

In the final model, a ubiquitous medical device has been reexamined to include greater functionality by offering multiple uses as a walking device, a resting device, and a seating device, and offering an aesthetic appeal by addressing issues of beauty, comfort, and form.

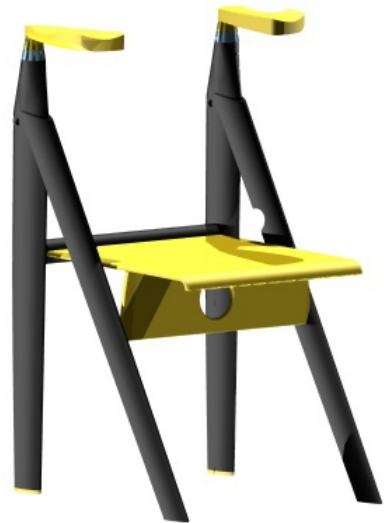
Several possible material options are shown above, including a model composed of a black anodized cast aluminum frame with a wood veneer seat pictured on the left. Pictured on the right are versions in brushed aluminum and wood veneer (top) and anodized aluminum with a colorful molded plastic seat.

Although not pictured in an effort to show clarity of form, the walker would be customized at the point of purchase to include accessories as standard, ranging from a removable bag (as seen on page 35) that attaches underneath the tray, attachable wheels, to various cutout options on the tray (to accommodate purses or extra cups). The models shown in the following pages feature a nylon foot on the front legs to provide smooth movement. The handles, molded in a soft material such as santoprene, provide multiple options for use. A concavity extending the length of the handle along the top provides a respite for forearms while a slightly deeper oval recess allows for a comfortable grip.

The design of the proposed walker engenders a sense of pride in the user through by elevating a piece of standard medical equipment to the realm of a personal accessory.



In the UP position the seat functions as a guard, providing a sense of security for the user. A hole in the built-in tray provide a dual function as a cup holder and a handle.



The walker transforms quickly and easily from a walking device to a seating device. A pneumatic assist housed in the cylindrical bar behind the seat helps the user effortlessly transform the tray into a seat. Grooves in the back legs hold the seat in place.

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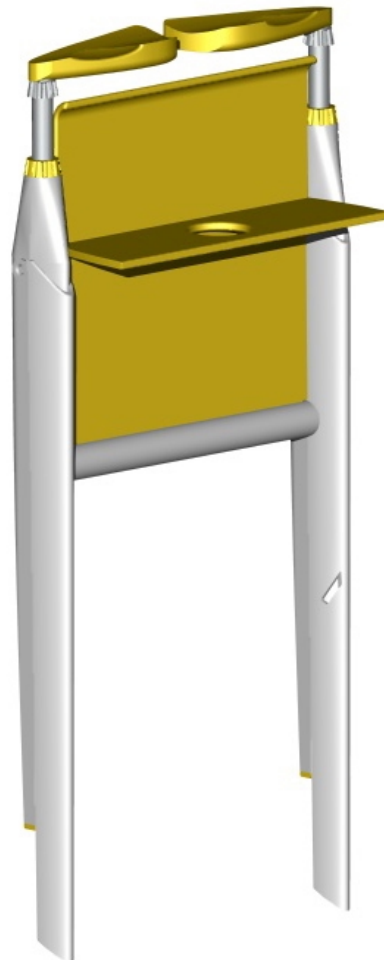
The handles are attached to a rod housed in the front legs and are height adjustable. To operate loosen the lower knobs, adjust handle height and tighten knobs. Use the upper knob located just underneath the handles to control the rotation angle of the handles.



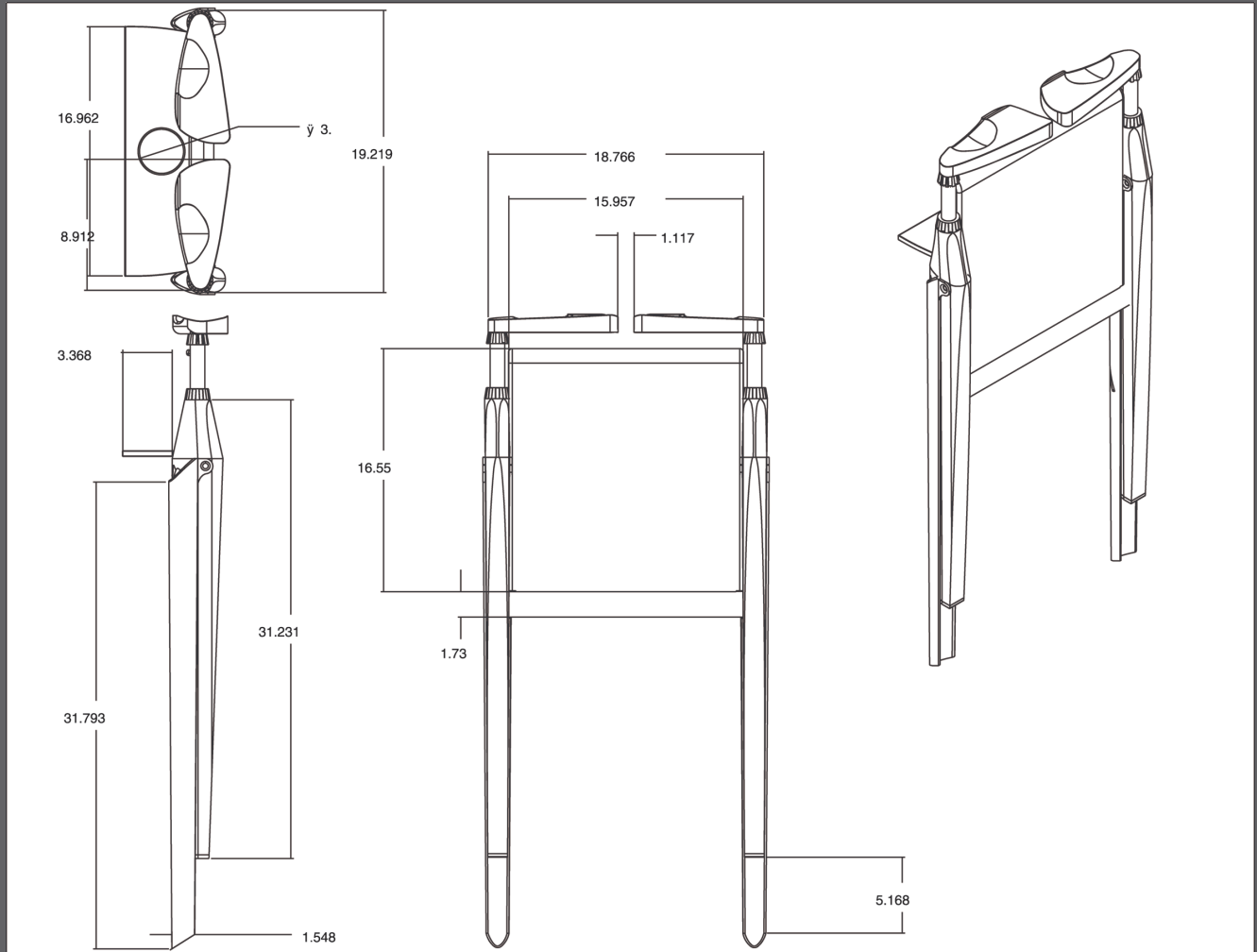


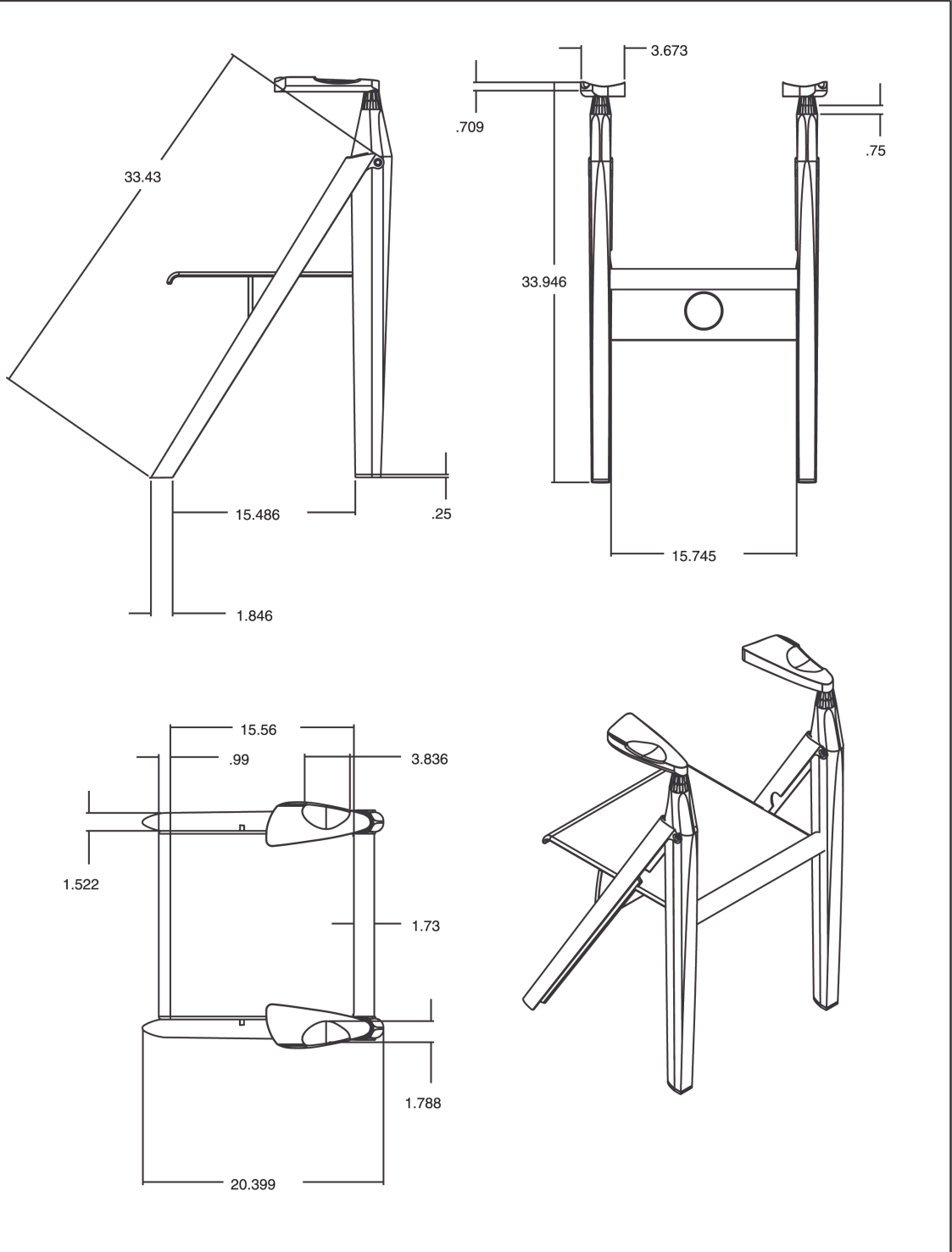
Rotate the handles 90 degrees and lock into place to form a comfortable backrest when using the walker as a seating device.

To close the walker, raise the seat to the UP position, press the button on the outside of each leg to release, and fold shut. The rotating handles face inward to further reduce the total volume of the unit. When the unit is collapsed the cup holder serves as a convenient handle to facilitate transport of the device.



Engineering Drawings





Considerations for Engineering Development

Describe the conditions in which:

santoprene handles meet the metal extrusions

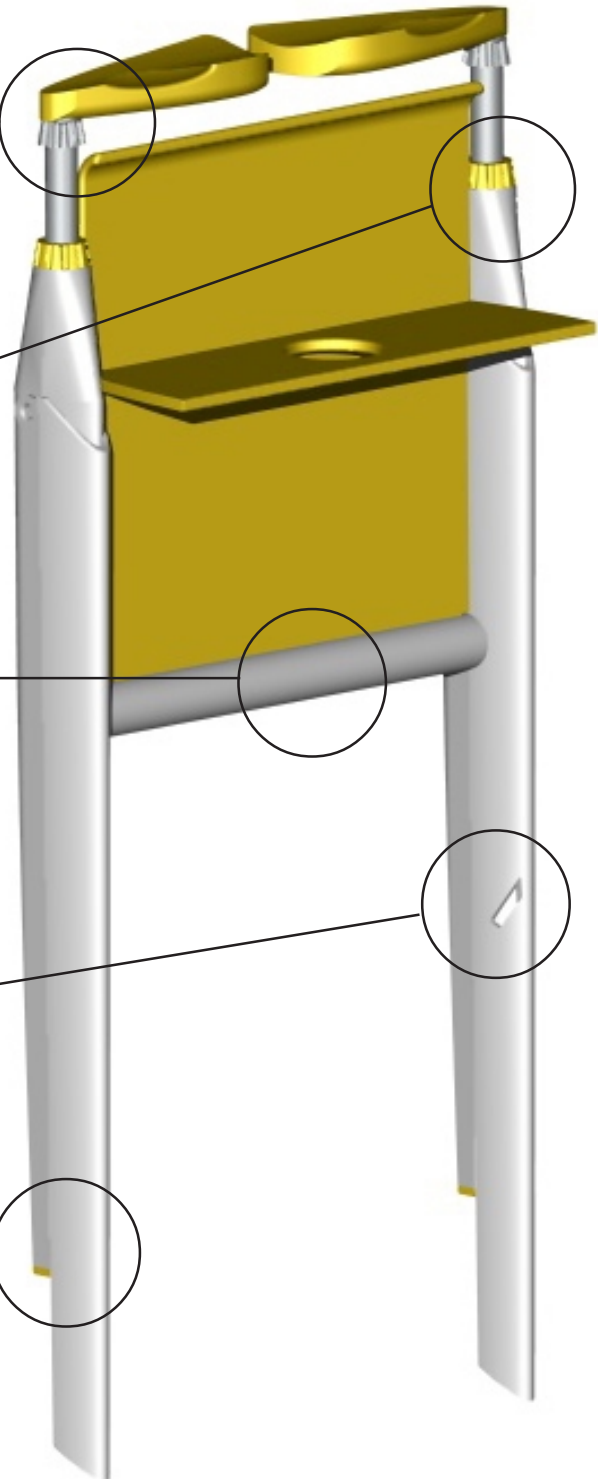
the handle height position is controlled by a push button release, adjust, and set.

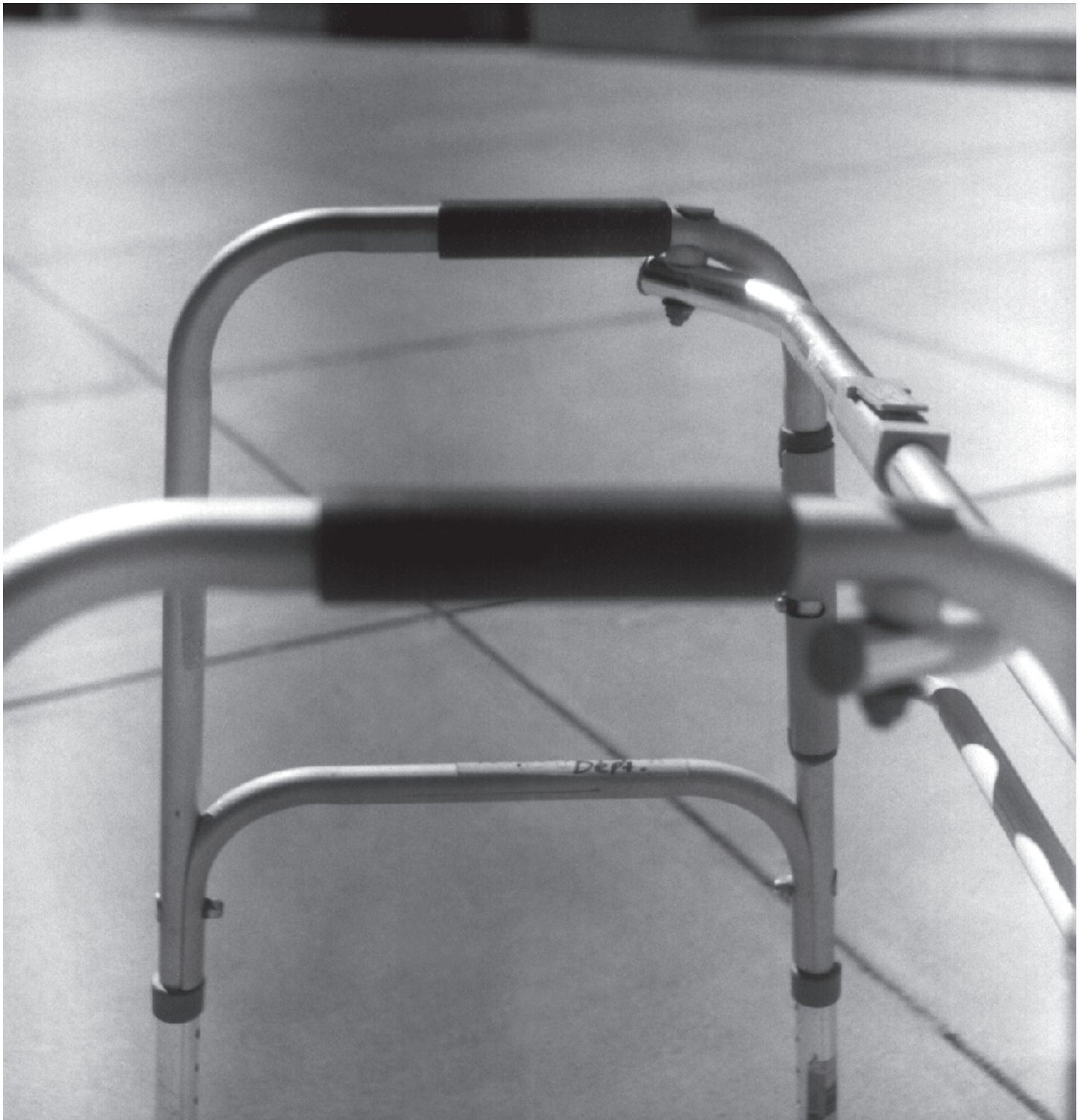
a controlled spring mechanism located in the seat pivot enables the user to effortlessly raise and lower

the seat meets the leg in the lowered position

optional wheels attach to legs

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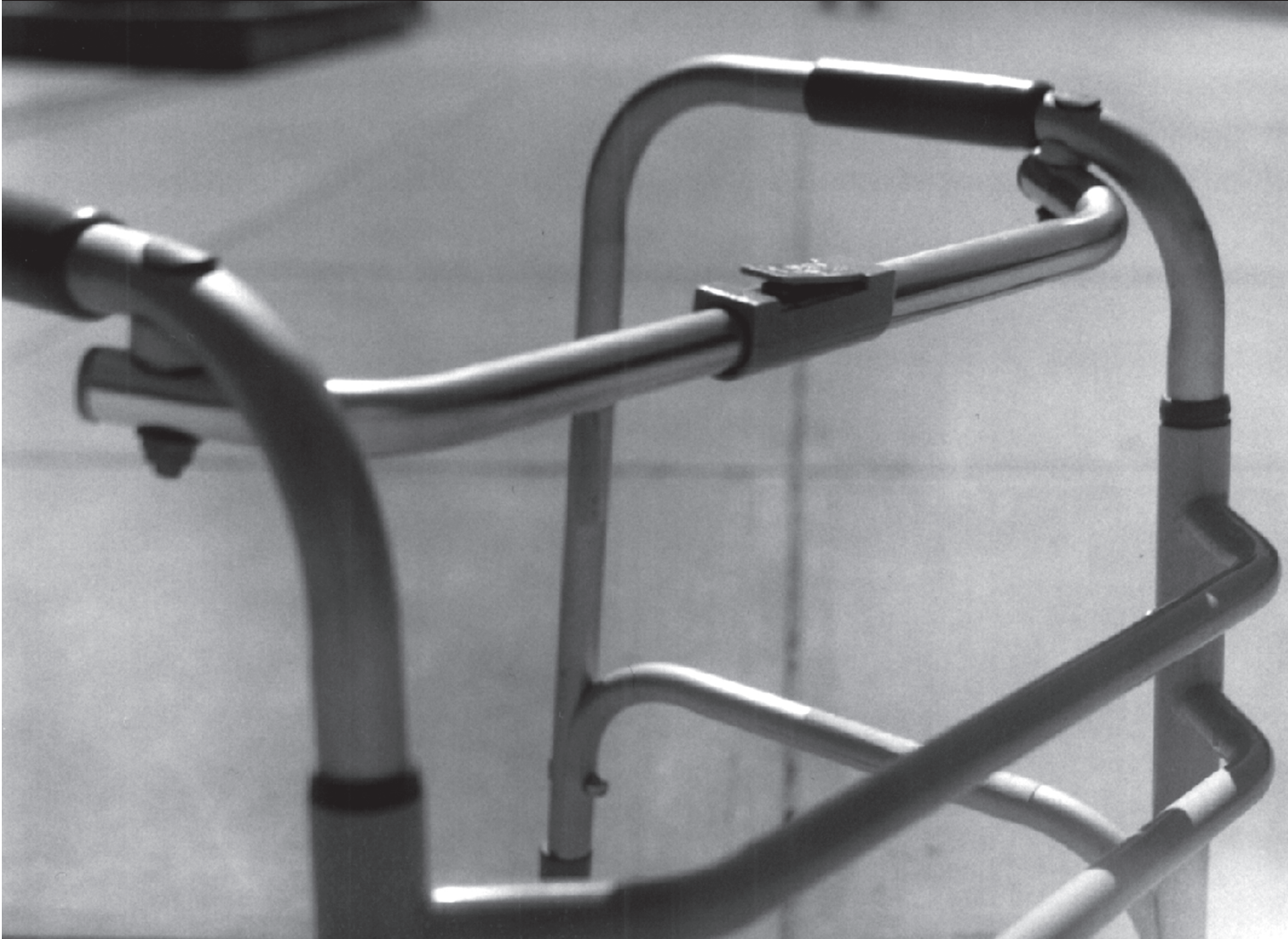
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Appendix

Part One: Results of Person to Person Interviews with Physical Therapists, Spring 2002:

Location: Heritage Hall Nursing Home, Blacksburg, VA

Description: Long Term Care Facility

Participants: Karrie Vogel, Physical Therapy Assistant
Deborah Pizzi, Physical Therapy Assistant

The following tape recorded interview has been translated and paraphrased by the interviewer:

Karrie: We are a long term care facility. Patients usually come here because their families can't provide 'round the clock care for them. Only about five percent of our patients ever leave. Ninety five percent are here until death. And many suffer from some form of dementia.

Interviewer: Acquaint me with the walker, in general:

Deborah: The walker provides a good base of support (BOS) and provides the most stability of the assistive walking devices, namely, walkers, canes, and crutches. Initially, the physical therapist introduces the patient to a walker, either rolling or four point, depending on ability and /or injury. The patient is taught to place the walker within an arm's reach in front of his body before taking a step. He then steps forward on the involved, or injured, leg or, if no injury is involved, the weaker leg. The patient is cautioned not to step too close to the front of the walker as doing so risks injury or falling. The patient is then instructed to follow through with the uninvolved or stonger leg. With enough practice, he should develop a smooth and natural gait. Some patients progress to the use of a hemi-walker, which is used with one hand, much like a cane, on the stronger side of his body. Users consist mainly of stroke patients who have gained stability over time. The walker is measured individually by a patient's physical therapist or doctor. The height of the walker generally reaches the greater trochanter, the upper part of the femur; It is at this point that the handle meets the wrist. A 20 to 30 degree of flexion at the elbow is standard.

Interviewer: There are so many different varieties of walkers available. How does a therapist or doctor decide what type of walker a patient needs?

Deborah: Mainly, it depends on the patient's endurance level. For instance, if the patient is strong enough, the caregiver will recommend a standard four point walker. This is walker with four fixed feet. The patient is instructed to lift and place the walker according to the gait pattern appropriate for their needs. If the patient experiences frequent or general fatigue, or decreased endurance, for example if the patient suffers from cardiopulmonary disorder (CPD), he is generally prescribed a rolling walker. This way, the user does not need to expend energy lifting the walker during his gait sequence. Instead, he rolls the walker forward as he steps.

Interviewer: Are you saying that the four point is more stable than the rolling walker?

Deborah: It depends on the user. A four point walker is more stable as a unit in that it has no ability to roll. A wheel can let a person slide out of control. A four point is best for outside. However, especially in the case of gravel, it is crucial that all four points are placed on the outdoor surface evenly and grounded before the user takes each step. If the user is accustomed to using a rolling walker, I would recomend a wheel with tread for outdoor use as well as hand brakes, which require a certain degree of dexterity. I would caution against the use of wheels on both the front and back tires as I feel it is too unstable. Rolling walkers are especially great for the person who needs just a little bit of assistance. I like the ones with the stopper extension that acts as a braking device-when the user presses on the handle the foot becomes engaged and acts as a brake.

Interviewer: Would it be advantageous, in your opinon, for a patient to have a standard four point walker with an optional wheel attachment ?

Deborah: Maybe, for instance, if the person were pretty ambulatory for the most part, but tended to tire out at times. Usually, one or the other would be sufficient. Generally, we try to build the patient's comfort level with one or the other to get them trained with one style of lift and gait.

Karrie: Patients get used to their usual routine. For instance, if the person is used to a four point, when we give them a rolling one, most of the time, they still pick it up and move it as if it had no wheels. There is also the risk of falling. If the patient is not use d to the wheels, it does present a risk.

At this point during our talk, Karrie had me test drive a wheeled walker. Our conversation led to a discussion of annoyances with the standard wheeled walker:

Karrie: These walkers are.... Here you try it. Tell me what you think....

Interviewer: (I take a few practice steps with th e walker, simulating a proper gait) Oooh, I don't like that noise, it's awful, it's disconcerting. It's loud.

Karrie: Anything else?

Interviewer: Yeah. It's vibrating when I try to move it. It's jarring. The rubber stoppers on the back legs are vibrating on the floor with each movement of the walker.

Interviewer: What kinds of alterations or modifications do you typically encounter ?

Deborah: Most of them are height adjustable. Some have baskets. Or feet to help them glide. Those cost extra. Most people use tennis balls. The tennis balls eliminate both the noise and the vibration that you experienced when you tried to use the walker. Most of our patients are on medicare, and since most of us(therapists) play tennis, its a lot cheaper to pick up stray tennis balls , rather than try to order extra parts.

Karrie: I sometimes add weights to the walkers for patients, for instance, who have had strokes and experience numbing, or tingling sensations in their upper extremities and therefore have trouble assessing where their limbs are in space. It's sort of like the feeling when your hand falls asleep. The weights give the patient something more substantial to push. This way he can feel where he's going and gain more confidence and control over his movements.

Interviewer: What about collapsibility--Is that a desired feature ?

Deborah: If the patient is stable enough to control and use the walker and fairly ambulatory, they love the convenience of storage. Some don't have the dexterity to open and close the walkers. Dementia can inhibit a person's ability to control opening and closing of the walker as well. This could be dangerous, especially if he went to use a walker that wasn't fully locked open. However, often times a family member or therapist will control the opening, closing, and storage of a walker. In that case, under strict supervision and/or if the person were mentally stable it would be very desirable. People love to be able to store them or close them up to fit in a car.

Interviewer: Do you notice people having trouble gripping the handles?

Karrie: The platform attachment is great for people who can't weight bear onto their hands. The platform device is an attachment to the walker that is screwed into place atop the handles of the walker. A doctor must approve the use of this device as with all others. A therapist or doctor would adjust according to the injury and the height of the patient. It is strapped onto the patient's forearm with velcro and he bears into his elbow. It has been successfully used with upper extremity amputees as well as weight is borne from the elbow up. The height is adjusted the same as with a regular walker. Keep the shoulder of the patient at 90 degrees, not hiked up or hunched. It's also good for patients with dialysis, which requires IVs in their arms, and patients with steel hand syndrome, who cannot weight bear into their hands due to tingling or sharp pain.

Interviewer: How important is the "look" or style of the walker--what are the psychological implications?

Deborah: It is important. The shape and colors--There's so much that could be improved. No one wants to look like a little old lady with a walker.

Part Two: Results of Person to Person Interviews with Walker Users, Spring 2002:

Location: Showalter Center, Warm Hearth Village, Blacksburg, VA

Description: Assisted and Independent Living Facility

Participants: Eight 65+ walker users, seven women and one man

The following tape recorded interview has been translated and paraphrased by the interviewer:

Participant: Is that a little tiny tape recorder?

Interviewer: Yes it is. Do you mind if I tape our conversation?

Participants: No.

Interviewer: How long have you been using a walker? Do you find it useful in certain situations or for performing certain types of tasks?

Participant 1: I guess about three years. I have a spinal condition. I really can't stand for lengths of time. I'm really pretty completely dependent on it to move around. I just recently got this new one, just a few weeks ago. I had the old one, like that one (points to a standard walker). This one rolls so much more easily. I can put the brakes on and sit down in the seat for a while.

Interviewer: How are the brakes? Are they easy to lock into position?

Participant 1: Yes. I have them on right now. It stays and I can turn around and sit down. (She gets back up and takes off the brake.) And then it's free wheelin'. It rolls really easily-so much better, even in the apartment. I can walk faster down the hall and make better time than I could and without the effort that the other one was (referring to the standard walker).

Interviewer: How do the brakes work? Do you pull up on them?

Participant: Yes, like a bike (she demonstrates slowing down and braking).

Interviewer: The physical therapists said that one needs to have quite a bit of dexterity and mobility to use the rolling walker as they can take off.

Interviewer: Can I see how much pressure it takes to turn off the brake? Is it hard to do?

Participant: Not for me. (She activates the brake with a quick snap of the wrist and then I practice her snapping technique. (It works.)

Participant 2: I don't think I could do it. I might have a hard time getting the brakes back into the unlocked position (referring to the snapping technique).

Participant 3: I have been using my walker for about a year.

Participant 4: You used a cane first didn't you?

Interviewer: You transitioned from a cane to a walker?

Participant 3: Its nice to have something on both sides of you (gesturing toward the walker) for balance.

Coordinator: She started off with a more traditional four point walker and just recently got a new one. You used to have one like Kathleen's (standard). And then you changed over to that sometime last year.

Interviewer: Someone gave it to you? It was a gift, not something that you purchased yourself? Which do you prefer, the standard or the one you have now with four wheels? (Her walker is very similar to the rollator but not quite as fancy. It has large sport wheels and bike style handles but no brakes. It has a seat with a basket underneath also.)

Participant 4: I like this one with four wheels. My daughter got it for me.

Coordinator: Let's do a comparison. Now hers (participant 4) doesn't have a hand brake on it.

Interviewer: Do you worry about it sliding when you go to sit on it?

Participant 4: No. Once you get your weight on it, it's ok. I really only use it to get from here to there. I really don't use it to sit on. I only sat on it once until today.

Coordinator: You like having the storage area compartment?

Participant 4: Yes. (She folds the seat up and collapses the walker. Ooohs and aaahs from the group.) I can put it in the car. I would like to have a tray for it. Barbara said that there is a tray with an edge to prevent things things from sliding off. I need to get with her to find out about how much it is... I think there is a catalog...That's what I dont like about this seat. I put a glass of water or a bowl of soup on here and it can slide right off- You have to be very careful.

Coordinator: I see that a lot. A lot of people do carry food.

Participant 1: I dont like having this protruding out-pointing to a basket attached to the front of her walker. I would like a removeable basket that I could take on and off when I go out for walks.

Participant 4: (Points to the storage basket underneath her seat.) I use this to store my mail and pocketbook if I am shopping. All walkers have advantages and disadvantages. All in all like this one best.

Coordinator: Kathleen and Charlotte are new walker users.

Participant 5: I used a cane before that. I have so many people come up and pat me on the back, I'm afraid they're going to knock me down! I don't want to fall and hurt my bones.

Participant 6: When I go to the store or Walmart I get one of the buggies and hold it.

Interviewer: And that is enough support? (She nods.) It's kind of like leaning on the rolling walker only higher. Does leaning on the cart take enough pressure from your legs?

Participant 6: It really does. I had scarlet fever as a child and it weakened my legs. Leaning on the cart takes the pressure off my legs. I'm glad I have plenty of strength left in my arms so I can hold on to something.

Interviewer: Do you find you use your walker more for certain situations?

Participant 5: Well, I'm legally blind. I can only see stuff up close and I have osteoporosis-my legs give out and the walker supports them. I have fallen less by using the walker. (She expresses her frustration with aging, losing mobility and fighting depression.)

Interviewer: Do you feel you are getting some of your mobility back with the walker?

Participant 5: It's helped a whole lot. I could really use one of those (points to a basket). I can't get my mail now. I don't have a basket.

Coordinator: I remember one resident who had attached a waste basket from Walmart to the walker. A family member had attached it with strips so it was secure. It was easy to find stuff in there because it was open. Now a bag like this...sometimes it's hard to find things. Marshall how do you like your bag?(She points to the cloth bag he has hanging from the front of his walker.)

Participant 7: My niece made that. I like it a lot.

Coordinator: Did you ever have a basket?

Participant 7: No.

Coordinator: Did you ask her for it -tell her that you needed something to carry it.

Participant 7: Yes.

Interviewer: How do you like your walker... or what do you not like about it?

Participant 7: I don't like to go outside with it. Too many cracks in the sidewalk. I don't like to go off the walk with it. Steps I don't like. When there are no elevators I need help.

The group agrees with the step comment.

Interviewer: Let's go back to accessories. Is there any accessory that exists that you would like to have?

Participant 5: Things are expensive. I had to get orthopedic shoes. The members of my church raised the \$700.00 to pay for them for me.

Participant 8: (She joins group late. She uses a rolling walker.)

Interviewer: Did you ever use a standard walker?

Participant 8: No. I have been using this one now for several months. My doctor prescribed it.

Coordinator: Did Medicare pay for it?

Participant 8: We don't know yet. I hope they will pay for part of it at least.

56 **Interviewer:** Do you find it useful for certain tasks?

Participant 8: I use it all the time, all day long.

Interviewer: Is there a feature you like?

Participant 8: It's easy to get around. The legs and wheels catch on things sometimes. I don't like the handles. Maybe it's because my hands are small. I really don't like the shape of the handles. It's not comfortable. I haven't had time to work out the design...

Interviewer: What about style or appearance?

Participant 5: Part of your independence disappears. I don't like being dependent on that thing. It wouldn't matter what it looked like.

Interviewer: Would style help at all?

Most people in the group nod. All are impressed with the stylings of the fancier rolling models.

Coordinator: Some people wish it would just disappear somehow when they go out to dinner or a play. It would be nice if you could just fold it up and stick it in your coat pocket. It's great to have when you're trying to move around but there are times you want it to disappear.

Interviewer: Is collapsibility a useful feature?

Participants: Some walkers fold up more than others. Some people have a hard time physically folding them up.

Interviewer: If you were at home, would you have occasion to collapse the walker?

Participant 8: I only fold it to put it in the car.

Interviewer: What is the purpose of the tennis balls?

Participants: It slides better.

One participant leaves. We notice that she can't get on the elevator because her rollator model is too large. She needs to wait for an empty elevator car.

Coordinator: Tennis balls work well.

Interviewer: Can I take a picture of one?



Vita

Tanya Blasko

B.S. Fine Art
University of Wisconsin-Madison
May 1991

M.S. Architecture-Concentration in Industrial Design
Virginia Polytechnic Institute and State University
December 2002