

Primate Startle Response

Mid-Semester Report

BME 400

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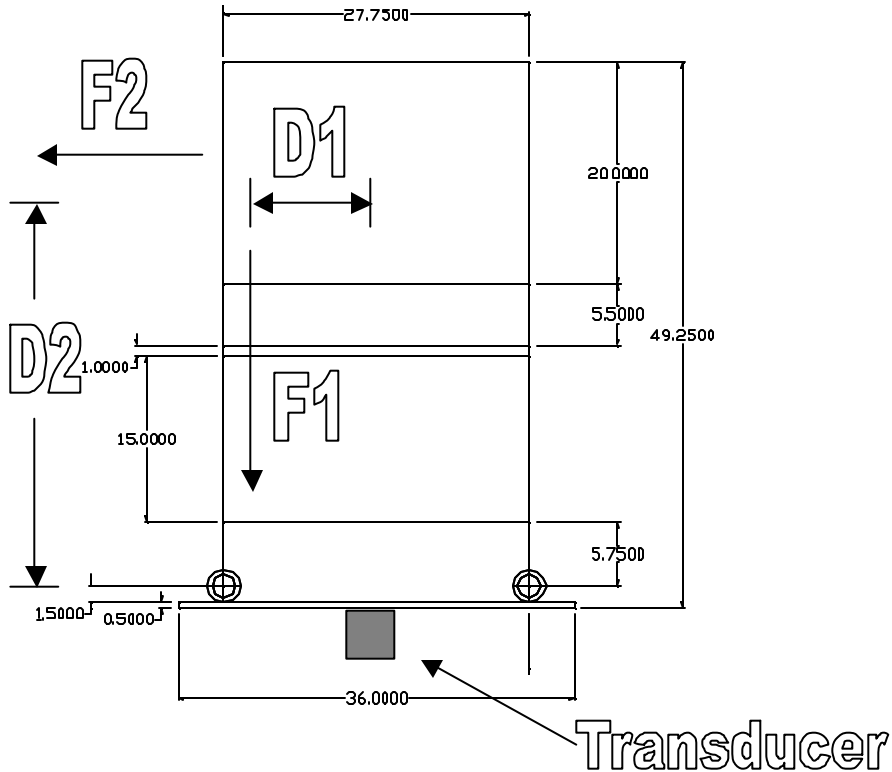
Mike Keller

Mike Mussallem

Braden Rudolph

## Introduction

This semester we have been faced with the challenge of redesigning our system to accommodate our force transducer. Because of a mix-up during the ordering process we received a transducer with insufficient moment capabilities for our design (See Figure 1). After this problem was solved we began implementing our design and are currently beginning the testing phase.



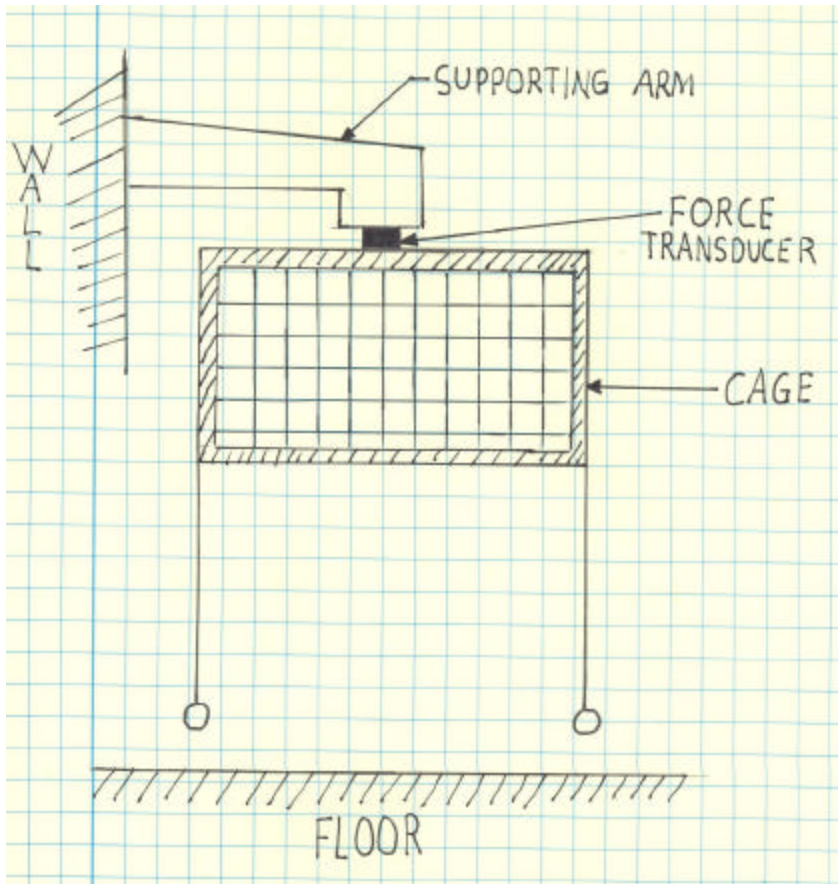
**Figure 1: Old Design With Critical Forces Labeled**

## Details

After consulting with Prof. Roderick Lakes on the 14<sup>th</sup> and 17<sup>th</sup> of September we decided that our old design would not work. Prof. Lakes suggested we meet with Dr. Kreg Gruben, who has a broad knowledge of force transducers. After our meetings with him on the 21<sup>st</sup> and 28<sup>th</sup> of September we had three possible ideas for a new design.

### Design 1:

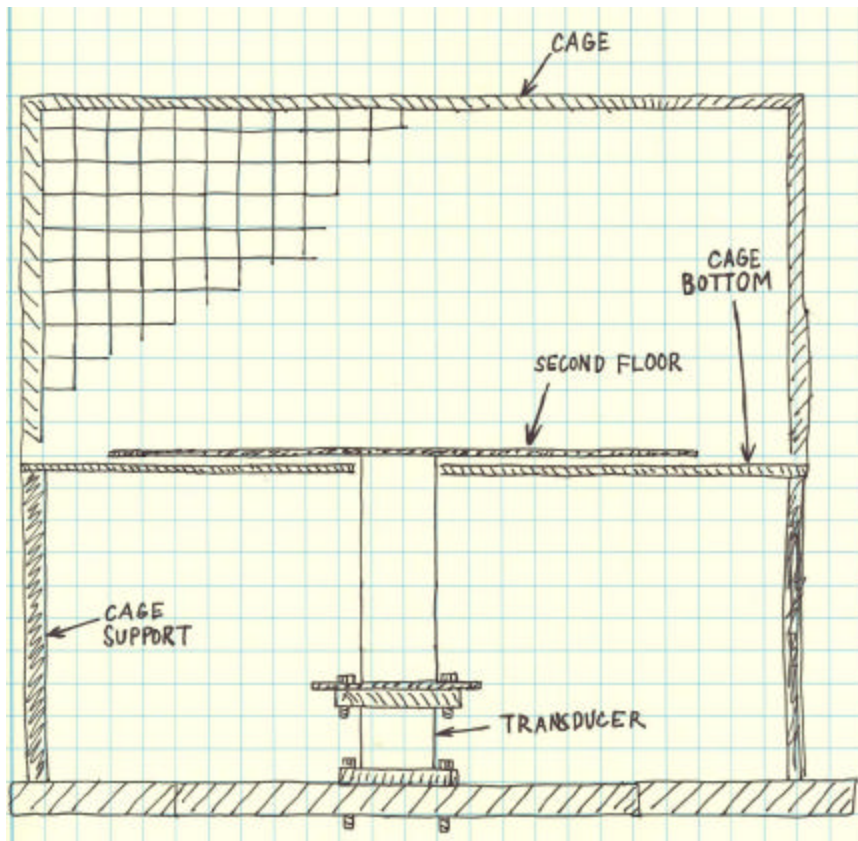
Mount the transducer directly to the top of the cage and suspend cage from arm mounted to wall (See Figure 2). This would effectively reduce the moment arm as seen in Figure 1 labeled D2, thus resulting in a moment within the transducer's range.



**Figure 2: Supporting Arm Design**

Design 2:

Design a smaller cage bottom to fit inside existing cage. This smaller cage bottom would be directly mounted to the transducer and the only monitored forces would be those exerted on the smaller cage floor (See Figure 3). This would eliminate D2 because the second bottom would not be attached to the side of the cage. It would also decrease D1 and its corresponding moment because the monkey could only exert force on a smaller cage bottom.



**Figure 3: Second Cage Bottom**

Design 3:

Use our current design or a slightly modified version of our current design and order a new transducer that can accommodate a larger moment. From the beginning of the semester Matt Delisle, a former team member, has attempted to contact AMTI about the possibilities of exchanging the transducer, but no ground has been made.

### *Evaluation of Designs*

Design 1:

Advantages:

- Reduce moments
- Use current transducer
- No need to modify cage

Disadvantages:

- Extremely complicated to design and build
- Expensive
- May still fail under certain conditions such as accidentally bumping bottom of cage while suspended

## Design 2:

### Advantages:

- Reduce moments
- Use current transducer
- Cheaper
- Easier to design

### Disadvantages:

- Must modify cage
- Reduces amount of data as monkey can move off second bottom

## Design 3:

### Advantages:

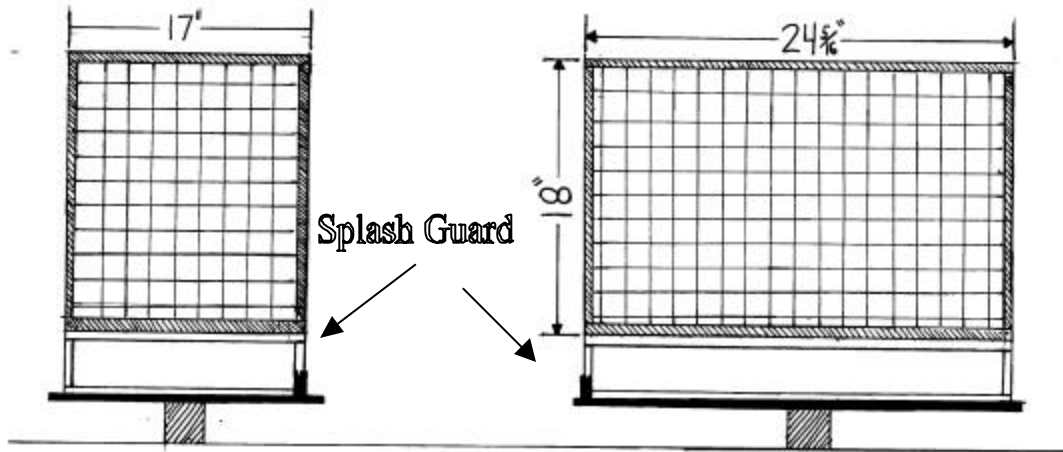
- Use current design

### Disadvantages

- Ordering time
- Expensive

## *Chosen Design*

Upon our request Andy brought the exact monkey cage to our lab at the Waisman Center. To our surprise the exact cage was different than the cage he had shown us previously. Namely, it was much smaller (See Figure 4). This allowed us to use the current transducer and modify our design slightly. With the new dimensions of the cage we no longer had to worry about the moment generated by the monkey standing at the edge of the cage because the moment arm was greatly reduced. However, D2 in Figure 1 was still a problem. This was easily solved by the fact that the cage can detach from the cart and the transducer can then be mounted much closer to the bottom of the cage. Our client had no problem with this minor change. In our new design the transducer is mounted directly beneath the splash guard (See Figure 4). With this design and the new cage size all moments are within our transducer's range of measurement.



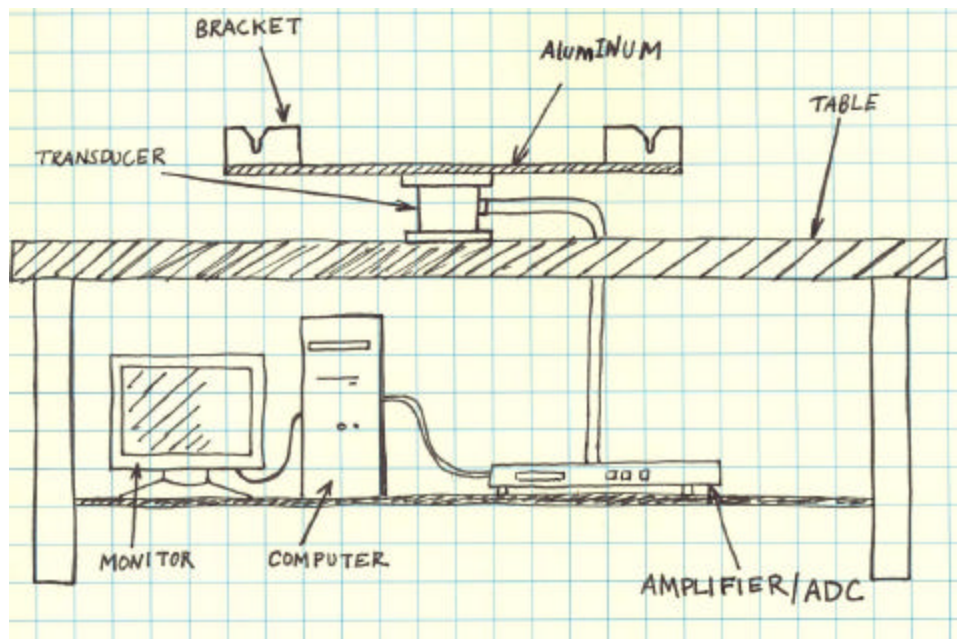
**Figure 4: New Design**

*Possible Problems With Design*

Any variation in positioning of the cage into the box attachment will necessitate recalibration. Also, we are unsure of the best method to construct the box system. Current options include welding the aluminum or bolting them together.

*Current and Future*

Currently we are testing our transducer as this is the most important feature of our design. Once the transducer's measurements and our position determining technique is verified we will then build a unit which incorporates the splash guard and the cage. Testing will consist of placing known weights at known distances and then verifying the output of the transducer. We will also use this to verify our positioning of the center of pressure.



**Figure 5: Setup For Testing**