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ABSTRACT

Child participation in design is a central focus of Child Computer Interaction (CCI) research, however, examples of participatory research with children are primarily situated in adult-led contexts (e.g. design lab, classroom, museum) where design objectives, activities and tools are devised and facilitated by adults. In this paper, we contribute to current discussions by describing a participatory study situated within the "child-led nature-play contexts" of nine children (7-11 years). By adapting the role of "least-adult" originally described in the childhood studies literature, we describe how this role can be established to access these exclusive play places and maintained through co-inquiry into each child's unique play practice. This research contributes to current discussions of child participation in CCI by (i) introducing the role of least-adult as an approach to engaging with children through participatory research, (ii) recognising the influence of place in shaping child participation, and (iii) pointing to spatial-temporal contextual factors as an important factor for enabling and shaping participatory research.

CCS CONCEPTS

• **Human-centered computing** → **Participatory design.**

KEYWORDS

Children, participatory design, least-adult role, context, CCI

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1 INTRODUCTION

Child participation in the design of digital technologies intended for their use is now accepted practice within Child Computer Interaction (CCI) [47]. Such an approach not only generates more relevant technological outcomes [23, 48], it also empowers children by giving them a voice in design decisions and building their research and design competencies [33]. As such, new participatory approaches, frameworks, methods and tools are continuously being devised and applied by the CCI community to improve our critical understanding of participation and participatory practices. These participatory approaches are often derived from Scandinavian Participatory Design (PD) - a socio-political design approach that supports future users of technology partner in its design [48]. PD can be distinguished from other design approaches through

(i) its intention to emancipate and empower future users of technology by partnering with them through all stages of the design process; (ii) establishing and maintaining equitable user-designer power relations; (iii) applying participatory methods and tools that support mutual learning between multiple stakeholders with diverse communication preferences, knowledge and skills; and (iv) an explicit concern for "user gains" such as user empowerment or learning as a consequence of participating in the design of new technologies [33, 48, 54].

The socio-political values often underpin participatory design with children. Within the CCI literature for instance are extensive discussions of adult-child partnerships and the roles of children in design [23, 33, 35]. A diversity of methods and tools have also been created to support mutual learning and bridge the different life-worlds between children and adults [23, 31, 51]. More recently, researchers have also focused on the benefits of participation afforded to children, such fun and enjoyment [39, 43], and building of design and research competences [30, 33, 52]. The sum of these discussions has led to a rich understanding and diversity of perspectives surrounding how children can and should participate in the design of technologies.

One question that deserves greater attention is how the qualities of a design context influence child participation and participatory design approaches. Context is a central theme across all design fields as it shapes the applications and approach to designing new technologies [6, 21]. Traditional PD situates design activities within the users' practice context to ensure that design processes adequately reflect contextual complexities, and enable participants to share tacit, implicit as well as explicit knowledge about their current and potential practices [7, 54]. Despite this, a large proportion of participatory research with children is situated in decontextualized settings, such as a design lab or workshop space [23, 33]. Examples of research situated within the practice contexts of children are generally constrained to adult-led, institutional settings, such as museums, libraries or school classrooms, e.g. [4, 18, 20, 52]. In all these examples, children are invited to participate in an adult-initiated and facilitated process, where the design objectives, methods and tools are devised by adults, often with little input from children. However, child engagement with digital technology extends well-beyond these adult-led, institutional settings and into their free-time where children experience greater autonomy to design and direct their own activities. Supporting children to participate in the design of these technologies is important from an ethical perspective. Furthermore, participatory design situated within these comparatively "child-led" contexts may contribute new theoretical and methodological insights to CCI.

This article explores the question *how can participatory design situated in child-led nature-play contexts influence our understanding of participation in CCI?* The scope will focus on the "beginnings" of a

participatory design process [60], detailing important infrastructuring activities carried out to establish roles and equitable adult-child power relations essential to participatory design research. Research described is situated within the nature-play contexts of nine children (7-11 years). These contexts are defined as the special places in nature that children regularly accessed during their free-time and played at the exclusion of adults.

This article will firstly describe the process of accessing these "child-led" contexts and the unique roles and power relations that emerged, including the reliance on establishing and maintaining the role of least-adult throughout all engagements with children. It will then describe the process of carrying out a co-inquiry activity with children whilst preserving this role of least-adult. Finally, it will revisit the overarching research question by outlining three contributions to current discussions of participation that emerged from this research: (i) the role of least-adult as an approach to engaging with children through participatory design, (ii) the influence of place in shaping child participation, and (iii) the influence of spatial-temporal contextual factors on enabling and shaping participation and participatory practices. Descriptions of the field activities will be written from the perspective of the first author who carried out this research.

2 RELATED WORK IN CCI

Equitable user-designer power relations is a central theme of PD [48, 54] and is echoed in discussions of roles and participatory approaches in CCI [24]. Druin [24] was one of the first to consider the role of children in technology design. In her "onion model" Druin illustrates four roles of children (user, tester, informant and design partner), advocating for children to play the role of design partner to improve the relevance and sustainability of technological outcomes. Through Cooperative Inquiry, Druin [23] proposes a method for partnering with children through long-term, lab-based design processes, detailing a range of child-friendly techniques and approaches to equalize adult-child power relations (e.g. wearing informal clothing, using first names, elaborating on ideas equally with children, and use of child-friendly language). The role of design partner has since become synonymous with more authentic forms of participation within CCI [49], revealing an underlying assumption that a greater contribution of time or child involvement in a design process equates to having a voice and influence in design outcomes [63].

In recent years, the role of design partner has been further developed to increase the transparency around the adult-child power relations through a design process, and the influence of children in shaping design decisions. For example, Barendregt et al. [3] propose a role definition matrix to increase transparency around the meaning of design partner to reflect fluctuations in the roles of children at different stages of PD. Others explore new roles beyond Druin's [24] original model to support new forms of child participation that often emerge in situated practice contexts [33, 49]. In IDC 2016, Landoni et al. [35] looked beyond Druin's four roles by asking *how many roles can children play?*, calling for a broadening of perspectives around child involvement in technology design. New roles have also emerged including the role of co-researcher where children carry out research on their peers [59], protagonist, where

children are empowered to lead design processes whilst building critical design competences [33], and process designer, where children contribute to design activities before and after their usual involvement [49].

Interestingly, the role of the adult researcher, and their influence in shaping power relations and child participation is often an implied component of PD studies that is rarely explicated [64]. In a recent study, Yip et al. [64] takes steps to address this gap by posing a relational model of child-adult interactions in PD, describing four dimensions of adult-child design partnerships (facilitation, relationship building, design-by-doing and elaboration) that can invite balanced (equal) or unbalanced (unequal) contributions to design. Prior to this study, Benton and Johnson [5] reviewed the PD literature to formulate descriptions of the roles, responsibilities and activities of both child and adult participants in technology design projects. These authors described adult researchers as *facilitators* of design activities, *motivators* for children to participate in the session, *caregivers* of children, *proxies* who participate in design on children's behalf, and *co-designers* and *design partners* who generate ideas, scaffold sessions, and collaborate in design activities. Barendregt [4] also explored the relational work between designers and teachers to enable PD with children in classroom settings. More closely aligned to the child-led focus of this research is the work by van Doorn [57] who advocates for child co-researchers to gather data about the life-worlds of children that are often inaccessible to adults. This research details the unique type of data gathered by child co-researchers along with the challenges caused by their limited experience of research. Beyond these examples, the role of the adult researcher and their influence in shaping power relations with children tends to be an ancillary component of child participation in CCI [64]. This may be a consequence of the adult-led contexts where PD is predominantly situated (e.g. design lab, school classroom, museum), as adults can easily assume the role of teachers, facilitators or mediators without reflecting on the influence of this role on child participation.

However, this wealth of discussions of roles and power-relations within CCI are derived from research predominately situated within adult-led, institutional contexts, such as universities, schools, museums or libraries. Within these contexts, the activities and participation of children is informed by the imperatives and processes set by adults, and the rules and assumptions embedded in the design location - both of which shape adult-child relations and the likely participation of children. As far as the authors are aware, only three examples of PD-related research situated in child-led contexts exists. Van Doorn [57-59] introduces children as coresearchers in design, in an attempt to engage with children in their life-worlds. Within her thesis, van Doorn [57] demonstrates that child coresearchers can carry out unique contextual investigations and concept evaluations by accessing places and perspectives inaccessible to adult researchers. Prior to this Iversen and Nielsen [32] conducted a study that invited children to use mobile probes to document the activities and thoughts during their free time. Finally, Cumbo et al. [17] reported on the potential of wearable-video recorders to gather insights into children's nature-play practice.

This research intends to build on the current research outlined by exploring the possibilities for adult researchers to access child-led nature-play contexts to carry out participatory research. It will do

this by drawing from the environmental psychology and childhood studies literature where extensive research has been situated within these contexts.

3 RELATED WORK IN ENVIRONMENTAL PSYCHOLOGY AND CHILDHOOD STUDIES

3.1 Child-led nature-play contexts

Child-led nature-play contexts are defined in this research as the "special places" in natural urban areas where children choose to play during their free time. The environmental psychologist Roger Hart [29] describes play or "free play" as one of the most genuine forms of child participation as it is initiated and enacted by and for children, and reflects their intrinsic needs and interests often without adult influence. Thus, situating participatory design within these play contexts may produce unique insights and design outcomes reflective of children's life-worlds.

Within the discipline of environmental psychology, it is well established that children in middle childhood (7-11 years) tend to play in special places they find or create that are hidden or removed from their adult caregivers [13, 53]. Within these places, children design and direct their own play activities at a distance from the rules and assumptions of their adult caregivers [34, 53]. Natural places close-to-home have traditionally contained these special places of children because they are freely accessible and contain a diversity of loose parts, structures and sensory affordances that cater to a diversity of play preferences [42, 46, 53], all of which contribute to a child's development and value for the natural world [36, 61, 62]. Consequently, context-specific approaches are necessary to access these child-only contexts and support children to participate in design activities that reflect their personal play-worlds.

However, accessing these play contexts or special places of children aged 7-11 years can be challenging for an adult researcher because play is an emergent and private practice that often emerges at the exclusion of their adult caregivers [14, 25]. A number of approaches to overcome the challenge of accessing children's play have been described in the environmental psychology and childhood studies literature. These have been summarised below under two themes: (i) the role of the adult researcher, and (ii) reciprocal trust-building approaches that lead to legitimate entry to children's play worlds.

Prior to describing these approaches, it is necessary to clarify the definition of "nature", as it is an inherently problematic term within western cultures that conjures a diversity of perspectives. Traditional perspectives define nature as the living, "wild" ecosystems that exist apart from human influence [15]. However, this definition has been criticized as it sets humans apart from the environments in which we are a part and reliant on, and does not address the graduated quality of human influence globally. Today over 95 percent of the globe is influenced by human activities [10]. To account for this fact, Carver et al. [10] propose an alternative definition of nature as a continuum of human-environment influence, ranging from completely human designed space to pure wilderness. This definition has been tailored for the purposes of this research, which defines the nature as the "local outdoor areas containing natural elements (e.g. trees, grass, other species) where children choose to

play during their free time". These can include small or large urban parks, local reserves, backyards or abandoned lots.

3.2 Role of the adult researcher

A diversity of roles for the adult researcher have been described to facilitate research within child-led play contexts. The first is a *detached observer* [53] commonly used in deterministic studies where the researcher is a fly-on-the-wall and does not participate in the activities of children. This role reflects a perspective that the social worlds of children and adults are distinct and inherently separate, and traditional notions of the child as a 'subject' of research [41]. The second and third roles of adult reflect more contemporaneous perspectives of the adult and child relations in research. The second is a semi-participatory role where the adult researcher is friendly yet only marginally involved in children's practice because of social differences in age, ability and experience [28]. Fine and Glassner [25] describe four semi-participatory roles of the adult researcher including the *researcher*, *leader*, *observer* and *friend*. The third role type aims for complete immersion in the social worlds of children, to understand and experience their child-led practice [41]. Roles such as the *eager participant* [14] and the *least-adult* [41] reflect such perspectives. This study will seek to achieve this latter notion of complete involvement by applying Mandell's [41] least-adult role to gain entry into children's play contexts, and inform research relevant to design.

The least-adult role was originally described by Mandell [41] in a participatory ethnographic study situated in the play contexts of pre-schoolers aged 2-4 years. Drawing from Mead's Philosophy of Action [44], the least-adult role aims to abolish differences between children and adults via three means: (i) accepting children 'as they come' and abolishing conventional assumptions linked to differences in age, height, ability and embracing children as they come; (ii) suspending judgements in interactions with children, and instead adopting an appreciation and respect for children's practices and ideas; and; (iii) engaging in joint action with children within their play contexts. By applying Mead's philosophy in her approach with pre-schoolers she was able to gain unique insights into their play practice and perspectives [41].

3.3 Reciprocal trust-building approaches

In addition to discussions of roles, the childhood studies literature contains a number of specific approaches to build the rapport and trust essential to researching play with children [28, 41]. Trust-building techniques include transparent and accessible forms of communication [56], a respectful approach to interactions [37], listening and responding appropriately [50], and taking time to build rapport [2]. Conventional adult-child power hierarchies can be addressed by dressing informally [45], adopting a conversational approach during communications [11], and being 'child-like' or playful [2]. Some suggest preserving the child-led quality of play through research by waiting to be invited into their play place before entering and seeking regular consent [12]. Others recommend empowering children through the use of child-friendly techniques built upon the competencies and interests of children [41], situating research in a familiar environments, and creating a process that is fun and enjoyable to mirror the playful nature of the context [41].

4 RESEARCH METHOD

The research described is a preliminary component of a three-year study exploring how to support children participate in the design digital technologies within their child-led nature-play contexts. The activities described in this article focus on the relational work carried out to gain access to children's exclusive play contexts and carry out a co-inquiry activity about their play. Despite the absence of any formal design work, this study is relevant to the CCI and PD literature because it describes the participatory and relational work critical to enabling later design activities with children. Descriptions of research activities and findings will be discussed from the perspective of the primary author who carried out this research to capture the reflexive quality of the process.

4.1 Research location and participants

Research was situated within nine nature-play contexts nominated by nine child participants (7-11 years) within a middle-class neighbourhood in Sydney, Australia. Children were recruited through a targeted, five-stage process that involved:

- (i) a social-spatial analysis of Sydney to identify a neighbourhood containing a diversity of parks and green spaces regularly used by local children (7-11 years) outside school hours;
- (ii) targeted engagement of parents within the nominated neighbourhood via informal and formal community networks;
- (iii) an initial screening within the home of potential child participants to seek consent from parents and children and verify the child's eligibility. Drawing on the theories from environmental psychology [13, 53], children were asked to draw a special place in their local area where they liked to play during their free time. Those that nominated a natural place were eligible to participate;
- (iv) A semi-structured interview with eligible children to learn about their nature-play context, specifically the location, timing of visits, the supervising adult/s and other core actors involved in their play (e.g. friends, siblings);
- (v) Recruitment of all other actors contained within the child's nominated nature-play context, including the adult caregivers (which were the parents in each case), and other children (via parent gatekeepers) prior to commencing situated research.

4.2 Accessing children's nature-play contexts

Following participant recruitment, I organized an introductory visit to each child's nominated nature-play context to familiarize myself with the natural place (e.g. Figure 1) and play practices that children had described in their initial drawing interview. These research visits were coordinated with parent caregivers to fall during the times children would usually access their nature-play places. Within each play context, I carried out observations and informal discussions with children and parents to learn about children's play, and respond to any further questions they had about the research process.

This initial visit confirmed that accessing children's genuine play practice would be challenging. Children played in special places that were spatially removed and often hidden from view, and were deeply private about their play activities, halting or changing their activities when I approached, or telling me directly to "go away". After children left these places and returned to the area their parents



Figure 1: Examples of children's natural play places.

were waiting, they continued to express a reluctance to share details about their play, responding to my questions about their play with vague responses or sometimes ignoring or avoiding the questions altogether.

Further observations revealed that this exclusive play practice was facilitated by established relations between the child, parent caregiver and the natural place (Figure 2). Parents respected their child's desire for privacy, providing them with the autonomy to seek out these play places, rarely approaching their child at play, and taking time at the beginning of the play session to negotiate play boundaries so both the child and parent felt safe. The place facilitated this separation as it was familiar to children and parents, and contained a breadth of spatial-physical affordances that enabled clear negotiation of territory and supported a diversity of play activities (e.g. climbing, exploring, making).

4.3 Establishing the least-adult role

In order to access children's play, I adapted approaches from the childhood studies literature to carve out my role as least-adult [41]

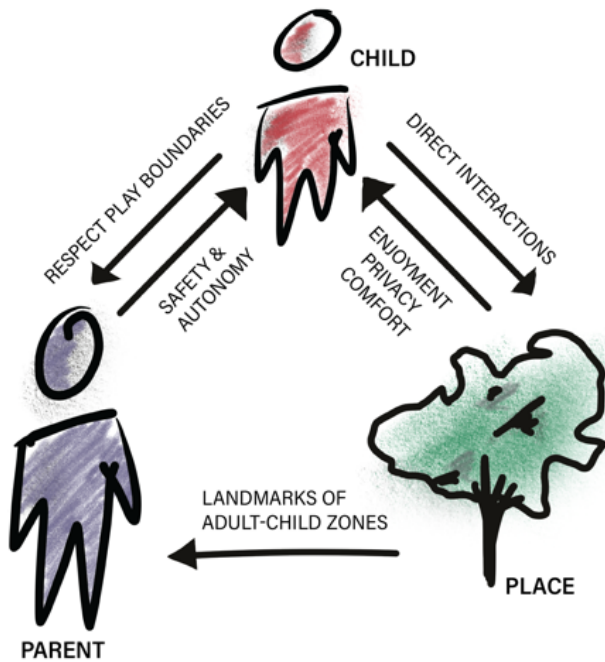


Figure 2: Established relations between the child, parents and the place that supported the emergence of children's play.

within each child's context through weekly visits carried out over a four to six week period. The intention of this role was to gain entry to children's play places and practices, whilst minimizing disruption of their usual activities so children retained autonomy over their activities.

Firstly, I aimed to distinguish my role from parents so children would understand that I was not there to supervise, judge or restrict their play, but to learn about their play worlds. I discussed this role with parents, emphasizing that I was not a substitute supervisor, and that regulation of children's play was their responsibility. Parents then openly distinguished our roles to children, emphasizing that I was curious to learn about their play and would respect their privacy and autonomy. Secondly, I used the spatial-physical place to visibly distance myself from parents during observations, whilst maintaining a distance from children's play places unless invited to demonstrate respect for their privacy. Finally, I aimed to establish a reciprocal trust-based relationship with children so children were comfortable sharing genuine details of their play practice.

A range of trust-building approaches were applied over the course of four visits to each child's nature-play context. These included maintaining a patient and consistent approach to interactions and plans; a curious, and open approach to communicating about play; and preserving children's autonomy and the child-led quality of their play through all interactions. I mirrored children's approach to communication and interactions as a way to consciously "shed my adult skin" during play activities. This involved actively listening and observing children and recalling my

own experiences of childhood to try and embody a uniquely "child-like" persona to put children at ease. I also wore informal dress, and maintained open-ended, child-led and playful forms of communicating to further reduce the adult-child power disparity. Finally, I maintained rapport and trust-building efforts with parents to maintain their support of research activities.

Through each visit, I observed and recorded children's attitudes and behaviors to gauge their trust of me and their willingness to share genuine details about their play. For example, during visits I would occasionally approach closer to children's play area to demonstrate a curiosity in their activities and to gauge children's responses. If children responded with discomfort by halting their activities, moving away or transforming their practice, I would move away to respect their privacy. At other times, children would approach me directly with questions about the research, and invite me on a tour of their play places where they would share details of their play places, activities and histories. Throughout all these interactions I was careful not to impose on children's practice, and provide children the space to choose if and how they would like to engage with me and the research process, with the continued support and encouragement of parents. The point when children initiated an invitation into their play place and volunteered details of their play was the indicator that trust had been sufficiently established to commence research interventions. Written field notes on a hand-drawn map of the child's play place were taken during each visit to a child's play place to record child responses to my presence and details of their practice. Audio and video recordings were avoided to minimize the likely disruption to children's play activities.

4.4 Co-inquiry into children's nature-play

After children had invited me into their play place, I introduced a series of co-inquiry activities to learn about child perspectives of their play as part of the larger participatory study. Early observations within their play place revealed that children's play had a rhythmic quality, continuously fluctuating between *immersive play*, where children are deeply involved in their practice, akin to the flow state described by Csikszentmihalyi [16]; *reflective play* where children suspend immersive activities to negotiate or reflect upon their play alone or with their friends; and the *play break*, where children halt their play to return to their parent caregiver. Co-inquiry activities were subsequently aligned with each child's 'play rhythm' to preserve the child-led, fluid quality of their play. One co-inquiry intervention - "My play cards" - will be described here to illustrate how the play rhythm facilitated my role as least-adult within these child-led contexts.

"My play cards" is an interview-based co-inquiry technique that uses card probes [26] to learn about the abstract, reflective qualities of children's play practice (e.g. meanings, histories, motivations). It aligns with children's play rhythm by co-reflecting about play during the reflective play phase, and pausing interventions during immersive play or the play break. While children were engaged in their immersive play activities, I laid twelve cards on the ground near their play place. Each card contained an image intended to evoke discussions around what children think, do or feel [1] during their play (Figure 3). To preserve the child-led quality of play, I did



Figure 3: Example card probes (clockwise from left) what children think, do and feel in their play practice.

not instruct children to participate in this activity, but waited for children to demonstrate a curiosity about the cards before describing the purpose of the activity and what it entailed. When children demonstrated an interest in the cards, they were invited to inspect the cards carefully and select a card that best represented what they think, do and feel during their play. A semi-structured interview was then carried out to understand children's perspectives on their play practice. The interview was adapted according to children's self-directed play rhythm where children would pause or shift discussions according to their play interests, or leave to engage in their immersive play, and later returning to reflect on another card and component of their play practice. This rhythmic co-reflection continued for as long as children were willing to engage in discussions, and was important for aligning the activity with the fluid, child-led quality of play. Child responses were captured with an audio recorder laid on the ground, and hand-written notes taken using crayons and coloured paper while children were engaged in immersive play.

4.5 Data analysis

Data sources included hand-written notes and audio recordings taken during and directly after a visit to each child's play context. All data sources were transcribed onto a digital file and organized using an affinity mapping process to explore: (1) the qualities of interactions between children, parents and place that enabled the emergence of play in each nature-play context; and (2) the processes that influenced the establishment of the least-adult role and its maintenance through the My play cards co-inquiry activity.

5 FINDINGS

The least-adult role was gradually established within each nature-play context over a four-week period. The evolution of this role and its unique qualities and implications for research will be illustrated here using case study examples from the data.

5.1 Establishing my role as least-adult

I was able to gradually establish the least-adult role by tapping into the established relations between the children, parents and place, and gradually carve out a space for my presence and research activities (Figure 4). Establishing these unique relational qualities was akin to "relational work" commonly referred to in PD activities [e.g. [8, 19]], however, it went beyond the social dimensions of relational work to also consider the spatial and temporal dimensions of interactions that were central to supporting participation. Below, I will detail the roles of children, parent and place and the quality of our interactions that enabled the emergence of the least-adult role, before detailing how the least-adult role facilitated the co-inquiry activity.

5.2 Children

Children were the gatekeepers of their play place and practice, challenging the assumption that consent from children and parents would enable me to automatically access children's play practice. As a relatively unknown adult seeking entry into each child's exclusive play place, I had to prove to children that I did not pose a threat to their play by judging or restricting their activities, or revealing details to their parent caregivers. The trust-building approaches applied were effective for building trust, and establishing my role as a least-adult. Children evolved from being wary of my presence and secretive about their play, to approaching me with personal or research-related questions, and eventually inviting me into their

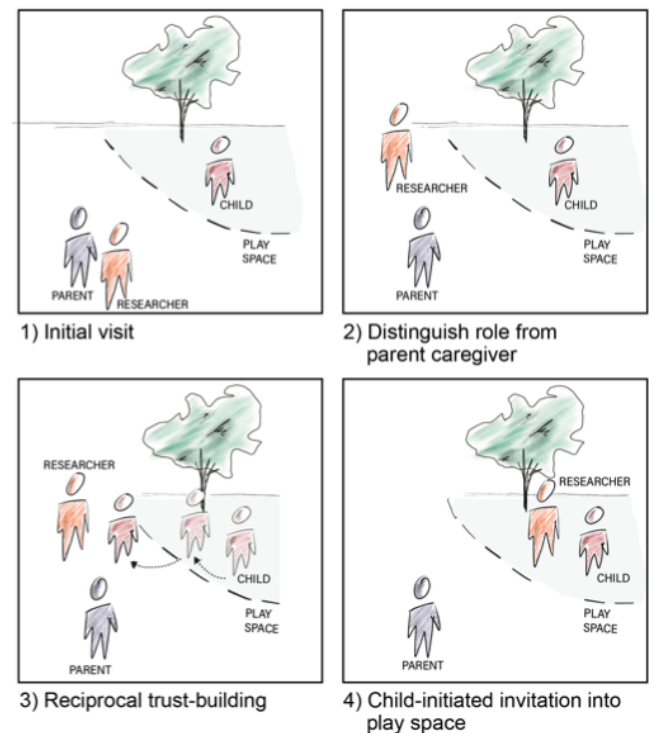


Figure 4: Establishing role of child-like adult over through spatial-social interactions

play place/s and sharing details of their play (Figure 4, Case study 1).

5.2.1 Case study 1. During my initial visits, Laila was wary of my presence and suspicious of my interest in her play, halting her play or telling me to "go away" when I came too close to the area she was playing with her sister. However, over time she became more curious about my presence and interest in her play. On one occasion she paused her play activities with her sister, and approached me with questions about the research.

Laila: What are you writing?

Me: I'm writing down information about this place. I'm interested in learning about your play. The kind of play and places you like.

Laila: How come?

Me: So I can learn more about how you play for my project. I am curious... Adults don't play like kids... I won't go too close to your play place unless I have permission from you and the other kids..

Laila: ...Ok well I can show you the hotel. But, it's secret so you can't tell anyone. Even mum.

Laila then led me into the play place called the "hotel", a large sandstone outcrop along the edge of the nature reserve that she found with her sister. Here she initiated a tour of her play place, sharing details of her play activities, place histories, and meanings.

Once invited into their play place, children continued to test my legitimacy by experimenting with the boundaries of the role. For example, children would engage with me as an "adult" by asking me to convey messages to their parents, or support them in play activities they would not be able to do alone (e.g. reaching a high branch on a tree, or crossing a creek). Sometimes children would venture beyond the play boundaries agreed upon by parents, or engage in potentially dangerous play activities (Case study 2). On these occasions, I maintained my role as a least-adult and did not intervene in their play or enforce play boundaries as this would break the trust established [28, 41]. Parents had agreed to supervise their children, and both children and parents understood their role. However, on some occasions it appeared that children were engaging in riskier play because of my presence. On these occasions, I disengaged with children by walking away and focusing on something else entirely.

5.2.2 Case study 2. In the hotel, Laila was slipping between "reflective play" where she would show me her play places and demonstrate activities, and "immersive play" where she would leave her tour duties and spontaneously engage in play with her sister, revealing other details about her play interactions and imaginary narratives. At one point, Laila and her sister started drinking water from the local creek as part of their play, when she suddenly remembered I was observing. She turned to me and said, "You can't tell mum about this, or we won't let you back here", before resuming her play activities.

My presence within each child's play place influenced the established role of children in this context [41]. For example, my presence influenced the quality of children's play at different phases of their play rhythm. Children continued to engage in their usual immersive play activities despite my presence, however they used their reflective play to share details of their play practices, perspectives and

place meanings. Over time, children evolved from play agents into committed co-researchers, where play learning shifted between observations to co-reflections in response to children's unique play rhythm (see Case study 2 and 4).

5.3 Parents

Through this process, the role of parents expanded from being enablers of children's play, to becoming enablers (and supporters) of the research process. Parents were crucial in establishing the least-adult role, providing children with a sense of security through their supervisory role, and providing an adult figure from whom I could distinguish myself. Furthermore, parents emerged as vital supporter of research, encouraging the participation of children during and in-between research sessions, and acting as a conduit to communicate information between myself and children. For example, during my initial visits to the nature-play context, children often directed questions about the research to their parents with whom they trusted, and parents would respond or invite open discussions about the research. Furthermore, parental trust in me and the research directly contributed to children's willingness to trust me and share details of their play (Case study 3).

5.3.1 Case study 3. Amy and her two friends were taking me on a tour of their play places.

Friend (to me): This is the boat we are trying to make, so we can get away if we run out of food, but we also have... [She turns to Amy].. should we show her?

Amy: Mum says it's ok. I think it's ok.

Friend: Ok.

The girls lead me to the "mulberry tree" where they hold secret club meetings a little further away.

5.4 The place

The place, which included the spatial-physical features and meanings children attached to the play areas, were vital to establish the least-adult role. Children and parents used spatial-features to differentiate their roles within the context with children seeking out play places bounded or hidden by specific landmarks, and parents staying in the "supervisor area" to provide children with a degree of safety whilst respecting their autonomy (Figure 2). Similarly, the place was vital for establishing the least-adult role. Children and I used the spatial-features to negotiate reciprocal trust-building activities. For example, I would approach children's play places to demonstrate my curiosity for their play and my respect for their privacy by maintaining a distance. Children would reciprocate this trust by approaching me outside their play place to question me about the research, and invite me into their play territory to demonstrate trust (Figure 4).

Once in their play place, children revealed the place histories and meanings they attached to areas and structures. Learning and appropriating these place meanings through communications with children demonstrated an openness to their ideas and an acknowledgement that this was "their place". It also provided a unique lens into the world of the child, as once certain that I was genuinely interested in their play children allowed me to experience their play practice first hand. In this sense, children used their play place and this embodied play experience to create a "third space" where

we were both learning and reflecting on their play practice (Case study 4).

5.4.1 *Case Study 4.* In her special place, Valerie directs me to sit on a log "seat" in a grassy area hidden behind a row of trees.

Valerie: That is the throne where we like to sit. Other times we do this. [She and her friend start to do headstands]. Try it! [After a failed handstand attempt I sit back on the log.]

Valerie: That's ok. Emily can't do them either.

Emily: I like making things. You have to get the grass from here because it's strong enough. She shows me the grass and demonstrates how to collect it. This is my garden. It's a special garden for making rock baskets..

Me: Are you making a rock basket?

Emily: Yes. Like this. [She begins to demonstrate how to weave the grass].

5.5 The least-adult role

The least-adult role emerged as a unique and effective approach to engage with children in their child-led nature-play contexts, and can be distinguished by three unique qualities. Firstly, building on the research originally described by Mandell [41], the least-adult role is characterised by an openness and appreciation for children's ideas, and a recognition that I was on the child's "turf" and children were the directors of their practice. As an adult, the reflex to control or facilitate interactions (as is common research practice in other contexts) had to be relinquished to avoid disrupting play or risking potential banishment from children's play place [41]. Instead, research was conducted in-response-to children's self-directed play rhythm, where curated activities took a more fluid, emergent approach, as illustrated in descriptions of the My Play Cards.

Secondly, the least-adult role was situated "in-between" the role of parents and children within each context. Unlike the parent, I was privy to unique details about children's play practices and places. However, unlike children, I remained a "guest" within their nature-play contexts, observing and learning about their play places and practices, rather than leading activities, or participating in children's immersive play. For example, during the My play cards technique, children shared detailed reflections of their unique play practices, merging in-and-out of immersive and reflective play (Case study 5).

Finally, the least-adult role is relational, evolving in-response-to the established and dynamic interactions between the child, parent and place. The character of the least-adult is in a continual state of flux, shifting in-response to children's play rhythm and self-directed activities (Figure 5). During immersive play when the child is engaging directly in their play place, the researcher is an observer of child play agents. During reflective play, when the child is reflecting on or planning a play activity, the researcher and child are co-researchers. Finally, during the play break, the roles-in-play subside, and the child, parent and researcher return to their nominal roles.

5.5.1 *Case study 5.* During My Play Cards, Sarah inspects the cards, and selects one. "This card is like my play..it's free. When I'm

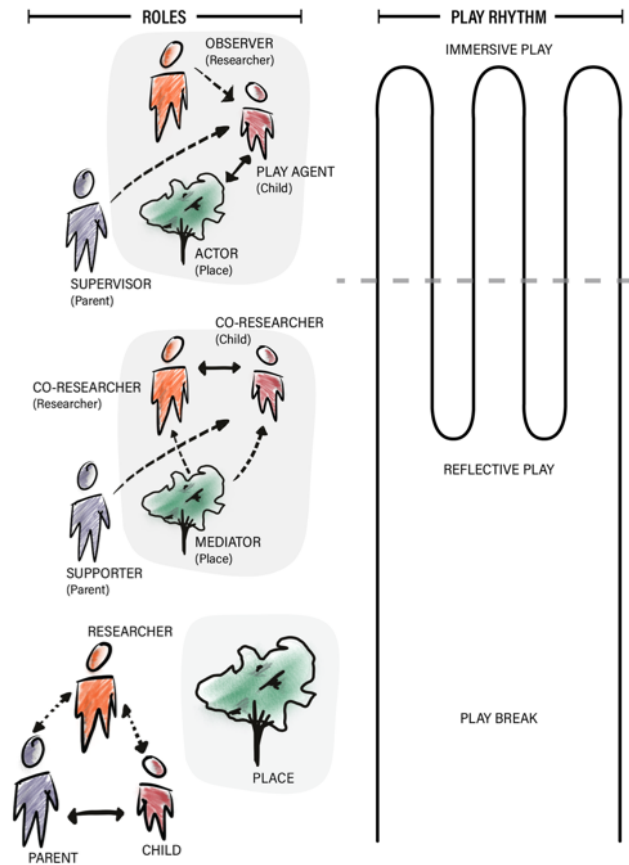


Figure 5: The roles of the child, place, parent and researcher at different stages of children's play rhythm (solid arrows refer to the primary interaction).

here I feel like I can do anything I want with my brain...I can do a really silly voice, and make my foot twitch like this [she starts to shake her foot]. I can make things that don't exist come real. And there is no one to tell me to be quiet, or 'stop being silly Sarah'. She jumps and starts spinning around with her arms out in the air before running back to her tree. After a time she returns and shares her thoughts briefly before returning to her play, a rhythm of play and reflection emerges through this process.

Marion is sitting reflectively on a rock looking at the creek. She has picked a "feelings" card. "When I'm here, I feel like I'm in a magical place... The trees are like big giants protecting me. And you can hear insects and birds ... the water ... the breeze. I feel like... I don't know...part of something bigger. It makes me feel small. I like that."

6 DISCUSSION

A range of novel perspectives on child participation emerged from situating research within this child-led context, including (i) the role and influence of the adult researcher; (ii) the influence place; and (iii) a spatial-temporal perspective on "relational work". The broader implications of these findings for CCI research will be

discussed below, along with ethical considerations and limitations of research.

6.1 The role and influence of the adult researcher

Situating participatory research within child-led nature-play contexts challenged the roles and adult-child power relationships commonly assumed in participatory design in adult-led contexts. In these play contexts, children were the gatekeepers of their play places having been granted the autonomy and security from their parent caregivers to play in remote or hidden special places. There was no precedent role for an adult researcher, which set up an unusual adult-child power relationship where the adult was reliant on the child to enable research. The least-adult role adapted from Mandell [41] emerged as an effective approach to address these challenges and gain access to children's exclusive play places and practices. It relied on a continuous, reflexive and relational approach to research, where activities were shaped by child-led interactions with the researcher, parent and place. These qualities of the least-adult role that emerged through this research process have broader implications for participatory research in CCI. Firstly, the research revealed that the personal characteristics of the adult researcher (e.g. gender and similar socio-cultural background) likely influenced the quality of relations established with parents and children, which directly influenced how children participated in research. This provides an argument for foregrounding the relational work (infrastructuring) carried out to establish relations with children and other actors in all research contexts, and for researchers to reflect more consciously on their personal traits and how these may influence child participation. Although attempts have been made to foreground this relational work in participatory research with adults [8, 19, 22] these qualities remain an implied component of participatory research with children.

Secondly, it highlights that the rules and assumptions embedded within a research context influence the roles and interactions between adult researchers and children. Within a classroom setting for example, an adult researcher is likely to assume the role of "teacher" or "facilitator" as this is the precedent role associated with an adult in this context, whilst children will presume the role of "student" [55]. This child-led play context was distinguished by an entirely new set of rules that evoked new responses and power hierarchies between child participants and the researcher. Adult researchers may benefit from reflecting on the role they assume within a design context, and how this may influence adult-child power relations and the quality of child participation in participatory design. For example, researchers carrying out design in a classroom or museum, could reflect on the natural adult-child power relations that emerge in these settings, and adapt approaches for establishing the role of least-adult to shift these assumed power relations where possible. Alternatively, design situated in decontextualized settings, such as design labs or workshop spaces, could opt to situate this within child-led contexts to inspire child-led forms of participation that may ultimately evoke new forms of creativity beyond the probes and frames curated by adults.

Thirdly, the least-adult role is both relational and dynamic, providing a novel perspective on how we conceptualise participation

and interactions between actors in participatory design contexts. Within CCI there are some discussions that acknowledge adult-child power relations as relational and dynamic. For example, Yip et al. [64] conceptualise adult-child interactions across four dimensions of design as either balanced (equal) or unbalanced (unequal) interactions. Barendregt et al. [3] present a Role Definition Matrix that depicts children's involvement in design across three design phases (Requirements, Design and Evaluation) and their activity in relation to the designer (Indirect, Feedback, Dialogue, Elaboration) during these phases. The least-adult role builds on these discussions by firstly acknowledging the evolving, dynamic quality of adult-child relations in participatory research, and emphasising approaches to both establish and maintain this relationship within these child-led play contexts. Secondly, the quality of the least-adult role and its interactions with children are understood in relation to a child-led practice, rather than an adult-curated design process as is often the case in CCI. Finally, the least-adult role is understood in relation to human (child, parent) and the place, given that the interactions between these three core actors were vital in shaping play and enabling research.

6.2 The role of place

A second discussion point that emerged from this research was the role of place in shaping child participation. "Place" is defined here as the spatial-physical qualities and embedded meanings of the objects and spaces we occupy [28]. This research found that these place features were crucial enablers and drivers of children's play practice, inviting autonomous, embodied play, as aligning with previously findings from the environmental psychology literature [9, 42]. However, these features were similarly essential for establishing the least-adult role, as it enabled the negotiation of trust over time. Furthermore, discovering and appropriating children's place meanings and practices through research provided a unique lens into children's play worlds, and invited reflexive discussions about their practice.

These findings aligns with discussions by Makhaeva et al. [38] and Malinverni et al. [40] who emphasise that the physical structures and embedded meanings within design places and artefacts influence child participation. However, it builds on these discussions by firstly emphasising the role of spatiality in shaping participation. These open, natural areas facilitated the negotiation of spatial "territories" that led to the emergence of children's private play, enabled the establishment of the least-adult role, and directly influenced the quality of children's participation. The majority of participatory research in CCI is situated in indoor, spatially constrained environments. Given our findings, it is likely that these indoor settings are likely to influence child participation, constraining participatory action, and child relations with the adult researcher and other actors. In line with the recommendations by Makhaeva et al [38] we suggest considering the role of spatial-physical factors in shaping child participation in design, and reappropriating the space to support children to create autonomous design spaces that they can appropriate and choose to invite the adult researcher.

Secondly, research revealed that the play places of children were embedded with meanings that influenced their participation and actions in the place. The open-ended affordances of these natural

play places enabled children to freely apply their own meanings to their play places to realise their participatory intentions. Makhaeva et al. [38] describe a similar experience demonstrating how the meanings attached to objects can inhibit or promote child creativity. Malinverni et al. [40] also emphasises how a disparity in the meanings individuals attach to objects can lead to a breakdown in communication vital to participation. To acknowledge and negotiate these importance place meanings in participatory design, we suggest firstly researching the meanings children attach to places and artefacts and how this may influence their participation. We also suggest situating design in contexts similar to nature-play contexts, where children have the opportunity to attach their own meanings to objects and places to evoke open forms of creativity.

6.3 A spatial-temporal perspective on "relational work"

The final contribution of this research addresses the spatial-temporal component of the relational work used to support the emergence and maintenance of the least-adult role in these child-led contexts. Relational work is a crucial component of participatory research as previously outlined, however current discussions are focused on the quality of social interactions between actors [19]. This research expands on current understandings of relational work by introducing a spatial-temporal dimension to current discussions. The establishment of the least-adult role relied on the careful negotiation of space and territory between children and parents. It also relied on temporal factors, as demonstrated in the shift in reciprocal trust-building approaches carried out with children during the four-week research period, and children's shifting play rhythm which determined the pace of research interventions conducted with children. Current discussions of relational work have not considered the influence of spatial-temporal interactions, and it could prove to be a valuable consideration in participatory practices, particularly future studies situated in child-led contexts.

6.4 Ethical considerations

A number of ethical questions emerged through this research. One consideration is the influence of research on the children's play as children were interacting with the researcher during their usual play activities, and became more conscious of their play, reflecting more consciously on previously tacit activities. Given that these valuable nature-play opportunities are declining for many children in urban contexts [27, 36], researchers should consider how research may influence play and preserve child access to their play where possible. Children also appeared to engage in "riskier" play activities in the presence of an adult by going beyond agreed boundary lines, or carrying out more challenging and potentially dangerous play activities (e.g. Case study 2). This raises important questions around the balance of child autonomy and security, and the divergence in perspectives around what is considered "safe" by parents, their child and the adult researchers. Clear communication with parents and children around the roles and responsibilities of all actors is one important approach to enable research and ensure the safety of children.

6.5 Limitations

There are a number of limitations to this research that deserve attention. Firstly, this research is based on research situated in nine nature-play contexts in a single urban context in Sydney, Australia. Applying this participatory approach in other contexts will likely face unique challenges or opportunities that have not been considered here. Secondly, the scope of research is limited to the preliminary design phase and the application of the least-adult role in the latter stages of participatory design require exploration. We invite CCI researchers to apply, scrutinize and develop this approach in other contexts and latter stages of participatory design with children. Finally, this research was enabled in-part because the primary researcher had time to establish these relations with participants and access these unique nature-play contexts. We advise researchers constrained by institutional barriers or time to adapt the approaches to fit within their capacities.

7 CONCLUSIONS

This paper describes a participatory research process within child-led nature-play contexts of children. By drawing from the disciplines of environmental psychology and childhood studies, we propose the "least-adult" role and accompanying relational approaches to gain entry to these child-led contexts. This research contributes three new perspectives on child participation in CCI. Firstly, it introduces the least-adult role for adult researchers seeking to access and support child participation within these exclusive child-led contexts. This role is characterised by an openness and appreciation for children's ideas, and a continuous, reflexive and relational approach to engaging with children, parent caregivers and place through research. Secondly, it emphasises the influence of the play place in shaping child participation, both because of its spatial-physical qualities and embedded rules and meanings. Finally, it presents an approach for gaining access to these child-led contexts through relational work that considers the social and spatial-temporal interactions between child, researcher, parent and place. We invite researchers in CCI to adopt and adapt this approach, and explore new possibilities for supporting child participation within both child-led, and adult-led contexts.

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