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The study of urban form and disasters: an opportunity for risk reduction

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'Urban morphology and the resilient city' is the theme of the forthcoming Twenty-Third International Seminar on Urban Form. As one of the key concepts relating to the management of disaster risk, resilience has recently been defined as the 'capacity of systems (ranging from national, local or household economies to businesses and their supply chains) to anticipate, absorb or buffer losses, and to recover' (United Nations Office for Disaster Risk Reduction, 2015, p. 268). However, studies that link urban form to disasters have a place beyond their connections to the resilient city concept.

Cities and their components and processes were incorporated into the 'risk equation' when humans and cities were widely recognized for their significance in the production of risks and increases in vulnerability. Yet little has been made so far of the potential contribution of urban morphology to the understanding of disasters. Arguably this role is still underestimated. It is certainly timely to draw attention to aspects of urban morphology that can contribute to strategies for disaster risk reduction.

Disasters can 'become processes in themselves and as such, are subjects that must be studied from a historical perspective' (García Acosta, 2007, p. 129). Diachronic approaches (as defined by Levy, 1999, pp. 79–85) are fundamental to analysing the juxtaposition of different urban fabrics over time. They make evident the potential risks that historical processes generate. An example is the application of urban models in the colonization of Latin American countries, German models in Brazil (Geissler, 2010), and the construction of Spanish urban models in such countries as Mexico and Chile, with consequent changes in the search for safer locations (Musset, 2002). The value of

identifying historical urban processes also helps the understanding of current risks, as for example in informal urbanization processes in Brazil (Okretic and Bueno, 2014, pp. 64–72).

A second perspective follows the premise that spatial configuration and street network analyses aid understanding of vulnerability and resilience. Space syntax theory has been extensively used to analyse, explain and predict some of the social phenomena related to different types and phases of disaster. At a local scale studies have demonstrated how the configurations of settlements affect evacuation from places subject to such risks as those accompanying earthquakes and tsunamis (Fakhrurrazi and van Nes, 2012; Sari and Kubat, 2012). At the urban and regional scale, street networks have been analysed in relation to the access they provide to emergency shelters (Dou and Zhan, 2011). Other researchers have analysed street networks to understand the indirect impacts of floods within cities (Gil and Steinbach, 2008), and to identify urban areas susceptible to flooding. Yet another type of analysis has focused on the interactions of recovery works, community cohesion and the built environment (Carpenter, 2013) and the assessment of the role of street networks before and after earthquakes (Cutini, 2013).

A third group of studies considers the characteristics and distribution of open spaces in relation to recovery from disasters. The integration of urban design and recovery theory is considered feasible if open spaces are regarded as a 'second city' (Allan and Bryant, 2010). The concept of resilience and its parallel meanings in urban design theories have also been discussed (Allan *et al.*, 2013): examples

Table 1. Contributions of the study of urban form to disaster risk reduction

Premises that link the study of urban form to disasters	Observed phenomenon	Relevance of urban fabric elements				Outcomes for disaster risk management
		Plot	Street	Building	Open space	
Diachronic analysis of urban form enables understanding of current disaster risks	Persistence of urban structures in risk areas or relocation of cities	High	High	High	High	Identification of urban strategies for risk adaptation; historical records of disasters
Street configurations increase or reduce vulnerability	Movement of people during emergencies; flood coverage	Low	High	Low	High	Identification of evacuation routes and access to critical sites
Form and distribution of open spaces affect recovery from disasters	Intensive use of open spaces after disasters	Low	High	Low	High	Identification of improvements to open spaces in risk areas
Analysis of building typologies clarifies their vulnerability and means of adaptation	Resistance of buildings to natural hazards and climatic change	High	Low	High	Low	Improvement of building codes; identification of building strategies for risk adaptation; delimitation of risk areas

include studies illustrating the importance of open spaces after an earthquake. Other authors have added more quantitative variables and classified the suitability of open spaces in relation to their accessibility following disasters (Anhorn and Khazai, 2015). Still others have studied the importance of public spaces for social interaction, emphasizing the detrimental effects of the replacement of open spaces by private residential areas in the process of reconstruction of damaged parts of cities (Calandra, 2015).

Finally, the analysis of building typologies reveals the limitations of risk adaptation strategies developed over time. Such studies have considered the interpretation of traditional architectural typologies in reconstruction projects affected by earthquakes (Masuo, 2015), the influence of seismic history on construction techniques and urban form (Currà *et al.*, 2015), and the effects of the Modern Movement on the configuration and vulnerability of buildings in seismic areas (Guevara, 2009). In this typological perspective, the influence of climatic attributes

on building typologies of different historical periods is considered, and measurements made of the energy efficiency of buildings in relation to new hazards posed by climatic change (Curdes, 2010).

The potential contributions of the study of urban form to disaster risk reduction are fundamental (Table 1). Achieving an integrated morphological vision in understanding and reducing risk remains a task in the search for a more resilient urban world.

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