

# Touchscreen Tablets as Enrichment for Female Rhesus Macaques: Use, Behavioral Response and Effects of Temperament

J. E. Perlman<sup>1</sup>, A. L. Martin<sup>1,2</sup>, C. Brennan<sup>1</sup>, K.M. Williams<sup>1</sup>, & M. A. Bloomsmith<sup>1</sup>

<sup>1</sup>Yerkes National Primate Research Center, Emory University, Atlanta, GA. <sup>2</sup> Department of Psychological Science, Kennesaw State University, Kennesaw, GA.

## Abstract

Touchscreen tablet technology is a potentially engaging enrichment option for captive nonhuman primates and may enhance welfare through sensory stimulation, the opportunity for choice and control, and cognitive engagement. This study evaluated tablet use and some behavioral responses (fear/anxiety and abnormal behaviors) of 23 singly-housed, female rhesus macaques (*Macaca mulatta*) over eight, 30-minute sessions. Subjects were evaluated in pre-exposure, tablet exposure, and post-exposure conditions, and focal animal data collection was employed. Subjects had access to "paint" and music programs (CHOICE Solo Enrichment program) on the tablet and a screen saver image that appeared following one minute of non-use. Use was low as subjects touched the tablet 1.95% of the time it was available but watched it 10.39%. Touching differed across weeks of exposure (Friedman's test ( $\chi^2(2) = 6.42, p = .04$ ), while watching was stable ( $\chi^2(2) = 2.84, p = .24$ ). Fear/anxiety behavior was reduced in the post-exposure condition ( $\chi^2(2) = 7.30, p = .03$ ). Abnormal behavior increased during tablet exposure ( $\chi^2(2) = 7.20, p = .03$ ). Subjects' temperaments were categorized by response to a novel object test. Kruskal-Wallis tests found no relationship between temperament and touching ( $H(2) = 3.02, p = 0.22$ ) or watching the device ( $H(2) = 0.60, p = 0.74$ ). The limited use of the tablet indicates training the monkeys may be helpful. The increased abnormal behavior associated with use must be further evaluated to better understand the role that touchscreen tablets may play in behavioral management programs.

## Introduction

Providing various types of environmental enrichments to captive nonhuman primates reduces some abnormal behaviors and increases some species-typical behaviors (Bloomsmith et al., 1988; Griffis et al., 2013; Gottlieb et al., 2011; Schapiro et al., 1996). Recent additions to some enrichment plans include the use of computer-based enrichment using tablets. However, the few studies evaluating their impact on nonhuman primate welfare measures show mixed results. Some studies found no effects on behavior (Carter et al., 2021), some showed positive increases in activity levels (Platt & Novak, 1997; Yamanashi & Hayashi, 2011) as well as decreases in stereotypical behavior (Fagot et al., 2014; Grunauer & Walguarnery, 2018; Washburn & Rumbaugh, 1998). Others showed increased stress behavior due to task difficulty (Honess & Marin, 2006; Leaven et al., 2001) and increased aggression due to resource competition (Tarou et al., 2014). There are questions about whether this type of enrichment is appropriate for all individuals, and if some individuals might benefit more than others (Coleman & Novak, 2017), as Coleman (2017) found individuals with inhibited temperaments avoided the tablet altogether.

In the current study, we tested subjects for temperament (e.g., inhibited, moderate, exploratory) and then provided access to a touch screen enrichment application with paint and music choices.

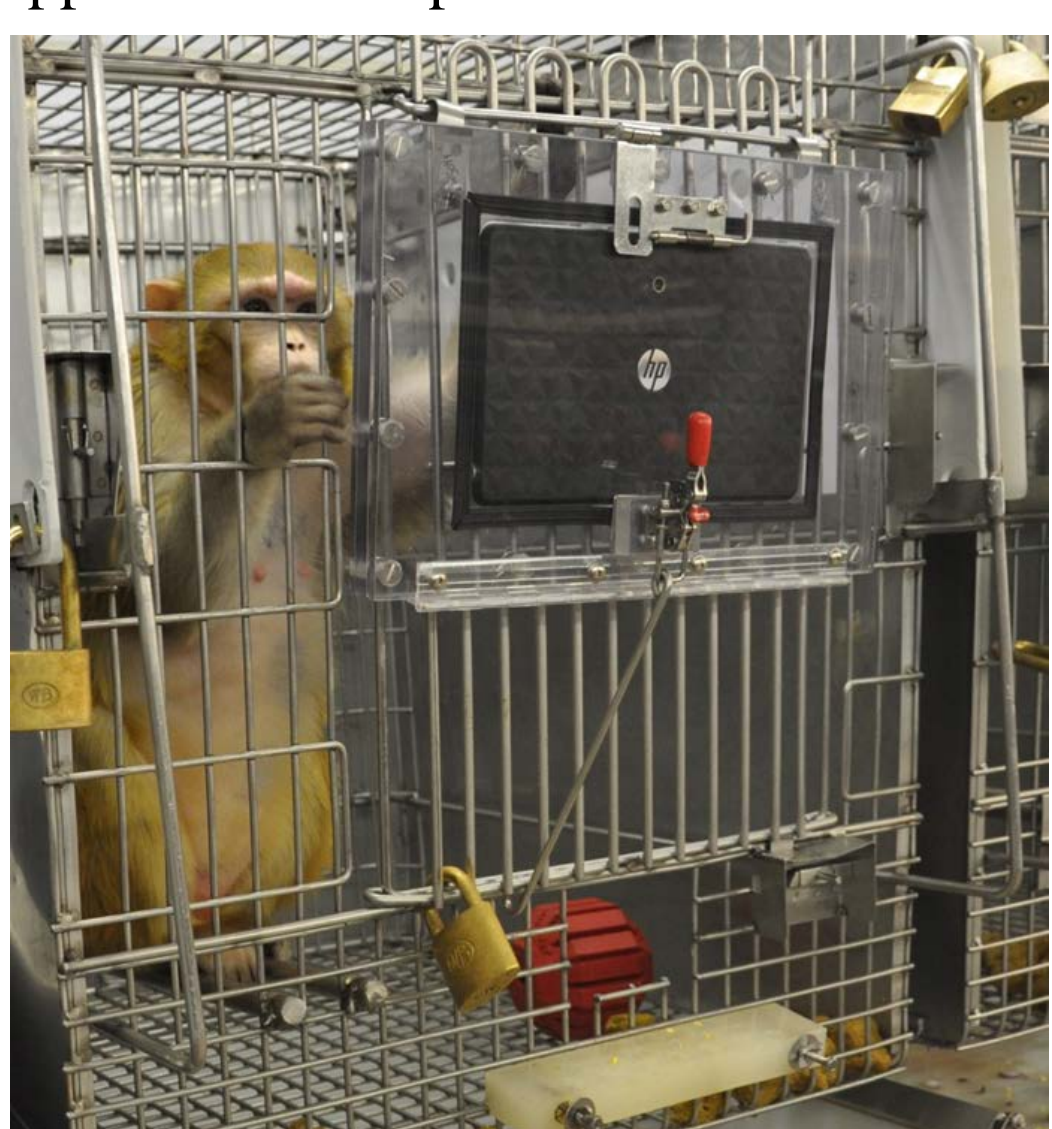


Figure 1. Physical tablet use.

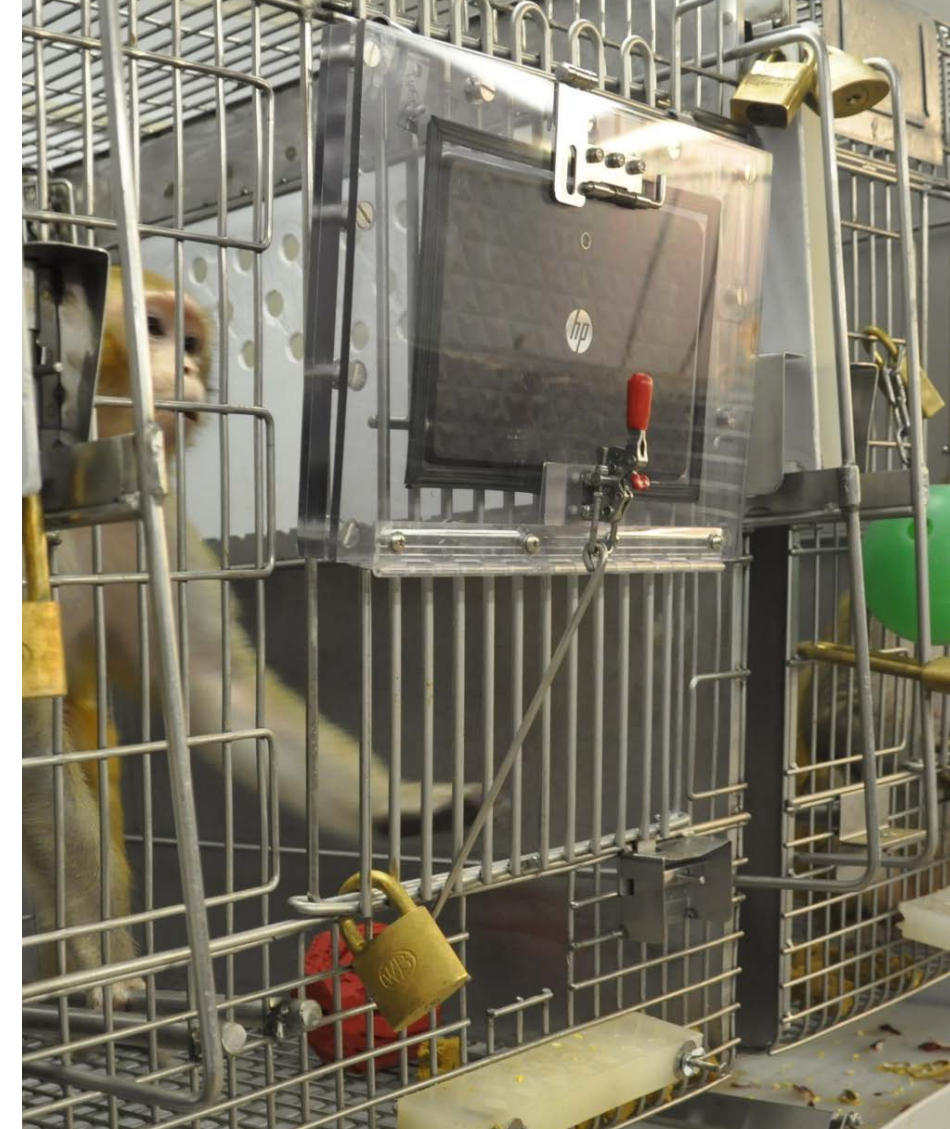


Figure 2. Visual tablet use.

## Research Questions

1. Does tablet use or response differ based on the temperament of the monkeys?
2. Do monkeys habituate to the tablet over time?
3. Does the use of tablet enrichment increase/decrease rates of anxiety, fear or abnormal behavior?

## Method

### SUBJECTS

• 23 female rhesus macaques, singly-housed indoors for other IACUC-approved research protocols.

### BEHAVIORAL DATA COLLECTION

• Trained observers (>85% inter-observer reliability) collected behavioral data using continuous, focal sampling techniques with NOLDUS Observer Software<sup>®</sup>. Thirty-minute observations included 1 baseline, 6 tablet exposure, and 1 post-exposure sessions.

### BEHAVIORS SELECTED FOR ANALYSIS

Four behavior classes were selected to answer our research questions.

1. Fear and Anxiety, combined.
2. Abnormal behavior included hair pluck, self-bite, floating limb, bizarre posture, other self-injurious behavior, appetitive behaviors, whole body stereotypy, eye directed behaviors, self-clasp, digit suck, other self-directed stereotypies.
3. Physical tablet use, engagement via physical contact with the device (see Figure 1)
4. Visual tablet use, near proximity and face oriented towards the tablet (see Figure 2)

### TEMPERAMENT TESTING

Subjects were temperament tested using a novel object test as part of a colony-wide testing program and were later selected for this study. The observer was blind to the subjects' temperaments. Subjects were categorized as:

- 8 Subjects, Inhibited, did not touch object within 3 minutes of presentation
- 8 Subjects, Moderate, touched object between 11 seconds and 3 minutes of presentation
- 7 Subjects, Exploratory, touched object within 10 seconds of presentation.

### TABLET ENRICHMENT

- Tablets were equipped with the CHOICE Solo<sup>®</sup> enrichment application (app) by Britz & Company and a clear glass case designed to fit the tablet and secure on to the front side of the subject's cage. See Figures 1, and 2.
- For this study, the CHOICE Solo Enrichment<sup>®</sup> program provided choice between two apps (paint and music) and choices within those apps (4 colors and 3 types of music). During week 3 the additional stimuli of a bubbles screen saver was added. This activated after 1 minute of no physical use. There was no training on touchscreen use and no food reinforcement provided for engagement with the tablet.

### EXPERIMENTAL DESIGN

Study Phase	# Obs	Description
Pre-Exposure	1	Baseline
Exposure1: Week 1&2	4	Exposure to paint and music choices
Exposure2: Week 3	2	Exposure to paint and music choices WITH Bubbles screen saver
Post-Exposure	1	Return to Baseline

## Results

*Overall tablet use was low for all subjects. Subjects touched the tablet 1.95% and watched it 10.39% of the time.*

### 1. Does tablet use or response differ based on the temperament of the monkeys?

- Tablet use and behavior during tablet exposure did not vary based on individual temperaments.

Tablet Use and Behavior by Temperament				Between-subjects, Kruskal-Wallis Test	
	Temperament	% Obs Mean	Mean Rank	H Value	P Value
Physical Use	Inhibited	2.04	9.63	3.02	0.22
	Moderate	1.08	11.25		
	Exploratory	2.83	15.57		
Visual Use	Inhibited	8.50	10.75	0.60	0.74
	Moderate	12.06	13.38		
	Exploratory	10.65	11.86		
Anxiety/Fear	Inhibited	2.65	11.63	3.85	0.15
	Moderate	2.33	9.00		
	Exploratory	3.61	15.86		
Abnormal Behavior	Inhibited	0.53	9.25	2.07	0.36
	Moderate	3.80	13.75		
	Exploratory	0.90	13.14		

Table 1. No significant relationships were found between temperament and percent of observations animals engaged in physical use, visual use, anxiety/fear or abnormal behavior.

### 2. Do monkeys habituate to the tablet over time?

- Animals habituated to the tablet over the first two weeks, but use increased in the third week when a more interactive feature (image of moving bubbles) was added.

*Visual use of the tablet did not differ across weeks. Friedman's Test,  $\chi^2(2) = 2.835, p = .242$ .*

*No significant difference in anxiety/fear across treatment weeks. Friedman's Test,  $\chi^2(2) = 2.174, p = .337$ .*

*No significant difference in abnormal behavior across treatment weeks. Friedman's Test  $\chi^2(2) = 2.338, p = .331$ .*

*Physical use of the tablet differed significantly among weeks. Friedman's Test,  $\chi^2(2) = 6.416, p = .04$ .*

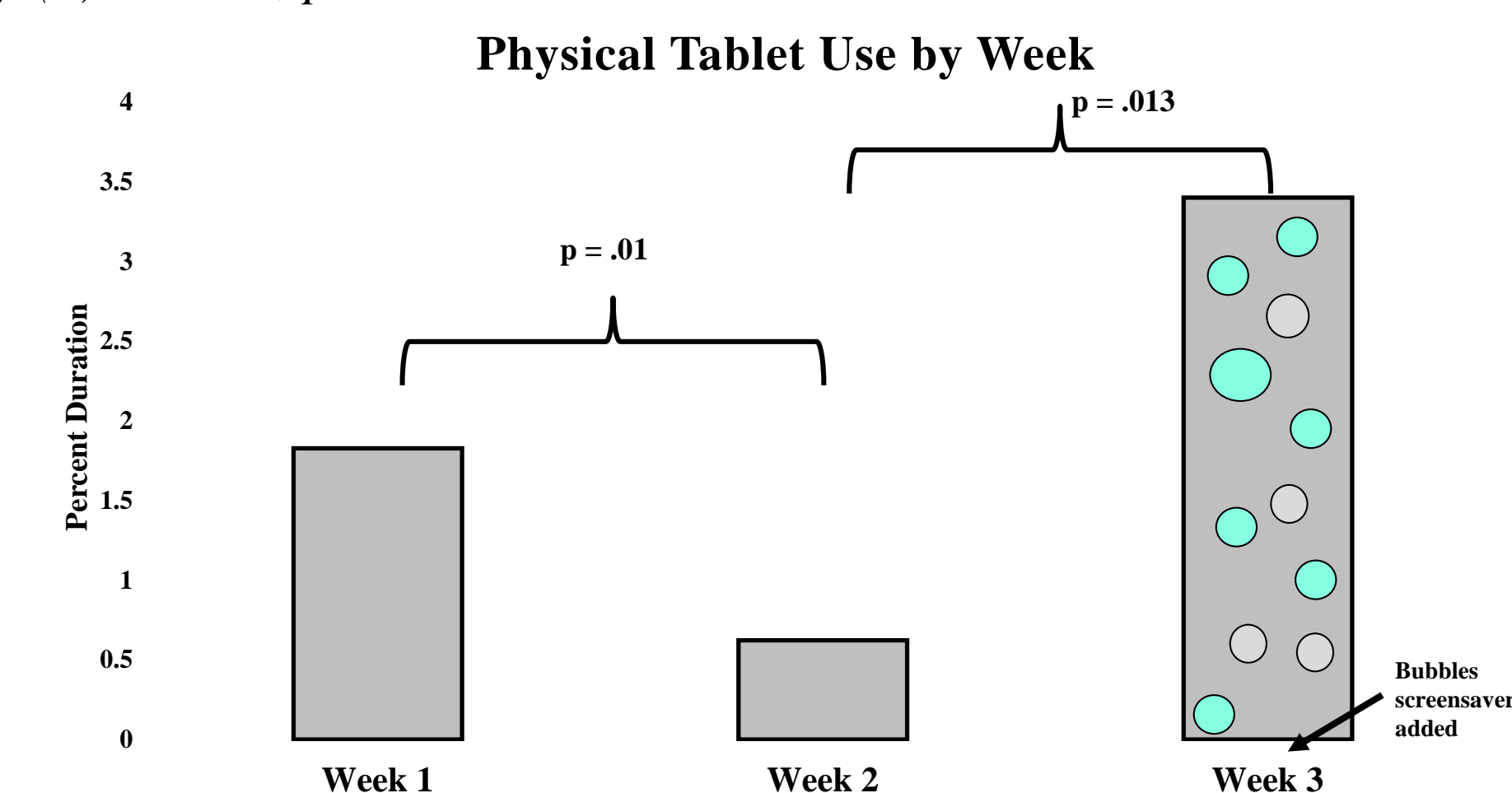


Figure 3. Pair-wise Wilcoxon Signed Ranks Test demonstrate significant differences in physical tablet use from Week 1 (mean rank=2.2) to Week 2 (mean rank=1.6) and Week 2 to Week 3 (mean rank=2.2). No significant difference between Week 1 and Week 3,  $Z = -1.307, p = .191$ .

## Results continued...

### 3. Does the use of tablet enrichment increase/decrease rates of anxiety, fear or abnormal behavior?

- Monkeys exhibited less anxiety/fear in the post-treatment condition.
- Monkeys exhibited increased abnormal behavior during exposure to the tablet compared to when the tablet was not present.

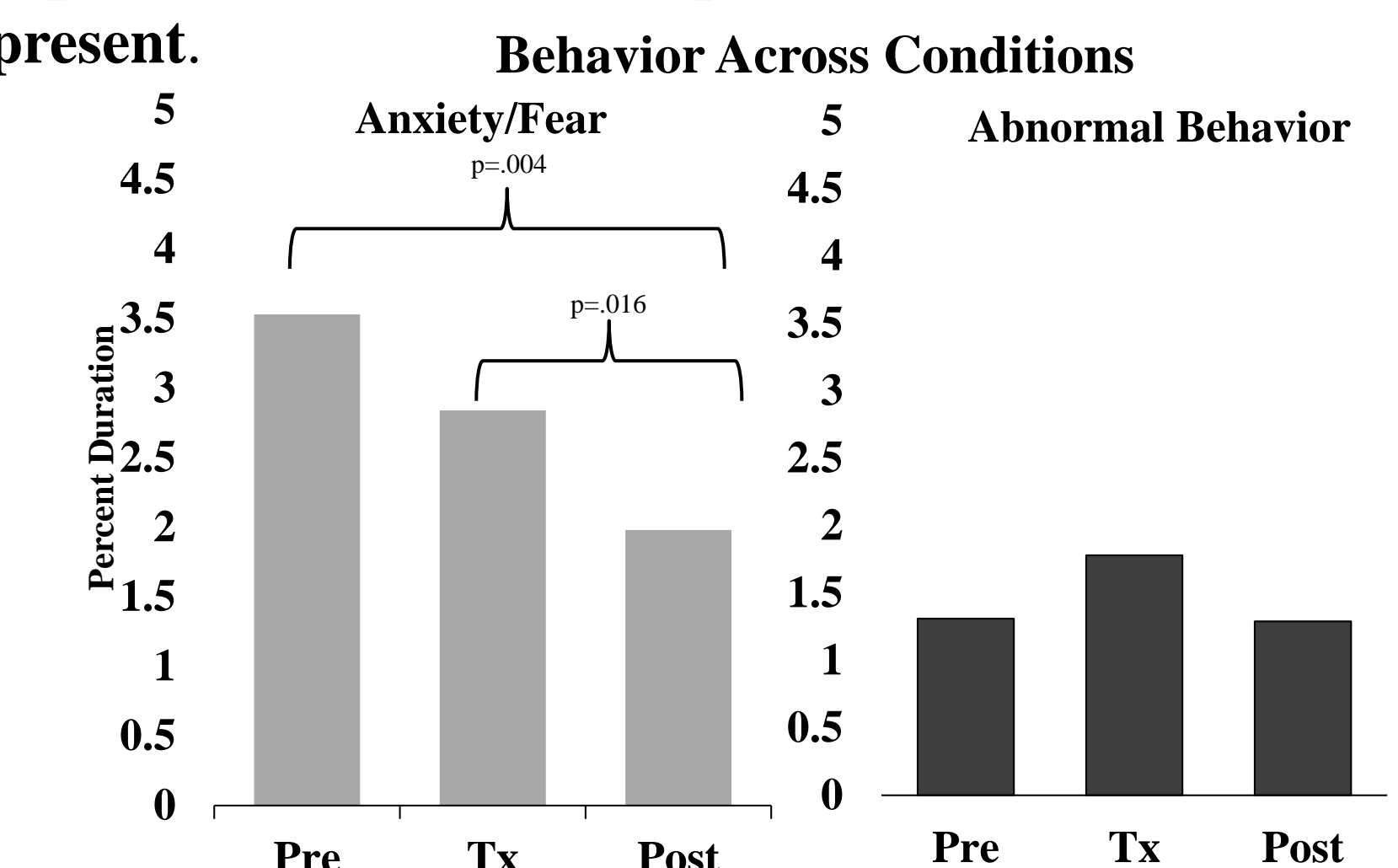


Figure 4. Means and Standard Deviations of Anxiety/Fear and Abnormal Behaviors Across Treatment Conditions

*There was a significant change in anxiety across treatment conditions. Friedman's Test  $\chi^2(2) = 7.304, p = .026$ .*

*There was a significant change in abnormal behavior across treatment conditions. Friedman's Test  $\chi^2(2) = 7.200, p = .027$ .*

	Anxiety/Fear Mean Rank	Abnormal Mean Rank
Pre	2.35	1.87
Treatment	2.09	2.39
Post	1.57	1.74

Table 2. Mean ranks of behavior across treatments.

## Conclusions and Interpretations

- Our finding of no temperament differences in tablet use varies from those of O'Connor et al. (2015). With more subjects, our findings indicate this form of enrichment may be of equal interest to animals of all temperaments and should be explored further.
- Low level of use by all subjects suggests additional steps may be needed to encourage initial engagement:
  - Brief training could be provided on touch screen use.
  - Automatic food dispensers could be used to pique initial interest and then faded over time if intrinsic reinforcement increases.
- We found an increase in tablet use when a more interactive feature (image of moving bubbles) was added to the app. As suggested by O'Connor et al. (2015), more interactive apps such as popping bubbles may increase use over something more passive such as selecting music to then listen to.
- Increases in abnormal behavior during our treatment phase should be further investigated to ensure the enrichment has a positive impact on welfare.
- The decrease in anxiety/fear behaviors over treatment conditions may be attributed to observer acclimation. This requires more investigation.
- Lastly, the choices provided in this study (paint and music) may not be of interest to female rhesus, therefore identifying other apps that draw more attention, and testing individuals for content preference may elucidate if tablet use can be an effective form of enrichment for captive nonhuman primates.

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