

# Chapter 4

## Urban Life and Evolving Infrastructures in Smart Cities: Experiences, Interactions, and Augmentations

### ABSTRACT

*The purpose of this chapter is to explore evolving understandings of urban life and infrastructure in smart cities in relation to experiences, interactions, and augmentations. As such, a review of the research literature is conducted focusing on infrastructures, experiences, interactions, and augmentations in smart, learning, and future cities. Issues, controversies, and problems emerging from the literature review are highlighted, contributing to formulation of a conceptual framework for urban life and the ambient featuring evolving infrastructures in smart cities. Using an exploratory case study approach combined with an explanatory correlational design, the conceptual framework is operationalized for use in this chapter. Through the lens of emerging infrastructures for experience, interactions, and augmentations, variables are identified, explored, and correlated to inform understandings of smart cities while identifying directions for future research and practice.*

### 1. INTRODUCTION

Celani, Falcone, and d'Alessandro (2019) argue for “defining an upgrade to the meaning of infrastructures” enabling “the transformation from a classic Smart City to a model based on human dimension” involving an interweaving of the social with the physical and virtual. Streitz (2021) challenges the “smart-everything paradigm” of smart cities, arguing for “humane and cooperative cities” requiring a rethinking of “software infrastructures” in “resetting the priorities” in support of “a people-centered design approach” and one that would “provide appropriate, livable, sustainable, and resilient spaces.” This chapter is significant in that, motivated by this earlier research literature, it explores evolving in-

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infrastructures in smart cities in relation to experiences, interactions, and augmentations giving rise to the following objectives.

**Objectives:** The main objectives of this chapter are to a) explore evolving infrastructures for experiences, interactions, and augmentations in the context of smart cities; b) formulate a conceptual framework for urban life and the ambient featuring evolving infrastructures in smart cities; and c) explore the nature of the relationship between variables such as *air quality* and *invisible infrastructures* as ways of learning more about and possibly rethinking infrastructures in smart cities in the context of rapidly changing needs and requirements. These objectives give rise to the main research question under exploration in this chapter – *How are urban infrastructures evolving in smart cities?*

## 2. BACKGROUND

Bauer (2015) points to the importance of identifying infrastructure inefficiencies, needs, and risks enabled by ambient intelligence which is described as “electronic environments that are sensitive and responsive to the presence of people.” As such, ambient intelligence infrastructures are said to be “the amalgamation of neural networks, big data, IoT, wearables, and device user interfaces into services” giving way to spaces “that can automate processes and make recommendations” with the aim “to improve the users’ quality of life” (Bauer, 2015). Qiao, Hiuang, and Yeh (2022) describe the notion of Mobility as a Service (MaaS) involving urban infrastructure consisting of transport-flow infrastructure, information-flow infrastructure, and computing-flow infrastructure with an ecosystem of traditional infrastructure along with “intelligent transportation concepts, such as high-speed communication networks and autonomous fleets.”

### 2.1 Definitions

Definitions are provided from the research literature for key terms used in this chapter.

- **Augmentations:** Smith (2016) describes augmentations in the context of urban life and evolving infrastructures in relation to street signs and “a number of quasi-hidden elements of ‘bundled infrastructure’ in the form of signal boxes and conduit junctions for water, electricity, and traffic control.”
- **Experience Infrastructures:** Dourish and Bell (2007) consider “space as infrastructure” and such spaces offer ways “through which we experience the world” in ubiquitous computing environments consisting of “the structures that lie below or beneath the surface of applications and interactions.”
- **Infrastructures (urban):** Smith (2016) describes urban infrastructures as “a constant work in progress” that “shapes and facilitates daily life” and “can be analyzed as a materialization of ongoing communication.”
- **Interactions (urban):** Dourish and Bell (2007) speak of the notion of “infrastructures of interaction” in urban environments and the complexities “between space, infrastructure, culture, and experience” in combination with the potential for technologies to introduce additional destabilizing and transformative forces.
- **Smart City:** Mohanty, Choppali, and Kougiannos (2016), citing the work of Harrison et al. (2010), describe the smart city as one “connecting the physical infrastructure, the information-technology

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