

A Method of Prototype Evaluation for Assistive Mobility in Animals: Intervention for a Congenitally Malformed Dog – A Case Study

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Outline

- Case Presentation
- Current Technologies / Research
- Design Goals & Method
- Results
- Future Application
- Questions

Tiny Tim

- Male Chihuahua
- DOB August 20 2006
- Congenital L wrist disartic, R transhumeral



Tiny Tim

- R Shoulder: Fixed 30 deg extension
- L Shoulder: Normal ROM +20 deg hyper extension
- L elbow: 50 deg flexion contracture with 5 deg of additional flexion



Tiny Tim

- Want to be able to take on walks
- Concerned about chin hitting ground
- Concerned about possible scoliosis



Current Mobility Devices



\$430+
(HandicappedPets.com)

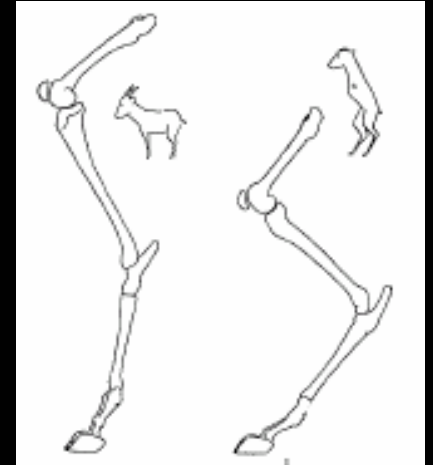
\$400+ (K9carts.com)



\$370+
(eddieswheels.com)

Bipedal Animals

Slijper – Goat (1942)



Liberty Bell (2006)

Faith (2007)



Amputee Dog Literature Review

- Dogs can adapt to 3 legs
- 3 legged stance can lead to scoliosis
- 3 legged dogs have been fit with prosthetic devices
- No detailed reports on the method of designing a device or training an animal to use the device



Methods & Goals

- Overall Goal: **Increased Mobility**
- Design Problem #1: **Create Usable Device(s)**
 - Owner can don/doff device(s)
 - Dog must tolerate device(s)
 - No “complaint” for 10 min’s of wear
 - No redness lasting >10 min’s after doffing device
 - Dog must be able to ambulate 5 feet*

Methods & Goals

- Overall Goal: **Increased Mobility**
- Design Problem #2: **Verify Increased Mobility**
 - Create a repeatable measure of mobility
 - Adaptation of the Timed Up & Go test
 - Measure mobility with and without the device(s) on different surfaces and compare
 - Carpet, hardwood, grass, asphalt
- Additional Goal: **Prevent Chin from Hitting the Ground**
 - Verified by visual assessment in the Timed Up & Go test

Design Problem #1: Create Usable Device(s)

- Owner can don/doff device(s)
 - instant
- Dog must tolerate device(s)
 - 3 prototypes for assisted standing
 - Additional Home training was instituted



Home Training Protocol

- All sessions: withhold food before, feed during, praise during
- Start @ 10 min wear
 - Assist if needed
 - Check for redness
 - Increase 10 min's every day or as frequent as possible not to exceed 1 hour
- STOP if excessive redness
- STOP if major objection (not tolerable)

Design Problem #1: Create Usable Device(s)

- Owner can don/doff device(s)
- Dog must tolerate device(s)
 - 3 prototypes for assisted standing
 - 3 prototypes for unassisted standing
- Dog must ambulate 5 feet
 - not able to achieve with 6th prototype
 - Additional Home training → excessive red marks



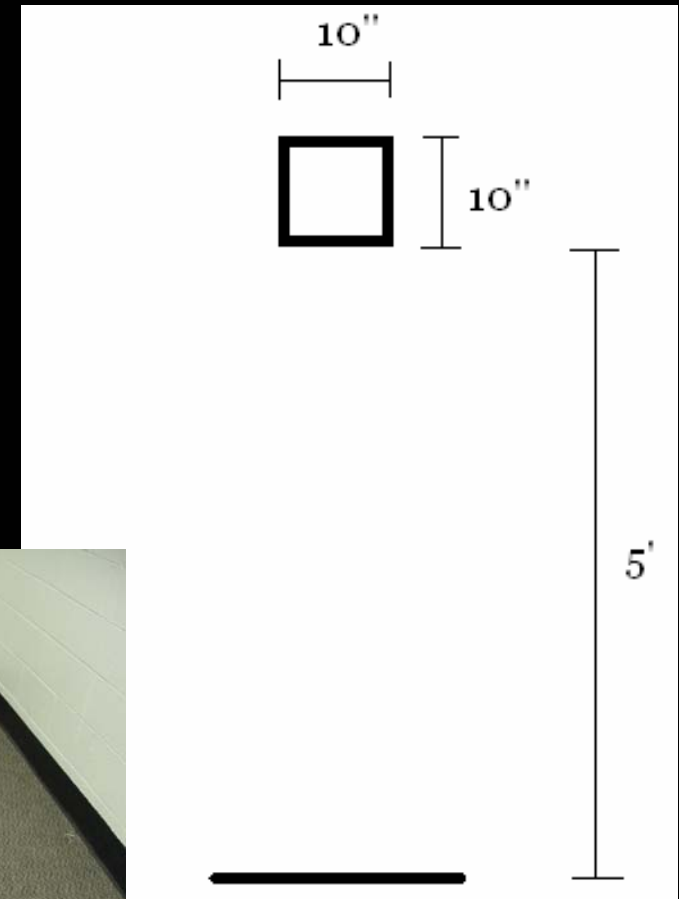
Design Problem #1: Create Usable Device(s)

- Dog must ambulate five feet
 - 2 prototypes using a wheeled system



Design Problem #2: Verify Increased Mobility

- Adapted Timed Up & Go
- Failed Trial if:
 - Dog refuses to finish
 - Dog is unable to finish
 - Dog requires assistance





Timed Up & Go Data



Unaided
18s
17.5s
26s*
9.5s
9s

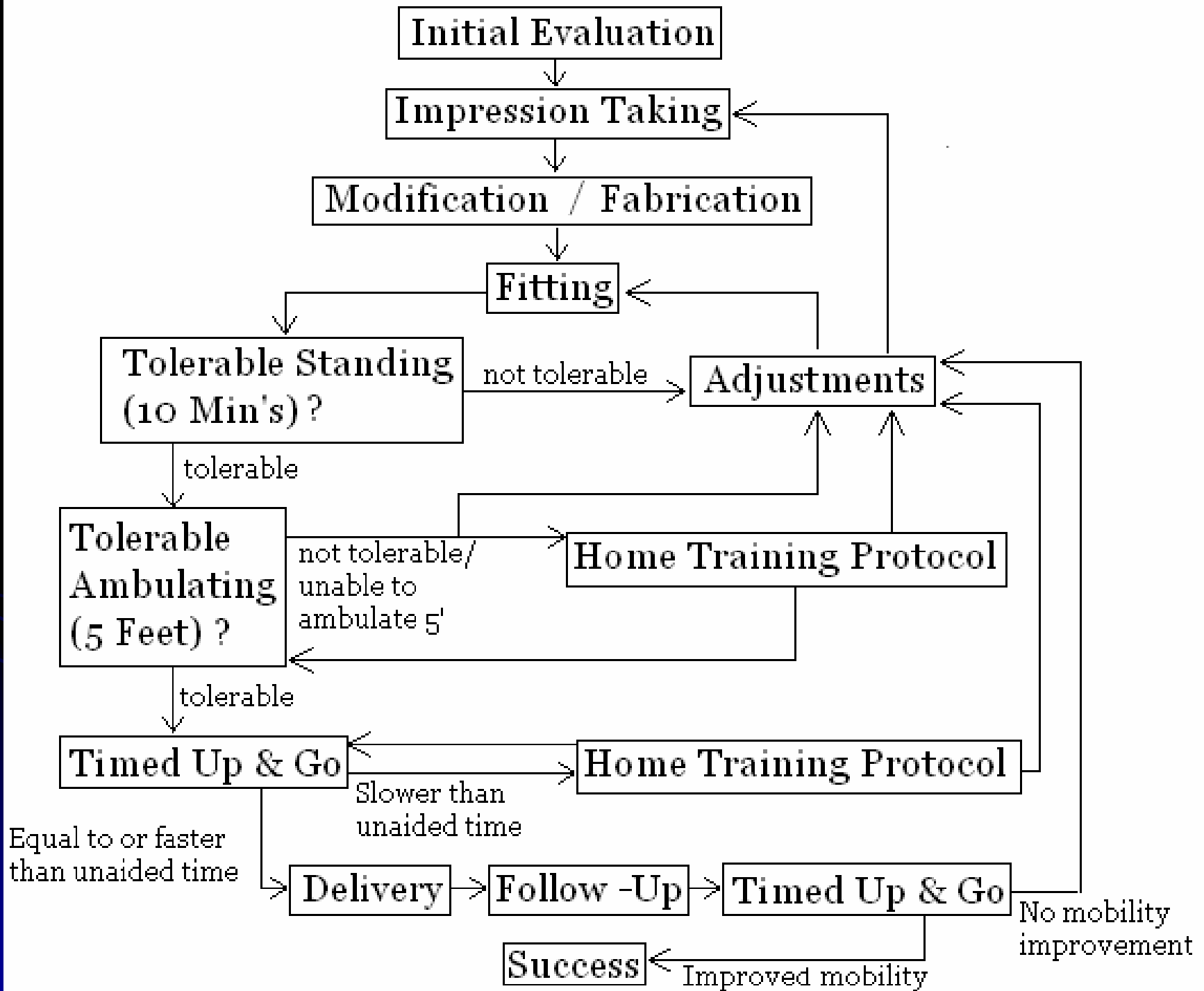
Aided
42s
6.5s
8s



Outside Times (asphalt)	
Unaided	Aided
18.5s	25s

Unaffected
2.5s
2s





Applications / Future

- Decision Tree for future prototypes
- Timed Up & Go test for animals
- Use to develop future prototypes
 - Wire frame
 - Larger wheels
 - Easier to steer

Questions?



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- Pictures for dog rang of motion provided by http://cal.vet.upenn.edu/saortho/appendix_b/appb.htm#shoulder

