



# The Design of Walking Sticks: Use, Manufacturing and Abandonment

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**Abstract.** This article studies the history of walking sticks, the consequences of the negative stigma around it and explores how it can be redesigned to serve people nowadays and help them to have a better posture, movement and occupy the space that belongs to them too. In order to develop a product better for their users, ergonomic problems were used in order to find the gap the products available leaves and to notice how the users handle the product. Meanwhile an investigation is made with the user, family and a team of physiotherapist focusing on how the user feels about the product and about being seen using it. With those points considered it was created an alternative for a new design that reduces the double gait support during the swing phase. It is also aesthetically pleasing, drawing attention to it by the design making the owner feels proud of using it.

**Keywords:** Assistive technology · Aging and gerontology · Walking sticks · Emotional design

## 1 Introduction

Walking aid devices as such allows people to exercise their right to come and go freely. The greatest public is the elderly, about 30% of them who lives in communities fall at least once a year and half of them fall on a recurring basis [1]. On the last 10 years the number of people over 60 grew by 60% in Brazil totaling 26 millions in 2017 according to Brazilian Institute of Geography and Statistics (IBGE) and 962 million in the World in 2017 (United Nations).

According to Perracini [2] among the major factors for falls are: cognitive decline, use of medications (benzodiazepines, sedatives, tranquilizers and polypharmacy), gait disturbances, reduced muscle mass and weakness, historic of falls, old age, dizziness and depression. Tinetti [3] adds as factors damage in balance, vision decline, use of four or more medications (especially psychoactive), postural hypotension and arthritis.

Dani Cascaldi, one of the physiotherapists that accompanied the case study, related that the patients usually decide to buy one in moments of critical pain and without any medical supervision or instructions, not knowing how to choose the right height and getting a habit of bad posture in the spine and wrist because of it, muscular pain and sometimes aggravating their initial pathology something that other studies confirmed

[4]. In 2014, a feedback system for walking sticks was created by Zaina [5] that showed harmful habits like putting too much weight on one of the sides however it still needs improvement as the author suggests since it was not customizable according to weight and required wires.

Moreover, the biggest issue is the isolation of the user from society that often accompanies the diagnosis caused by the negative stigma it carries. Shaming the way someone walks is the equivalent of saying it would be better if the person never left home at all. It is important to remark here that this feeling is not always caused by persons and their reactions however by the architecture of the city. The gateways are narrow, the banchs are you tall, o tempo de travessia is not enough and aid is restrict.

Then it comes with little surprise that some people prefer to stay at home than be seeing using a walking aid [6], specially if the family does not give support. The use abandonment on the first 12 months is a decisive factor, raising the chances of falls and diminishing the user independence. In this study three users were interviewed with different neuropathies and they presented multiple reasons to avoid the use of walking aids as seeing on the table below (Table 1).

**Table 1.** Main problems related by the users.

	Main problem	Secondary problem
User 1	Easily forgotten	Incapacity of standing without aid
User 2	Height disponible is not comfortable	Judgment of others
User 3	Family’s opinion	Judgment of others

Price is not the decisive factor for any of three, but well-being is. The article will follow with the study of the origins of the product, state and how participatory design can influence on the creation of a better product.

## 2 Brief History

In order to understand the behavioral between user and product nowadays, a study about the historical production was made to understand how it developed over the ages identifying what is mutable and what is a constant, moreover it helps to clarify in this case how the negative stigma has developed.

The walking stick started as a tool for shepherds and travelers defending them of robbers and keeping the animals on line. Later on the objects earned a symbolic context. On Ancient Egypt pharaohs were portrayed with sticks up to 2 m (78.74 in) heights decorated with a lotus shaped head and similarly the gods of Greek mythology also were portrayed using canes.

In medieval times, use was restricted to the three most important classes: the nobles wear it on the right hand, justice on the left, and the bishops wore a special walking stick with their heads in the form of hooks, carrying the flock back to the church.

London, on 1702, men needed to have a license to carry a walking sticks and it was considered a privilege. They needed to walk with the cane around the city of London

and on a 10 miles radius they could not be bothered. He could never walk with it under the arm, moving it on air and support on the coat, otherwise his privileges would be suspended. On the same period on France canes were more used by women.

It was on this period that walking sticks with hidden functions started being made, like with hidden swords or revolvers. There are about two thousand patents for walking sticks with double function, not just as weapons but with compass for travelers, binoculars or even hidden compartments for cigarettes.

The Industrial Revolution popularized the use of canes with the mass production but when second war came and with the great number of injured, canes as fashion accessory was not a priority anymore being now used majority by disabled people. Since it was needed a mass production, the design mainly followed the function aspects and now with few models, there are not a lot of variation between materials, weights or even height.

### **3 Participatory Design**

A Study made in 1993 by Phillip and Zhao [7] with 227 users of assistive technology says that 29,3% are abandoned by the users on the first five years. One of their conclusions was that the products were made without knowledge of the user needs and based only in assumption of the theme or one talk only, creating a faulty product not adequate by their necessities. Therefore, the need to work on cooperative design, involving the user in the problem, not only observing his actions, but actively talking with the user and showing them the progress that has been made and in the end testing it with them. Using this methodology helps to create a link between user and product fulfilling another dimension on design. According to Norman [8] there are three levels of design: visceral - how the appearance and feel makes the user reacts, behavioral - the pleasure and effectiveness of the user or the usability of the product and reflective- the level of conscious thought that guides the user. If he can feel proud or even empower themselves with the product.

Design often focus on the physical side of the product but the emotional aspects is what links the product to the user creating a relation between them.

### **4 Overview of the Ergonomic Investigation**

To analyse the situation three focal areas were observed: the user, a team of physio-therapist and the existing products together with the stores that sell them. Through a series of regular visits within the first two areas a deeper understanding has been developed about how the relationship between user, doctors and walking sticks works. For instance, the refusal to use the product, the blind buy of it by the user in pain and his adaptation and the aftermath with several cases of later falls. This kind of approach used on ergonomic studies [9] was essential to get to know the behavior of the user and his needs maintaining the main focus of walking sticks: give support during the act of walking.

Aging also brings a series of modifications on the human body specially in the central and peripheral nervous mechanisms affecting the balance and generating the senile gait - with the stooped posture, knee and hip flexion and diminished arm swinging.

The strides are broad-based and with small steps, the swing phase also changes with the increase of the double support phase by 15 to 20% or up to 25–30%. During this phase the gravity center is between two feet which improves the balance. A walking aid tool would serve at that moment to decrease this pressure and recover a gait more similar to the regular one. When the gait is below 0,8 m/s or the individual can't stay 5 s standing on one leg, chances are there he will have great difficulties being functional and independent on society and specially on public places.

This case approach helps to develop a solution that is tailored to suit the needs of the user and the problems in the relationship between the product and the product, leading to a better design that will be easier to use and more enjoyable as well.

During the passive observation a series of problems on day to day situations came to attention. Since walking is an activity with many variations the gait was the main focus and how the user would sit down and get up on a chair. Problems related to the way and soil condition were disregarded in this study because of the many variables.

### Anthropometric Recommendation

In order to create a product that followed the principles of universal design the project was based on Panero [10] anthropometric study. It was used the 5 percentile for the shortest woman and the 95 for the tallest man to measure the height variation and the size of the hand (Fig. 1).

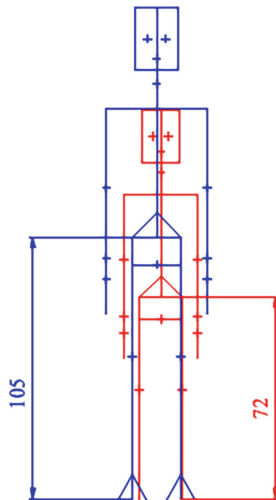


Fig. 1. Height of the pubis of the tallest man 41 in and the shortest woman 28'3 in

### **Main Problems**

The issues listed in this section were found in most of the users interviewed and related by the physiotherapy team. The posture is inadequate mostly because of two factors: First one is the lack of height regulations forcing the hand posture and second one is that people do not receive any orientation so they do not know how to choose the correct height. Considering the average age of the user, the prolonged time in the wrong posture is even more harmful.

On the ones that are regulated it is not easy to change the height. It requires a lot of force that not every user has, specially the ones with already other muscular problems or articulations issues. The shape of the walking cane handle also forces an angulation of the wrist that is constant and created a vicious posture. The social problem still is the most serious one involving the dependence of the user and his exclusions from society.

### **The User**

During the project 3 users were interviewed but one of them was chosen to accompany the project closer. The user in question is a 65 old woman, 158 cm (62 inches) with lupus, fibromyalgia and joint problems. She is a retired nurse and felt the need of a walking aid after noticing she could not walk on a straight line diverting to both sides trying to keep the balance. She uses the walking stick on the right side (her left side is more compromised, so she uses on the right).

The cause of her unbalance is the pain she feels on the bones and muscles, she still tried to not use anything during five years, because it was uncomfortable and her husband said she would get used to it and would be incapable of walking without it but during a travel she bought one on a moment of acute pain because she could not keep walking without aid anymore.

On her interviews she said that the orientation on the moment of the purchase was vague and if she did not have a background being a nurse, she would not have used it appropriately. She does not use the product often since her pain is subdued nowadays but during the time she used it she related it was easy to identify the chronic pain point and in which phase of the walking gait was harder to reach a balance. In addition, it forced a straighter posture something that she used to forget with nerve pain and ended up falling before even small obstacles.

She related that people around her were preoccupied seeing her with the walking stick and regularly thought she was sick and fragile. "When I need to use both hands, I support the cane on a surface and it usually ends up falling. I feel I need to ask someone to pick it up on the floor and the noise scares people and they start judging me".

## **5 The Project**

Based on the interview, research and on the notations made, the following points were considered the most important ones: a aesthetic pattern that draws attention in a positive way, height variation, a handle more ergonomic and a way of hanging the walking stick as to not fall when user needs to support himself/herself.

The solution chosen between the user and the design with the counseling of a medical board is composed of rectangular section tubes of anodized aluminium that fits

one inside the other with multiples holes on the exterior one creating the height variation. The decision of a rectangular shaft is to avoid the costume of putting the hand around the tube that worsen the arthritis. The ferrule was substituted for a foot shaped wood feature capable of sustaining the walking stick when left alone. The form makes it easier to simulate the impulsion movement easing the double gait phase. The handle follows a natural shape for the hand, three types were made and tested to find which one provided a better contact surface. The final solution was a mix of two of the options. This part is also made of wood without any cushion, to make the cable firmer.

A full-scale mock up was made to test the shapes and structure to see if it held steady and whether the handle was good for the tallest man and the shortest woman and after that a prototype was build.

**Test Results**

The first test was of usability. The test was made to verify the height limitations of the smallest woman and the tallest man and testing if they would use the double support: first behind and then on the front. The users were not instructed to make this movement to see what their natural reactions would be. The test was positive, but one of the feedbacks received was while a soft handle was more enjoyable to touch it did not feel really firm.

Another thing the test verified was the height regulations. On the mockup the difference between the holes were 5 cm but on the prototype the difference was 2.5 cm, 9 holes on a 50 cm space. The final cost of the material to create one unit was around 15 dollars.

The final tests were made on a street situation with the user and her husband. The usability, adjust and the use in different situations were tested like when the user



**Fig. 2.** Tallest man and smallest woman walking



**Fig. 3.** Rendering of the prototip on the first adjust on 72 cm (28,34 in) and on the last, 105 cm (41,33 in)

needed to use a handrail elevator. The product was left with the user during 24 h, the one feedback received was that the weight as tiresome after 6 h of continuous use (Figs. 2 and 3).

## 6 Conclusion

During the test it was noticeable that the product drew attention to itself generating curious looks especially the foot format. The proper use was natural for both the test subjects in the following aspects: the handle, the height regulation and the correct gait. It is necessary to do a longer test and creating a new model using other wood since this one was not so resistant and it was a little bit heavy.

The development of the product based on the user needs made it possible to see not only the regular needs but the latent needs. Not one of the users talked about the double gait phase or the need to feel represented with the product. The user does not notice everything but through observation and interview it was possible to determine the problems and being able to create a solution that could be satisfying empowering the

user to live a more satisfying life. It is not every time the user knows what wants and needs, it was through observation but mostly interdisciplinary approach that this project was developed.

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