

DR. KANE'S CANES

Team Quadruped

ENGR 110: Perspectives in Assistive Technology

Final Presentation

March 9, 2010

PRESENTATION OUTLINE

- Introduction to the Team and Dr. Kane
- Background and Motivation for the Project
- Prototype I (Doug Schwandt, MS)
- Outline of the Project
- Recap of the Design Phase
- Final Project
- Future Directions



TEAM QUADRUPED

Junior and Mechanical Engineering Major
Interested in Medical Devices & Social Entrepreneurship



DR. THOMAS R. KANE

Dr. Kane is 86 years old and a Professor Emeritus at Stanford University.

MEET DR. THOMAS R. KANE

- For balance and stability, Dr. Kane requires some external support while walking, standing, and negotiating stairs.
- He currently uses a 4-wheel walker as his main mobility device.
- Literature shows that 4-wheel walkers are used by higher functioning patients who require minimal weight bearing.



CURRENT 4-WHEEL WALKERS

Too Large, Too Bulky, and Not Ideal for Storage and Portability

WHAT ABOUT CANES AND CRUTCHES?

Lightweight and Occupy
Minimal Space

Canes Provide Balance

But, Canes Load-Bear



WHAT DOES DR. KANE NEED?

THE ONE SENTENCE PROJECT DESCRIPTION

Dr. Kane seeks a streamlined mechanical solution that matches his four-wheeled walker in function, but, unlike his walker, is lightweight and compact.

IS THIS PROJECT ONLY DR. KANE?

Short Answer: No

Potential to benefit other individuals who require balance and stability.

These individuals may have had foot, ankle, knee, or hip surgeries, or knee or hip implants, or experience weakness and paralysis in their legs.

PROTOTYPE I

DOUG SCHWANDT, MS



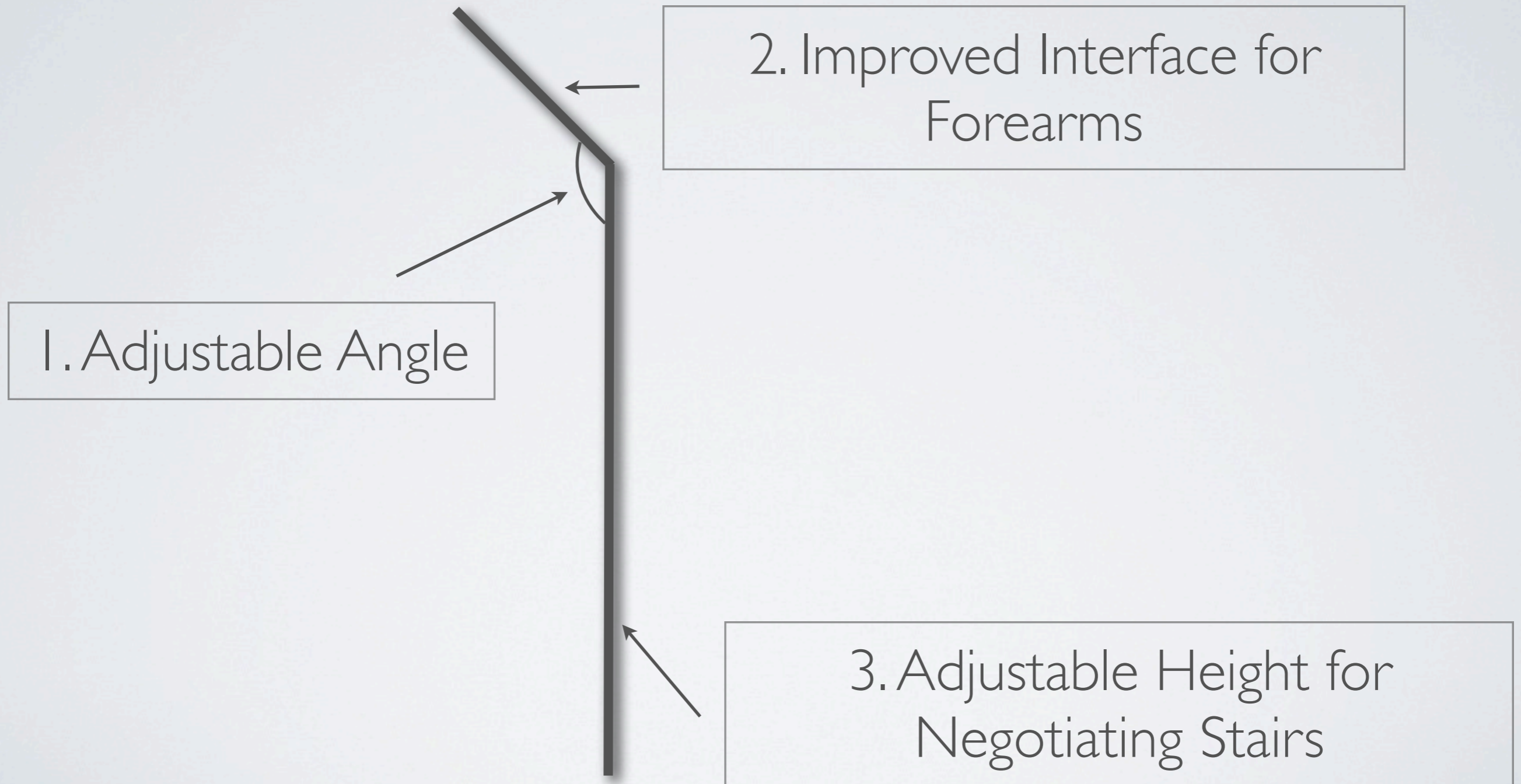
Created using PVC tubing and fittings and tape



Dr. Kane was extremely content with the general “look and feel” of the first prototype.

OBJECTIVE OF TEAM QUADRUPED:

ENHANCE THE INITIAL PROTOTYPE THROUGH THE ADDITION OR IMPROVEMENT OF 3 FEATURES



QUADRUPED GAIT

Unique Optimum Gait with Maximum Static Stability



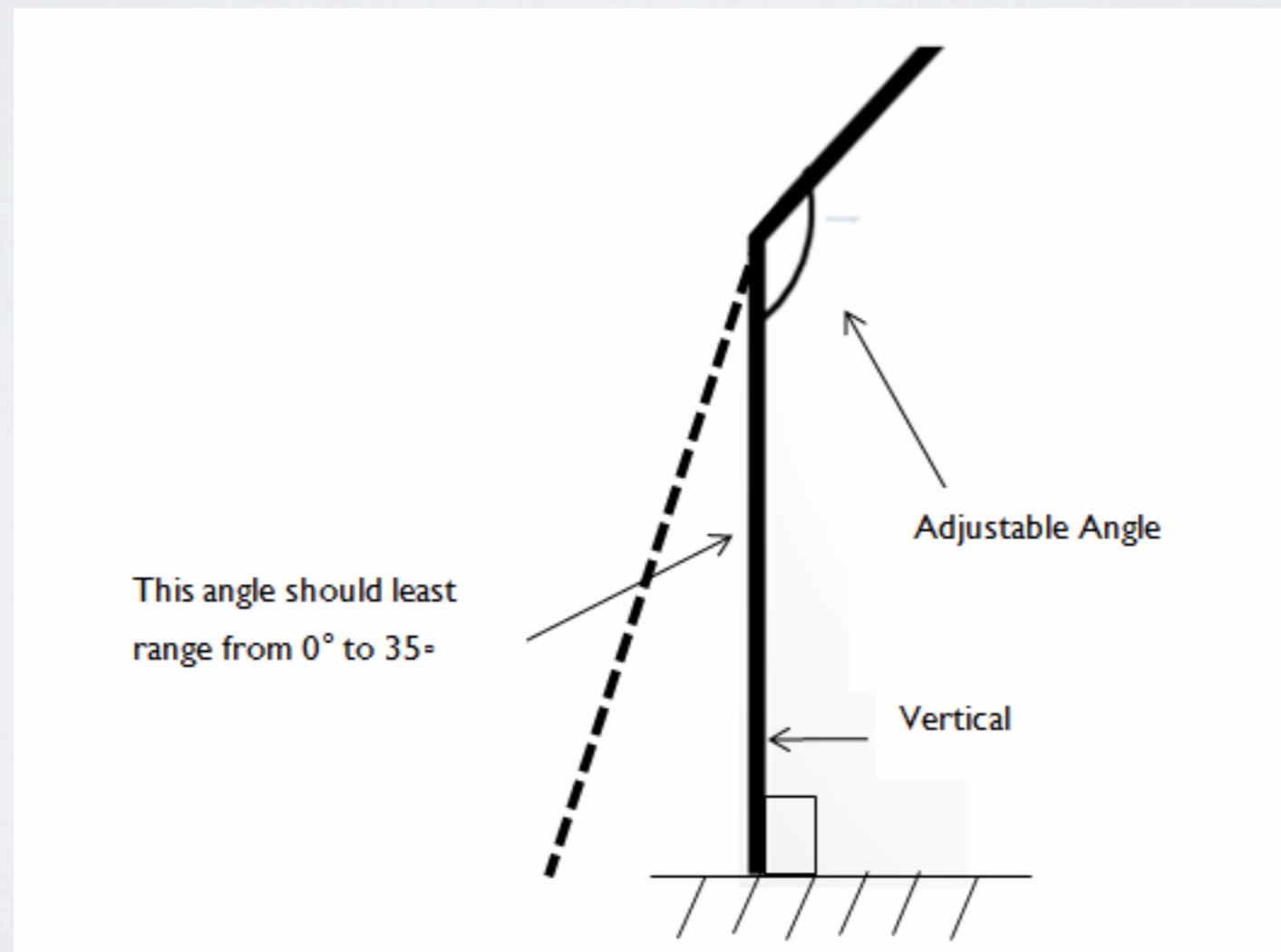
Since the device does not need to support Dr. Kane's weight, a low-weight material, such as graphite composite, could be used for final construction.

ADJUSTABLE ANGLE

- Dr. Kane feels that the ability to adjust the angle will enable him to customize the canes to his personal preferences.
- He desired the ability to adjust the angle about 35 degrees and in increments of 5-10 degrees.
- Option to exceed 35 degrees or have negative angles may provide the ability to efficiently store the device
 - Negative angles may also aid in ascending or descending stairs.
- There isn't an analytical way to determine the perfect angle.

AIM OF THIS PROJECT:

To provide Dr. Kane with the ability to change the angle by at least 35 degrees in 5-10 degree increments

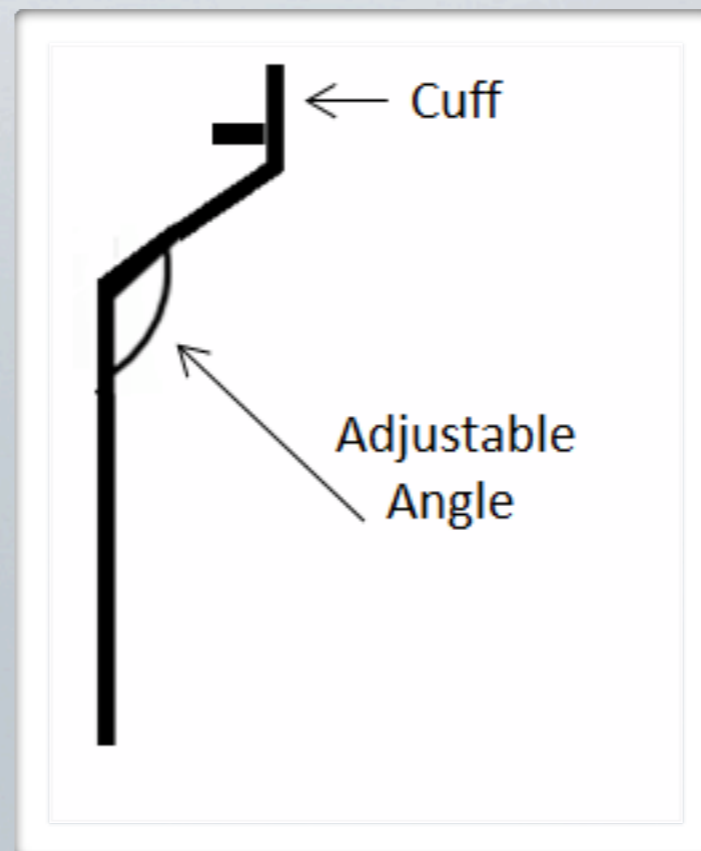
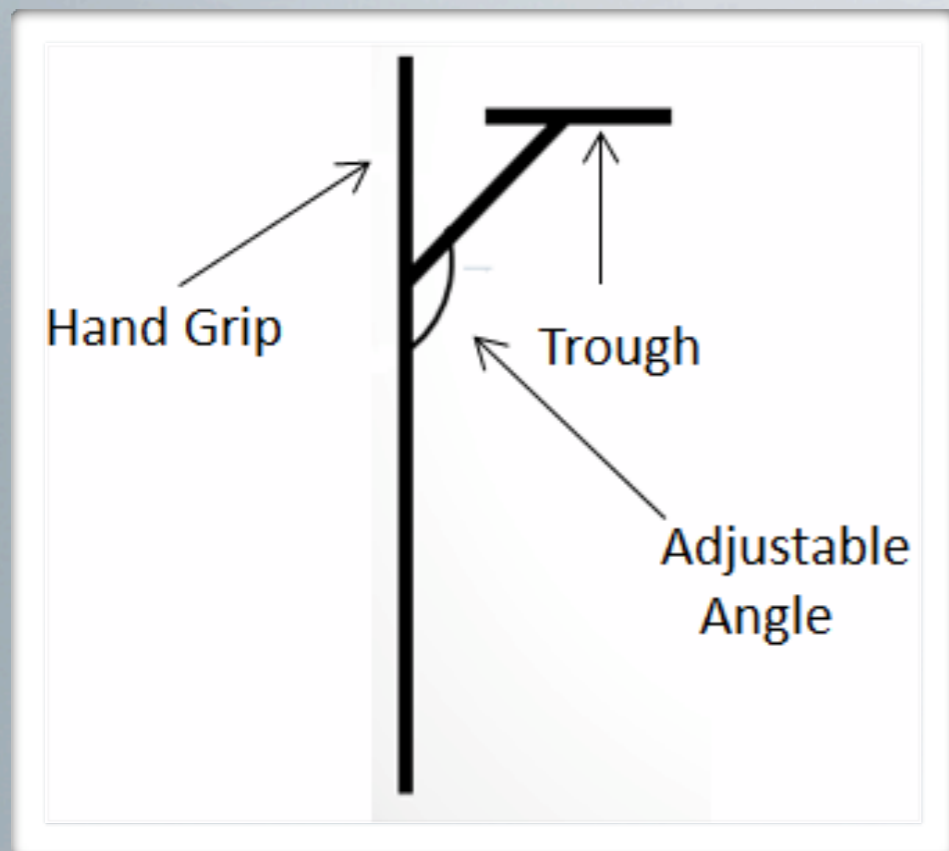


INTERFACE FOR FOREARMS AND HANDS

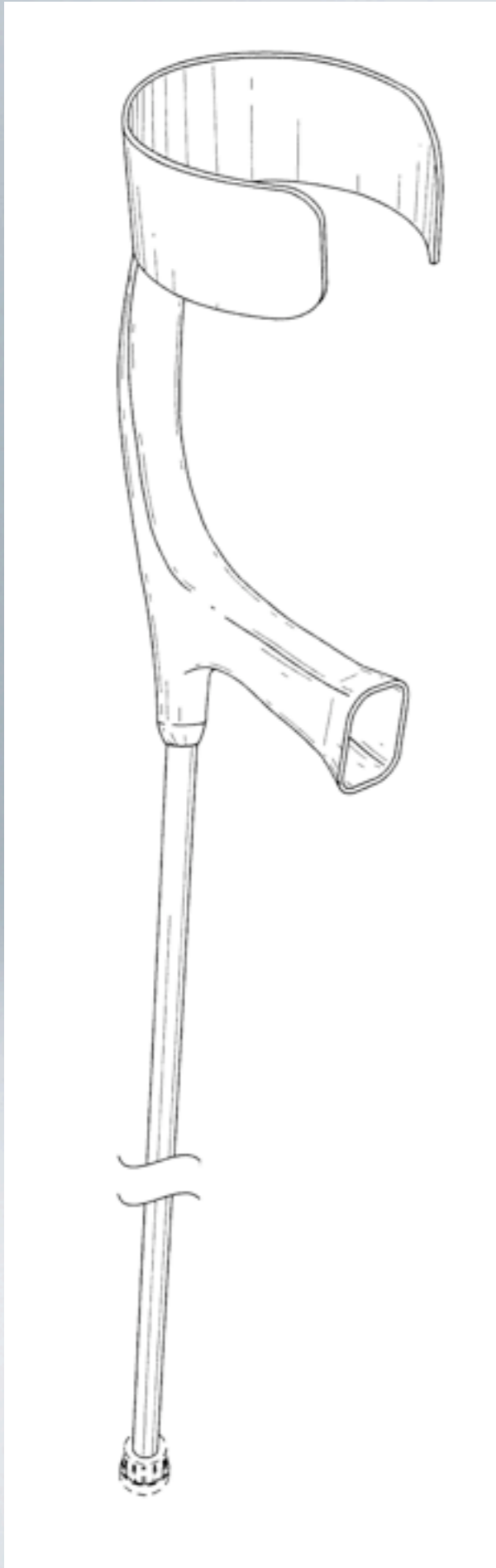
- The original prototype lacks a well functioning interface between the forearms/hands and the corresponding segment on the canes.
- The second iteration sought to provide Dr. Kane better forearm rests and the ability to grip onto the canes using horizontal handlebars.

NEGOTIATING STAIRS

- To negotiate stairs and to customize to personal preferences, Dr. Kane wants the length of the member that is in contact with the ground adjustable.
- While designs that would allow the bottom member to be of varying height were considered, the team was not able to integrate this feature in its final prototype due to shortage of time.



DESIGN CONSIDERATIONS FOR OVERALL CONFIGURATIONS

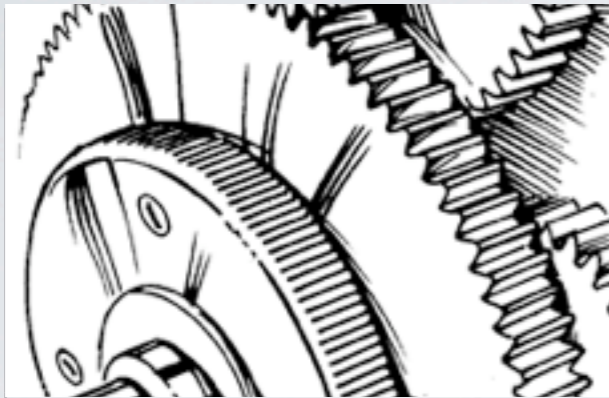


VERTICAL
HANDGRIP

VS.

HORIZONTAL
HANDGRIP

HOW TO MAKE THE ADJUSTABLE ANGLE?



Gear Mechanism

Ratchet Mechanism



Pin-Slot Mechanism

A CONVERSATION WITH DEBORAH KENNEY, MS, OTR/L

From a safety point-of-view, the adjustable angle and height features weren't attractive to Kenney.

General Recommendation: Build Device with the Fewest
Number of Moving and Adjustable Parts

DUE TO THE SHORTAGE OF TIME,

Team Quadruped was not able to consider designs that addressed Kenney's concerns, and pursued the initial design configuration, as suggested by Dr. Kane.

THE OVERALL CONFIGURATION WAS GENERALLY KEPT THE SAME AS THE INITIAL PROTOTYPE

Dr. Kane didn't express this as an area where improvement was needed.

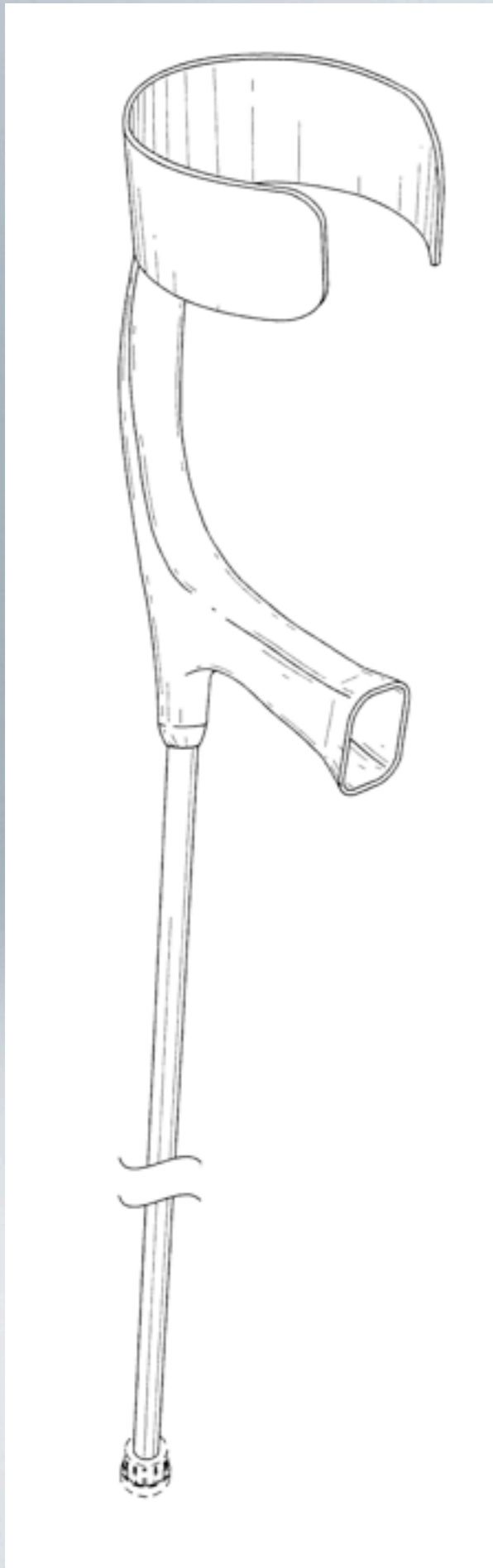
Concern about the arm orientation and position was resolved in a conversation with Deborrah Kenney.

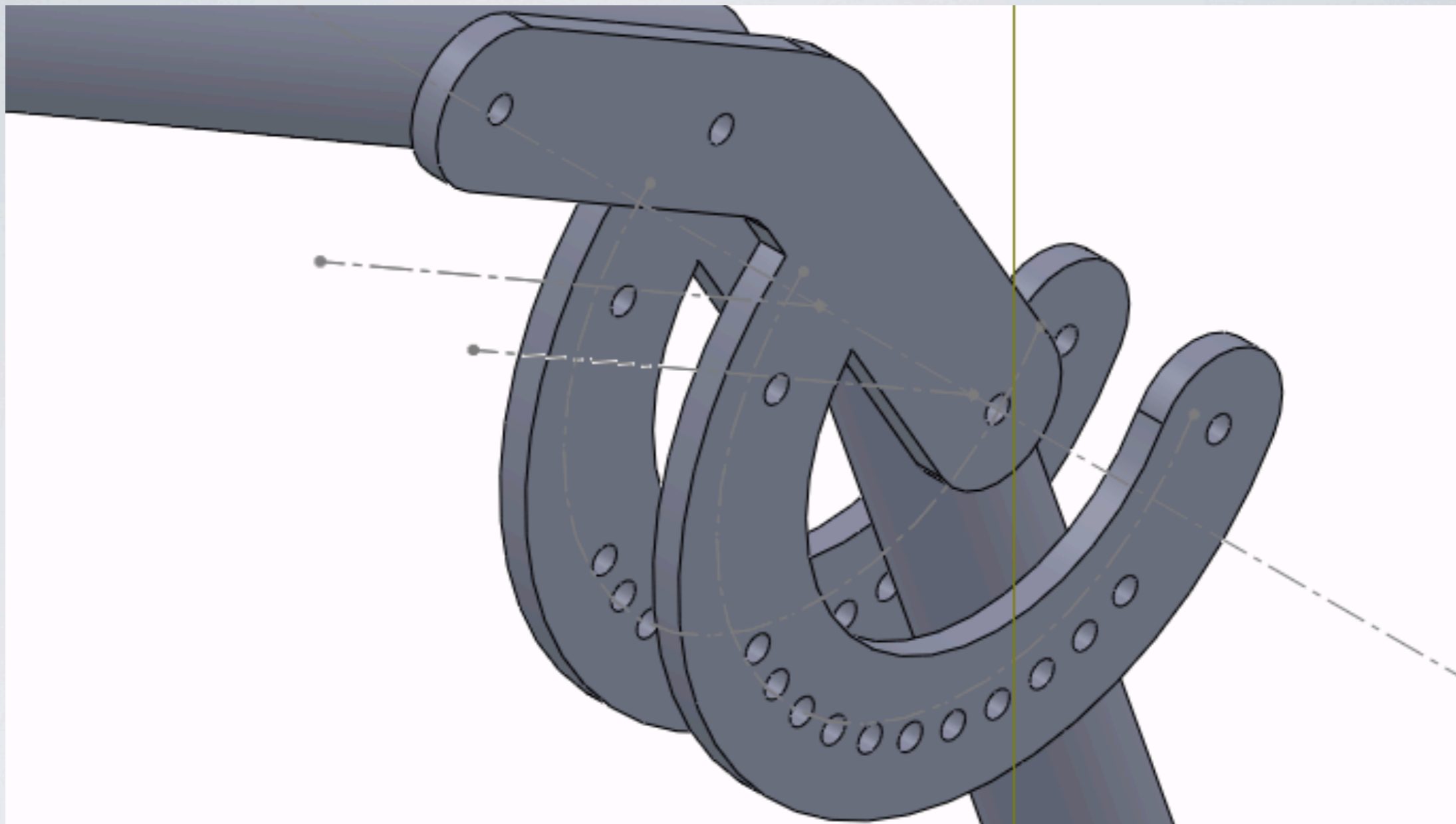


VERTICAL
HANDGRIP

VS.

HORIZONTAL
HANDGRIP WITH
CUFF

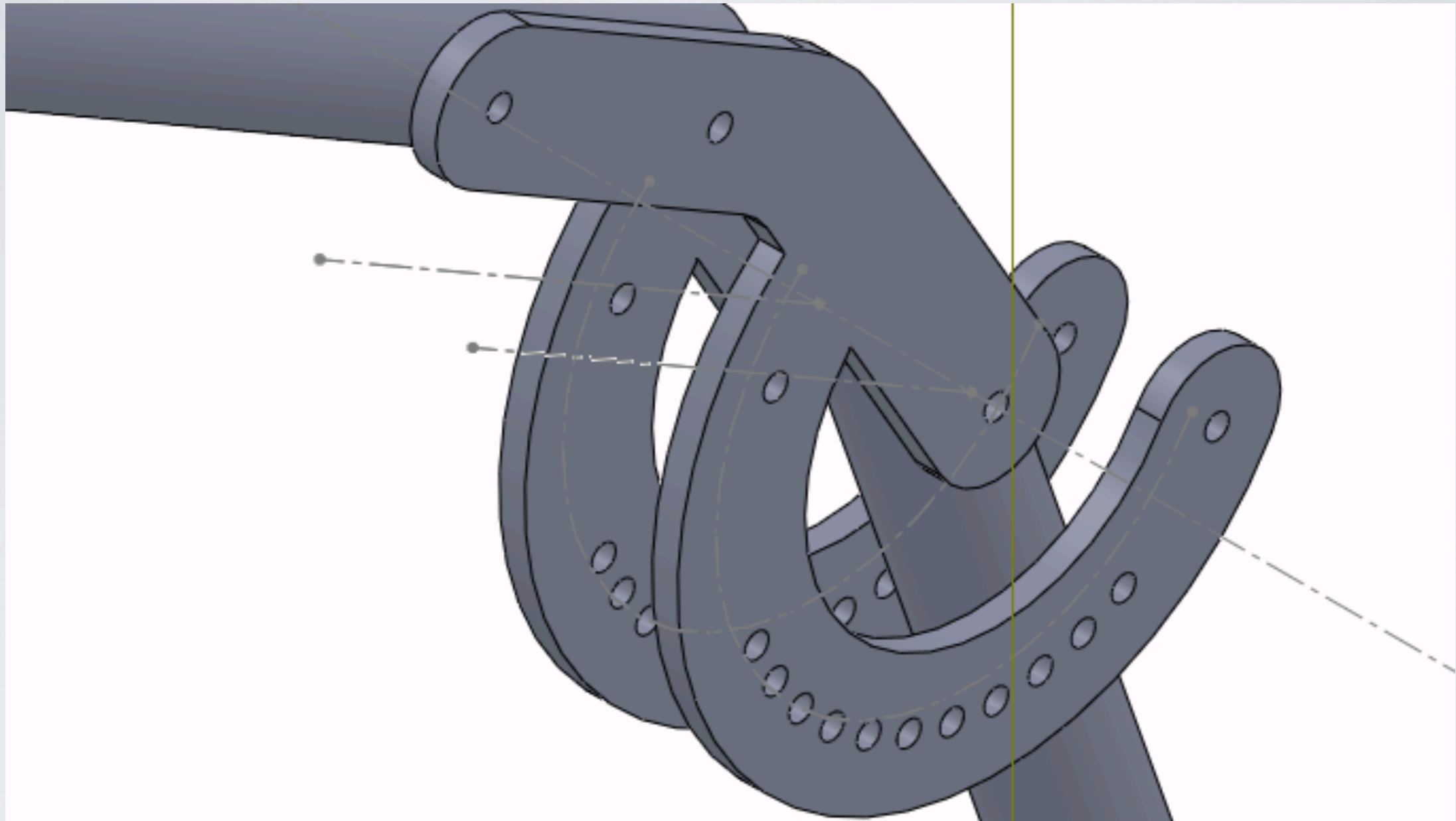




“PIN SLOT” MECHANISM

Original	Intuitive Interface	Wide Range of Angles	Easy to Manufacture	Integrates Well	Strong and Simple
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WEIGHT OF CANE



Wherever possible, efforts were made to minimize the weight of the canes.

FINAL CANE SUMMARY

- Adjustable Angle Feature
- Lightweight
- Horizontal Handlebar for Grip and Cuff for Forearm
- Can Be Conveniently Stored and Transported

ADJUSTABLE ANGLE SUMMARY

- Feature functions in increments of 10 degrees and allows for a wide range of angles.
- The angle can be changed by 40 degrees in both directions with respect to the “vertical”.

REVIEW OF ADJUSTABLE ANGLE FEATURE

- Spring within the ball-detent clevis pin is extremely stiff
- Dr. Kane needed assistance in changing the angles. On a second thought, the current mechanism may not be suitable for him given his eyesight impairment
- Preferred narrower angles (as opposed to wider angles)
- Further extensive testing of the prototype will be beneficial

EFFICIENT STORAGE AND CONVENIENT PORTABILITY



HANDLEBAR AND CUFF

- The diameter and the length of the handgrip allow Dr. Kane to comfortably hold on to the canes using three fingers.
- The shape of the handle bar is tubular and the material used is Delrin. In designing the handgrip for future iterations, an ergonomic analysis should be performed.
- Despite adjusting the cuffs to match his forearms, Dr. Kane didn't feel "buckled in enough". In order to achieve a more sealed connection between his forearms and the canes, Dr. Kane expressed a desire for straps that he can wrap around his forearms.

IN GENERAL

- Dr. Kane was content with the second iteration of the canes and labeled them as “a step in the right direction”.

FUTURE DIRECTIONS

- Improve the 2nd prototype
 - Angle changing mechanism
 - Adjustable height
 - Forearm rests need to feel “securer”
- Consider the next designs also from an occupational therapy POV
- Perform analysis to determine loads

ACKNOWLEDGEMENTS

THANK YOU FOR YOUR INVALUABLE SUPPORT & ADVICE

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- Dr. Thomas Kane
- Mike Norell
- Deborrah Kenney
- Paul Noonan





THANK YOU!