

2016

Dusting Elephants

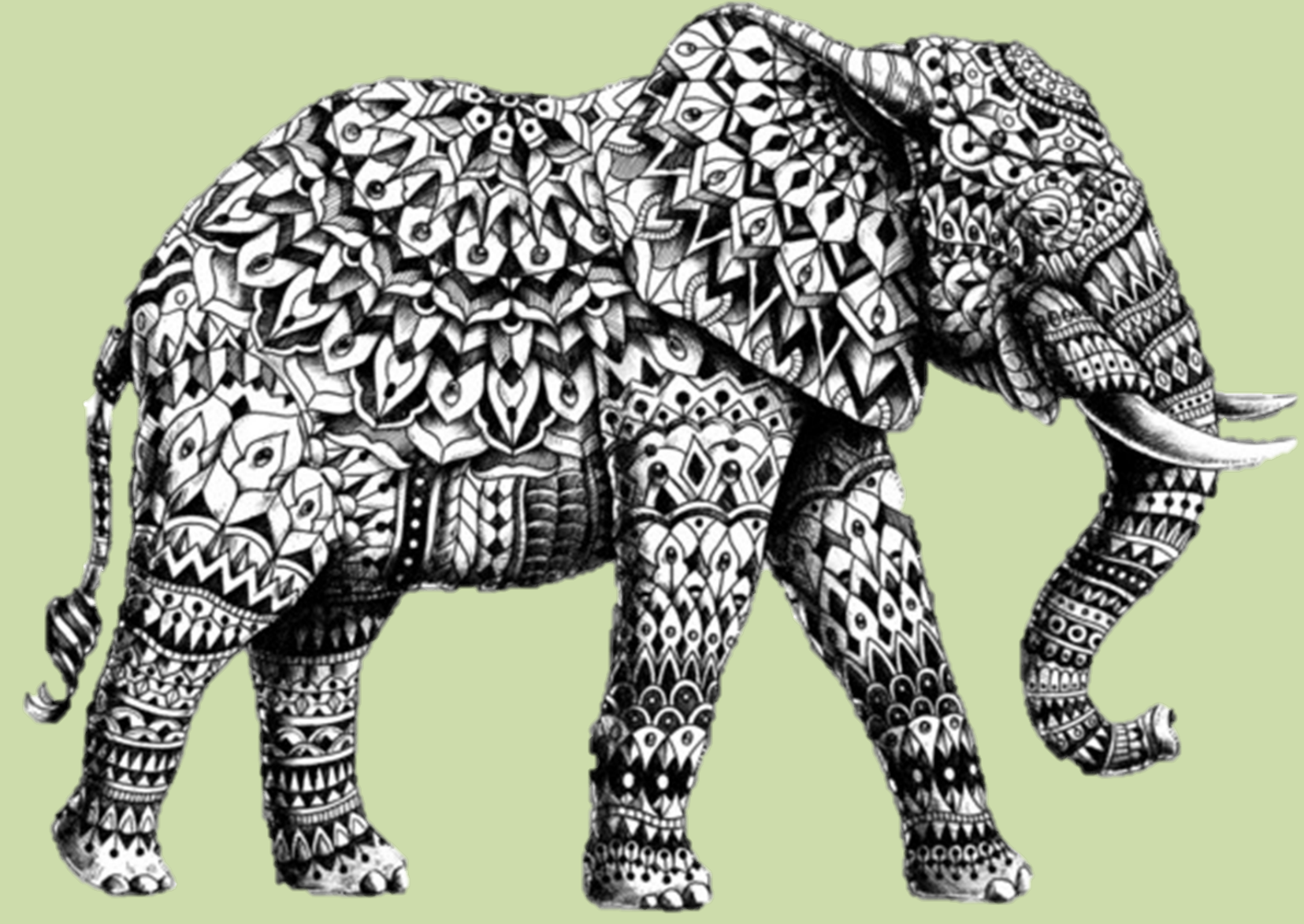
Kelly Summers

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Introduction

Elephants, like all animals, rely on behavioral adaptations in order to protect themselves from seasonal variations in their environment. Asian elephants (*Elephas maximus*), in particular, inhabit tropical biomes known for maintaining temperatures above 60 degrees Fahrenheit and high humidity year-round (Ciszek 2002). In order to sustain a healthy body temperature, biological processes couple with unique voluntary behaviors to combat the intense tropical climate. Unlike the human body, elephants lack the glands required to produce sweat, and must rely on alternative means to avoid overheating. As a result, elephants perform dusting bathing in order to aid the body cooling process.

Previous studies indicate that elephant dusting behavior can be triggered by several environmental factors including sun intensity (Haltenorth and Diller 1980), skin discomfort (Spearman 1970), and to protect an individual from parasites (Barnes 1984). According to Rees (2002), the frequency of dusting performance might also be related to ambient temperature and/or social interactions.

Hypotheses

- 1) If dusting behavior is related to thermoregulatory processes, then increased environmental temperatures will result in an increased rate and frequency of elephant dusting behavior.
- 2) If dusting behavior is influenced by social interactions, then male and female elephants will exhibit dusting behavior at similar rates.

Methods

Data were collected at the Columbus Zoo and Aquarium from January 23, 2016 though March 28, 2016.

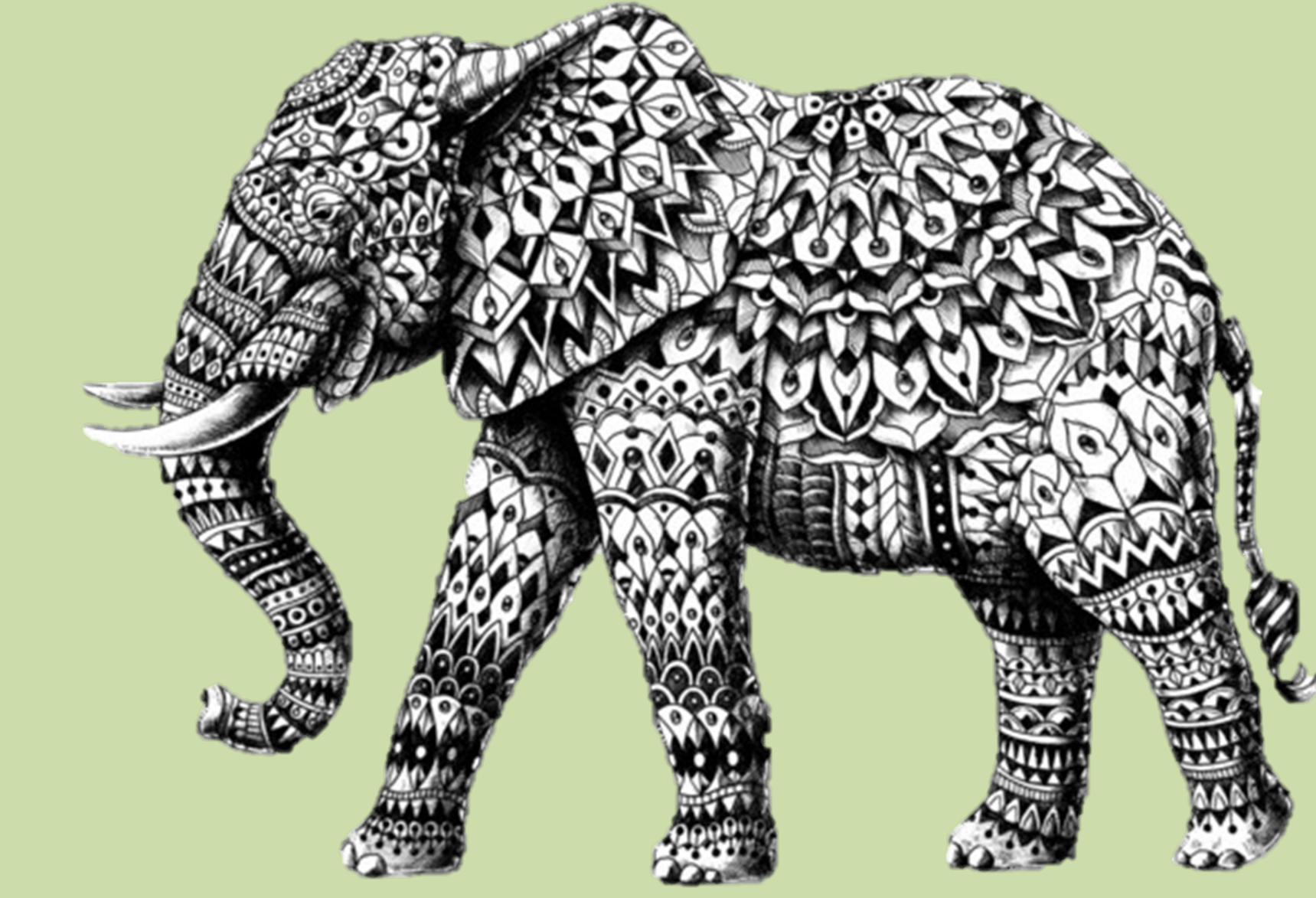
- Subjects included 4 Asian elephants (*Elephas maximus*)
 - 2 Females: Connie (matriarch in Mid-40s) Phoebe (active breeding female aged ~26 yrs.)
 - 2 Males: Hank (~15,900lbs, active breeding male) Beco (isolated maturing juvenile aged ~7 yrs.)
- Collected data around the same time each day (11:00AM and 5:00PM).
- Performed behavioral observations continuously in 5 minute intervals.
- Measured the number of times dusting was exhibited by each individual.
- Calculated the overall hourly rate of dusting.
- Recorded which individual performed the behavior.
- Reported the approximate density of the covering present on each individuals' back both before and after the daily observations.
- Noted where the dusting occurred (outdoor or indoor enclosure), and whether the elephants were restricted to a particular enclosure.
- Recorded the indoor and outdoor temperatures every half hour, and the weather conditions over time.
- Indicated the type of material used, and any changes in resource availability.
- Data were analyzed using the IBM SPSS Statistics software package (2015).

Works Cited:

Ciszek, Deborah. 2002. "Elephas maximus Asiatic elephant." Animal Diversity Web. Accessed 21 January 2016. <http://animaldiversity.org/accounts/elephas_maximus/>.
Barnes, R.F.W. 1984. *Elephants*. In: Macdonald, D.W. (Ed.), Encyclopedia of Mammals. Andromeda Oxford Ltd., Abingdon.
Fox, M.W. 1968. *Abnormal Behavior in Animals*. Philadelphia, PA. W.B. Saunders Company.

Elephant Dusting: An Examination of Behavioral Influences.

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Results

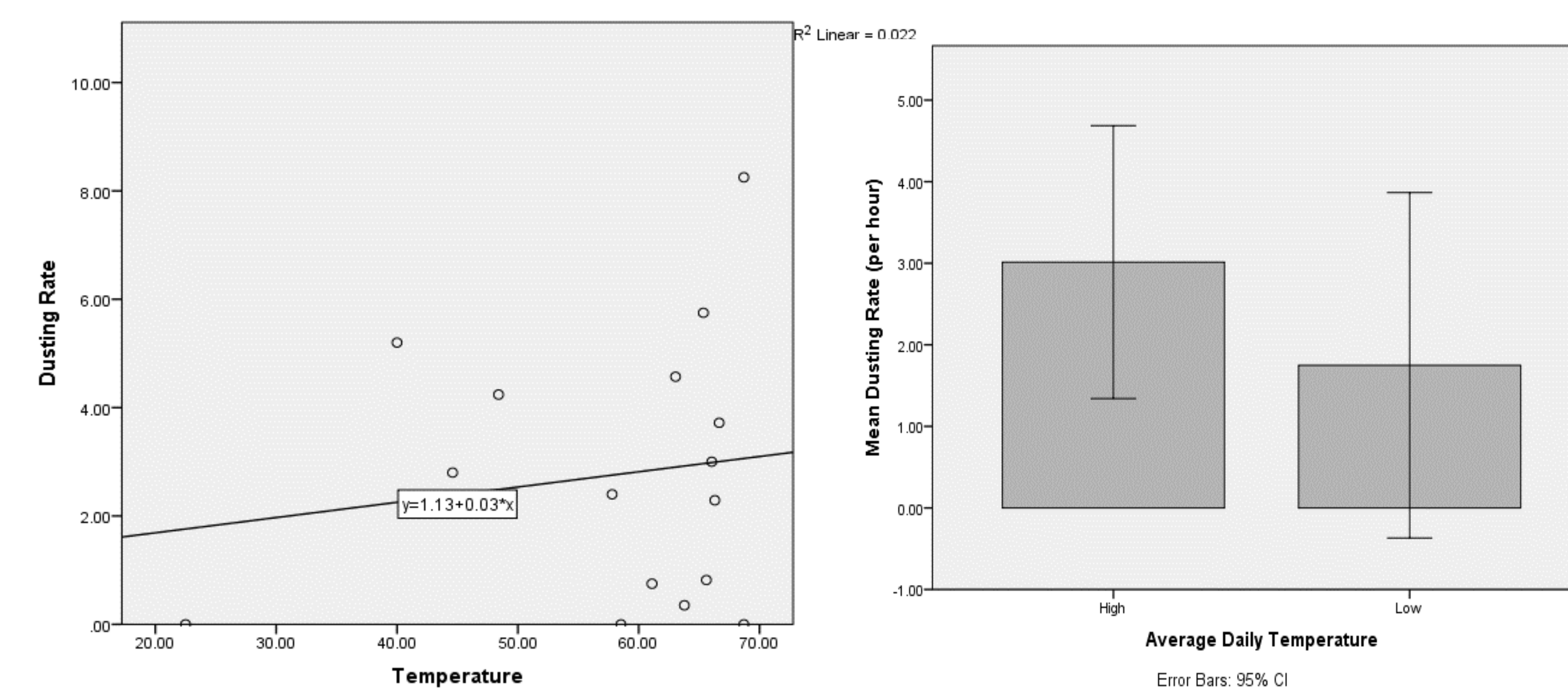


Figure 1 suggests that increased environmental temperatures could cause an increase in the rate of elephant dusting. The predicted p-value was 0.253 indicating that there is no relationship between temperature and dusting rate. **Figure 2** suggests that the dusting rate was higher when the environmental temperatures were above the daily average. The t-test predicted a p-value of 0.317 indicating there was no significant difference between the dusting rates.

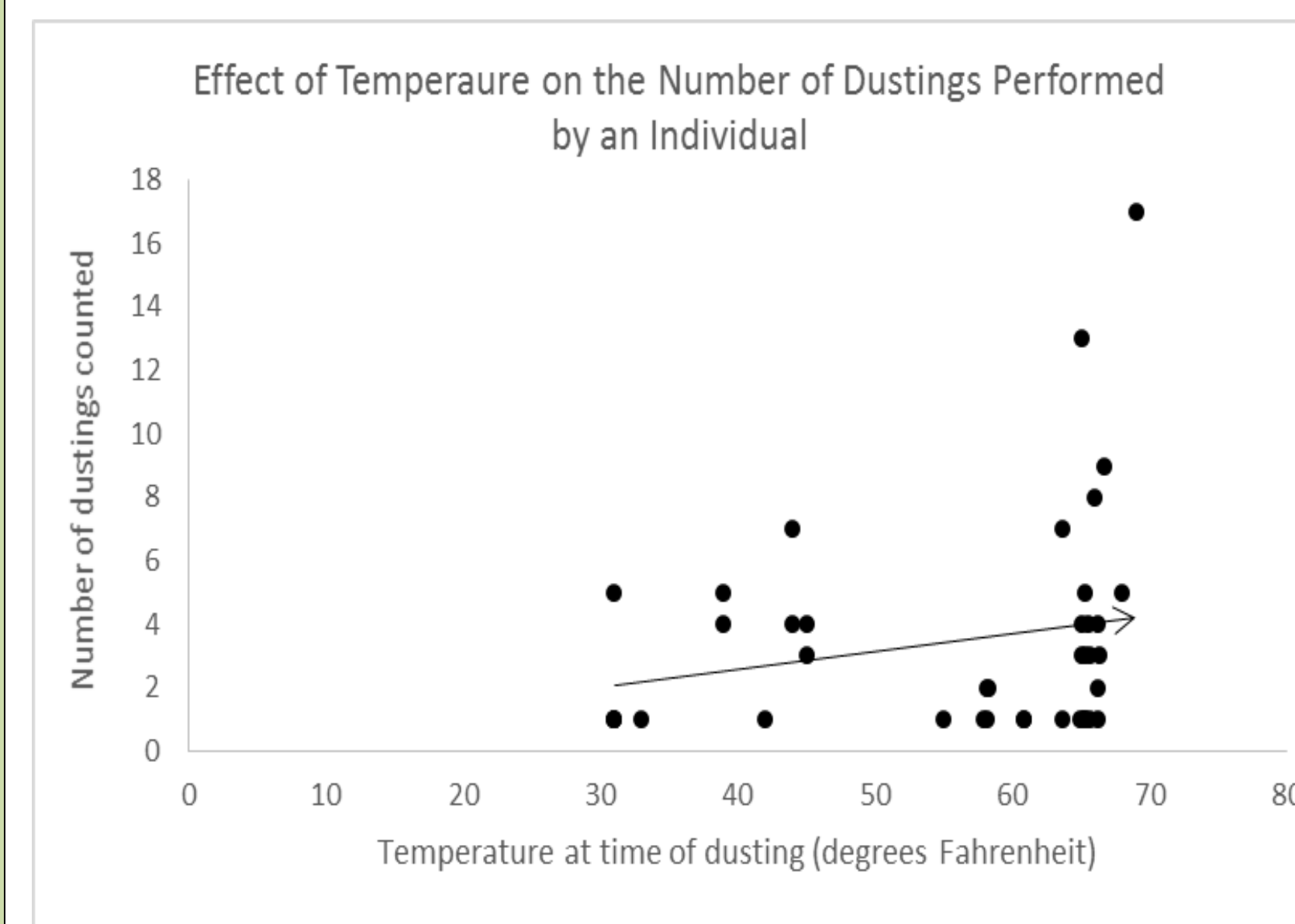


Figure 3 suggests that increased environmental temperatures could increase the number of dustings performed by an individual. The predicted p-value was 0.189 indicating that there is no significant relationship between the temperature and the number of dustings performed by an individual.

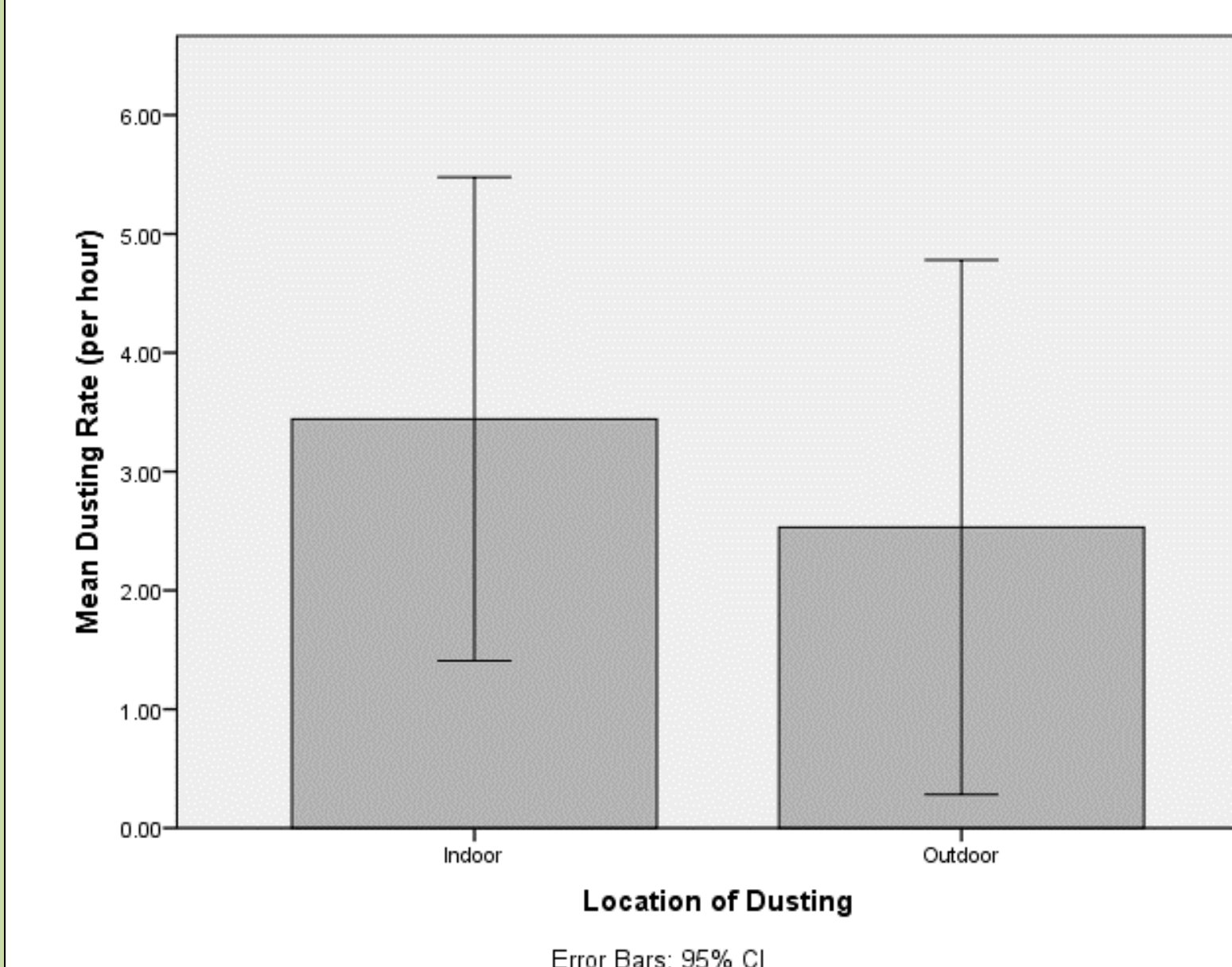
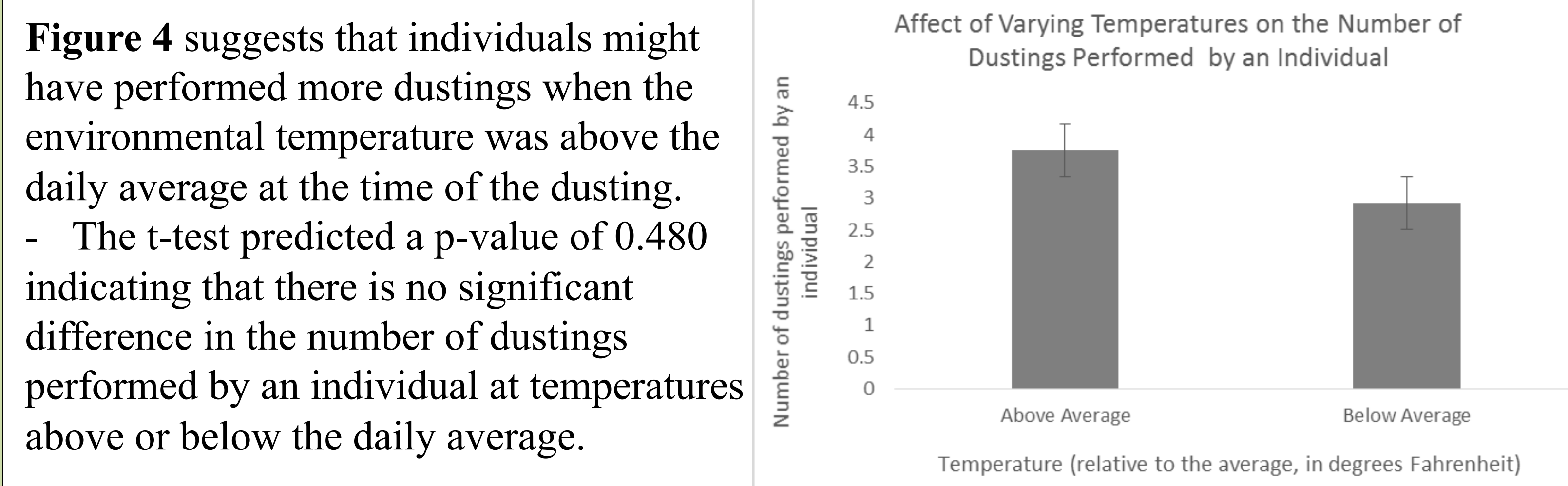
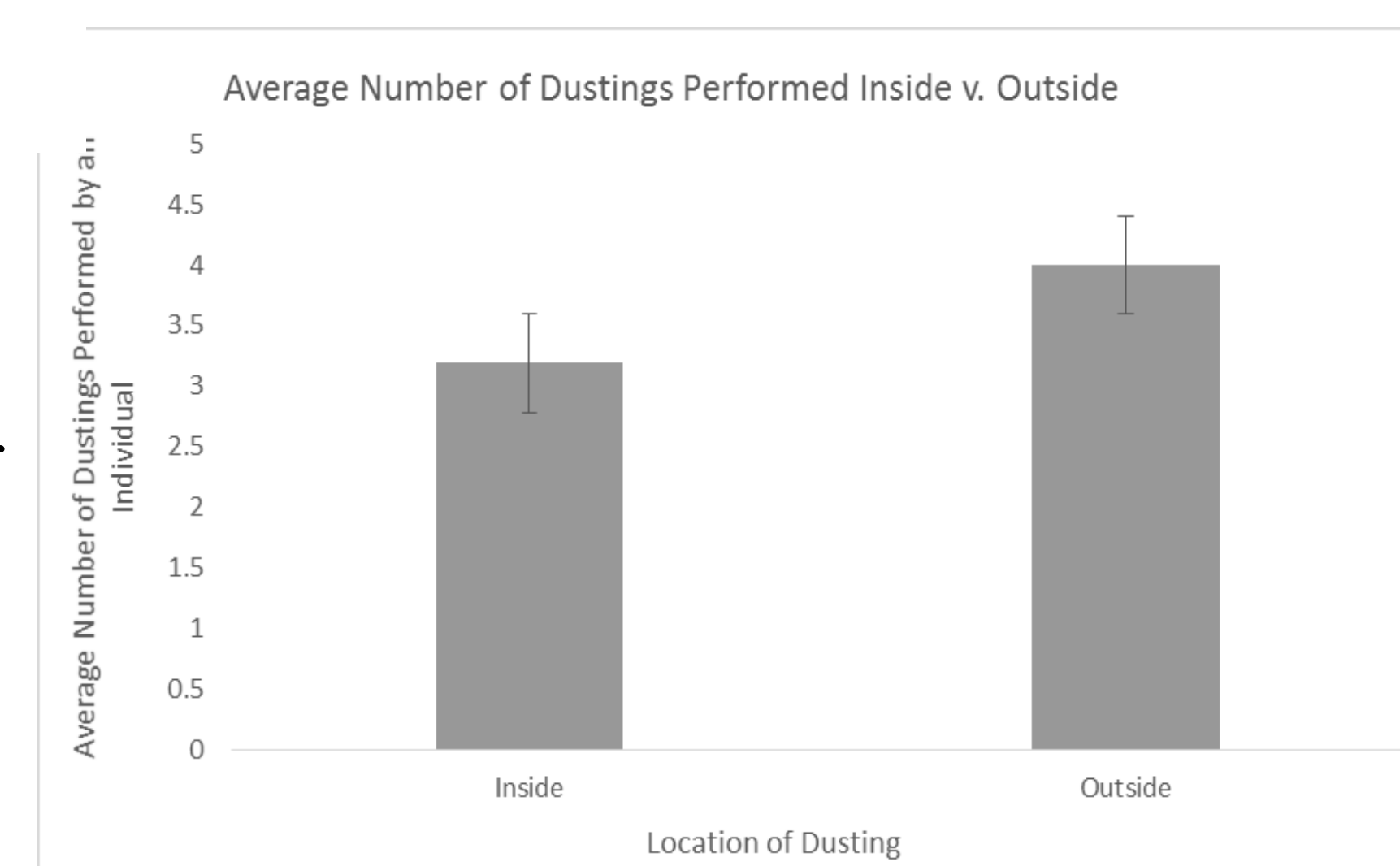


Figure 6 suggests that individuals performed more dustings in the outdoor enclosure. The average temperature of the outdoor enclosure was lower overall (~43° F). The results of the t-test predicted a value of 0.475 indicating that there is no significant difference between the number of dustings performed outside and inside.



Promising Outlook

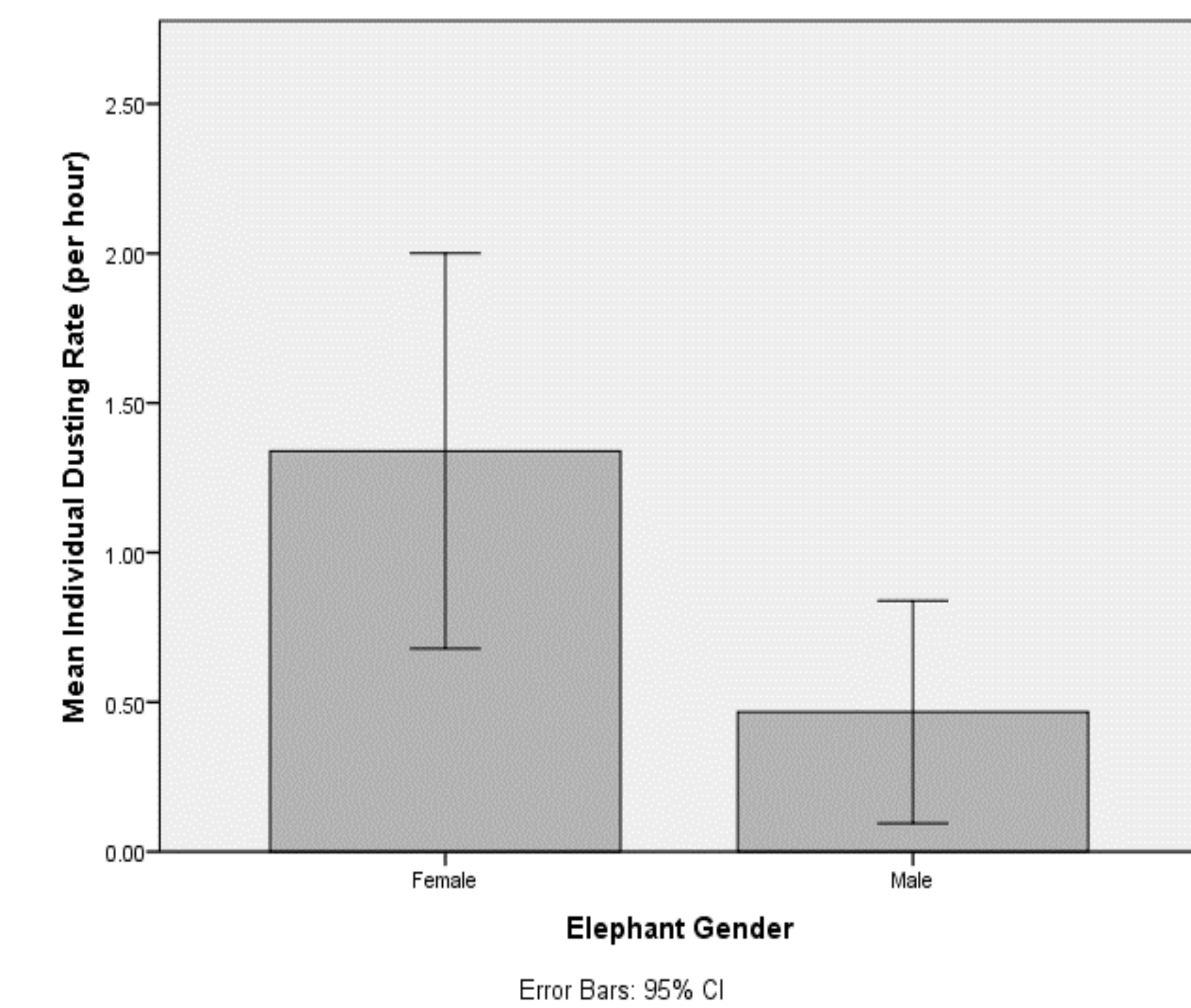


Figure 7 suggests that female elephants exhibited a greater rate of dusting than males. Males exhibited about 0.467 dustings per hour, while females exhibited about 1.34 dustings per hour.

The results of a t-test predicted a p-value of 0.060 which indicates that there is no significant difference between the dusting rates of male and female elephants. However, the p-value was close to being significant.

Implications and Future Prospects

Two factors could explain the absence of a relationship between temperature and elephant dusting behavior in this study:

- 1) The keepers had control over where the elephants had access to. Overall, the indoor enclosure was warmer (~58° F), while the outdoor enclosure was cooler (~43° F). However, the winter-spring climate might not have facilitated dusting behavior because the temperatures were not high enough. Outlook: I hope to repeat the study during the fall – more access to the yard and potential exposure to higher seasonal temperatures.
- 2) The materials available for use were also limited – especially when the elephants were indoors. The ultimate choice of materials might depend on the perceived quantity and alternative functions of the resource. Potential evidence for the presence of displacement behavior (Fox 1968).

Three factors could explain the potential differences between male and female dusting rates:

- 1) Lack of replicates due to the limited number of subjects.
- 2) Matured male, Hank, might devote less energy to dusting because the energetic demands outweigh the benefit of performing the behavior. Outlook: Examine the impact of body mass on the frequency of dusting.
- 3) Maturing juvenile, Beco, is isolated from the other elephants and might lack exposure to the social cues that influence dusting behavior. Outlook: Examine the origin of the behavior – ie. cultural transmission.

Importance: Understanding captive adaptations, maintaining natural instincts, recognizing human threat to elephants, connecting people to wildlife.

Works Cited:

Rees, Paul A. 2002. "Asian Elephants (*Elephas maximus*) dust bathe in response to an increase in environmental temperature." Journal of Thermal Biology. Vol. 27 Issue 5. Pp. 353-358. Doi: 10.1016/S0306-4565(01)00100-0.
Spearman, R.I.C. 1970. *The Epidermis and its keratinization in the African elephant (Loxodonta africana)*. Zoology of African Vol. 5, No. 2. Pp. 235-345.
T. Haltenorth, H. Diller. A Field Guide to the Mammals of Africa including Madagascar, Collins, London (1980).

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