Cultural Differences in Infant Motor Development: A Comparison of Early Locomotor Experience

by

Yitong Wang

B.A. (Hons.), Simon Fraser University, 2022

Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of
Master of Arts

in the
Department of Psychology
Faculty of Arts and Social Sciences

SIMON FRASER UNIVERSITY
Fall 2022

Declaration of Committee

Name:	**Yitong Wang**
Degree:	**Master of Arts (Developmental Psychology)**
Title:	**Cultural Differences in Infant Motor Development: A Comparison of Early Locomotor Experience**
Committee:	**Chair:** **Lara Aknin** Professor, Psychology
	Tanya Broesch Supervisor Associate Professor, Psychology
	Jeremy Carpendale Committee Member Professor, Psychology
	Laura Shneidman Examiner Assistant Professor, Psychology Pacific Lutheran University

Ethics Statement

The author, whose name appears on the title page of this work, has obtained, for the research described in this work, either:

a. human research ethics approval from the Simon Fraser University Office of Research Ethics

or

b. advance approval of the animal care protocol from the University Animal Care Committee of Simon Fraser University

or has conducted the research

c. as a co-investigator, collaborator, or research assistant in a research project approved in advance.

A copy of the approval letter has been filed with the Theses Office of the University Library at the time of submission of this thesis or project.

The original application for approval and letter of approval are filed with the relevant offices. Inquiries may be directed to those authorities.

Simon Fraser University Library
Burnaby, British Columbia, Canada

Update Spring 2016

Abstract

Infant motor development, much like developmental science, is based on studies with Western samples, yet ethnographic observations across diverse cultural contexts points to potential variability across cultural groups in infant experiences. To better understand whether group differences in early experience affect development, we examined 220 video recorded natural observations of 49 infants (M=12 mos, SD= .72, range = 10-15 mos) and their families in three culturally distinct societies: Tanna Island in Vanuatu, Aka foragers in the Central African Republic, and rural villages in Tajikistan. We determined the proportion of observed time in which infants were locomoting as well as the duration of time their movement was restricted by either a device or a caregiver. Overall, we found that the more infants were restricted, the less then tended to move when they were left unrestricted (r = -.615, p < .001). We also found differences between cultural groups in infants' propensity to move spontaneously. Infants living in Tajikistan spent less time moving than infants living in Vanuatu (p = .023) and Aka infants (p = .001). We also found a similar pattern with the proportion of time infants were constrained, with Tajikistan infants being constrained more than Aka infants (p < .001) and Vanuatu infants (p = .008). Interestingly, we found that infants' cultural group did not have a significant contribution to the variance in the proportion of time infants were engaging in spontaneous locomotion (p = .153). This study provides further insight into the formative role of experience in motor development and highlights the importance of examining development across diverse social and ecological contexts. This study also underscores the importance of taking a nuanced approach to understanding group cultural differences.

Keywords: motor development; culture; infant locomotion; caregiver practice; early experience; hunter-gatherer

Acknowledgements

This research was funded by the Social Science and Humanities Research Council Insight Development Grant (31-R640044) to Tanya Broesch as well as the Laurine Harrison Graduate Thesis Award funding, and a Simon Fraser University Graduate Fellowship and research support to Yitong Wang.

Table of Contents

List of Figures

Chapter 1. Introduction

Motor development refers to improvements and decrements in motor skills over the life span and the processes that underlie those changes (Adolph, 2018). Infant motor development is one skill that generates a host of new experiences and serves as a catalyst for developmental cascades (Walle, 2016). Studies have shown that independent locomotion is associated with a wide range of psychological functions, including spatial cognition, memory, and emotional and social processes (Anderson et al., 2013). For example, the advent of crawling results in improvements in spatial cognition and memory, and the ability to walk stimulates changes in emotional independence and social interactions (Adolph & Robinson, 2015). Ever since motor development has been described in terms of age-related stages, cultural-specific variation in timing and contexts of motor development have been reported (Adolph, 2018; Karasik et al., 2015). However, most research in developmental science has focused on the standardization of motor skills relative to western norms and assumes universals in developmental processes and outcomes (Bril & Sabatier, 1986). In fact, our understanding of motor development is based on a narrow focus on children from WEIRD societies (western, educated, industrialized, rich and democratic) (Adolph et al., 2010; Henrich et al., 2010). This understanding assumes that motor development happens in an invariant sequence and that motor milestones are achieved with little flexibility in timing (Gesell, 1946). The classic motor milestone charts with accompanying achieved ages are utilized as developmental assessment tools to set the “normal” standard of children’s motor development (Karasik, 2015). However, cross-cultural descriptions (typically in the field of anthropology) of early mobility indicate widespread variability in the timing of motor milestones attainment and presumed sequence of development (Adolph et al., 2012). These cross-cultural reports expand our understanding of the potential range of variability in motor development across diverse environments and provide new insight into how cultural features may influence children’s motor behaviours.

Although ethnographic reports point to widespread variability in the timing and sequence of motor development, very few studies have examined this directly to better understand the factors or processes that specifically lead to such variation. In fact, it is typically assumed to be a result of cultural goals and beliefs around motor achievement (Schaik et al., 2018). There are other explanations that move beyond a strict cultural

interpretation; we refer to this as the ecological explanation. Although ecology and culture are inevitably intertwined, we sought to examine these by investigating one aspect of motor development across cultures – motor restriction and motor movement.

A cross-cultural approach is essential for understanding any aspect of human development. According to Amir and McAuliffe's (2020) review of approaches to studying child development, cross-cultural, developmental science needs to combine the strengths of the breadth (larger, multi-site studies) and depth (detailed, ethnographic investigations) approaches to better understand how variation in early experience can lead to variation in behavioural outcomes. In particular, the authors suggest that cross-cultural observational research can be a useful tool for providing insights into evolutionary questions by documenting the variations in early development and attempting to explain observed variability. Others have also highlighted the importance of using observational methods to triangulate our data for a deeper understanding of development (Dahl, 2018). In this project, our objective was to contribute to knowledge about infant motor development by examining and comparing infant motor experience in three diverse contexts (Tanna Island in Vanuatu, Aka foragers in the Central African Republic, and rural villages in Tajikistan). It should be noted that this project was conducted by examining an existing secondary dataset consisting of natural observations of daily family life and we did not select these societies for this particular purpose.

1.1. Infants' Motor Development and Cross-Cultural Differences

Infant motor development provides infants with a broader and more diverse set of opportunities for engaging with their environments (Gibson, 1988). Developing motor skills allows the infant to interact with the environment in increasingly complex ways and affects the way infants understand and use social information (Adolph, Karasik, & Tamis-LeMonda, 2010). As infants develop the ability to sit, crawl, and walk, they also gain new opportunities for learning and social understanding (Adolph & Franchak, 2017). For example, the upright posture of walking frees the infant's hands to manipulate objects and affords a more flexible viewpoint while locomoting (Clearfield, 2011). These physical changes may promote infants' following of adult attentional cues and has a significant

impact on how infants engage with caregivers and then generate social contexts around them. Studies linking motor and psychological development state that the acquisition of walking correlated with the development of language, increase goal-directed behavior, and concept formation (Campos et al., 1997; Walle & Campos, 2013). These findings suggest that achievement of new motor milestones may facilitate the development of such psychological phenomena and can instigate cascades of developmental changes in perceptual, cognitive, and social domains. Parents are receptive to these developmental changes and adjust their interactions to accommodate the new challenges, abilities, and interests of developing infants. In other words, not only the way infants understand and use social information changes with achieving new motor milestones, but their social environment changes with changing motor abilities.

Traditionally, the development of infants' motor skills was thought to follow a fixed sequence, which supported the assumption that infants' motor development trajectory is similar across cultures. However, in Mendonca, Sargent, and Fetters' (2016) systematic review, the authors found that motor development screening and assessment tools created and developed in Western European and North American countries have limited validity when used to evaluate the motor development of children aged 0 to 2 years in different cultures. The authors suggest that the range in ages of achievement of key motor milestones may need a shift towards a more flexible and culturally relevant view (Mendonca et al., 2016). Rather than assuming children display locomotor skills in an invariant sequence regardless of cultural or contextual influences, context-specific variation in early motor development across cultures have been documented and reported in many populations around world. Additionally, Lohaus and colleagues (2011) investigated motor development among the Cameroonian Nso and urban German infants, and they found that Nso infants were more advanced than German infants in gross motor development, but the fine motor development is significantly advanced in German infants, compared to Nso infants. Furthermore, other studies also report significant variation in the age of acquisition of motor achievements. Whereas Western norms report that 90% of infants achieve independent sitting by seven months, infants in Uganda sat independently at four months and infants from West Indies sat independently at five months (Karasik et al., 2015). Moreover, 29% of Jamaican infants skipped crawling, and some Jamaican infants began crawling at the same age they began walking (Hopkins & Westra, 1990). In earlier studies from Nigeria (Iloeje et al.,

1991), it was found that the Nigerian infants achieve most gross-motor milestones such as “crawl”, “stand well alone” and “walk well alone” earlier compared with the Caucasians. However, some transitional milestones such as “roll over” and “stand holding on” were achieved later by Nigerian infants. Thus, cross-cultural research challenges the universal or standardization of motor development in early years and raises the question of what could contribute to these group-level differences.

1.2. Possible Explanations

Although cross-cultural observations and limited empirical data points to widespread variability in infant motor development, very little is known regarding the cause of these differences. Cross-cultural differences in motor development is typically assumed to reflect differences in caregiving goals and beliefs about ideal development (Keller et al., 2002). Yet, a cultural explanation is only one explanation. It could be the case that such group-level differences reflect differences in the living situation (ecological differences), or caregiving practices (e.g. restriction due to safety concerns) or temperamental differences (Aime et al., 2019).

Cultural explanation. Different culture groups have distinct ways of restricting infants’ locomotion. In some cultures, this restriction is a result of the ecological constraints of the society, while in others, it may be a result of cultural beliefs. For example, a traditional infant equipment “cradleboard” is commonly used in Navajo households (Donaldson, Clancey, & Russell, 2020). Chisholm (1978) reports that Navajo culture believes that the use of cradleboards will offer both physical and spiritual benefits to the infant to calm the infant and promote sleep. Infants are often tightly swaddled and wrapped with little ability for active movement or exploration on the cradleboard (Chisholm, 1978). Furthermore, Inuit mothers use an “Amauti” (a traditional clothing that designed with a large hood and pouch) to pack and carry their infants on their backs, and most Inuit children spend their first three years nestled in the amauti (Blackduck, 2001). The close and prolonged contact between the Inuit mother and child protects the child from cold and frees the mother’s hands for other activities. Similarly, mothers from a foraging society “the Ache” of Eastern Paraguay rarely put their infants down or let them venture more than a meter away because of the dangerous forest environment (Kaplan & Dove, 1987). These descriptions of caregivers’ restrictive parenting behavior across diverse cultures shows that culturally distinct childrearing beliefs can lead to

differences in caregiving behaviors such as restricting the movement of the infant. However, the effects of restricted movement are not well known because research on infant motor development around the world is limited (Karasik, 2015).

The level of motor skill performance may reflect the amount and type of practice encouraged by the culture, and be attributed to culture-specific practices, cultural beliefs, and expectations (Adolph, 2010). For instance, previous studies found that cultural practices involving prolonged supine positioning result in delayed onset of gross motor milestones in Chinese and Japanese infants (Cintas, 1995). Moreover, in Ghana and Bali, girls are trained in load carriage, and this begins in early childhood, and this cultural practice results in advanced walking abilities in Ghana women (Agarwal et al., 1997). In addition, parents have different culture-specific expectations about when children should acquire various motor milestones. For example, crawling is not a culturally valued behavior in Caribbean culture because it is perceived as being apelike (Hopkins & Westra, 1990). Mothers from Congo showed higher expectations of the achievement of sitting and walking alone compared with French mothers (Bril et al., 1989), because these are treated as an essential step toward becoming an adult.

Parents are influenced by specific social norms or cultural background to expect the ages at which children in the culture acquire various skills that are important to the culture. For instance, achieving the sitting milestone early in infancy is critical to Ugandan mothers because it reflects social manners and is required for a special naming ceremony (Ainsworth, 1967). Malian mothers value infants' walking because it is linked with the age of toilet training (Bril et al., 1989). In addition, Keller et al. (2002) compared the different role of motor stimulation in parental ethnotheories between Cameroonian Nso and German mothers. They showed that the Nso women focused significantly more on handling than German women because of the diverse conceptions of good parenting across cultures. For the Nso, stimulating the infant in an upright position expresses good maternal care due to Nso tradition, and the German practice of keeping the infants lying on their backs is considered a retarding development. Therefore, caregivers share ideas about parenting practices and their developmental consequences based on their local culture. Mothers' expectations about motor milestone onset ages are influenced by the importance that their culture places on the timing or sequence of motor skills. Moreover, these parental belief systems inform behavioral practices and preferences, and thus shape motor developmental pathways of infants.

Ecological explanation. We also know that differences in the family household or setting can impact motor opportunities. In Oudgenoeg-Paz, Atun-Einy and van Schaik's (2020) research, the authors suggested that the settings of motor development, both distal environment (such as different climate and landscape between countries) and proximal settings (such as providing space and objects), could potentially support or hamper motor development by influencing the children's immediate environment and opportunities for movement. For the distal environment, previous research (Atun-Einy et al., 2013) found that infants who were born during the winter months started to crawl at a younger age compared to the infants who were summer- born. The authors argued that seasonality appears to impact parental behavior in many ways, including notable differences of infant clothing worn at home and opportunities for practicing motor skills outdoors.

In addition, the range of stimuli provided by proximal settings, including physical spaces, toys, and housing conditions (Ammar et al., 2013; Bombarda et al., 2017), also influence parental practices and ultimately affect infant motor development. Specific social contexts in which a child is reared place specific demands on the motor competencies of infants. These differences in proximal settings are typically assumed to reflect cultural differences in parenting practices, beliefs, and goals, yet they may also reflect differences in the immediate environment that are outside of the parental control. For example, whereas a caregiver may have a goal for their child to explore and achieve motor milestones early, they may be constrained by the safety of the immediate environment.

There are several lines of evidence suggesting that childrearing practices and caregiver beliefs may play an essential role in explaining the differences in motor development. For example, in many cultures in Africa and India, the caregiver usually includes formal massage and stretching in infants' daily bath routine (Adolph et al., 2010). Experiments showed that the timing of motor skills can be accelerated with a few minutes of stimulation each day over several weeks (Clark, et al., 1977; Porter, 1972). Moreover, !Kung mothers of Botswana wear decorative objects around their necks, and infants grasp and manipulate these objects during the day (Konner, 1972). As a consequence of continual access to objects and the practice of grasping, !Kung infants show an acceleration in prehension skills (Konner, 1977). Thus, different childrearing practice may affect the timing or sequence of motor milestones by providing various

kinds of stimulation and opportunities for practicing motor skills in daily routines. In contrast, some caregivers deliberately discourage or restrict children's independent mobility because they fear the likelihood that infants will encounter danger. For example, caregivers in Kenya discourage infants' independent mobility for fear that young children will encounter dangers such as stumble into fire and get burned (Ishak et al., 2007). Caregivers in urban and Western societies such as Canada and the US use safety gates on indoor stairs and deliberately restrict infants' sleep position for preventing potentially dangerous and sudden infant death syndrome (Berger et al., 2007). These descriptions of child development and family life across cultures suggest that there may be differences between cultures in the way parents encourage or restrict motor development, as a result of their caregiver goals. Everyday childrearing practices such as how infants are dressed or placed also can alter the course of motor development. Therefore, differences in the way caregivers structure the environment and interact with their children affect the form of new skills, the ages when they first appear, and the shape of their developmental trajectory.

1.3. Restricted Movement and Infant Motor Development

Some prior research claimed that restricted movement could delay the development of infants' postural and locomotor skills (Cole et al., 2012; Karasik et al., 2018). For example, previous research showed that the Northern Chinese custom of rearing infants in sandbags for most of the day delays the onset of sitting, crawling, and walking by several months (Mei, 1994). In addition, Cole et al. (2012) found that infants displayed less mature gait patterns and more missteps and falls while wearing diapers. Their findings indicated that whether infants are placed in a constrained posture may also delay their motor development. However, one recent study describes a traditional childrearing practice ("gahvora" cradling) in Tajikistan and other parts of Central Asia (Karasik et al., 2018). "Gahvora" cradling severely restricted infants' movements: Caregivers tightly swaddled and bound infants' arms, legs and torsos to the cradle bed, and infants could only move fingers and toes in most cases. According to Karasik et al., infants' visual experiences may be restricted by gahvora cradling, but they did not examine whether the infants' motor development might be affected by gahvora use. In addition, there is also no evidence that time in the cradleboard results in delayed motor development in Navajo infants.

1.4. Current Research

We had three objectives with this project. First, the current study examined whether there was a relationship between infants' opportunity to move freely (unrestricted time) and infants' self-generated motor behavior. We examined the amount of time infants are constrained by a caregiver or device (e.g. being held, being in a stroller) throughout the day and the amount of self-generated locomotion (e.g. walking or crawling) by the infant. Hypothesis 1: We expected that infants' time spent being constrained will be negatively correlated with infants'self-generated locomotion. Second, we examined and compared the relative proficiency of infants' self-exploratory movements across three societies. To the extent that we find differences in restriction patterns across cultures (infant opportunities to explore), we also expect infant self-given differences in the context factors of three culturally diverse groups. We expected that infants' locomotion proficiency will be higher in the cultural group which give infants more opportunity to move freely. Third, the current study identified parents' restricting practices under different cultural contexts. We expected that caregivers in different societies will demonstrate different restriction practices (hold the infant themselves or put in the device).

Chapter 2. Method

2.1. Participants and Locations

Forty-nine infants were observed. They were on average 12 months of age (SD = .72), ranging from 10 – 15 months. The final observation dataset consists of three datasets: Vanuatu (N = 9; age range = 11 -15 months); Central African Republic of the Congo (Aka) (N = 7; age range = 10 -12months); and Tajikistan (N = 33; age range = 11-12 months). Overall, the final dataset consists of 220 videos, and the total observation time is 66 hours. The researchers used a "focal follow" procedure with video recording devices. In each society, either the primary investigator or a trained local research assistant identified, and video recorded a target child for a short duration, over several days. All video recordings were collected during field visits and the field researcher had the objective of capturing video recorded observations of infants and children engaging in their day-to-day activities.

Vanuatu: The data collected on Tanna Island consisted of 178 observations of 9 infants aged 12 months (M = 12.8, SD = 1.2, range = 11-15). We coded a total of is 565 minutes, with each individual video observation lasting, on average 4 minutes (range = 3-5). Tanna island is located within Tafea province and is one of several islands in the archipelago of the Republic of Vanuatu, located in the South Pacific region. The island itself is of volcanic origin with coral reefs and narrow coastal flats surrounding a mostly forested central highland region. Tanna is a subsistence island society, and each village contains fewer than 100 people typically living in smaller family units. The majority of Vanuatu's population live in rural communities practicing forms of traditional subsistence. Much of adult and child life is spent attending to crops, food gathering, harvesting, and fishing. From an ethnographic observation on Tanna between 2012 and 2019, (Aime et al,, 2020; Broesch, Crittenden et al., 2021; Cebioglu et al., 2022; Smit et al., 2019) observed that parents encouraged their children to develop independent subsistence skills very early on. The parents on Tanna expect children to be responsible for assisting adults in labor from a very young age, such as cooking, prepping crops, and helping with the childcare of younger siblings. On Tanna Island, families rely primarily on subsistence agriculture with most households producing their own food. Much of adult and child life is spent attending to crops, food gathering, harvesting, and fishing. The life of an infant on

Tanna consists of very little exposure to manufactured items, and much of the child's life appears to be spent outdoors with extended family and mixed-age groups (Aime et al., 2020). Infants are typically carried by the mother or father or long distances or in the arms of the parent with the infant facing outward. The rural sedentary life and the extended family structure for Tana are typically associated with hierarchical agrarian societies and an authoritarian parenting style (Kağıtçıbaşı, 1996). The people on Tanna are typically characterized as leading a collective or interdependent lifestyle. Infants are exposed to a rich social life with children, adults and grandparents taking pleasure in the presence of an infant.

Central African Republic: The data collected in the Central African Republic consisted of 9 observations of 7 infants with an average age of 12 months (M = 11.29, SD = .76, range = 12 - 14). We coded a total of 600 minutes, with each individual video observation lasting, on average 60 minutes. The Aka (or BaYaka) foragers live in the tropical of the southwestern Central African Republic in the tropical forests of the Congo Basin. The Aka live in fluid communities of 25 to 50 people who move about four times per year. The Aka economy is based on a mix of hunting and gathering wild foods from the forest, small-scale, low-effort slash-and-burn agriculture, and exchange with neighboring farmers. Community life is open and intimate, and as much as 80% of food procured is shared with other camp members. Aka foundational schemas include respect for autonomy and egalitarianism. Status differences between people are minimized, and all individuals including children do as they please. Aka children typically either accompany their parents on foraging trips or stay close to home with the other children younger than five-years- old, typically casually attended to by any adult who has not left camp. There are no fences between houses, and children move freely throughout the neighborhoods (Broesch et al., 2021).

From Hewlett (2014) described the general features of Congo Basin forager childhood and examined diversity in childcare patterns between forager ethnic groups. He emphasized that respect for an individual's autonomy and a giving or sharing way of thinking represent the foundational schema among forager life. The way of life of most Congo Basin foragers is characterized by high mobility, temporary shelters, and regular foraging. During infancy and early childhood, foragers show more giving and are more responsive to their infants than famer groups. For instance, Fouts et al. (2011) found that

forest foragers breastfed more frequently, had more breast-feeding bouts per hour, and were more likely to be holding infants when nursing than farmer groups.

Tajikistan: The data collected from Tajikistan consisted of 33 observations of 33 infants aged 12 months on average (M = 11.96, SD =.17, range = 11-13). We coded a total of 2799 minutes, with each individual video observation lasting, on average 85 minutes.

Tajikistan is a mountainous landlocked country in Central Asia. The video set we used focused on the warmer, arid, Khatlon district and the colder, mountainous, Rasht district. From Karasik's (2018) study that documented the "gahvora" cradling use in Tajikistan, the author described that each family lives in a single-room, one-story clay home. Several homes are clustered around a small courtyard or garden with fruits, nuts, and vegetables grown for consumption and trade. Chairs, tables, and beds are rare, instead, indoor surfaces are covered in carpets. Infants are surrounded by many adults and children and cared for by parents, relatives, and neighbors. According to the report (Karasik et al, 2018), Tajik people historically have cared for newborn children in a small traditional rocking cradle. Infants from birth to 20 months of age are bound on their backs in a tightly wrapped swaddle with arms extended along the sides of the torso and legs straightened and tied together. In this way, the child cannot move its arms and legs, and cannot turn from side to side.

2.2. Data Coding

To examine our three research objectives, I developed a coding ethogram after watching five videos and determined the best practice for coding these behaviors. After the ethogram (Appendix A) was complete, I trained one undergraduate student to watch the videos in real time (one pass) and identify four mutually exclusive behaviors: child-generated locomotion, being constrained by caregiver, being constrained by device, and falling. To do this, I dentified the start and stop time of each of the four categories of behavior of interest using Behavioral Observation Research Interactive Software "BORIS" (Friard & Gamba, 2016). I coded child-generated locomotion as instances that child is engaged in salient self-generated locomotion in any form, i.e., bum shuffling, scooting, belly crawling, cruising, walking. I coded caregiver constrained as the infants is restricted by their caregiver and cannot engage in self-generated moving. I coded device

constrained as the infant is restricted by a device, i.e., bathtub, swing, box, stroller. For the fall behavior, the onset occurs at the infant's initial loss of balance, and the offset is determined by the infant's body reaching the ground and stabilizing.

Inter-rater reliability was achieved by two independent coders. A primary coder coded all the videos, and a subset (20%) of randomly selected videos from all three culture groups were re-coded by a second coder with a minimum of 70% agreement. Each coder coded videos (n = 3) separately after they developed the first version of the ethogram. Where minimum levels of agreement were not met, disparities were settled through review of the disputed observation and discussion of ambiguity in the definition of coding behaviour. Then each coder independently recoded the videos until agreement was achieved. Following the final revision of the ethogram, the coders achieved a high degree of reliability for all the variables (kappa $\geqslant$ .85) except fall behaviour. Disparities were settled through discussion and independent recoding of the videos until agreement was achieved (*kappa* $\geqslant$ .7).

Chapter 3. Results

3.1. Descriptive Data

First, I explored the dataset to determine whether there was any significant differences in infants' age between the three groups. A one-way ANOVA revealed that there was a statistically significant difference in infant's age across three cultural groups ($F(2,46) = 13.1$, $p < .001$). Tukey's HSD Test for multiple comparisons found that the mean value of infants' age was significantly different between Vanuatu infants ($M = 12.78$, $SD = 1.2$, range = 12 - 14) and Aka infants ($M = 11.29$, $SD = .76$, range = 12 - 14). There was no statistically significant difference in infant's age between Tajikistan infants ($M=11.96$, $SD = .17$, range = 11-13) and Vanuatu infants or between Tajikistan infants and Aka infants.

Next, I examined infants' self-generated locomotion, infants' constrained experience, and fall behaviour across all three societies ($N = 49$). Infants spent an average of 8.9% of their time in self-generated locomoting ($SD = 8.6\%$; range = 39%). Infants were constrained an average of 52.36% of the time by either their caregiver or a device ($SD = 24.01\%$; range = 89%). Infants experienced an average of 0.12% fall in their observable time.

3.2. Infants' Self-generated Locomotion and Infants' Opportunity to Move Freely

A Pearson correlation coefficient was computed to assess the linear relationship between the proportion of time an infant was in self-generated locomotion and the proportion of time that infant was being constrained. There was a statistically significant negative correlation between the two variables ($r = -.615$, $p < .001$), indicating that the higher proportion of time infant was constrained, the less proportion of time they engaged self-generated locomotion (*Figure 3.2.1.*).

More specifically, I also analysed this relationship within each group separately. There was a statistically significant negative correlation between infants' time in self-generated locomotion and time being in both the Vanuatu group ($r = -.685$; $p=.042$) and the Tajikistan group ($r = -.454$; $p=.008$). The AKA group also showed negative

correlation between infants' time in self-generated locomotion and time being constrained, but this correlation was not statistically significant (r = -.45, p =.311).

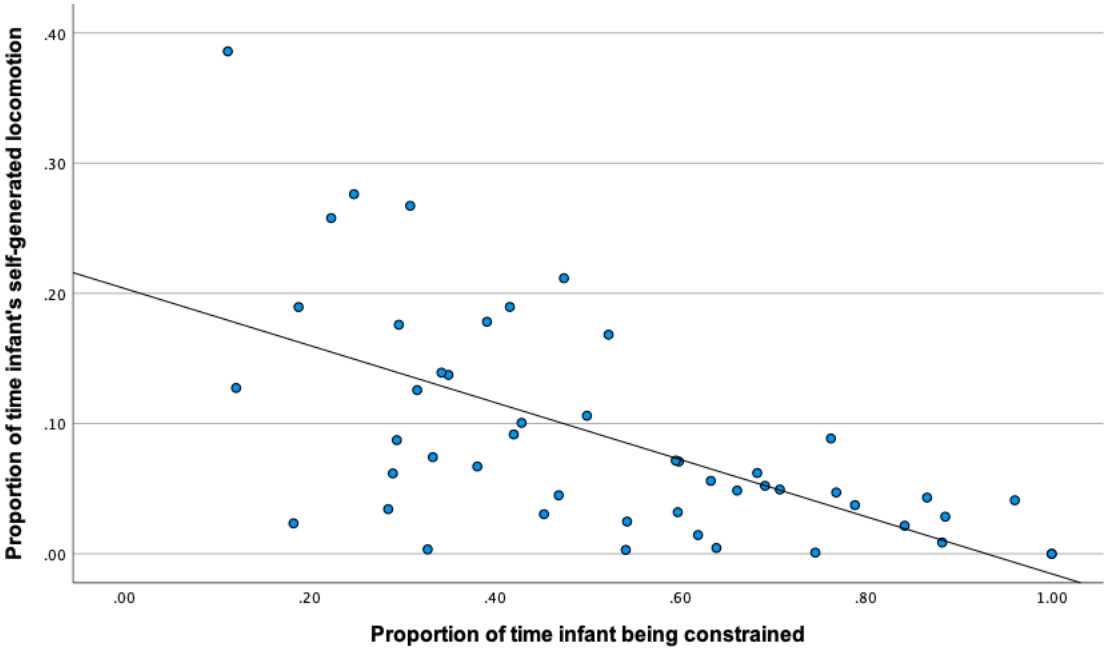

Figure 3.2.1. Relationship between the proportion of time infants were in self-generated locomotion and proportion of time they were constrained. Pearson's r < .001

To investigate whether there are significant differences in the proportion of time infants engaged in spontaneous locomotion among three cultural groups, I conducted a one-way ANOVA with the proportion of time infants engaged in self-generated locomotion as the dependent variable and the different cultural groups as the independent factor. The results showed that there was a statistically significant difference in the proportion of infants were in self-generated locomotion between the cultural groups, F (2,46) = 9.563, p <.001. A Tukey post hoc test revealed that the Tajikistan infants' proportion of time engaging in spontaneous locomotion (M = 5.81%; SD = 5.46%) was significantly lower than Vanuatu infants (M = 13.49%; SD = 2.83%; p =.023) and Aka infants (M = 17.58%, SD =12.6%, p = .001). There was no significant difference between the Vanuatu infants and AKA infants (p = .827).

To approach whether there are statistically significant differences in the proportion of time infant were constrained among the three cultural groups, I conducted

a one-way ANOVA with the proportion of time infants were constrained as the dependent variable and different cultural groups as the independent factor. The results showed that there was a significant difference in the proportion of time infants were constrained between the cultural groups ($F(2,46) = 12.072$, $p < .001$). A Tukey post hoc test revealed that the Tajikistan infants were constrained significantly longer ($M = 61.78\%$; $SD = 21.37\%$) than AKA infants ($M = 26.22\%$; $SD = 20\%$; $p < .001$) and Vanuatu infants ($M = 38.15\%$; $SD = 11.9\%$; $p = .008$). There was no statistically significant difference between the Vanuatu infants ($M = 38.15\%$; $SD = 11.9\%$; $p = .718$) and AKA infants. Indicating that the proportion of time Tajikistan infants were constrained was higher than both Vanuatu infants and AKA infants (*Figure 3.2.2.*)

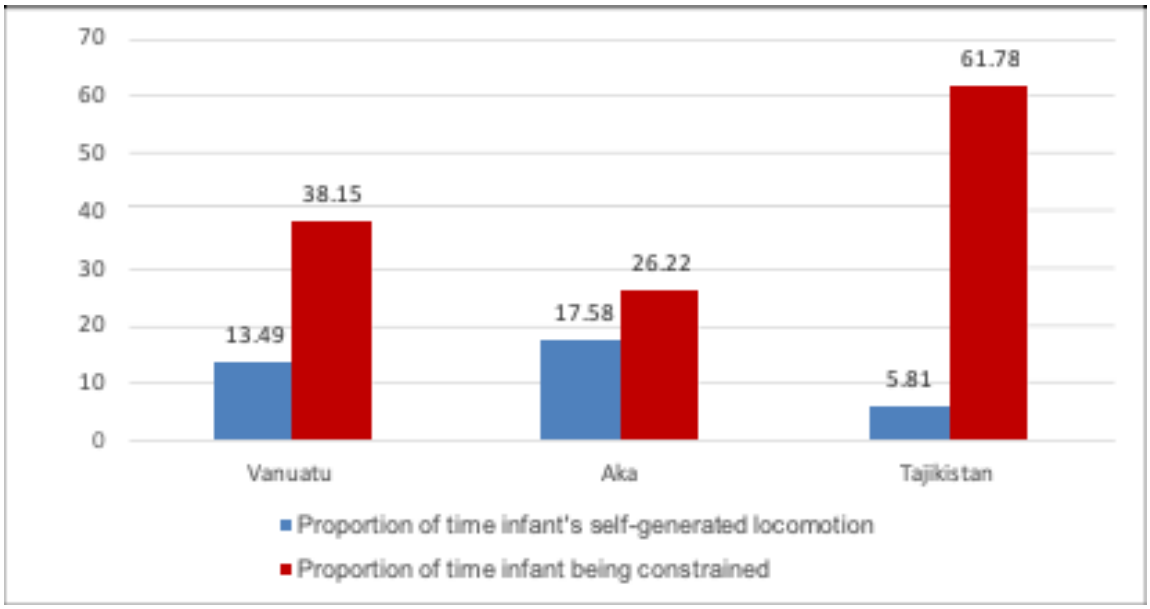

Figure 3.3.2. The proportion of time infants were in self-generated locomotion and the proportion of time they were constrained (both by caregiver and by device) in three cultural groups.

In addition, to further investigate whether infants' experience of being constrained is a predictor of infants' motor-exploratory behaviours, a multiple linear regression analysis was conducted to test if the proportion of time infants engaged in self-generated locomotion could be explained by the proportion of time infants were constrained (including both constrained by caregivers and by device), and their cultural group. The results of the regression indicated that the two predictors explained 40.5% of the variance ($R2 = .41$, $F(2,46) = 15.672$, $p < .001$). Looking at the unique individual contributions of the predictors, the results showed that the proportion of time infant were

constrained (β = -.187, t = - 4.048, p < .001) negatively predict the proportion of time infants engaged in spontaneous locomotion. Infants' cultural group (p =.153) did not have a significant contribution to the changes in the proportion of time infant engaged in spontaneous locomotion.

3.3. The Relative Proficiency of Infants' Self-Exploratory Movements Across Three Societies

To investigate whether there are significant differences in the relative proficiency of infants' self-exploratory movements among the three cultural groups, I conducted a one-way ANOVA with the infants' locomotion proficiency level as the dependent variable and the different cultural groups as the independent factor. The results showed that there was no statistically significant difference in the infants' locomotion proficiency level between cultural groups (p = .059).

A Pearson correlation coefficient was computed to assess the linear relationship between the proportion of time infant experienced falling and the proportion of time infant were constrained. There was a statistically significant negative correlation between the two variables (r = -.38, p =.007), indicating that the more time infants were constrained, the less opportunity they had to fall. In addition, I also examined the linear relationship between the proportion of time infants experienced falling and infants' time in self-generated locomotion. The results showed that there was a statistically significant positive correlation between the two variables (r = .403, p =.007), indicating that the more time infants engaged in self-generated locomotion, the more opportunity they had to fall.

3.4. Parents' Restricting Practices Under Different Cultural Contexts

To investigated whether there were statistically significant differences in the proportion of time infants were constrained among the three cultural groups, I conducted a one-way ANOVA with the proportion of time infants were constrained as the dependent variable and different cultural groups as the independent factor. The results showed that there was a statistically significant difference in the proportion of time infants were constrained between cultural groups (F (2,46) = 12.072, p < .001). A Tukey

post hoc test revealed that the Tajikistan infants were constrained significantly longer (M = 61.78%; SD = 21.37%) than AKA infants (M = 26.22%; SD = 20%; p <.001) and Vanuatu infants (M = 38.15%; SD = 11.9%; p = .008). There was no statistically significant difference between the Vanuatu infants (M = 38.15%; SD = 11.9%; p = .718) and AKA infants. Indicating that the proportion of time Tajikistan infants were constrained was higher than both Vanuatu infants and AKA infants.

To further investigate whether there were significant differences in the proportion of time infants engaged in spontaneous locomotion among the three cultural groups, I conducted a one-way ANOVA with the proportion of time infants engaged in spontaneous locomotion as the dependent variable and different cultural groups as the independent factor. The results showed that there was a statistically significant difference in infants' self-generated locomotion between the cultural groups, $F(2,46) = 9.563$, $p < .001$. A Tukey post hoc test revealed that the Tajikistan infants' proportion of time engaging in spontaneous locomotion (M = 5.81%; SD = 5.46%) was statistically significantly lower than Vanuatu infants (M = 13.49%; SD = 2.83%; p =.023) and Aka infants (M = 17.58%, SD = 12.6%, p =.001). There was no statistically significant difference between the Vanuatu infants and AKA infants (p =.827).

Chapter 4. Discussion

The purpose of this research was to examine potential explanations for the variations in infants' motor development between cultural groups. Through the current research, I aimed to investigate the extent of the variability of infants' daily experiences and its effects on motor development. More specifically, I investigated the role of the opportunity to move freely and parents' restrictive behavior in infants' locomotion development. Indeed, I examined three broad research questions related to these concepts: (1) does more opportunity to move freely lead to more self-generated locomotion, (2) is caregiver's restrictive behavior a predictor of infants' motor-exploratory behaviors, (3) is there variation in caregivers' restrictive behaviors across three cultural groups?

The results indicated that the more time an infant was constrained, the less time they engaged in self-generated locomotion. This is in line with the first hypothesis; however, we failed to achieve statistical significance in Aka sample and therefore were unable to draw a definitive conclusion within this population.

Regarding my first research question, the current study provides follow-up results concerning whether variation in time being constrained relates to infants' developing motor skills. One previous study found that the extent of inside space was the most important predictor of gross-motor skill development (Valadi & Gabbard, 2020). Instead of focusing on the home environment, we observed the availability of infants' moving opportunities in both indoor and outdoor environment across different societies. From Gibson's (2001) perspective, the environment for motor development is referred to as 'resources and opportunities for action'. The result of my study may build upon existing evidence that environments with sufficient stimuli and incentives can have a positive effect on acceleration of infants' motor skills (Hospodar et al., 2021).

Next, in addressing my second research question, results indicated that there was a statistically significant difference in the proportion of time infants were constrained and their self-generated locomotion among the three cultural groups. Interestingly, Aka infants were constrained the least and they had the highest amount of self-generated locomotion. In contrast, Tajikistan infants were constrained the most and they had the lowest amount of self-generated locomotion. This is in line with our hypothesis that

infants' spontaneous movement will be higher in the cultural group which give infants' more opportunity to move freely. In fact, freedom to move is a central tenet of most caregiving practice; however, to what extent and how long infants' movements are restricted by caregivers can vary widely by culture and context. From my study, the average time Tajikistan infants were constrained was over 60% of the total observation time. According to previous documentation, the gahvora cradling practice is a common childrearing routine in Tajikistan and Central Asia. Infants spend about 6 hours to 19 hours in the gahvora in a day (Karasik, et al., 2018). We also noticed that when an infant was unrestricted, Tajikistan caregivers seemed to prefer setting a fixed small moving area for their infants, such as putting infants on a rug or between two caregivers. This shows that although the infant was not directly restricted by their caregivers, their moving space was still limited. On the contrary, Vanuatu and Aka caregivers normally put infants outside the house with their community members, and infants were able to move freely throughout the neighbourhoods. These variations in parental choices for daily settings and the way in which they shape children's immediate environment across three cultural groups may explain the differences in infants' level of self-generated locomotion. In addition, the quantity and type of practice matter for motor skill development (Adolph et al., 2008). Previous research was based on the assumption that infants who walk more would have more practice, thereby leading to greater walking skill. The relations between activity and skill could be in either direction, which means that it could also be true that infants with better walking skill would walk more (Hospodar et al., 2021). In our study, the Aka infants were the least constrained across three societies. The adequate free moving time may provide Aka infants more opportunities to practice their motor skills, and lead to higher motor proficiency compared to other two societies. This may also help to explain why Aka infants engaged in more spontaneous movement than Tajikistan and Vanuatu infants.

To fully appreciate the enormous variability in children's experiences, our research offers unique insight within this area of developmental research by observing infants' early motor experience across three non-WEIRD cultural groups. Caregivers in many societies actively discourage exploration to guard children against environment hazards; but the ways infants are constrained may vary significantly between cultural groups. Our results showed that caregivers in different societies preferred different restrictive practices. In more detail, Tajikistan caregiver restrict their infants mostly by

using a device (traditional cradle name ‘gahvora’), whereas Vanuatu and Aka caregivers usually restrict infants by holding them. In Tajikistan and presumably other parts of Central Asia, gahvora cradling is a traditional cultural childrearing practice. From our observations, Tajikistan caregivers used different devices to help them restrict their infants, including cradle, stroller, and baby walker. However, Aka and Vanuatu caregivers barely use any tools to restrict their infants. In contrast to Tajikistan infants, manufactured items are rare in Aka and Vanuatu infants’ daily life. From our observations, most of Vanuatu caregivers restricted infants’ locomotion because of daily tasks, such as changing infants’ cloth, bathing, toileting, or feeding. Aka caregivers rarely actively restrict infants’ movement, and sometimes they hold infants as a way to respond to infants. Although we did not directly examine caregivers’ intention or attitude towards why they restrict infants’ locomotion, our study showed that caregiver restriction practices may serve different roles in each society.

In conclusion, the current research helps us realize the extent of the variability in everyday experience and its effects on motor development. My goal was to investigate the effects of early restrictive experience on infants’ self-generated locomotion across cultures. Our findings uniquely contribute to a developing body of literature reporting notable differences in infants’ motor development across societies. We found that infants’ early opportunities to explore was linked to their propensity to explore when left unrestricted. The variability in childrearing – restriction practices – offers different opportunities for infants’ locomotion, which in turn explain variation in motor development.

References

Adolph, K. E., & Franchak, J. M. (2017). The development of motor behavior. Wiley Interdisciplinary Reviews. Cognitive Science, 8(1–2).

Adolph, K. E., & Hoch, J. E. (2019). Motor Development: Embodied, Embedded, Enculturated, and Enabling. Annual Review of Psychology, 70(1), 141–164.

Adolph, K. E., & Robinson, S. R. (2015). Motor development. In L. Liben & U. Muller (Eds.), Handbook of child psychology and developmental science (7th ed., Vol. 2 Cognitive Processes, pp. 114-157). New York, NY: Wiley.

Adolph, K. E., Karasik, L., & Tamis-LeMonda, C. S. (2010). Motor skill. In M.Bornstein (Ed.), Handbook of cultural developmental science, (pp. 61-88). New York: Taylor & Francis

Agarwal, S., Attah, M., Apt, N., Grieco, M., Kwakye, E. A., and Turner, J. (1997). Bearing the weight: The kayayoo, Ghana's working girl child. International Social Work, 40, 245-263.

Aime, H., Rochat, P., & Broesch, T. (2020). Cultural differences in infant spontaneous behaviour: Evidence from a small-scale, rural island society. Infant and Child Development. https://doi.org/10.1002/icd.2204

Ainsworth, M. D. S. (1967). Infancy in Uganda: Infant care and the growth of love. Oxford: John Hopkins Press.

Amir, D., & McAuliffe, K. (2020). Cross-cultural, developmental psychology: Integrating approaches and key insights. PsyArXiv.

Ammar, D., Acevedo, G. A., and Cordova, A. (2013). Affordances in the home environment for motor development: a cross-cultural study between American and Lebanese children. Child Dev. Res. 2013:152094. doi: 10.1155/2013/152094

Anderson, D. I., Campos, J. J., Witherington, D. C., Dahl, A., Rivera, M., He, M., Uchiyama, I., & Barbu-Roth, M. (2013). The role of locomotion in psychological development. Frontiers in Psychology, 4.

Atun-Einy, O., Cohen, D., Samuel, M., & Scher, A. (2013). Season of birth, crawling onset, and motor development in 7-month-old infants. Journal of Reproductive and Infant Psychology, 31(4), 342–351.

Berger, S. E., Theuring, C. F., and Adolph, K. E. (2007). How and when infants learn to climb stairs. Infant Behavior and Development, 30, 36-49.

Blackduck, A. (2001, June 1). Pauktuutit to continue work on amauti protection. Nunatsiaq News.

Bombarda, A., Valentini, N., Felipe, P., & Ribeiro Bandeira, P. (2017). Affordances in the home environment for motor development: Validity and reliability for the use in daycare setting. Infant Behavior and Development, 47, 138–145.

Bril, B., & Sabatier, C. (1986). The cultural context of motor de- velopment: Postural manipulations in the daily life of Bambara babies (Mali). International Journal of Behavioral Development, 9, 439-453.

Bril, B., Zack, M., & Nkounkou-Hombessa, E. (1989). Ethnotheories of development and education: A view from different cultures. European Journal of Psychology of Education, 4, 307-318.

Campos, J. J., Kermoian, R., Witherington, D., & Chen, H. (1997). Activity, attention, and development transitions in infancy. In P. J. Lang,R. F. Simons, & M. T. Balaban (Eds.), Attention and orienting: Sensoryand motivational processes (pp. 393–415). Mahwah, NJ: LawrenceErlbaum Associates Publishers

Chisholm, J. S. (1983). Navajo infancy: An ethnological study of child development. Hawthorne, NY: Aldine Publishing Company.

Cicchetti DV (1994) Guidelines, criteria, and rules of thumb for evaluating normed and standardized assessment instruments in psychology. Psychol Assess 6:284–290

Cintas, H. (1988). Cross-cultural variation in infant motor development. Physical and occupational therapy in pediatrics, 8, 1-20.

Clark, D., Kreutzberg, J., and Chee, F. (1977). Vestibular stimulation influence on motor development in infants. Science, 196, 1228-1229.

Clearfield, M. W. (2011). Learning to walk changes infants' social interactions. Infant Behavior and Development, 34(1), 15–25.

Cole, W. G., Lingeman, J. M., & Adolph, K. E. (2012). Go naked: Diapers affect infant walking. Developmental Science, 15(6), 783–790.

Dahl A. Ecological Commitments: Why Developmental Science Needs Naturalistic Methods. Child Dev Perspect. 2017 Jun;11(2):79-84. doi: 10.1111/cdep.12217. Epub 2016 Nov 26. PMID: 28584562; PMCID: PMC5455774.

Donaldson, C., Clancey, S., & Russell, M. (2020). Understanding Navajo Parents' Beliefs About Cradling and Early Mobility Practices (pp. 45–56). Springer International Publishing. https://doi.org/10.1007/978-3-030-35590-6_4

Gesell, A. (1946). The ontogenesis of infant behavior. In L. Carmichael (Ed.), Manual of child psychology (pp. 295-331). New York, NY: John Wiley.

Gibson, E. J. (1988). Exploratory Behavior in the Development of Perceiving, Acting, and the Acquiring of Knowledge. 42.

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? Behavioral and Brain Sciences, 33(2–3), 61–83.

Hopkins, B., and Westra, T. (1990). Motor development, maternal expectations, and the role of handling. Infant Behavior and Development, 13, 117-122.

Iloeje, S. O., Obiekwe, V. U., & Kaine, W. N. (1991). Gross motor development of Nigerian children. Annals of Tropical Paediatrics, 11(1), 33–39.

Ishak, S., Tamis-LeMonda, C. S., and Adolph, K. (2007). Ensuring safety and providing challenge: Mothers' and fathers' expectations and choices about infant locomotion. Parenting: Science and Practice, 7, 57-68.

Iverson, J. M. (2010). Developing language in a developing body: The relationship between motor development and language development. Journal of Child Language, 37(2), 229–261. https://doi.org/10.1017/S0305000909990432

Kaplan, H., & Dove, H. (1987). Infant development among the Ache of eastern Paraguay. Developmental Psychology, 23(2), 190–198.

Karasik, L. B., Adolph, K. E., Tamis-LeMonda, C. S., & Bornstein, M. H. (2010). WEIRD walking: Cross- cultural research on motor development. Behavioral and Brain Sciences, 33, 95-96.

Karasik, L. B., Tamis-LeMonda, C. S., Ossmy, O., & Adolph, K. E. (2018). The ties that bind: Cradling in Tajikistan. PLoS ONE, 13(10), e0204428–18.

Keller, H., Yovsi, R. D., & Voelker, S. (2002). The Role of Motor Stimulation in Parental Ethnotheories: The Case of Cameroonian Nso and German Women. Journal of Cross-Cultural Psychology, 33(4), 398–414.

Konner, M. J. (1972). Aspects of the developmental ethology of a foraging people. In N. Jones (Ed.), Ethological studies of child behavior. Oxford: Cambridge University Press.

Konner, M. J. (1977). Infancy among the kalahari desert san. In P.H. Leiderman, S. R. Tulkin and A. Rosenfield (Eds.), Culture and infancy: Variations in the human experience (pp. 287-328). New York: Academic Press.

Lancy, D. F. (2008). Recent Developments in the Anthropology of Childhood. Anthropology News, 49(4), 9–9.

Mendonça, B., Sargent, B., & Fetters, L. (2016). Cross-cultural validity of standardized motor development screening and assessment tools: A systematic review. Developmental Medicine & Child Neurology, 58(12), 1213-1222.

Oudgenoeg-Paz, O., Atun-Einy, O., & van Schaik, S. D. M. (2020). Two Cultural Models on Infant Motor Development: Middle Class Parents in Israel and the Netherlands. Frontiers in Psychology, 11.

Porter, L. S. (1972). The impact of physical-physiological activity on infants' growth and development. Nursing research, 21, 210- 219.

Walle, E. A. (2016). Infant Social Development across the Transition from Crawling to Walking. Frontiers in Psychology, 7.

Walle, E., & Campos, J. (2013). Infant Language Development Is Related to the Acquisition of Walking. Developmental Psychology, 50.

Vaivre-Douret, L., Dos Santos, C., Charlemaine, C., & Cabrol, D. (2005). Effects of sleeping and waking positions on infant motor development. European Review of Applied Psychology, 55(1), 1–8. https://doi.org/10.1016/j.erap.2004.12.001

Van Schaik, S. D. M., Oudgenoeg-Paz, O., & Atun-Einy, O. (2018). Cross-cultural differences in parental beliefs about infant motor development: A quantitative and qualitative report of middle-class Israeli and Dutch parents. Developmental Psychology, 54(6), 999–1010. https://doi.org/10.1037/dev0000494

Vierhaus, M., Lohaus, A., Kolling, T., Teubert, M., Keller, H., Fassbender, I., Freitag, C., Goertz, C., Graf, F., Lamm, B., Spangler, S. M., Knopf, M., & Schwarzer, G. (2011). The development of 3- to 9-month-old infants in two cultural contexts: Bayley longitudinal results for Cameroonian and German infants. European Journal of Developmental Psychology, 8(3), 349–366.

Appendix A.

Coding Ethogram

Child-generated locomotion: We coded child-generated locomotion as instances that the child is engaged in salient self-generated locomotion in any form (i.e., bum shuffling, scooting, belly crawling, hands-knees crawling, cruising, supported walking, independent walking, etc.). To determine locomotion, coders watched for steps with the feet, the knees, or the bum. Any other movements that are not initiated from these three body locations are considered to be a transition between postures and are subsumed by stationary, because it is likely a transition rather than salient locomotion. If the scope of the video does not include the infant's legs and/or feet but coders can make an inference of motion by following environmental cues (ie. the infant's upper body is moving to different locations around the room), we coded this as locomotion. Turning onto the infant's belly does not count as locomotion. For infants that are walking, we didn't code a step that is only used for a pivot.

Caregiver constrained: We defined caregiver constrained as the infants is restricted by their caregiver and cannot self-generated moving. For this study, we assumed that the caregiver is the mother. If it is a male figure or another child or if multiple women are passing the infant back and forth, we made a note. Constraint requires that the individual is restricted in scope, extent, or activity.

Device constrained: We defined device constrained as the infant is restricted by a device (bathtub, swing, box etc.). For this study, the onset of this code occurs at the video frame when infants be constrained in a device, and the offset marks the video frame when infants were leave the device. If the infant is in a device that is not holding them up but still restricting their ability to move, coders coded this as device constrained as they are still restricted in scope of movement.

Fall: Fall behavior is determined by an infant locomoting (typically walking), and the onset occurs at the initial loss of balance. Offset of this code is determined by the infant's body reaching the ground and stabilizing.

Infant's spontaneous locomotion level: We measured the infant's spontaneous locomotion level by the proportion of time infants spent engaging spontaneous locomotion over the entire session: the accumulated time of child-generated locomotion duration divided by the total time of codable duration. Higher proportion indicates infant with higher spontaneous locomotion level.

Parenting restriction level: We measured the parenting restriction level by the proportion of time infants being restricted over the entire session: the accumulated time of caregiver constrained duration and device constrained duration divided by the total time of codable duration. Higher proportion indicates a higher parenting restriction level.

Infant's locomotion proficiency level: We measured the infant's locomotion proficiency level by the proportion of time infants experiencing falling over the total time of engaging self- generated locomotion: the accumulated time of infants' fall duration divided by the accumulated time of child-generated locomotion duration. Higher proportion indicates infants with lower locomotion proficiency level.