

Surveys, Odometers, & Global Positioning Devices

Challenges and Solutions to Measuring Physical Activity
and Participation in Full-Time Wheelchair Users

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1 R21 HDO46540-01A1 "The Impact of Power Assist Wheelchair on QOL"

Thanks to:

- Pete Giacobbi, PhD
- John Chow, PhD
- Mark Tillman, PhD
- Bill Mann, OT, PhD
- Sandy Hubbard, OT, PhD
- Mike Stancil
- Kim Fournier

Clinical Challenges and Solutions



Clinical Challenges and Solutions



Research/Clinical Challenges

- How Should Effects of a PAPA_W Be Evaluated?
- Who Benefits from a PAPA_W?

Medical Model

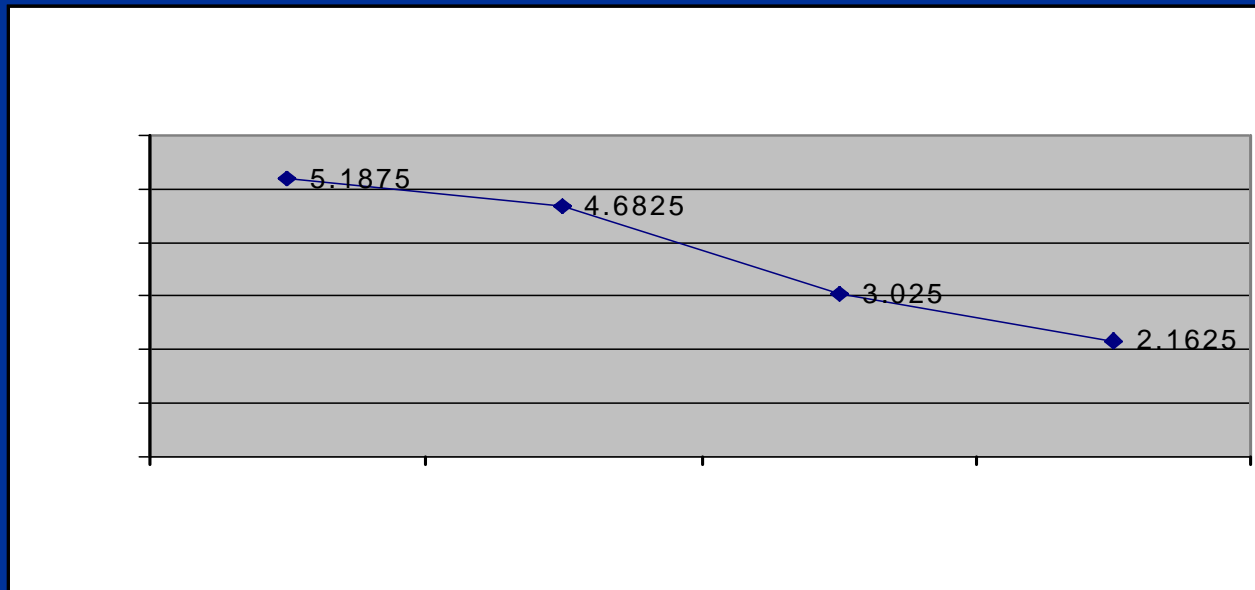
- Examine Physiological/Psychological effects

Impact on Body Function and Structure

- Short term (weeks, months)
 - Pain
 - Fatigue
 - Affect/mood
 - Performance
- Long Term (years)
 - Amount, rate, extent of upper limb injury
 - Radiographic imaging of the upper limb

Do Body Level Outcomes Tell The Whole Story?

Wheelchair User's Shoulder Pain Index



Preliminary Data

Table 1. Participant Ranks and Characteristics

Subject number and age	Average Rank*	Diagnosis	Years Post Injury	Vehicle lift	Overall assessment of power assist wheels
1 (28)	4.3	Spina Bifida, non-ambulatory	28	Yes	Positive
3 (22)	3.3	T5 Complete SCI	6	No	Negative
4 (40)	5.0	T1 Complete SCI	22	Yes	Positive/negative
6 (29)	2.3	T12 Motor Complete SCI	11	No	Negative
7 (38)	1.0	L1 incomplete SCI (limited walking)	19	No	Negative
9 (47)	5.3	C6 Complete SCI with tendon transfers	27	Yes	Positive

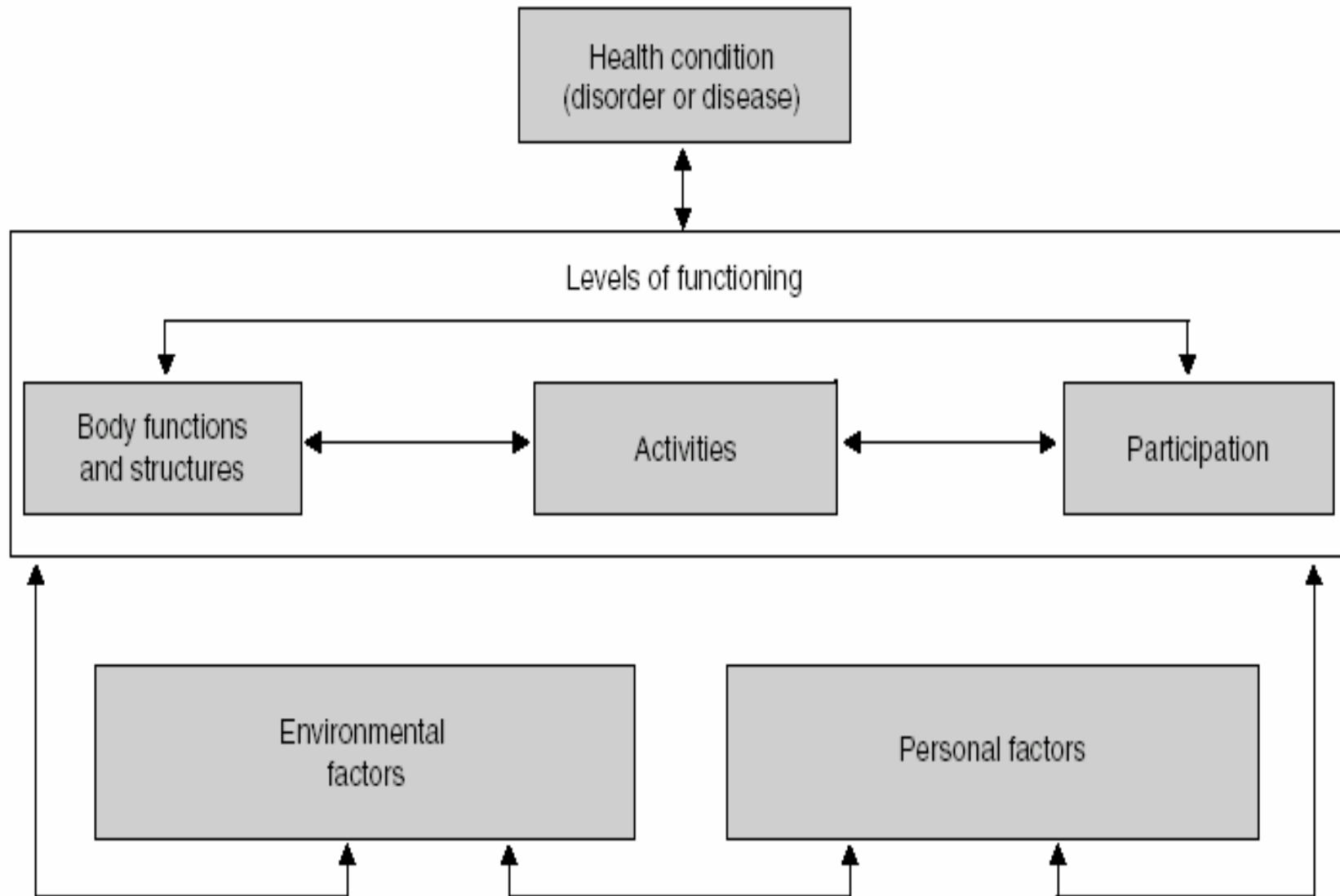
The International Classification of Functioning, Disability, and Health (ICF)

- Model of Disablement
- Medical + Social = Biopsychosocial
 - Body function and structure
 - Activity
 - Participation

Definitions

- Body functions: Physiological/Psychological
- Body Structures: Organs, limbs
- Activity is the execution of a task or action by an individual
- Participation is involvement in a life situation
 - Note: It is difficult to distinguish “activities” vs. “participation”

ICF Summary



How to Measure Activity and Participation?

■ Surveys

- Advantages: Measures users' perceptions
- Quick (not always), Easy (usually), standardizable
- Inexpensive , Relatively simple

■ Disadvantages:

- Depends on recall,
- Subjective bias

Logs

- Advantages
 - Participants' direct report of activity/participation
- Disadvantages
 - Dependant on recall
 - Demands persistence

Odometers: Activity

- Relative Distance



Odometers Measure Relative Distance

■ Advantages

- An objective measure of activity
- Relatively inexpensive

■ Disadvantages

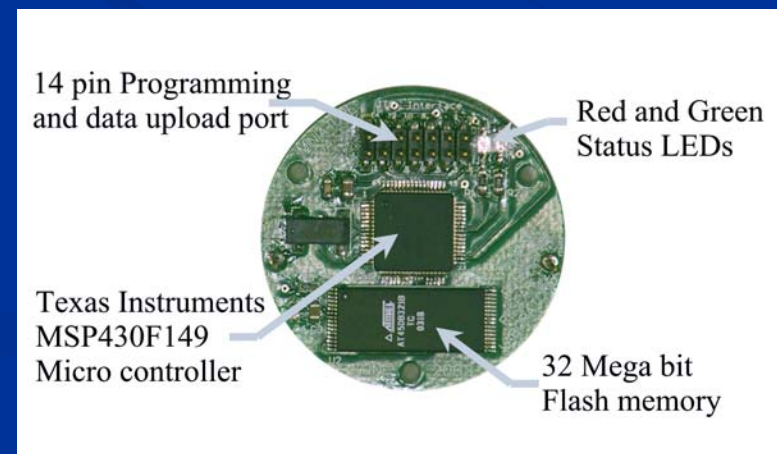
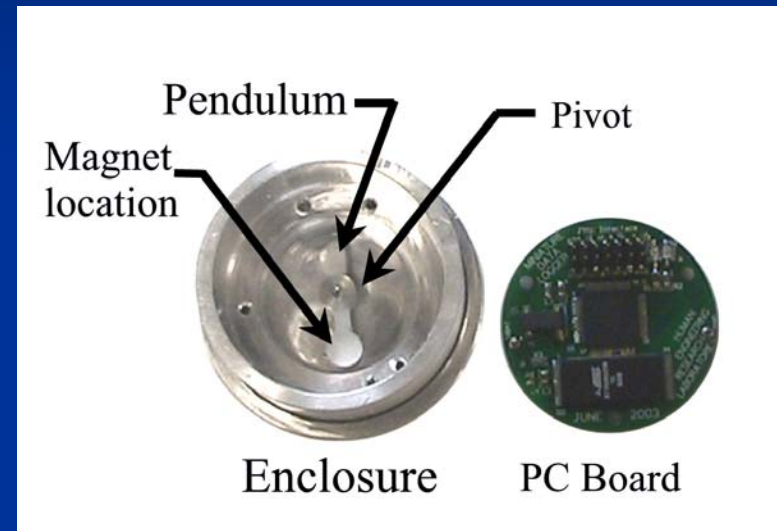
- Does not tell much about participation
- Data must be recorded (daily? weekly?)

Data Logger: Activity Measure

- Gives time stamp and distance
- Absolute Time, Relative distance

Miniature Data Logger

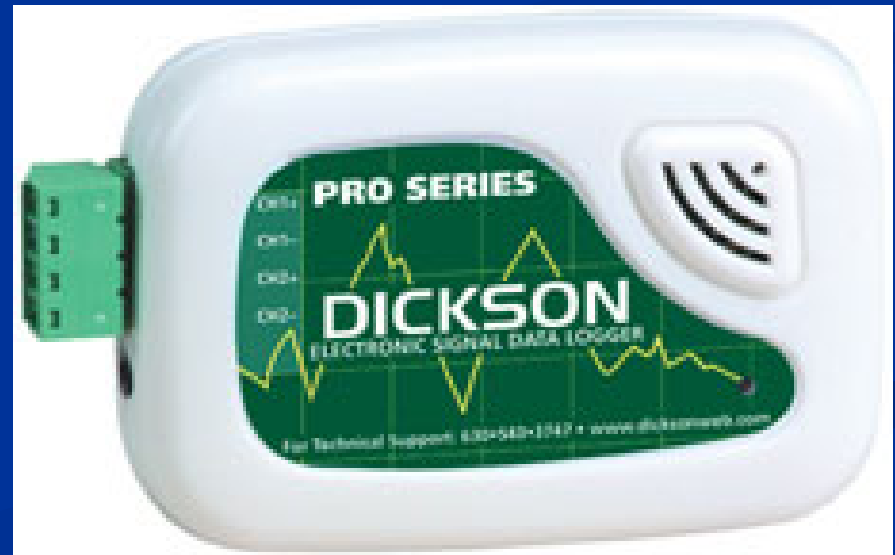
Human Engineering Research Laboratories, Pittsburgh VA Healthcare System



Commercial Data Logger

http://www.dicksonweb.com/product/model_ES120.php

- \$200/unit
- Requires an external sensor
- Mainstream methods of transferring and decoding data
- Memory capacity?
- Watertight?



Global Positioning Devices

■ Advantages

- Direct measure of destination...implies participation
- Data collection can be accomplished at a distance
- May also measure absolute distance

■ Disadvantages/Challenges

- Data may disappear inside buildings,
- Lots of data: how to quantify?

Body Function and Structure

■ WUSPI (pain)

- Curtis, Kathleen, et al., 1999. Shoulder Pain in Wheelchair Users with Tetraplegia and Paraplegia. *Arch. Phys. Med. Rehabil.* 80:453-57

■ Affect (PANAS)

- Watson D, Clark LA, Tellegen A. Development and validation of brief measures of positive and negative affect. The PANAS scales. *Journal of Personality and Social Psychology*, 1998;54:1063-70

■ Fatigue SF-36: Physical Fatigue Subscale of Physical Functioning subscale

- Ware JE. SF-36 Health Survey: Manual and interpretation guide. Lincoln (RI): Quality Metric; 2000.

■ Wheelchair performance in laboratory

Activity/Participation

- DLE-R
- Physical Activity Scale for Individuals with Physical Disabilities (PAS-PD)
- Odometer
- Global Positioning Device

Daily Life Events Checklist Revised

- Daily Events: Please rate those events that happened since you awoke this morning. For those events that occurred, complete the rating scale next to the event. Do not write anything if you did not experience the event.

Stone AA, Neale JM. Development of a methodology for assessing daily experiences. In Baum A, Singer J, editors. *Advances in environmental psychology: Environment and health*. Hillsdale (NJ): Erlbaum, 1982;4:49-83

Giacobbi PR, Jr, Hardin B, Frye N, Stegelin A, Hausenblas H, Sears S. The relationship between exercise and daily outlook with physically disabled individuals: A naturalistic investigation. (submitted)

DLE Ratings

- 1 = Extremely Desirable/Positive
- 2 = Moderately Desirable/Positive
- 3 = Slightly Desirable/Positive
- 4 = Slightly Undesirable/Negative,
- 5 = Moderately Undesirable/Negative
- 6 = Extremely Undesirable/Negative

Concerning Co-Workers, Employees, Supervisees, and/or Clients

- Positive emotional interactions and/or happenings with co-workers, employees,
 - supervisees, or clients (work events that were fulfilling)
- Negative emotional interactions and/or happenings with co-workers, employees,
 - supervisees, or clients (work related events that were frustrating or irritating)
- Firing or disciplining done by you
- Socializing with staff, co-workers, employees, supervisees, or clients

Disability Specific Issues

- Trouble gaining access to parking
- Trouble with wheelchair (wheel pressure, equipment problems)
- Difficulty with transportation
- You heard positive news regarding your disability
- You overcame some difficulty related to your disability
- You gave a public speech or testimonial about your disability
- You engaged in public advocacy about disability rights/issues.
- Someone patronized you

DLE-R

■ Advantages

- It is a daily instrument.
- Long research tradition used with adults in community settings. Construct validity is well established
- Recently used to assess associations between daily events and exercise with community dwelling adults with physical disabilities

■ Disadvantages

- It's a long measure (20 minutes the first time, shorter with experience)

PAS-PD: Household Activity

- During the past 7 days, how often have you done Light Housework such as dusting, sweeping floors, or washing dishes
 - A. never (go to question #8)
 - b. Seldom (1-2 days)
 - c. Sometimes (3-4 days)
 - d. Often (5-7 days)
- On average, how many hours per day did you spend
 - a. Less than 1hou
 - b. 1 but less than 2 hours
 - c. 2-4 hour
 - d. More than 4 hours

Washburn RA, Zhu W, McAuley E, Frogley M, Figoni SF. The physical activity scale for individuals with physical disabilities: Development and evaluation. Arch Phys Med Rehabil 2002;83:193-2000.

PAS-PD: Leisure Time Activity

- During the past 7 days how often did you engage in *stationary activities* such as reading, watching TV, computer games, or doing handcrafts?
- ...in *moderate sport and recreational* activities such as doubles tennis, softball, golf without a cart, ballroom, dancing, wheeling or pushing for pleasure or other similar activities?

Physical Activity Scale for Individuals with Physical Disabilities

■ Advantages

- Developed specifically for individuals with physical disabilities
- Scores for different activities (work, moderate sport, vigorous sport, total score) are roughly equivalent to MET scores
- Published normative data

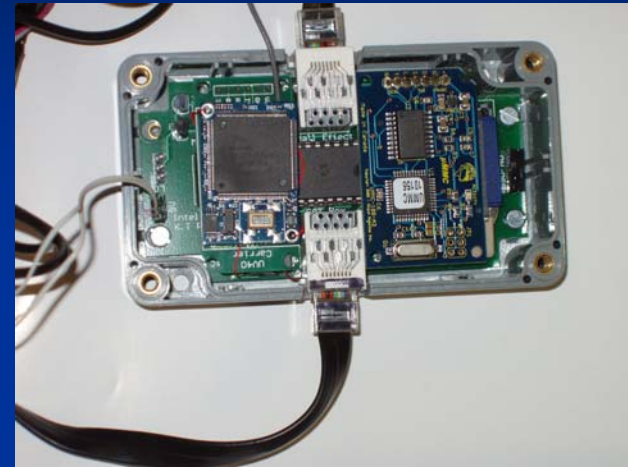
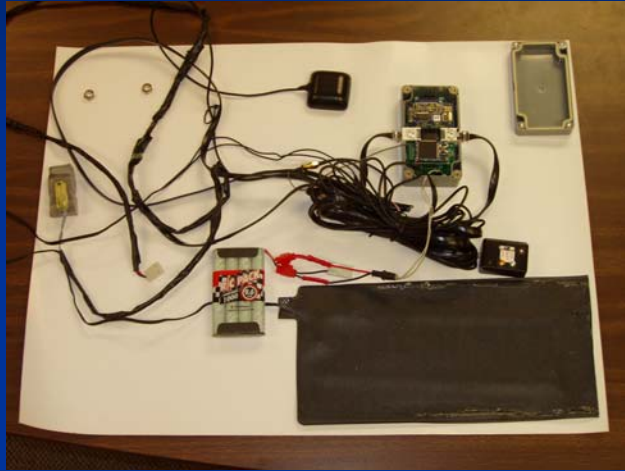
■ Disadvantages

- Recall
- Potential for biased responses

Global Positioning Devices

- Make Your Own
- Buy One

Make Your Own



Raw GPS Data

2/21/10	21:17:51	00I	00I	0	3		
2/21/10	21:18:03	00I	00I	0	10		
2/21/10	21:18:16	00I	00I	0	10		
2/21/10	21:18:28	00I	00I	0	10		
2/21/10	21:18:41	00I	00I	0	10		
2/21/10	21:18:53	00I	00I	0	10		
2/21/10	21:19:06	2937.13	N	8222	W	0	10
2/21/10	21:19:19	2937.13	N	8222	W	0	10
2/21/10	21:19:31	2937.13	N	8222	W	0	10
2/21/10	21:19:44	2937.14	N	8222	W	0	13
2/21/10	21:19:56	2937.14	N	8222	W	0	13
2/21/10	21:20:09	2937.15	N	8222	W	0	13
2/21/10	21:20:22	2937.15	N	8222	W	0	13
2/21/10	21:20:34	2937.16	N	8221	W	0	13
2/21/10	21:20:47	2937.16	N	8221	W	0	13
2/21/10	21:20:59	2937.16	N	8221	W	0	13
2/21/10	21:21:12	2937.17	N	8221	W	0	13
2/21/10	21:21:24	2937.16	N	8221	W	0	13
2/21/10	21:21:37	2937.16	N	8221	W	0	13
2/21/10	21:21:50	2937.16	N	8222	W	0	13
2/21/10	21:22:02	00I	00I	0	13		
2/21/10	21:22:15	00I	00I	0	16		
2/21/10	21:22:27	00I	00I	0	16		

A Commercial GPS

- Wherify GPS Watch
 - Website displays location within a few feet and displays it on an aerial photo or street map
 - “Bread Crumb” feature allows checks at predetermined intervals
 - Cost: \$200 plus \$20-45 monthly fee.

Wherify Watch

■ www.wherifywireless.com/



Wherify Tracking



Welcome John Doe. Please use the buttons on the left to manage your device(s).

[Manage Devices](#)

[Manage Account](#)

[Technical Support](#)

[Contact Wherify](#)

[Log Off](#)

NewPhone ▼

[Pgm Button for Call](#)

[Pgm Button for Locate](#)

[Setup Breadcrumb](#)

[Send Text Message](#)

[Perform Locate](#)

[Emergency Locate](#)

[Display History](#)

Set Breadcrumb

* All fields marked with an asterisk are required

Number of Locates * Min of 1; Max of 64

Number of Locates

Time between Locates * Min of 1; Max of 999

Time between Locates

Report back interval Min of 1; Max of 99

Report back interval

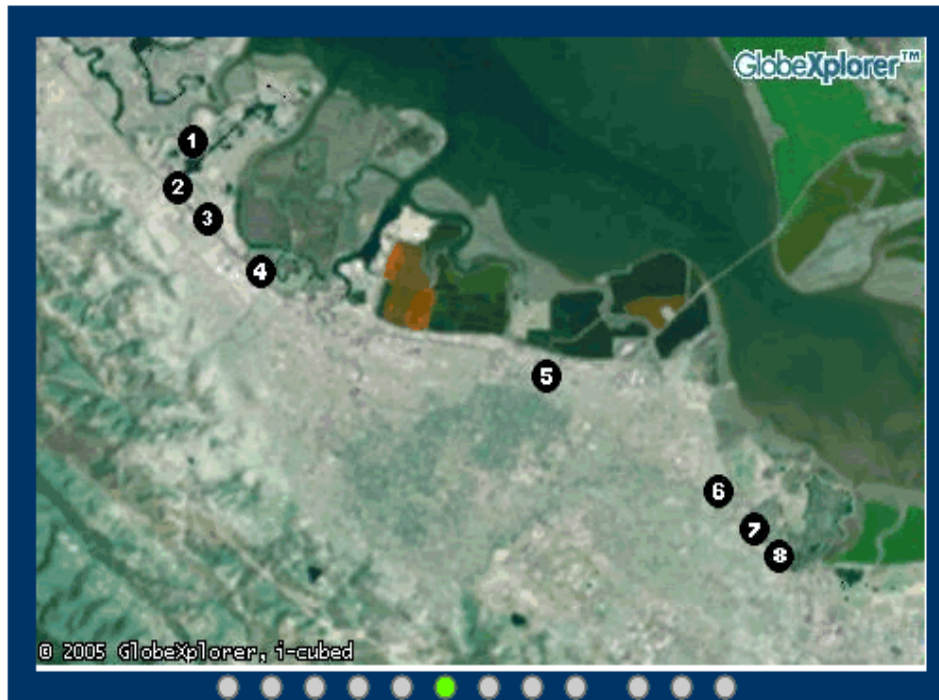
Set Breadcrumb

Wherify Mapping



Mapping Complete!

Wherify Mapping



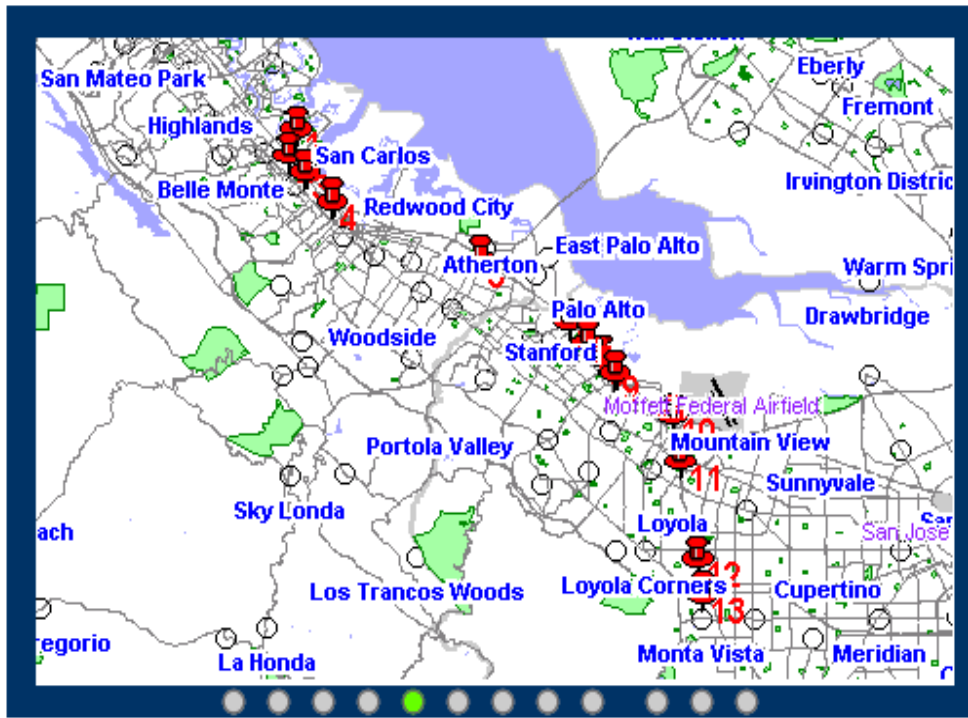
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796 Bridge Pkwy
Redwood City, CA 94065
- 2) [2/3/2005 4:54:12 PM](#)
1262 Shoreway Rd
Belmont, CA 94002
- 3) [2/3/2005 4:53:31 PM](#)
500 Skyway
San Carlos, CA 94070
- 4) [2/3/2005 4:52:31 PM](#)
800 American St
San Carlos, CA 94070
- 5) [2/3/2005 4:48:27 PM](#)
100 Pierce Rd
Menlo Park, CA 94025
- 6) [2/3/2005 4:44:53 PM](#)
2286 E Bayshore Rd
Palo Alto, CA 94303
- 7) [2/3/2005 4:44:05 PM](#)
1198 Colorado Ave
Palo Alto, CA 94303

Wherify Street Map



Mapping Complete

Wherify Mapping



- 1) [2/3/2005 4:58:31 PM](#)
796 Bridge Pkwy
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1198 Colorado Ave
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Challenges/Solutions

- How to appreciate and quantify the impact of mobility equipment? Consider the ICF framework.
- How to measure activity and participation?
Consider surveys, logs, odometers, GPS.
Qualitative interviews

Challenges / We are still working on it

- Which logs, surveys, odometers, GPS
- What is a significant difference in distance? In participation?

Questions?

