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A Kaleidoscope of play: a new approach to play analysis in childhood

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ABSTRACT

Play is a frequent and relevant activity during childhood, and developmental psychologists agree that it offers a unique window on development. Play, however, remains a fuzzy concept, and difficulties persist in its definition, often leading to obstacles in building and comparing experimental studies. This may be due to widespread tendencies to define play by referring to non-observable inner states, to consider playing something that occurs in the head rather than in-the-world and to overreliance on developmental stages. Enactive approaches to child play have instead recently stressed the importance of play contexts, considering child play an activity in-the-world rather than a mental state, thereby de-intellectualizing play and pretense. Along these lines, in this paper the authors propose a novel approach to the definition of play types by considering the roles of organism, environment, and task constraints, within the framework of Material Engagement Theory. Focusing on the material world surrounding the child and the interactions which characterize play, we critically review the strategy of resorting to non-observable categories in the study of play, and we propose a new model (the Kaleidoscope Model) for play analysis.

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1. Introduction: two riddles on play

For children, play is a natural and spontaneous act coloring a great number of daily activities, but for developmental psychologists it is both a complete riddle and the perfect setting to observe child development. Contrary to eating and sleeping, play does not appear to be directly associated with a child's physiological needs, and rather than being a means to an end it seems to be an activity without a specific goal. Therefore, the first riddle about play is: why do children play?

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This question received many different answers throughout the history of developmental psychology. Jean Piaget considered child play an opportunity to enact acquired behaviors in contexts detached from the ones that characterize their acquisition. In his view, play skills are linked to specific developmental stages and consolidated, rather than acquired, through repetition and reorganization ([Piaget, 1962]). Lev Vygotsky valued play as a child's invention, a pleasure space, intrinsically linked to social rules that in real-life experiences are condensed and employed by others, but in which the child is able to use these rules more broadly and freely ([Vygotsky, 1976]). For Gregory Bateson play leads from a two-dimensional world of necessity into a three-dimensional world of possibility and fantasy – a door through which we need to step in order to acquire cultural symbols. In this view, the contribution of play to development should not be sought in its contents, as much as in its processes, as play allows one to learn about learning ([Bateson, 1955]). Other authors stressed the importance of play in producing spaces in which objects are used in “as if” situations as well as a way to discover novel prototypes and associations that constitute an adaptive potential to be used when in need ([Sutton-Smith, 1967, 1976]). Alternatively, play may create a safe environment in which to freely and flexibly exercise motor skills detached from their consequences in real-life scenarios ([Bruner, 1972]). These theories differ in conceiving play either as a *locus* where child skills are exercised or a *forge* shaping them, but they agree in recognizing that when a child starts to play we are offered a unique opportunity to observe development *in action* ([Rubin et al., 1983]). Therefore, a wealth of studies have been dedicated to analyzing children's play at different ages (mostly between 4 months and 11 years of age), in different contexts (in home, school, lab, or outdoor environments), in different cultures and socio-economic realities (which influence play on multiple levels), with different materials (toys, tools, and natural objects) and in different situations (alone, with peers, and with caregivers). But whatever the experimental setting, and however constrained or not the conditions may be, parsing out and analyzing quantitative and qualitative aspects of children's play remains to date a difficult task. This leads to the second riddle about play: what is child play?

Many authors have stressed that this second question is hard to answer, due to the fuzziness of the concept, which raises multiple definitional problems ([Lillard, 2015; Rubin et al., 1983; Sparaci & Bonsignori, 2023]). For example, consider the following behaviors: (A) a young infant starts blowing raspberries, the mother smiles, the infant notices her smile, blows more raspberries and then laughs; (B) an infant on her highchair bangs a spoon, while her mother is attempting to feed her; (C) a toddler puts a wooden stick in the sand and turns it; (D) a child points at a cloud and says: “My favorite dragon”. All these acts

stand at the cross-roads between play and other skills. In fact, they may be listed as different types of play, but they could just as well be considered communicative acts (A), exploratory behaviors (B), functional actions (C), or daydreaming (D), which fall outside the realm of play.

Difficulties with defining play persist today and, far from being only a theoretical problem, they impact experimental research: without a definition of a behavior, it becomes hard to parse it out and analyze it, while the existence of multiple contrasting definitions makes comparisons between data extremely complex. In this paper, we do not presume to reach a unique definition of play, nor fully address all forms of play occurring among different cultures around the globe, but rather to propose a new theoretical roadmap for its definition, largely influenced by current enactive approaches to cognitive development. Our aim is to provide a common theoretical background, while highlighting some common aspects of play that have been overlooked or misconceived by current theories of play. We will begin by presenting two different strategies that have been employed in defining childhood play. These are based, respectively, on: psychological dispositions and play types. However, as we shall see, both strategies find their main limit in an overreliance on non-observable inner states, considering playing something that occurs in the head rather than in-the-world.

2. Defining play: dispositional approaches vs. play types

One strategy for defining play is to pinpoint psychological dispositions which characterize it and mark its occurrence. Dispositional approaches describe play as characterized by intrinsic motivations, attention to means rather than ends, presence of non-literal and simulative acts, guided by organism-dominated questions and active engagement of participants ([Rubin et al., 1983]). This rules out behaviors, highlighted above, that do not fall within play (communicative acts, exploratory behaviors, functional actions, daydreaming), defining play as an enclosed concept. Play is understood as intrinsically motivated because it is not governed by physiological needs or externally induced. Children across the globe spontaneously play to various extents and in different ways often displaying common developmental patterns, even if child play is characterized by tremendous variability across culture and social class ([Lillard, 2015]). Often enough play goals are not external to the behavior itself,¹ which allows distinguishing play from communicative acts (A). In play children focus on processes rather than end states and this, alongside the frequent presence of simulative acts, sets play apart from real-life functional actions (C). Furthermore, in its relation to objects, play seems to be led by organism-dominated questions such as “what can I do with

this object?” rather than environmentally guided questions such as “what is this object?”, distinguishing play from exploratory behaviors (B) ([C. Hutt, 1966, p. 76; S. J. Hutt et al., 1989]). Finally, play requires active engagement of its players, disentangling it from other pleasant or restful activities such as daydreaming or loafing (D).

Dispositional approaches thus distinguish play from other behaviors and highlight often-overlooked aspects of play. However, these definitions seem at best useful in clarifying specific aspects of a play behavior once this has been detected, rather than parsing out bouts of play within a child’s daily activities. For example, in observing a toddler shaking a nut, how can we state that she is led by organism-dominated play questions (such as “what can I do with this?”), rather than environmentally guided questions, which characterize object exploration (such as “what is this thing?”), or no questions at all? A common approach in developmental psychology is to rely on detailed structural analyses of observed actions rather than inner disposition. For example, given that functional object-directed actions, in contrast with play, usually tend toward behavioral optimization, through removal of unnecessary and redundant action components, repeated observations may allow us to parse out functional acts from play behaviors in non-human primates ([Candland et al., 1978; Hughes, 1979; Fragaszy et al., 2010; Cenni et al., 2020]). In other cases, the intrinsic organization of specific action sequences may allow parsing out exploratory behaviors from functional acts in infants ([Zelazo & Kearsley, 1980; Sparaci et al., 2018]). However, this way of distinguishing play from other actions (e.g., exploratory actions) is based on observed behavior sequences rather than the ascription of inner dispositions.

Therefore, dispositional approaches may at best be used to occasionally rule out non-play behaviors or to flag ambiguous cases, but relying on such an approach in order to ascribe often arbitrary and non-observable inner states to the child makes them of little use in applied research. Conceiving play as an enclosed concept, we may delimit its borders, but we will possess little information of its landscape, which would instead be essential in parsing out play behaviors.

An alternative approach, then, is to define play based on observable behaviors. Given that multiple behaviors, across the globe, may be considered occurrences of play, developmental psychologists often parse these behaviors into different types defining them and distinguishing one from the other. This is a significant shift. The analysis of play types allows moving away from an enclosed concept of play, toward a more open concept, possibly based on similarities and relationships among observable behaviors ([Sparaci & Bonsignori, 2023]). To clarify what this means, it will be useful to briefly describe the main play types often described as characterizing early development, which include exploratory, relational, functional, and

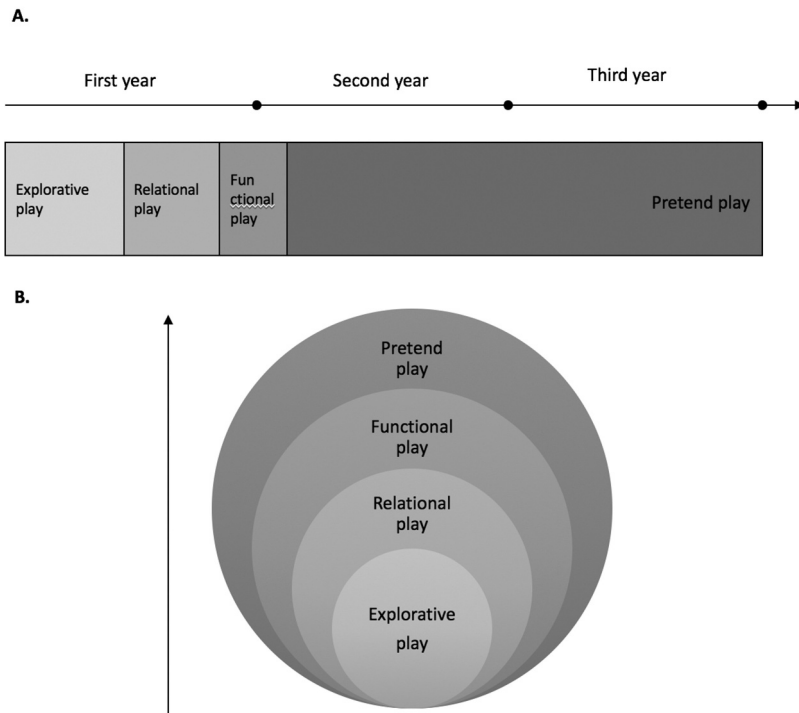


Figure 1. A. Play types represented as proceeding in stepwise temporal succession; B. Graphic rendering of play types as juxtaped in development.

pretend play (see Figure 1A). It is important to state that while these play types have been found in multiple cultures, play is characterized by tremendous variability across cultures and social class, as will be better described below ([Lillard, 2015]).

Exploratory play is one of the first play types to emerge around 4 months of age, when infants, as they grasp objects, begin to enact patterns of sensorimotor exploration (rubbing, shaking, scratching, banging, poking, mouthing). These patterns gradually grow in complexity as independent sitting, freeing the hands, allows for longer and more sophisticated play bouts ([Gibson, 2000; Halverson, 1943; Vondra & Belsky, 1989; Lockman 2000; Connolly & Elliott, 1972; Gesell & Ilg, 1937; Newell, 1986; Iverson, 2010]). Exploratory play is usually repeated and accompanied by emotional displays of pleasure which may be shared with caregivers or peers, which contribute toward distinguishing it from simple exploratory (B) or communicative actions (A). For example, an infant may shake a rattle to produce a sound, while looking at her mother and laughing ([Lifter et al., 1993; Uzgiris & Hunt, 1975]). However, this distinction is at times hard to make.

Between 7 and 18 months, infants start putting multiple objects together leading to relational play, enacting more complex play sequences. These are characterized initially by the juxtaposition of objects in an unrelated way but

are soon followed by behaviors progressively suggesting awareness, if not enactments, of objects' functional use ([Belsky & Most, 1981; Fenson et al., 1976; Lifter & Bloom, 1989; Rosenblatt, 1977; Zelazo & Kearsley, 1980; Vondra & Belsky, 1989]). The juxtaposition of objects characterizes relational play, while once again specific quality and timing of co-occurring behaviors (social smiling, eye gaze, vocalizations, gestures, etc.) are typically used to distinguish relational play from exploratory acts (B) – once again leading to rather subtle distinctions.

Around 10 months of age infants begin to clearly use objects within specific function-related action sequences (e.g., grasping a spoon by its handle to eat), enacting *functional play* schemes ([Connolly & Dalgleish, 1989]). Functional play is distinguished from previous play types, as it demonstrates in children a clear knowledge of object affordances and use, which could previously only be inferred ([Zelazo & Kearsley, 1980]). For example, if a child grasps a spoon from its handle and places it in a cup, it is impossible to establish whether this is just relational play or the prelude to functional play. In fact, this act may just be the product of repeated encounters with specific contexts or scripts in which this layout occurs. But, if a child turns a spoon in an empty cup, knowledge of object affordances and function becomes more apparent. Co-occurring behaviors (eye gaze, vocalizations, etc.) are used in this case to distinguish play occurrences from simple functional acts (C) [see Sparaci et al. (2018) and Fanning et al. (2020) for an example of how these distinctions may affect experimental research].

By the end of the first year child play undergoes one of the most relevant observable changes as *pretend play* emerges. This begins with a gradual increase in forms of de-contextualization, occurring when a familiar action (e.g., drinking, eating, and sleeping) is detached from its typical time or space of execution and produced in another situational context (e.g., pretending to sleep on a book instead of a pillow or at a time that is neither nap nor bed time) ([Bates, 1979]). Initially, de-contextualization is related to the self (e.g., the child pretends to eat with a spoon), but soon after it comes to include other agents both real and imaginary (e.g., a child pretends to feed his mother or a doll) ([Fein, 1975]). Furthermore, while others are initially passive agents, between 12 and 30 months they become active (e.g., a child feeds a doll then lays her to sleep and pretends to speak in an undertone so as not to wake it). Pretend acts and scenarios become increasingly more complex during the second and third years as children move from single actions (e.g., combing the mother's hair) to ordered combinations (e.g., combing the mother's hair and then holding a mirror so that she can look at it) ([Nicholich, 1977; Fenson & Ramsay, 1980]). These scenarios often resemble situations

experienced in real-life or stretching into imaginary narratives, and the amount of engagement and effort that the child invests in building them is typically used to distinguish them from other behaviors such as daydreaming (D). We will say more on the definition of pretend play below.

Summing up, play types capture different play-related behaviors in early childhood and frame attempts to distinguish play from the non-play behaviors that we have listed above. However, in the case of play types, these distinctions are often not easily made. It is important to note that usually each play type co-occurs with the acquisition or with being in the process of acquiring specific sensory-motor and/or cognitive skills (e.g., exploratory play is boosted by independent sitting, functional play requires knowledge of object affordances, etc.). Furthermore, play types are defined based on multiple behaviors and on their material or social context of execution (e.g., social smiles contribute to pinpoint exploratory play, while the presence of multiple objects is essential for relational play). More will be said on these aspects below.

Even if play types support more detailed descriptions of play behaviors allowing researchers to parse out the specific play landscapes, current definitions still present some major drawbacks. First, there is a persistent Piagetian tendency to consider play as progressing in a neat stage-like succession during development, which fails to capture the fact that multiple play behaviors may co-exist and overlap in development. For example, functional play is considered as a precursor of pretend play, but child pretense often exploits functional play acts (e.g., pretending to feed a doll with a spoon a child also enacts a functional play act). Therefore, it is often hard if not impossible to correctly set a border between play types ([Sinclair, 1989]). In placing such borders, authors often end up relying on specific cognitive skills, leading to the second drawback: definitions of individual play types end up once again relying on non-observable inner states. Finally, these play types largely derive from studies conducted on Western and middle-class samples, leading to obvious methodological problems in cross-cultural investigations, i.e., categories designed in one culture may not be appropriate in the analysis of behavior in another ([Prosser et al., 1986]). For example, as shown by Feitelson's (1977) seminal presence of specific toys (e.g., dolls) or acts (e.g., imitation) in non-Western societies should not be automatically interpreted as indicating occurrences of pretend play. And, more importantly, even if occurrences of a specific play type are found in non-Western societies, these should be analyzed by keeping in mind that "style of play in any one society is by no means a random occurrence, but is instead closely linked to its social make-up" ([Feitelson, 1977, p. 9]). As we shall see below, this leads to considering other factors which influence and shape specific play types.

To better illustrate problematic issues linked to play types, we will now consider more closely definitions of a specific play type: pretend play.

3. Limits of play types: the case of pretense

As we have seen in Western societies pretend play² emerges around the first year, peaking around 4 years, it is still extremely frequent, in different forms, until 11 years of age and some authors even stress its continuing presence in adulthood ([Lillard, 2015; Göncü & Perone, 2005]). Given its longevity, it is not surprising that pretend play has attracted major research attention and that it has come to include many different behaviors. Therefore, it is extremely hard to produce a “watertight” definition of pretend play ([Leslie, 1987, p. 414]). Multiple criteria have been applied to infer that a young child is pretending: treating inanimate objects as animate (feeding a doll), performing an activity in the absence of its necessary materials (drinking from an empty cup); performing acts usually belonging to others (cleaning, cooking); performing acts without their usual outcome (place a purse over an arm, wave, but not go out); substituting one object for another (using a shell as a drinking cup); producing affective or instrumental behaviors that show the non-literal quality of an activity (lamenting the loss of an imaginary toy) ([McCune-Nicolich, 1981]).

To overcome this difficulty, authors often group all these behaviors under the common banner of “as if” states ([Belsky & Most, 1981; Fein, 1975; Casby, 2003; McCune-Nicolich, 1981]). This implies considering pretend play the mark of symbolic thought, where a signifier (a wooden block) is made to stand for or be used “as if” it were a specific signified (a car). This definition and its reliance on symbolic thought extends well beyond the notion of de-contextualization and originates in the Piagetian statement that pretense implies the representation of an absent object and a comparison between a given and an imagined element ([Piaget, 1962, p. 111]).

Cognitivist approaches take the definition of pretend play as an “as if” state one step further by stating that this kind of symbol manipulation relies on *mental representations*. For example, Alan Leslie famously suggested that a child pretending that his cat made of felt is a real cat, that it eats and meows, must have a *primary mental representation* of “cat,” which includes what real cats usually do (eating and meowing), and a *meta-representation* in pretense that “felt cat-is as if-cat.” The two mental representations need not only co-exist but must also be kept separate or *decoupled* in the child’s mind, so that this may be considered a form of pretense and not an error or folly ([Leslie, 1987]). In this view, pretend play requires five elements: a pretender, some reality that is pretended about, mental representations that differ from reality, layering of the mental representation on reality in the same time and space, and awareness in the pretender of all these

components ([Lillard, 1993]). This results in an internalist definition of pretend play: the child's mental capacities occupy center stage and pretense is something that happens in the head, rather than a relationally constructed skill happening in-the-world. Furthermore, the emergence of pretend play may hardly be seen as gradual and is mostly constrained to a narrow developmental stage, as the necessary meta-cognitive skills must be in place. In anthropological psychology, a critical view of this conception has led to underscore environmental factors that have been shown to influence pretend play. For example, Feitelson suggests that pretend play quality in any society is strongly influenced by four factors: (1) the play space or spaces that are allocated to child play in different cultures; (2) the availability of sufficient legitimate time away from chores or nursing peers to be dedicated to the unfolding of plots or themes which characterize pretend play; (3) availability of play objects that are familiar, permanent, and freely available; (4) a play conducive atmosphere and in particular adults' attitudes toward pretense ([Feitelson, 1977, pp. 10–13]).

The case of pretend play shows how resorting to play types, while broadening our descriptive understanding of play forms, may shackle childhood play to a rigid stage-like progression while doing nothing to avoid an internalist perspective centered on non-observable inner states. In the following section, we will propose a way to overcome these limitations by shifting toward a less internalist view, and re-assessing the relevance of organism, environmental, and task constraints.

4. From a stage-like progression to the *gestalt* of play types

Piagetian origins of play types and their tendency to be related to the child having acquired or being in the process of acquiring specific skills, induced researchers to believe that play types follow each other in an orderly fashion. A similar belief characterized also early studies on motor skills: considering motor development as a step-wise neurophysiological maturational process through which the infant progressed as a whole, and in which milestones were reached in a fixed sequence ([Gesell, 1929]). Therefore, initially, research on motor skill only gave minor relevance to the organism's relation to environment or task space. But data did not add up, and subsequent studies began to suggest that action contexts may instead play a very relevant role in determining a child's pattern of motor control and coordination.

Karl M. Newell described organismic constraints, environmental constraints, and task constraints, as essential in the definition of motor skills, given that changes in these constraints proved to shape and impact children's possibilities for movement [Newell (1986), see also [Figure 2A](#) for Newell's depiction of the relation between these constraints].³ For example,

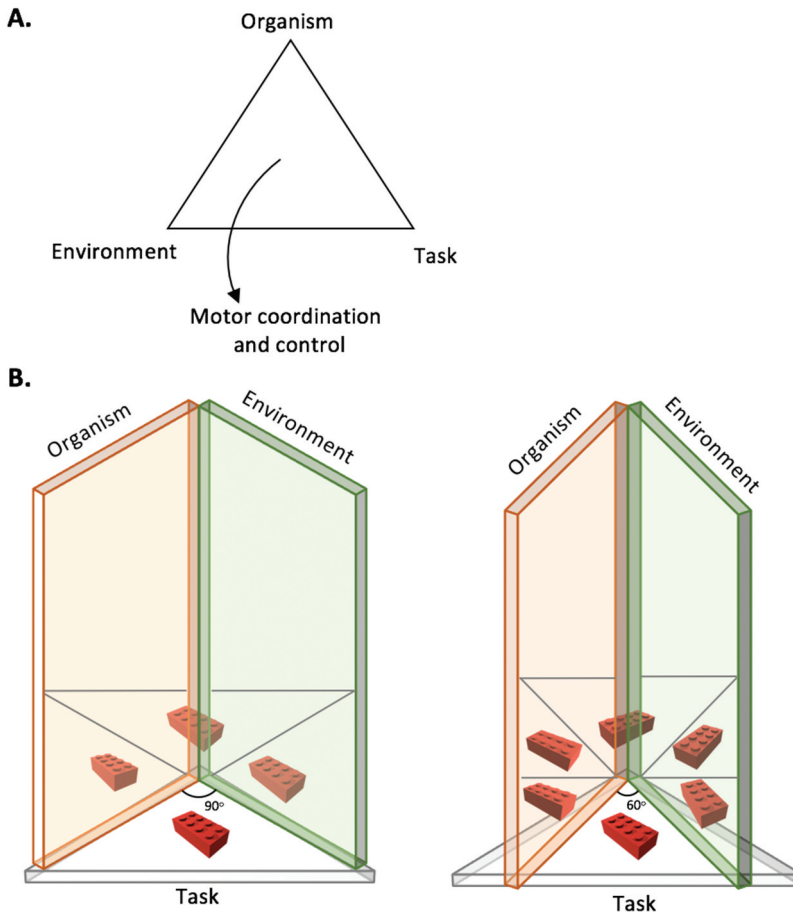


Figure 2. (A). Newell's depiction of categories of constraints that specify motor coordination and control (Newell, 1986); (B). Graphic rendering of the Kaleidoscope Model for play analysis showing how changes in the relation between organism and environmental constraints affect the task space and the dynamic gestalt of play scenarios.

Esther Thelen in a famous series of experiments showed that changes in environmental constraints (placing young infants in water) allowed the stepping reflex, which disappeared between 4 and 16 weeks, to reappear ([Thelen et al., 1984]). Data therefore suggested that motor coordination and control originate from co-occurring constraints and each skill must be evaluated in relation, not only to the child but also to the task and environment in which he is acting [see Newell (1986), p. 348 for a graphic representation of this interaction]. Newell's proposal as well as new empirical research led to a significant shift in developmental studies on motor skills: understanding motor development as relationally constructed in-the-world, rather than something happening only in the head ([Clark, 1998; Thelen & Smith, 1996]). In this kind of action and skill complex, involving situated interaction of organism-environment-task (a dynamical combination of

functional integration and task dependency [Slors, 2019]) it is important to note that typically the environment is highly social, involving not only the presence of others but explicit and implicit constraints introduced by cultural practices and institutional frameworks ([Gallagher, 2020]). For example, as we shall see below, in different cultures play can be cultivated, tolerated, or discouraged ([Gaskins et al., 2007]).

In the following sections, we propose to shift our perspective in analyzing play types. Play types, we will argue, are better described as characterized by a dynamical juxtaposition and interaction, rather than a step-wise maturational progression. This new conception of play types allows moving beyond the stage-like scenario to explain how play types may co-exist and overlap within the same developmental stage. In this view, play types are interrelated in a dynamical *gestalt* from which each play type grows, expands, and loops back into (rather than replacing) the previous one, extending specific acquired skills to a growing number of environments and tasks as the child adapts and copes with them in a dynamical engagement [see Figure 1B].

We will start out from Newell's (1986) analysis of the development of movement coordination in children. In contrast to traditional theories that conceive of the development of motor control as involving the acquisition of prescriptions or instructions for action in the form of symbolic knowledge structures informing executive function, Newell, as we noted, focused on dynamical constraints and distinguished between organism (brain-body), environmental and task constraints, to provide a description of how a variety of factors shape movement coordination. We take this model as a starting point for the enactive and situated analyses of child play. However, we will then move away from Newell's model, and introduce the Kaleidoscope Model for play analysis, which, in contrast to traditional maturational approaches, may better account for creativity in child play.

5. Moving forward: playing-in-the-world

In describing play types, we mention how co-occurrence of specific sensory-motor and/or cognitive skills and the presence of multiple behaviors contribute toward their definition. We will now describe how the kaleidoscope of forms that make up child play may originate from the dynamic relation between three different planes that actively shape its morphology: the organism, environment, and task space. This heuristic elaborates on Newell's original depiction [Figure 2A], but changes and enriches the parameters of these constraints to account for an enactive relation between the child and her environment in the context of play [see Figure 2B].

5.1. Organism constraints: structural and functional

In Newell's depiction organismic constraints include structural constraints (body weight, height, and shape) and functional constraints (synaptic connections). These must be distinguished as operating on different time scales and developing at a different pace. While structural constraints are time independent and change very slowly (although systematically) in development, functional constraints are relatively time dependent as they change more rapidly ([Newell, 1986]). The interplay between structural and functional constraints also shapes changes in other factors such as the movement of inertia of each body segment (a bio-mechanical constraint) as well as body-schematic processes for motor control. Therefore, organismic constraints operate with different degrees of complexity while reciprocally influencing each other in complex cycles of feedback within the individual. Furthermore, Newell stresses that changes in organismic constraints are in turn influenced by elements that may be found outside the individual organism (environmental and/or task constraints). For example, a child's ability to grasp an object, her motor planning and control will depend on object size as well as on her previous experiences [see Figure 2A]. In fact, objects in the world with their characteristic shape, weight, texture, and mass support specific action sequences, or in other words: "The environment provides (affords) resources or supports that an animal may (or may not) attend to and use" (Gibson, 2000, p. 54). Therefore, the ability to grasp and use an object is highly-context related, given that, in order to do so, children must detect and relate to object affordances (Lockman - 2000). In turn, specific play actions may contribute to a child's physical development and to the acquisition of competencies that are of use in adult life. For example, the "aim game" played by children in a community in the Okavango Delta in Botswana, in which a boy picks a spot on the ground and throws a stick at it, has been shown to be preparatory for adult competence in hunting [Bock & Johnson 2004].

In regard to play types, this perspective requires going beyond Piagetian approaches to consider the development of real-world skills as a form of adaptive acting and not as based on abstract, logical and rational thinking ([Thelen, 2000]). In this view, the nervous system with its functional constraints is a dynamic system embedded in and coupled to the body, a dynamic system, with its own structural constraints, and together they are embedded in and dynamically coupled to the environment within specific task spaces ([Thelen, 2000; Chiel & Beer, 1997]). Embodied approaches to cognition have contributed toward highlighting how the body plays an active part in shaping the emergence and development of specific skills ([Gallagher, 2005, 2020]). However, current definitions of play types that tend to overly rely on cognitive skills and mental representations,

thereby overplaying the role of a narrow set of brain-related functional organismic constraints and structural organismic constraints are often overlooked. We suggest that it would be important to gain better understanding of their role in play development ([Orr & Geva, 2015]).

For example, we mentioned above the importance of independent sitting for exploratory play, given that by freeing the hands sitting allows for longer play bouts which in turn lead to longer sitting time ([Iverson, 2010]). Similarly, we may consider crawling and walking as opportunities to extend the infant's world beyond her proximal surroundings, allowing the infant to reach far away objects and supporting combinations which encourage relational play and enforce gross motor skills ([Karasik et al., 2011]). On the other hand, for functional play to emerge specific grasping competencies may need to be in place; these, as stated above, will rely not only on brain maturation and functional constraints but also on biomechanical constraints and child experiences with specific tools and tasks ([Connolly & Elliott, 1972]).

The importance of considering different organismic constraints and their interplay when analyzing play types is reinforced by studies on both typical and atypical development suggesting that fine and gross motor proficiency influence play and vice versa ([Butcher & Eaton, 1989; Sparaci et al., 2018; Fanning et al., 2020]).

5.2. Environmental constraints: social, cultural, and material

If structural organismic constraints have often been overlooked, play-related *environmental constraints* have been completely underplayed in developmental psychology. As pointed out by multiple studies, developmental psychology has often focused on an excessively thin, and rather unusual, slice of humanity: children from Western, Educated, Industrialized, Rich, and Democratic (WEIRD) societies ([Henrich et al., 2010; Nielsen et al., 2017; McCoy, 2022]). Some forms of play have a long history and may be found in multiple cultures and contexts. For example, Lancy highlights how games that involve using some kind of projectile to dislodge an opponent's stationary target (e.g., marbles) were not only already present in the Roman era but described among Piaget's Swiss children, as well as among children in Sulawesi, Fiji, and Liberia ([D., Lancy, 2022, pp. 216–219]). Similarly, “sowing” games, which involve scooping up playing pieces and dropping them in specific holes or pits, are common in Africa (i.e., bao), the Middle East (i.e., mancala), Asia (i.e., sungka), America (e.g., wari), and Europe (e.g., Bohnenspiel) ([D., Lancy, 2022, p. 227]). Even if games stay the same, the ways in which they are played differ greatly, and while Piaget's observations on Swiss marble players may be used as reference,

environmental constraints play an important role in shaping games across the world ([D. F. Lancy, 1996]). However, what we suggest is not simply that there may be differences in play types across cultures, therefore highlighting a need to adjust our WEIRD lenses to specific environmental conditions, but that the WEIRD lens is intrinsically biased by an overreliance on mentalizing. For example, we have seen above how pretense has been viewed as a symbolic activity occurring mostly in the head rather than in-the-world, often assuming an internalist narrow approach in analyzing pretend play. Initial challenges to this view may be found in authors criticizing Piaget for considering pretense as a solitary activity, which only served to consolidate skills that children already possessed and as scarcely dependent on social intercourse ([Smolucha & Smolucha, 1998; Göncü & Gaskins, 2007; Lillard, 2015]). These authors gladly embraced the more socially oriented perspective proposed by Lev Vygotsky, who warned against the downfalls of an excessively internalist and intellectualistic approach to play behaviors ([Vygotsky, 1976; Smolucha & Smolucha, 1998, 2021]).

More recently, enactive approaches to pretend play have challenged approaches to pretense that rely on the manipulation of mental representations ([Hutto & Myin, 2017; Gallagher, 2017; Rucinska, 2017, 2019; Rucińska & Weichold, 2023]). The enactivist turn also introduced different explanatory tools to describe pretend play such as capacities for sense-making, social practices, and affordances ([Rucińska & Weichold, 2023]). These tools allow researchers to highlight different and interrelated environmental constraints contributing toward shaping play scenarios. While authors do not always agree on how and to what extent environmental constraints may shape child play, we will propose three types of environmental constraints: social, cultural, and material. At this point, we are going significantly beyond Newell's model, which is concerned with explaining movement coordination; play is not reducible to just bodily actions any more than it is reducible to symbolic knowledge. Moreover, the environment is not just the physical surround; it includes social and cultural constraints as often stressed by cross-cultural studies ([D. F. Lancy, 2017]).

First of all, it is important to stress how empirical research has shown that play types are co-construed and shaped within social interactions and molded by overt social behaviors. For example, Lillard and Witherington (2004) analyzed the behavior of 36 mothers and their 18-months-old children while having a real snack vs. a pretend snack. Mother-child interactions were filmed and later coded in two settings with the same utensils and differing only for the presence (real scenario) or absence (pretend scenario) of food and drinks ([Lillard & Witherington, 2004]). The researchers analyzed five behavioral dimensions:

- (1) facial expressions (presence, duration, and referent of smiles);
- (2) looking patterns (duration and direction of mothers' gaze);
- (3) functional movements (functional actions pertaining to eating, drinking, pouring, and serving);
- (4) verbal behavior (total word count and references to objects, snacking behaviors, items of consumption, and use of the word "pretend");
- (5) nonverbal noises (noises mimicking sound made during eating, drinking, serving, and/or pouring, as well as comment noises such as laughter and/or "mmm").

Differences were found across all dimensions. In particular, in the pretend scenario, mothers smiled more and longer at their actions (facial expressions), they looked longer toward the child, whereas they looked more at the task in the real scenario (looking behaviors), they produced more eating-, drinking- and serving-related actions, with differences also in movement velocity (functional movements such as holding were significantly longer in pretend eating than in real-life eating), they also talked more, with some use of the word "pretend" and greater references to concrete objects and behaviors, but not consumables (verbal behaviors) and made more sound effects mostly linked to eating, drinking, and serving noises (non-verbal noises). Data from this study show that caregivers actively shape pretend scenarios using multiple perceptual, motor, and emotion-related cues.

In a subsequent study, Nishida and Lillard (2007) used sequential analysis of mother-child interaction sequences in a similar scenario to capture whether the caregivers' cueing would facilitate pretense comprehension in children. By considering onset and offset of mothers' behaviors (smiles, looks, and functional movements) as well as onset and frequencies of children's behaviors (smiles, laughs, and snack-related actions), they concluded that children actually use their mothers' cueing and social referencing in the pretend condition to interpret her unusual actions. These results have been replicated using different settings, on older age groups and in other cultural contexts, showing consistent results ([Richert & Lillard, 2004; Ma & Lillard, 2006; Nakamichi, 2015]).

Taken together, these studies and their fine-grained analyses of caregiver-child interactions, show that there may be no need to refer to mentalizing skills in defining pretense. What we need to consider instead is the extent to which social environments may play an active role in shaping pretense in childhood. For example, some authors suggest that pretend meanings are often construed and co-construed with others in a form of participatory sense-making ([De Jaegher & DiPaolo, 2007]). In building these pretend meanings language may play different roles which need to be disentangled in order to better understand pretend dynamics [see also Rucińska and Weichold (2023) for

a full review]. Furthermore, we need to consider how differences in social environments may impact pretense. For example, studies observing joint attention in everyday contexts but considering human infants from diverse socio-ecological settings (i.e., infants from western, middle-class UK families living near universities, from communities of subsistence farmers in Cameroon, and from foraging communities in the tropical rain forests of the Central African Republic), show that although joint attention is universal, significant variations emerge in partner, shared topics, emotional tone, and initiator, reflective of differences in caregiving style, parental practices, parenting goals, and focus ([Bard et al., 2021]).

Culture and socio-economic status (SES) are other factors that impact child play. For example, while cross-cultural analyses suggest that pretense is a widespread and potentially universal activity, cultural and SES variations affect both quantity and quality of pretense, as well as the role of pretense and imaginative play in cultural activities ([Gaskins, 2013]). In fact, play varies across cultures not only in its content, in the type of social interactions that are experienced and in the materials available to children (of which more will be said below), but also in the relation between play and other everyday activities. Something that we must keep in mind in today's multicultural societies.

For example, Gaskins et al. (2007) offer an interesting comparison between four societies: North American, Taiwanese, Kpelle, and Yucatan Mayan. In North America and Taiwan, play is a cultivated activity: caregivers support pretend play before the child begins to play spontaneously, participate directly in child pretend play, and provide toys specialized for pretending as well as physical play spaces. But even within these societies some differences emerge related alternatively to gender roles, physical environments, or cultural beliefs and traditions. For example, within North American families, the relation between parenting beliefs and practices varies with gender, highlighting that mothers feel their participation in play is more mandatory, while fathers have a more discretionary approach ([Parke, 1996; Haight et al., 1997]). Physical environments or space allocated to play also have an important role as stated above. For example, as smaller Taiwanese apartments allow for fewer toys than large North American homes, children in Taiwan use fewer toys within play scenarios and rely more on ritualized social exchanges. Furthermore, as Confucian thought emphasizes the importance of harmonious interaction through respecting the elders and adherence to rules, play themes of Taiwanese mothers and children revolve less around fantasy worlds, and more around everyday social routines with non-kin adults, such as addressing or responding to a teacher or interacting with a street vendor. Greater cultural differences emerge, shifting to cultures that accept play without cultivating it,

such as the Liberian Kpelle, or cultures in which play is curtailed, such as the Yucatec Mayan. For example, Kpelle children's play is limited by being tethered to their mothers or older female siblings, allowing less exploration of the environment and less play with same-age peers. While for Yucatan Mayan children play it is strongly limited by the time spent in working chores or observing adults for learning purposes ([Gaskins et al., 2007]).

Observations of child play in multiple cultures and at different time-points allow us to better understand and outline how different environmental constraints (e.g., space, time, toys, and adult attitude) may change over time while still contributing to shaping child play ([Edwards, 2000]). This brief overview shows how cultural constraints may contribute to actively shaping not only play quantity but also its meaning and quality. Furthermore, sociocultural approaches to child play have contributed toward revising dispositional approaches' definition of play. Investigation of specific cultural environments highlights that child play may in fact be motivated, goal-oriented, and not always led by pleasure ([Göncü & Vadeboncoeur, 2017]). Accordingly, culture is another relevant environmental constraint in child play.

Culture is not only a world of people and instituted practices but also a world of things present in space and time. Material culture, which includes play materials, constitutes another relevant environmental constraint. Play materials may take multiple forms, including everyday objects (a pot and wooden spoon present in a kitchen suffice to build a cooking/eating/feeding scenario), structured toys (toy sets including small pots and eating utensils are explicitly built to elicit pretend cooking/eating/feeding behaviors) and/or unstructured toys (a clam shell and a stick can also become an occasion for a cooking/eating/feeding scenario). In fact, play is often not only elicited but even shaped by the simple presence of specific material objects and/or settings ([Szokolszky, 2006]). Children often learn to make do with what materials they have available ([D. Lancy, 2022]). For example, Tsimane' girls in the Bolivian Amazon build their dolls from plant stems shaved with a sharp machete to make hair, then dress them in cloth or cast-off bottle wrap, build a "fire" to cook their meal in old tuna cans, and then send them on journeys on canoes made of banana bracts ([Martinez-Rodriguez, 2009]). To date, however, the role of material culture in active molding play is unfortunately rarely analyzed and often considered an accessory in developmental psychology.

For example, if pretend play is considered mainly a mental transformation process in which different "as if" states are processed in response to diverse objects present in the world, play materials will at best have the role of passively initiating specific action patterns, which are then actively guided by the child's choice ([Fein, 1975; Piaget, 1962]). For example, Greta G. Fein recognizes that when children

build pretend scenarios (a horse feeding scenario), specific play materials (prototypical objects, such as a toy horse and a plastic egg cup) may trigger fewer “as if” states than other less prototypical objects (such as a horse shape and a clam shell). But, according to her analysis, the entire symbol manipulation process takes place in the child’s head or at best in a social landscape, whereas material objects are completely passive ([Fein, 1975]).

What we propose here is a radical revision of this unidirectional and intellectualist view. We will argue that play materials, their very shape and materiality, play an active role in child play and that the relation between children and play materials is bi-directional. This path has rarely been explored even by enactive approaches. In fact, while some authors recognize the active role of object affordances in shaping play, dynamically influencing organismic constraints, as exemplified, for example, in the action-perception-action relation ([Rucinska & Reijmers, 2015]), others suggest that materials may act as an initial trigger, but meanings are then detached from their immediate presence ([DiPaolo et al., 2010]). We wish to highlight instead that similar to organismic, social, and cultural constraints, materials may *actively* shape child play. To do this, we borrow some of the dynamics of human-object interactions described in Material Engagement Theory (MET) ([Malafouris, 2008, 2013]).

MET originated within archeological studies, bringing together the idea of a symmetry between the role of humans and artifacts in shaping evolution and the extended mind hypothesis ([Clark & Chalmers, 1998; Malafouris & Renfrew, 2010; Webmoor & Witmore, 2008]). MET proposes that instead of objects being considered as the “mere passive substratum” on which social acts are projected or imprinted, we should instead focus on “the sphere of the fluid and relational *transactions or relations between people and things*” [Malafouris and Renfrew (2010), p. 2 and 4]. Lambros Malafouris (2008) appeals to a description of a potter throwing a vessel on the wheel to explain how we can move from an internalist view of agency to a concept of material agency. In this situation, every action that the potter performs has a “local Background,” which includes a set of skills, pre-intentional knowledge, practices, and habits realized both in the brain and body, constituting the essential know-how for an action to take place ([Malafouris, 2008, p. 32]). The potter’s clay, its very materiality, presents its physical affordances, motivating human action intentions (the potter’s intention to grow a vessel out of the clay). Actions which characterize pottery making are distributed between the potter and the clay, as they are based on a dynamic interaction stretching on from the beginning of the act throughout the shaping of the pot. This is considered a “collaboration between the potter and the mass of wet clay rapidly spinning upon the wheel” ([Malafouris, 2008, p. 34]). This sort of “dance” between the potter and the clay, in turn

enables and constrains patterns of action, while agency becomes a relational and emergent product of material engagement ([Malafouris, 2008, 2013]).

Moving from pottery to play, we can easily observe that materials and play spaces often precede, enable, and constrain specific play types in a variety of ways. For example, within a single object, the immediate presence of given affordances offered by its material characteristics (shape, color, weight, texture, etc.) dynamically shape pretend play in real-time. Consider, for example, the following scenario:

One evening I was playing with my 2.5 year old son in the bedroom. Suddenly he suggested to play cooking; he grabbed a pillow from the bed, put it on the ground and said to me: “This is the stove and I am making a soup”. He paused as if looking for something to serve as a pot, then said: “I am making bread” and he started to knead the pillow. (Szokolszky, 2006, p. 67)

In this case a pillow’s presence in the child’s immediate environment elicits a pretend play proposal, which is immediately changed to accommodate not only for the unavailable object (a pretend pot) but for the characteristics of the objects which are present and possess specific affordances which entice the child to begin one specific narrative scenario rather than another (a pillow is soft and “kneadable,” therefore making it easier to build a bread baking scenario than a cooking one) ([Szokolszky, 2006]).

In a telling study, Chemero and Heyser (2005) pointed out how relevant and frequently cited experimental papers on object exploration and provided few or no details on the nature of the objects selected for these tasks ([Chemero & Heyser, 2005]). They highlighted the fact that most of the experiments were motivated by a reductionist strategy to focus only on what occurs in the head, rather than what happens in the world. Yet as Chemero and Heyser correctly pointed out, the lack of concern about the to-be-explored objects may prove critical, since different objects afford different activities (some can only be touched, whereas others can be climbed unto) “leading to potentially *qualitatively* and *quantitatively* different exploratory behaviors” ([Chemero & Heyser, 2005, p. 410]). Similar limitations can be found today in research on childhood play development. Play materials, for example, are rarely selected or described with an awareness toward their role in actively shaping pretense. This is surprising considering not only that research continues to show that different quantities or qualities of toys influence play types ([Burns-Nader et al., 2019; Ban & Uchiyama, 2020]), but also that the quality and characteristics of play materials has long been a major focus of pedagogical approaches ([Honegger Fresco, 1998]). Some studies have attempted to parse out specific aspects of objects that may have a greater impact on pretend play, often with contrasting results. For example, some studies have investigated the different effects of high structure (HS) vs. low structure (LS) play materials. HS materials commonly refer to

replicas of real-life objects linked to a specific functional use (a toy hammer). While LS materials include natural or human-made objects that do not possess in and of themselves a specific function, they lend themselves to different uses (a wooden stick). Use of HS vs. LS play materials has been shown to effect both *quantity* and *quality* of pretend play also in relation to child development. For example, in younger children (22–27 months) more pretend play seems to be elicited by HS materials, while older children (5-year olds) easily incorporate LS materials in their play schemes ([Fein, 1975; McLoyd, 1983]). As for quality, LS materials seem to elicit better pretend play allowing for more flexibility and more object substitution, also supporting more changes in play schemes and themes ([Pulaski, 1970; Moran et al., 1988; Trawick-Smith et al., 2015; Burns-Nader et al., 2019]).

Finally, play materials may be used in a specific space and time, which may be defined as all those elements which specify or limit play behaviors that a child is able and/or willing to produce. In this sense space constrains the quantity and quality of a child's play activities. This phenomenon is well known to educators in Montessori schools where environments (kitchen area, play area, reading area, etc.) are well distinguished and objects presented to children in each environment are limited in number (in order to avoid overstimulation) and type (in each area the child will find objects that are closely related to that task space, e.g., the kitchen will contain dishes and cutlery, while the playing area may include blocks and puzzles and the reading area will provide books) to elicit specific pretend play behaviors ([Montessori, 1959]). Space is not only to be understood as linked to physical elements but also to social ones. For example, a group of little girls playing together may leave a specific place when this is occupied by children that are not involved in their pretense and return only when the original conditions of the setting are restored ([Picchio et al., 2023, p. 70]). In fact, social factors may influence the composition of the playground on multiple levels ([D. ,Lancy, 2022]). For example, Margaret Mead noted that in Samoa toddlers only came into contact with children watched over by their caregiver's friends, suggesting that adult peer associations may indirectly structure the playground ([Mead, 1928]).

A second important constraint is the quantity and frequency of play time. For example, we have mentioned above that for Yucatec Mayan children quantity of time spent in working chores or observing adults for learning purposes affects play style. Similarly, the frequency of time bouts allocated to a specific play type may influence the emergence of specific play behaviors. For example, Picchio et al. (2023) observing child pretend play in early childhood and education centers (ECEC) described a group of children pretending that an unconventional object is a cake on day 1 and then, upon repeating this same play scheme a few days later, returning to the same shared meaning without any explicit definition ([Picchio et al., 2023,

pp. 65–67]). In this case, the repeated frequency of a specific play type seems to affect the possibility of building shared meanings that persist in time, thus acting as a relevant task constraint.

Taken together, environmental constraints contribute toward delimiting a sort of ecological niche that shapes and scaffolds specific pretend scenarios. In his 1935 description of play Griffiths stated how the “five-year-old London boy is often an expert with a whip and top, which he can spin in a corner of the pavement,” while “the Brisbane boy with his greater freedom roams in the bush, hunting for bush flowers and learns much about animals and birds” underscoring how a particular ecological niche may support one or the other form of play ([Griffiths, 1935, p. 324]).

Summing up, environmental constraints – social, cultural, and material – play active roles, enabling, guiding, and shaping specific play types. Space and time constraints within play contexts may be compared to a diaphragm in a film camera: by widening or narrowing the amount of space or time, broader or narrower behaviors will be allowed to enter the play scheme. The studies mentioned above suggest that pretend play is neither arbitrary nor equivalent to real-life states. Rather, although exceptionally flexible and able to exploit different scales of abstraction, it is dynamically and consistently influenced by social and environmental factors which can be parsed and analyzed.

5.3. Task constraints and the Kaleidoscope model

Finally, we will consider *task constraints*, and, in doing so, we will introduce the Kaleidoscope Model to better account for specific characteristics of child play.

In Newell’s description of motor coordination and control, task constraints are distinguished from environmental constraints, which reflect the broader ambient conditions. Task constraints are defined as the goals, rules, and implements that determine and shape a specific motor action or response dynamics ([Newell, 1986]). But we have seen above how dispositional accounts of play highlight that, unlike simple motor acts, child play is characterized by intrinsic motivations and attention to means rather than goals. As for rules, these are often used by children to “set the stage” for a specific play scheme, but may just as quickly be abandoned or completely modified in its dynamic enactment. For example, children may say “let’s play house” or “let’s play pirates” referring to specific play scenarios shared by a community of peers, but these norms and rules are extremely flexible and are often violated or modified to adapt to changes in play schemes. When novice players are present children that are better players may self-handicap, to ensure that play may proceed and that novices may not be too frustrated ([D. ,Lancy, 2022, p. 219]). Some authors refer to “subjective

worlds” in play, where ordinary social rules concerning people or life in general may be violated, mostly with great player enjoyment ([Sutton-Smith, 2008]). These rules or norms are largely dependent on mutual attention given by children to their respective activities, the reference to a common ground of shared experiences and habits, and the active but not intrusive, participation of caregivers, who may foster the propagation of a play theme ([Picchio et al., 2023]). In other words, in child play rules and norms seem to be molded by those same organismic and environmental constraints that we have described above, while allowing for a significant level of flexibility in how they are actively used to support creativity. Similarly, we have seen how social, cultural, and material environments may constrain the implementations present in a specific play task space. For example, in considering broader cultural differences between North American and Taiwanese children we mentioned that the number of toys available to children was dependent on available home space, leading to differences in play style. But the ways in which these toys may be creatively and enactively exploited within a task space are often infinite. For example, we have seen that the flexible use of objects and their affordances is a core characteristic of pretend play, where a wooden block may become a car, a phone, or even a candlestick.

Accordingly, we are led to propose a different definition of task space in relation to play types. In particular, we suggest that in play, the task space depends on organismic and environmental constraints, while allowing at the same time to extend their boundaries through enactive creativity. This view urges us to move beyond Newell’s original depiction to a multi-dimensional representation of how organismic, environmental, and task constraints may interact in creating play scenarios. What we propose here is a kaleidoscope model.

A simple kaleidoscope is made up of two mirror planes touching along a common edge. These planes are placed in a tube with an eyehole at one end and a flat box at the other with an outer surface acting as a diffusing screen and often containing colored glass or beads. When the diffusing screen is illuminated the light passes through the objects inside and is then reflected by the two mirror surfaces creating beautiful colorful patterns. The number of light reflections is determined by the angle made by the reflective surfaces which also changes the number of objects viewed, but the originating pattern combinations are infinite. Similarly, as we have observed above, in play scenarios organismic and environmental constraints may mold and delimit a child’s play task space, while enactive interactions within play allow for \approx infinite creative combinations. Therefore, we can consider organismic and environmental constraints as two separate reflective planes rather than the extremities of a triangle. Metaphorically similar to what happens in a kaleidoscope, these two planes touch along a common edge,

such that the angle formed by these planes will determine a play task space, while at the same time influencing the number of possibilities or affordances available for a specific instance of play [see [Figure 2B](#)]. However, the combinations supported within this task space will be \approx infinite as a child's enactive creative play can create \approx infinite combinations of play scenarios, just as a kaleidoscope can produce an infinite number of colorful pattern combinations. Furthermore, just as in a kaleidoscope, smaller angles between mirrors lead to more refractions, and in play scenarios fewer constraints (e.g., unstructured play materials) lead to more flexible task spaces. This structure allows organismic and environmental constraints to actively shape the task space without limiting a child's creativity.

By proposing this Kaleidoscope Model for play analysis we are attempting to fulfill two objectives: on one side we are proposing that the relation between an organism and its environment has a direct impact on the task space showing how play is both forged and situated in-the-world rather than in-the-head, on the other we are implying that play types observed in experimental psychology are arranged as a holistic dynamical gestalt ([Gallagher, 2018]), rather than as a linear set of stages. In line with this, we can still think of play as involving different components (with the whole being more than the sum of its parts) and we can still use specific planes of constraints (organismic, environmental and task related) and their dynamic interrelation to analyze and understand the emergence of specific play types in childhood.

6. Conclusions: playing-in-the-world as a new road map for experimental research

Summing up, we have shown how organismic, environmental, and task constraints may suggest a shift from current internal, intellectualist, or anthropologically narrow definitions of play types toward considering how child play is a relationally constructed skill occurring in-the-world and actively shaped by multiple dynamic relations. Our intent was to propose a new way of observing child play that would avoid the tendency to explain it exclusively in terms of children's symbolic or non-observable inner states. In doing so, we have also outlined how the different constraints (organismic, environmental, and task related) entertain a dynamical relation. In particular, we have seen above how specific organismic and/or environmental constraints may impact the play task space without limiting its creativity.

In proposing the Kaleidoscope Model we do not wish to imply that a child playing is an empty puppet simply moved by external constraints. To the contrary, it is important to stress that, as Brian Sutton-Smith suggests, "what may be most important in all this is the benefit play

affords each child, who gains confidence in a variety of these play pretense forms and therefore develops an inner, subjective life, a life that becomes the child's own relatively private possession" ([Sutton-Smith, 2008, p. 118]). The organism-environment-task dynamics are what drive the experiential and cognitive processes which can loop back into the play process. Accordingly, the individual and subjective experiences, which contribute to the richness of play, are not something artificially initiated or constructed in a child's head, but are rather actively co-constituted in a space of possibilities, opportunities, and constraints that involve the body, others, the environment, and play itself.

By stressing the importance of multiple constraints, we propose a revised approach to defining play types in developmental psychology, fostering attention to elements that have often been overlooked by the current literature. We hope that the Kaleidoscope Model for play analysis will suggest to researchers on child play a new way of looking at play types as child-world interactions in which multiple constraints constantly re-arrange themselves to form new, colorful, and creative patterns.

Notes

1. For example, games-with-rules, characterized by competition and established rules, have goals internal to the game itself (Piaget, 1962). Such as the rules that define when an opponent is "caught" in a game of tag. These rules are often derived, negotiated, or built on previous forms of play (Pellegrini, 1989). Some may argue that by winning a game-with-rules, a child may also achieve an external goal, e.g., obtaining social recognition from his peers for being a good "catcher" in tag. But this is an indirect goal not linked to the rules of the game in itself.
2. Pretend play is also known as representational, symbolic, make-believe, imaginative, socio-dramatic, or thematic play ([Feitelson, 1977]). We will use pretend play in the following paragraphs as a label for this play type.
3. Organismic constraints included both structural (body weight, height, shape), functional (synaptic connections), and biomechanical constraints (changes in the movement of inertia of each body segment due to body growth); environmental constraints were generally external to the individual (gravity, temperature, light); while task constraints were determined by the activity (task goals, rules, and implements specifying or constraining response dynamics) ([Newell, 1986, pp. 348–356]). Newell notes the fuzziness of the distinction between environmental and task constraints, taking the former as more general constraints, and the latter as more specific environmental features.

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