# Infant Phenotypes and Correlation of Life History and Attachment; An Eye-Tracking Study

Matthew K. Argo

Oklahoma State University

## Abstract

The continuation of genetics and offspring survival is important for the fitness of animals, including humans. The allocation of finite resources is a part of the life history strategy approach, in which determining if reproduction is viable, or if one will prosper in the current environment. The overall health of the infant can signal to the caregivers the state of its care. What is to be determined is if life history strategies imposed by the parents effect the visual attention put upon the infant, and what is the area of focus. In this investigation, an eye-tracker was used to follow the eye movements of ($N$ = 239) college student participants as they viewed images of infant phenotypes. A preference task was set in place to analyze which infant phenotype was most preferred. In the early viewing period (first fixation duration) the head region drew more focus, however during the latter period (total duration, and dwell time) focus on the torso, mostly the overweight torso increased. This study shows that infant phenotype does influence and attract visual attention.

Infant Phenotypes and Correlation of Life History and Attachment Theory

According to the Law of Conservation, matter/energy cannot be created or destroyed, but rather converted from one form to another. Due to the Law of Conservation, there is a finite of energy/resources available for use. This law governs living creatures, wherein energy allocation is segmented into two categories: somatic growth and reproductive growth. According to the Life History theory, organisms allocate resources and energy into somatic growth (development, mass increase, neural/cognitive development) or reproductive growth (fecundity, breeding). To prevent exhaustion of resources, Life History Strategies are implemented. Attachment between offspring and caregiver also requires the allocation of energy and provides an adaption to the current environment available (harsh/safe) (Ellis et. Al, 2009). The health of the offspring can be seen through visual or external cues provided by the offspring (Chau, 2017). What is unclear, however, is the importance of infant body weight in the utilization of life history strategies, as infant body weight may appear to provide details about the current environment. This study aims to recognize the saliency of infant phenotypes under the scrutiny of individual life history strategies using an eye-tracker.

**Life History and Attachment**

Attachment theory and Life History Strategies correlate with one another as both are susceptible to environmental cues and strategies implemented in one, generally follow the other (Cassidy, 2016; Szepsenwol, 2019). The fast-slow continuum of Life History provides an understanding of the actions an individual will take according to the availability of resources. Scarcity of resources breeds fast history approaches: reproduction occurs sooner, self-growth is inhibited or slowed, and insecure attachment styles (anxious, avoidant) are more common. On the other hand, slow strategies favor self-growth, later reproduction, and secure attachment styles

(Szepsenwol, 2019). As mentioned before, attachment styles mirror the fast-slow continuum and the life history strategies utilized. A safe environment provides a stable ground for the formation of relationships of which themselves are an adaptation during resource availability; harsh environments generate insecure attachment styles do to unstable foundations and resource scarcity (Figueredo et. al, 2009; Szepsenwol, 2019). A study focused on nutritional deficits and attachment in Chile found that ninety-three percent of the children with nutritional deficits suffered from insecure/disorganized attachment styles (Valenzula, 1990). The children were located in a harsh environment, with resource scarcity. The attachment style of the mother can also effect the parental care received from the baby, and the perceived attractiveness of the infant (Jia et. al, 2017; Adam et. al, 2004; Wilson et. al, 2005).

**Infant Phenotypes**

Offspring of humans are visually appealing creatures to their caretakers, and this appeal encourages care of the child. The cuteness of the infant relates the amount of time spent looking at the infant (Hildebradt et. al, 1978). Greater attention to the infant promotes better care as the individual is more likely to view the infant, and ascertain if the child needs food, attention, etc. The health of an infant demonstrates the availability of resources and a safe environment. Infants who are over or average weight signal that the surrounding environment is not harsh, and also that an abundancy or good amount of resources are available. In a study concerning infant weight and facial cues, the results found demonstrated that infants/children with low body weight that exhibited thin facial features, an indication of being underweight, negatively affected cute and adoption ratings (Volk, 2005). The images presented in this study where manipulated to have the children look as if they were underweight. Children with low body weight were perceived as being less health, or attractive compared to their average weight counterparts.

### Current Study

The current study aims to answer if individual life history strategies influence visual attention of infant phenotypes, (underweight, overweight, and average weight). Research in the area of weight and infant/child attractiveness does have an effect on what is viewed and the behavior expressed by the individual who looks upon the child. What is unknown is if life history strategies have a part to play in the allocation of cognitive resources, and if infant weight has an effect on visual attention. The hypotheses posed include 1.) Individual life history strategies would predict the infant phenotypes (underweight, overweight, and average weight), viewed at first, and which would draw the most attention (duration, and dwell time), 2.) The overweight and underweight phenotypes would be viewed longer than the average weight do to their extremes in either direction, and 3.) The overweight phenotype would be viewed longer especially in the torso region do to the attractiveness of the infant (babyishness) and fat distribution located in the abdomen.

## Method

### Participants

239 participants were enlisted from an undergraduate population in the local community, $M_{age}$ = 19.02, $SD_{age}$ = 1.43. There were 96 men and 143 women who participated. They reported their ethnicities as Caucasian, 75%; African-American, 8%; Hispanic, 7%; Asian, 2%; and Native-American/Other, 7%.

### Measures

**Life-History Measure.** The K-SF-42, a short form of the Arizona Life History Battery (ALHB), was administered to discern the participants' life history strategies (Figueredo et. al,

2017). The K-SF-42 measures life history stratagems on a fast-slow continuum (*r*-*k*). The responses are additive, and a higher score correlates with the use of slow life history strategies, while a lower score corresponds to utilization of fast life history strategies.

**Eye-tracking measures.** The Tobii X2-60 eye-tracker was used to analyze visual motion and attention to infant phenotypes. Three different measures were used to examine visual attention to infant phenotypes. First fixation duration measured the first fixation of a possible salient region of interest (ROI), either the head or torso and the time spent viewing said regions. First fixation duration is a salient measure, as the ROI will be visited quickly upon view. Total visit duration is the average amount of time each ROI is viewed between trials. Total dwell time represents the average time spent on each infant phenotype (overweight, underweight and normal). The time for the eye-tracker was recorded in milliseconds. A Tobii X2-60 software editor was used to isolate the head and torso regions by marking them in a rectangular region where visual movements were recorded. The head region included the top of the head to the neck/should region, while the torso included the rest of the body.

**Preference task.** Preference of body type was measured through a preference task where participants were asked to pick a preferred body type. The pairs of infant phenotypes presented were underweight vs. overweight, average weight vs. underweight, and average weight vs. overweight.

## Procedure

After recruitment on the SONA scheduling system, the participants were directed to the eye-tracking lab where they were given a consent form and were instructed to situate themselves in front of the eye-tracker system. Once situated the participant was asked to fill out a demographic survey that covered information such as age, ethnicity, sex, whether they had

children, or if they were in a relationship. After filling out the survey, participants filled out K-SF-42 to determine life history strategies implemented (fast-slow). The Tobii X2-60 eye tracker was then used to capture the visual eye-movements and gaze of the participant. The software was loaded, and the participant was lead through the set up process which included a calibration stage where the participant was instructed to follow a red, pulsating dot around the monitor. After calibration a prompt appeared with instructions for the participant to press 'spacebar' and to view the images presented to them.

Next, the participant was instructed to use the software OpenSesame (Version 3.2.8: *Kafkaesque Koffka)* for the preference task. A prompt for the preference task instructed the participant to choose which infant phenotype they preferred by pressing the 'z' key if the preferred the left image, and pressing the 'right enter' key if they preferred the right image. The infant phenotypes were introduced in pairs (underweight vs. average weight, overweight vs. average weight, and underweight vs. overweight). During the process a lab assistant was available to answer questions, and lead the participant through the study. After the preference task, the participant was thanked for their participation and released from the lab.

## Results

**First fixation duration**. Certain aspects of the first fixation duration were significant while others were not. ROI provided to be significant, in which the head ($M$=294.16, $SE$ 8.90) was viewed longer then the torso ($M$ = 228.64, $SE$ = 6.67). The ROI and sex interaction also produced significant results, with males viewing the head region ($M$ = 329.55, $SE$ = 14.22) for a longer duration compared to females ($M$ = 258.77, $SE$ = 10.71) see figure 1. ROI and body phenotype exhibited significance, as the underweight head region ($M$ = 313.67, $SE$ = 16.82) was viewed for a longer duration compared to the average weight head region ($p$ = 0.026). The

underweight head region and overweight head region (*M* = 311.62, *SE* = 14.76) did not significantly differ in view time. In the context of individual life histories as a moderator, there was not a significant effect of individual life histories on the visual saliency of the infant phenotype.

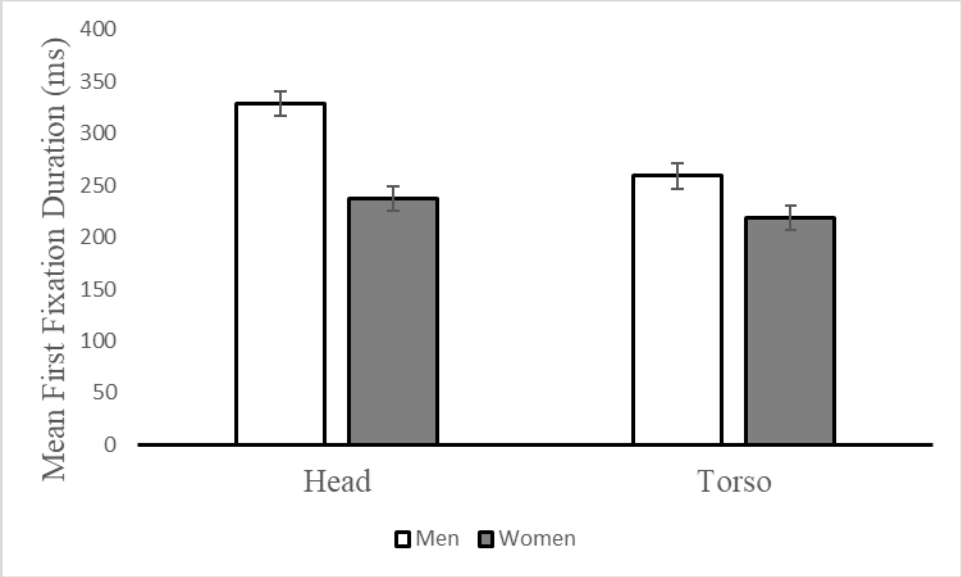


Figure 1: Mean first fixation duration for sex and ROI

**Total visit duration.** The region viewed the longest was the torso region (*M* = 974.76, *SE* = 32.42) compared to the head region, (*M* = 434.26, *SE* = 9.81). When viewing the ROI with different body types, the overweight torso (*M* = 1058.55, *SE* = 45.00) was viewed longer than the average weight torso (*M* = 911.12, *SE* = 36.33) and the underweight torso (*M* = 954.61, *SE* = 37.95), see figure 2. There was not a significant difference between the underweight an average weight infant phenotypes. With individual life histories as a moderator, there was not a connection between duration visit and individual life history. Life history as a moderator was insignificant.

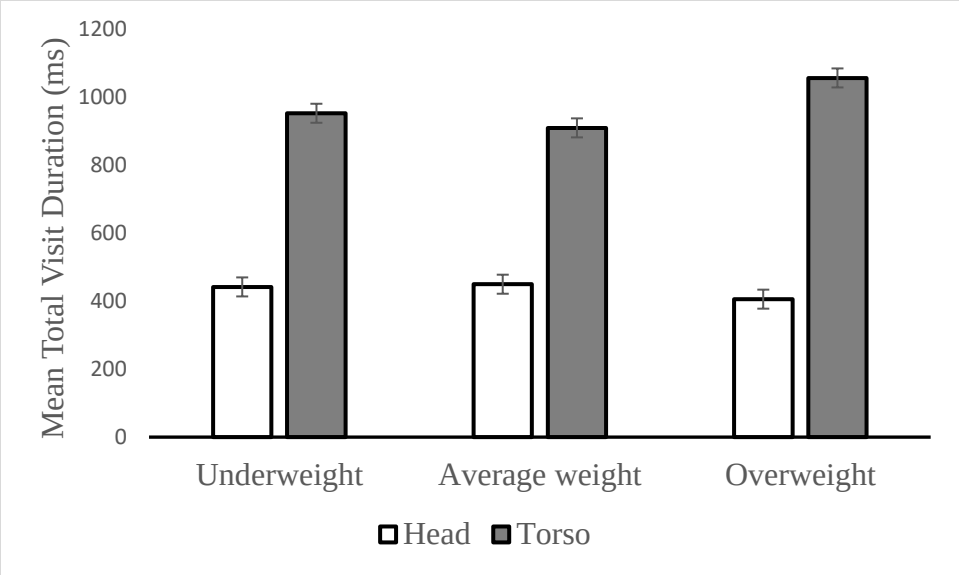


Figure 2. Mean total visit duration for ROI by infant phenotype.

**Dwell Time.** There was a significance in the average time viewing different infant phenotypes. The overweight phenotype (*M* = 3,234.41, *SE* = 118.00) was viewed more than the average weight phenotype (*M* = 2,774.43, *SE* = 104.31), however there was not a significant difference between the overweight and underweight phenotype (*M* = 3161.63, *SE* = 116.94) see figure 3. There were not any other significant results, as the two-way analysis of sex and body type did not yield any significant results. With individual life histories as a moderator, there was not a connection between dwell time and individual life history. Life history as a moderator was insignificant.

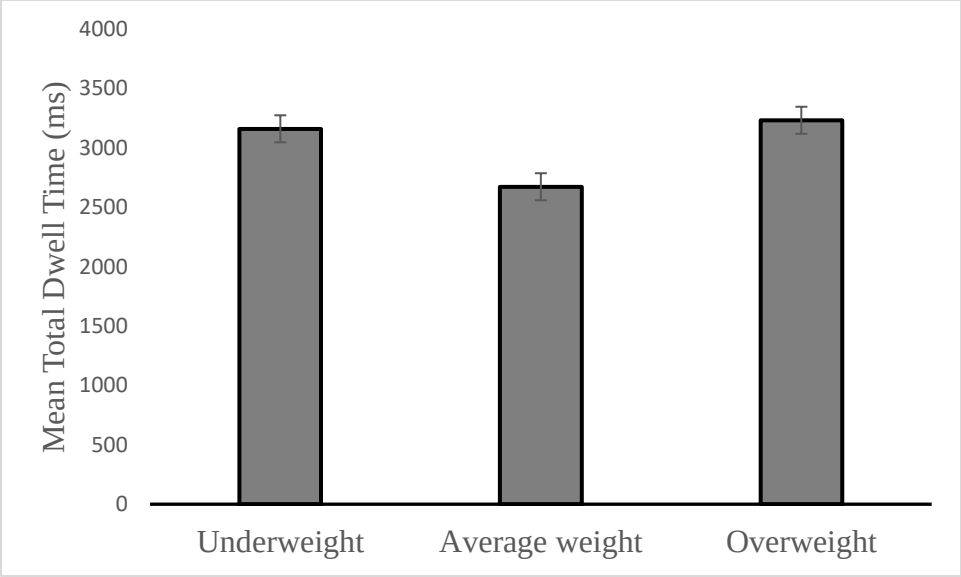


Figure 3. Mean total dwell time (ms) by infant phenotype.

## Discussion

The results demonstrate that infant phenotypes (overweight, underweight, and average weight) does have an impact on the salience of infants. During the first period of viewing images, the participants focused upon the head region, with males viewing the region longer than females. The attraction of the head region is possible related to facial expressions, and can be key key indicator of infant health, and whether the infant is in pain. As the viewing time of each image continued, there was a shift of interest from the head region to the torso region (total time duration and dwell time). The overweight torso received the most attention, compared to the average torso and the underweight torso. This is possibly doing to the noticeable size difference, and that a larger abdomen region indicates better health. The overweight infant would possess qualities that would draw the attention of individual who utilize slow life history strategies (Kaplan & Gangestad, 2005). The negligible difference between underweight and overweight phenotypes for the dwell time may be due to the noticeable extremes. Sex differences did occur

with first fixation duration, where the head appeared to be more salient to men rather than women. It is important to note that the images used where line drawings of infants. Using line drawings minimized the facial expressions and color of the infants (black and white), leaving infant weight as the sole independent variable. However, this simplistic infant may not provide enough details or may be rather abstract to the viewers. Future studies can include photos of infants that have been manipulated to have different weights.

The K-SF-42 was used to analyze individual life history strategies, and pertained to the *k* value on the *r*-*k* continuum which correlates with a slow life history. The belief was that those with slower life histories would focus their attention to the overweight infants, as it would be more adaptable to allocate resources for the infant (Cassidy & Shaver, 2016). However, the influence of life history strategies as a moderator proved to be lacking, as there was a negligible effect to the salience of the infant phenotypes. A general cause for this could be linked to the population available. Individual differences in life history strategy could have been hampered in diversity due to the participants available for this study. According to Figueredo et. al, the K-factor or the individual life history strategies in a population are connected by the inter-individual personality variation (Figueredo et. al, 2005). The population pooled from the Midwestern university may have been lacking in demographic diversity, and could not cover a wide range of SES, cultural, or age groups. Another study could be done that includes participants form other universities in the United States, or from universities from other countries as the K-SF-42 was designed for culturally diverse populations.

## Conclusion

Conclusively, the results from the eye-tracker indicate that there are regions of interest that are visually salient such as the head during the early periods of viewing the images.

Overweight infants are preferred and the torso received the most views in later stages indicating that fat distribution does play a large role, and the abdomen is more noticeable. Areas of interests that facilitate the visual attention of adults indicate hidden mechanisms that can be important for infant health, and when surrendering resources to offspring is beneficial rather than detrimental.

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