Progression and Protectiveness of Social Bonds and Play in a Captive Group of Western Lowland Gorillas

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Progression and Protectiveness of Social Bonds and Play in a Captive Group of Western Lowland Gorillas

A Dissertation Presented to the Faculty of the Department of Psychology

West Chester University

West Chester, PA

In Partial Fulfillment of the Requirements for the

Degree of

Doctor of Psychology in Clinical Psychology

By

Madeline L. Vandevere

April 2023

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“In what terms should we think of these beings, nonhuman yet possessing so very many human-like characteristics?”

Jane Goodall
Acknowledgments

I could not have undertaken this journey without the support of my family. Mom, Dad, and Katie: thank you so much for walking with me through my crazy graduate school stories and for always being my biggest supporters and loudest fans.

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An overwhelming thank you is in order for the West Chester University Primate Lab, and all that have come and gone during my time involved – this study, and many others, would never have been able to occur without you and your devotion to collecting uninterrupted longitudinal data for so many years. Thank you for your time and dedication to the animals we have all grown to love.

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Abstract

The current study aims to bring to light the critical role that play has on healthy development, not only for nonhuman primates, but also for humans. In addition to building the literature concerning social and play development among gorillas and humans, this study also hopes to promote the observation and welfare of captive gorillas. The present study conducted longitudinal observational research of a troop of captive western lowland gorillas (*Gorilla gorilla gorilla*) to gain insights into primate play development and how it relates to social bonding and zoological enrichment. The study followed the early infancy and juvenile years of two gorilla infants, one male and one female, housed at the Philadelphia Zoo in Philadelphia, Pennsylvania. This study used focal scanning to obtain approximately 280 hours of data across 58 nonconsecutive months, which was organized to create a frequency-based activity budget of the typical behaviors of gorilla infants. This activity budget revealed that gorilla infants engage in several styles of play for an average of 15-20% of their days. This indicates that play is a necessity in appropriate, healthy, and enriched development. These analyses are reviewed with consideration of primate personality styles and through a comparative psychology lens, offering both clinical and zoological implications.

*Keywords*: comparative psychology, western lowland gorillas, unstructured play, play development, activity budget, social development, optimal child development
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Introduction

Background and Significance

An estimated 43% of children who experienced adverse early childhood experiences are at risk of failing to achieve their full potential (WHO & UNICEF, 2012). Inadequate resources and poor psycho-social care often negatively impacts a child’s ability to develop into a successful adult; however, there is strong evidence to support that clinical interventions that target social bonding and play can intercept the causal factors that can lead to poor development. To build an understanding of how children can best achieve optimal development, a wealth of research must be made available from varied perspectives. There are already many factors that have been identified as contributors to optimal child development, including a strong caregiver-child relationship. However, despite the general understanding that a positive caregiver-child relationship significantly improves the child’s developmental and mental well-being in the long term, there is still a call for further integration of research and theory development (O’Connor, 2002).

Like humans, non-human primates may also be at risk for adverse outcomes if they are not provided with positive social relationships in early infancy. Hoff and colleagues (1994) observed a cohort of four infant gorillas who were artificially separated from their mothers in early infancy. They observed all four infants express anxious behaviors such as self-holding and fetal positioning. Hoff et al. (1994) also noticed that even after reintroduction to their mothers, infants displayed a significant decrease in play behaviors, which are developmentally necessary for gorillas to learn appropriate pro-social behavior and develop dexterity and fine motor skills. Anxiety-inducing and neglectful situations experienced by primates may also influence a
decrease in affiliative social behaviors and an increase in aggressive, antagonistic behaviors (Todd, MacDonald, & Coleman 2007; Kuhar, 2008).

One aspect that strengthens caregiver-child bonding is play interaction. Amodia-Bidakowska (2020) acknowledged that play interactions between caregivers and their children in the first few years of life are linked to more optimistic social, emotional, and cognitive outcomes later in life. Play is so critical to the caregiver-child bond that multiple psychotherapeutic techniques utilize play as a component in the therapy process. Russell Barkley’s Parent Training protocol (Barkley, 2013) requires the caregiver to engage in frequent one-on-one “special playtime” time with their child. This special playtime allows caregivers to practice positively attending to their child, which helps to strengthen the caregiver-child relationship in a natural way.

Parent-Child Interaction Therapy (PCIT) is an evidence-based treatment protocol for children and caregivers (McNeil & Hembree-Kigin, 2010). PCIT also has a primary goal of strengthening a caregiver’s bond with their child, notably through the use of child-directed play. Caregivers in this protocol are trained to be able to engage in a set of skills that encourage the parent to positively attend to their child’s play by praising appropriate behaviors, reflecting appropriate talk, imitating play, describing play behaviors, and expressing enthusiasm. These skills have been shown to significantly increase the appropriate behaviors of the child and improve the relationship between the parent and the child (Thomas & Zimmer-Gembeck, 2012). There is very little recent literature concerned with infant gorilla play, which purports a need for more current research.

Researchers have found various commonalities in the ways humans and gorillas experience stress, and have found that gorillas, too, are susceptible to fatal stress- and anxiety-
related diseases as evidenced by measures of allostatic load in captive gorillas (Kenny et al., 1994; Edes, Wolfe, & Crews, 2018). To continue combating adverse physical and mental health problems related to prolonged stress, more evidence must be generated to understand what predicts these outcomes in infancy and early childhood.

**Purpose of the Study**

Healthy relationships are one of the many factors that contribute to positive early childhood development. This study aimed to evaluate primate social bonding through the lens of attachment theory to comparatively link primate and human research and to further elaborate upon existing zoological research on primate bonding. This study will conduct longitudinal observations of captive western lowland gorillas (*Gorilla gorilla gorilla*), which are one of the closest primate relatives to humans. The captive environment allows for a rich, comprehensive analysis of relational development among each gorilla dyad in a way that would be nearly impossible to accomplish in the observation of a human family. I hypothesized that infant gorillas in the observed family will follow the trends expected of a healthy and positive mother-child bond, as evidenced by prosocial interactions.

Play is a natural, innate occurrence in the process of optimal child development and is observed within all human cultures and across a variety of species. This study aimed to investigate the critical nature of play on development through longitudinal observations of a captive gorilla family. The play of infant gorillas is comparable to that of human play, and their captivity allows for a thorough investigation of their play patterns and preferences. I hypothesized that gorilla infant play behaviors will follow the trend expected of wild populations and that similarities between gorilla and human infant play behavior will be identifiable.
The present study is novel in that it is one of the first to collect longitudinal data for up to five years on the same gorilla infants, and the first to capture data immediately following the infant’s birth through their early juvenile years. The completion of this study adds useful data to the clinical, comparative, and zoological fields of research and it will promote various aspects of human and primate developmental well-being.
Literature Review

Positive Social Relationships in Humans

The interest in understanding how the quality of early social relationships impacts developmental well-being has been prevalent since the time of John Bowlby’s preliminary studies of attachment theory. Bowlby’s early research on these relationships led to the discovery of the severe harm that can result from a lack of emotional bonding in early infancy and childhood. These discoveries were so profound that Bowlby was commissioned by the World Health Organization (WHO) to conduct more research on the topic; specifically, he looked into studying the mental health of children who were made homeless and parentless following World War II (Bretherton, 1992).

From these initial investigations, Bowlby gradually began to develop the rationale of attachment theory. Bowlby’s paper, “The Nature of the Child’s Tie to His Mother” (Bowlby, 1958), was one of the first works that Bowlby published where he began to introduce concepts that are now acknowledged to be factors contributing to attachment theory. It was in this paper that Bowlby also identified clinging, sucking, and following as some of the most salient human behaviors to indicate attachment security in early childhood; all of which are also observed in gorilla populations.

Positive Social Relationships in Gorillas

Although there is no current research indicating a way to measure the security of infant gorilla attachment to their caregivers, there are some studies that have attempted to observe a generally positive mother-infant bond. Maestripieri (2001) collected focal observations on eleven captive mother-infant dyads over a period of 12 months, and exclusively identified a sensitive
period of bonding between an infant and its mother immediately following birth. This sensitive period allows mothers to become acquainted with their offspring and learn more about their movements and vocalizations (Maestripieri, 2001). Gorilla mother-infant dyads spend approximately six months in near constant contact with one another to promote the most longevous lifespan and higher cognitive function before the infant breaks contact (Nakamichi et al., 2004; Maestripieri et al., 2002).

One study conducted by Nakamichi et al. (2007) observed a captive social group of twelve gorillas for about three years, though their data focused on two gorilla infants of interest. The researchers observed gorilla infants who were "swapped" from their biological mothers to a foster mother, and then swapped back to their biological mothers approximately two years later. After each swap, they observed the infants exhibit various anxiety-related behaviors, including abnormal hair-plucking behavior. These observations indicated that a rapid change in attached primary caregivers is psychologically stressful for gorilla infants, and a steady positive relationship is necessary for secure development, which is consistent with human attachment theory.

**The Importance of Childhood Play**

To date, much of the literature surrounding childhood play has focused on the benefits that it can provide for an individual and the many kinds of play. Article 31 of the United Nations Convention on the Rights of the Child (2013) states that children have “the right to leisure, play, and participation in cultural and artistic abilities.” This right acknowledges that play is a critical component of child development. Unstructured free play allows children to explore the world in a way that best helps them to understand it, such as through learning and practicing social roles
and coping with difficult emotions. Current research on the benefits of play indicates that it promotes positive social, emotional, cognitive, and physical development (Lee et al., 2020).

Unfortunately, there has been a steady documented decrease in free play time since the 1970s among children and adolescents, and researchers are now observing that children and teens are now spending about 75% of their wakeful hours nearly motionless (Strauss et al., 2001). This decrease in play time may be stunting children’s abilities to develop the numerous cognitive benefits of play, including self-confidence and resilience (Hurwitz, 2003).

Ginsberg (2007) reported a link between a lack of free play and an increased risk of developing depression and anxiety. However, this link was made based on the self-reports of children, adolescents, and parents, not through observations. There is a need to develop a richer understanding of what genuinely unstructured play looks like, and the detriments that a lack of this play can have on long-term development.

Unstructured child-guided play has been shown to have many benefits for the developing child. Ginsberg (2007) notes that this type of play is essential for healthy brain development. It allows the child to practice adult roles within the comfort of their imagination. This play also allows children to develop dexterity, language, and battle fears (Ginsberg, 2007). The child may also build upon their leadership skills, creativity, and decision-making ability (MacDonald, 1993).

Over the years, parents have felt increasingly pressured to provide their children with various educational toys, books, and computer programs for them to develop as quickly as possible (Luthar & Becker, 2003). With the growing industry for early enrichment programs,
organized sports, and easy access to screens and social media, children and adolescents have been spending more time engaging in scheduled activities and less time being able to play freely.

Some literature suggests that the enforcement of structured activities for children may be hurrying them into more adult roles at earlier ages (Elkind, 2001). While some research supports the hypothesis that structured activities provide benefits for children, conflicting research suggests that children can respond with increased levels of stress and pressure (Mahoney, Harris, & Eccles, 2006; Villaire, 2003).

Some research has attempted to utilize play as a buffer for chronic stress. Al-Yateem and Rossiter (2017) created the opportunity for unstructured playtime for an experimental group of children in a pediatric inpatient care center. They found that children encouraged to have this time to play freely displayed significantly decreased levels of stress over several days compared to children who were not given the opportunity. This study highlights the benefits play can have on childhood anxiety and how it can be critical for children to build their understanding of their emotions, increase resilience, and decrease stress.

**Play among Western Lowland Gorillas**

Play with gorillas has many of the same risks and benefits as it does for humans. In gorillas, play enables infants to explore their environments and learn what is and is not safe. Like human infants, gorillas spend much of their infancy crawling and mouthing anything they can find. They also utilize play to build their muscles, improve dexterity and motor skills, and become proficient with climbing and swinging. Gorilla play also allows infants to build social bonds with other members of the troop so that they may understand the social hierarchy.
Sensorimotor and intellectual development has also been directly correlated with the frequency of infant play (Parker, 1999).

Hoff, Nader, and Maple (1981) thoroughly investigated the play development of infant gorillas reared in captive environments over the course of their first year and a half of their lives. They identified several stages of play, including mother-infant social play, infant solitary play, and infant-infant play.

Hoff and colleagues (1981) discussed that mother-infant social play typically appeared in the fourth month of the infant's life. The mother typically instigated this stage of play, and she would gently nudge or wrestle her infant. During the fifth month of the infant's life, researchers began to observe infant solitary play. This stage of play typically begins before the infant completely breaks proximity to their mother. Solitary play may include the examination of novel objects or slapping the ground while laying dorsally. The solitary play appeared to develop into more intricate activities, such as locomotor play, as the infant aged. The locomotor play began to emerge around the infants' 12th month of age when they would begin galloping and walking bipedally.

During the fifth month of age, infants may have noticed one another. Around the 8th month, infants started to make contact with one another to engage in playful activity. Hoff, Nader, and Maple (1981) identified two varieties of infant-infant play: active social play and moderate social play. Active social play, also known as rough-and-tumble play, involves running, chasing, wrestling, and play-fighting behaviors. Moderate social play may include laying on another infant or mild pulling of the other infant.
The researchers involved in this study acknowledged that play behavior is a very complex and integral part of development for gorillas as well as all species. While this study provided a preliminary interpretation of play stages, more research must occur to gain a more valid concept of its development. Parker (1999) conducted a single captive gorilla infant case study that compared it’s stages of play development to that of humans with specific regard to Piaget's stages of play. Parker found that there appeared to be some similarities in the sensorimotor stage of play among the gorilla infant, in that it seemed to develop cognitive skills though the explorative nature of play behaviors. The present study aims to continue comparing primate play to various stages of play exhibited by humans through the long-term observation of a family cohort of gorillas.

**Gorilla Personality Research**

Within the past decade, comparative psychology researchers have grown increasingly interested in the personality profiles of gorillas. Scientists from the Dian Fossey Gorilla Fund's Karisoke Research Center in Rwanda introduced the study of gorilla personality dynamics as a way to provide insight into evolutionary perspectives of ecology and social systems (Eckardt et al., 2015). Investigators in this study utilized a 54-trait personality questionnaire to assess various personality dimensions among 116 wild mountain gorillas (*Gorilla beringei beringei*). The measure that was used was an adapted version of the Hominoid Personality Questionnaire (HPQ), which was developed to capture personality among chimpanzees (King & Figueredo, 1997). The HPQ was directly adapted and developed from Goldberg's Taxonomy of the Big Five personality dimensions, further highlighting how closely human and primate personality can be correlated (Goldberg, 1990). Their findings emphasized how certain personality traits can be
correlated with the frequency of certain observed behaviors; for example, high Sociability as a trait was correlated with a greater amount of time playing with other apes (Eckardt et al., 2015).

Gold and Maple (1994) also developed a measure intending to aid in the human understanding of gorilla personality profiling. This team had an interest in specifically profiling captive gorillas to determine whether their cognitive needs were being met. An alternative goal of the assessment development was to determine the likelihood of successful and stress-free relocation between zoos and compatibility with other gorillas. Gold and Maple (1994 created the Gorilla Behavior Index (GBI) to measure four subscales of personality traits that can be gleaned from behavioral observations. The four subscales included: Extroversion, Dominance, Fearfulness, and Understanding. The Extroversion subscale recorded behaviors and traits of gorillas based on their willingness to approach and interact with other gorillas. Dominance was measured by gathering information about the permissiveness or subordination of the gorilla in question compared to others in the troop. The subscale of Fearfulness was determined based on the gorilla’s willingness to engage in risky behaviors and take advantage of new opportunities. The final subscale, Understanding, was measured through observations that a gorilla reacts appropriately to other gorillas within a troop. Gold and Maple (1994) indicated that gorillas scoring high on Extroversion and low on Fearfulness are typically psychologically well.

Personality is being studied within captive populations of various primates to ensure subjective well-being and stress management among the animals. Research has also supported the concept that human raters can assess primate personality with high levels of validity and reliability (King & Figueredo, 1997).
Zoological Stress Management

In populations of captive gorillas, stress management is of particular interest to researchers and zoo administrators alike. Researchers find zoos to be ripe grounds for observational research for various species because it allows for consistent visibility and access (Crockett & Ha, 2010). However, for researchers to be able to gain the most fundamental understanding of captive animals compared to wild animals, the species of interest must be in the most natural environment possible, given its circumstances.

Zoological research has focused on providing an enriched environment for captive animals to decrease boredom or anxiety (Carder & Semple, 2008). Carder and Semple (2008) provided evidence that an enriched environment acted as a mediator for anxiety-inducing situations. They observed many gorilla troops in the UK during feeding enrichment periods. The researchers found that gorillas who received enrichment via the feeding procedures exhibited significantly fewer instances of self-scratching and visual monitoring.

In addition to an enriching environment, positive social relationships are also critical for optimal captive gorilla well-being. An epidemiological study conducted by Meehan and colleagues (2016) suggested that an enriched enclosure and positive social relationships may be more critical to captive species' psychological well-being and development than enclosure size. This finding further emphasized the importance of social bonding as a mediator for chronic anxiety among captive animals.

Gorilla and Human Risk Factors

It is essential to build a more comprehensive review of the identification of positive relationships and optimal development in captive primates. Building awareness of the reasons
gorillas experience stress may also prove to help understand human health and well-being. When experiencing sustained periods of stress and anxiety, gorillas also may become at risk for developing severe, and potentially fatal, anxiety-related diseases (Kenny et al., 1994; Edes, Wolfe, & Crews, 2018). For gorillas, chronic anxiety behaviors can look like self-scratching, self-biting, frequent and repeated regurgitation, or hair-plucking. Lay (2000) found that animals are also at risk for impaired immune function, gastric ulcers, and impaired growth as a result of being present in a chronically stressful environment. Keeping the genetic similarities of gorillas and humans in mind, research exploring the gorilla experience may promote better insight into the human experience.

**Anticipated Implications of the Present Study**

The present study aims to link current early human development research with longitudinal observations of a captive gorilla family. This study will introduce western lowland gorillas as a viable species to research to learn about the evolutionary advantages and protective factors of positive relationship bonding and childhood play in humans. Building an understanding of how primate ancestors have continued to encourage strong, positive relationships will translate to the human need to emphasize and promote these relationships. Through the thorough investigation of play throughout infant gorilla physical and social development, this study hopes to promote the importance of incorporating free playtime into a human child's day.

This study will also further elucidate the complex underpinnings of captive animal research. In addition to building the literature concerning social and play development among gorillas and humans, this study also hopes to promote the observation and welfare of captive gorillas. While many people find zoological institutions to be controversial, many zoos have
taken strides toward a focus on conservation and education. All animals in captivity should be monitored for positive development as well as psychological well-being so that keepers and zoo administration can be confident that their animals are physically and mentally healthy.
Methods

The purpose of the current study was to analyze the behavior patterns of western lowland gorillas (*Gorilla gorilla gorilla*) from a clinical and developmental perspective. The research looked at the behavioral differences among a captive troop of gorillas in the years following the births of two gorilla infants. The study also analyzed the development and trend of play behaviors among infants.

This study complied with regulations prescribed by the IACUC committee of West Chester University and with ongoing permission and support from the Philadelphia Zoo.

Participants

This study analyzed the behaviors of five western lowland gorillas (*Gorilla gorilla gorilla*) housed at the Philadelphia Zoo. The subjects included one silverback male, two adult females, one female infant, and one male infant (See Table 1). Any data obtained from the two male bachelor gorillas housed at the Philadelphia Zoo were excluded because they were not integrated with the family group.

Table 1

*Subject Information*

<table>
<thead>
<tr>
<th>Name</th>
<th>Sex</th>
<th>Born</th>
<th>Parentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motuba (MO)</td>
<td>M</td>
<td>January 23, 1985</td>
<td>In captivity</td>
</tr>
<tr>
<td>Honi (HO)</td>
<td>F</td>
<td>September 7, 1994</td>
<td>In captivity</td>
</tr>
<tr>
<td>Kira (KI)</td>
<td>F</td>
<td>August 8, 1999</td>
<td>In captivity</td>
</tr>
<tr>
<td>Amani (AM)</td>
<td>F</td>
<td>August 26, 2016</td>
<td>Motuba x Honi</td>
</tr>
<tr>
<td>Ajabu (AJ)</td>
<td>M</td>
<td>June 2, 2017</td>
<td>Motuba x Kira</td>
</tr>
</tbody>
</table>
**Housing**

Researchers observed the gorillas in their enclosure within the Philadelphia Zoo. They were observed either in an indoor enclosure (31' x 37' x 45') or an outdoor enclosure (5,000 sq. ft.; see Figure 1). The indoor enclosure includes a daily rotation of enrichment items, including hammocks, fire hoses, barrels, crates, blankets, various toys, and food. The gorillas only have access to the outdoor enclosure if the weather permits.

**Figure 1**

*Diagram of Peco Primate Reserve at the Philadelphia Zoo*

*Diagram Courtesy of the Philadelphia Zoo*
Procedure

Study Design

A frequency analysis design analyzed the social and play development of infant gorillas. The variables of interest included the infant being analyzed, their age (in months), and instances or frequency of play behaviors (i.e., playing with objects, social play with another gorilla). I utilized brief personality assessments as qualitative data in the ongoing investigation to better understand the social profiles of each member of the gorilla troop and to inform the quantitative data.

I chose the western lowland gorillas housed at the Philadelphia Zoo to be studied due to proximity, the consent that the Zoo gave the Primate Lab to research their animals, and the unique opportunity to study a family troop of gorillas with two similar-aged infants. Data for the present study were collected from 2016 through 2021.

Trained students and volunteers involved with the Primate Lab at West Chester University recorded observational data on site at the Philadelphia Zoo. To ensure the reliability of observational scanning, each lab member was required to train under multiple senior lab members before they were permitted to submit data collected on their own. Lab members obtained focal samples 4-6 times per week. Each focal sample included the recording of daily temperature, access to food, and enclosure accessibility. During hour-and-a-half-long observation periods, lab members recorded focal scans every 2 minutes. At the point of each scan, the lab member recorded the name of the gorilla being observed, the enclosure they were currently in, their proximity to each other gorilla in that enclosure, arboreality (whether the gorilla is above ground), and the activity the gorilla was exhibiting, all on a set of printed data.
collection sheets (see Appendix A). Any novel behaviors were to be included in the optional “Notes” section of the data collection sheet. Alternatively, if the behavior was of particular interest, it was to be recorded on a Special Occurrences Data Sheet (see Appendix B). Lab members were trained to identify and code many possible activities that each gorilla could display, including aggressive behaviors, behaviors that indicate stress or anxiety, and pro-social behaviors (see Appendix C). Following data collection, senior lab members entered data into a master spreadsheet with all longitudinal focal scanning data. These data were analyzed to understand changes in the frequency of social and play behaviors.

Materials

Observational focal scans were completed on several datasheets constructed and modified by the Primate Lab at West Chester University. There was a Gorilla Focal Scan Sheet (Appendix A) and a Special Occurrences Sheet (Appendix B). Each lab member also kept an Operational Definition Guide (Appendix C) if they did not know or remember how to code a behavior. Each lab member was also required to have a watch or timer, so they were prompted to do a focal scan of the gorilla group every two minutes during the observation period.

Measures. Gorilla Personality Traits. Gold and Maple (1994) developed the Gorilla Behavior Index (GBI) to assess the psychological well-being and behavioral profile of captive gorillas. The GBI consists of 25 items that measure four subscales: Extroversion, Dominance, Fearfulness, and Understanding (Appendix D). While the GBI aimed to help manage captive gorilla assignments in the United States, I utilized it in the present study to build a behavioral profile of each of the gorillas within the family troop being studied.
The GBI showed inter-rater reliability between zoo staff that completed the surveys, as evidenced by a Pearson correlation with significant results (Gold & Maple, 1994). Validity was not explicitly measured in current research; however, the authors suggested to preserve validity by only permitting Keepers who have worked with the primates for at least one year to complete the index.

I virtually distributed the Gorilla Behavior Index to current gorilla Keepers at the Philadelphia Zoo. To preserve the validity of the personality measures, only Philadelphia Zookeepers who had worked with the Gorilla Family Troop for at least one year were invited to complete the GBI. Keepers sent their completed GBIs back to the primary investigator via email.

Statistical Analysis

I analyzed data obtained during the first four-to-five years of each infant's life for the present study. I totaled the frequencies of each behavior observed to best understand and interpret the changes throughout the infant-to-juvenile developmental timeline. This method resulted in a complete, comprehensive activity budget with all observed behaviors and the percentages of time that the gorilla would, on average, spend on each specific activity. From this budget, I assessed all relevant behaviors related to play across 6-month time increments to allow for the examination of preferred play trends throughout infancy.
Results

Overall Activity Analyses

Over a period of 58 nonconsecutive months, approximately 280 hours of observational scanning data were combined to create a comprehensive all-activity budget of both common and uncommon gorilla behaviors. I ran frequency analyses to determine the percentage of the daily activity budget dedicated to diverse types of primate play: Play with Enrichment Object, Solitary Play, and Social Play. Play with Enrichment Object was recorded when a gorilla was observed to be in contact with an enrichment item placed by keepers in the enclosure. Such items often included cardboard boxes, blankets, plastic toys, and miscellaneous seasonal objects. Of note, the gorillas housed in the Philadelphia Zoo have been determined to be a part of a particularly well-resourced program and exhibit. Solitary Play was denoted when a gorilla was observed engaging in entertainment-style behaviors, such as playing with hands and feet, spinning, or tumbling. Social Play was documented when the infant was observed chasing, wrestling, or engaging playfully with another gorilla without any apparent intent to harm them.

I analyzed the frequency of play behaviors in just the female infant (Amani), just the male infant (Ajabu), and both infants combined. I investigated data from birth to age 5 for Amani and birth to age 4 for Ajabu. Of note, Amani’s 4th year of life and Ajabu’s 3rd year of life occurred during the Covid-19 pandemic. Throughout the pandemic, the Philadelphia Zoo opted to intermittently close its doors to all nonessential personnel and guests, so data collected from 2020 through 2021 was sparse compared to earlier years. While this may have lessened the amount of time allowed to collect observational data, the data that were collected were determined to be sufficient to continuously analyze play trends and development.
Play Behavior Data

Amani Play Analysis

I studied the female gorilla infant, Amani, across the first 5 years of her life, allowing this study to capture her infancy and early juvenile years. Amani appeared to display a strong preference for social play, especially following the introduction of her younger half-brother, Ajabu, to the troop. She spent up to 4.7 hours (19.80%) of her daily activity budget engaged in social play (Table 2, Figure 2). Amani appeared to be more interested in Play with an Enrichment Object between the ages of 1 and 2, and she mostly maintained her interest in spending some portion of the day interacting with new and interesting objects in her environment. Also at this time, Ajabu was scarcely able to break his attachment to his mother as he was in early infancy.

Table 2

Amani Play Frequency Activity Budget

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Play with Object (%)</th>
<th>Solitary Play (%)</th>
<th>Social Play (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>3.00%</td>
<td>0.00%</td>
<td>0.40%</td>
</tr>
<tr>
<td>1</td>
<td>5.20%</td>
<td>0.00%</td>
<td>1.70%</td>
</tr>
<tr>
<td>1.5</td>
<td>7.30%</td>
<td>0.20%</td>
<td>5.20%</td>
</tr>
<tr>
<td>2</td>
<td>3.10%</td>
<td>1.70%</td>
<td>11.70%</td>
</tr>
<tr>
<td>2.5</td>
<td>2.00%</td>
<td>4.80%</td>
<td>15.80%</td>
</tr>
<tr>
<td>3</td>
<td>1.60%</td>
<td>3.90%</td>
<td>19.80%</td>
</tr>
<tr>
<td>3.5</td>
<td>2.10%</td>
<td>2.70%</td>
<td>14.90%</td>
</tr>
<tr>
<td>4</td>
<td>0.00%</td>
<td>2.70%</td>
<td>9.80%</td>
</tr>
<tr>
<td>4.5</td>
<td>2.50%</td>
<td>0.00%</td>
<td>14.40%</td>
</tr>
<tr>
<td>5</td>
<td>1.60%</td>
<td>0.00%</td>
<td>17.50%</td>
</tr>
</tbody>
</table>


**Figure 2**

*Amani Play Frequency Activity Budget (Graph)*

![Graph showing play activity budget for Amani](image)

**Ajabu Play Analysis**

The male infant, Ajabu, displayed similar play preferences and trends as his elder half-sister. I observed Ajabu across the first four years of his life, capturing his full infancy and early juvenile development, as well. Like Amani, Ajabu consistently appeared to have a strong preference for social play compared to other types of play; however, Ajabu began to prefer social play around his sixth month of age, whereas his sister did not exhibit a clear preference for social play until about 20 months of age. This likely occurred because Ajabu was immediately able to engage in social play with his elder sister when he first began to break contact with his mother at about 5-6 months of age. Amani, on the other hand, was only able to engage in social play with
her mother when she was 6 months old, as Ajabu was not yet born. At his peak interest in play, Ajabu spent 19.70%, or approximately 4.7 hours, of his wakeful hours engaging in social play.

Table 3

_Ajabu Play Frequency Activity Budget_

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Play with Object (%)</th>
<th>Solitary Play (%)</th>
<th>Social Play (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>1.80%</td>
<td>0.00%</td>
<td>1.20%</td>
</tr>
<tr>
<td>1</td>
<td>2.70%</td>
<td>0.90%</td>
<td>12.70%</td>
</tr>
<tr>
<td>1.5</td>
<td>1.10%</td>
<td>5.50%</td>
<td>17.20%</td>
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<tr>
<td>2</td>
<td>1.90%</td>
<td>6.00%</td>
<td>19.70%</td>
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<tr>
<td>2.5</td>
<td>4.20%</td>
<td>3.90%</td>
<td>8.10%</td>
</tr>
<tr>
<td>3</td>
<td>5.60%</td>
<td>6.30%</td>
<td>7.60%</td>
</tr>
<tr>
<td>3.5</td>
<td>3.10%</td>
<td>0.00%</td>
<td>13.00%</td>
</tr>
<tr>
<td>4</td>
<td>5.60%</td>
<td>4.20%</td>
<td>8.50%</td>
</tr>
</tbody>
</table>

Figure 3

_Ajabu Play Frequency Activity Budget (Graph)_
Gorilla Infants Combined

The infant gorillas observed in this study spent up to 22.40% (about 5.4 hours) of their daily activity budget engaging in play behaviors (Table 4). Analysis of the infants’ daily activity budget also indicates that gorilla infants spend no less than 11.00% of their days engaged in some kind of unstructured play activity. I identified Social Play as the most preferred form of play for both the male and female infant, taking up to 15.70% or 3.8 hours of the infants’ day (Table 4). Play behaviors appeared to peak between the ages of two and three years old (Figure 4). Qualitative observations and proximity data indicate that gorilla infants initially engaged in social play with their mothers, and then later preferred to participate in social play with the other gorilla infant.

Table 4

Combined Average Play Frequency Activity Budget

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Play with Object (%)</th>
<th>Solitary Play (%)</th>
<th>Social Play (%)</th>
<th>Total Play (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5</td>
<td>2.40%</td>
<td>0%</td>
<td>0.80%</td>
<td>3.20%</td>
</tr>
<tr>
<td>1</td>
<td>3.95%</td>
<td>0.45%</td>
<td>7.20%</td>
<td>11.60%</td>
</tr>
<tr>
<td>1.5</td>
<td>4.20%</td>
<td>2.85%</td>
<td>11.20%</td>
<td>18.25%</td>
</tr>
<tr>
<td>2</td>
<td>2.50%</td>
<td>3.85%</td>
<td>15.70%</td>
<td>22.05%</td>
</tr>
<tr>
<td>2.5</td>
<td>3.10%</td>
<td>4.35%</td>
<td>11.95%</td>
<td>19.40%</td>
</tr>
<tr>
<td>3</td>
<td>3.60%</td>
<td>5.10%</td>
<td>13.70%</td>
<td>22.40%</td>
</tr>
<tr>
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<td>2.60%</td>
<td>1.35%</td>
<td>13.95%</td>
<td>17.90%</td>
</tr>
<tr>
<td>4</td>
<td>2.80%</td>
<td>3.45%</td>
<td>9.15%</td>
<td>15.40%</td>
</tr>
</tbody>
</table>
Figure 4

*Combined Average Play Frequency Activity Budget (Graph)*

**Personality Data**

Because only one current Keeper at the Philadelphia Zoo met the necessary criteria for accurate and valid completion of the Gorilla Behavior Index, only one personality inventory was completed per gorilla. The results will be interpreted with caution, and to inform and profile the personalities of the gorillas being studied from a qualitative perspective.

The gorilla infants of interest in the present study appeared to display the highest Extroversion scores of the group and fairly low scores on Fearfulness. In future studies, it may be beneficial to gather personality data across the developmental timeline to glean a better understanding of personality development. Future research may also incorporate generational capturing of personality data, to assess whether infant gorillas appear to inherit or learn personality traits from their biological ancestors.
Table 5

*Personality Factor Scores*

<table>
<thead>
<tr>
<th>Name</th>
<th>Extroverted</th>
<th>Dominant</th>
<th>Fearful</th>
<th>Understanding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motuba (MO)</td>
<td>0.33</td>
<td>2.33</td>
<td>0.14</td>
<td>4.40</td>
</tr>
<tr>
<td>Honi (HO)</td>
<td>1.17</td>
<td>2.67</td>
<td>1.43</td>
<td>3.00</td>
</tr>
<tr>
<td>Kira (KI)</td>
<td>1.50</td>
<td>2.50</td>
<td>0.86</td>
<td>3.20</td>
</tr>
<tr>
<td>Amani (AM)</td>
<td>3.00</td>
<td>1.83</td>
<td>0.71</td>
<td>2.60</td>
</tr>
<tr>
<td>Ajabu (AJ)</td>
<td>3.00</td>
<td>2.33</td>
<td>0.57</td>
<td>1.80</td>
</tr>
</tbody>
</table>

Figure 5

*Personality Scores Per Gorilla*
Discussion

The Present Study

This study followed the birth and first four to five years of life of two gorilla infants born at the Philadelphia Zoo in Philadelphia, Pennsylvania. The primary goal of the current study was to offer preliminary investigations into primate play development and social well-being through years of observational focal scanning to gather data on typical activity budgeting. Activity budgets were compiled from several hundred hours of observational focal scanning that took place on-site at the Philadelphia Zoo by a team of investigators within the Primate Lab at West Chester University. This study also provided the first recorded use of personality profiling of captive gorillas to track familial similarities in personality throughout generations.

The personality data collected provided a frame of reference for better understanding the dynamics of the gorilla family. Both Amani and Ajabu, the focal points of the present study, were recorded to have relatively high levels of the trait Extroversion and low levels of Fearfulness. Amani was reported to be slightly less Dominant than Ajabu, but more Understanding. These traits, within the context of their family dynamics and living environment, indicate that Amani and Ajabu have grown into happy and healthy juveniles.

The present study provided initial data supporting the critical role that unstructured play has in the early lives of gorilla infants. The trends of play development of the captive gorillas in the current study appear consistent with the trends observed in wild populations (Hoff, Nader, & Maple, 1981). Taking up to almost a quarter of the infants’ waking hours, the various types of play proved to be a vital part of a juvenile primate’s day. While the gorillas engaged in all forms of play to some degree across their early infancy, both the female and male infant displayed clear
and consistent preferences for socially-involved play with nearly all other members of the gorilla troop.

When considering how the observations in the present study may compare to human child development, the purpose of play can first be considered. Both human infants and gorilla infants engage in play for many specific, evolutionary purposes. Physiologically, gorillas and humans need to engage in rough-and-tumble, full-body play. This style of play allows for the development of dexterity and muscle tone in gross motor muscles. Intellectually, play has been linked to cognitive flexibility and problem-solving proficiency. Mentally, it has also been shown to influence resilience and positive social-emotional development. Socially, play allows infants of all species to safely explore social hierarchies and practice their comfort in specific social roles. Unstructured free play is deemed to be an essential aspect of development for many species (Koener & Francis, 2020). The present study was able to successfully collect and analyze data that supported the belief that play time is essential for positive social and emotional development in a western lowland gorilla population. These results, in the context of a more comparative and clinical lens, can be used to support the resounding call to action to allow human children to regain their right to play – freely, and without structure or restriction.

Clinical and Practice Implications

While new research is promoted each year on the importance of allowing children the opportunities to engage in unstructured free play, little movement in daily play percentages seems to occur as a result. The average child's amount of free play time decreased by 25% from the years 1981 to 1997, and declines have continued to be monitored in the decades following (Hofferth and Sandberg, 2011). Further, due to ever-increasing pressure for children to be consistently academically ahead, approximately 30% of kindergarten children in the United
States have lost recess altogether to enforce additional academic time (Murray and Ramsetter, 2013). These findings continue to be shocking, especially as research continues to observe that high-quality time for unstructured free play, especially during recess, has direct correlates to the improved mental health of children, regardless of racial background, socioeconomic status, and even trauma history (Massey et al., 2021).

Researchers have argued that unstructured free play is necessary for children to be able to form resiliency in adversity and that a lack of time dedicated to playing can even be harmful to brain structure and core executive functioning skills (Yogman et al., 2018; Zelazo, Blair, & Willoughby, 2017). Play is also observed as a buffer to adversity, as it helps humans and nonhumans to reduce stress hormones to levels that are more compatible with resilience and positive coping (Garner et al., 2012). Wang and Aamodt (2011) also recorded close associations between high amounts of play and low levels of the stress hormone, cortisol; indicating that either play reduces stress hormones, or unstressed beings play more frequently. Similar findings are observed across human and nonhuman research. The results of this study may also be considered in conjunction with the advocacy efforts that have been made nationwide to promote the importance of play for developing youth.

The present study was devised in hopes of providing a comparative analysis of gorilla behaviors to human behaviors, as gorillas are a close relative to humans. Gorillas, like humans, require plenty of social bonding, enrichment, and free play time, or else they are at risk for chronic stress, which can further lead to stress-related negative health outcomes. The gorilla juveniles that were observed in the present study displayed almost zero instances of anxious behaviors. This positively suggests that the gorillas have been thriving in their appropriately
enriched environment and they were able to engage in as much time for social bonding and play as they needed to reduce undue stress.

**Zoological Implications**

Of exciting note, evaluations of overall activity budgets suggest that the gorilla infants that were observed in this study displayed scarce instances of behaviors that indicate stress or anxiety (including self-scratching, self-biting, and regurgitation). Only one occurrence of self-scratching was observed across almost 8,000 individual focal scans that were utilized for this project. The results from this study also revealed that the captive gorilla infants housed at the Philadelphia Zoo are engaging in play trends consistent with wild populations, which furthers the support for an enriched environment (Hoff, Nader, & Maple, 1981).

This is a greatly encouraging observation, as it indicates that the infants housed at the Philadelphia Zoo are thriving developmentally and emotionally. The lack of anxiety behaviors shows that the gorilla infants are experiencing minimal stress, which can be attributed to their socially-flourishing and environmentally-enriched living conditions.

**Limitations of the Present Study**

The first limitation of the present study was that the personality measures were only able to be collected on one occasion and were only completed by one keeper who knew the gorillas well. Ideally, these measures would be updated for several years as the juveniles age into adults, to gain a better understanding of personality development and how similarities may be able to be observed across generations.

Another limitation of the current study was that, while positive, very few observations of stress- or anxiety-related behaviors were collected. It would have been of interest to evaluate
periods of heightened anxiety in comparison to play behaviors, to determine whether a correlation could be made.

**Future Research Considerations**

Future research should consider multigenerational studies of captive primates. As illustrated by the present study, the observations of gorillas offer incredible insight into the evolutionary perspective of understanding human behaviors. This study was able to capture the blooming of a family as it grew from one silverback and two females to a family with one female infant and one male infant. This allowed the unique opportunity to witness and document the interactions between similar-age infants, their relationship with their mothers, and their relationship with their father. Future research may consider observing gorillas with variable troop make-ups, such as a troop with only one infant, or perhaps more than two infants. This would encourage researchers to determine whether family make-ups influence frequency or preference of play behaviors; for example, would a solitary infant have as strong of a preference for social play if they are unable to play with a similar-age juvenile?

Additionally, future studies may also consider adding additional play categories to get even more clarity on infant and juvenile play preferences. For example, Social Play may be broken down into Social Play with Another Infant, Social Play with Mother, and Social Play with Father. To even more clearly capture how primate play develops, continued studies may also consider whether relationships exist between play preferences and other environmental factors, such as access to enrichment items, time of day, crowd size, or other variables of interest. These changes may also allow for further insight into family dynamics and enrichment success.
As captive gorilla families grow and change, more unique opportunities will arise and allow for a better understanding of how different family dynamics can also be understood through a comparative lens. Future studies may also consider following several generations of captive gorillas and discovering whether similar personality trends occur across each new generation.

Concluding Thoughts

The present study was devised out of love and passion for the children who have been stripped of their accessibility to free, unstructured play. Despite the constant publications from psychological, educational, and political fields of practice that show clear negative consequences when children lose time for play, our society continues to discount its importance in favor of forcing children into more academic tasks, screen time, or regimented/structured “play”. While there will always be time and purpose for those kinds of opportunities, it is simply unethical, unfair, and immoral to tear children away from the imagination, magic, and creativity that comes only from free unstructured play.

The great philosopher Plato once wrote, “You can discover more about a person in an hour of play than in a year of conversation”. This sentiment is true in many populations, especially in therapeutic contexts. Play permits children to tackle emotional or difficult situations in a way that is safe and comfortable for them, and it helps them to better understand their emotions and their roles in these situations. Play is functional, developmental, and emotional. It is safety, and it is healing. The present study’s underlying goal was to show, without human bias, that play is an evolutionary necessity, and it is a right. The comparison of primate well-being to human well-being reinforces the already strong support that all beings, no matter the species, deserve the right to play.
References


https://doi.org/10.1177/1077559512459555


Appendices

Appendix A

Gorilla Focal Scan Sheet

<table>
<thead>
<tr>
<th>Time</th>
<th>Individual</th>
<th>Location</th>
<th>Arboreal?</th>
<th>Distance to MO</th>
<th>Distance to HO</th>
<th>Distance to KI</th>
<th>Distance to AM</th>
<th>Distance to AJ</th>
<th>Activity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:10</td>
<td>MO</td>
<td>1</td>
<td>N</td>
<td>N/A</td>
<td>P</td>
<td>D</td>
<td>P</td>
<td>D</td>
<td>F</td>
<td>feeding on browse</td>
</tr>
</tbody>
</table>
Appendix B

Special Occurrences Sheet

<table>
<thead>
<tr>
<th>Time</th>
<th>Ind.</th>
<th>Location</th>
<th>Arboreal?</th>
<th>Behavior</th>
<th>Actor</th>
<th>Receiver</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>12:12</td>
<td>KA</td>
<td>1</td>
<td>yes</td>
<td>H</td>
<td>KA</td>
<td>LO</td>
<td>KA hit LO and ran away</td>
</tr>
</tbody>
</table>

Observers:
Group Observed - circle one:
(Family, Bachelors, LO only, KA only):
Date:
Time In:  Time Out:

Special
Occurrences
Data Sheet

Temperature (Fahrenheit):
Food (Y or N):
Access to what enclosures:
Appendix C

Operational Definitions Guide

Operational Definition Sheet updated 10/16

Things to record on special occurrences when watching the population:

- **Play Structure behaviors (PS):** Any instance of any infant using the Play Structure outside or coming into contact with it. Use the notes to write if it is being used for foraging.
- **Regurgitation (R):** An individual expelling food from their mouth and then proceeding to reingest it (R&R).
- **Feeding on Regurgitation (FR):** When an individual is not actively regurgitating but is feeding on regurgitation already produced.
- **(All RR will be recorded on All Occurrences for the start and end time in the Notes. If there is an interval of 3 minutes of no activity between occurrences of RR, record a new occurrence if the individual engages in RR again.)**
- **Nursing (N):** The infant is feeding from the mother.
- **Wean (W):** Mother terminates or prevents nursing.
- **Sexual behaviors:** Mating, masturbation, mounting — any type any individual.
- **Aggression, Sexual behaviors, Stereotypic behaviors, grooming, anything odd**

Things to record on special occurrences all the time no matter who you are watching:

- **Groom:** Any and all occurrences of grooming between any and all individuals — *Be sure to note which individuals it is between and duration*
- **Sexual behaviors:** Mating, masturbation, mounting — any type any individual.
- **Nest building:** Any individual manipulating bedding and putting it around them.
- **Other:** Anything out of the ordinary or different to you. Right now an example of this is Motuba’s weird dancing.

**Individual Proximity to Another Individual**

- **Contact:** Individuals are physically touching.
- **Proximate:** Individuals are within arm’s reach of each other (*less than or equal to 5 meters*).
- **Distant:** Individuals are out of reach of each other but still remain in the same enclosure (*greater than 5 meters but still in same enclosure*).
- **Far:** Individuals are in different enclosures.
Activity Budget Behaviors

Aggressive Behavior: hostile, destructive, or injurious behavior aimed at another individual

- Attack (A): physical contact between two or more individuals with intent to harm
- Banging (BA): fiercely banging on glass of exhibit or parts of trail with body or another object
- Chasing (C): running after another individual (can also be social play depending on context)
- Charging (CA): charging towards the glass at an individual on the other side
- Chest Beat (CB): beating chest in a stiff legged stance
- Displacement (DI): an individual moves away from another individual or area after being approached
- Hitting (H): one individual striking another (can also be social play depending on context)
- Kick (K): fiercely kick an object or individual (can also be social play depending on context)
- Pilotection (PE): hair is raised towards another individual
- Throwing objects (TO): throwing rocks, blocks, or toys at another individual (can also be social play depending on context)

Social Play Behavior: the state of being productively active without the intent to harm

- Contact (CO): physical touching between individuals without intent to harm
- Grooming (G): cleaning other individuals without intent to harm
- Knocking (KN): an individual uses knuckles to knock on an object, the trail way, or the glass of the enclosure
- Playing with an object (PO): manipulating something in the environment with either hands or feet without intent to use it to harm
- Social Play (SP): engaging in play like behavior with another individual without the intent to harm

Anxiety/Stress Related Behavior:

- Self – Biting (SB): piercing or nipping one’s own body causing harm
- Self – Scratching (SS): rubbing one’s own skin or hair with fingernails for an extended period of time causing bodily harm
• Regurgitation (R): an individual expelling food from their mouth and then proceeding to reingest it (R&R)

• Feeding on Regurgitation (FR): when an individual is not actively regurgitating but is feeding on regurgitation already produced

**Feeding / Foraging Behavior**

• Feeding / Foraging (F): when an individual is investigating for, holding, or ingesting food such as lettuce, tomatoes, cardboard, eggplant, cheerios, raisins, browse, etc.

**Natural Behavior**

• Defecation (D): releasing of urine or feces

• Nest Building (NB): when the individual is manipulating bedding around themselves on the floor constructing a nest or when they are carrying bedding to another location and constructing a nest

• Self Grooming (SG): cleaning oneself for a short amount of time

**Sexual Behavior**

• Mating (MA): engaging in copulation with another individual

• Masturbation (M): touching genitals

• Mounting (MG): when one of the females is on top of or humps the other

**Locomotion Behavior:**

• Laying Down (LD): individual’s body is laying on the ground

• Moving or Traveling (MT): the act of walking or running around one’s environment without intent to harm or intent to play

• Sitting (SI): individual is sitting on the ground or on an object

• Standing (ST): individual is standing without moving or traveling

**Other Behavior:**

• Other (O): an other type of behavior *(make sure you make a note of what you saw)*

• Out of View (OV): an individual cannot be seen
Infant Specific Behaviors (can use full words for these):

- Clinging (CI): the infant is grasping any part of the mother’s body. Write in special occurrences if an infant is clinging an individual besides the mother
- Climbing (CL): the infant is moving up the mesh or scaffoldings
- Retrieve (R): Infant is retrieved by the mother
- Solo Play (Solo): engaging in play like behavior alone without another individual participating. Can be used in conjunction with PO
- Struggle (SR): Infant trying to break contact with mother but mother restraining
- Approaches: Anytime anyone approaches the individual you are watching or anytime the individual you are watching approaches another individual

Numbers of Enclosure and Trail System:

- 0 – In the outside yard that is visible from inside and outside of PECO
- 1 – Inside the dayroom enclosure
- ISO – bottom of stairs before going into trail
- S – Stairs leading up into the trail
- 2 – first straight stretch of trail
- 3 – first loop of trail
- TP – Training platform located between 3 and 4
- 4 – second straight stretch starting after the first loop (3) and ending by the bend in the straightaway
- 5 – third straight stretch starting from bend in the straightaway and ending at the second loop
- 6 – second loop of trail
- 7 – final straight stretch near Orangutan yard (Gorillas rarely use, if ever)

Arboreal:

In 0: when on the climbing structure

In 1: when on the scaffoldings or ropes/logs hung above the ground
Schedule – 2 teams can go each day (estimated times)

Morning Team = 9:30am-1:00pm
Afternoon Team = 1:00pm – 4:00pm (5:00pm)

Door Names:

Down under: door from yard leading to underneath dayroom
Door to ISO: door in the back of the dayroom leading into ISO
Door to holding: door in the front of the dayroom that leads to the basement holding area
Door to outside: door on the far left of the dayroom that leads to the yard

Last updated on 08/20/19 CP
Appendix D

Gorilla Behavior Index (Gold & Maple, 1994)

<table>
<thead>
<tr>
<th>Gorilla’s name</th>
<th>Age</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Rater’s Name</td>
<td></td>
</tr>
</tbody>
</table>

Instructions for Ratings

Consider each item according to its definition, and independently of any other item. Rate over one item before proceeding to the next. For each item circle one of the following ratings: 1) the item is weakly represented, or it is not present at all; 2) the item is distinctly present, but falls below average; 3) the individual falls just about halfway between the extremes, or average for gorilla behavior as you know it; 4) the item is strong, although not outstanding; 5) the item is very strong and conspicuous, approaching the extreme.

1 2 3 4 5 | Active: moves about a lot
1 2 3 4 5 | Aggressive: causes harm or potential harm; displays, chases, bites, etc.
1 2 3 4 5 | Apprehensive: seems to be anxious about everything; fears and avoids any kind of risk
1 2 3 4 5 | Confident: behaves in a positive, assured manner, not restrained or tentative.
1 2 3 4 5 | Curious: readily explores new situations, environments, objects
1 2 3 4 5 | Eccentric: shows stereotypes or unusual mannerisms; coprophagy, regurgitation, rock, pace, self-clasp, etc.
1 2 3 4 5 | Effective: gets own way, can control others
1 2 3 4 5 | Equable: reacts to others in an even, calm way; is not easily disturbed
1 2 3 4 5 | Excitable: overreacts to any change
1 2 3 4 5 | Fearful: fear grins; retreats readily from others or from outside disturbances
1 2 3 4 5 | Insecure: hesitates to act alone; seeks reassurance from others
1 2 3 4 5 | Irritable: reacts negatively with little provocation
1 2 3 4 5 | Motherly: Provides a warm, receptive, secure base
1 2 3 4 5 | Opportunistic: seizes a chance as soon as it arises
1 2 3 4 5 | Permissive: could but does not interfere with the behavior of others
1 2 3 4 5 | Playful: initiates play and joins in when play is solicited
1 2 3 4 5 | Popular: is sought out as a companion by others
1 2 3 4 5 | Protective: prevents harm or possible harm to others
1 2 3 4 5 | Slow: moves and sits in a relaxed manner; moves slowly and deliberately, not easily hurried.
1 2 3 4 5 | Sociable: seeks companionship of others
1 2 3 4 5 | Solitary: spends time alone
1 2 3 4 5 | Strong: depends upon sturdiness and muscular strength
1 2 3 4 5 | Subordinate: gives in readily to others
1 2 3 4 5 | Tense: shows restraint in posture and movement; carries the body stiffly, which suggests a shrinking tendency, as if trying to pull back and be less conspicuous
1 2 3 4 5 | Understanding: responds in a discriminating and appropriate manner to the behavior of others
March 12, 2023

Madeline Vandevere,

Prior to the commencement of your dissertation research the IACUC committee met and discussed the need for you to submit a protocol for your research on the captive gorilla population at the Philadelphia Zoo. The committee determined that since your proposed project involved no manipulations or methodologies that would affect gorilla behavior or welfare in ways that the normal viewing public would that you did not need to submit a formal proposal for approval.

Please feel free to contact me if you need any further clarification or have additional questions.

Sincerely,

Aaron Rundus

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