

# Inventors

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DIGEST

## Joy Ride

Merry Lynn Morris' Wheelchair Offers Freedom of Movement and Expression

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Canadian breakdancer Luca "Lazylegz" Patuelli teaches breakdancing as a disabled person to non-disabled people at the University of South Florida during *A New Definition of Dance* in October 2015.



Renowned Chinese classical dancer Liu Yan, of the Beijing Dance Academy, performs in the omnidirectional hands-free wheelchair with Merry Lynn Morris and Cynthia Hardegree. Yan was chosen to perform a solo during the 2008 Beijing Olympics, but suffered a fall that resulted in a spinal-cord injury two weeks before the games.

# Joy Ride

New Wheelchair Offers Freedom of Movement and Expression

BY RENÉE C. QUINN AND MERRY LYNN MORRIS



PHOTO BY TOM KRAMER; FAR LEFT PHOTO BY MERRY LYNN MORRIS

Many people have a friend, family member or loved one who has limited movement due to a physical disability. Some are born with disabilities, while others are struck by a debilitating disease, wounded during military service or are victims of tragic accidents. Being disabled, however, does not mean being dysfunctional. Modern technology has enabled those with even the most crippling of diseases to give joy to others while savoring life.

Merry Lynn Morris' life was affected by a tragic accident. One day, her father, Bill, left the family home to run a quick errand and was in a head-on collision that left him using a wheelchair for 21 years. Morris' experience with the family's resulting struggle motivated her to create an omnidirectional, hands-free wheelchair that gives those constrained to

wheelchairs the freedom and independence to move about in ways that most manual and powered wheel chairs do not allow. The first patent on the chair, U.S. Patent No. 7,748,490, involved seat tilting. It was issued on July 6, 2010 and assigned to the University of South Florida, where Morris is a faculty member of the School of Dance and Theater at the University of South Florida.

Although the wheelchair was prompted by her father's experience, Morris was inspired to begin work on the chair in 2000 after she saw a performance by Dancing Wheels, a professional dance company that includes dancers in wheelchairs. That's when she and her mother began disassembling her father's wheelchairs and wondering if clamps, sticks and pulls might make the chair move—maybe even dance.

Dancer Frank Hull tests the wheelchair in front of a group of University of South Florida dance majors as part of a dance and disability event Morris directed in October 2015.



## In Her Words

In 2005, Morris approached the USF College of Engineering about designing a wheelchair that was propelled by the user's body. After experimenting with Segways at the university, a firm in California built an entirely new prototype chair that incorporated all of Morris' design ideas. Morris engaged in an intense collaboration with the company to bring the chair to fruition. Her work with dancers with and without disabilities helped shape the chair's technological and aesthetic design. Pensacola developer Neil Edmonston has been working with Morris on the programming of the chair since it arrived at the university.

I met Morris in 2014 at the USPTO Smithsonian Innovation Festival, where Morris and her chair were featured. Following, Morris explains why she created the wheelchair, the process she and her collaborators have gone through in the research and development of the chair, and why the wheelchair is so important.

The idea for the rolling dance/mobility chair emerged from two distinct motivations. One was my experience as a caregiver to my father for 21 years. The automobile accident he was involved in left him with permanent brain damage, a seizure disorder and significant issues of paralysis. For our family, it meant completely restructuring our lives. My mom, who is my hero and perpetual inspiration, cared for him with an unwavering sense of commitment and hope. She always looked for creative ways to improve the situation for our family, working toward embracing the new reality and moving forward.

She is a visual artist, and her artistic inclinations and ability to think outside of the box helped heal our family and get us through many challenges. She inspired my creativity with regard to re-conceptualizing the design of wheelchairs. Seeing her perspective as spouse and primary caregiver provided me with an important perspective on addressing disability issues as a whole interactive, human and social condition. Disability affects everyone. We are all only temporarily "abled." Many times, in design, the focus becomes solely on the disabled person's needs as an independent, autonomous being, not taking into account the surrounding family, caregivers, friends and community who interact and want to connect with that person's life.

The second motivation came from my work as a choreographer and teacher of individuals with disabilities. In working with many people in wheelchairs, I began to conceive of



Merry Lynn Morris frequently works with chairs and other props in her choreography.



PHOTOS BY JIM LENNON

design ideas for the chair that might be more conducive for the dance experience and enable additional interactive movement and expressive possibilities. In dance, we are generally concerned with movement precision and quality/texture—the “how” of the movement, not just the goal of the movement, such as transporting a body in space from one destination to the next. When considering the wheelchair from a dance design perspective, a host of other priorities came to the forefront in terms of facilitating movement quality/texture. In particular, I noticed that the control system for most traditional chairs—hand-to-wheel propulsion or hand-to-joystick propulsion—generally restricted other options for hand/arm use in space. There were other missing movement dynamics that I wanted to create in the chair to enable a three-dimensional experience of space. Adding height control, omnidirectionality and seat rotation, as well as a mobile control system created new three-dimensional movement dynamics.

I continue to look for ways to enhance the motion dynamics of the device and create intuitive, organic means of controlling them with the human body. The chair’s development, in some ways, is not unlike other types of technological extensions, such as pointe shoes, tap shoes and aerial silks, used in dance to enhance movement experience. The experimentation process has consistently involved multiple perspectives, and a variety of individuals with and without disabilities have tested the existing prototype chair to provide input and feedback.

### Science and Art Merge

One of my concerns in developing the device has been with the ways in which the wheelchair facilitates an individual’s long-term health. As a dance/movement practitioner with a kinesiology and movement science background, I constantly look at human movement experience with both art and science lenses. I worked for two years at an assisted living facility developing movement programming for the residents. The chairs they utilized (often traditional manual chairs) did not assist in their circulation by stimulating or enabling movement, or supporting healthy postural positions. Instead, the individuals were usually hunched over. Their heads dropped down, and they sagged into their chairs. In the development of the rolling dance/mobility chair, I have sought to embrace health (posture/alignment/circulation/conditioning effects) and artistry (movement quality/dynamics, expressive relational interaction) with those of a social and functional nature.

Consider that in many care-giving situations, the spouse, friend and/or caregiver stands behind the individual, pushing the chair. Power chair controls are also at the back of the chair. This makes human communication virtually impossible. It also distorts the relationship psychophysically. Try talking or relating to someone who is behind you much of the time. It does not work very well.

One goal of the dance/mobility chair was to try to facilitate human relational interactions, such as walking side-by-side

“The experimentation process in this project is incredibly important. You can theorize in your head all of these kinds of ideas and concepts and things, but then the actuality of being in the chair, is a totally different piece of it.”

—MERRY LYNN MORRIS

holding hands and talking/interacting in a seamless manner. The mobile (smart-phone) control, which can be worn on the body (making the individual hands-free) or held easily in one hand by the caregiver or individual, helps restore relationships.

### Height Matters

Another point of emphasis is the importance of height control in wheelchairs. The implementation of height control raises the disabled individual to a higher level of stature—literally. Being in a seated position means being looked “down upon” by most standing individuals (and having elbows thrust in your face, etc.). Height change became of paramount importance in the design of this wheelchair for restoring eye contact between individuals, as well as helping basic tasks, such as reaching. Additionally, it enables the natural greeting exchange of hugging to happen more easily. When a person is lowered in space in a seated position, hugging the individual usually becomes a more awkward and less fulfilling experience for both individuals. There are many power chairs with height control; however, the critical importance of a feature such as this from a psychosocial perspective has yet to be fully embraced as an absolute design necessity.

I think the main focus of the problem-solving or innovating process has been to broadly and simultaneously consider human mobility from a creative, artistic, social and relational perspective. This recognizes the importance of the human movement experience as a critical formative force in shaping the identity and quality of an individual's life.



Liu Yan performs in *Concealing/Revealing*.

### Path of Experimentation

I first began the project by ordering Segways and looking for ways in which seats could possibly be mounted to them. At the time (2005/2006), Segway technology was one of the closest existing technologies I found that could enable individuals to be “hands-free” by simply leaning their bodies to direct the motion of the device. Innovation and experimentation processes are rarely, if ever, linear in nature. My path of experimentation has involved multiple collaborators. Many rough-draft prototypes emerged before realizing the more complete design in the current prototype chair.

Of course, the innovation process, like the choreographic process, is never really done. Once something has been created,

there is a natural instinct to reflect upon its potential improvement and consider other embellishments and possibilities. In this manner, the chair, as a product, will never be finished; it will continue to evolve and be shaped by those who utilize it in different ways.

An original rough-draft prototype came to fruition in 2007. It involved placing a sensory apparatus underneath the seat, and when the seat tilted, the chair moved. Therefore, when a person's weight shifted forward in the seat, the seat would tilt, and the chair would move forward. The person essentially acted as a joystick in the seat. This early prototype did not incorporate other goals for the design, but it did create a first step toward making the individual potentially hands-free in the chair. Initially, I worked with students and faculty in the College of Engineering to build this early chair prototype.



Morris performs in her piece *Blood Matrix*, which utilized sweeping fabric, as well as Segways and the prototype wheelchair.

PHOTOS BY TOM KRAMER

## Progress and Patents

Due to my development of the chair project within the University, the Office of Patents and Licensing at USF was a very helpful resource. I worked closely with representatives from the office as the chair technology developed. I came to understand issues of intellectual property protection and the function of patents from them. An initial patent filing occurred soon after the first prototype was developed, and forthcoming patents have been filed in a similar fashion. I (with my collaborators) now have two design patents: (U.S. Patent Nos. D642,962 and D719,071) and two utility patents (U.S. Patent Nos. 7,748,490 and 9,027,678). The most recent ones are more relevant to the current existing prototype.

During 2012, significant progress was made on the chair project. I worked with companies in California and Florida to develop the chair with my design goals and specifications. This collaboration resulted in the current chair prototype, which was featured at the Smithsonian's Innovation Festival. This chair embodies the hands-free/mobile wireless control with omnidirectional wheels and many other features to expand movement potential. It is the first prototype to embody the majority of design goals. I was able to arrive at this point with the chair with the help of USF internal grants, an external award (Thatcher Hoffman Smith Award) and a few small donations.

## Successful Journey

Although Bill Morris died decades after his accident, he did get to see his daughter's invention take shape. A series of dance performances at USF featured an early prototype of the rolling dance chair.

Today, Morris continues to refine the chair to increase its ease of transportability, fluid responsiveness, smooth transport and customizability. She and her collaborators are experimenting with different motor drives and lighter-weight materials. They are refining programmatic options, adding independent wheel suspension and addressing user-interface differences. The chair is still in developmental stages, but Morris hopes to move toward commercialization in the near future. She is working with wheelchair industry partners Quantum Mobility and National Seating and Mobility to develop the chair into a robust, consumer-ready device. 🐕

Donations to fund the project can be made at: <http://usf.edu/ua/FUND?fund=230025> or [www.gofundme.com/tma2tunj](http://www.gofundme.com/tma2tunj).

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