Exploring the Differences in Grasping from an Evolutionary Perspective

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Introduction

Judgement is a part of human nature. Many human judgements stem from conscious or unconscious biases. [1] In this study, we will be examining human judgement between curved objects and sharp objects by studying the primate brain in monkeys (rhesus macaques).

We hypothesized that monkeys would prefer curved objects because of their correlation with comfort. Conversely, we assumed that because sharp objects are correlated with danger (take a knife for example), they would not be prefered. We based our hypothesis on an assumption that evolutionarily, humans developed predisposed, negative judgements against sharp objects as a defense mechanism. [1] We tested these preferences by studying and comparing the grasping reaction times and reach accuracy for a number of curved and sharp objects.

Methods

To conduct this study, monkeys (rhesus macaques) grasped three sets of objects pictured below. Each time the monkey grasped an object, the code for the turntable on which the objects were placed caused a delay, to keep the monkey's hand safe.

When the monkey grasped an object, his movements were recorded using a software called deep lab cut, a pose estimation tool. Images from this tool are depicted in figure 4. The monkey's reaction times, and grasping accuracy were also recorded. After successfully grasping an object, the monkey was given a reward. This cycle is depicted in the diagram below.
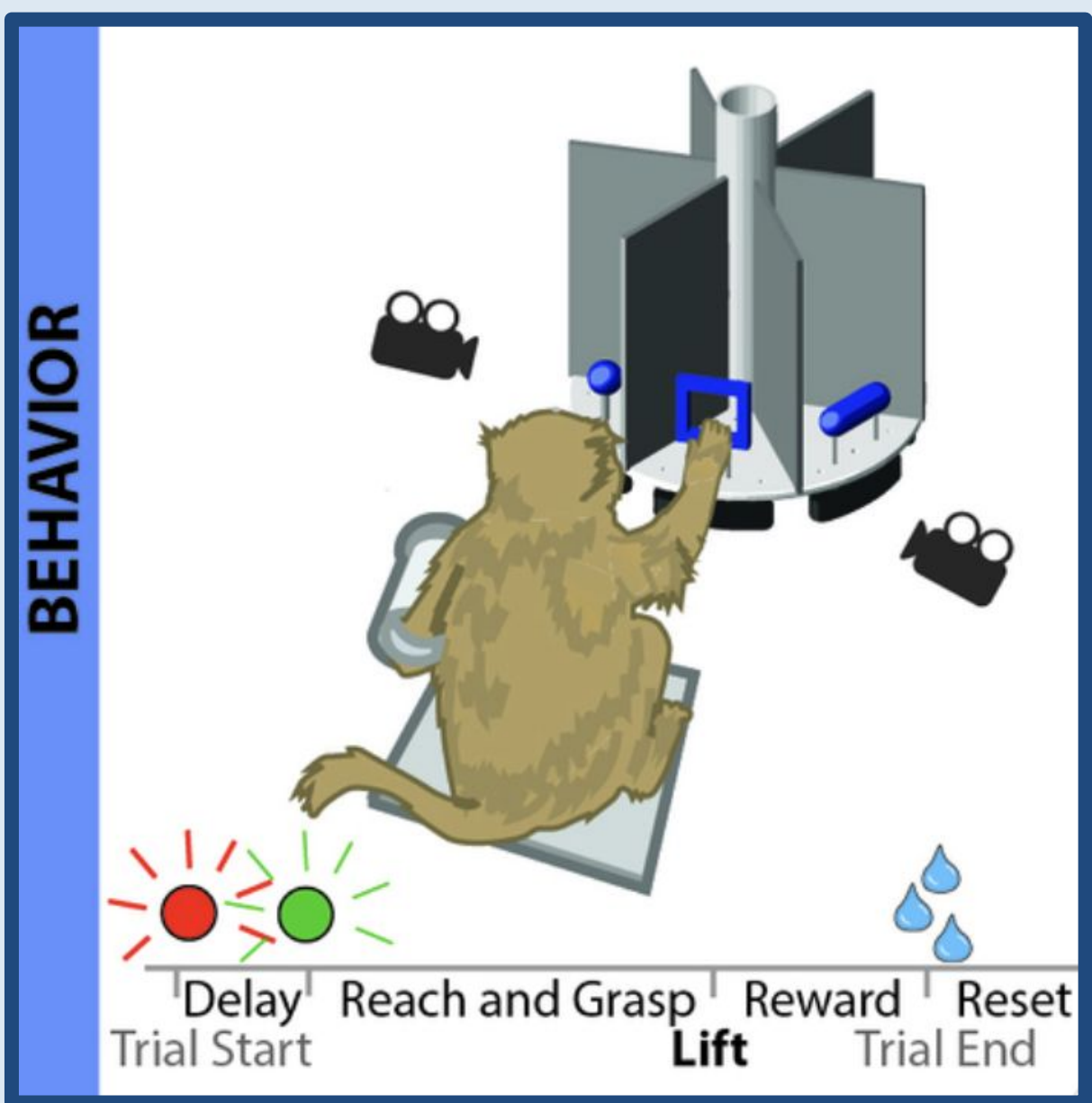

Figure 1. The Turntable reaching task design

The objects being picked up are depicted in figure two. They were designed using fusion 360 software and printed with a prusa slicer. They were printed in pairs with each sharp object having a corresponding curved object and vise versa.
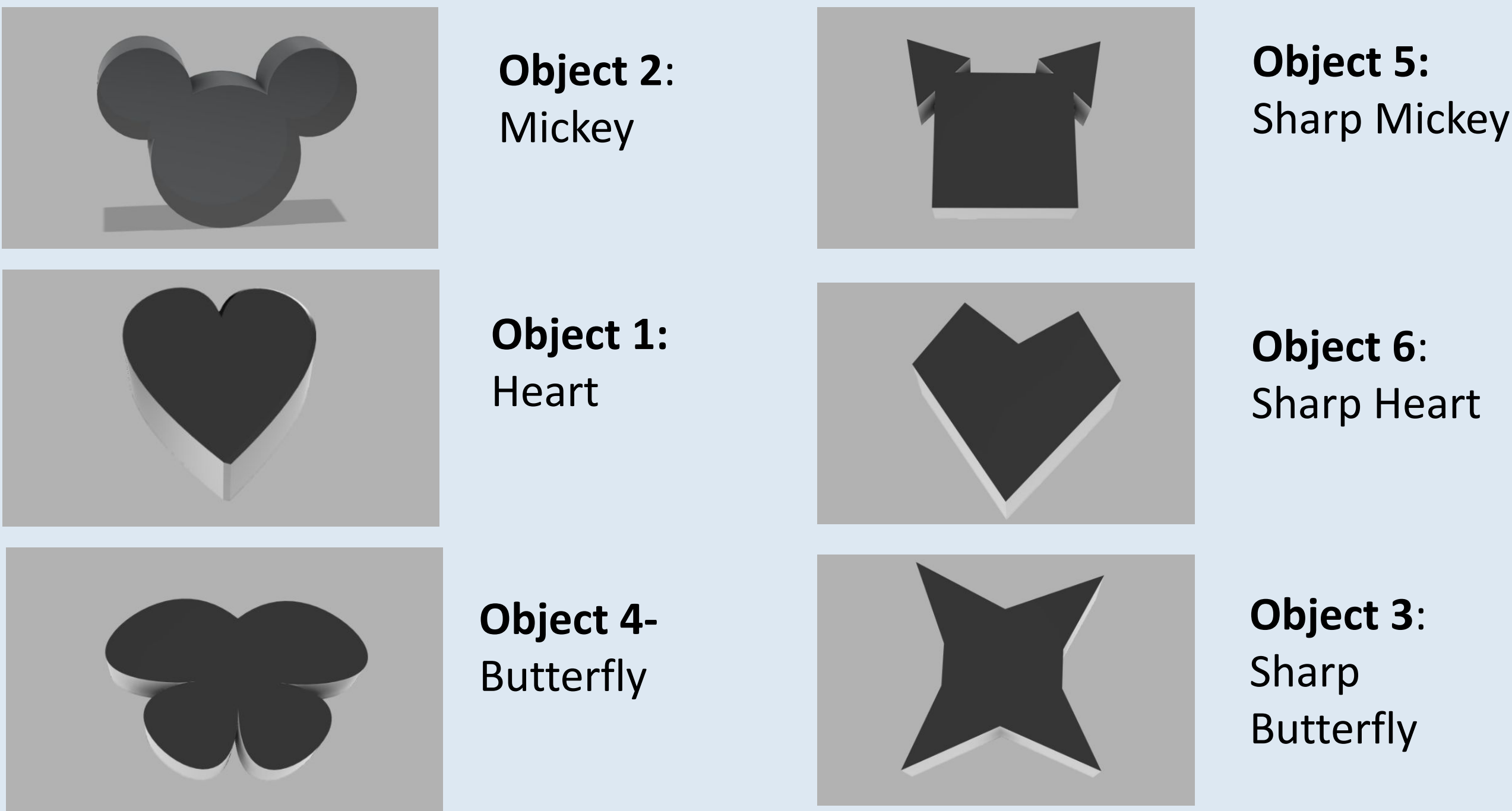
Results

Object 2: Mickey
Object 1: Heart
Object 4- Butterfly
Object 5: Sharp Mickey
Object 6: Sharp Heart
Object 3: Sharp Butterfly

Figure 2. Objects 3D images, names, and numbers
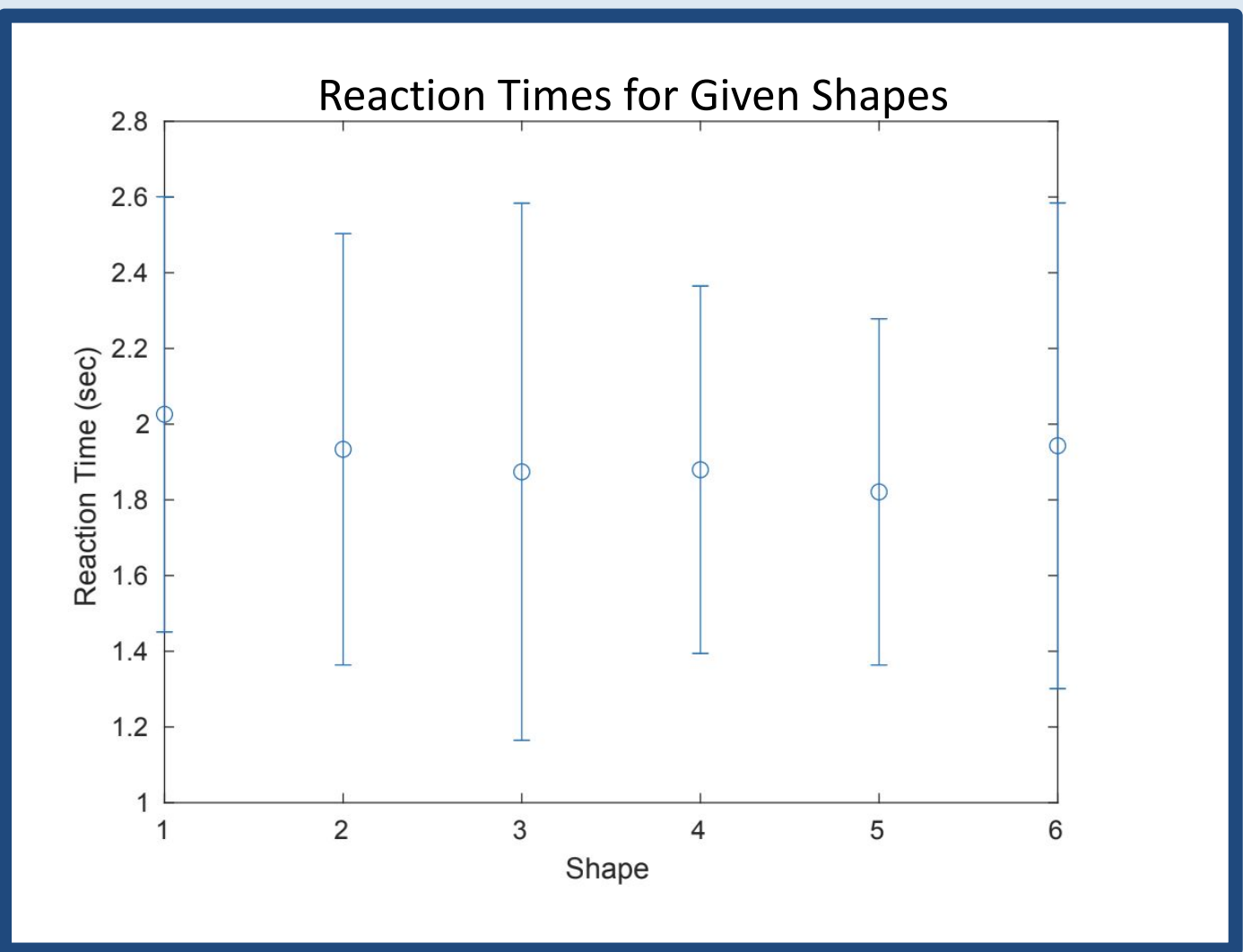

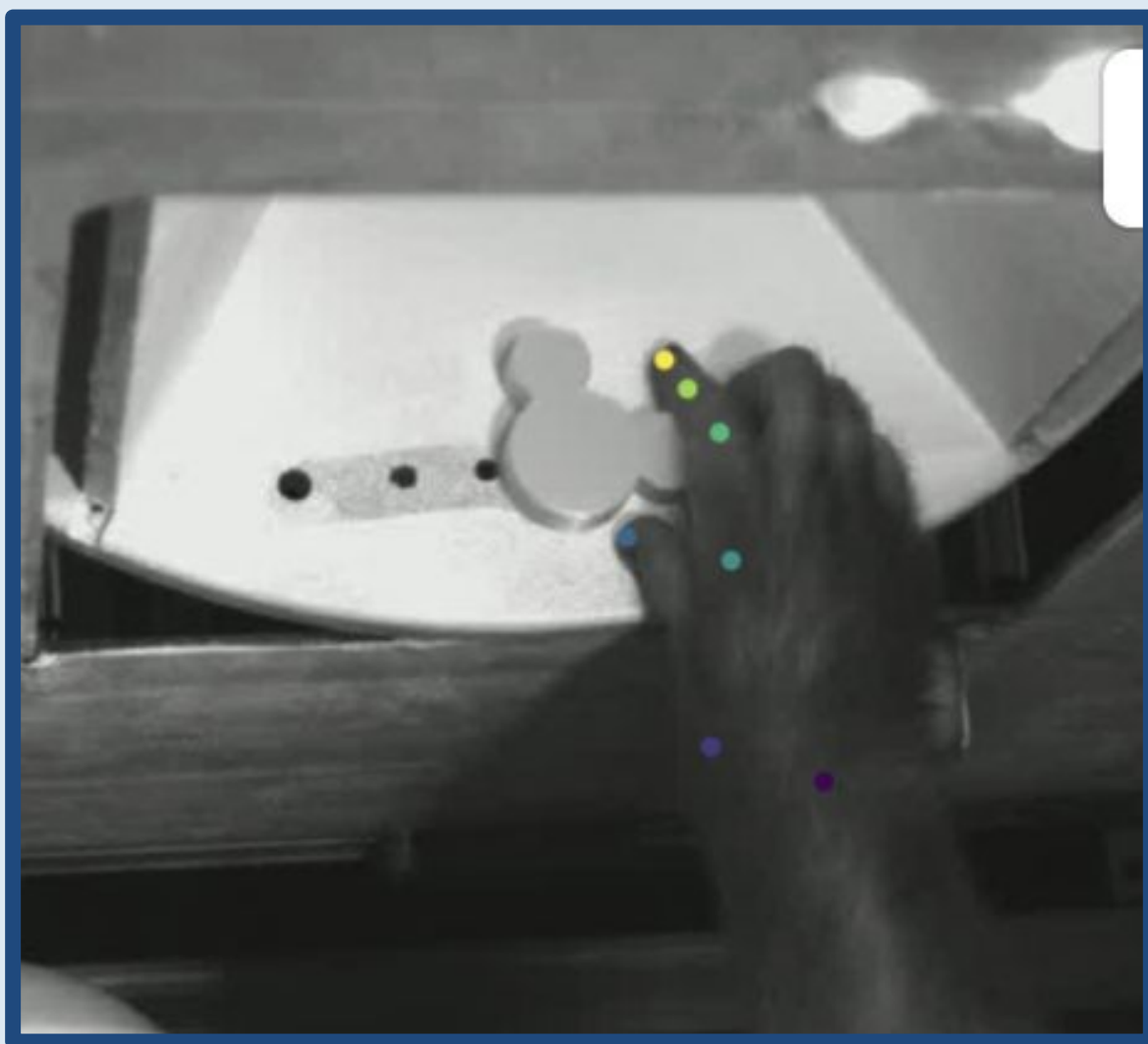**Figure 3. Reaction times and variations show slight differences between shapes**

Figure 4. Deep Lab Cut imaging and labeling of turntable setup on Mickey grabbing task

Shape Number	Shape Name	Reaches	Reach Accuracy
1	Heart	196/203	96.6%
2	Mickey	195/202	96.5%
3	Sharp Butterfly	196/203	96.6%
4	Butterfly	193/201	96.0%
5	Sharp Mickey	194/200	97.0%
6	Sharp Heart	190/200	95.0%

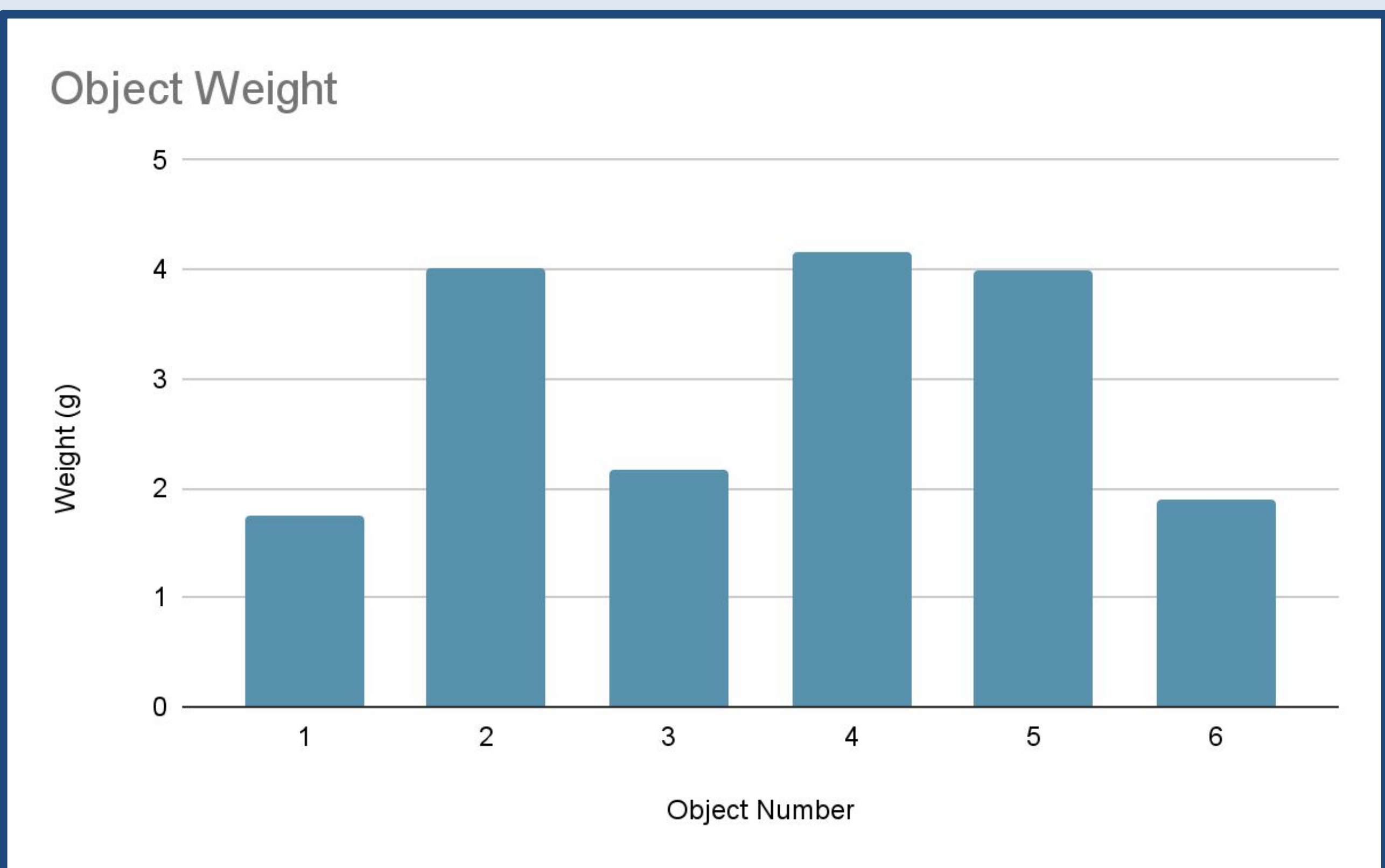**Figure 5. Shape accuracy and average reaction times**

Figure 6. Object weights may contribute to grasp accuracy

Discussion

The results suggest that although the sharpness of an object plays a role in the monkeys preference, the weight and the ease of grasping also play a role

Object 3: Sharp Butterfly
➢ Second fastest reaction time.
➢ Configuration that allows for optimal hand placement
➢ One of the lighter objects
➢ Most variation in reaction time.
➢ Sharpness of the object may have thrown the monkey off, causing such a variability.
➢ configuration likely caused fast reaction time.

Object 1: Heart
➢ slowest reaction time
➢ not many crevices that make grasping easy - could account for why the reaction time was so high as the monkey could not figure out how to hold onto the object.

Object 4: Butterfly
➢ second slowest reaction time
➢ weighs the most
➢ also not many crevices to hold onto - probably impacted the low reaction time.
➢ weight and lack of crevices contributed to slow reaction time

Practical obligations such as weight and places to place a hand seem to outweigh the monkeys preference for curved objects, but this preference is likely to still be present.

Object 1: Heart VS **Object 6**: Sharp heart
➢ Reaction time lower for sharp heart than curved heart
➢ sharp heart has place to put hands, regular heart does not
➢ sharp heart lower reach accuracy indicates a possibility that the monkey disliked the sharp edges

Object 4: Butterfly VS **Object 3**: Sharp Butterfly
➢ sharp butterfly has a lot more reaction time variability- monkey was hesitant to pick it up
➢ sharp butterfly weighs less and has faster reaction time

References

1. Bar, M.; Neta, M. Humans Prefer Curved Visual Objects. *Psychological Science* 2006, *17* (8), 645–648. https://doi.org/10.1111/j.1467-9280.2006.01759.x.

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