

Reimagining Play Spaces: A Visual–Verbal Video Analysis of Children’s Spatial Behavior and Material Engagement in Early Learning Environments

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Abstract

This study explores how recycled tyres as sustainable play materials influence the spatial behavior and developmental outcomes of preschool children. Drawing on Visual–Verbal Video Analysis (VVVA), the research investigates the dynamic interactions between children, materials, and space in two urban preschools in Accra, Ghana. Forty-five children aged 2–4 years were observed over a three-month period through video recordings, field notes, and photographic documentation. Using Nicholson’s Loose Parts Theory and spatial affordance principles, recycled tyres were introduced into play environments to encourage creativity, movement, and cooperative engagement. Data were analyzed through VVVA, integrating visual and verbal modalities to identify patterns across five play types—constructive, dramatic, physical, cooperative, and games with rules. Findings revealed that recycled tyres enhanced open-ended exploration, spatial coordination, and peer collaboration, fostering both cognitive and socio-emotional growth. The integration of VVVA themes and spatial dimensions (as summarized in Tables 1 and 2) demonstrated that material flexibility, spatial layout, and group interaction collectively shape children’s play experiences. The study contributes to early childhood and environmental design research by showing how sustainable materials can transform play spaces into inclusive, developmentally enriching environments. Implications for preschool design, sustainability education, and child-centered learning are discussed.

Keywords: *recycled materials, spatial play, Visual–Verbal Video Analysis (VVVA), early childhood education, sustainable design, loose parts theory, spatial behavior.*

Introduction

Play is a vital component of childhood development, contributing to children’s physical, cognitive, social, and emotional growth. In recent years, growing attention has been directed toward how spatial design and material environments shape children’s play behavior and engagement. Within architectural and early childhood design research, play spaces are no longer seen as neutral backdrops but as active mediators of behavior, imagination, and learning (Clark, 2010; Ginsburg, 2007). As global efforts move toward sustainable design, the reuse of materials—such as tyres, wood, or metal parts—has emerged as a crucial practice that not only supports environmental sustainability but also enhances the diversity of play opportunities available to children (Fjørtoft, 2004; Maxwell et al., 2008). The study builds on this growing intersection between environmental design and child development, examining how the reuse of tyres as loose play materials stimulates children’s spatial behavior and learning in outdoor environments.

In Ghana and other sub-Saharan African contexts, school play spaces often rely on improvised materials due to financial constraints. However, this limitation presents a unique opportunity to explore innovative, child-centered design approaches that integrate upcycled materials as meaningful spatial elements. The creative use of such materials allows children to reinterpret ordinary objects, transforming them into tools for exploration, dramatization, and cooperation (Herrington & Brussoni, 2015). In this study, we focus on how the presence of reused tyres in play areas influences children’s spatial engagement—the ways they occupy, move through, and interact within outdoor spaces. Using the Visual–Verbal Video Analysis (VVVA) framework, the research observes, interprets, and documents the visual patterns of spatial behavior among children, connecting architectural form with developmental theory.

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This inquiry is guided by the assumption that well-designed spatial affordances, even from repurposed materials, can enhance children's play intensity, creativity, and social collaboration (Gibson, 1979; Moore & Cosco, 2010). The study therefore seeks to understand not only how children play, but also how spatial and material configurations—including reused tyres—mediate the relationship between body, environment, and imagination in play.

Theoretical Framework

This study is underpinned by socio-constructivist and ecological theories of play and spatial behavior, primarily drawing on the works of Vygotsky (1978) and Piaget (1962), while integrating architectural and environmental behavior perspectives. Vygotsky's theory emphasizes that learning and cognitive growth occur through social interaction and mediated activity. Within play, children use symbols and tools—including spatial and material elements—to construct meaning collaboratively. The reuse of tyres as open-ended play materials thus functions as both a social and symbolic tool, enabling shared construction of imaginative spaces that scaffold children's learning and cooperation.

Complementarily, Piaget (1962) posited that play reflects stages of cognitive development, evolving from sensorimotor exploration to symbolic and rule-based play. From this lens, spatial design and material reuse afford opportunities for children to negotiate meaning through direct manipulation of their environment. The physical act of climbing, stacking, or transforming tyres corresponds with developing spatial reasoning and abstract thinking skills.

From an architectural standpoint, spatial affordance theory (Gibson, 1979; Heft, 1988) offers a bridge between developmental psychology and environmental design. Affordances refer to the action possibilities that environments provide to users. Reused materials such as tyres serve as loose equipment (Nicholson, 1971) which expand the affordances of play spaces by encouraging creative reinterpretation and flexible use of space. The VVVA framework (Jewitt, Bezemer, & O'Halloran, 2016) complements these perspectives by offering a multimodal analytic lens that captures how visual, verbal, and embodied interactions within a spatial setting produce meaning (Khan & Kaewsang-On Saeed, 2019). It allows architectural researchers to analyze how children visually navigate and transform spaces, linking environmental design to behavioral outcomes.

Together, these frameworks reorient the study toward a spatial-material understanding of play, positioning children not just as users of space but as co-designers and interpreters of the built environment. Through the reuse of materials and adaptive spatial engagement, children demonstrate how architecture can be experienced as a living, performative medium, shaping their sense of agency, identity, and environmental awareness.

Methodology

Research Design

This study adopted a qualitative observational design rooted in the interpretivist paradigm. The aim was to explore how recycled tyres, when introduced into preschool play environments, influence children's spatial behavior, creativity, and social interaction. The design emphasizes naturalistic inquiry, allowing children's spontaneous play behaviors to unfold in context without researcher interference (Creswell & Poth, 2018).

Research Setting and Participants

The study was conducted in two urban preschools in Accra, Ghana, each incorporating recycled tyres into their outdoor learning environments. These schools were purposefully selected for their contrasting spatial layouts and design philosophies—one with an open, natural landscape and the other with structured play zones.

Participants included 45 children aged 2-4 years and 8 caregivers who supervised or facilitated play. The children represented mixed socio-economic backgrounds, providing a diverse sample for observing spatial engagement and interaction. Ethical clearance was obtained from the university's ethics review board, and informed consent was secured from the school administrators, caregivers, and parents.

Materials and Play Environment

Recycled car tyres of varying sizes were cleaned, sanitized, and painted in bright colors. They were arranged as open-ended loose parts, in line with Nicholson's (1971) *Loose Parts Theory*, which posits that flexible materials enhance children's exploration and creativity. The tyres were integrated into the play environment as movable, stackable, and transformable objects, encouraging both unstructured play and games with rules. This approach aligns with sustainable spatial design principles emphasizing reuse, adaptability, and inclusivity (Elliott & Årlemalm-Hagsér, 2019; Fjørtoft, 2004).

Data Collection

Data were collected through:

1. Video Recordings:

Continuous CCTV recordings captured daily outdoor play sessions over three months. The video data provided rich visual and auditory information for analyzing children's movements, gestures, and spoken interactions.

2. Field Notes:

Observers documented spatial use patterns, group interactions, and object manipulation. Spatial maps were drawn to document how children occupied and moved through the play area during specific play sequences (Heft, 1988).

3. Photographic Documentation:

Still images captured key moments of material interaction and spatial transformation (e.g., tyre stacking, rolling, or cooperative carrying). These visuals supplemented VVVA coding by providing static representations of spatial arrangements.

Data Analysis

Data were analyzed through Visual-Verbal Video Analysis (VVVA), a multimodal interpretive approach that emphasizes the interaction between spatial movement, verbal expression, and material affordance (Fazeli et al., 2020). Each video segment was coded for:

- Type of play (constructive, dramatic, physical, cooperative, games with rules)
- Spatial dimension (object manipulation, movement flow, social grouping, environmental engagement)
- Developmental outcome (motor, cognitive, social, and emotional skills)

Coding followed a thematic reflexive process (Braun & Clarke, 2019), where emergent patterns were iteratively compared across visual and verbal modalities. Table 1 and Table 2 (from the results section) summarize the integration of VVVA categories with observed spatial behaviors.

Triangulation of data sources-video, notes, and images-ensured reliability and interpretive depth. Reflexive memos were used to record analytical decisions and researcher reflections, enhancing transparency and validity (Nowell et al., 2017).

Data were interpreted using the Visual-Verbal Video Analysis (VVVA) framework (Fazeli et al., 2020), which integrates multimodal data-visual (movement, gesture, space use) and verbal (speech, expression, symbolic representation)- to construct a layered understanding of play activity. This framework is particularly suited for architectural and early childhood contexts where visual space and social interaction intersect (Kytä, 2004; Woolner, 2018).

Ethical Considerations

Ethical standards were maintained throughout data collection and analysis. Pseudonyms replaced all participant identifiers, and video data were securely stored with access limited to the research team. Consent forms explicitly outlined the purpose, confidentiality, and right to withdraw. The use of recycled materials also followed local environmental safety standards to ensure children's physical safety during play.

Results and Discussion

Overview of Findings

The Visual–Verbal Video Analysis (VVVA) revealed (ref table 1) that recycled tyres facilitated a diverse range of play types—constructive (creating something), functional (simple repetitive moves), dramatic (imagining and imitating everyday roles), cooperative (playing together towards one goal), and games with rules (Berk, 2018). These activities represented not only children’s creative adaptation to space but also the dynamic relationship between material reuse, spatial cognition, and social learning.

By integrating visual (movement, gesture, arrangement) and verbal (dialogue, narration) cues (ref. table 2), VVVA enabled an in-depth interpretation of how children actively *constructed* and *co-authored* space through play. This co-production of spatial meaning supports Piaget’s (1962) theory of cognitive constructivism, Vygotsky’s (1978) sociocultural learning framework, and Nicholson’s (1971) Loose Parts Theory. Two dominant categories—Unstructured Play and Games with Rules—emerged, but within them, play was fluid and hybrid, combining symbolic and physical interactions that reinforced social collaboration and embodied understanding of spatial relationships.

Unstructured Play and Spatial Exploration

Unstructured play provided the richest evidence of children’s spontaneous spatial learning. Children transformed tyres into vehicles, tunnels, and towers, turning the playground into a site of architectural imagination. As seen in one video segment, children built a tyre tower while shouting, “Let’s make it taller!”—a clear manifestation of constructive play and spatial reasoning. This aligns with Piaget’s (1962) notion of children as active constructors of knowledge through manipulation and experimentation.

Dramatic play emerged when children imitated bus conductors shouting “Kaneshie last stop!”—a distinctly Ghanaian urban experience. Here, the playground became a cultural landscape, reflecting children’s lived experiences and socio-spatial awareness. The recycled tyres provided both the *material* and *symbolic* foundation for this narrative expression.

Games with Rules and Structured Spatial Learning

Children also demonstrated structured play through “goalpost” and “ball toss” games, showing the use of tyres to define boundaries and order within open space. The verbal cues—“Wait for your turn!”—revealed rule-following, fairness, and self-regulation, reflecting the transition from egocentric to socialized behavior described by Vygotsky (1978) and Whitebread et al. (2012). Similarly, tyre hopping sequences revealed how children internalized rhythm and balance through movement, forming kinesthetic understanding of space. Each act of play was a spatial negotiation—defining, reconfiguring, and adapting material and social structures in real time.

Table 1: Summary of VVVA Play Segments

Play Category	Type of Play	Visual Observation	Verbal Element	Core Learning/Developmental Outcome
Unstructured	Constructive	Children stacked and climbed tyres	“Let’s make it taller!”	Spatial reasoning, collaboration
	Dramatic	Pretending to drive bus	“Kaneshie last stop!”	Symbolic play, cultural learning
	Cooperative	Carrying tyres together	“You take this side...”	Teamwork, gross motor coordination
	Physical	Tyre seesaw	“You’re heavier!”	Physics concepts, balance awareness
Games with rules	Physical	Tyre goalposts	“Wait for your turn!”	Rule-following, self-regulation
	Physical	Ball tossing	“Good job!”	Eye-hand coordination, encouragement
	Physical	Tyre hopping	“We’ll wait for you.”	Patience, peer cooperation

Figure 1: Conceptual Summary of VVVA Findings

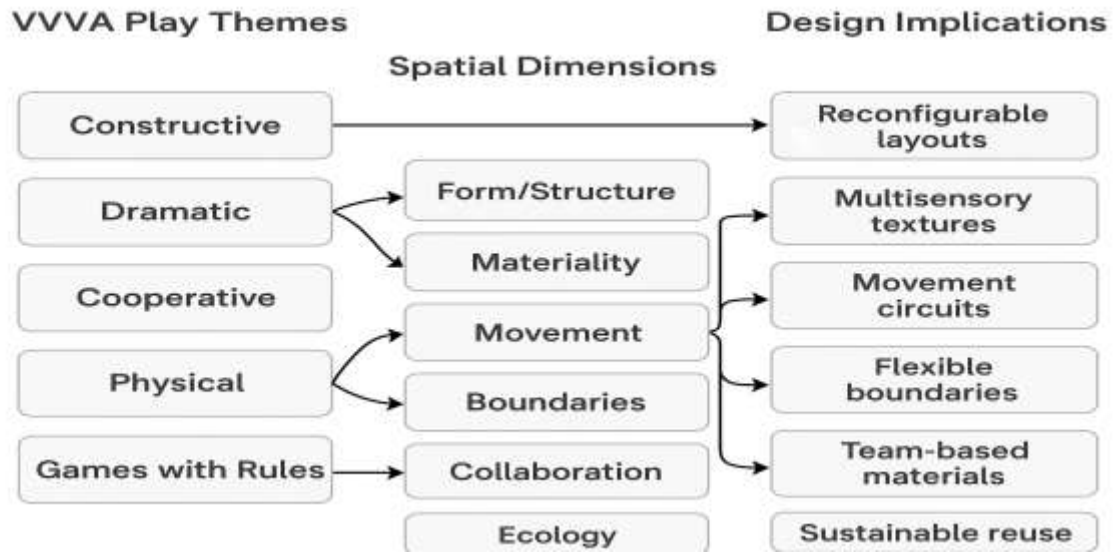


Table 2: VVVA-Derived Themes Categorized by Spatial Dimension

Spatial Dimension	VVVA Play Themes	Illustrative Observation (Visual-Verbal)	Spatial Interpretation	Developmental and Educational Implications	Design Insight for Play Spaces
Form and Structure	Constructive Play; Games with Rules	"Let's make it taller!"	Tyres as modular architectural forms defining height and proportion	Enhances spatial reasoning and geometry understanding	Modular, reconfigurable play units
Materiality and Texture	Dramatic; Cooperative Play	"I'm driving to Kaneshie!"	Recycled rubber texture promotes tactile exploration	Stimulates sensory integration and symbolic thinking	Mix natural/recycled textures
Movement and Kinetics	Physical; Tyre Hopping	"You're heavier!"	Space understood through rhythm and motion	Promotes gross motor coordination	Continuous circuits for movement
Boundaries and Spatial Order	Games with Rules	"Wait for your turn!"	Tyres define spatial zones and order	Builds fairness and rule-following	Flexible boundary markers
Social Collaboration	Cooperative Play	"You take this side!"	Shared manipulation of materials	Encourages teamwork and empathy	Cooperative-use materials

Spatial Dimension	VVVA Play Themes	Illustrative Observation (Visual–Verbal)	Spatial Interpretation	Developmental and Educational Implications	Design Insight for Play Spaces
Cultural Symbolism	Dramatic Play	“Mate! Last stop!”	Culturally grounded imaginative spaces	Reinforces identity and belonging	Integrate local symbols and colors
Ecological Awareness	All Play Types	Children stack tyres after play	Play as stewardship of reused materials	Builds environmental responsibility	Use recyclable, local materials

Interpretation and Implications

The integrated results (Tables 1 & 2; Figure 1) reveal that children’s play behaviors are deeply architectural—they design, test, and inhabit spatial ideas through embodied experimentation. The reuse of materials, such as tyres, becomes both an ecological act and a design process, showing that sustainability and child development can coexist through creative spatial engagement.

Children’s manipulation of reused materials reinforces ecological consciousness—as they stack, and reassign tyres, they model stewardship and circular use, reflecting early environmental ethics (UNCRC, 1989; NAEYC, 2013). The findings also illustrate how cultural scripts shape spatial play, showing that design for children should resonate with local identity rather than import universalized playground models.

Implications for Play Space Design and Educational Policy

1. Spatial Flexibility – Playgrounds should allow children to rearrange and redefine boundaries, fostering spatial reasoning and autonomy.
2. Material Diversity and Reuse – Integrating recycled tyres and natural materials promotes sustainability and sensory engagement.
3. Cultural Embedding – Incorporate locally recognizable forms, colors, and narratives to affirm identity and belonging.
4. Collaborative Design – Provide materials and layouts that encourage teamwork and shared problem-solving.
5. Environmental Education Integration – Link material reuse in playgrounds to ecological literacy in the curriculum.

Through these, play becomes an architectural laboratory where children learn to negotiate social, spatial, and environmental systems—transforming discarded materials into meaningful spatial experiences.

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Appendix: Sample photos



Figure 2. Child sitting on a tyre and pretending to drive a car (Symbolic play).

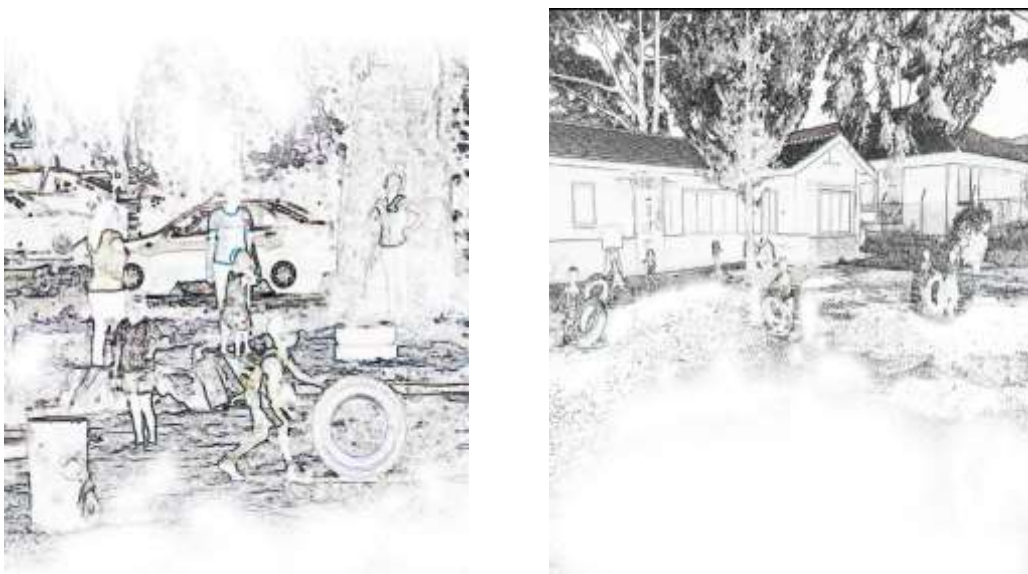


Figure 3. Children rolling tyres while imitating a Ghanaian “mate” (Dramatic play).

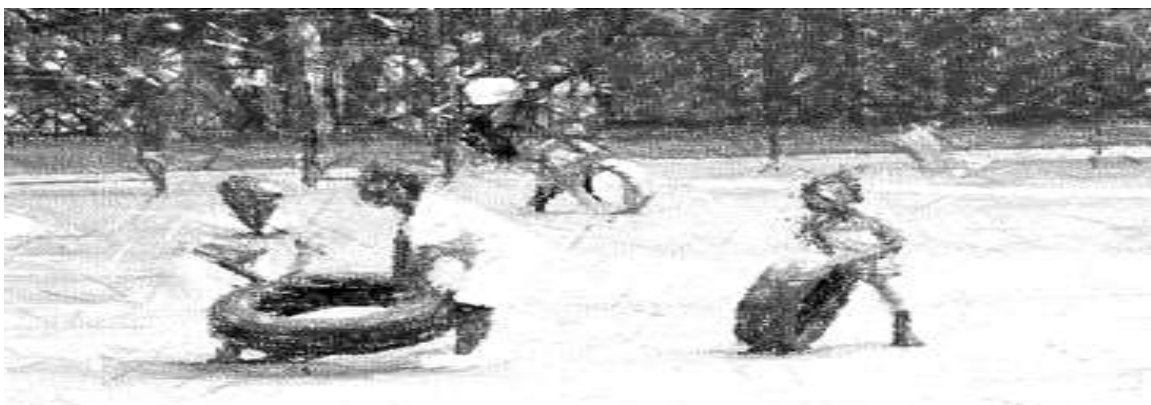


Figure 4. Children carrying tyres to storage together (Cooperative play).

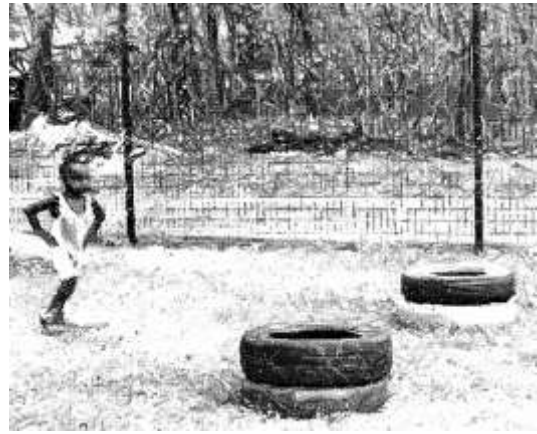
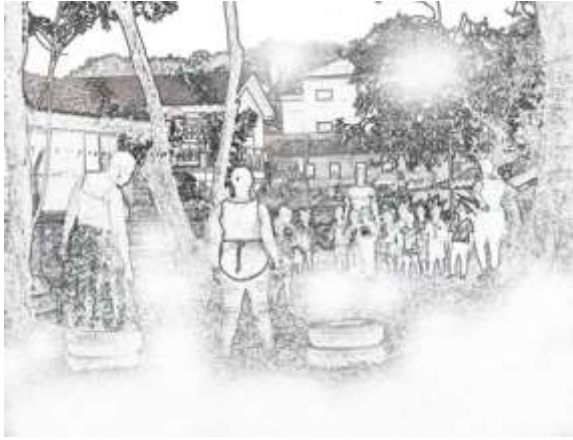


Figure 5. Tyres stacked as goalposts for kicking game (Game with rules).

Figure 6. Children throwing balls into stacked tyres (Hand-eye coordination).



Figure 7. Children hopping through tyres arranged in a line (Gross motor play).