Grab
Always in Reach
User Profile

Investigation

- Market: 2.8 M Wheelchair Users in US
- Testing with Boston Home

Needs

- Improved gripping ability
- Comfortable and intuitive motions
- Compact storage
Concept Vision
## Product Contract

<table>
<thead>
<tr>
<th>Customer Need</th>
<th>Product Attribute</th>
<th>Engineering Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to lift heavier items</td>
<td>Lifting Capability</td>
<td>Lift max load &gt; 5 pounds with end deflection &lt; 3 inches</td>
</tr>
<tr>
<td>Easily stored</td>
<td>Size</td>
<td>Collapsed length &lt; 18 inches</td>
</tr>
<tr>
<td>Personally portable</td>
<td>Weight</td>
<td>&lt; 1.5 pounds</td>
</tr>
<tr>
<td>Minimal grip strength required</td>
<td>Mechanical Advantage</td>
<td>&gt; 2:1 input to output force ratio</td>
</tr>
<tr>
<td>Objects on the ground or shelf are reachable</td>
<td>Extension</td>
<td>Extended length &gt; 30 inches</td>
</tr>
</tbody>
</table>
Design Exploration
Design Exploration

- Underactuated hand with fingers
- Designed around use case
- Conforms to retrieved objects
Risks

- Moments from Extended State
- High Grip Strength Requirement
- Specificity of Gripper Design
- Safety
Model Testing

Moment at Handle is too Large

Reduce Weight of the Product

user | vision | contract | design | risks | testing
Requires Too Much Gripping Force from User

Amplify Force Output From User