Children as designers of their play and builders of their knowledge

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Abstract

The importance of play in children's development has been widely studied and confirmed in academic literature over the decades. This paper studies the intertwining of children's play and learning processes, focused on unplanned, spontaneous instances of children's undirected play within the constructivist educational setting of the Reggio Emilia approach. Findings include several characteristics of undirected play, including choice of objects/materials as playthings and reinventing known games and attention to detail leading to meaningful learning. The focus on process rather than result highlights the value of undirected free play, when children are the designers of their play and builders of their knowledge. This analysis aims to offer insight on observing and considering children's play.

Key words: undirected play, unstructured play, free play, play and learning, children's play, Reggio Emilia approach

Introduction and knowledge background

Undirected play happens every day, all over the world, at home, at school, in parks and playgrounds, in streets and squares, in large groups, small groups or individually, and where there is play, there is learning. Yet the value of play has often been disregarded due to 'the tendency to define learning in terms of formal learning (i.e. learning as an outcome of direct instruction and school-based approaches that focus on teacher-led, goal-directed activities and declarative knowledge)' (Nilsson et al, 2018, p. 1). Academic research has highlighted the value of play, 'both in and out of school with emphasis on the importance of play and its contribution to child development and learning' (Lewis, 2017, p.10) and specifically to consider 'learning and development not as an outcome, primarily, of instruction and teaching, but as an outcome of play and exploration' (Nilsson, 2018:1), as it has been shown that play fosters and supports children's physical, cognitive, social and emotional development.

The first theories about play and its role in education were systematically developed starting in the 18th century and since then researchers and educators have continued investigating the importance of play as a main aspect of children's cognitive and psychological development (Piaget, 1952/2013; Montessori, 1967; Vygotsky, 1978; Munari, 1981; Nachmanovich,1990; Resnick, 2017). Recent research (Gray, 2012; Whitebread,et al. 2017; Nilsson et al., 2018) recognizes the fundamental, pervasive importance of play in the development of a child's personality, skill set, life experience and ability to process information, emotions and form and maintain relationships.

The study herein analyzes unplanned instances of undirected play and games created by children for children in order to study play as an activity through which children engage in meaning making, by exploring and building their knowledge and understanding of the world around them. A second aim is to offer adults (parents, educators, teachers) insight on observing and considering children's play and their knowledge building process. In this paper, play is referred to as 'undirected' to emphasize that, although an adult was present, the children were the creators of their play which they structured and managed themselves. In their undirected play, these children posed questions to themselves and each other and then investigated and developed their thinking (i.e. playing with ideas, trying them out, exploring what happened, etc.) by following their intuitions and ideas to find answers for themselves and build their own knowledge. The examples discussed herein aim to make the children's learning processes visible, bearing witness to the interconnection between play and learning.

Undirected play and learning

Peter Gray believes that children's drive to play freely, without adult intervention or direction, is a basic, biological impulse because children are wired to learn on their own, and they learn through their play (Gray, 2012, p.4). This study focuses on children's undirected play that was not mediated by adults, in order to identify some characteristics of these play experiences and the possible learning activated during undirected play. The cognitive framework of Reggio philosophy posits that, through play, children build their understanding of the world, their identities and relationships, gain knowledge and life experience, engage in meaning making and construct their own learning (Edwards et al, 1998, p.403). In the words

of Carla Rinaldi, 'play and learning are like the two wings of a butterfly- one cannot exist without the other' (Lego Foundation, 2017, p.11). Through play, especially undirected play, children make use of both already acquired knowledge and they learn new things. They can gain scientific, mathematical, kinesthetic, spatial and esthetic knowledge. Nachmanovitch (1990, p.48) gives an example of the complex learning underlying play:

> A girl riding her bike discovers that the secret of the effortless control is balance- continuous adjustment of continuous change. When she reaches the point of shouting "Look, Ma, no hands!", she has learned that she can use less and less means to control greater and greater power. She has learned to encounter and consciously play with rhythm, timing, weight, balance, geometry, right- and left-handed coordination. She does this by herself, from her own body. The emotions attendant on such a discovery are fear, delight, pride, disbelief, elation, and a desire to try it again and again.

Play is also essential in developing soft skills like cooperation, negotiation, listening, turn-taking, respect, conflict resolution and getting along with other people (see Gray, 2012). Play is practice for life itself, from an intellectual, cognitive, emotional, social, affective, expressive, creative and relational points of view.

This study refers to the Reggio Emilia approach (REA), an educational philosophy first developed in Italy after World War II for children aged 0-6. Among the principal values of this educational philosophy[1] are: the child as a citizen with rights, the adult as co-inquirer, the environment as the third educator, the concept of the hundred languages (which recognizes and valorizes the many forms of

[1] There are several resources for those interested in further information about REA, beyond the scope of this paper, including but not limited to: Edwards et al., 1998; Giudici et al., 2001; Rinaldi, 2021.

expression children use to make meaning) and the importance of pedagogical documentation. Currently REA educational experiences take place in formal, informal or non-formal settings within a lifelong learning perspective all over the world. Listening to and valorizing children's ideas and perceptions is informed by to the pedagogy of listening (Rinaldi, 2021), which underlies Reggio thinking and this study.

Widespread (Western) ideas that play is limited to childhood and is replaced by seriousness and responsibility in adulthood (Rosen, 2019, p.21) certainly impact how play is considered and (under)valued in contemporary society. Currently there is much debate about the role, meaning and value of play in connection to existential attitudes and lifelong learning (Rosen, 2019; Resnick, 2017; Gray 2012). What exactly play can be often seems to reflect adult's ideas of what it should be and how it should be done. Toys, games and playful learning activities are often devised by adults for children, sometimes aimed at turning children's undirected play into a 'learning' experience based on adults' ideas and values of what is worth learning. This way of approaching children's undirected play, however, may not achieve its intent and may even have the opposite effect, causing children to lose interest in their play when adults interfere (Gray, 2012, p.141; Hughes, 1990, p.59). Disregard for children's play on the part of adults may be due, in part, to a lack of awareness and appreciation regarding the significance of children's undirected play and its dynamics.

Types of play, (possible) types of learning

Recent play taxonomies by Hughes (2002) and Marsh (2016) include a wide variety of different types of play, while in this study the instances of undirected play

analyzed specifically regard the role of objects in play, language use, and the hybridization of digital and analog tools. This is due to the unplanned undirected play instances that the researcher happened to witness and document in the non-formal setting described below. A brief explanation of these three categories will link these types of play to possible learning processes activated or drawn on.

Regarding play with objects, this study focuses particularly on unstructured materials and objects rather than toys or items specifically designed for children to play with. Since Froebel invented his gifts in the 1840s, followed by Montesori's materials, less structured objects and materials have been recognized as having educational value. As Hughes (1990) and Grey (2012) have pointed out, however, play objects that are designed for children by adults tend to be rigid, "fixed" unchanging, unable to "adapt… and cope with (children's) ever-changing (needs and) demands" (Hughes, 1990, 60), and are often abandoned after losing their novelty. In this study, and in Reggio Emilia educational settings in general, objects and materials are open-ended and unstructured, chosen and used freely, because regarding how they are "(used and transformed)... the important thing is to see the potential within an item" (Rosen, 2019, 183). Children's explorations and learning are linked to spheres like beauty and aesthetics (Vecchi, 2010), metaphorical thinking (Giudici et al., 2022) or storytelling (Rodari, 2023).

Language is another play dimension explored in this study. Playing with language starts as infants, babbling and internalizing the sounds of mother tongue(s), later involving meaning and grammar. Making words and sounds, using the voice, is also a physical process, rooted in the body (mouth, tongue, teeth, lungs). Words can be disassembled, reinvented, turned around and inside out and used in unexpected ways to generate new mental dimensions that can impact

meaning making and learning processes, as Rodari's seminars for teachers in Reggio Emilia in 1972, which were collected and published in The Grammar of Fantasy (2023), exemplified. Words are the building blocks for socialization, connection and cooperation with other people. Words give shape to ideas about the world, oneself and how they interconnect. A few shared words in a common *lingua franca* can make it possible for people to interact and play together, as will be discussed below.

Due to the blurring of boundaries between digital and non-digital spheres, analog/digital hybridization of objects, materials, tools and environments characterizes children's play more and more (Cowan et al, 2021), as well as their meaning-making and learning processes. Recognizing that meaning making, activated also through play, can involve a wide range of languages widens the idea of what learning and knowledge construction can look like. In Reggio thinking, the concept of the hundred languages, based on the belief that children create meaning, construct their knowledge and express and explore their thoughts, feelings and theories about the world through multiple languages and ways of seeing and being, embraces both the physical and the digital (Vecchi et al., 2019; Di Rocco et al., 2021). Hybrid play between these two dimensions tests and shifts their boundaries, generating dimensions that can impact meaning making and learning processes regarding many formal disciplines but also more existential aspects.

This paper aims to give some examples of undirected play that highlight the value and significance of learning that is activated and drawn on and that that may be overlooked when children, rather than adults, are the designers of play and games for themselves and other children.

Research questions

The premise of this study is that undirected play offers children opportunities to build their knowledge in meaningful ways. To investigate this idea, the underlying questions are:

- What are some characteristics of undirected play and games that children invent for themselves and other children in non-formal settings?
- What kinds of learning and knowledge building might undirected play promote?

The examples discussed below offer insight into how these children played and what they played with, using objects, materials, language and digital tools freely. The experiences exemplify the hybridization between analog and digital tools, natural elements and phenomena, toys and the surrounding environment, the body and mind.

Research design and methods

Six separate, unplanned, undirected spontaneous play experiences were observed during six different occasions (either during 2-hour after-school sessions just for children offered once a week or during weekend opening hours for children and their parents) featuring a total of 21 children between the ages of two and a half and nine were observed and documented by the author, an *atelierista*[2], in a non-formal setting, scintillae- play and learning in the digital age[3], located in Reggio Emilia, Italy. Photos, videos and observational notes were collected by the researcher, who was

[2] An *atelierista* is a figure in REA schools who does not have a pedagogical background, but training in another field- usually in the visual arts. The atelierista works with children and teachers to develop and document projects. The author has worked as an atelierista since 2010.

[3] The space and project to research play and learning was promoted jointly by Fondazione Reggio Children and the Lego Foundation. Its first iteration ran from 2018-2021.

present in each instance and directly observed and documented the undirected play experiences analyzed herein. The materials collected thus provided a comprehensive view of the children's unplanned, undirected play: videos and photos captured specific moments featuring undirected play experiences, contextualizing and complementing the author's observational notes. Of note is that the children were free to explore the space and choose the objects and materials- analog and/or digital- that attracted them.

The data was analyzed using thematic analysis based on the work of Braun and Clarke (2006) to identify themes in the empirical material. Regarding the characteristics and qualities of undirected play, the analysis was carried out by identifying keywords in the materials (including the researcher's notes, visual documentation and the children's words) which were then used to generate deeper, less evident themes (see Figure 6 below). The author manually coded the experiences and subsequently discussed the themes with colleagues and other researchers, who were not co-researchers in this study. Further analysis, based on the researcher's empirical observations, the children's words and actions and the visual/physical/digital aspects of the play experiences documented, aimed to identify what kind of learning might have been activated or drawn on (see Table 2 below).

Ethical considerations

All the families received a statement of informed consent and signed release forms for their children to be documented (photographs, video), in accordance the European General Data Protection Regulation (GDPR). The study adheres to Fondazione Reggio Children rules and regulations regarding research ethics and the studies were approved by the scientific committee of Fondazione Reggio Children.

The children were aware that they were being documented and could request not to be photographed or recorded, since participation was voluntary. To protect their privacy, the children are referred to by their first initial and age (years, months)- M. 7 for example.

Limitations

This study has some limitations. One is the fact that these examples are not replicable- undirected play happens in an unplanned, unpredictable manner. Each experience is unique and will never happen again in quite the same way. However, the educational approach as a model promoting children as designers of their own play and the relationship with adults as co-inquirers who foster children's learning processes generated by their undirected play are transferable to other situations and contexts.

A second limitation is the fact that the types of play discussed below- specifically play with objects, words and the hybridization between analog and digital tools and materials- are not exhaustive[4] and simply reflect the undirected play experiences that the researcher happened to observe.

Another limitation is that the material was not collected specifically for this analysis, thus no standard observation grid was utilized. The materials analyzed were not specifically collected with this study in mind, and the data was both collected and subsequently analyzed by the author. Finally, although the number of children involved in the study is small, their experiences can offer insight into the dynamic relationship between play and learning.

[4] For a broader survey of types of play, see Hughes' 2002 taxonomy developed for playworkers and Marsh's 2016 adaptation of it to include digital play.

Results and Discussion

Three main types of undirected play situations were observed, all of which happened indoors: play with objects, play between analog and digital dimensions and play with words/language. Table 1 gives an overview of the play experiences observed.

name of game	**age**	**n. of children**	**types of undirected play**
A. Stellina and her enemies	8	1	objects
B. Don't wake the mummy	7	7	objects
C. Catch me of you can	2.5, 5	2	physical/digital
D. Visual treasure hunt	6-8	8	physical/digital
E. From digital to analog	8	1	physical/digital
F. One to ten	8-9	2	words and language

Table 1. Overview of undirected play experiences documented

The details of each example are described below, including the children's own words and the author's description.

Undirected play experiences

Example A. Stellina and her enemies by I. 8

I. created a hand-drawn grid for a board game on a piece of paper and using familiar and unfamiliar things, old things, broken things, strange things, funny things that she found at home as markers (Figure 1). With these known or strange-looking objects, plus curiosity, imagination and creativity, the ordinary turned into the extraordinary and objects took on new identities and became the protagonists of a board game she invented to play together with friends or by herself. The rules of her game turned into a story as she moved the 'characters' around the grid::

There are some things and (Stellina) has to jump over them. (The pink timer) freezes her because it stops time, so she has to go back a square, in any direction. She can jump from here to here to here to here (in a zig-zag, around the other objects). (The tap) sprays water, so if you go near it, you have to be careful because if you touch it you have to go far away. _I. 8

Figure 1. Stellina and her enemies. Source: Fondazione Reggio Children

Example B. Don't wake the mummy by M. 7

This game featured an oblong skein of colored wool as a mummy, surrounded by wooden disks and golden buttons (Figure 2). The goal was to collect as many gold buttons as possible without moving the wooden pieces and 'waking' the mummy. After M. created his game, he explained the rules to a small group of children and they played it together, observing each other and taking turns.

You wake the mummy if you move the wooden pieces when you take the golden buttons. To win, you need to get 10 buttons _M. 7

Figure 2. Don’t wake the mummy. Source: Fondazione Reggio Children

Example C. Catch me if you can by S. 2.5 and E .5

The game was inspired by a golden button. S. and E. were playing together on a large piece of white paper taped to the floor in a dimension that straddled the physical world and the digital one, where this object existed in different ‘places’ simultaneously: the physical button, its digitized image on the iPad screen and its image projected on some paper on the floor (Figure 3). S. began to play and experiment with the physical button- picking it up, turning it around, moving it from one position to another on the floor- and then with the digitized one, resizing and

moving its projected image on the white surface of the paper. After observing S., E. took a turn, exploring a multitude of possible transformations of the button.

The button is really really big, then small, smaller and it can move... and it hides, then it comes out again, it's running away! _E. 5

E. started a game of 'Catch me if you can' with S. and the button projected on the floor, by making the button 'run away and disappear' and then reappear while she tried to 'catch' it.

Figure 3. Catch me if you can. Source: Fondazione Reggio Children

Example D. Visual treasure hunt by a group of eight children aged 6-8

A small group of children explored everything around them, looking for details of objects to photograph (a texture, a shape, a pattern, etc). The children took turns, taking pictures of details with a smartphone or tablet (Figure 4), and one by one these images were projected on a wall. The other children had to find the objects that were somewhere in the room. This variation on the game of hide and seek is a

transposition of a familiar game that was transformed by looking for objects between a physical/digital dimension.

I got the idea after taking a photo by mistake, it was all blurry _M. 7

Figure 4. Visual treasure hunt. Source: Fondazione Reggio Children

Example E. From digital to analog by G. 8

In this example, G. was fascinated by the fragmentation of his face created by a kaleidoscope effect he saw on the screen of an ipad that was connected to a webcam.

It's like 1000 eyes! _G. 8

Seeing his face multiplied and splintered led to an investigation of his own face and he decided to recreate this kaleidoscope effect in an analogical way, arranging small mirrors and other reflective materials on a table. While looking at himself- first in the ipad and then in his mirrored composition (Figure 5)- he discovered a new way to observe himself, playing freely in a way that could not have been anticipated.

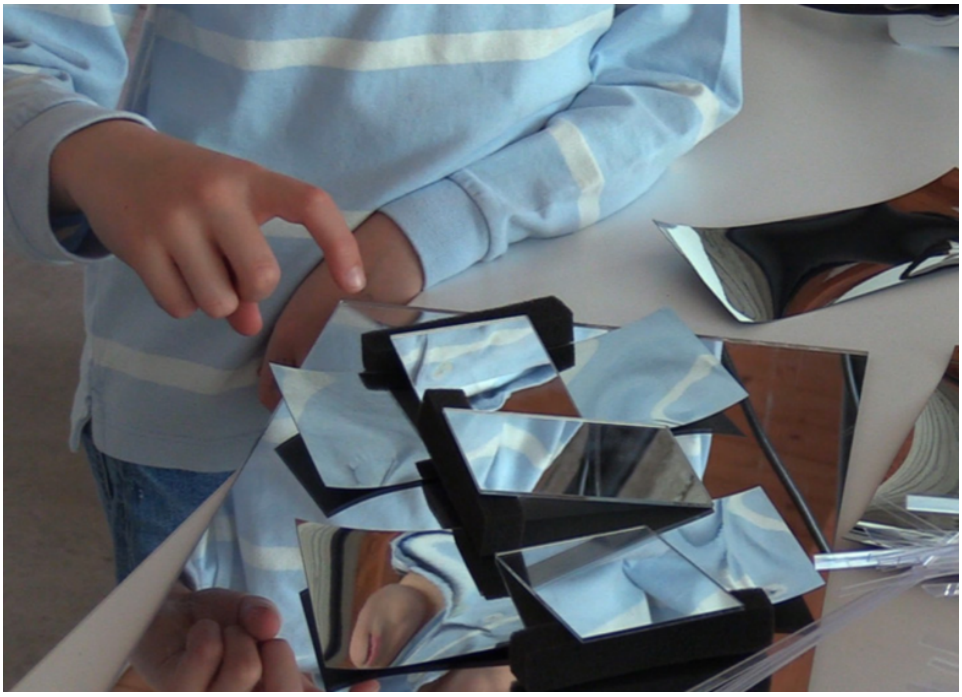

Figure 5. From digital to analog. Source: Fondazione Reggio Children

Example F. One to ten by S. 8 and A. 9

S., an 8-year old Japanese girl, was part of a group of Italian adults and children, and everybody needed to make an effort to find strategies to communicate without sharing a common mother tongue. Play was a natural vehicle for doing this. A. invited S. to play Chinese Checkers, but neither girl knew the rules. Using body language, actions/gestures and a bit of English, A. managed to explain some rules she had made up to S., and invited S. to invent her own. The numbers from 1-10 in English created a common ground: counting the spaces in English out loud together, setting the pace and giving meaning to their game, making it both foreseeable yet surprising.

The following section will present the findings regarding some general characteristics of undirected play based on the experiences analyzed.

Some characteristics of undirected play

This collection of instances of children's undirected play aims to highlight some characteristics that may offer insight into the relationship between play and learning. Figure 6 shows the themes generated through thematic analysis.

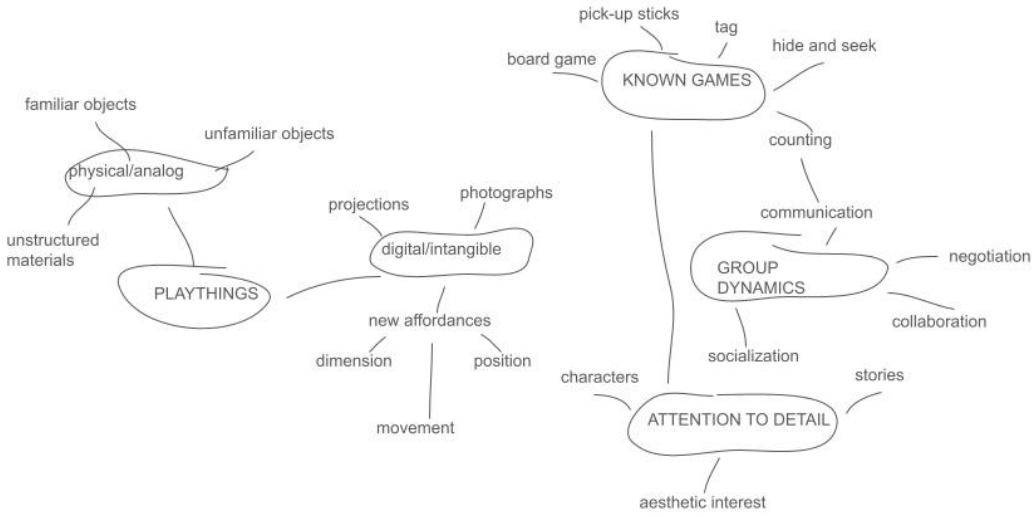

Figure 6. Themes generated through thematic analysis

One finding from analysing the empirical data is that all kinds of objects can be playthings. This idea may recall Maria Montessori's 'Treasure basket' where different objects found in the surrounding environment are gathered by adults (teachers, educators, parents) and offered to babies or very young children to stimulate motor skills and enhance sensory experiences (Montessori 1967 219). In REA settings, unstructured materials '(which) are generally extremely rich in suggestive qualities, memories and meanings' (Vecchi, 2010, 32) are regularly offered to children from very early on, to foster creativity and non-linear thinking as seen in the examples herein where the children created games with items that were not designed to be playthings. In examples A and B, the children used a range of found objects to create characters for their games, chosen sometimes linked to their

appearance (i.e. a skein of yarn became a mummy) or linked to their function (i.e. a faucet that could ‘spray’ people or a timer that ‘froze' time). In example D, any object could become a possible visual clue and in example E various shiny, mirrored or reflective items served G. in recreating the kaleidoscopic image of himself that he had seen on the ipad screen. Using objects or unstructured materials creatively in new ways, chosen for their expressive qualities attests to children’s ways of seeing and experiencing the things around them in creative, non-linear ways. The idea that all objects and materials can be used as playthings means that there is no right or wrong way to use them- and children’s ideas are often surprising, thinking up uses, juxtapositions and associations that are quite different from what adults might think of. This attitude of embracing the unexpected also links to what M. (age 7) said about the very genesis of the invented game in Example D: *I got the idea after taking a photo by mistake, it was all blurry.*

Another finding is that several of their invented games were based on known games, thus the familiar was in a sense reinvented or became a starting point for creating original iterations. In example A, the grid and the ways the pieces could move around the board might recall chess or checkers as each piece had a specific way of moving around the grid. Example B seemed to put a new twist on pick-up-sticks, a game M. and his friends had played together before at scintillae, M. designed his own version of it. Example C transposed the game of Tag, or Catch me if you can, into a new dimension between the physical and the digital. Example D might recall Hide and Seek- except that objects, rather than people, were hiding in plain sight. These re-elaborations are an example of how children explore, extend, and enrich their play based on prior experience and knowledge. Starting from something known and turning it into something novel by making new rules or adding

to existing ones also allowed the children to sustain their undirected play, since all play always has structure and follows rules, even undirected play (Gray 2012 7).

Several games featured the interplay between physical and digital dimensions. Given the increasing role of digital tools in children's lives, and the fact that they were all "digital natives", digital materials and tools were integrated with analog ones in natural, seamless ways. While it is beyond the scope of this paper to discuss this aspect in depth, recent research has been dedicated to exploring the impact of digital tools, materials and dimensions in children's play (Marsh, 2016). In Reggio thinking, the digital dimension is a dynamic and evolving aspect of the educational philosophy and the co-inquiry that children and adults are involved in together (Di Rocco et al, 2021; Vecchi et al, 2019).

Regarding the interplay between analog and digital dimensions, in some instances, the children used digital materials, taking time to explore and familiarize with a tablet or another digital tool, allowing them to develop awareness of and knowledge about digital materials, both through peer-to-peer learning and/or the support of adults. In example C, an ipad and a projector allowed the golden button, the protagonist of the children's undirected play, to change size and move between 2D and 3D dimensions, just by swiping or using their fingers, modifying position and speed as part of their game, but also engaging with their play using (moving) their bodies. Example D also featured the digital sphere, where a photograph of an object could be modified- enlarged, for example, to mask its identity and draw attention to details that might otherwise have gone unnoticed. In example E, featuring the translation of a digital image into an analog one, G.'s interest in recreating a kaleidoscopic visual effect using several different materials arranged and layered on

a flat surface was a fascinating study of the relationship between physical and digital materials and dimensions.

Great attention to detail was another characteristic of several of their games. In example A, I. chose the characters for her game based on what they were used for, expanding and embellishing the identity of everyday items to become part of a story. In example B, M. also chose a series of items, giving each one an identity- the golden buttons were the Mummy's precious treasure, the wooden elements were the Mummy's resting place, the Mummy itself was a soft, elongated, pinkish skein of wool. To play the treasure hunt game in example D, extrapolating a detail and making it into something unfamiliar and to be searched for was the whole point of the game. In example E, G. would not have been able to recreate the image of his face had he not spent time studying and looking at himself and thinking about what he needed to recreate the image. I would also go as far as to say that this attention to detail also brought out the children's natural interest in exploring the aesthetic dimension of their games in examples B, D and E, where the visual aspect was an essential part of the game itself.

Examples B, C and D (those featuring more than one child) also offer instances of how children socialized and collaborated with each other using language to communicate and negotiate, while example F adds the element of playing with language. There are instances when people need or want to do things together but they do not speak the same language. Children often find surprising and innovative ways to create channels of communication which go beyond mere words. Example F focuses on the communication strategy put into practice within a group of children, starting from an intuition by A., in an effort to include S., since S. only spoke Japanese and the other children and adults in the group were Italian speakers. The

only words they had in common were a few numbers in English, but by using these few shared words they were able make the rules for a game that they invented on the spot. Counting in English created a common linguistic space which allowed them to engage in something meaningful and enjoyable. This use of using a foreign language as a language for play, for creating a pleasurable and creative space, will hopefully remain in the minds of the children involved and continue to impact their relationship with other languages they may study or be exposed to in a positive way, as often learning a second/foreign language can be a fraught experience.

Possible learning and knowledge activated

In addition to the findings discussed above, further analysis regarding the possible learning that these instances of undirected play possibly activated or drew on are shown in Table 2. The spheres of meaningful learning identified, often overlooked, are based on the researcher's own empirical observations, which took into account the children's words and actions as well as the visual/physical/digital elements of their undirected play and the author's direct experience in observing and documenting them.

Game	**Possible sphere of learning and knowledge activated**
A. Stellina and her enemies	aesthetics, movement, storytelling
B. Don't wake the mummy	aesthetics, history
C. Catch me of you can	the body/movement, spatial and dimensional awareness
D. Visual treasure hunt	aesthetics (details), spatial and dimensional awareness
E. From digital to analog	aesthetics, observation, exploration of materials
F. One to ten	social skills/English

Table 2. Learning and knowledge possibly activated or drawn on

The most prevalent theme regarding the play experiences observed was aesthetics, in characterizing four out of six games, Examples A, B, D and E, where composition and choice of materials were fundamental aspects of their play. In Reggio thinking, the visual sphere and the dimension of beauty are important aspects of the learning environment (see Vecchi, 2010 for more on this) and the term 'aesthetics' refers to care and attention paid to visual harmony linked to a sort of artistic expressiveness, despite the fact that none of the play experiences were explicitly centered on art-making. Specifically, in Examples A and B, the choice of objects was closely linked to the identities of the characters who populated the gameboard and the unfolding storyline, while in Example D the focus was on paying attention to detail. Example E, the reconstruction of a digital image/effect using reflective materials, exemplifies the in-depth inquiry of the esthetic dimension during undirected play.

A second theme, characterizing three of the examples had to do with spatial and dimensional awareness of the body/movement in the surrounding space. In Example A, the characters moved on the board indifferent ways: they could go forward or back, freeze in place, jump, make zig-zags. In Example C, the children were experimenting with the size and movement of digital objects (hiding, running away, reappearing), while in Example D, the group of children concentrated on details of objects in the environment, locating and identifying them.

Some other unique themes identified through thematic analysis that the children used for building knowledge included: Example A, I. used her game to construct a narration and engage in storytelling in a non-linear way, as the story evolved as the objects moved around the grid in an unpredictable way. In example B, I noticed the importance of ancient history- I wondered: was M perhaps studying

Ancient Egypt at school? The shape of the wool recalled a mummy-like form- was that what inspired him to 'play' with history? It was certainly a way to play with a subject he might have been exposed to in the classroom. Example C helped the children to develop spatial awareness, as they also explored concepts like movement and the permanence of objects, moving between analogical and digital dimensions. In example D, the children explored concepts of dimension and form with the help of a digital tool. Example E is an esthetic exploration of materials by G, poised between the physical and the digital spheres. Finally, in Example F, friendship, sociability and collaboration were spontaneously co-constructed in the game that was freely developed where the children used prior knowledge of numbers in English to relate to and engage with each other in a shared, invented game.

The role of adults

It is important to say a few words about the role and attitude of adults in fostering children's play, especially undirected play. Loris Malaguzzi, the pedagogue who initially developed Reggio philosophy, believed that adults (teachers, educators and parents) needed to be able to play and cultivate the same curiosity to try new things- like children and/or based on children's ideas. He promoted the idea that adults needed to 'mess about' with materials- playing with and exploring with them- an idea he got from David Hawkins (1965; Edwards et al., 1998, p.73)- in order to directly experience and understand first-hand the pedagogical value of play. Malaguzzi believed that 'children build their own intelligence. Adults need to provide them with activities and context, and above all, they need to be able to listen' (Loris Malaguzzi, author's translation).

Carla Rinaldi, a close collaborator of Malaguzzi for many years, poses questions that are at the basis of listening on the part of adults (and at the foundation the pedagogy of listening, a key characteristic of REA):

> How can we help children find the meaning of what they do, what they encounter, what they experience? And how can we do this for ourselves? These are questions of meaning and the search for meaning (why? how? what?) … it is a very difficult search and a difficult task… that involves making connections, giving meaning to these events, to these fragments that are gathered over the course of many and varied experiences. (Rinaldi, 2006, p. 63).

In terms of practical application, since the undirected play instances described are not in themselves replicable, the attitude and thinking of adults informed by Reggio philosophy is what is most broadly generalizable. Listening to children and supporting/facilitating them, building on children's knowledge, means that adults are co-inquirers together with children and observers/documenters of their learning processes, but not in charge of what or how they learn through play.

Conclusion

This paper highlights the intertwining of children's learning with undirected play and games they invented for themselves and other children. Findings from the data analysis give insight into several characteristics of undirected play (including choice of objects/materials as playthings, reinventing known games, attention to detail and esthetic qualities) that can lead to meaningful learning. The experiences focused on how children explored the world around them and questioned things freely, incorporating what they already knew as they built their knowledge. The

complexity of how children approach the world and how they learn about it follows their own way of reasoning because 'when children are free to follow their interests, they take diverse and unpredicted paths' (Gray, 2012, p.81), and this study supports Gray's findings while also highlighting the possible learning activated during undirected play. Children's actions and thought processes manifest in unguided and unpredictable moments of undirected play and its role in children's knowledge-building processes offers insight into the significance of undirected play at school, at home or in other informal and non-formal contexts, since it is through play that children engage in meaning-making as they create their understanding of the world around them, construct their identities and relationships, gain knowledge and life experience (Edwards et al., 1998). In the instances of undirected play analyzed, play was a way to establish relationships, overcome obstacles (i.e., children who did not speak a shared language) or invent novel games using the body, objects, materials, the surrounding environment/space, as well as digital tools (tablets, smart phones, etc.). In the words of Rosen:

> Play as 'trial and error with no fear of failure'. Not only do we not know what's going to happen (the outcome), but the outcome doesn't really matter very much. It's the play that's important, not the result. In fact, there may not be a result, or it may be something entirely unexpected. (Rosen, 2019, p.14).

Thus focus on process rather than result epitomizes the value of undirected play, when children are the designers of their play and builders of their knowledge.

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