Coding Manual for:
Modeling Child-Nature Interaction in a Forest Preschool

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ABSTRACT

There is increasing evidence that interaction with nature provides substantial benefits to the mental and physical development of children. While children's time spent outdoors has declined substantially in recent decades, nature-based education programs like Fiddleheads Forest preschool in Seattle allow children to engage with nature in a supportive learning environment**.** The goal of this research was to begin to develop a model of child-nature interaction in a specific outdoor nature learning environment. To accomplish this, we systematically analyzed child-nature interaction through characterizing its essential features in the form of interaction patterns: the functional units of human interaction with the relevant physical characteristics that nature affords. Using a randomized time-sampling methodology, we collected video recordings of child-nature interaction and coded this data by means of an interaction pattern analysis framework. This technical report provides the coding manual used to systematically code each participant's behavioral interactions. By a coding manual, we mean a document that systematically explains the process used to formally code the video data. Our goal is to present this manual such that, as part of an ongoing iterative scientific process, it can be used and modified by others interested in investigating the development and significance of children's interactions with the natural environment.

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1. INTRODUCTION

Nature contact has been linked to many positive mental and physical health outcomes for people, including reduced anxiety and reduced obesity (Cohen-Cline et al., 2015). For children, time spent in green play areas has been associated with improvements in ADHD symptoms, as well as improved overall cognitive and motor development (Kellert, 2005). However, in recent decades, children's outdoor play has declined substantially. Americans are spending more than 90% of their time indoors (Klepis et al., 2001). Much of that time is being spent on technological devices – with screen time climbing to a daily average of almost two hours for children younger than 8, and over seven and a half hours for children between the ages of 8 and 18 (Lauricella et al., 2015).

Recognizing the need to investigate this shift in the lived experience of children, researchers have begun examining nature and forest preschools, where most of the class time takes place outdoors in a natural setting. In this study, we set out to develop a contextualized model of child-nature interaction for a nature preschool in Seattle, WA. We conducted an observational study of three-to-five-year old at Fiddleheads Forest Preschool. We collected and analyzed video data of child-nature interactions to develop a model of child-nature interaction. The mechanism by which we constructed our model is through an interaction pattern analysis of our video footage. Interaction patterns (IPs) represent characterizations of essential features of interaction between humans and nature, specified abstractly enough such that countless different instantiations of each one can occur – in more domestic or wild forms –given different types of nature, people, and purposes (Kahn et al., 2010).

An example of an interaction pattern is *immersing one's body in water*. This pattern is defined by a direct interaction between the human body and a physical aspect of nature – in this case, a body of water. Interaction patterns can be instantiated in more wild and more domestic ways. Wild interaction patterns characterize humanity's biological legacy accrued through hundreds of thousands of years of evolution in tandem with nature. Domestic interaction patterns

characterize the shift from hunting and gathering to agriculture that occurred in human societies during the Neolithic era and is now continuing into modern times. For instance, *swimming in a cold mountain river* represents a relatively more wild instantiation of an interaction pattern, while *wading in a chlorinated backyard pool* represents a relatively more domestic instantiation. In this way, IPs allow for a systematic characterization of human interaction with nature that can be uniquely applied to different types of nature, people, or purposes.

The concept of interaction patterns draws inspiration from the ideas of an architect and design theorist who provided extensive characterizations of 253 design patterns that represent essential solutions to structural problems that help to maximize the quality of architectural space (Alexander, 1977). An example of a design pattern that should be included in an effective space for human inhabitance is described as *windows overlooking life.* According to Alexander, “rooms without a view are prisons for the people who have to stay in them” (pp. 889-892). This idea is effectively corroborated by a study investigating the recovery of postoperative gallbladder surgery patients. Half of the patients spent their recovery in a hospital room adorned with a window view of deciduous trees, while the other half of people’s rooms looked onto a brown brick wall. It was found that those patients quartered to rooms with the view of trees spent significantly less time in the hospital, required less pain medication to be administered, and incurred fewer negative notes from attending nurses (Ulrich, 1984). It seems that this example of Alexander’s design pattern may not only represent an alluring architectural choice, but perhaps even an allusion to the restorative capacity that contact with nature (even just through a window) offers to the human mind and body.

In the development and refinement of our model of child-nature interaction, three core theoretical constructs informed the development our model of child-nature interaction for Fiddleheads Forest Preschool:

Phylogenetic History

The first is that humans have an affiliation with nature based upon our evolutionary history. This proposition draws on the concept of biophilia, which Wilson (1984) described as the innate tendency of humans to seek connections to nature and other forms of life. Building upon this notion, Roszak (1992) explained through his development of the field of ecopsychology that while today the human mind is affected and shaped by the modern social world, its deep structure is inevitably adapted to, and informed by, the more-than-human natural environment in which it evolved. With these ideas in mind, we can consider that despite our technological advancements and decreasing daily interaction with nature, we must consider the essential role nature still plays in our lives, both physiologically and psychologically.

Landscape Affordances

The second is that interaction patterns rely on the combination of recognizing environmental affordances and engaging with them through one's primary, direct experience. Gibson (1977) postulated that the world is perceived by the individual not only in terms of shapes and spatial relationships, but also in terms of possibilities for action. Gibson's theory of affordances, therefore, indicates that it is our perception of the potential for interaction with the environment that guides our understanding of our surroundings. Noting that the dictionary includes the term "afford" but not "affordances", Gibson defends his creation of the latter term as a means to explain the complementarity of an organism and its environment. As an example of an environmental affordance for a particular animal, he considers that the physical properties of a surface as horizontal, flat, extended, and rigid creates an affordance of support. Affordances, however, cannot only be defined in terms of the scales and standards of physics, as they are also unique to the properties of the being interacting with it. While the interaction between surface tension and the small relative size of water bugs allows water to offer an affordance of support to the insect, this surely is not the case for a human. As well, not all environments offer the same number of affordances, of possibilities for interaction. According to Gibson (1977), "the possibilities of an environment and the way of life of an animal go together inseparably" (p. 143).

Thus, the behavior of people ultimately relies upon the affordances of the environment in which they find themselves.

Reed (1996) built upon Gibson's notion of affordances with respect to the modern world by considering the technological mediation of information. In his work titled The Necessity of Experience, Reed makes a case for people needing to have direct experience of the world in order to fully understand it and its particular affordances. Primary experience that is gained through our physical senses, according to Reed, is our most basic way of understanding reality and learning for ourselves. The rise of technology in recent decades and the shift from primary to secondhand experience of reality represents a cultural shift from perceptual discernment by the individual to selected and packaged information by an external source. Reed contends that although we enter an age of unprecedented information processing and transmission capabilities, we simultaneously are experiencing in our lives a diminished role of ecological information, that which we can gain only through our own interaction with the world.

Ontogenetic Significance

The third theoretical construct informing our understanding of interaction patterns draws on Jean Piaget's constructivist theory, in which he contended that children construct knowledge and form meaning by accommodating and assimilating their schemata as needed, and as dictated by their direct experience in the world (Piaget, 1954). Piaget's ideas regarding Constructivism allow us to consider the genesis of knowledge as a function of individual human development, as children make meaning in relation to their interactions and experiences with their environment.

To examine child-nature interaction at Fiddleheads Forest School, we considered the possibilities for interaction with respect to the particular affordances of the outdoor classroom sites. In light of the relative dearth of prior research in this area, we determined that partitioning the classrooms into equivalent zones and collecting video data via a randomized time-sampling methodology would allow for an effective means of capturing, categorizing, and understanding the interaction patterns germane to this nature preschool. We expect that certain patterns of

behavior with respect to particular natural affordances in the outdoor classroom environments would be revealed by collecting a database of filmed child-nature interactions. Furthermore, we expected to find a finite set of possible child-nature interaction combinations that would encompass all observed interaction patterns.

Method

In our study, we recruited 49 participants between the ages of three and five years old, with 27 being female. There are two outdoor classroom sites, called Trillium and Magnolia, located across from one another in the University of Washington Arboretum. In collecting video data, we used a randomized time sampling of 10-minute intervals per classroom zone.

Each classroom was divided into five film zones to ensure full classroom coverage under our time-sampling procedure. Figures 1 and 2 show the breakdown of the two classrooms, Trillium and Magnolia - and their associated five film zones. Each zone, labeled respectively T1-T5 and M1-M5, include varying landscape affordances that are designated on the maps, such as mud pits, obstacle courses made of stumps and wood, as well as natural tree enclosures. These will be discussed in more detail under the section titled “Tripartite Nature Features Classification System”.

2. CODING MANUAL DEVELOPMENT

This technical report provides the coding manual used to guide the coding of 35 weeks of video data collected at Fiddleheads Forest Preschool in Seattle, WA from October 2016 to May 2018. By a coding manual we mean a systematic document that explicates how to interpret and characterize (and thereby “code”) the qualitative data.

To develop the coding manual, members of the Fiddleheads research study team - a subset of the Human Interaction with Nature and Technological Systems (HINTS) lab - met over a period of two years to interpret the child-nature interactions occurring in the video data. The process of developing the behavioral and landscape affordance coding manual was guided in

part by the research questions of interest and in part by the data itself. Our primary purpose was to systematically characterize the ways in which children interact with the landscape affordances of a natural environment to begin to develop a model of child-nature interaction for this nature preschool. To fulfill this purpose, we sought to answer the following question in the development of our model of child-nature interaction: 1) What keystone child-nature interaction patterns occur in this forest preschool, and how may different environmental features of the outdoor classrooms lead to different interaction patterns? With respect to the second portion of this research concern, we expected that relatively more wild parts of the outdoor classroom sites would give rise to more relational interaction patterns. For this study, we conceptually defined relational child-nature interactions to refer to behaviors that show respectful awareness and/or mindfulness of one's environment. As discussed later in this document in the Keystone Interaction Pattern (IP) descriptions and definition, we operationally coded a specific subset of observed IPs to be consistent with our theoretically grounded understanding of relational human-nature behavior in this study. These are represented broadly by behavior by individuals' experiential sense of oneness with the natural world. Some researchers have gone so far to posit that an emphasis on human–nature connectedness and associated relational values may provide a mechanism to foster greater concern toward sustainability and planetary stewardship (Riechers et al., 2001).

As an additional exploratory research concern, we were curious if more domestic parts of the outdoor classroom sites would allow for the instantiation of interaction patterns that are directly harmful to the environment. We considered these behaviors to perhaps be 'dominating', referring to observed child-nature interactions that show aggression toward and/or seek to control the environment. However, we ultimately decided to consider this category as one with the more developmentally appropriate label of 'impactful', with a single keystone interaction pattern (IP) representing it as *directly harming nature*. Ultimately, we did not have sufficient predictive power at the time this coding manual was created to make an informed stance on this position and therefore did not have any specific hypothesis to this point.

This technical report thereby provides open access to our core intellectual qualitative work on this project. Our hope is that it can be used by others to conduct related research on how children interact with the landscape affordances of different environments to add to a developing model of child-nature interaction.

3. CODING SYSTEM

The following section details the Keystone Interaction Patterns and Nature Features at Fiddleheads Forest preschool. Twenty-six keystone interaction patterns (IPs) are divided into five distinct descriptive categories: Elemental, Physical, Social, Animal, and Impactful. Eighteen nature features are divided into two descriptive categories: Relatively Domestic and Relatively Wild.

KEYSTONE IPS	NATURE FEATURES	
A) ELEMENTAL *Being outside in inclement weather* B) PHYSICAL Level I: *Leaning and hanging from supple tree limbs* *Climbing high in small tree* *Leaning against tree* *Lying on earth* *Striking wood on wood* *Constructing shelter* *Digging in ground* *Falling on ground* *Recovering from a potential fall on ground* Level II: *Gathering nature items* *Balancing on natural features* *Clambering on natural features* Level III: *Manipulating nature items* *Grappling with nature items* Level IV: *Using one's body vigorously in nature* C) MENTAL *Imagining nature to be something other than it is* D) SOCIAL *Making social boundaries on earth* *Pushing to the edges of social boundaries* *Being in solitude in nature, actively* *Being in solitude in nature, passively* E) ANIMAL *Calling birds* *Cohabiting with a wild animal* *Imitating animals* *Looking at wild animals* F) IMPACTFUL *Directly harming nature*		
	RELATIVELY DOMESTIC [-1]	RELATIVELY WILD [+1]
	LOGS AND STUMPS PATHS SOCIALLY BOUNDED PLANT AREAS AND BOUNDARIES WOOD-CHIP GROUND AND MULCH ROOT BALL	BIG TREES INSECTS AND ANIMALS SMALL TREES ROCKS, STONES, PEBBLES LOW-HANGING BRANCHES TREE ROOTS TREE BARK PLANTS AND FOLIAGE STICKS BRANCHES MOSS, LEAVES, AND DISASSEMBLED PLANT MATERIALS EARTH, DIRT, AND MUD PITS WATER

3.1 **The Coding Process:**

1. Use the following coding template:

Clip ID **A**	Keystone Interaction Pattern **B**	Direct Nature Rating: [-1 or +1] **C**	Holistic Environmental Rating: [-1, 0, +1] **D**	Total Wild to Domestic Rating [-2, -1, 0, +1, +2] **E**	Time stamp **F**	Notes **G**

A Clip ID: Refers to specific identification tag assigned to video. All videos are organized in their respective Week # folder [Week 1 – Week 35] using the following hierarchical caching system: Date_Classroom_Zone.

B Keystone Interaction Pattern: Specify which interaction pattern from the list of 26 is occurring in the video.

C Direct Nature Rating: Specify which nature feature (or combination of nature features) from the list of 18 is being directly interacted with in association with the identified interaction pattern. This nature feature is scored with a value of either a -1 or a +1 (given its classification identity as Relatively Domestic or Relatively Wild, respectively).

D Holistic Environmental Rating: Specify your rating of the holistic scene encompassing the identified interaction pattern based upon the relative wildness or domesticity of the peripheral natural and artefactual features in the video. This will yield a score of -1, 0, or +1.

E Total Wild to Domestic Rating: Specify the total wild to domestic rating by summing the Direct Nature Rating and the Holistic Environmental Rating. This will yield a score between -2 and +2.

F Time Stamp: Identify the exact time stamp associated with the entirety of the enactment of the identified keystone interaction pattern. This will yield a time stamp in the range between 0:00 and 10:00.

G Notes: Include any additional comments you may wish to have for future reference.

2. Code videos in chronological order. Code all videos from a classroom zone as if they are a single video.

3. Begin a timer at 0:00 and continue the timer for the duration of the video clip [up to 10:00 mins possible per zone per day].

3.2 Definitions:

3.2.1 Wildness and Domesticity

For the coding purposes of the Keystone Interaction Patterns occurring in Fiddleheads Forest Preschool, both natural and artefactual features are rated on a scale of relative wildness to domesticity. The scale ranges from -2 to +2, with the more negative end of the spectrum representing more domestic features and the more positive end of the spectrum representing more wild features.

Direct Nature Rating

The Direct Nature Rating refers simply to which of the 18 nature features (specified earlier) with which the participant is interacting.

Holistic Environmental Rating

The Holistic Environmental Rating refers to the context in which the child-nature interaction is taking place with the lens of wildness-domesticity that circumscribes the direct child-nature interaction.

Central Nature Features and Peripheral Nature & Artefactual Features

Central nature features refer to any of the nature features with which the child/children in the video clip are directly interacting. There can be more than one central nature feature in a particular video clip.

Peripheral nature and artefactual features

Peripheral nature and artefactual features refer to any of the nature features or artifacts that are in the immediate or surrounding vicinity of the child/children in the video clip. These are environmental features that are <u>not</u> involved in any of the coded keystone interaction patterns but are present in the surrounding area.

Total Wild to Domestic Rating

a. Score -2: Domesticity characterizes features of the outdoor classrooms that exist as a direct result of human mediation or intervention. This mediation can exist in a more extensive or more mild fashion. A higher degree of domesticity (-2) exists as

a result of extensive mediation represented by artefactual features occupying a permanent position in the outdoor classrooms, such as the metal structure in the Magnolia classroom or the covered art area in both the Magnolia and Trillium classrooms

b. Score -1: A milder degree of domesticity (-1) is represented by natural features such as logs and stumps that once existed as wild nature features but then were modified by human activity.
c. Score 0: A neutral rating (0) represents a characterization of the outdoor classroom sites that is neither domestic nor wild.
d. Score +1: A milder degree of wildness (+1) exists when the central nature features are still self-organizing but with a degree of human mediation that permeates the holistic consideration of the environmental scene.
e. Score +2: Wildness characterizes features of the outdoor classrooms that exist in a manner less mediated by human intervention. More wildness (+2) because of less human intervention is represented by the presence of more natural features of the outdoor classroom sites such as dense plants and foliage or big and small trees

All Nature Features are coded as either relatively domestic (-1) or relatively wild (+1). The neutral rating of 0 exists only in consideration of the Holistic rating when the collective impression of the environment formed can be described as one of the following cases: 1) a combination of highly domestic and highly wild components, 2) mildly domestic and mildly wild components, or 3) a complete lack of either wild or domestic environmental features.

3.2.2 Nature Features

The following section includes a description of the eighteen identified landscape affordances of the Fiddleheads Forest Preschool outdoor classroom sites. A prototypical image of each nature from both outdoor classroom sites (Trillium and Magnolia) is also provided.

1. **Big Trees**

This nature feature classification applies to trees that have a trunk circumference larger than the width of a three-to-five-year-old child.

Associated Interaction Patterns: *Balancing on natural features, Clambering on natural features, Directly harming nature, Leaning against tree, Being in solitude in nature-passively, Using one's body vigorously in nature*

2. **Small Trees**

This nature feature classification applies to any tree with a circumference less than the width of a 3-5-year-old child.

Associated Interaction Patterns: *Being in solitude in nature-actively, Being in solitude in nature-passively, Clambering on natural features, Climbing high in small tree, Leaning against tree, Leaning and hanging from supple tree limbs*

3. **Root Ball**

This nature feature classification applies to the inverted roots of a tree that have been removed from the ground and placed into one of the nature classrooms. Only one exists in Fiddleheads, located in zone T2 of the Trillium classroom.

Associated Interaction Patterns: *Clambering on natural features, Imagining nature to be something other than it is, Using one's body vigorously in nature*

4. **Logs and stumps**

This nature feature classification applies to pieces of trees that have been cut and shaped into logs and stumps.

Associated Interaction Patterns: *Balancing on natural features, Clambering on natural features, Constructing shelter, Falling on ground, Gathering nature items, Grappling with nature items*

5. **Socially bounded plant areas and boundaries**

This nature feature classification applies to the boundaries that have been socially constructed within the outdoor classroom. This includes the large logs children are forbidden from climbing upon that surround the periphery of the classroom bordering the road, as well as the orange tape that demarcates the border of the classroom from the rest of the arboretum on the interior edge. Additionally, this nature feature includes the borders surrounding the plants and foliage inside the classroom that the children are forbidden to cross. These are referred specifically to as socially bounded plant areas and are not in reference to the plants and foliage within, but rather the boundary surrounding the flora itself.

Associated Interaction Patterns: *Falling on ground, Making social boundaries on earth, Pushing to the edges of social boundaries*

6. **Paths**

This nature feature refers to the trails that have been specifically constructed within the outdoor classroom. They often occur alongside socially bounded plant areas.

Associated Interaction Patterns: *Using one's body vigorously in nature*

7. **Wood-chip ground and mulch**

This nature feature refers to the covering of woodchips that lies on top of most of the floor surface in both outdoor classroom sites, as well as the occasional piles of mulch that exist periodically.

Associated Interaction Patterns: *Digging in ground, Falling on ground, Gathering nature items, Imagining nature to be something other than it is, Lying on earth, Manipulating nature items, Recovering from a potential fall on the ground, Being in solitude in nature-actively, Being in solitude in nature-passively, Using one's body vigorously in nature*

8. **Plants and foliage**

This nature feature refers to any flora within and near the borders of the outdoor classroom sites. Specifically, this also refers to the plants and foliage existing within the socially bunded plant areas. The roots of small plants are also included in this category.

Associated Interaction Patterns: *Being in solitude in nature-actively, Being in solitude in nature-passively, Directly harming nature, Gathering nature items, Imagining nature to be something other than it is, Manipulating nature items, Recovering from a potential fall on the ground, Using one's body vigorously in nature*

9. **Earth, dirt, and mud pits**

This nature feature refers to the natural earth components of the surface of the outdoor classrooms that lies beneath the woodchips. This also includes the mud pits specifically created and designated as such.

Associated Interaction Patterns: *Digging in ground, Falling on ground, Gathering nature items, Imagining nature to be something other than it is, Lying on earth, Manipulating nature items, Being in solitude in nature-passively, Using one's body vigorously in nature*

10. **Low-hanging branches**

This nature feature refers to branches from both big and small trees that reach low enough to the ground that preschool-aged children may interact with them.

Associated Interaction Patterns: *Being in solitude in nature-actively, Being in solitude in nature-passively, Leaning and hanging from supple tree limbs, Manipulating nature items*

11. **Tree roots**

This nature feature refers to the roots of both big and small trees that are either visible above-ground or are covered by earth.

Associated Interaction Patterns: *Balancing on nature items, Directly harming nature, Gathering nature items, Imagining nature to be something other than it is, Manipulating nature items, Recovering from a potential fall on the ground*

12. Tree bark

This nature features refers to the outermost layer of big and small trees in the outdoor nature classrooms. This nature feature is identified as its own separate entity from big or small trees *only* when it is being interacted with directly.

Associated Interaction Patterns: *Balancing on natural features, Directly harming nature, Gathering nature items, Imagining nature to be something other than it is, Manipulating nature items, Recovering from a potential fall on the ground, Using one's body vigorously in nature*

13. Branches

This nature feature refers to branches that are no longer attached to a tree. They often require the child to use two hands to hold them, they are not easily breakable, and they tend to be bigger than the child interacting with it.

Associated Interaction Patterns: *Balancing on natural features, Constructing shelter, Gathering nature items, Grappling with nature items, Imagining nature to be something other than it is, Manipulating nature items, Recovering from a potential fall on the ground*

14. Sticks

This nature feature refers to wood pieces that have become dismembered from the trees or branches from which they originated. In contrast to branches, sticks are often quite small and can be held easily by a child with one hand. They tend to be easily breakable.

Associated Interaction Patterns: *Gathering nature items, Imagining nature to be something other than it is, Manipulating nature items, Striking wood on wood, Using one's body vigorously in nature*

15. Moss, leaves, and disassembled plant materials

This nature feature refers to the various disassembled flora that the children interact with in the outdoor classrooms. This includes moss, leaves that have been removed from trees and plants, and other pieces of plants that no longer are attached to the originating entity. An item included in this nature feature can be smaller or larger than the child interacting with it.

Associated Interaction Patterns: *Gathering nature items, Imagining nature to be something other than it is, Grappling with nature items, Lying on earth, Manipulating nature items, Recovering from a potential fall on the ground, Being in solitude in nature-actively, Being in solitude in nature-passively, Using one's body vigorously in nature*

16. **Rocks, stones, and pebbles**

This nature feature refers to the varying composites of hard earth minerals that the children interact with in the outdoor classroom. They may come in varying sizes, from larger than the child than small enough to fit in their hand.

Associated Interaction Patterns: *Gathering nature items, Grappling with nature items, Using one's body vigorously in nature*

17. **Insects and animals**

This nature feature refers to the only fauna that exist in the outdoor classrooms. The primary human- animal interactions involve birds and squirrels, while the human-insect interactions often involve worms, spiders, and caterpillars.

Associated Interaction Patterns: *Calling birds, Cohabiting with a wild animal, Imitating animals, Looking at wild animals, Directly harming nature*

18. **Water**

This nature feature refers to rainwater as well as water produced from a hose inside the nature classroom.

Associated Interaction Patterns: *Being outside in inclement weather, Gathering nature items, Manipulating nature items*

3.2.3 Keystone Interaction Patterns

A) <u>ELEMENTAL</u>

Being Outside in Inclement Weather

This keystone interaction pattern (IP) is characterized by a child experiencing challenging weather conditions. To identify this keystone IP, a video clip must clearly display evidence of heavy or torrential rainfall, the presence of snow or ice, or include demonstrable behavior from children that indicates their need to accommodate themselves to the weather conditions. When coding for this interaction pattern, no time stamp is needed (see section "Decision Rules"). A child shall only be coded for this interaction pattern once per film day that they are recorded. A new instance of this interaction pattern shall be coded for each child filmed on that study day.

NOTE: When the inclement weather involved is simply the cold temperature outside, this IP <u>does not</u> involve a coded nature feature. Thus, this represents a special occasion in which no Direct Nature Rating, Holistic Nature Rating, or Total Wild to Domestic Rating can be assessed. However, it is important to code for this IP, nonetheless. The ability to deal with cold temperatures represents a critical aspect of children's engagement with nature in this forest preschool through seasonal changes and recalls the human need to accommodate oneself with the periodicity of nature in general.

B) <u>PHYSICAL</u>

Level I:

Leaning and Hanging from Supple Tree Limbs

This keystone interaction pattern is characterized by children grasping supple tree limbs with either one or two hands, while counterbalancing their body weight through shifting movements. This keystone IP encompasses motions such as swaying, swinging, or leaning. Tree limbs may be any size and can come from large or small trees. Often, the tree limb is a "low-hanging branch" (see Nature Features section). This IP often involves active movement interspersed by periods of passivity. To distinguish this IP from *leaning against tree*, this interaction pattern requires slightly more vigorous movement that *does not* include the child leaning their back upon the tree. As well,

to distinguish this IP from *climbing high in small tree*, this keystone interaction pattern *only* takes into account the child's behavior at ground level.

Climbing high in small tree

This keystone interaction pattern is characterized by a child climbing up and onto the limbs of a small tree. As well, the child must move their body above ground level and/or above the tree's base. This keystone IP frequently encompasses acts of balancing, lifting oneself up with arms, the intentional placement of feet, and seemingly testing the limits of tree limbs. This IP often involves moderate to more vigorous physical activity. A tree shall be coded as a *small* tree only in cases where the trunk's diameter is smaller relative to the size of the child. To distinguish this IP from *clambering on nature features* and *balancing on nature features,* this keystone interaction pattern shall be exclusively coded for child-nature interaction involving small trees.

Leaning Against Tree

This IP is coded for any instance of a child sitting with their back against a tree, standing with their back against a tree, leaning forward with their torso against a tree, or using their hands or some other part of their body (excluding feet) to demonstrably show that the tree is supporting a portion of the child's bodyweight. There must also be an observable degree of repose, rest, or inactivity for this interaction pattern to be coded. Standing on tree roots and sitting on tree limbs shall not be coded as *leaning against tree.*

Lying on Earth

This keystone interaction pattern is characterized by children lying with their full back, front, or side on the ground. In this keystone IP, the term "earth" refers only to the specific nature features of *earth, dirt, and mud pits*, as well as *wood-chip ground and mulch* (see Nature Features section).

If there is a natural or artefactual feature between the child and one of the aforementioned nature features, this IP shall not be coded.

***Striking Wood on Wood*:**

This keystone interaction pattern is characterized by a child using their hands to strike any piece of natural wood (sticks, branches, and bark) upon any another piece of natural wood. The natural wood that is struck upon may be larger or smaller than that struck with, and often includes such nature features as logs, stumps, trees and low-hanging branches. This keystone IP shall be exclusively coded for natural wood items and therefore excludes the use of include domestic tools, such as shovels, pans, or toys. This IP may involve vigorous to moderate physical activity demonstrated by the child. To distinguish this IP from *directly harming nature,* this pattern *does not* include acts of striking to remove a piece of nature, i. e. bark off a tree, nor verbal expression of intended harm to nature items.

Constructing Shelter

This keystone interaction pattern is characterized by a child's utilization of various nature objects (such as sticks, branches, leaves or logs) in the service of assembling a shelter-like structure. For this keystone IP to be coded, there must either be verbal or physical evidence that the child intends to go inside the shelter or the structure must have physical dimensions that would feasibly allow for said child to fit inside. In instances where a child builds a small shelter (such as a bird's nest) and verbally states this fact, the above stated requirements are not needed. This IP is often observed alongside *gathering nature objects* and occasionally with *imagining nature to be something other than it is;* such as crafting an imaginary meal with nature items within the shelter. One count of behavior is coded for *each* individual focal child observed constructing the shelter and is recounted in instances when the child utilizes materials not originally used for the shelter. For consecutive videos of same focal child/same behavior/same zone this pattern *would not* be

recounted. Most materials will be natural, but some could be artefactual: including cardboard, plywood, bricks. The constructed shelter is likely to have a roof, but this is not necessary –walls would be sufficient. The creation of social boundaries does not qualify as the enactment of this interaction pattern.

Gathering Nature Items

This keystone interaction pattern is characterized by any act of removing or moving nature items (sticks, leaves, branches, rocks, earth- rename with nature features) – collecting is a subset of this interaction pattern. A participant who performs this interaction pattern should 1) gather the same type of nature items, and often but not always place into some container, and then may also 2) move the gathered nature items to the same location. To distinguish from the interaction pattern *digging in earth*, *gathering nature items* involves the aspect of moving and putting the gathered nature items to some location. This interaction pattern will only be coded if the participant performs this interaction pattern for at least 2 seconds continuously or if the gathered quantities are observed in the video to amount to two or more nature items. If multiple participants gather nature items simultaneously, one instance of this pattern will be coded for each participant who meets the above requirements. This interaction pattern often occurs in conjunction with *constructing shelter*. When coding, only count the initial gathering of nature items. Once the construction of a shelter begins, then subsequent acts of gathering will not be coded unless there is a 30 second break in between or if there is a new material being gathered.

Falling on Ground

This interaction pattern involves any instance of a child tripping or falling onto the ground, with the point of contact ranging from one limb to full body contact. Often this interaction takes place when a child loses their balance causing them to fall on either a mediating natural feature or the ground. This interaction pattern constitutes an act without intent, not occurring as an accidental

loss of control over one's movement. This pattern should only be coded there is the risk of the child not landing on their feet recorded in the video.

Recovering from a Potential Fall on the Ground

This keystone interaction pattern often involves a child tripping or showing some instance of saving themselves from a potential fall on the ground. This interaction often takes place when a child loses their balance while climbing and playing on different natural features, and is observed in tandem with *balancing on nature features.* When looking for this interaction, the coder may see the child flail their arms in attempts to save themselves from a fall similar to the visual appearance of an infant's moro reflex. In order to code for this interaction, there needs to be potential for the child to fall on their face, head, or back. This interaction pattern often involves the counterbalancing of body parts in attempt to regain balance and establish recovery from a potential fall. (Note: if a child is balancing on a log and steps off, this will not be coded as *recovering from a potential fall on ground*)

Level II:

Digging in Ground

This keystone interaction pattern often involves use of artifacts or tools, in addition to the use of a stick, rock, or hand to attempt or successfully complete an action of removing or moving earth from the ground. This includes the child exerting energy to complete the action, often relocating dirt, mud, woodchips, from the ground into an artifact (such as a wheelbarrow, bucket, or pot/pan), or to another part of the classroom.

When coding using the tripartite Holistic Environmental Rating, the nature of the tool used by the child to dig in the earth must be accounted for. As this scale takes into account the Peripheral Nature and Artefactual Features, if the child uses a plastic shovel or other artefactual implement to enact the interaction pattern of *digging in ground*, then the Holistic Environmental Rating shall

automatically reduced by -1 point, unless it is already at a -1. For example, if a child is coded as *digging in ground*, and the Holistic Environmental Rating is initially coded as a +1 because of the largely self-organizing natural surroundings in the clip, if the child is using a toy shovel to dig then -1 point will be subtracted from the Holistic Environmental Rating to yield a total score of 0. If a child is digging but uses their hand or a nature item (such as a stick or stone) to complete the interaction pattern, then no points shall be added or deducted from the overall Holistic Environmental Rating. This coding practice allows for the inclusion of the domestic consideration of the common artefactual mediation occurring with this pattern.

Balancing on Natural Features

This keystone interaction pattern does not involve the use of hands, but rather some degree of lack of stability that requires a child to attempt to maintain equilibrium in movement across nature features (stump, log, rootball) or to remain in a stationary position for at least 2 seconds. This interaction pattern requires the careful act of standing, kneeling, walking, or lying on precarious features, while also involving an attempt to stabilize the body from falling over. In this interaction, the child may extend an arm out to maintain their balance or the child may also step off the log or stump they are attempting to balance on. In these cases, this is still coded as *balancing on natural features* because the child is attempting and learning to maintain equilibrium as they walk or stand on the unstable nature feature.

Clambering on Natural Features

This keystone interaction pattern involves children climbing on branches, trees, tree limbs, stumps, logs, or other natural features. Clambering captures the movement (as up or over something) with the help of hands and feet in holding or pulling one's bodyweight. This interaction pattern might occur alongside *climbing high in small tree*. In order to code for this interaction pattern, there must be at least three points of contact (only using hands and feet), and active

movement on the natural features. If the child clambers on multiple nature features, once they shift and disengage with their previous nature feature, another instance of clambering shall be coded. Difficult or strenuous physical activity is often associated with instantiations of this interaction pattern.

Level III:

Manipulating Nature Items

This keystone interaction pattern involves the exploration of the properties of natural objects, such as sticks, branches, leaves, and other natural items. Manipulating captures within it the action of bending, twisting, rolling, pushing, scratching, or in some other way transforming the nature item through interacting with it physically. The child may also appear to be testing the properties of the object, such as by tapping or waving. After the child manipulates the nature item, that nature item often transforms in that its shape changes or part of the nature item detaches. However, this interaction pattern shall also be coded in instances wherein the child uses a nature item to build or create something (not a shelter in this case, as that is covered by a different keystone interaction pattern). For instance, a child may create a bridge between two stumps using a stick or log, thus manipulating the said nature item to fabricate a new construction. The child should exhibit a degree of control over the manipulated nature items. Manipulation will only be coded in instances where there are distinct attempts at physical exploration or transformation of the nature object. For coding, if two nature items are being manipulated in tandem, assign ½ point to the first nature item and ½ point to the second nature item, and then add for the Direct Nature Rating.

Grappling with Nature Items

This keystone interaction pattern is similar to *manipulating nature items* but differs in that this interaction pattern involves an aspect of struggle in relation to the natural object. This exploring of the physical properties of a nature item often involves grasping with the hands and struggling

to conform the involved nature item to the child's will. This interaction pattern is defined by an act of contact with a difficult nature object that often involves wrestling or struggling. The children often grapple with nature items that tend to be bigger than themselves; however, sometimes the nature objects may not be larger than the child, but represent something that is unwieldy or difficult to deal with. This interaction pattern will only be coded if a participant struggles with a nature object by using both hands.

LEVEL IV:

Using one's Body Vigorously in Nature

This keystone interaction pattern describes instances in which children exert above-average energy while moving throughout space or relative to a nature object. This pattern involves motions such as running, jumping, crawling, rolling, skipping, sliding, and hopping. This interaction pattern should only be coded when the physical activity captured in a recording is not properly covered by any of the other physical category keystone interaction patterns. The duration required for this interaction pattern should last for at least 2 seconds of continuous action or 3 consecutive instances of an action occurring with no more than 2 seconds apart between each instance. Any instance of running will be coded, with no minimum time limit. In the case of jumping, a child jumping off of something knee-height should be automatically coded as one instance of this pattern. When a child switches from one type of "vigorous motion" to another (such as crawling) a new count is added only if it fulfills the 2 second rule.

C) <u>MENTAL</u>

Imagining Nature to be Something other than It is

This keystone interaction pattern is characterized by children pretending a natural object is something else. This often occurs in pretend play. This can be verbally stated or visually confirmed

D) SOCIAL

Making Social Boundaries on Earth

This keystone interaction often involves children constructing borders or demarcating a space by using nature features (such as sticks and branches) or using artefactual pieces (such as strings and traffic cones). This keystone IP necessitates the presumed intention of the child to divide or separate areas of the nature classroom, or to direct the movement of people within the outdoor classroom. This IP shall be coded only if the child successfully constructs a clearly discernible form of border or demarcation.

Pushing to the Edges of Social Boundaries

This interaction pattern involves the child breaching or nearly breaching the social boundaries of the nature classroom with some part of their body, either to achieve a goal (i.e. reaching over a classroom boundary line to retrieve some leaves for gathering) or simply in service of attempting to cross the boundary. Social boundaries are defined by the demarcation of certain areas of the nature classroom, usually marked by tape, long branches on the ground, or large logs positioned around the periphery. A child who is interacting with the social boundary (such as touching the classroom tape) shall automatically be coded for this interaction pattern.

Being in Solitude in Nature

The overarching interaction pattern of being in solitude in nature manifests when a participant is not accompanied by anyone (teachers included) within a 20-30 foot radius AND the child is secluded, concealed, or isolated in some way by natural or artificial features. This interaction pattern is further coded into ‘being active in solitude’ or ‘being passive in solitude’.

Being in Solitude in Nature, Actively

The distinction between *being in solitude in nature -actively* and *being in solitude in nature-passively* is that former shall be coded when clear physical exertion is apparent. This does not necessarily entail the keystone interaction pattern of *using one's body vigorously in nature*, but is often manifested as *clambering on nature features*.

Being in solitude in nature, passively

A child shall be coded as *being in solitude in nature -passively* when they are standing/sitting/lying calmly and are relatively motionless.

E) ANIMAL

Calling Birds

This keystone interaction pattern is characterized by a child's attempt to communicate with birds. This can be accomplished through the verbal simulation of bird calls as well as the physical imitation of bird-like movements through arm flapping. It must be clear that the child is seeking or responding to birds rather than simply mimicking a bird without the express intention to communicate. The coder may identify this IP through audible evidence of the verbal context from the child, or through identifying distinct arm-flapping or other kinetic efforts from the child in an attempt to resemble a bird. This interaction can occur over any time frame, as either a quick instance or an ongoing action.

Cohabiting with a Wild Animal

This keystone interaction pattern is characterized by a child's awareness, vigilance, and/or respect of the presence of a wild animal or insect. This keystone IP may involve relocation of the involved organism to a new area in order to preserve its wellbeing because of the child's or other children's activities. This IP often involves scaffolding by a teacher. *Cohabiting with a wild animal* differs from the interaction pattern *looking at wild animals* in that the act of cohabiting requires

deeper understanding or consideration of the organism's life by the child. Instantiations of this interaction pattern often involve the child touching, handling, or holding the organism. The presence of a wild animal or insect is necessary for this IP to be coded.

Imitating Animals

This keystone interaction pattern is characterized by children's behavior that appears to simulate the audible or physical traces of an insect or animal. Verbal context from the child or clear representative physical actions resembling an animal or insect are the key indicators for the coding of this keystone IP. This IP does not require the presence of the imitated insect or animal.

Looking at Wild Animals

This keystone interaction pattern is characterized by any account of a child attentively observing wild animals or insects. This keystone IP often involves children discovering the insect or animal. Children may be looking at the wild animal or insect from a near or far vantage point. The presence of an animal or insect is necessary for this IP to be coded.

F) <u>IMPACTFUL</u>

Directly Harming Nature

While this interaction pattern did not ultimately get included in our final analyses, it represents harm that is enacted onto an organism or the environment in a manner that is not incidental and captures children's interactions with vegetation, fauna, or other environmental elements in a nature preschool that involves harm caused by the child's directed actions. It does not, however, presuppose this behavior as being defined in some normative fashion as 'wrong' or 'bad'. Rather, this represents to us perhaps a vital step in the creation of a child's relationship with the surrounding environment. In testing the boundaries of one's ability to interact with nature, children are learning how to exist and coexist with the flora, fauna, and elements of the earth.

Some examples of this behavior we observed in the video data included the following:

- *Imagining nature to be something other than it is: a power tool or other artifact used to destroy nature (ex: chainsaw, robot grabber)*
- *(Failing to) cohabit with a wild animal*
- *Digging in earth at roots of tree*
- *Peeling bark off tree*
- *Striking wood or artifact on wood (not in service of exploring properties)*

3.2.4 RELATIONAL INTERACTION PATTERNS

These represent a subset of child-nature interactions coming from across the categorized Physical, Social, and Animal Keystone Interaction Patterns. These were determined by our conceptual understanding of the construct ‘relational’ described earlier in this report.

- *Calling birds*
- *Cohabiting with a wild animal*
- *Looking at wild animals*
- *Imitating animals*
- *Leaning against tree*
- *Lying on earth*
- *Being in solitude in nature, actively*
- *Being in solitude in nature, passively*

4. DECISION RULE

4.1 Individual Rule

Interaction patterns (IPs) shall be coded for each child individually. Although children are sometimes engaged in an activity together, it is important to capture the relative frequency with which IPs occur for each child to understand how often certain IPs are enacted, regardless of if children are alone or in a group.

Example: If two children are digging with shovels, two counts of *digging in ground* shall be coded.

4.2 Active Engagement Rule

Children must be actively engaged in the IP for it to be coded to ensure a representative frequency distribution of IP enactment. This will protect the data from having any IP over-coded.

Example: If Child A is gathering nature items and using them to build a shelter, and Child B sits inside the shelter, only Child A will be coded as engaging in *constructing shelter.* Child B is not actively participating in the shelter's construction, and therefore shall not be coded for the IP *constructing shelter*.

Example: If Child A is digging with a shovel, and Child B is sitting beside them but not digging, only Child A is coded with the IP *digging in ground*.

4.3 Clearly Discernable Protagonist Rule

Only participants who are the actors in a clip shall be coded for the IP. Children are protagonists when their entire body is in view of the camera. They may be in the center of the video frame, or they may be on the periphery. There may be multiple protagonists in one frame of reference, with some children in the center and others on the edges. Children who are not completely discernible to the viewer shall not be coded. If children move from the undiscernible periphery to become fully and clearly visible, they then become protagonists. This may also occur if the camera shifts to focus on new children. Protagonists to the scene shall only be coded to decrease potential ambiguity of coding for behavior of participants who may be on the fringes of the scene or hard to discern their actions in entirety.

Example: If Child A is focal to the scene and is collecting leaves into a bucket, they shall be coded with the IP *gathering nature items*; while Child B, who is only partially in frame and appears to be hitting a tree with a stick, shall not be coded. However, if Child A remains a protagonist, and Child B moves to be completely discernible within the video frame and hits another tree with the stick, then Child B shall be coded as *striking wood on wood*.

EXCEPTION: In the case of enacting the IP *using one's body vigorously in nature*, children running in the background shall be coded. They may only be clearly discernible for a brief time, but if the Two Second Rule (explained below) is fulfilled, this IP shall be coded.

4.4 One Second Rule

If a child is in the scene for under one second, they shall not be coded as engaging in any IPs. This rule exists to reduce the ambiguity of coding children's behavior that may occur for a negligible amount of time.

4.5 Two Second Rule

All IPs in the Physical category must last for a minimum of two seconds to be coded. This rule exists to demarcate a minimum amount of time required for an IP to occur.

EXCEPTION: For the Physical category interaction pattern *using one's body vigorously in nature*, the specific instantiations of "kicking", "jumping", and "throwing" do not fall under the Two Second Rule. The physical act of these movements often requires fewer than 2 seconds to occur, and thus exists beyond the feasible application of this rule.

4.6 No Minimum Time Rule

All IPs in the Elemental, Mental, Social, and Animal categories shall be coded with no minimum time requirement. These IPs are distinct from the Physical category because *being outside in nature, imagining nature to be something other than it is, being in solitude in nature (actively or*

passively), calling birds, cohabiting with a wild animal, imitating wild animals, and *looking at wild animals* do not depend upon a child's physical movement and thus retain no minimum time requirement for this child-nature interaction to occur.

4.7 Ten Second Rule

Once the enactment of an IP has terminated, the coder must start a timer for 10 seconds. Once the timer has reached 10 seconds, only then can the same IP be coded. This only applies to situations in which the child-nature interaction is unbroken. This rule exists to prevent the possibility of some IPs being over-coded - particularly for IPs that are inherently sustained or occur over a lengthy interval of time.

Example: Child A is observed sitting on the ground with their back resting against the trunk of a tree at video recording time 1:01. The coder shall then code for one count of the IP *leaning against tree*. No matter the duration of this IP enactment, there shall be only one count coded so long as the child-nature interaction continues unbroken. Once the interaction no longer meets the requirements of the IP's definition, the coder begins a timer for 10 seconds. If the same IP is enacted by the same child when the timer reaches 10 seconds or more - and if it persists for two or more seconds afterward (in accordance with the Two Second Rule) -then another count of this IP shall be coded.

EXCEPTION: If IP(1) intersects the enactment of IP(2), and then IP(1) is again enacted - a new count of IP(1) shall be counted <u>even if the timer has not yet reached 10 seconds</u>. For example, if a child is *digging in ground*, and then starts *gathering nature items*, and then again begins *digging in ground*, a new count of *digging in ground* shall be coded even if 10 seconds have not yet elapsed.

EXCEPTION: If the same IP occurs again before the 10 second mark, but now occurs in a different form or with a different mediating artifact or nature feature, a new count shall also be coded. For example, if a child is *digging in ground* with their hand, and then proceeds to pick up a shovel and

begins digging with this artifact, a new count of *digging in ground* shall be coded to reflect this change. This allows for the representation of different forms of the same IP to be documented and will illuminate the diversity with which IPs may be instantiated via the utilization of varying natural and artefactual affordances available to the children in this environmental setting.

4.8 Category Rule

An IP shall only be coded with one keystone interaction pattern from within each category (Physical, Mental, Social, Animal), but can be double coded *only* if the keystone interaction pattern comes from another category. This rule allows for the filmed child-nature interaction to be accurately identified for the discrete within-category interaction patterns in addition to the appropriate characterization that is identified in other relevant categories.

Example: A child leaning against a tree by herself shall be coded both as *leaning against tree* as well as *being in solitude*. *Leaning against tree* represents a keystone interaction pattern from the Physical category, while *being in solitude* represents a keystone interaction pattern from the Social category. There is no limit to how many times an interaction pattern may be coded (double, triple, and so on) as long as each keystone interaction pattern comes from a different category.

Example: Child A is filmed collecting sticks. This shall be coded as one count of *gathering nature items*. Child A then begins using the sticks to form a domicile, and they verbally express that they would like to go inside it once it is finished. This shall be coded as one count of *constructing shelter.* Child A then gathers more sticks. This shall not be coded as another count of *gathering nature items*: this interaction exists now as part of the process of *constructing shelter*, and since both keystone interaction patterns are in the same Physical category, they shall not be double-coded.

4.9 Descending Specificity Rule

Interaction patterns shall be coded from the most specific keystone interaction pattern applicable in each category to the broadest. This rule allows for the appropriate characterization of the observed child-nature interaction that captures the most specific level of information available.

Example: if a child is climbing high in a small tree, then the keystone interaction pattern *climbing high in small tree* from the Physical category shall be coded, and not the broader keystone *moving one's body vigorously in nature* - even though the action of climbing could be said to be nested within this higher-order keystone interaction pattern. This is because the higher order characterization does not effectively communicate the specific behavior of the child aligned with the environment that is available given this classification system.

Note: The Physical category includes levels that denote the hierarchy of the listed keystone interaction patterns. All other categories exist without levels and are inherently hierarchically arranged.

4.10 Whole Zone Coding Rule

Videos from each zone for a particular filming date shall be treated as one unit. Per our methodological procedures, video data was collected from one of the 10 possible film zones in a randomized order for 10 continuous minutes at a time for each study day. The instructions for the researcher recording video data dictated that filming would begin once any participant entered the scene and should continue uninterrupted until one of the following situations arose: 1) no participants remained in scene or 2) non-participants entered the scene and filming could not continue without capturing the nonparticipant in the data. Thus, the number of videos for any zone for a day could range from 0 to 100. To account for the arbitrary number of videos per film zone per day, each zone shall be coded in its entirety for keystone interaction patterns that occur. For consecutive videos from a film zone, a child shall only be coded once for engaging in a keystone interaction pattern that persists across videos.

Example: When coding video from a single day of data collection, if it is evident that the weather conditions meet the criteria for the keystone interaction pattern of *being outside in inclement weather*, then a child shall only be coded for this interaction pattern once even if they appear in other videos from that study day and across multiple zones.

4.11 Sequential Coding Rule

Keystone interaction patterns shall be coded according to their occurrence within the time frame of the coded zone. For example, each filmed zone for each day has a possible 10 mins of recorded data. While the Category Rule still holds for only coding an interaction pattern once for a specific keystone interaction pattern per category, if a different interaction pattern occurs over the course of time, it shall then be coded so long as it is not occurring simultaneously with the other coded interaction pattern.

Example: A child in the M5 film zone is using a shovel to dig in the earth in video clip 2_26_M5_01. A non-participant enters the scene, and the researcher must turn off the camera briefly. In film data clip 2_26_M5_02, the same child is still *digging in ground* with a shovel. The coder shall not recode this clip, as it is a keystone interaction pattern that persists from the previous clip and would have been seen as a continuous interaction assuming there was no interruption in the linearity of the film time.

4.12 Artefactual Inclusion Rule

When an interaction pattern is instantiated using a mediating artefactual implement, the Holistic Environmental Rating shall be reduced by -1 point (unless the original Holistic Environmental Rating would already be -1, representative of the highly domestic environmental surroundings). While the Direct Nature Rating shall solely indicate the binary quality (1 or -1) of the immediate nature feature being interacted with as wild or domestic, the Holistic Environmental Rating shall reflect the peripheral and artefactual nature features implicated in the specific instantiation of the

keystone interaction pattern. Thus, if an artifact of any sort acts as a direct mediator between the child and the nature feature that they are interacting with, the Holistic rating shall be reduced by -1 point from what it would typically be coded as without the intermediating artifact. This may occur for the following keystone interaction patterns: *constructing shelter, digging in ground, gathering nature items, making social boundaries on earth,* and *directly harming nature*. This rule allows for the inclusion of the artifact as acting as a primary mediator across different child-nature interactions.

Example: A child *digging in ground* with a shovel shall have the Direct Nature Rating coded with the direct nature feature they are interacting, potentially “wood-chip ground and mulch” [-1] or “earth, dirt, and mud pits” [+1]. The Holistic Environmental Rating shall then be reduced by -1 point to reflect the use of the shovel as a mediator between the child and the nature feature. If the original Holistic Environmental Rating would be a +1 (assuming the summed peripheral, artefactual, and surrounding environmental affordances skewed relatively wild), then the resulting Holistic Environmental Rating would be 0. Similarly, if the original Holistic Environmental Rating were 0 (assuming the summed peripheral, artefactual, and surrounding environmental affordances skewed relatively neutral), then the resulting Holistic Environmental Rating would be -1. In the same way, if the original Holistic Environmental Rating were -1 (assuming the summed peripheral, artefactual, and surrounding environmental affordances skewed relatively more domestic), then the resulting Holistic Environmental Rating would still be -1, as this is the lowest number this rating can reach within the range of this holistic coding category.

Example: If a child is *gathering nature items* such as leaves into a plastic bucket, the Holistic Environmental Rating will be reduced by -1 point to reflect the intermediating artifact (in this case, the plastic bucket).

4.13 Additive Halves Nature Feature Rule

When coding for the Direct Nature Rating, if there are two nature features directly implicated in the enactment of an interaction pattern, code for ½ of each nature feature and then sum them. This will allow for the specific nature features to be accounted for in the instantiation of each interaction pattern and will also allow for the Direct Nature Rating to yield a value within the +1 to -1 range.

Example: If a child is *striking wood on wood* by using a stick to hit a big tree, then the Direct Nature Rating involves both the central nature feature of “sticks” [+1] and the central nature feature of “big trees” [+1]. The Direct Nature Rating shall therefore be calculated by adding ½ the value of sticks [+1/2] and ½ the value of big trees [+1/2], yielding a sum of +1.

Example: If a child is walking on a fallen branch and then nearly falls on the floor of the outdoor classroom but regains their balance, then the interaction pattern of *recovering from a potential fall on the ground* shall be coded with the two central nature features “branches” [+1] and “wood-chip ground and mulch” [-1]. The Direct Nature Rating shall be calculated by adding ½ the value of branches [+1/2] and ½ the value of wood-chip ground and mulch [-1/2], yielding a sum of 0.

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