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OF ECONOMICS AND  
POLITICAL SCIENCE ■

LSE**Cities**



Ove Arup Foundation

LSE Cities Working Papers

## Hybrid Cities: Conceptual Framework

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# 1 Introduction

Approaching a topic as complex and multifaceted as virtual-physical hybridity in cities requires a robust framework and a range of methodological approaches. In developing the Hybrid Cities Lab (HCL), we have constructed a conceptual approach that builds upon concluded and ongoing research across various fields, addressing existing cross-sectoral dependencies and relationships, and revealing areas in which further research is urgently needed. Our framework consists of a taxonomy of urban hybridity, which captures the present and future impacts of hybrid technologies in urban systems, and a methodological approach in mapping ‘ecosystems’ around relevant developments in urban hybridity which also underpin the proposed scenario planning. The Hybrid Cities Framework will be used to direct and inform research inquiries and policy approaches by the Lab. The fundamental and guiding questions at the centre of the proposed HCL are:

*“What are short and medium-term implications of the changing relationship between physical and digital spaces for cities and urban development? What agency does civil society and urban governments have shaping urban hybridity?”*

# 2 Taxonomy of urban hybridity

The central pillar of the Hybrid Cities Framework is a taxonomy of urban hybridity that provides a lens to study its impact on urban practices and policymaking. The taxonomy is based on two broad categories, asynchronous and simultaneous hybridity, with further segmentation for each. Types A, asynchronous hybridity, refer to activities for which hybridity is sequential: where digital engagement and physical engagements in cities are mutually reliant but do not occur at the same time. The frequency of these engagements from years (A1) to minutes (A4) indicates the difference in the actors involved, the technology required, the policy implicated and the impacts between them. While such forms of hybridity have existed and been developed in cities over the past few decades, they should be defined in contrast to more novel and emergent forms of simultaneous hybridity.

Types S, simultaneous hybridity, include engagements for which digital and physical

engagement occur concurrently. These include hybrid connection (S1), hybrid activity (S2), autonomous systems (S3), augmented space (S4), and virtual space (S5). S1 and S2 focus on human actors as they are engaged both physically and virtually: S1 denotes interaction between human actors, exemplified by the near-ubiquitous hybrid meeting, while S2 denotes simultaneous engagement in physical and digital activities, available via the widespread reliance on mobile interfaces such as smartphones. S3 is concerned with autonomous machines and virtual assemblages as they interact with people in the city space. S4 and S5 are organised around the use and experience of city space, whether consisting of both physical and virtual elements or extracting from physical space while maintaining a limited sensorial presence. Our taxonomy is depicted in Figures 1–3.

The taxonomy is instrumental for analysing the cross-sectoral impact of hybridity on interconnected areas of urban life. This is demonstrated in the Hybrid Cities Matrix (see Figure 4), which charts the types of hybridity, defined above, against the urban domains of work, leisure, care, education, housing, transport, retail and governance. This categorisation was developed to also help map the prominence of related web content (Figure 4) and examples of literature (Figure 5). The relationship between these two axes becomes clear in matrix form. Certain areas in our matrix, such as autonomous vehicles (S3/transport) and hybrid work (S1/work), are hotspots in industry sectors and public discourse. The matrix depicted here, taken from our presentation at the first hybrid cities workshop held on 13 November 2023, incorporates these differing levels of broad relevance.

The usefulness and urgency of such cross-sectoral perspectives are noted in recent academic literature, industry reports and other grey literature (Sienkiewicz, 2022, Körte, 2022). The sentiments were echoed by participants at the first hybrid cities workshop. Representing different backgrounds and areas of expertise, workshop participants discussed the resilience and scale of the taxonomy. They also identified urgent implications and further axes upon which to conduct primary research into existing unknowns in policymaking, industry and technological fields.

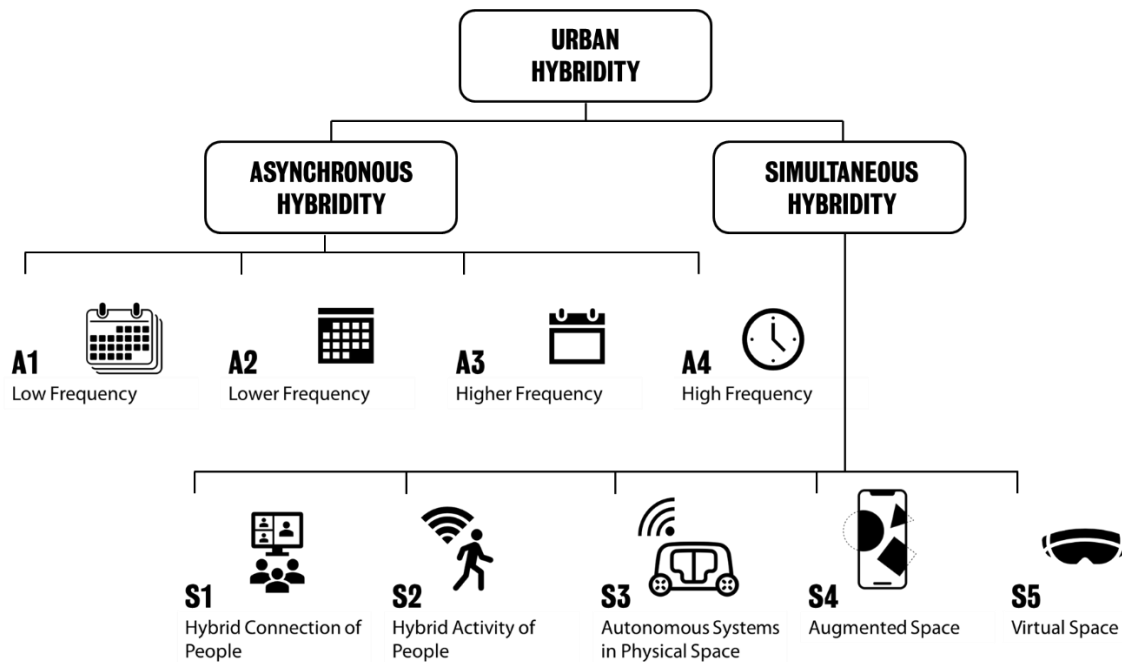


Figure 1: Taxonomy of urban hybridity.

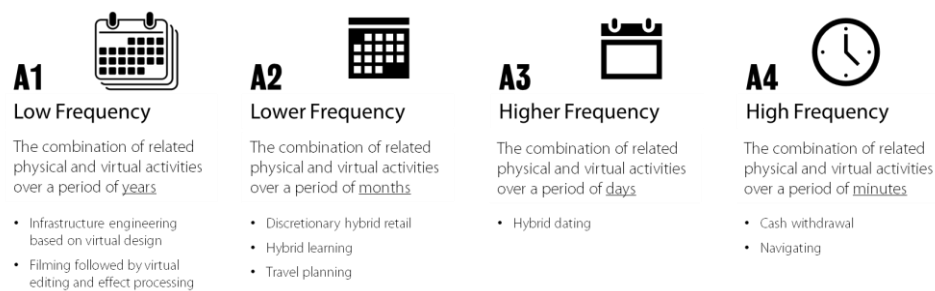


Figure 2: Definition and examples of asynchronous hybridity.

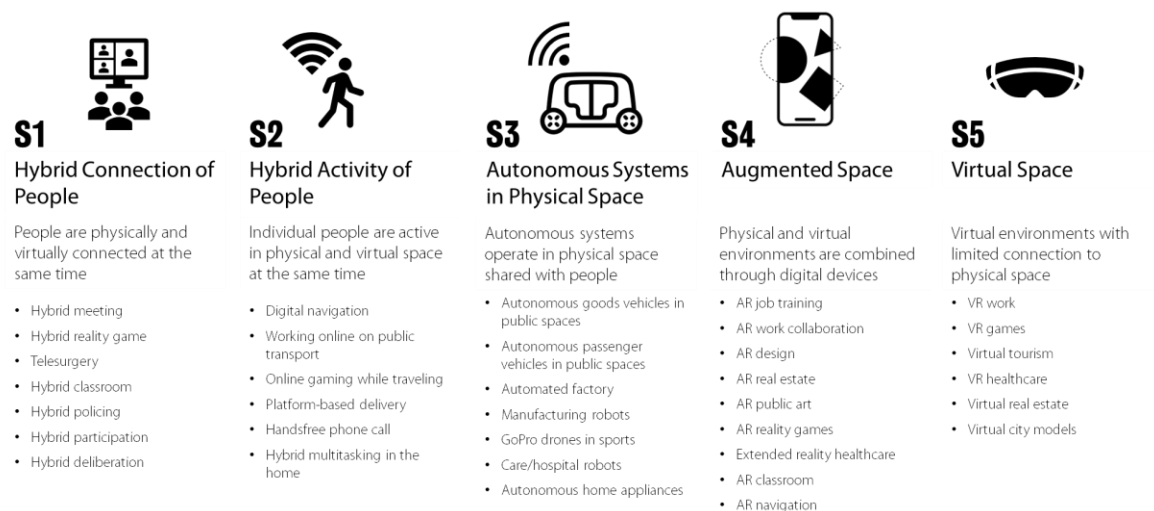
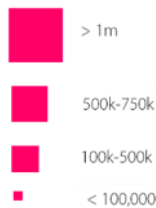


Figure 3: Definition and examples of simultaneous hybridity.

## HYBRID CITIES MATRIX

Web hits by type of hybridity and urban domain (based on related key terminologies)

Legend (web search results)



Work  
Leisure  
Care  
Education  
Housing  
Transport  
Retail  
Governance

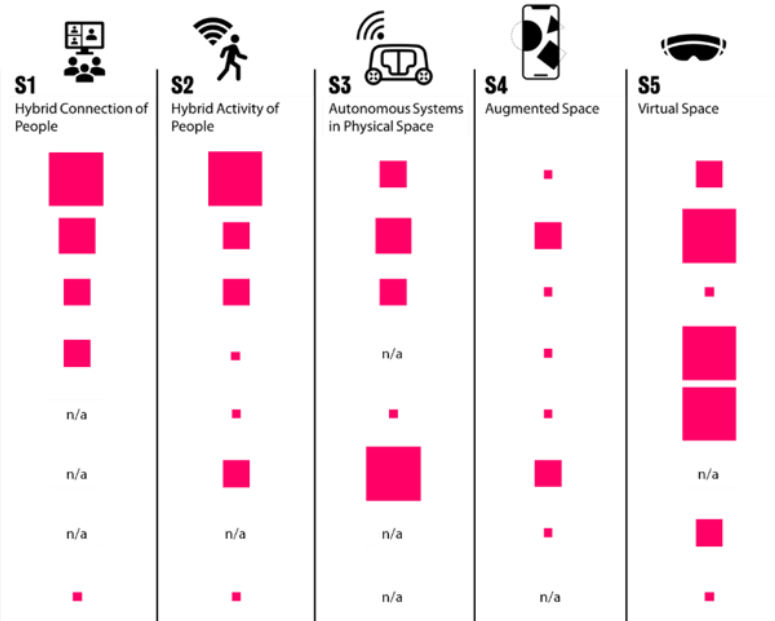


Figure 4: Hybrid Cities Matrix with web hits heatmap.

## HYBRID CITIES MATRIX

Selected academic work by type of hybridity and urban domain

Work  
Leisure  
Care  
Education  
Housing  
Transport  
Retail  
Governance

|            | S1<br>Hybrid Connection of People                                                       | S2<br>Hybrid Activity of People                                            | S3<br>Autonomous Systems in Physical Space                                                  | S4<br>Augmented Space                                                | S5<br>Virtual Space |
|------------|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|----------------------------------------------------------------------|---------------------|
| Work       | Di Marino et al. (2023)<br>Swist et al. (2017)                                          | Vilhelmson & Thulin (2016)<br>Schroeder (2010)<br>Nardi & Whittaker (2002) | Cheng et al. (2021)<br>Langer, König, & Busch (2020)                                        |                                                                      |                     |
| Leisure    | Xu et al. (2023)<br>Djukic, Vlastos, & Jokliva (2019)<br>Trachana (2014)                | De Souza e Silva (2017)<br>Pucciarelli & Vannini (2018)                    | Forgas-Coll et al. (2021)                                                                   | De Souza e Silva (2006)<br>Boj & Diaz (2008)                         |                     |
| Care       | Miller et al. (2021)<br>Sabel et al. (2021)<br>Gallegos-Rejas et al. (2022)             |                                                                            | Liu et al. (2022)<br>Rantanen et al. (2018)                                                 |                                                                      |                     |
| Education  |                                                                                         | López-Fernández, Burgueño, & Gil-Espinoso (2021)<br>Molenaar (2022)        |                                                                                             |                                                                      |                     |
| Housing    | Gil, Martinez, & Sequera (2023)                                                         |                                                                            | Nicholls & Strengers (2019)<br>Oh & Lee (2016)                                              |                                                                      |                     |
| Transport  |                                                                                         | Aihara, Bin, & Imura (2019)<br>Aihara et al. (2018)<br>Moran et al. (2018) | Csepinsky et al. (2015)<br>Sumalee & Ho (2018)<br>Yigitcanlar, Wilson, & Kamruzzaman (2019) | Frith (2012)<br>Vickerman (2021)<br>Ren & Kwan (2007)<br>Shaw (2023) |                     |
| Retail     |                                                                                         | Guo et al. (2019)                                                          |                                                                                             |                                                                      |                     |
| Governance | Innocent & Stevens (2021)<br>Apostol, Antoniadis, & Banerjee (2013)<br>Den Akker (2014) | Chen (2023)<br>Serrou, Behrendt, & Horst (2023)<br>Lokot (2019)            |                                                                                             | Innocent (2018)<br>Marques & Borba (2017)                            |                     |

Figure 5: Hybrid Cities Matrix with selected publications.

### 3 Ecosystem mapping and the 'Lab Units Approach'

The Hybrid Cities Matrix also assists a modularised and layered approach to map out hybrid city ecosystems. Three ecosystems of particular relevance were identified to inform potential research 'Lab Units,' built around existing and emerging hybrid urban developments. These

ecosystems serve as entry points for primary research and critical assessments across technical, societal and governance fields. The initial set of three critical ecosystems include:

- 1) The emerging geography of knowledge
- 2) Public space, connected people and autonomous systems
- 3) Hybrid retail, deliveries and city logistics

The ecosystem map for the first is depicted in Figure 5 and maps for the second and third ecosystem are provided in Appendix A. Each of the three units prompt key research questions that stem from the critical questions posed above. Published research and ongoing projects point towards suitable research methods for addressing the existing knowledge gaps in each area. Please refer to Hybrid Cities Briefing Papers 1–3 (D3.1–3.3) for further detail on each Unit.

Due to the ongoing hybridisation of work, industries based on knowledge creation, information and communication have been adapting to technological developments. The ecosystem for the emerging geography of knowledge work concerns evolving policies, practices and locations in increasingly common hybrid work arrangements. Developments in this area have external impacts on the workforce's social and personal lives (Alotaibi, 2023, Breideband et al., 2023), the built environment of neighbourhoods (Zenkteler et al., 2023) and transport planning for cities (Di Marino et al., 2023). As such, our approach identifies instrumental 'nexuses' of inquiry by which to access the complex interactions

and dependencies depicted in the ecosystem map. Included in Figure 6 are three nexuses that are important to the emerging geography of knowledge work ecosystems.

Research utilising primary datasets is necessary for informed policy decisions. Besides established methodologies of urban and transport studies, approaches in cybernetics and systems theory from the field of information systems are crucial in developing a strategic understanding of the dynamics within each of the nexus ecosystems. Though a considerable amount of research is conducted for some of the constituent parts of these nexuses – particularly in hybrid and remote work – the connection between them needs to be strengthened in both concept and practice for effective policy responses to urgent issues facing cities in a post-pandemic landscape. This also includes scenario planning exercises which acknowledge uncertainties for these connections. As such, the Hybrid Cities Framework acts as a strategic tool helping stakeholders to sense how the future of hybrid and autonomous technologies would affect the design and implementation of urban systems.

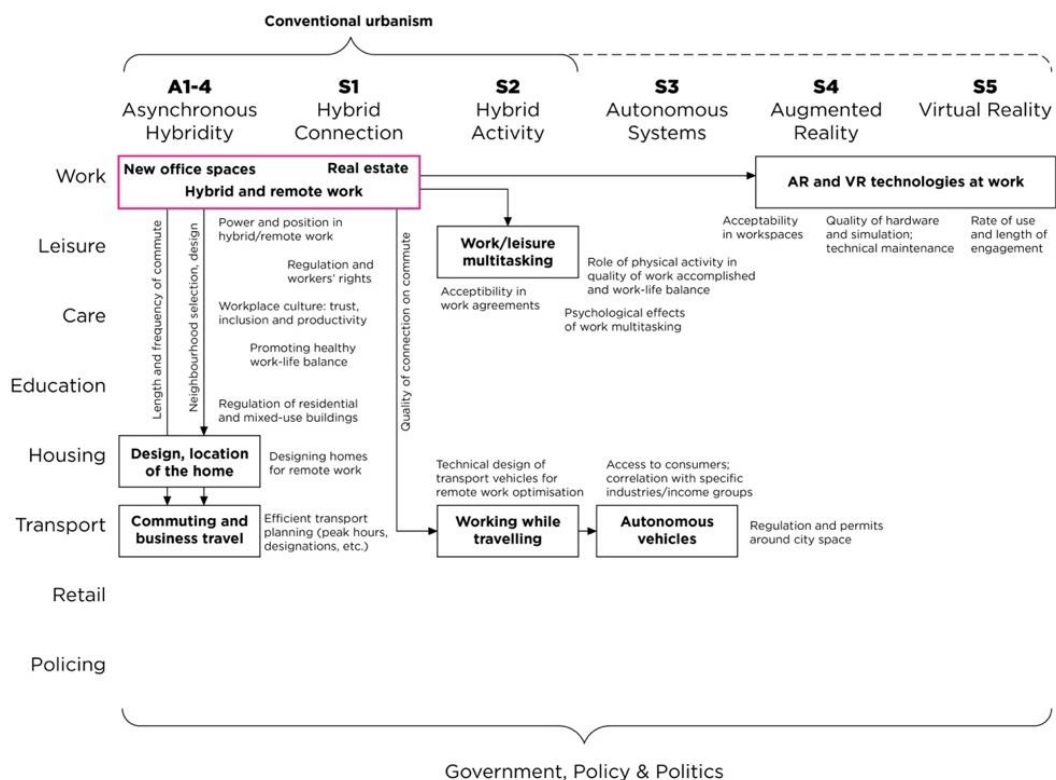


Figure 5: The emerging geography of knowledge work ecosystem.

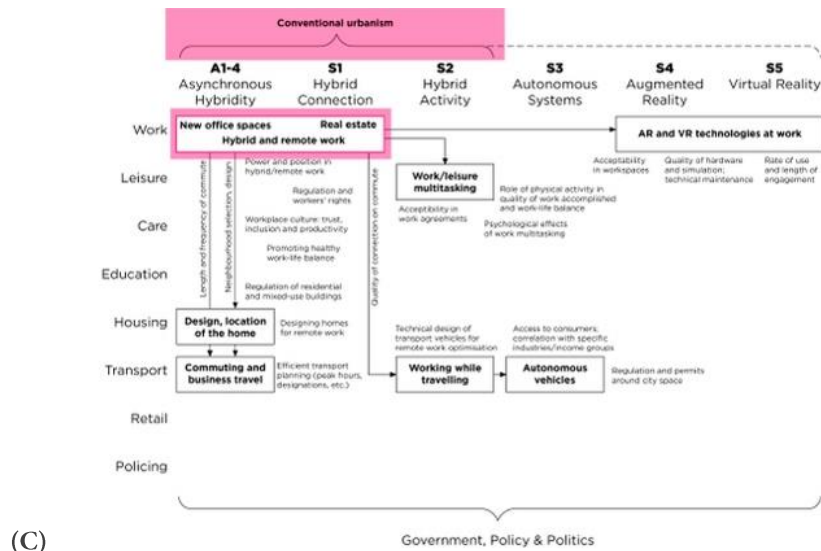
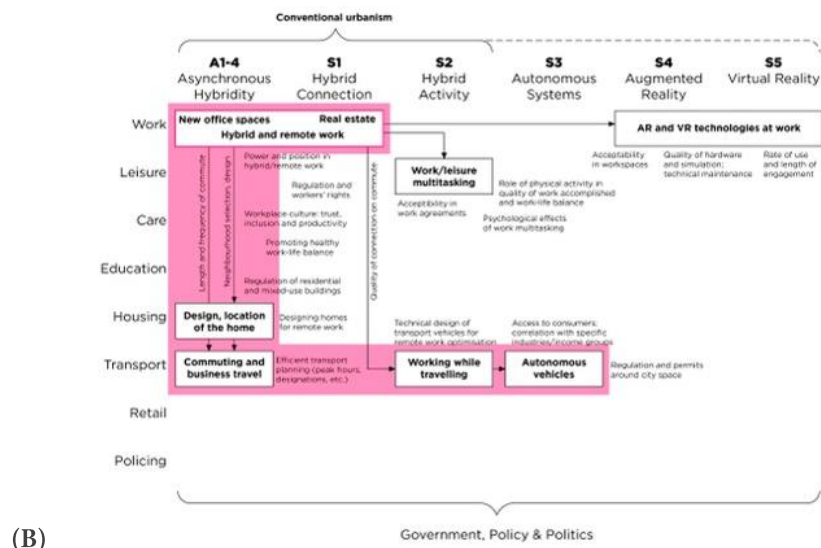
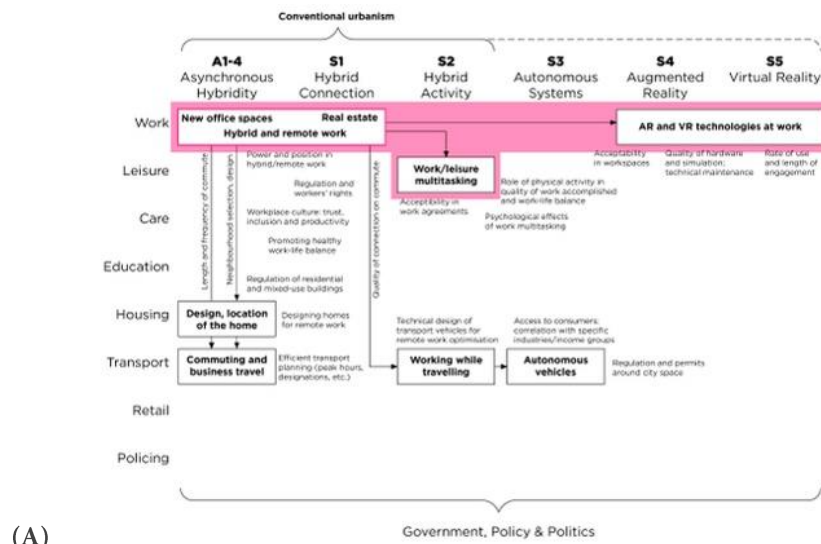


Figure 6: Three nexuses for Unit 1: (A) Remote working agreements, habits and talent retention; (B) New working spaces and the value of real estate; and (C) Changes in commute planning and housing markets.

## References

- ALOTAIBI, T. S. (2023). Flexibility and Saudi employees' perceptions of job satisfaction: a multisector study. *Journal of East-West Business*, 29, pp.199–225.
- BREIDEBAND, T., MOULDER, R. G., MARTINEZ, G. J., CARUSO, M., MARK, G., STRIEGEL, A. D. AND D'MELLO, S. (2023). 'Location, Location, Location': an exploration of different workplace contexts in remote teamwork during the COVID-19 pandemic. *Proc. ACM Hum.-Comput. Interact.*, 7, Article 71.
- DI MARINO, M., TABRIZI, H. A., CHAVOSHI, S. H. AND SINITSYNA, A. (2023). Hybrid cities and new working spaces – the case of Oslo. *Progress in Planning*, 170, 100712.
- KÖRTE, P. (2022). The emergent industrial metaverse. *MIT Technology Review Insights*. Siemens.
- SIENKIEWICZ, Ł. (2022). *PES staff management – challenges in the 'new normal'*. In: *European Network of Public Services* [online]. *European Commission/Icon Institute*. Available from: <https://ec.europa.eu/social/> [18 April 2023].
- ZENKTELER, M., LEONARD, F. R., CUSHING, D., HEARN, G., FOTH, M., HANSEN, V. G. AND CALDWELL, G. (2023). Implications of working from home for the design of healthy work environments in the post-pandemic city. *Built Environment*, 49, pp.423–439.

## Appendix A: Maps for Hybrid Cities Ecosystems 2 and 3

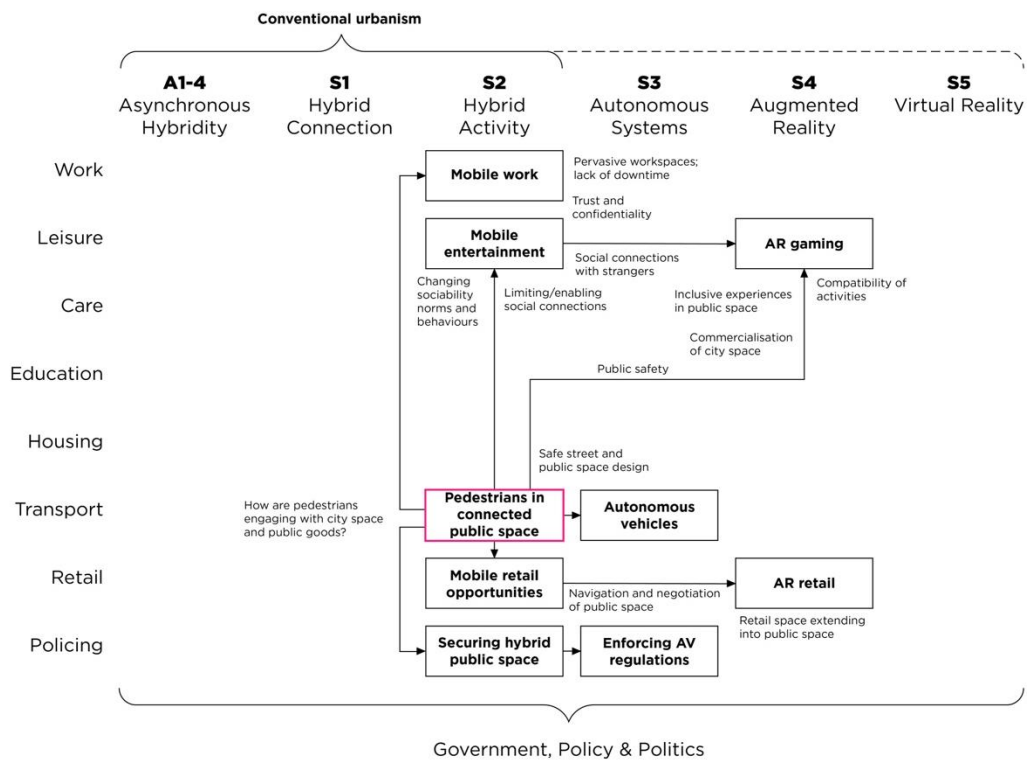


Figure 7: Public space, connected people and autonomous systems.

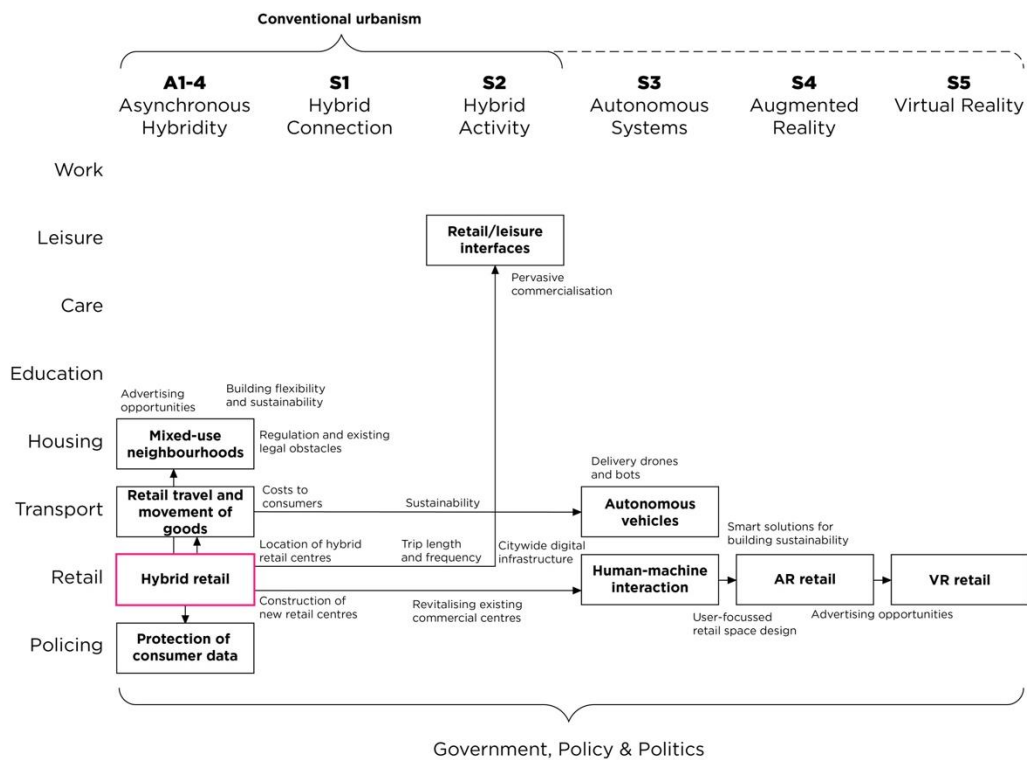


Figure 8: Hybrid retail, deliveries and city logistics.