disciplines.

The hybrid character of a space can be related to its cultural dimension according to Homi Bhabha, who in the early 2000s stated how the concept of hybrid space should return to "cultural diversity" and "cultural difference". For Bhabha, hybrid space is «an image of the cultural diversity and cultural difference associated with modern design methods and practices» so that hybrid space is like a «compound space trying to adapt to maintain more than one property of the original space», «allowing the overlap of two cultures or two different concepts that maintain a kind of interaction»[4].

From another point of view, hybridity can be a matter of accessibility and ownership, as Sylke Nissen pointed out, noticing that urban spaces with a hybrid character were emerging, in terms of the ambiguous distinction between public and private spaces. Spaces are no longer only defined as public or private spaces, but also as semi-public, semi-private spheres. Nissen explains that the reason for the emerging hybrid character in urban spaces is related to privatisation. In her view, *hybrid space* is characterised by reduced accessibility and usability, exclusiveness, and the ensured sense of security. «These spaces are characterised by the partial or complete transfer of state or local rights to private or commercial actors as well as by the reduction or even loss of public control»[4]. In this sense, the hybridising process is a privatising process in urban spaces.

In the field of architecture and urban design, *hybrid space* commonly refers to multi-functional space[5, 6, 7, 1, 11]. According to Krasilnikova and Klimov, the development of hybrid spaces in the sense of urban spaces designed to be multifunctional began in the late 1980s. One of the early examples of designed hybrid space is the Parc de la Villette, a multifunctional architectural and landscape complex, in a post-industrial abandoned area[1]. In this regard, *hybrid spaces* are multifunctional architectural and landscape complexes[1]. Moreover, *hybrid spaces* in the structure of big cities usually have a social recreational purpose with a developed residential or social function. In this sense, *hybrid spaces* have definite typological and morphological varieties in urban fabric structure[1].

Aligning with this definition, Fabrizio Zanni highlights the phenomenon of urban hybridisation. Urban hybridisation, the process of hybrid

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space formation, allows the creation of spaces in the city structure that connect its different parts according to cultural, historical, and social context[12]. Urban hybridisation is determined by the multi-layered and multi-scaled urban tissue. Differentiating from traditional zoning, urban hybridisation encourages a more diverse and integrated use of urban spaces, while zoning has a very strict separation of functions in the planned areas. Urban hybridisation fosters a more dynamic and versatile urban environment and promotes the coexistence of different activities and functions within the same area[7].

Considering the use of widespread mobile technologies, the emergence of *hybrid space* can also be considered as the location where virtual communities migrate to physical spaces, so that the boundary between reality and virtuality, between physical and digital space, has gradually turned to faded. In this context, Adriana de Souza e Silva proposes the concept of hybrid space: a conceptual space. For her, a *hybrid space* is a kind of connected space, linked with mobile spaces and social spaces, in the sense that people constantly produce information about urban space in cyberspace with their movements in the city[9]. Therefore, *hybrid spaces* are networked, digital and physical spaces. Furthermore, the logic of hybrid space mediates various connections, merging the physical and digital spaces, which change people's perceptions of physical space[10].

Aligning with Silva, many recent architectural studies indicate that hybrid space is the integration of physical space and digital space[4, 13, 10]. *Hybrid space* is not only the combination of public and private spaces, but it also allows multiple layers of users and use across time, and the overlap between cyberspace and physical space[4, 10]. Braifkani and Günçe's research investigates adaptive reuse in architecture from the perspective of *hybrid space*. They emphasise that the concept of *hybrid space* helps to consider different dimensions of architectural adaptation. Tan argues that public space cannot just be defined by its physical boundaries but also by the integration of the digital context with the physical. As a result, the concept of *hybrid space* is revealed by this phenomenon: the digital space is superposed on the physical space[13].

Parametric Approach for Hybrid Space Formation

The parametric approach is widely recognised in dealing with quantitative parameters during the architectural and urban design process, so far, even if the use of formal parameters has been recognised in the urban regeneration process and the investigation of future urban forms in recent urban morphology studies[14]. The work on the translation of

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formal values into parameters is essential in this regard to bridge urban morphology and parametric approaches[14].

Beirão (et al., 2012) explore the potential of urban morphology studies in a parametric approach, introducing a parametric urban design tool that allows the confrontation of alternative morphological solutions with indicators based on a reliable database[15]. This design platform, integrated with Rhinoceros, Grasshopper and Geographic Information Systems (GIS), provides a dynamic design environment where designers can continuously explore solutions[15]. The design model can distribute different function areas by setting values ("predefined attractor weights") able to characterise functionally hybrid spaces.

Peeters and Etzion work on automated recognition and extraction of morphological attributes of urban objects[16]. Their study provides a detailed exploration of the methodology and application of GIS-based automated recognition of urban objects in terms of climate-related urban morphology, emphasising the potential for context-based recognition[16]. Significantly, the application of the model as a parametric model can be seen as a basis for morphological pattern recognition in urban form, whose relationship with hybrid spaces in terms of public accessibility seems to be promising.

Different from automated recognition, the research *from numbers to form* attempts to explore "the translation of morphological aspects of the city with an abstraction tool (which) is capable of connecting with the computational language"[17]. The study proposes to integrate morphological elements (as tools), namely: type, diagram, and model, into the parametric process of urban forms generation, filling the gap of implementing merely quantitative parameters in a parametric design process[17] to emphasise the cultural value of urban spaces.

Çalışkan (et al., 2020) developed a conceptual model of a heterotopian system as the theoretical framework of a new design approach[18]. In this model, the fragmented urban forms (living quarters) interact with "intermediary areas generated in the form of common zones of hybrid spatial typologies"[18]. Sequentially, concerning the relation between the new urban space and the existing urban form, Çalışkan and Barut discuss the computational capacity of parametric modelling to simulate variations from local fabric and further integrate them into a larger context[19]. They argue that parametric modelling as a method can guide the current "fragmentary developments towards the pluralist production of coherent urban fabrics"[19]. Both studies together have significant contributions to studying hybrid space through a parametric approach with specific attention to urban morphology.

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An urban laboratory. Scalo Vanchiglia, Torino, Italy

Within a broader investigation on transitional urban morphologies, the parametric approach was tested as a design tool in a pedagogical context. Over the past two academic years, students in a second-year Master's studio in Architecture were assigned the redesign of a former dismantled railway yard. The site, named Scalo Vanchiglia, is a 110.000 sqm area in the northern part of the city of Torino, in Italy, close to the city's historical centre and its characteristic square grid pattern. The area is nowadays almost empty, and the municipality aims to regenerate it through a mixed program involving mainly private stakeholders. The area is considered one of the major strategic areas for the development of the city because of its location, near to city centre but also to the highway connecting Torino with Milano, for its dimension, a huge plan area with no reclamation needed, and for its connectivity, it is situated along the trace of the new subway line under construction. Despite all these advantages, the transformation of the area is difficult to trigger, and few stakeholders came forward with regeneration proposals.

From a morphological point of view, Scalo Vanchiglia displays a marked heterogeneity, hybridising tracks from the industrial settlements with ancient rural traces, meeting with the square pattern of the historical core of the city and the curvy line of the river. The context, a vibrant neighbourhood, suffering from some social conflict with strong connections to the city centre, is also characterised by strong social hybridisation mixing former industrial workers together with African and Asian migrants, but also young creatives and many students. The student's project aimed at improving the attractiveness of the area by forecasting possible regeneration proposals, focusing on the hybrid feature of the site. First of all, the hybrid cultural composition of the district is considered a positive asset and an improved design of different types of housing to encourage social integration and diversity. Secondly, several students' proposals specifically focus on the ground floor design to carefully identify which spaces are strictly private or totally public and also design innovative hybrid spaces that straddle between the status of private or public space. The accessibility of those open spaces may vary over time to ensure dynamic use of the city. In this sense, several interesting solutions for hybrid spaces in between the traditional private/public distinction have come up. Finally, the students, complying with the program of the general urban plan, have included different functions into their proposal, mixing residences, services, commercial and sports activities and an urban park, not following the functional zoning, heritage of the Modern Movement, but physically intertwining

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the different activities. The resulting urban context is therefore *hybrid* in multiple senses.

Towards a Parametric Methodology for Hybrid Urban Design

Designing *hybrid spaces* means dealing with a high number of variables, engendering a remarkable degree of complexity in the project, in which the parametric approach seems to be an effective design tool. The challenge undertaken by this pedagogical experimentation is to apply the parametric approach at the urban scale, taking into consideration not only quantitative parameters but also qualitative parameters. The morphological pattern of the urban context became, together with the parameters of density, coverage area and building height, the variables to deal with to explore the possible future scenarios for the Scalo Vanchiglia Area, aiming at a vibrant and hybrid system of urban open spaces. The design strategy was not to design a final, static proposal for the regeneration of the area, but to work through scenarios. This means that each group, starting from a morphological hypothesis, produced a series of visions, of scenarios, showing how the future hybrid city might look according to the variations of the aforementioned parameters. Those visions were based on an algorithm elaborated through Visual Programming Language (VPL) by the students, able to control the surface ratio established by the planning rules between the different functions while prefiguring their spatialization into the building shape, ensuring a functionally hybrid environment. On the other hand, parametric logic has been able to explore several ground floor agencies to configure *hybrid space* in terms of accessibility while ensuring the proper coverage ratio required by the standards.

This design experience conducted by the students helped us to validate an innovative design methodology using a parametric approach, and the related software, to deal with the complexity of urban design in order to forecast a multi-level hybrid city.

Notes

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Morphological Behaviours, dynamics of development, generation and modification of the form of Popular Habitat in the Buenos Aires Metropolitan Area (AMBA):
1. Concentration and condensation;
2. Embedding; 3. Completion and expansion; 4. Encircling key central spaces. (Image courtesy: Mattia Croci)

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