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CONCEPTUAL FOUNDATIONS OF THE DESIGN OF MULTIMODAL SYMBOLIC SYSTEMS FOR CHILDREN'S SPACES

Liu Jianfeng[1], Skliarenko Nataliia Vladyslavivna[2]
[1] Postgraduate Student at the Department of Graphic Design,
Kyiv National University of Technologies and Design, Kyiv, Ukraine,
e-mail: lccw7846@gmail.com, orcid: 0009-0000-8012-3980
[2] Doctor of Study of Art, Professor,
Professor at the Department of Architecture and Design,
Lutsk National Technical University, Lutsk, Ukraine,
e-mail: nata_skliarenko@ukr.net, orcid: 0000-0001-9188-1947

Abstract. ***Purpose.*** *This article clarifies the conceptual foundations for designing multimodal symbolic systems in children's spaces. It interprets the Perception–Action–Feedback (PAF) cycle as a design structuring logic and uses that logic to explain how visual, tactile, and auditory cues can work together as one spatial communication system. The aim is to show how multimodal cues can be organized coherently in child-centred environments.*

Methodology. *The study adopts a systematic design-research approach that combines conceptual analysis, a synthesis of recent work on multimodal wayfinding and experiential graphic design, and a comparative reading of built cases. Three documented cases from museum and healthcare settings are examined to map how cue hierarchy, spatial sequencing, and confirmation mechanisms are structured through the PAF lens. The analysis is interpretive and design-oriented rather than experimental.*

Results. *The article defines multimodal symbolic systems as spatial communication infrastructure and frames multimodality as coordinated cue organization rather than simple sensory layering. It develops a design-oriented reading of PAF in which perception supports identity and legibility, action supports movement and decision-making, and feedback supports confirmation and recovery. From this, the study derives a concise set of design implications and shows, through three cases, how the framework can be used to compare system organization across different children's environments.*

Scientific novelty. *The study reinterprets PAF as a design logic for multimodal symbolic systems and brings together a system-based account of identity, legibility, sequencing, and confirmation in children's spaces. It also shifts discussion away from isolated cue variables toward the coordinated organization of symbolic environments.*

Practical relevance. *The study offers a design-oriented framework that can support the planning and evaluation of multimodal symbolic systems in children's spaces. Its results may be useful for designers, educators, museum planners, and healthcare professionals involved in shaping child-centered environments, particularly when organizing cue hierarchy, route sequencing, and confirmation mechanisms across different spatial settings.*

*Keywords**:** multimodal symbolic systems, children's spaces, wayfinding design, signs, routes, visual cues, tactile cues, auditory cues, spatial guidance, confirmation, PAF cycle.*

INTRODUCTION

Children's spaces, such as museums, libraries, schools, and pediatric service environments, have become increasingly complex in both layout and information structure. This complexity is related to the growing combination of open-plan zoning, themed environments, interactive media, and layered guidance systems. For adults, these environments may already demand sustained attention and quick interpretation, but adult users are generally more capable of reading longer text, interpreting abstract symbols, and connecting information distributed across different points in space. For children, the challenge is usually sharper because successful navigation depends more on age-appropriate sign design: salient landmarks, simple and concrete visual cues, and repeated confirmation are often more effective than dense text or highly abstract symbolic information. In this article, "children" refers broadly to users aged approximately 3–12 years, spanning early childhood, preschool, and primary school. This group is not treated as homogeneous: wayfinding ability changes markedly with reading fluency, attention stability, and independence level. For clarity, the discussion distinguishes three practical bands—roughly 3–5, 5–7, and 7–12. Although the PAF cycle remains relevant across these stages, the balance between modalities shifts: younger children rely more on salient anchors and frequent confirmation [14], whereas older children can interpret more abstract symbol conventions and sustain multi-step navigation with less dense feedback [13]. Broader reviews of children's wayfinding research also support the need to recognize such developmental differences in design [27]. Within spatial design, symbol systems are therefore better understood as communication infrastructure than as a loose collection of independent signs. They connect place identity, route logic, and expected action, distributing meaning across surfaces, junctions, thresholds, and transitions rather than concentrating it in a single sign panel. This system perspective is especially important in children's spaces, where orientation often depends on repeated cues, environmental anchors, and clear confirmation rather than on long stretches of text. Although multimodal approaches are increasingly discussed in relation to wayfinding and experience design, practice still often treats modalities as parallel add-ons instead of as parts of one coordinated system. Visual, tactile, and auditory cues may all be present, but their roles are not always clearly differentiated or aligned. As a result, multimodality can become dense rather than helpful, adding stimulation without necessarily improving legibility or movement.

A further limitation in the literature is the gap between modality-specific findings and system-level design logic [12; 19]. Many studies examine separate variables, such as colour coding, sign placement, landmarks, tactile maps, or audio prompts, but fewer explain how these cues should be organized together as a coherent symbolic environment. That gap matters in practice, because designers rarely work with one variable at a time; they shape whole routes, thresholds, decision points, and confirmation moments. To address this gap, the article adopts the Perception–Action–Feedback (PAF) cycle as a conceptual framework for organizing multimodal symbolic systems in children's spaces. In this study, PAF is used as a design structuring logic linking cue hierarchy, spatial sequencing, and confirmation within one coherent spatial communication system.

ANALYSIS OF RECENT RESEARCH

Recent work relevant to multimodal symbolic systems in children's spaces can be grouped into three design-oriented streams: experiential graphic design (EGD/XGD) as spatial communication, multimodal wayfinding and accessibility research, and multisensory experience design in museums and public environments. Together, these streams provide useful pieces of the puzzle, but they do not yet offer a consolidated framework for organizing multimodal symbolic systems in child-centred settings.

The first stream comes from experiential and environmental graphic design, where wayfinding is treated as part of the spatial system rather than something added afterward. Petković et al. discuss experiential graphic design as an integrated spatial practice and emphasize identity, hierarchy, sequencing, and the coordination of graphic and environmental cues in physical environments [19]. Jamshidi and Pati focus on the role of maps and signage in interior wayfinding and indicate that navigation depends not only on the presence of signs, but also on how information is organized and encountered in real movement situations [10]. De Villiers et al. examine a university wayfinding system from the perspective of linguistic inclusivity and indicate that spatial communication also depends on how visual and verbal information are structured for diverse users [6].

A second stream focuses on multimodal wayfinding and accessibility, often prompted by the needs of users with different sensory abilities. Giudice et al. examine cognitive mapping without vision and compare learning from digital touchscreen-based multimodal maps with embossed tactile overlays, showing that multimodal supports can improve navigation and spatial learning [8]. Kuriakose et al. review multimodal navigation systems for users with visual impairments and note that adding channels does not automatically produce clarity unless the modalities are meaningfully coordinated [12]. Ottink et al. investigate how auditory, haptic, and multimodal information support cognitive map formation in persons with blindness, again suggesting that effectiveness depends on how different channels are structured and combined [18].

A third stream looks at multisensory experience design in museums and related public environments. Luo et al. argue that multisensory museum environments can deepen engagement, memory, and participation, but they also warn that sensory richness needs structure if it is to remain legible [15]. Zhang et al. examine museum sensory experiences and indicate that visual, auditory, and physical expression can shape visitors' emotional resonance and place identity [28]. Pietroni discusses multisensory museums and hybrid realities, emphasizing that real collections, digital content, and exhibition layout need to be effectively integrated if multisensory communication is to remain meaningful and authentic [20]. This point is especially relevant to children's spaces, where stimulation can support exploration but can also become distracting if cues are not well organized.

Across all three streams, the same limitation keeps surfacing: the literature is rich in context-specific findings and modality-specific insights, yet still relatively thin when it comes to a unified design logic for coordinating symbolic cues as one system.

PURPOSE

The purpose of this article is to clarify the conceptual foundations of multimodal symbolic systems in children's spaces. To address this question, the article develops a design-oriented interpretation of the PAF cycle and uses it to derive practical implications for child-centred environments.

To achieve this purpose, the article proceeds in three steps: 1) define the key concepts related to multimodal symbolic systems in children's spaces, with particular attention to the roles of visual, tactile, and auditory cues; 2) interpret the PAF cycle as a design structuring principle for cue hierarchy, spatial sequencing, and confirmation mechanisms; 3) apply this interpretation to the comparative analysis of representative cases from museum and healthcare environments in order to derive design-oriented implications for multimodal coordination.

RESULTS AND DISCUSSION

Case-based application of the conceptual framework. The proposed conceptual framework and the PAF structuring logic are applied to three built cases drawn from different spatial typologies: a children's museum (Cayton Children's Museum) and two healthcare environments (Nationwide Children's Hospital and SickKids Patient Support Centre). These cases were selected because they move beyond isolated sign objects and provide enough project or user-facing documentation to support system-level mapping of cue hierarchy (perception), spatial sequencing (action), and confirmation/recovery (feedback).

The analysis focuses on how multimodal cues are organized as a spatial communication system through code coherence across channels, continuity along routes, and confirmation points at transitions and decision nodes rather than on isolated sign features [10]. To support cross-case comparison, the study compiled publicly available project descriptions and representative images for each site, along with user-facing wayfinding information such as campus maps or path instructions when available. The mapping followed four steps: identifying key navigation moments, especially entrances, junctions, vertical circulation points, and zone thresholds; extracting multimodal cues and grouping them by channel (visual, tactile, auditory, and interactive feedback); coding each cue group by function through the PAF lens – Perception (identity, hierarchy, legibility), Action (sequencing and staged decision support), and Feedback (confirmation, checkpoints, and recovery/re-entry support); and summarizing how these components work together to support legibility, movement continuity, and confirmation/recovery as one coherent spatial communication system.

Cayton Children's Museum is most useful as a case of coordinated multimodality within an exploratory environment, where strong visual zoning, tactile accents, and interactive media operate not as separate additions but as parts of one coherent symbolic system (Fig. 1) [1]. Particularly clear here is the principle of sensory hierarchy and visual dominance. Bold colour bands and high-contrast environmental graphics establish the primary layer of orientation, giving each zone an immediate identity and allowing children to recognize spatial differences without relying heavily on sustained reading. Within this dominant visual structure, tactile details do not compete for attention; instead, they function as secondary cues that reinforce interpretation at transitions and decision points. This relationship matters because it shows that multimodality in

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children's spaces can become effective not when every channel speaks at once, but when channels are differentiated in role and coordinated within a stable visual order. A related feature of the case is the way digital interactive elements contribute to feedback. Rather than functioning only as entertainment, responsive media at key nodes can be read as event-based confirmation: they mark arrival, reinforce location, and connect orientation with engagement. In this respect, Cayton suggests that multimodal symbolic systems in child-centred environments are most effective when experiential richness is organized through visual dominance, coordinated secondary cues, and meaningful moments of confirmation.

Nationwide Children's Hospital is most effective as a case of sequential route support in a stress-sensitive healthcare environment, where path continuity, staged decision-making, and repeated confirmation are organized through a path-based guidance system (Fig. 2) [17]. The most distinctive feature of this case is the way route information is distributed along movement rather than concentrated in isolated signs. A simplified path map and color-coded path flooring stripes establish a strong primary code, allowing users to recognize direction and maintain orientation across corridors and transitional spaces [11]. This structure can become especially significant in healthcare settings, where stress and time pressure can quickly undermine legibility. What the case makes particularly clear is the principle of sequential route support: decision-making is guided through continuity, with simple three-part directions (Path/Elevator/Level) preparing the choice before a transition and then confirming it afterward. At the same time, the case also illustrates the principle of feedback-based recovery. Repeated path colours, destination identifiers aligned with the path system, and digital signage do not merely supplement the route; they stabilize it by offering predictable confirmation and helping users realign when uncertainty arises [7]. In this sense, Nationwide shows that effective guidance depends less on sign density than on the continuity, sequencing, and recoverability of information along the route.

SickKids Patient Support Centre provides the clearest example of integrated inclusivity, showing how tactile confirmation, high-contrast visual coding, and accessible symbolic language can be embedded within one coherent wayfinding system (Fig. 3) [21]. What makes this case especially valuable is that accessibility does not appear as a separate layer added for selected users; instead, it is built into the basic structure of orientation itself. High-contrast signage, a large pictogram set, and colour zoning establish a shared visual language that supports destination recognition while reducing dependence on written text [6]. This already points to the principle of integrated inclusivity, since the

Fig. 1. Multimodal wayfinding at Cayton Children's Museum: 1 – zone identity through bold color bands and tactile signage [1]; 2 – digital interactive node providing visual confirmation cues [5]

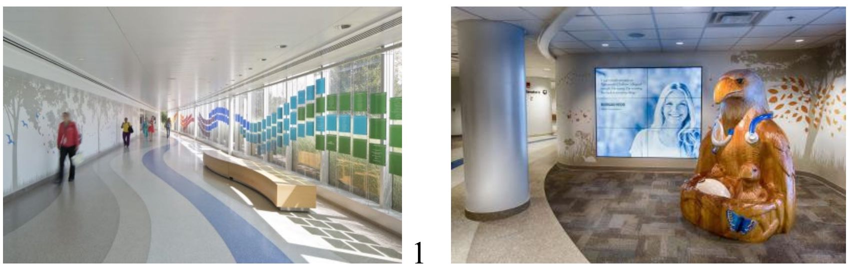

Fig. 2. Path-based wayfinding at Nationwide Children's Hospital: 1 – continuous color-coded route striping supporting corridor continuity [9]; 2 – landmark-based environmental cues supporting confirmation at nodes [2]

environment organizes visual communication in a way that can be used across linguistic and sensory differences rather than splitting users into parallel guidance tracks. At the same time, the case illustrates the principle of tactile confirmation with particular clarity. Tactile mapping at elevator banks, coordinated with tactile flooring, is positioned precisely where users are most likely to verify direction or recover from uncertainty. In this sense, tactility does not function as an isolated accessibility feature; it remains aligned with the same coding logic as the visual system and strengthens confirmation at key decision points [24]. Taken together, these features indicate that inclusive multimodal symbolic systems are most effective when accessibility is embedded in the core spatial language and when confirmation mechanisms are integrated into the moments where navigation is most vulnerable to error.

Taken together, the three cases indicate that the PAF framework offers a consistent way of comparing how multimodal symbolic systems are organized in children's spaces, as summarized in Table 1. Across the cases, perception is expressed through cue hierarchy and code coherence, action through sequencing and staged decision support, and feedback through confirmation and recovery. At the same time, these functions do not appear in identical forms. In Cayton Children's Museum, multimodal coordination is tied to exploratory movement, strong visual zoning, and event-based confirmation. In Nationwide Children's Hospital, the same logic is translated into a path-based guidance system in which continuity, sequencing, and repeated confirmation help stabilize navigation under conditions of stress and uncertainty. In SickKids Patient Support Centre, the framework can become most visible in the integration of inclusivity, tactile confirmation, and cross-level coherence within one shared symbolic language. What remains stable across the three cases is not the surface form of the system, but the underlying organizational logic through which multimodal cues support recognition, movement, and re-orientation.

Structural model of multimodal symbolic systems. Building on the case analysis, the PAF framework can be described as a structural model for understanding how multimodal symbolic systems work in children's spaces. In this context, a symbolic system is not treated as a loose collection of isolated signs, but as a form of spatial communication infrastructure [3]. It organizes information through the relationship among place identity, route legibility, and user action, so that meaning is distributed across surfaces, nodes, and transitions rather than concentrated in a single plaque [4]. From this perspective, system quality can become visible through consistency, hierarchy, and spatial sequencing [3; 19]. Research on multimodal navigation systems likewise suggests that simply multiplying channels does not guarantee better orientation; what matters is how different cues are distributed, aligned, and made to work together [12]. Seen in this way, multimodality can become effective not through accumulation, but through coordination. At the same time, the model assumes that orientation is shaped by the ongoing relation between perception and action rather than by static sign recognition alone [26].

This issue can become especially important in children's spaces, where the conditions of orientation differ from those of adult users. Research on children aged 8–12 shows that wayfinding performance is shaped by developmental differences in navigation and spatial learning [13], while studies of younger children emphasize the importance of salient landmarks and easily recognizable cues [14]. More broadly, reviews of children's wayfinding research indicate that reading fluency, attention stability, and

Table 1

Cross-case comparison of multimodal symbolic system structuring

Case	Perception: cue hierarchy & identity	Action: sequencing & decisions	Feedback: confirmation & recovery	Demonstrated design value
Cayton Children's Museum	Strong zone identity through color, graphics, and tactile accents	Exploration structured through zoning and route continuity	Interactive and digital confirmations reinforce orientation	Play-based legibility and engagement through coherent system design
Nationwide Children's Hospital	Simplified path map, consistent path color coding, and landmark cues	Path continuity supports junction decisions and reduces hesitation	Repeated markers and path coding confirm progress along the route	Stress-sensitive wayfinding through route continuity and predictable confirmation
SickKids Patient Support Centre	High-contrast signs, pictograms, and color zoning support floor and destination identity	Cross-level coherence supports vertical and horizontal transitions	Tactile maps, braille, and tactile flooring formalize confirmation and recovery	Inclusive symbolic infrastructure across ability and language differences

independence level all affect how children move through unfamiliar environments [27]. These conditions do not mean that children require reductively simplified settings, but they do suggest that cue hierarchy, confirmation, and environmental consistency take on greater importance. Within this framework, the Perception–Action–Feedback (PAF) cycle serves as the organizing principle for structuring multimodal symbolic systems in children's spaces. Here, perception refers to cue hierarchy and immediate legibility, action to route sequencing and decision support, and feedback to confirmation, correction, and re-entry after uncertainty. Used in this way, PAF turns complex symbolic environments into a workable model in which cues are perceived, acted upon, and confirmed in an iterative loop, linking symbolic planning to actual movement through space rather than leaving it at the level of abstract sign design. The relationships among these dimensions are summarized in Fig. 4.

More specifically, perception concerns the design of legibility and salience: how the symbolic system can become recognizable through a stable cue hierarchy [3]. In practice, this includes dominant visual codes, repeated environmental anchors, contrast, scale, and the distribution of supporting tactile or auditory cues. For children, perception is not simply a matter of seeing a sign; it is about quickly grasping what matters and what can safely be ignored. Action concerns spatial sequencing and decision support, describing how cues guide movement through routes, thresholds, and choice points [10]. In this sense, the symbolic system works like a choreography in which information is staged over time before a decision, at the decision, and after it [22] so that users do not need to decode everything at once and movement feels guided rather than interrupted. Feedback concerns confirmation and recovery. It describes how the system validates interpretation and supports re-orientation after uncertainty. In child-centred spaces, this function is especially significant, because hesitation can quickly accumulate into confusion when confirmation is weak or inconsistent. Taken together, these three dimensions show why PAF is useful as a structural model: perception organizes cue hierarchy and code coherence, action organizes sequencing across routes and decisions, and feedback organizes confirmation and recovery. In this sense, the

Fig. 3. Inclusive wayfinding at SickKids Patient Support Centre [21]: 1 – high-contrast environmental graphics and large pictograms supporting destination recognition; 2 – colour zoning and integrated graphic markers supporting corridor legibility

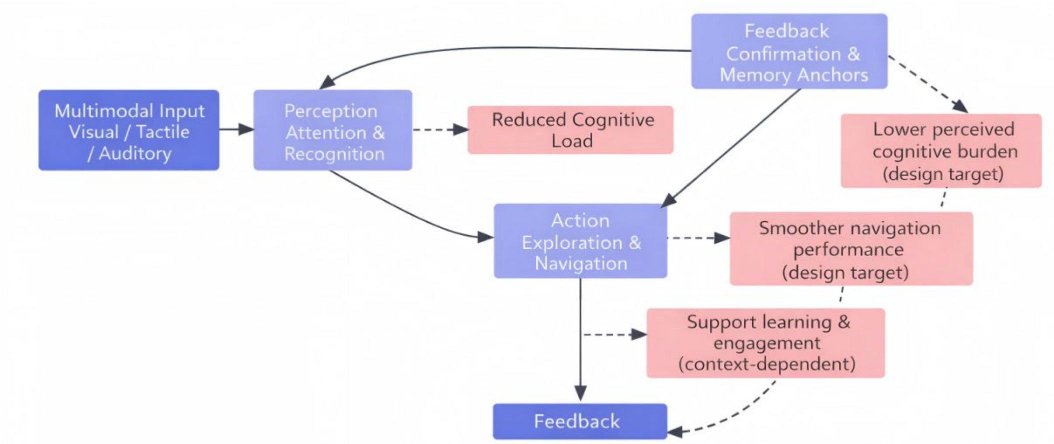

Fig. 4. Perception–Action–Feedback (PAF) model of multimodal symbolic systems. Created by the authors

model does more than provide an analytic vocabulary; it also offers a way of describing how multimodal symbolic systems hold together as one spatial communication structure.

Design implications for system organization. Derived from the conceptual foundations and the PAF structuring logic, the discussion points to several principles for organizing multimodal symbolic systems in children's spaces.

The principle of coordinated multimodality. Across both the literature and the examined cases, multimodality does not appear to work effectively as simple sensory accumulation; rather, it can become meaningful when different channels are given complementary roles within one coherent system. In this sense, visual coding tends to carry identity and route continuity, tactile information tends to support confirmation at nodes and transitions, and auditory or interactive cues tend to provide brief verification tied to meaningful spatial events [23]. This is especially visible in the Cayton Children's Museum, where strong visual zoning establishes spatial identity while tactile accents and digital interactive nodes reinforce interpretation at key moments. A related pattern appears in Nationwide Children's Hospital, where path colour, route markers, and digital confirmation cues all participate in the same guidance logic rather than operating as detached layers. What matters here is not the mere presence of multiple modalities, but the fact that they remain differentiated in role while still aligned within one dominant system.

The principle of sensory hierarchy and visual dominance. The environments examined here do not distribute attention evenly across all cues. Instead, they rely on a primary layer that supports immediate recognition and a secondary layer that supports confirmation, accessibility, or recovery. This distinction is particularly significant in children's spaces, where attention can be selective, unstable, and easily overdrawn by competing signals. More broadly, wayfinding research on selective attention also suggests that poorly prioritized information can undermine orientation, reinforcing the importance of sensory hierarchy in symbolic design [16]. In Cayton, bold colour bands and high-contrast environmental graphics clearly take the lead, while tactile accents remain supportive rather than attention-seeking. In Nationwide, the path-based colour system works as a continuous primary code across corridors and transitional spaces, while route identifiers and digital signage play a more confirmatory role. SickKids follows the same general logic: high-contrast signage, pictograms, and colour zoning define the dominant visual order of the environment, while tactile features reinforce that order without displacing it. Seen together, these examples suggest that symbolic systems become more legible when one cue layer carries recognition and continuity, and when additional modalities remain subordinate but still meaningful.

The principle of sequential route support. Here the important issue is not simply whether signs are present, but how information unfolds in time and space as users move. Route guidance can become more effective when it is staged in relation to movement – before a decision, at the decision, and after it – so that users are prepared, directed, and then reassured. This sequencing is particularly clear in Nationwide Children's Hospital, where continuous path coding and simple three-part directions support route decisions through anticipation and confirmation. In Cayton, zone identity remains visible through movement and helps organize exploration as a continuous narrative rather than a series of disconnected choices. SickKids shows the same logic in a more institutional form, where cross-level coherence and repeated visual markers help maintain continuity across corridor splits, elevator banks, and floor transitions. Route guidance, these cases suggest, depends less on the sheer number of signs than on the temporal and spatial staging of information along the user's path.

The principle of tactile confirmation. In the examined cases, tactile information is most effective not when it spreads continuously across the environment, but when it appears at moments where interpretation is likely to be checked. This is most evident in SickKids Patient Support Centre, where tactile mapping at elevator banks and tactile flooring are positioned at natural verification points and remain aligned with the visual coding logic of the environment. Cayton offers a softer version of the same principle: tactile accents appear near transitions and decision points, where they reinforce the museum's visual organization rather than functioning as a separate channel. What these examples show is that tactility contributes most meaningfully when it is tied to moments of verification and embedded in the same symbolic logic as the visual system.

The principle of feedback-based recovery. In all three cases, feedback does more than decorate or supplement the main guidance system; it helps stabilize orientation and supports reentry after uncertainty. In Nationwide, repeated path colours, destination identifiers, and simplified maps provide recognizable confirmation along the route and help users realign when they hesitate. In SickKids, tactile maps, braille, and tactile flooring extend this recovery function by offering explicit mechanisms for verification and re-orientation, especially for users with limited vision. Cayton handles feedback differently, since confirmation is tied more closely to interactive engagement and exploratory movement, yet even here digital and responsive elements still play an orienting role by marking progress and reinforcing location. The broader point is that feedback is not a finishing layer added after the fact; it is part of the infrastructure that keeps complex symbolic systems usable when uncertainty begins to build.

The principle of integrated inclusivity. Inclusive wayfinding appears strongest when accessibility features are embedded in the core symbolic language of the environment rather than attached afterward as a separate track for selected users [25]. This is most fully realized in SickKids, where high-contrast signage, pictograms, colour zoning, braille, tactile maps, and tactile flooring all participate in one coherent spatial language. The same tendency appears, in different forms, in Cayton and Nationwide, where visual identity, route logic, and confirmation mechanisms are designed as shared environmental cues rather than parallel systems for different user groups. In this sense, inclusivity depends less on multiplying special features than on ensuring that different modalities participate in a common logic of identity, sequencing, confirmation, and recovery.

Together, these principles describe how multimodal cues can be organized across perception, action, and feedback to support coherent navigation in children's spaces.

CONCLUSIONS

This article has clarified the conceptual foundations of multimodal symbolic systems in children's spaces by defining such systems as spatial communication infrastructure and by treating multimodality as coordinated cue organization rather than additive stimulation. Building on the case analysis, it has shown that the PAF framework can be used as a structural model for understanding how multimodal symbolic systems are organized through three interrelated dimensions: cue hierarchy and legibility at the level of perception, spatial sequencing and decision support at the level of action, and confirmation and recovery at the level of feedback. In this way, the study links symbolic planning not to isolated sign elements, but to the broader organization of recognition, movement, and re-orientation within one coherent system. The findings support a system-based understanding of multimodal symbolism in which visual, tactile, and auditory layers contribute distinct but aligned functions. When these functions are coordinated, spatial legibility can become stronger, movement can become easier to follow, and confirmation can become more dependable. Reduced cognitive burden is therefore better understood here not as an independent claim, but as a likely outcome of effective organization across cue hierarchy, route sequencing, and confirmation/recovery.

Limitations and future work. This study is conceptual and design-oriented, and its findings should be understood within that scope. The analysis relies on publicly available project materials and user-facing documentation rather than on-site observation, controlled user testing, or direct measurement of navigation performance. For this reason, the article does not claim to validate behavioural outcomes empirically; instead, it uses the selected cases to illustrate how the proposed framework can be applied comparatively and analytically. In addition, the present discussion is derived primarily from museum and healthcare settings, so its applicability to other child-centred environments, such as schools, libraries, or recreational facilities, remains to be examined further. Future research could extend this framework through age-banded user studies, field-based observation, and comparative testing of cue hierarchy, route sequencing, and confirmation or recovery mechanisms in a wider range of settings.

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АНОТАЦІЯ

Лю Цзяньфен, Скляренко Н. *Концептуальні основи проєктування мультимодальних символічних систем для дитячих просторів*

Мета. *У статті проаналізовано концептуальні основи проєктування мультимодальних символічних систем у дитячих просторах. Інтерпретовано цикл «Perception (Сприйняття) – Дія (Action) – Зворотний зв'язок (Feedback)» (PAF) як концепцію структурування дизайну та використано цю модель для пояснення узгодженої роботи візуальних, тактильних та слухових сигналів як єдиної просторової комунікаційної системи. Мета роботи полягає в тому, щоб показати послідовність організації мультимодальних сигналів у середовищах, орієнтованих на дитину.*

Методологія. *У роботі застосовується систематичний підхід до проєктування та дослідження, який поєднує концептуальний аналіз, синтез останніх робіт з мультимодального орієнтування та емпіричного графічного дизайну, а також порівняння представлених прикладів. Обрано три приклади музеїв та медичних закладів для візуалізації ієрархії сигналів, просторової послідовності та механізмів підтвердження, структурованих крізь призму моделі PAF. Аналіз є інтерпретаційним та орієнтованим на дизайн, але не експериментальним.*

Результати. *У статті визначено мультимодальні символічні системи як просторову комунікаційну інфраструктуру та представлено мультимодальність не як просте сенсорне нашарування, а як скоординовану організацію сигналів. Розроблено дизайн-особливості моделі PAF, у якій сприйняття підтримує ідентичність та розбірливість, дія забезпечує рух та прийняття рішень, а зворотний зв'язок формує підтвердження та відновлення. У дослідженні визначено набір дизайнерських наслідків та основі аналізу прикладів показано способи використання цієї моделі для порівняння організації системи у різних дитячих середовищах.*

Наукова новизна. *Дослідження переосмислює модель PAF як концепцію дизайну для мультимодальних символічних систем та об'єднує системне пояснення ідентичності, розбірливості, послідовності та підтвердження в дитячих просторах. Акцент дослідження зміщено від ізольованих змінних сигналів до скоординованої організації символічних середовищ.*

Практична значущість. *Дослідження презентує дизайн-модель, яка здатна забезпечити планування та оцінку мультимодальних символічних систем у дитячих просторах. Результати можуть бути корисними для дизайнерів, викладачів, працівників музеїв та медичних установ, які займаються формуванням середовищ, орієнтованих на дитину, особливо при організації ієрархії сигналів, послідовності маршрутів та механізмів підтвердження у різних просторових умовах.*

Ключові слова: *мультимодальні символічні системи, дитячі простори, дизайн навігації, знаки, маршрути, візуальні сигнали, тактильні сигнали, слухові сигнали, просторове управління, підтвердження, цикл PAF.*

АВТОРСЬКА ДОВІДКА:

Лю Цзяньфен, *аспірант кафедри графічного дизайну, Київський національний університет технологій та дизайну, Київ, Україна; Шеньсійський університет науки і технологій, Сіань, Китай; e-mail: lccw7846@gmail.com, orcid: 0009-0000-8012-3980.*

Скляренко Наталія, *доктор мистецтвознавства, професор, професор кафедри архітектури та дизайну, Луцький національний технічний університет, Луцьк, Україна; e-mail: nata_skliarenko@ukr.net, orcid: 0000-0001-9188-1947.*

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