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Planning and Building Children's Outdoor Play Zones for Multiple Affordances: A Community-Engaged Process

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ABSTRACT

A robust emergence of outdoor nature-based play areas in several European, Australian, Asian countries, as well as North America Canadian provinces, has occurred recently. This study explored the rationale for and construction of different play zones and affordances for children at a United States Central Kentucky local arboretum and research forest. The study provided background information and guidance for constructing an outdoor nature-based play zone for various learning venues (e.g., nature centers, schools, city parks, day-care centers, etc.). The study used a convenience sampling technique wherein two planning personnel were interviewed during nine site visits (6 in-person; 3 virtual) for a total of nine hours of audio/video recordings. Exploratory qualitative methods were used to code planning documents and 114 pages of transcription. The data indicated five themes: organic relationships, play self-reflection, site research/experimenting, site accessibility/safety/risk affordance, and fiscal opportunities. This study outlined several factors (e.g., access, materials, use, personnel, risk, funding) to consider during the planning phase prior to construction as well as during the actual building phase. It also supported the idea of embracing "failure and change" in that some of the affordances may not work during or after construction.

***Keywords*:** building outdoor play areas, affordances in outdoor play, natural playscapes, early childhood education

There has been a robust emergence of outdoor nature-based play areas in several European, Australian, and Asian countries, as well as North America Canadian provinces. In 2020 amid a global pandemic, Dr. Anthony Fauci, director of the National Institute for Allergy and Infectious Diseases, suggested that school districts "should find ways to offer as many outdoor activities as possible, from classes to recess and lunchtime. …Get as much outdoors as you can. If you look at the super spreader events that have occurred, they're almost always inside" (Associated Press, 2020, para. 1 & 3). Thus, emergence of outdoor nature-based environments in childcare and public/private school settings have increased across the United States (U.S.). A question then emerges regarding how schools, day care providers, and informal learning centers plan for and construct appropriate outdoor nature-based play areas. Acar (2014), Keeler (2015), and Loebach (2004) have reported on purposeful play area design; however, additional research is needed, specifically for United States-based settings.

In exploring the rationale for and construction of different play zones and affordances for children at a United States Central Kentucky local arboretum and research forest, this study provides background information and guidance for constructing an outdoor nature-based play zone for various learning venues (e.g., nature centers, schools, city parks, day-care centers, etc.). To characterize the play zones, the local arboretum and research forest designers coined the term *Playcosystem*, which is a riff of "Ecosystem" combined with "Play." Natural playscapes, as described by the

Natural Playscape Initiative (Luken et al., 2011), are founded on a set of design principles specific to encouraging young children's interest and comfort in nature. Such principles include the affordance of risk-taking through play in areas, and with materials, that are designed for undetermined, open-ended uses. Playcosystem, used herein, reimagines a natural playscape, with the inclusion of three distinct areas, or zones, as part of a system of natural areas that offers graduated opportunities for risk and engagement for children beyond early childhood. For example, Zone 1, the subject of this study, is entirely fenced and includes risky, though not hazardous, fall heights. Plans for Zones 2 and 3 do not include fencing and propose higher fall heights, offering appropriate risk for children who are bigger and/or experienced in previous risk assessment. The origin of the Playcosystem's "graduated opportunity idea" coincided with an employee's daughter's birth. Reflections on children's play expanded as his daughter moved through developmental stages. This experiential knowledge informed decisions that contributed to the evolution of Playcosystem.

The three zones of Playcosystem consists of 17 continuous acres embedded within 17,000 acres of the nonprofit Bernheim Arboretum and Research Forest (https://bernheim.org/) located in Central Kentucky. With over 40 miles of sloped hiking trails, three lakes, several gardens, and artist renderings, visitors can engage with and learn from nature and art during four distinct seasons. Depending on the season, temperatures range from below zero to over 100° degrees Fahrenheit within a deciduous forest where native animals roam freely. The fenced Playcosystem's Zone 1, the subject of this study, consists of one and half acres of mostly flat grass and earthen areas with several deciduous trees (e.g., Sycamore, Weeping Willow, Red Bud, Sumac, Magnolia, Maple), coniferous trees, (e.g., Arborvitae, Cypris) and shrubs (e.g., Bottlebrush Buckeye, Witchhazel).

Theoretical Framework and Literature Review

A foundational tenet of Playcosystem was that the constructed play zone areas would have thoughtful design, meaning the intended use of the space would align with children's sense of play. Roger Barker's (1968; 1976) *Theory of Behavior Setting (TBS)* as described by Khan et. al (2020) underscored that "certain environments or settings elicit particular kinds of behaviour and different sets of people and objects exhibit the same patterns of behaviour within the same behaviour setting" (p. 147). Scott (2005) provided an overview of Barker's *TBS* as specific, identifiable units of the physical and social "elements of an environment which have very powerful influences on human behavior" (p. 297). Within Scott's analysis of eight oral histories including Barker's wife, doctoral students, and colleagues, she provided a nuanced view of the history and trajectory of the *TBS*. In conclusion, Scott (2005) reported the *TBS* as

> "strong empirically because settings have been repeatedly shown to have very strong influences on behavior. This is not to say that individual differences do not also play a role in behavior, but they are often less influential than the behavior setting." (p. 321)

We applied a broad lens of *TBS* in that the Playcosystem environment afforded opportunities for children's play behaviors; this is similar to the broad approach that adults display certain behaviors in a grocery store, at an athletic event, or inside a hair salon, etc. In applying *TBS,* we intended to explore the complexity of designing a children's play environment (i.e., Playcosystem) with the understanding that the constructed play zone would be the medium of ecological units wherein children would display episodes (e.g., climbing, sitting, walking) with object props (e.g., tree logs, sand, rocks, loose parts).

To explore the ecological visual perception of a system (Gibson, 1979), such as Playcosystem, we applied the *Theory of Affordance*, where "affordances are properties of the environment as they are related to animals' [humans'] capabilities for using them" (Gibson & Pick, 2000, p. 15). The perception-action reciprocity aspect of an affordance was notable as the human individual "must take into account the environmental resources presented in relation to the capabilities and dimensions of its own body" (Gibson & Pick, 2000, p. 16). For children to interact with the environment, they must perceive what the environment affords before taking any action. For example, a child may approach going down a sloped terrain from varying possibilities (i.e., crawling, scooting, rolling, walking, skipping, or running); these choices and actions imply a myriad of action possibilities based upon the child's learned developmental skills (Gibson, 2019).

In a summary of widely accepted, descriptive essentials of an affordance, Heft (2010) elaborated that an affordance is a "specifiable property of the environment taken relative to the person" (p. 19). This relational property was explained in an affordance of a six-inch ledge, wherein an older-aged individual perceived the ledge as a potential tripping hazard, and a young child perceived the same ledge as a potential resting or climbing spot. When applying the lens of affordance functionality, Heft cautioned the use of a passive perceiver stance, but rather claimed the need for an "action" lens. Using Roger Barker's observational data of a day in the life of a nine-year-old boy, Heft enumerated, listed, categorized, and then clustered the boy's actions. Heft concluded that even though the affordance list was not an exhaustive list, it was an initial approximation of functionalities of the nine-year-old boy and positionally others like him. In summary, affordances are essentially about functions and the possibilities of action within a particular setting. Heft cautioned against the use of causality, where affordances can "cause" an action, but rather he focused on the individual's consideration of functional possibilities and meaningful experiences for action.

Lastly, a model for outdoor play space design that prioritized the use of natural materials was the Canadian based *Seven Cs*, which consist of character, context, connectivity, clarity, change, chance and challenge (Herrington et al., 2007). Brussoni et al. (2017) investigated an intervention on children's health and well-being that used the *Seven Cs* criteria to increase natural risky play environments. They found that "providing high quality, natural outdoor play environments for children does not require expensive equipment, nor complex interventions to have a significant and positive impact on children's health and wellbeing" (Brussoni et al., 2017, p. 148). In fact, simple tree climbing provided benefits that outweighed potential risks according to Gull et al.'s (2021) study of 415 United States personnel working within early childhood settings with ages two through eight. Parents' (n=1602) view of simple tree climbing was that children

> "have the potential to grow socially, emotionally, physically, cognitively, and creatively, and have increased resiliency. Bans on tree climbing and other risky play pose problems such as limiting access to natural spaces, creating fear of participation in adventurous activities, and fewer opportunities to negotiate risk and develop resiliency." (Gull et al., 2018, p. 24)

Our study explores the detailed rationale and documents the planning and building of a Playcosystem of different play areas and affordances. Our analysis of the rationale and construction process provides findings which add to the current research on designing nature-based play affordances while tangentially supporting the learning disciplines of Child Psychology and Development and Early Childhood Education Research. As Khan et al. (2020) reported, "these attributes of the ecological environment are important in order to understand how much an environment can influence children's behavior" (p. 147).

Methodology

Participants and Data Collection

From July 2020-July 2021, the authors interviewed two arboretum and research forest planning personnel, which we will refer to as "Designers" herein, during several Playcosystem site visits (6 in-person; 3 virtual). During each face-to-face site visit, all attendees adhered to CDC social distancing and mask guidelines. The six in-person site visit interactions were audiotaped, while the three virtual visits were videotaped; all interactions were then transcribed verbatim. Upon immediate return of each in-person site visit, the first author revisited personal notes and added photographic documentation (see Figures 1, 2, and 3).

Figure 1: Entrance to Zone 1 from Visitor Center.
Cores of limestone rock from drilling flagpole holes were on rock table.

Figure 2: Compacted rocks and dirt, or berms, were added to initial stream after observing flow of water.

Figure 3: Another view of berms that were created to assist flow of water.

The following interview questions were used as a guide for each visit wherein authors asked clarification or expansion questions.

1. Based upon your personal opinion, what was the impetus for considering and designing the planned natural environment for children (Playcosystem)?
2. What previous research, if any, did you access and apply to the planning phase?
3. What stakeholders, if any, were involved in the planning process?
4. What consultants (e.g., agencies, landscape designers, play work specialists, early childhood professionals), if any, were involved in the planning process?
5. What is the rationale for Playcosystem?
6. Based upon your personal opinion, explain the rationale for selecting the play affordances in Playcosystem.
7. Were there any affordances or structural elements dismissed within the planning iterations, and if so, why?

Throughout the year, the Designers shared digital planning documents that included email correspondence, schematics/drawings, aerial photographs, and external meetings notes. Pre-existing photographs, designs and meeting notes were provided during in-person site visits as additional planning documents.

Note: To comply with *Procedures to Ensure Ethical Considerations in Research with Human Subjects,* each Designers signed an IRB-approved consent. There were no foreseen risks to participating in this research; an unforeseen risk is that the Designers identities may not be masked.

Data Analysis and Findings

To explore the ideas for the planning, constructing, and modifying Playcosystem environment, the authors transcribed individual site visit audio/video-taped conversations and reviewed all planning documents (e.g., email communication, schematics/drawings, photographs, meetings notes). Total transcribed data included 69,802 words within 114 pages from 534 minutes (≈9 hrs.) of audio or video recordings. Exploratory qualitative methods (Saldana, 2013; Strauss & Corbin, 1998) of open and axial coding of all data sources were used to determine and report upon initial themes. Each author began the initial coding by reading all transcript data for a first impression, or 'feel' of data. Next, each author conducted line-by-line coding by labeling/highlighting reoccurring relevant words or phrases. Each author decided on the most important/prevalent words and created categories based on those (i.e., axial coding). Authors individually sorted the categories and examined connections between categories (i.e., theming data). Authors then collectively met to discuss and compare themes as well as provide any new knowledge from an individual's perspective. Authors determined if a hierarchy existed among categories (i.e., if some categories were more important than others) and described the resulting categories (themes) with supportive quotes. Authors conducted "member checking" with the Designers regarding final themes with supportive quotes.

The data indicated five themes: organic relationships, play self-reflection, site research/experimenting, site accessibility/safety/risk affordance, and fiscal opportunities. Below include the five themes with discussion and select evidence.

Organic Relationships

During each in-person or virtual site visit, the Designers mentioned in immense detail the networking and collaborating with organizations external to the arboretum; therefore, the authors did not directly ask interview Questions 3 or 4. In reviewing the transcript data, we noted the integral nature and importance of personnel with "brighter minds" and their involvement with the planning phase. Designers' comments included that

> "we want to work in the larger community, so we're building those relationships and keeping those relationships and nurturing those relationships throughout this process so that more people can be a part of it and feel ownership of it and build the kinds of relationships that make people feel comfortable about going to a place like this [Playcosystem]" (personal communication, July 23, 2020)

and "to the extent possible, everything we do is informed by others" (personal communication, July 13, 2020). External personnel who provided some type of input or experience varied across disciplines and included artists, welders, engineers, children, schoolteachers, as well as personnel from community associations, local parks, nature centers, and businesses. Additionally, the Designers wanted to work with as many constituents as possible to "find out what their constraints [were] so that when [they] design [the Playcosystem], it becomes adoptable or adaptable by other organizations" (personal communication, July 13, 2020). In essence, they wanted to create a "menu of things" that one could consider implementing across a broad range of institutions. A full listing of influential personnel who were specifically mentioned is included in Appendix A.

Play Self-reflection

Immersed in a decade-long reading of literature of *loose parts theory* and *theories of play,* as well as being a "keen observer of play for a very long time," one Designer explained the impetus or rationale for Playcosystem. He frequently provided his definition of "play" as activities "defined by the player, initiated by the player. The rewards are intrinsic. There can be rules, but if there are rules, those are provided by the player, not by the rules of a game like baseball or soccer" (personal communication, July 13, 2020). He elaborated that "anywhere a child is, [that] is the playground" and "children are good at what they do: play" (personal communication, July 13, 2020).

Based on reading and experience, the Designers wanted children taking control doing things on their own and "free of directed play" in Playcosystem. Because one of the designers had several years of experience in working with teachers, parents/guardians, and school directors, he wanted to create comfortable places so that adults could pull themselves away from the children; thus, he planned to "talk to adults about free play and why it's valuable and what it is [to be] able to help the adult remove direct supervision of the child" (personal communication, July 13, 2020). In designing Playcosystem, he selected any opportunity that provided the child more play autonomy; for example, he opted for a single rope swing over a double-roped swing. A double-roped swing is intended for a singular, predictable direction, whereas a "singular rope swing can go in 360 degrees and is turning over more control to the child" (personal communication, July 23, 2020). Based on research, he also knew that a fence blending into and encompassing the Playcosystem landscape would be needed which adults would "have to trust."

Site Research/Experimenting

The Designers made seemingly startling statements such as the "work that we do is based in ignorance" to explain why research was important and intended. They believe that you would not actively seek to do research, unless in fact, you were not ignorant about something. "You would only do research to find out things that you don't know. If you do research to find out things that you do know, that's not research, that's self-confirming actions" (personal communication, July 13, 2020).

Playcosystem Designers applied thoughtful intentionality in choosing materials, locales, and quantities; in fact, at the outset, they expected "25% of everything built would go away within 2-3 years because it wasn't right" (personal communication, July 13, 2020). In fact, literally everything in Playcosystem environment, except for a large steel-framed dome, posed an opportunity for investigation (e.g., color and location of sails, size and location of rocks, meanderings and location of stream, materiality and size of logs, etc.). That said, Sycamore trees were planted along the dome's steel beams allowing for study of the tree type and growth. The Designers elaborated on the experimental nature about the living environment: "What is the life span of different species of plants going to be in a play environment? We will experiment with species of trees and pruning of trees to create trees that are particularly helpful in a play environment" (personal communication, July 23, 2020).

In discussing the use of "loose parts" in Playcosystem environment, often the word "laboratory/model" arose in reference to areas that researchers could manipulate the "loose parts accessibility" to increase site visit time and/or child's autonomy (i.e., parent withdrawal from child's interactions). The Designers explained that one of the "hardest parts of this whole project is going to be how do we provide the loose parts in a public setting outdoors" (personal communication, August 13, 2020). There was also the strong impetus to be a living laboratory of various aspects that others could visit and emulate or transfer to their own sites.

Continuous evaluation was planned for various areas and items of Playcosystem upon the completion of initial construction. Queries included, for example, what materials migrate (pea gravel, sand, rocks); what soil areas are impacted; what amount of water is retained after rainfall; what trees are thriving; what trees are declining; what tree textures allow safe climbing; what shade areas are beneficial; etc. There were numerous references to ambiguity, such as, we "don't know what it'll do" referring to sand migration; "but now we are reconsidering" regarding a mulch area; "play with it and see how much of it we remove" referring to texture on stationary logs; "we don't know; we are going to think about that" referring to log placement; "so that is a down-the-road decision … whether or not that's even a wise decision, we don't know, but it's an option" referring to making a five sided pyramid over steel structure (personal communication, October 1, 2020), "we think we don't know, but that's part of it" regarding use of ferns; and "we are going to start with those and see what happens" regarding Sycamores on steel structure (personal communication, October 15, 2020).

Honesty about the unknown (i.e., ambiguity) continued throughout the year-long construction phase of Playcosystem. The area was designed so that, if needed, big equipment could re-enter to alter or create a new experience in the space. The overarching goal would be to make changes that would "make it more playful from suggestions from children … we can even turn it over to a bunch of children to ask, would you like to move the balance beam logs" (personal communication, March 17, 2021). The common reference of "we'll keep our eye on

it" was made regarding the stream, plants, drainage, rocks, logs, benches, etc. Variables that could potentially be controlled include the quantity, type, and arrangement of loose parts introduced into the area (personal communication, April 1, 2021). The experimental nature of "see how people use" Playcosystem offers short and long-term study opportunities.

Site Accessibility/Safety/Risk affordance

Often the Designers' perspectives shifted among varying points-of-view based upon who would be using Playcosystem. Example perspectives included guardians of children, teachers of students, children who play, visitors with disabilities, communicators of English as second language, etc. When considering the risk affordance of the space, the Designers attempted to include all participants who would potentially engage with the site. They noted that "we will make mistakes here and there and we are willing to own those mistakes and share those mistakes" (personal communication, July 23, 2020). For example, "we have rope and we're careful with rope because that is statistically one of the most dangerous things that children can have, and we understand that, and we accept that risk carefully" (personal communication, July 23, 2020). Surface texture/type (e.g., pea gravel, sand) and graduation (e.g., height, slope, berms) were considered for use of young children of varying ages (e.g., toddlers who are practicing their footing; young children who are testing their agility skills). Fall zones or challenges were calculated so that if children were standing on top of the cedar logs, for example, they would fall to a slope. A "fall to a slope is less impactful than a fall to a flat surface" (personal communication, October 1, 2020). If the area provided "enough appropriate risk, it's actually safer than providing objects that are supposed to be super safe." The perception that an object is "super safe" allows one to "quit focusing and rely on the equipment to keep you safe or use the equipment to do inappropriate things and that's when injuries occur" (personal communication, October 15, 2020). To allow children to move through affordances with appropriate risk, they realized the need to scaffold adults' supervision:

> "We are creating a hiding spot on the other side of those hills; when the kids go down the other side of those hills they'll [e.g., children] be out of sight. That's practice for adults to let their children out of sight into a zone that they know is fenced, that they will get nervous, they will want to go over there and over time that we have repeat visitors we can work with. Your child survived last time; we think they're going to survive this time." (personal communication, July 13, 2020)

Accessibility for all was pervasive throughout the planning and construction process as points-of-view from varying visitors were considered. In fact, they said we "are actually designing to what's called Universal Design Standards (UDS), which has very clear descriptions of what that means. We will also work with wheelchair communities and others as we step into those areas" (personal communication, July 13, 2020). For example, the Designers referenced that any slope had to be adjusted for wheelchair accessibility with "rise of one foot for every twelve feet" (personal communication, April 1, 2021). When considering accessibility, they said, "the image that pops into the average brain is a wheelchair. But the number one condition, a human condition that needs to be addressed in terms of accessibility and design, is autism" (personal communication, March 17, 2021). To demonstrate that the Designers sought opportunities to enhance the inclusivity of the Playcosystem environment for visitors regardless of age or ability, initial visitors provided information regarding limitations or barriers to play that any member of their group experienced.

Fiscal Opportunities

The final theme regarding fiscal opportunities was supported with the reoccurring reference to "funders." The previous reference to "ignorance" leading to research was used to capture funders' attention because

> "people don't typically say that they're an institution of ignorance. I will tell you this, though; I use it and I use it in front of funders and funders dig it. We get their attention when we tell them we don't know what we're doing because everybody else that's coming and talking to them about getting their money is coming to them and saying, we know exactly what we're doing and that's why you need to fund us. So, it separates us from a herd." (personal communication, July 13, 2020)

Playcosystem endeavors helped broaden the type of site visit experience and research possibilities, which in turn helped financially with broader grant opportunities. “Sustainability, including financial sustainability was a part of this” (personal communication, July 23, 2020). Increased time and repeated Playcosystem visits on behalf of funders help with revenue and with a potentially new capital campaign, which has not been completed in over 20 years.

Fiduciary responsibility was at the forefront of several conversations. Comparable informal institutions spent 1 to 2 million per acre with similar designs; design and construction of Playcosystem was “one tenth of the amount” of other institutions embarking on this work because of “doing it in-house” on a “shoestring” budget (personal communication, August 13, 2020). Description of Playcosystem will become self-evident upon a site visit because the “storytelling shifts and people will see the general feel of what we’re doing” (personal communication, October 15, 2020). Rather than having to imagine Playcosystem’s features and potential play affordances, a funder would be able potentially to physically interact with the site and/or observe the effects. Thus, Playcosystem experiences become a fundraising tool in providing meaningful and important connections to funders. The Designers explained that limestone cores from the drilled rock for flag poles were intended to be used meaningfully in acknowledgment of donors:

> “these are the cores that came out. I'm going to cut them in half and will mount them to boards and put a little plaque on them. And those will be gifts to the funders as opposed to, you know, a little plaque that doesn't have anything from the playground.” (personal communication, March 17, 2021)

Discussion

This unique study showcased the thought processes around planning and building of a nature-based, children’s play area (Playcosystem) “in-house on a shoestring budget.” The study underscored Brussoni et al.’s (2017) finding that neither expensive equipment nor complex interventions are required for impactful play-based affordances or experiences. The articulated themes showed the involvement of purposeful relationships and inclusion of prior research. The mindset that 25% or more of the entire Playcosystem site would change within a 2-3-year time frame of use emphasized the welcomed thought of ongoing research and change. In fact, anticipating changes or improvements was built into the overall design by allowing site access to large equipment, collecting data on site use, interviewing site visitors, etc. Our evidence also showed an ongoing stance of considering multiple perspectives from various visitors to Playcosystem. Such visitors include populations previously marginalized by constraints including transportation, personal mobility, or language that either prohibited or made difficult the access to natural, outdoor play spaces. Considering access for individuals of all abilities was at the forefront of design and safety. Explicit consideration for accessibility and mobility is precisely what Hunt (2010) claimed should “occur early in the design process rather than as an afterthought” (p. 23). Lastly, the ongoing priority of self-sustaining fiscal measures to include future research and development was apparent for providing continued use of the site (i.e., replenishing sand and loose parts).

Conclusion

As the growing need for outdoor, play-based nature areas rises, this study can be used by anyone (e.g., parent, informal learning center, school, city) wishing to replicate similar affordances or experiences. The transference of similar scaled experiences as those found within the Playcosystem to other sites is achievable. This study provides a template to consider several entities during the planning phase prior to construction as well as during the actual building phase. It also allows designers to embrace “failure and change” in that some of the affordances may not work during or after construction.

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Appendix A
Listing of Influential Personnel

- artists (sculptor, painter)
- local welders/metal workers
- visiting adults, children play facilitators
- "actual real" engineers, construction crew, superintendent
- Site personnel (director, education directors, horticulture team, visiting artist, wildlife management biologists)
- community agencies (Play Cousins Collective, Bridge Kids International, Children at Play Network)
- associations (American Public Gardens Association, American Society of Landscape Architects, Nature Rich Louisville Association, Kentucky Association for Environmental Education)
- nature centers (Creasey Mahan Nature Preserve, Cincinnati Nature Center, Morton Arboretum, Denver Botanical Garden, Atlanta Botanical Garden, Missouri Botanical Garden)
- School teachers and leadership personnel (Jefferson County Public School, Bullitt County, Nelson County, Second Presbyterian Preschool, Sacred Heart, Backside Learning Center, Homeschool, YouthBuild Louisville/Summer Works Program, Bluegrass Development Center)
- University School of Public Health and College of Education
- parks (Metro government, Lexington, Kentucky Children's Garden in Lexington)
- community businesses (Jim Beam, insurance companies)
- donors

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