

The School Street as Extended Cognitive Space. A Participatory Framework for Evaluating Temporally Activated Public Spaces

Luciana Mastrolonardo, Stefania Gruosso, Chantal Zurlo

Università degli Studi "G. d'Annunzio" Chieti-Pescara, Italy

l.mastrolonardo@unich.it | stefania.gruosso@unich.it | chantalzurlo@gmail.com

Abstract

Contemporary cities face a paradox: as urbanization intensifies, children's access to public space contracts. Vehicular dominance, parental safety concerns, and digital shifts in social behaviour converge to produce spatially dispossessed childhoods: not merely a mobility issue but a cognitive and developmental crisis. Children's growth depends on embodied exploration, unstructured play, and independent navigation, yet prevailing evaluation frameworks privilege permanent features and adult priorities, failing to capture how spaces serve children's cognitive and social development. This paper proposes a theoretical and methodological framework conceptualizing public space as cognitive infrastructure: urban streets function as distributed cognitive systems when activated through tactical, temporary, and participatory interventions. We focus on school streets, those regularly closed to traffic near schools to enable children's free play and interaction and argue that reconceptualizing the street as cognitive infrastructure carries direct methodological consequences, since conventional, feature-based evaluation tools are structurally unable to capture these dynamic and relational processes. In response, we develop a four-dimensional evaluation framework based on spatial-cognitive affordances, temporal rhythms, participatory co-design, and perceived safety, which is operationalized through participatory, practice-based methods that position children and families as co-researchers rather than research subjects. We grounded the framework in an early-phase action-research project in Pescara, Italy, where a street in a working-class neighbourhood is being transformed. Findings from the preparatory phase already begin to corroborate the framework's core premises, indicating that the methodology is a logically derived structure under test rather than an untested proposal. The framework equips municipalities, designers, and communities with actionable tools to evaluate interventions that reclaim streets for children's development.

Keywords: school streets, extended mind, children's autonomous mobility, public space, living painting

To cite this article:

Mastrolonardo, L., Gruosso, S. and Zurlo, C. (2026) "The School Street as Extended Cognitive Space: A Participatory Framework for Evaluating Temporally Activated Public Spaces", *The Journal of Public Space*, 11(1), pp. 169-184. doi: 10.32891/jps.v11i1.1902.

This article has been double blind peer reviewed and accepted for publication in *The Journal of Public Space*.



This work is licensed under a Creative Commons Attribution - Non Commercial 4.0 International License <https://creativecommons.org/licenses/by-nc/4.0/>

I. Introduction

The relationship between childhood and public space is among the most urgent and least theorized challenges facing contemporary urban design. Across European and North American cities, this relationship has significantly shifted. Evidence from the United Kingdom reveals that only 9 percent of primary school children were permitted to travel to school unaccompanied by the early 1990s, a sharp decrease from 80 percent in 1971 (Hillman, Adams & Whitelegg, 1990). Most industrialized countries, Italy included, have seen this trend intensify (Shaw et al., 2015).

The causes are multiple and interconnected: the priority assigned to vehicular traffic in the urban design of spaces between buildings, the shift in parenting cultures and increase in anxiety over children's safety, the expansion of structured and supervised childhood activities, and the progressive displacement of physical sociality towards digital environments (Gill, 2007; Malone, 2007).

This spatial dispossession affects not only mobility and urban planning but also children's cognitive and developmental capacities. It amounts to a cognitive and developmental crisis. A substantial body of evidence from developmental, environmental, and cognitive psychology demonstrates that children's intellectual, social, and emotional development depends fundamentally on embodied exploration, unstructured play, and autonomous navigation of complex environments (Hart, 1979; Heft, 1988; Kytä, 2004). When children lose access to the street as a public space, they lose the opportunity to draw upon an infrastructure for motor, cognitive, and socio-emotional development that cannot be adequately replaced by indoor, supervised, or digital alternatives.

Practice-based evaluation positions children as active co-designers and evaluators. This approach acknowledges children's unique spatial knowledge and their interpretations of walkability and urban design elements, which often diverge from adult-centric expert intentions. This departure is crucial because children, particularly during the concrete operational phase, perceive and interact with their environments differently, exhibiting heightened sensitivity to environmental stimuli that shape their learning and navigation (Lefebvre, 1991). This participatory paradigm therefore moves beyond viewing children as passive recipients of urban planning, valuing their insights as critical to developing inclusive and responsive urban environments. It involves incorporating their expressed preferences for street design, such as green barriers, wider sidewalks, and reduced litter, which contribute to perceived safety and aesthetic appeal. This active involvement in urban design enhances their sense of competence, self-esteem, and communication skills, and fosters a deeper connection to their community and attachment to places. Such co-creative methods, previously explored in broader public open space design, demonstrate the efficacy of integrating adolescent perspectives to generate nuanced, user-sensitive urban interventions.

Yet the evaluation of public space quality continues to overlook the importance of child-centred design and its capacity to shape thoughts, behaviours, and social interactions in public spaces for youngsters (Gruosso, Del Signore, Di Cinzio, 2025). Dominant assessment tools, from the Project for Public Spaces' Place Performance Evaluation to various municipal liveability indices, privilege permanent physical features, adult-use patterns, and quantifiable metrics such as pedestrian counts or maintenance standards (Carmona, 2019). They fail to capture the dynamic, relational, and cognitively constitutive role that public spaces play in children's lives. Moreover, they are poorly equipped to evaluate temporary, tactical, and participatory interventions, precisely the kind of low-

cost, reversible actions that many cities are exploring as alternatives to large-scale infrastructural projects.



Figure 1. "Piazze Aperte Project" at the intersection of Via Spoleto and Via Venini, Milano, Italy
(© Comune di Milano)

In this paper, we propose an original theoretical and methodological framework for understanding and evaluating school streets as the practice of temporarily closing streets adjacent to schools to vehicular traffic on a regular and predictable basis, to enable children's free play, social interaction, and autonomous navigation. Drawing on extended and embodied mind theory (Clark & Chalmers, 1998; Gallagher, 2005; Varela, Thompson & Rosch, 1991), the school street is interpreted not as a mere traffic-calming measure but as an external structure that, when reliably coupled with children's internal cognitive processes, becomes a constitutive component of cognition itself. In this paper, we propose an original theoretical and methodological framework for understanding and evaluating school streets, the practice of temporarily closing streets adjacent to schools to vehicular traffic on a regular and predictable basis, to enable children's free play, social interaction, and autonomous navigation. Drawing on extended and embodied mind theory (Clark & Chalmers, 1998; Gallagher, 2005; Varela, Thompson & Rosch, 1991), the school street is interpreted not as a mere traffic-calming measure but as an external structure that, when reliably coupled with children's internal cognitive processes, becomes a constitutive component of cognition itself. This theoretical repositioning carries direct methodological consequences. If the street functions as cognitive infrastructure rather than merely a physical backdrop, then conventional evaluation tools, which privilege

permanent features, static audits, and adult-centred metrics, are structurally inadequate for capturing what school streets do. What is required instead is a framework that measures dynamic, relational, and temporally embedded processes: how children couple with space over time, how routines form and stabilize, and how participatory co-design constitutes a cognitive act in itself. Accordingly, we develop a four-dimensional evaluation methodology, encompassing spatial-cognitive affordances, temporal rhythms, participatory co-design, and perceived safety, that positions children and families as co-researchers rather than research subjects, and integrates longitudinal, mixed-methods data collection with community-defined indicators. This comprehensive assessment integrates multiple dimensions to capture the dynamic interplay between the built environment and children's developmental needs, thereby offering a more holistic understanding of urban spaces (Mehta, 2013). The framework addresses a critical gap in current research by focusing on how temporary street closures can transform urban thoroughfares into dynamic environments that support children's cognitive and social development, moving beyond traditional safety and active travel evaluations. It integrates participatory design principles with robust evaluation metrics to assess how school streets function as extended cognitive spaces, thereby contributing to children's holistic development and well-being.

The testing phase of the proposed model is defined by a 24-month action-research project currently underway in Pescara, a medium-sized city on the Italian Adriatic coast (Whyte, 1980), where the street fronting a primary school in the working-class neighbourhood of Santa Filomena will be activated through a combination of regular traffic closures, participatory design interventions, environmental education, and community mobilization. The project, entitled "Pescara Feet on Colors", was developed in partnership with the Municipality of Pescara, the Department of Architecture of the University G. d'Annunzio, and local third-sector organizations, and builds upon preparatory community engagement work conducted by the Department of Architecture from 2025.

The paper is organized as follows.

Paragraph 2 defines the theoretical framework by articulating the connections among extended mind theory, environmental affordances, and children's spatial cognition.

Paragraph 3 presents the urban context and the genesis of the Pescara project.

Paragraph 4 describes the spatial and material design strategy.

Paragraph 5 details the four-dimensional evaluation methodology.

Paragraph 6 discusses the early implementation phase and stakeholder mobilization.

Paragraph 7 examines the framework's implications for public space evaluation.

Paragraph 8 offers conclusions and directions for future research.

2. Theoretical Framework: The Street as Cognitive Infrastructure

2.1 Extended and Embodied Cognition

If cognitive processes are not confined within the brain but extend into the environment (Clark & Chalmers, 1998), then external structures that reliably couple with internal mental processes qualify as components of an extended cognitive system. Following this theory, a notebook regularly consulted for memory, a calculator used for arithmetic, or a familiar spatial layout navigated for orientation all qualify as components of an extended cognitive system, provided they satisfy requirements of reliability, accessibility, and trust.

This positions cognition as a distributed, situated, and materially embodied process. The tradition of embodied cognition, developed by Varela, Thompson, and Rosch (1991) and extended by Gallagher (2005), complements this view by emphasizing that cognition is fundamentally shaped by the body's sensorimotor interaction with its environment. Perception, action, and thought are not separable processes but aspects of a single embodied engagement with the world: even social cognition, the capacity to understand others' intentions, emotions, and perspectives, is grounded in embodied face-to-face interaction rather than abstract mentalization processes.

These theories help illuminate the relationship between children and public space. If cognition is extended and embodied, then the environments in which children move, play, and interact are not mere backdrops to development but active components of it. A street that a child walks daily becomes part of their spatial memory system. A place where social encounters are repeated becomes part of their social cognition. The textures, sounds, and spatial configurations of urban environments are not stimuli processed by an isolated brain but materials through which cognition constitutes itself.

2.2 Environmental Affordances and Children's Spatial Agency

The concept of affordance (Gibson, 1979), applied to children's environments (Heft, 1988), provides a crucial bridge between extended mind theory and public space design. Affordances are action possibilities that emerge from the relationship between an organism and its environment, not properties of objects in themselves, but relational structures that depend on the perceiver's capabilities, intentions, and developmental stage. A low wall affords sitting for an adult but climbing for a child; a puddle affords avoidance for a pedestrian but splashing exploration for a young child (Mastrodonardo & Nanni, 2024).

The degree of independent mobility is the strongest predictor of affordance actualization. Kyttä (2004) distinguishes between potential affordances, those objectively present in an environment, and actualized affordances, those that children actually perceive and use. Children who can move freely within their neighbourhood discover and utilize a significantly greater number of environmental affordances than those confined to supervised spaces.

Children who walk to school autonomously develop richer and more accurate cognitive maps of their neighbourhood than those driven to school, even when controlling for exposure time (Rissotto & Tonucci, 2002). The act of autonomous navigation, making decisions at intersections, calibrating speed and attention, and reading environmental cues, constitutes a form of distributed spatial cognition qualitatively distinct from passive transport.

2.3 Temporary Design and Tactical Urbanism

The concept of tactical urbanism (Lydon & Garcia, 2015) describes low-cost, temporary, and often citizen-initiated interventions in the built environment that aim to catalyze long-term change. Unlike conventional urban planning, which operates through permanent infrastructure and top-down regulation, tactical urbanism works through reversible, iterative, and participatory actions, painted crosswalks, temporary plazas, and pop-up parks that test possibilities, build community consensus, and demonstrate alternative uses of space before committing to permanent transformations.

School streets represent a fertile testing ground for tactical urbanism. Originating in Italy,

where they are linked to the Pedibus tradition (Tonucci, 1996), and subsequently adopted across Europe, school streets involve the regular and temporary closure of streets adjacent to schools during arrival and departure times, and, in some cases, for extended periods during the day. Unlike permanent pedestrianization, this temporal activation creates rhythmic patterns that structure collective expectations while maintaining the flexibility needed for adaptation and learning. The predictability of the closure, the same street, at the same times, on the same days, is itself a cognitive resource, enabling children, families, and communities to develop routines, anticipations, and shared practices around the activated space. Where environmental and social conditions allow, the school street can serve as a preliminary intervention type leading to the complete and permanent closure of a street, returning it to the community.

3. Context: Pescara, Santa Filomena, and the Genesis of the Project

3.1 The Urban Context

Pescara is a city of approximately 120,000 inhabitants on the Adriatic coast of central Italy, in the Abruzzo region. Like many medium-sized Italian cities, it was characterized during postwar development by rapid and largely unregulated building expansion that prioritized residential density and vehicular circulation over public space quality. The result is a morphologically and socially fragmented urban fabric, marked by physical and social barriers that separate places and people (Pozzi, Potenza 2008).

The project area is located in the Santa Filomena neighbourhood, at the city's northern edge bordering the municipality of Montesilvano, a neighbourhood characterised by a concentration of social housing, a proportion of families with children significantly above the municipal average (approximately 15–17 per cent), and a cluster of collective services along and near Via Carlo Alberto dalla Chiesa: a nursery and a primary school (Piano T), nationally and locally prominent civil-society organisations (Misericordia di Pescara, etc.), the parish church of the Visitation of the Blessed Virgin Mary, sports facilities, and a weekly neighbourhood market.

Via Carlo Alberto dalla Chiesa presents a paradox characteristic of the Italian periphery: a wide street with low traffic, a dual carriageway with parking on both sides, narrow sidewalks, and little greenery. The generous road width, dimensioned for a vehicular capacity never realized, coexists with a minimal provision of pedestrian comfort and spaces for sociality. Architectural barriers and spatial fragmentation reduce the street's quality as public space and its capacity for meaningful interaction with the surrounding urban context.

3.2 Project Structure and Partnership

"Pescara Feet on Colors" is an iterative learning project. At present, the project is in the first six months of the preliminary phase, dedicated to participatory co-design with the community and stakeholders. Regular traffic closures begin immediately afterward and continue until the end of the project, with spatial design interventions introduced progressively following the co-design phase. A second phase of participatory engagement and dissemination allows for intermediate adjustments based on observed use patterns and community feedback, while also proposing systemic and permanent interventions and new urban areas to test the same solutions. The final months will be dedicated to evaluation, public restitution, and documentation of a replicable operational model.



Figure 2. Suggestion and insight from the first meetings in Pescara, Piano T school, May 2026.
(Photo by La cabina di regia)

4. Proximity Design Strategy

4.1 Conceptual Approach: Phases, Time, Space, Colour, Matter

The project's spatial design strategy is grounded in a conceptual approach that treats public space as a painterly work: a veritable canvas upon which layers of colour, graphic marks, functional areas, and urban furniture elements are progressively stratified. This metaphor is not merely aesthetic but operative, structuring a design methodology in which the road surface (the parterre) becomes the primary design element, and transformation occurs not through a single definitive intervention but through a slow process of layering and accumulation unfolding over time.

Like a painting, the space is constructed through glazes and superimposed layers, built up gradually, as a formal transformation requiring time to balance solids and voids, presence and absence, permanence and transience. This approach foregrounds what might be called the slowness of spatial creation, underscoring how meaningful places are not produced instantaneously but emerge through iterative processes of making, inhabiting, observing, and adapting. The design strategy is intrinsically aligned with the participatory methodology: each layer responds to what was observed, used, and desired in previous phases. This conceptual position is inscribed within a tradition of contemporary public space design that uses colour and graphic intervention on ground surfaces as tools of spatial reconfiguration. International precedents (from the Superkilen project in Copenhagen to the chromatic interventions of LMN Architects and Boamistura) demonstrate that chromatic treatment of horizontal surfaces can radically alter the perception and use of urban space without requiring heavy infrastructure. Colour operates simultaneously as an aesthetic element and a spatial organizer: it defines zones, suggests uses, slows traffic, and constructs visual identity. The transformation is not only physical but cultural: the urban landscape becomes a "living painting," in progress, capable of welcoming and stimulating social interaction.



Figure 3. Superkilen project in Copenhagen, BIG architect (Photo by Luciana Mastrodonardo)

4.2 The Parterre: The Ground as Design Project

The first fundamental dimension of the design intervention concerns the road surface. Through chromatic fields, patterns, and graphic marks applied with non-toxic, removable paints, the road surface is progressively transformed from an exclusively vehicular surface into an active, legible, and multifunctional horizontal plane. Colour is not merely decorative: it functions as a design tool that organizes space, suggests differentiated uses (pedestrian areas, rest zones, play zones), and visually decelerates traffic. The continuity of the ground-level design creates a new visual identity for the street, reinforcing the sense of belonging and activating new urban practices as an externalized cognitive map. The chromatic differentiation of zones provides environmental cues that children internalize through repeated use: the blue area is for quiet activities, the coloured pathway leads to the play zone, and the decorated surface marks the boundary of the activated space (Heller, 2004). Over time, these visual signs reliably couple with children's spatial expectations and behavioural routines, functioning as distributed memory and orientation systems.

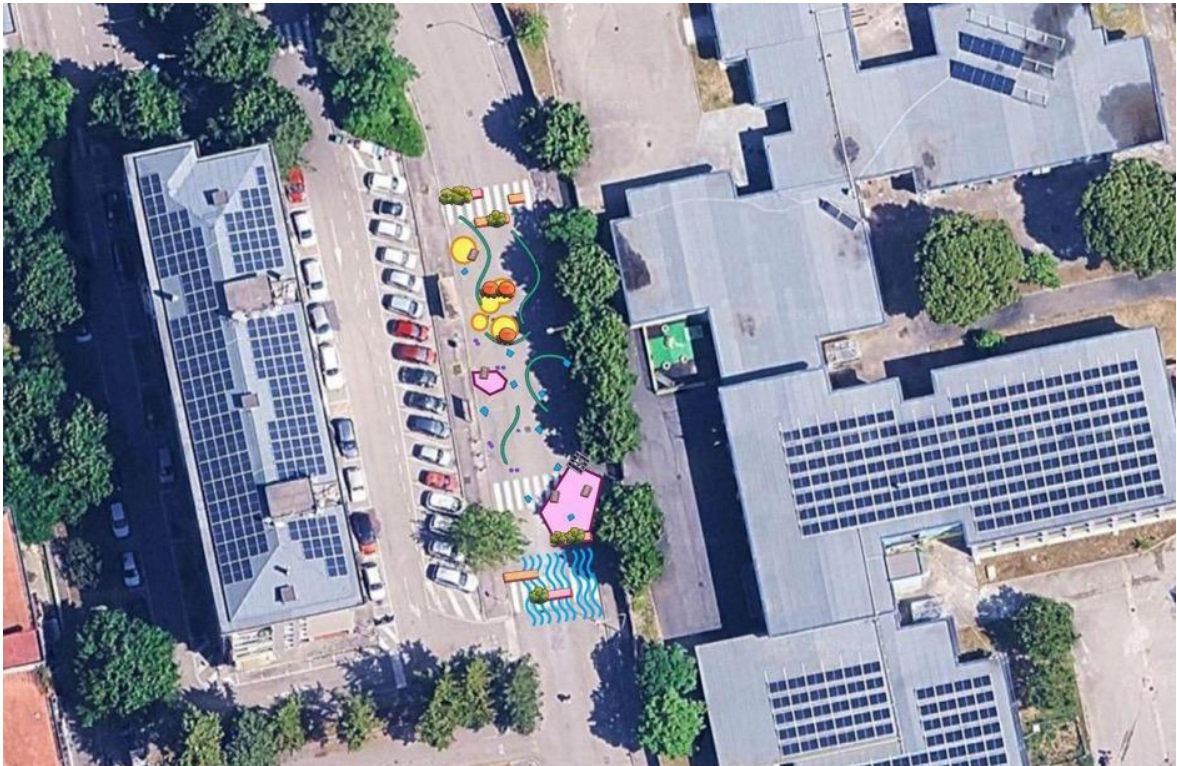


Figure 4. A preliminary conceptual idea of the new coloured parterre in Santa Filomena neighbourhood, Pescara, Italy. (image processed by the authors)

4.3 Urban Furniture: Light, Modular, and Flexible Elements

The second dimension of the design strategy concerns urban furniture, conceived as a system of light, modular, and flexible elements that dialogue with the ground's graphic design without overwhelming it. The furniture system includes linear seating (modular benches with clean geometries), folding tables, mobile planters with vegetation on self-locking wheels, outdoor poufs and cushions for informal rest, and play elements (table tennis, table football, obstacle-course components, bouncing balls). These elements are not arranged hierarchically but distributed diffusely throughout the space, encouraging free and spontaneous use.

The furniture's chromatic and material language maintains a deliberate neutrality, with muted tones that leave the coloured ground surface as the principal role in constructing visual identity. The furniture thus operates as a discreet yet fundamental support, structuring the space without competing with the parterre design. The perimeter areas function as traffic barriers through the arrangement of planters that provide greenery and shade, while the central zone remains open and reconfigurable.

This approach to urban furniture is informed by the concept of 'affordance density'. The project aims to maximize the diversity of actions available in the space: sitting, lying down, climbing, hiding, gathering, reading, playing formal games, and practicing informal sports. The modular and mobile character of the elements is particularly important from the perspective of participatory co-design, since it allows children and the broader educating community to reconfigure the space according to their own needs and desires, a form of spatial agency that is itself a process of cognitive and social learning.

4.4 Thematic Zones and Programmatic Flexibility

The spatial organization of the activated street is not conceived as a fixed plan but as a flexible framework of thematic zones capable of accommodating diverse and simultaneous uses. These include a sports area (aligned with the existing sports facility and activated one afternoon per week), a free-play area (activated one afternoon per week), zones for quiet activities (reading, studying, conversation), and, crucially, a generous undesignated space that resists programmatic determination and remains available for spontaneous appropriation.

The existing ground-floor arcades of the adjacent residential buildings are incorporated as covered spaces usable in adverse weather, extending the temporal arc of the intervention beyond favorable conditions. This strategic use of existing architectural elements exemplifies the tactical approach: rather than building new infrastructure, the project activates latent spatial resources in the urban fabric that are currently underutilized or unrecognized.

5. Evaluation Framework: Four Dimensions of Spatial-Cognitive Assessment

The evaluation methodology is designed to capture the multidimensional character of the school street as an extended cognitive space, integrating four interconnected dimensions: the framework positions children and families as co-researchers rather than research subjects, consistent with the project's participatory methods and with methodological developments in childhood studies (Christensen & O'Brien, 2003).

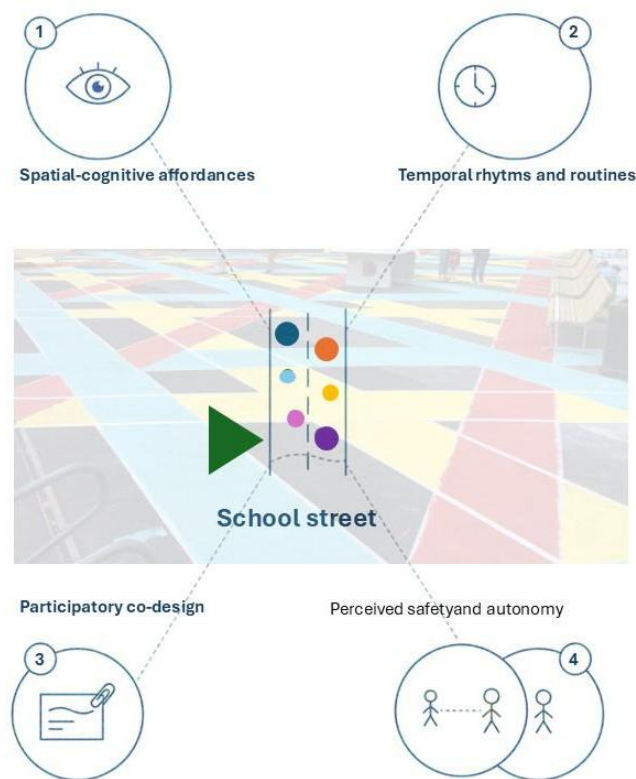


Figure 5. Four Dimensions of Spatial-Cognitive method. (image processed by the authors)

5.1 Dimension 1: Spatial-Cognitive Affordances

This dimension assesses the action possibilities that emerge from the coupling between children's cognition and environmental features. Following Heft's (1988) functional taxonomy of children's environmental affordances and Kyttä's (2004) distinction between potential and actualized affordances, we employ three complementary methods:

1. Child-led mapping exercises, in which children aged 6 to 14 are invited to draw, annotate, and narrate their experience of the activated street, identifying places they use, routes they follow, and activities they engage in.
2. Observational analysis of spontaneous play, conducted by trained observers using a structured protocol adapted from public life studies (Gehl, 2011), recording the types, locations, durations, and social configurations of children's activities during traffic-closure periods.
3. Sensory audits are co-conducted with children to document the qualitative and multisensory experience of the space, what children see, hear, smell, and feel tactilely, capturing dimensions of spatial experience that conventional metrics do not register.

5.2 Dimension 2: Temporal Rhythms and Routines

This dimension assesses how regular activation pattern's structure collective memory and expectations. The temporal predictability of the school street closure, daily at school arrival and departure times, once weekly in the afternoon, is theorized as a cognitive scaffold that enables anticipation, planning, and routine formation. It is evaluated through longitudinal participation tracking (attendance registers over the 18 months of activation) and narrative analysis of anticipation and memory through semi-structured interviews with children and parents at three time points.

5.3 Dimension 3: Participatory Co-Design as Cognitive Coupling

The third dimension treats the co-design process as a form of distributed cognitive activity. When children participate in designing their own street, choosing mural colours, proposing play configurations, deciding where to position furniture, they are not simply providing input to a design process but performing a collaborative cognitive act that couples their imagination, spatial reasoning, and social negotiation capacity with external material resources (paints, furniture, spatial layouts) to produce new environmental configurations. This is extended cognition in participatory practice.

We document this dimension through design workshops using age-appropriate methods (drawing and model-making for younger children, mapping and discussion for adolescents), analysis of child-initiated space modifications during activation periods (spontaneous furniture rearrangements, invention of new games, creation of informal rules), and feedback boards where children and families can propose, evaluate, and vote on spatial changes. The intermediate participatory phase is specifically designed to integrate these observations into iterative design adjustments, creating a feedback loop between use, reflection, and redesign.

5.4 Dimension 4: Perceived Safety and Autonomous Navigation

The fourth dimension addresses the subjective dimension of safety as the precondition for cognitive extension. Children's autonomy depends not only on objective safety conditions but on the perception of safety held by both parents and children (Tonucci, 1996). Parental questionnaires measure willingness to permit unsupervised play at three time

points; semi-structured interviews with children explore their sense of safety and spatial confidence; and behavioural observation of supervision distances, the physical distance between parents and children during activation periods, is used as a proxy for the evolution of trust in the space's safety.

This dimension is theoretically crucial because perceived safety functions as a gating mechanism for cognitive extension. An objectively safe street perceived as dangerous by parents will not generate the conditions for autonomous exploration; conversely, a space perceived as safe enables the relaxation of supervision necessary for children to interact freely with the environment and develop the spatial-cognitive competencies described in Dimension 1.

5.5 Methodological Integration

The four dimensions are not evaluated in isolation but through a mixed-methods design that integrates quantitative tracking (pedestrian counts, attendance registers, time-use diaries), qualitative ethnography (field observation, photo-voice, video documentation), and participatory action (design workshops, feedback boards, collective sense-making sessions). Data collection occurs at three principal intervals corresponding to the project phases: baseline and co-design, intermediate monitoring, and final evaluation. This longitudinal, multi-stakeholder approach aims to generate locally grounded indicators that reflect community-defined values rather than imposed universal standards, an approach consistent with the invitation in this special issue to reinterrogate theoretical frameworks and evaluation modalities of public space.

6. Preliminary Findings: validating and refining the methodology

Although the activation phase is not yet complete, the preparatory and early-implementation work already constitutes a first empirical test of the proposed framework. Rather than reporting outcomes of the interventions themselves, this section examines what the preparatory process reveals about the effectiveness and internal coherence of the methodology, treating the four-dimensional framework not as an untested hypothesis but as an analytical structure whose premises can be progressively corroborated, calibrated, and refined through engagement with the field. Three findings are particularly instructive.

First, the stakeholder-mapping process validates the methodological premise that participatory co-design (Dimension 3) is a viable and generative cognitive activity in this context. The mapping revealed a dense, differentiated network (the school community, civil-society organizations with complementary competencies, religious institutions, and sports associations) concentrated within a compact urban area. This density is not merely an encouraging contextual feature: it confirms that the co-design dimension can draw on the distributed social resources the framework presupposes, and that working-class neighbourhoods, often characterized by strong local ties and traditions of collective self-organization, supply the relational substrate on which participatory cognitive coupling depends. The finding thus substantiates a load-bearing assumption of the methodology rather than simply describing the site.

Second, the preparatory engagement corroborates the theoretical link, central to Dimension 4, between perceived safety and the suppression of children's spatial agency. Community meetings, informal conversations, and preliminary spatial analysis conducted

before the project in 2025 revealed a strong latent demand for safe outdoor space: parents consistently reported that their children have limited opportunities for autonomous outdoor play and expressed willingness to participate in creating and maintaining such spaces. This pattern is consistent with the literature on parental safety anxieties and their constraining effect on children's autonomy (Gill, 2007; Malone, 2007), but its methodological significance is greater: it demonstrates, in advance of activation, that perceived safety operates as the gating mechanism the framework theorises, and that the instruments designed to measure it (Dimension 4) are addressing a live and decisive variable rather than a hypothetical one. It also yields an early, testable prediction that community-supported tactical interventions can shift parental risk perception, which the longitudinal design is specifically structured to capture.

Third, the construction of the participatory activity calendar has empirically confirmed and forced a refinement of the framework's treatment of temporal rhythms (Dimension 2). Scheduling workshops, meetings, and initial closure tests required aligning the intervention with the daily rhythms of school, work, and domestic life. This practical constraint did more than complicate logistics: it demonstrated that temporality is not an incidental characteristic of the activated space but a design parameter that determines accessibility, inclusion, and the formation of routine, precisely the role Dimension 2 assigns it. The finding has already fed back into the methodology, prompting the temporal dimension to be operationalized not only as an *outcome* to be measured (do routines form?) but also as a *precondition* to be designed (does the activation schedule afford participation?). This is an instance of the framework being derived and corrected through practice rather than imposed.

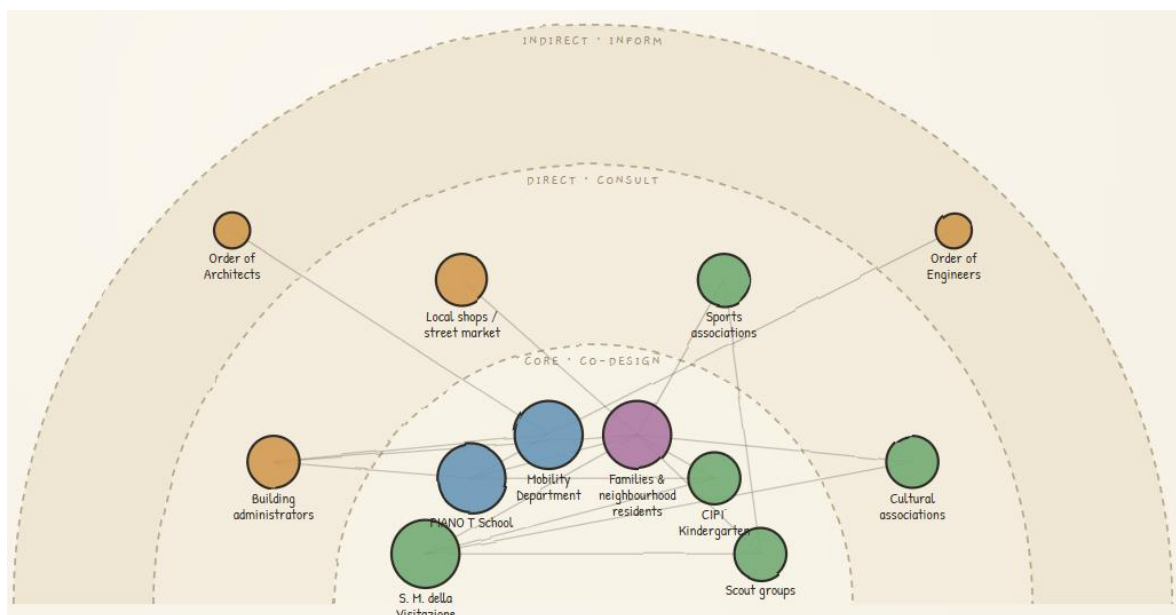


Figure 6. Stakeholders map. (image processed by the authors)

Taken together, these findings indicate that the methodology is not a speculative proposal awaiting data but a logically derived structure whose constitutive assumptions are already being borne out, and whose dimensions are being calibrated, through systematic

engagement with the field. The activation phase will extend this process from the validation of premises to the measurement of outcomes, but the evaluative architecture itself is, in a meaningful sense, already under test.

7. Discussion: Implications for Public Space Evaluation

The framework presented in this paper offers three interconnected contributions to the ongoing debate on public space evaluation, each responsive to concerns raised in the broader literature and by the call for papers of this special issue.

The framework provides a starting point for arguing that public space quality cannot be reduced to physical attributes or quantifiable metrics. If streets function as cognitive infrastructure, extending children's memory, spatial reasoning, social cognition, and executive functions, then evaluating them requires methods capable of capturing these dynamic, relational, and subjectively experienced processes. This reconceptualization shifts the evaluative question from "what features does this space have?" to "what cognitive and social processes does this space enable?" This is a fundamentally different orientation, foregrounding use, experience, and developmental impact over design compliance or maintenance standards.

Furthermore, the four-dimensional evaluation framework provides a replicable structure for assessing temporally activated public spaces, adaptable to diverse urban contexts, cultural settings, and community capacities. The framework's emphasis on mixed methods, longitudinal observation, and participatory co-research responds to the critique, voiced by Carmona (2019) and others, that conventional public space metrics privilege snapshot evaluations over processual understanding, and expert judgment over lived experience. By positioning children as co-researchers and integrating their perspectives through age-appropriate methods, the framework holds that public space quality is not an objective property to be measured but a relational outcome to be documented, interpreted, and negotiated.

The Pescara test project demonstrates a model of tactical urbanism that is financially sustainable, institutionally embedded, and designed for replicability. The deliberate choice of reversible, low-cost interventions makes it accessible to municipalities with limited resources. At the same time, its connection to long-term planning objectives ensures that tactical experimentation feeds into strategic urban transformation rather than remaining an isolated initiative.

A critical question concerns the tension between local specificity and generalisability. The framework is deliberately grounded in a specific place, community, and institutional context. The indicators it generates are locally defined, reflecting the values, priorities, and capacities of the Santa Filomena community rather than universal standards. This is a strength in the context of critiques of evaluation frameworks, yet it raises questions about transferability. We suggest that what is transferable is not the specific indicators but the evaluative structure, the four-dimensional framework, the participatory methodology, and the theoretical lens of extended cognition, which can be adapted to generate locally meaningful indicators in different contexts.

Finally, the framework raises important questions about temporality and sustainability. The school street model depends on regular, predictable activation to function as cognitive infrastructure. If closures are irregular or discontinued, the conditions for cognitive extension (reliability, accessibility, trust) are no longer met. This observation has

implications for urban policy: school streets are not one-off events but institutional commitments requiring ongoing support. The Pescara project addresses this challenge by investing in community capacity building and documenting a replicable operational model, but the long-term sustainability of such initiatives remains an open question, warranting further research.

8. Conclusion

This paper has proposed a framework for understanding school streets as extended cognitive spaces, external structures that, when reliably coupled with children's internal processes through regular activation, become constitutive components of cognition itself. Grounded in extended and embodied mind theory, affordance theory, and tactical urbanism, the framework integrates four evaluation dimensions through a mixed-methods, longitudinal approach that positions children and families as co-researchers. The "Pescara Feet on Colors" project, treating the street as a slowly evolving painting through layered chromatic interventions and modular furniture, demonstrates that low-cost tactical actions can produce richly affordant, cognitively enabling, and aesthetically compelling public spaces. As the project advances through its implementation phases, empirical data will test and refine the theoretical propositions advanced here. The core contribution is a shift in evaluative logic: from asking what features a space possesses to asking what cognitive and social processes it enables. What is transferable across contexts is not any specific set of indicators but the evaluative structure itself: a replicable architecture for generating locally grounded assessments of how ephemeral, participatory, community-driven interventions produce spatial justice and developmental flourishing for children. Future publications will report longitudinal findings on how temporally activated school streets shape children's spatial cognition, social development, and autonomous mobility.

Acknowledgement

The authors worked together on the conceptualization and methodology of the paper. Specifically, Luciana Mastrodonardo (L.M.) wrote Section 2 (Theoretical Framework), Section 5 (Evaluation Framework, Sections 5.1–5.5) and Section 6 (Preliminary Findings); Stefania Gruosso (S.G.) wrote Section 4 (Proximity Design Strategy), the introduction to Section 5, and Section 7 (Discussion); Chantal Zurlo (C.Z.) wrote Section 3 (Context and Project Genesis). All authors wrote the Abstract, Introduction and Conclusions. All authors reviewed and edited the final manuscript.

AI Tools Disclosure

In accordance with the journal's authorship and AI tools policy, we disclose that AI language tools were used in a supporting capacity during the preparation of this manuscript. Specifically, AI assistance was employed to improve the English translation and phrasing of certain passages, and to support the production of the methodology diagram and the stakeholder map included in the paper. The authors remain fully responsible for all content, interpretations, and conclusions presented in the manuscript.

References

- Carmona, M. (2019) 'Principles for public space design, planning to do better', *Urban Design International*, 24, pp. 47–59. Available at: <https://doi.org/10.1057/s41289-018-0070-3>.
- Christensen, P. and O'Brien, M. (2003) *Children in the City: Home, Neighbourhood and Community*. London: Routledge Falmer.
- Clark, A. and Chalmers, D. (1998) 'The extended mind', *Analysis*, 58(1), pp. 7–19.
- Gallagher, S. (2005) *How the Body Shapes the Mind*. Oxford: Oxford University Press.
- Gehl, J. (2011) *Life Between Buildings: Using Public Space*. Washington, DC: Island Press.
- Gibson, J.J. (1979) *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin.
- Gill, T. (2007) *No Fear: Growing Up in a Risk-Averse Society*. London: Calouste Gulbenkian Foundation. Available at: <https://rethinkingchildhood.com/wp-content/uploads/2010/10/no-fear-19-12-07.pdf>.
- Gruosso, S., Del Signore, M. and Di Cinzio, A. (2025) 'The extended mind of public space: how urban design shapes human experience', *Frontiers in Built Environment*, 11, 1504549. Available at: <https://doi.org/10.3389/fbuil.2025.1504549>.
- Hart, R. (1979) *Children's Experience of Place*. New York: Irvington.
- Heft, H. (1988) 'Affordances of children's environments: a functional approach to environmental description', *Children's Environments Quarterly*, 5(3), pp. 29–37.
- Heller, E. (2004) *The Psychology of Colour: How Colours Affect Feelings and Reasoning*. Barcelona: Editorial Gustavo Gili.
- Hillman, M., Adams, J. and Whitelegg, J. (1990) *One False Move: A Study of Children's Independent Mobility*. London: Policy Studies Institute.
- Kyttä, M. (2004) 'The extent of children's independent mobility and the number of actualized affordances as criteria for child-friendly environments', *Journal of Environmental Psychology*, 24(2), pp. 179–198.
- Lefebvre, H. (1991) *The Production of Space*. Translated by D. Nicholson-Smith. Oxford: Blackwell.
- Lydon, M. and Garcia, A. (2015) *Tactical Urbanism: Short-term Action for Long-term Change*. Washington, DC: Island Press.
- Malone, K. (2007) 'The bubble-wrap generation: children growing up in walled gardens', *Environmental Education Research*, 13(4), pp. 513–527.
- Mastrolonardo, L. and Nanni, A. (2024) 'Active times and public space: spatial devices and affordances for sharing urban space', *Rivista Italiana di Ergonomia*, 28. Available at: https://www.societadiergonomia.it/page-section/rivista-italiana-di-ergonomia_n-28/.
- Mehta, V. (2013) *The Street: A Quintessential Social Public Space*. London: Routledge.
- Pozzi, C. and Potenza, D. (2008) *Pescara, a Changing City*. Pescara: Carsa Editore.
- Rissotto, A. and Tonucci, F. (2002) 'Freedom of movement and environmental knowledge in elementary school children', *Journal of Environmental Psychology*, 22(1–2), pp. 65–77.
- Shaw, B. et al. (2015) *Children's Independent Mobility: A Comparative Study in England and Germany (1971–2010)*. London: Policy Studies Institute.
- Tonucci, F. (1996) *La città dei bambini*. Rome: Laterza.
- Varela, F.J., Thompson, E. and Rosch, E. (1991) *The Embodied Mind: Cognitive Science and Human Experience*. Cambridge, MA: MIT Press.
- Whyte, W.H. (1980) *The Social Life of Small Urban Spaces*. New York: Project for Public Spaces.