Forging a New Future Participatory Action Design and Engineering Technologies with People with Disabilities

Rory A. Cooper, PhD, PLY

FISA Foundation – Paralyzed Veterans of America Distinguished Professor

Director

Human Engineering Research Labs

Pitt Research

PERSONAL BEST

INSIDE ▸ AL ROKER'S HOME SHOW P. 66
A FATHER AND DAUGHTER RECONCILE P. 69
HOW CHEF ART SMITH GOT FIT P. 70

Cooper on the Three Rivers Heritage Trail in Pittsburgh

My Marathon

'Being Physically Fit Is What Saved My Life'

Engineering professor Rory Cooper defied an injury and a pandemic to complete his race

ON A RAINY morning last October, I set out to compete in the Marine Corps Marathon in Washington, D.C., riding a three-wheeled hand cycle that I designed with friends and colleagues. Since you pedal a hand cycle with your arms, this takes upper-body strength, as well as an understanding of ergonomics. That said, no matter how strong you are or how carefully designed your bike is, accidents happen.

That morning the pavement was wet, and I took a bad turn on a curvy on-ramp. I bounced over a curb, flew across the grass and landed in the bushes. I've used a wheelchair since I was paralyzed in an accident at age 20, so I couldn't hop up and wave somebody down for help.

I'm not sure how long I was lying there, but it felt like an eternity. Finally, I realized nobody was coming to save me, so I crawled to my cycle and climbed on. Somehow I made it to the finish line 23 miles later, but I was in rough shape. It turned out I had broken both feet and legs and had a huge gash on my back, as well as hypothermia. I spent a week and a half in the ICU and long months of healing back home in Pittsburgh. It wasn't my first long recuperation. In fact, I recently marked the 40th anniversary of my "alive day"—the day I was in that accident, a near-fatal road crash by my Army base in Germany, and didn't die.

I truly believe that being physically fit is what saved my life back then, and I think it's why I survived my accident last year. Muscle strength and flexibility and cardiovascular strength are important for everyone, whatever your age or physical challenges. So last year, I was back to exercising as soon as the doctors allowed it. I set a goal to hand cycle in the 2020 Pittsburgh Marathon in May.

Then the COVID-19 crisis hit. The in-person marathon was canceled, but participants could run (or ride or walk) the 26.2 miles on their own and post their times online. I did it and was able to finish in two hours and 24 minutes. I may not have been one of the fastest competitors in the hand-cycle division this year, but I'm certain I was one of the most grateful. *—As told to Robin Westen*

Rory A. Cooper, 60, is the director of the Human Engineering Research Laboratories at the U.S. Department of Veterans Affairs and the University of Pittsburgh, as well as the associate dean for inclusion at the university's School of Health and Rehabilitation Sciences.

PHOTOGRAPH BY RYAN SMITH

YAKITORI

By David Lammers

It's the thought that counts

We had flown across the United States and checked into the Sheraton Hotel in downtown Seattle. My three young children all started wailing for something to eat, preferably a hamburger.

I was tired and needed a shower, but we took the kids down the street and into a Wendy's. To get the kids out of my hair, I asked my weary, pregnant wife to go find a table while I ordered food for all of us.

I carried two trays over to where my family was waiting. But the only place for me to sit was at a small table nearby. A man in a wheelchair was already sitting at one side of the table, eating a baked potato and drinking milk.

"Mind if I sit down here?" I asked.

"Go right ahead."

The guy had a beard and wore an old tee shirt with a wheelchair racer on the front. My mind started turning.

"This is downtown Seattle. This guy is probably living on a stipend, in some rooming house. A baked potato is probably all he can afford," I thought to myself.

"Nice children you have over there," he said. He spoke with a confident voice. Pretty soon I felt comfortable enough with Rory Cooper to ask what had put him in a wheelchair.

He had been living in West Germany, working as a translator—a *certified* translator, he told me. One day, while he was riding a bicycle, a bus ran over him.

After he got out of the hospital, he went to California and got interested in electronics. He got his PhD in electronics engineering last year. His dissertation was in control theory, and now he is teaching at the University of California at Sacramento and developing controls that ease the lives of people in wheelchairs.

My mind flashed back to 1972. Working at a golf course outside of Boston, I was riding a bicycle to work early one sunny Sunday morning when a German shepherd, sitting on the front porch of a mansion, spotted me. His ears stood straight up, and he tore across the lawn.

Way behind me I heard a car go into a slide. The dog grabbed my coveralls at the ankle, and my 10-speed started to topple. The sliding car closed in.

"It's over," I thought, forgetting Yogi Berra's maxim.

Later, the doctor told me how lucky I was that my rear end had jammed into the car's passenger window without damaging my spinal column.

I thought of that incident while I talked to Cooper.

He said he was in Seattle for a big wheelchair race at the University of Washington. His wife, a German, was back home for a visit. He thanked us for the dinner company before he wheeled down the street to his hotel.

I promised myself never to judge someone again, and never to feel sorry for myself again over some stupid little thing.

Promises like that are more easily made than kept.

I thought about Cooper again the other day. My wife was in a small maternity hospital, having given birth to a healthy baby girl a few days earlier. The kids started wailing for something to eat, preferably a hamburger.

After paying for the second extra cheeseburger, I commenced to worrying: "How can we take care of all of these kids? How much will it cost to send all of them to school?" And so on.

No bearded man wheeled in to ease my mind. But I remembered the man I'd met in a distant hamburger joint, and I felt a bit stronger. For a moment I thought about how lucky we are. I thought about how some people deal with adversity and strive for greatness.

With human beings, most of the time it's the thought that counts, one way or another.

Rory Cooper, left, competing with Tim Davis in the Central Coast Marathon last December, hopes to raise enough money to compete in the National Wheelchair Games in Hawaii June 14-19.

Cooper has life back on track

By Jon Hastings
Staff Writer

Rory Cooper was born to race.

Nothing has stopped him the past 21 years — not even a semitruck in Worms, Germany, nearly three years ago.

Cooper was paralyzed from the mid-stomach down after the bicycle he was riding collided with a city vehicle on July 21, 1980.

And while Cooper is quick to recall the exact date of the accident, he seems far removed from the incident. The past is just that — the past.

Cooper, a 1977 graduate of San Luis Obispo High School, is more concerned with the future — which he looks upon with plenty of optimism.

The junior electrical engineering major at Cal Poly is one of the nation's premier wheelchair athletes, concentrating on track and field.

He is currently trying to raise money through a drawing to subsidize his trip to Honolulu, Hawaii, for the National Wheelchair Games on the University of Hawaii-Monoa campus. The Games are slated for June 14-19, with over 300 athletes competing.

Cooper is the current Class 3 Division collegiate record holder in the 1,500 meters with a time of 5:30.44.

He also competes in the 400, 800 and marathons, displaying potential in just about every event he enters.

Cooper competed on the track team at SLO High for two years, specializing in the two-mile. "I was slow," he now says of his top prep time of 10:41.86.

He kept his running up in the army, competing on the all-Armed Forces team in Germany.

He said it didn't take long to get involved in athletics after the accident.

"Athletics for people in wheelchairs is so critical because part of what you lost — or the physical limitations — can be overcome through athletics," said Cooper. "Your physical well-being becomes more important once you have a physical disability.

"I kind of think athletics is the key to my mobility, which is my independence. By working through athletics I have more awareness and also I have greater strength and better health. Participation sports opens so many doors."

Cooper said he didn't brood about his situation, even immediately after the accident: "No, because my injury wasn't that serious."

Part of Cooper's positive thinking may be a result of what a German newspaper printed days after his accident. It may have made him realize what could have been. The publication erroneously reported he had been killed in the accident.

"Of course I didn't know about it, but my first reaction was what Mark Twain said: 'Rumors of my death are greatly exaggerated.' "

Cooper's enthusiasm for life, however, isn't exaggerated at all.

He plans to get even more involved in wheelchair athletics, both as a participant and as a organizer. In April he was responsible for organizing the Tri-City Wheelchair Track Meet at Cal Poly.

Over 20 athletes competed — a number Cooper wasn't particularly impressed with. Next year he hopes to have closer to 100.

"It seemed like we had more spectators and helpers this year than participants."

Cooper also hopes to start focusing more attention on marathons. His best time thus far has been 3:19.06. The world record is held by Jim Knaub (1:47.08).

Cooper thinks he can lower his own time by nearly an hour in the immediate future.

He currently devotes 20 hours a week to his training, which includes over two hours a day on the track. His muscular upper body is the result of rigorous weight training.

"My upper body has never been this strong before," he said.

He hopes to be in Boston next spring for the most prestigious of all marathons.

For now, however, he still needs some help getting to Hawaii.

Tickets for the benefit drawing are available at the Disabled Students Office on the Cal Poly campus and in the University Union.

Several prizes, including free dinners, albums and the grand prize of a one-month membership to a local health club will be offered.


AKERY SQUARE
Google

A perspective on the ultralight wheelchair revolution

Issue title: Tech Act/Outcomes Measurement

Article type: Research Article

Authors: Cooper, Rory A.

Affiliations: Human Engineering Research Laboratories, University of Pittsburgh, Department of Rehabilitation Science and Technology, VA Medical Center, 7180 Highland Drive, Pittsburgh, PA 15206, USA

Note: [] Corresponding author. Tel.: + 1 412 3654850; fax: + 1 412 3654858.

Abstract: Driven by a desire to improve their sports performance, a few wheelchair users began to challenge the rules for wheelchair sports. In so doing the flame of a revolution was lit. By producing their own wheelchairs, standard wheelchair technology was challenged. During the late 1970s, several companies arose out of the demand for custom sports chairs for daily use. The demand for improved performance and lighter weight was great enough to support an industry because the large wheelchair manufacturers at the time did not recognize this change in the market place, the door was left open for new players. Although there has been recent consolidation of many of the original ultralight wheelchair manufacturers, growth continues. This trend should produce some exciting technologies to reduce costs and improve quality.

Keywords: Wheelchairs, History, Sports and Design

DOI: 10.3233/TAD-1996-53-419

Journal: Technology and Disability, vol. 5, no. 3-4, pp. 383-392, 1996

Building research capacity among people with disabilities

Issue title: The Role of Consumers in R & D

Article type: Research Article

Authors: Cooper, Rory A.

Affiliations: Department of Rehabilitation Science and Technology, University of Pittsburgh, Human Engineering Research Laboratories (151-R1), 7180 Highland Drive, Pittsburgh, Pennsylvania 15206, USA

Note: [] Tel.: + 1 412 3654850; fax: + 1 412 3654858; e-mail: rcooper@pitt.edu

Abstract: The full inclusion of people with disabilities in rehabilitation science and disabilities studies is necessary for growth and long-term success. Full inclusion of people with disabilities can only be accomplished through building research capacity and changing rehabilitation research paradigms. There must also be a national effort to build a rehabilitation research infrastructure with short- and long-range programs to recruit and train scientists with disabilities. The building of research capacity requires the cooperation and collaboration of federal agencies, national laboratories, universities, and advocacy organizations. Research capacity and research quality must be increased to achieve the goals expected by people with disabilities.

Keywords: Research, Rehabilitation science, Disability studies, Science

DOI: 10.3233/TAD-1998-9303

Journal: Technology and Disability, vol. 9, no. 3, pp. 97-101, 1998

Awareness of disability culture in research

Article type: Research Article

Authors: Cooper, Rory A.

Affiliations: [illegible]

Note: [illegible]

Abstract: [illegible]

Keywords: Research, Disability, Public policy, Human rights

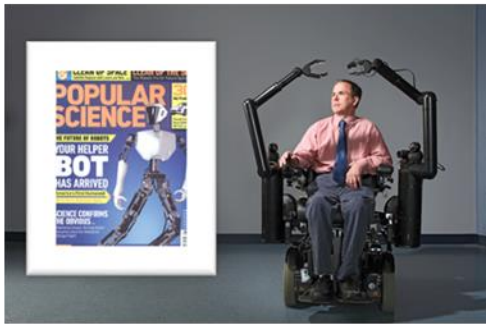
DOI: [illegible]

Journal: Technology and Disability, vol. 7, no. 3, pp. 211-218, 1997

Technology promotes social mobility, health, and participation

National Council of Disability

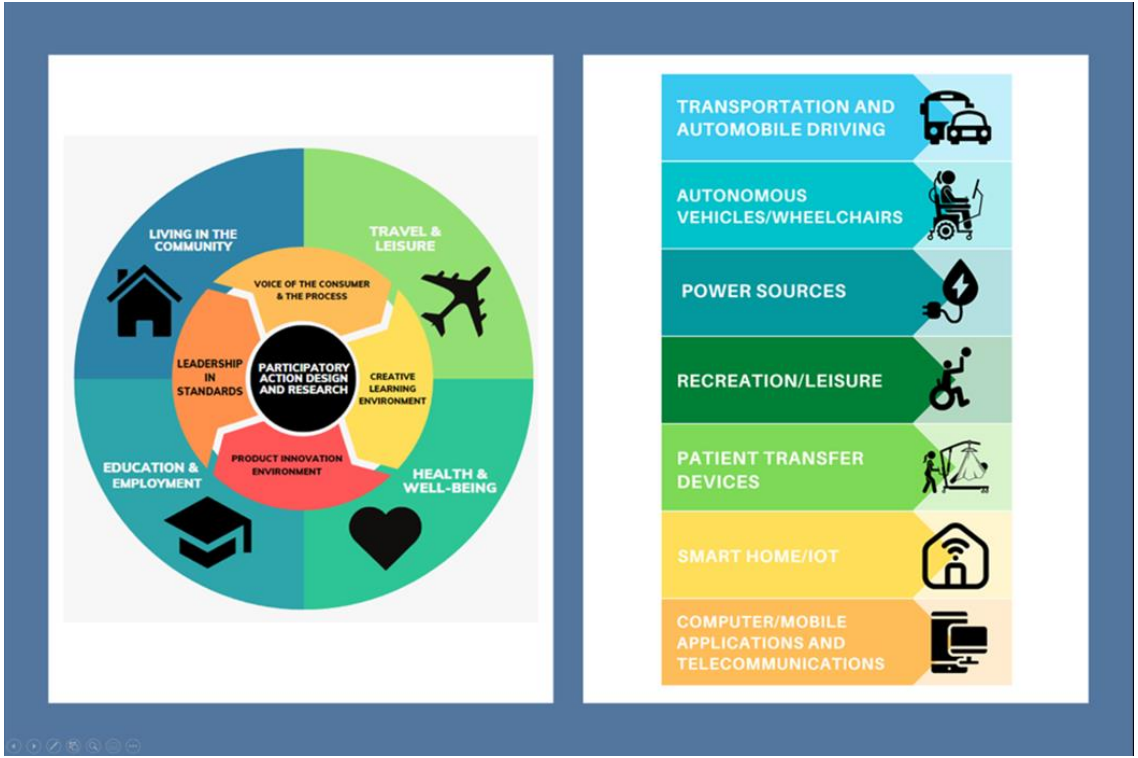
"The disability community knows better than any other how being involved in the planning from day one is critical to a successfully accessible product, regardless of how many years in the future it lies."



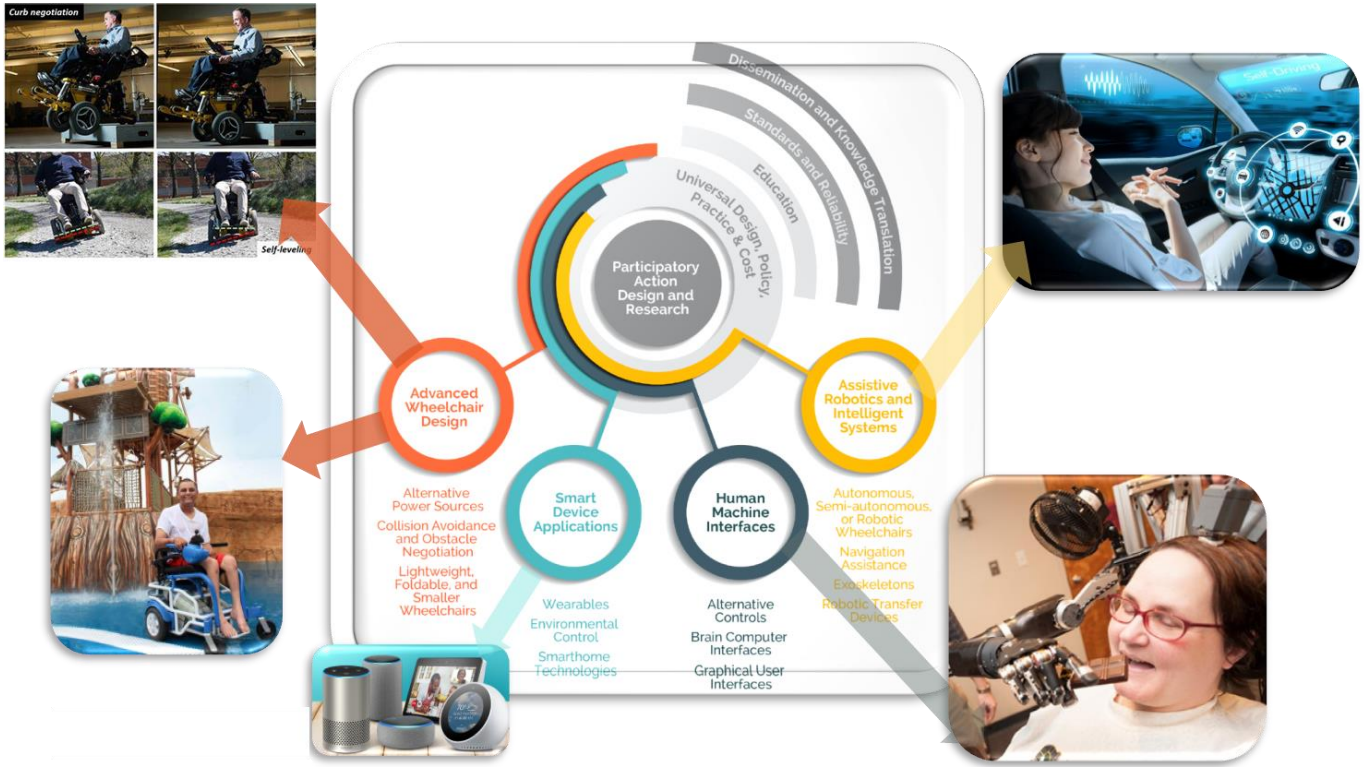
Design Processes

University of Pittsburgh

Voice of Consumer – Meta Analysis



Participatory Action Design Engineering – Research (PADE-R)



Participatory Action Design Engineering – Research (PADE-R)

- Sample Tools
  - Focus Groups
  - Journey Mapping
  - Story Boards
  - Expert Opinion
  - User Testing
  - User Acceptance

User Perspectives on Robotic Arm Control

Interview with Current Robotic Arm Owners: JACO Robotic arm is a life-changing benefit.

The robot arm has given me **a reliable source of mobility.** I don't think I've ever been able to fully trust my body to do what needs to be done . So it has created choice in how I operate and live my daily life. I previously relied a lot more on care assistance. And it was stressful if somebody didn't show up for a shift because of illness or whatever. But now if I am on my own for an extended period of time, it's not really stressful for me.

I feel like it's kind of hard to quantify how the arm has benefited me, just in that there are so many tiny tasks throughout the day that I can do **without needing to plan ahead** or like specifically ask someone to do it for me …

There's no privacy and it's kind of humiliating when you have to go to someone and say can you wipe my eyes and you don't want to explain things. And I think **one of the greatest things for me** was when I realized that I could get Kleenex and pull out my own tissue.

Understanding control input preferences.

Touch Control | Voice Control | Autonomous Shared Software Control

Wang, E., Styler, B., & Ding, D. (2023). Autonomous or Manual Control? Qualitative Analysis of Control Perceptions From Current Robotic Arm Owners. *IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)*.

Chung, Cheng-Shui, Styler, B. K., Wang, E., & Ding, D. (2023). Robotic Assistance in Action: Examining Control Methods for Long-Term Owners of Wheelchair-Mounted Robotic Arms. *RESNA Annual Conference 2023*. https://www.resna.org/sites/default/files/conference/2023

Styler, B., Wang, E., & Ding, D. A Life-Changing Benefit: Qualitative Perspectives from Kinova® Jaco® Robotic Arm Owners.<Under Review>

I think they all serve their purpose for certain users, and I think it's important that we acknowledge that disabilities come in all kinds of shapes and sizes, and Jaco is about restoring independence, not being told, "No, you can't because there's no control method for you."...I think they all have their purpose, and with some combinations for certain users, they could really excel together .

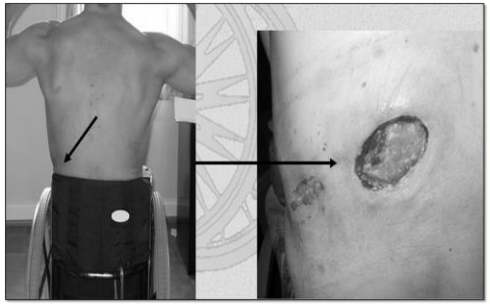
Exploring Control Authority Preferences at the NVWG: Participants prefer to be in-control by operating the system at all times.

Interactive Assistance Design Recommendations.

Styler, B., Deng, W., Simmons, R., Admoni, H., Cooper, R., & Ding, D. Exploring Control Authority Preferences in Robotic Arm Assistance for Power Wheelchair Users.<Under Review>

Design as Extension of Person

- 3D Scanning
- 3D Modeling
- Athlete and Coach Engagement
- Close fit to body
- Ergonomic analysis



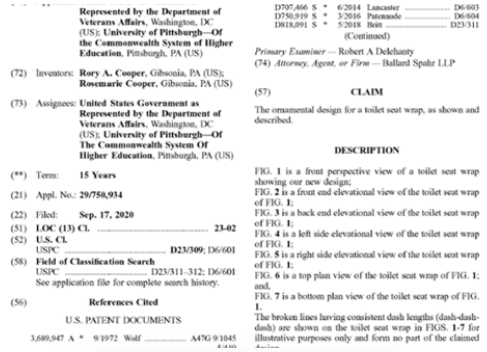
Wheelchair Racing

- Custom devices designed for sports specific performance
- High speed and Acceleration
- Steering compensation for power and turning
- Close fit to body

3D Printing High Performance Parts

- PEEK (polyetheretherkeetone) with composite based additive manufacturing (CBAM) process.
- PEEK can be 3D printed to make durable, lightweight and geometrically complex carbon fiber composite parts.
- Parts can achieve tensile strength of 205 MPa with heat resistance to 250 Celsius.
- Nylon and ABS are also commonly used.

On the Move Pad



Represented by the Department of Veterans Affairs, Washington, DC (US); University of Pittsburgh—Of the Commonwealth System of Higher Education, Pittsburgh, PA (US)

(72) Inventors: **Rory A. Cooper**, Gibsonia, PA (US); **Rosemarie Cooper**, Gibsonia, PA (US)

(73) Assignees: **United States Government as Represented by the Department of Veterans Affairs**, Washington, DC (US); **University of Pittsburgh—Of The Commonwealth System Of Higher Education**, Pittsburgh, PA (US)

(**) Term: **15 Years**

(21) Appl. No.: **29/750,934**

(22) Filed: **Sep. 17, 2020**

(51) **LOC (13) Cl.** **23-02**

(52) **U.S. Cl.**
USPC **D23/309**; D6/601

(58) **Field of Classification Search**
USPC D23/311–312; D6/601
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,689,947 A * 9/1972 Wolf A47G 9/1045

D707,466 S * 6/2014 Lancaster D6/603
D750,919 S * 3/2016 Patenaude D6/604
D818,091 S * 5/2018 Boit D23/311

(Continued)

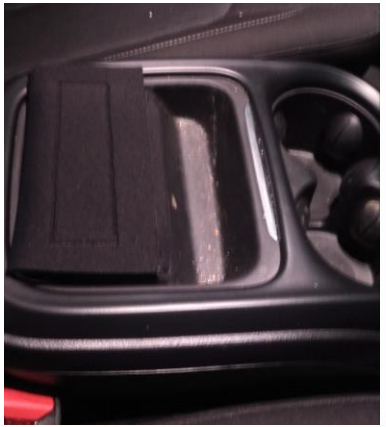
Primary Examiner — Robert A Delehanty
(74) *Attorney, Agent, or Firm* — Ballard Spahr LLP

(57) **CLAIM**

The ornamental design for a toilet seat wrap, as shown and described.

DESCRIPTION

FIG. **1** is a front perspective view of a toilet seat wrap showing our new design;
FIG. **2** is a front end elevational view of the toilet seat wrap of FIG. **1**;
FIG. **3** is a back end elevational view of the toilet seat wrap of FIG. **1**;
FIG. **4** is a left side elevational view of the toilet seat wrap of FIG. **1**;
FIG. **5** is a right side elevational view of the toilet seat wrap of FIG. **1**;
FIG. **6** is a top plan view of the toilet seat wrap of FIG. **1**; and,
FIG. **7** is a bottom plan view of the toilet seat wrap of FIG. **1**.
The broken lines having consistent dash lengths (dash-dash-dash) are shown on the toilet seat wrap in FIGS. **1-7** for illustrative purposes only and form no part of the claimed



Kirigami inspired Wheelchair Design

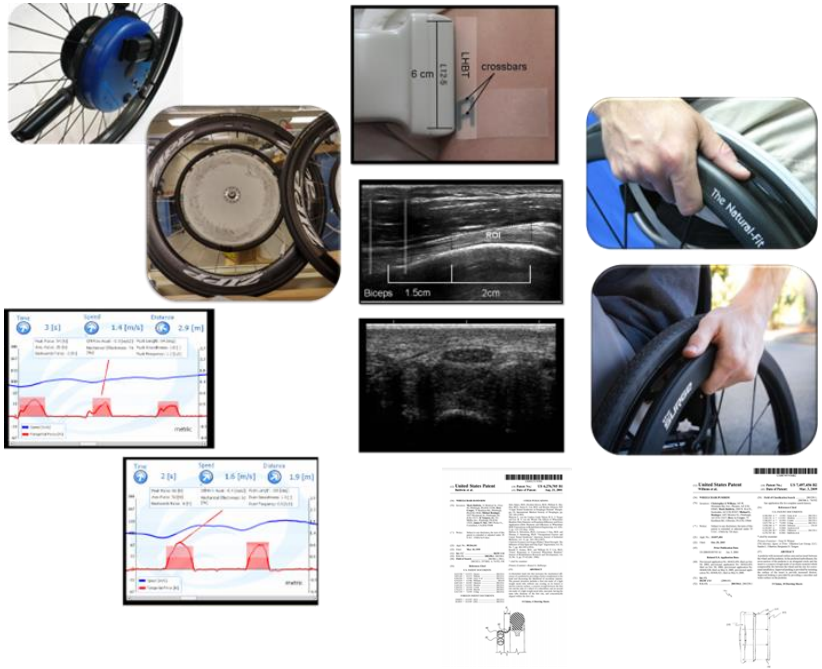
- Cutting and folding metal to transform wheelchair design for improved performance at lower cost.

Measurement and Coaching

University of Pittsburgh

Wearable Monitors

SMARTWheel and Ergonomics



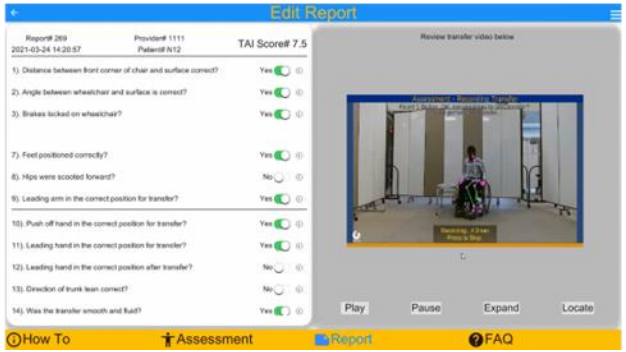
Activity Monitoring

Variable	Community Based (n=52)	Basketball (n=20)	Rugby (n=18)
Distance (meters)	2457.0 (1195.7)	2679.52 (1103.66)	2364.78 (956.35)
Velocity (m/s)	0.79 (0.19)	1.48 (0.13)	1.33 (0.25)
Stops and Starts	141.8 (60.0)	239.78 (60.61)	242.61 (80.31)
Activity Time	8.3 (3.3) Hours	30.28 (9.59) Mins	29.98 (11.79) Mins
Data Collection Period	24 Hours	Approx. 1 Hour	Approx. 1 Hour

Remote Sensing and Coaching

TransKinect

- Overuse pain and injury is common among WC users and linked to weight-bearing ADLs.
- TransKinect is a software application designed to analyze the quality of independent transfer technique with the goal of reducing UL forces.
  - Microsoft Xbox Kinect and machine learning models in a simple GUI
  - Scores transfer based on ergonomic and biomechanical features

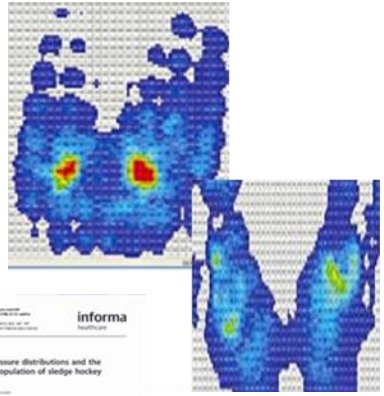


Intelligent Body Mass

- Help people with limited mobility be weighed in bed.
  - Metabolic Disease
  - Health weight maintenance
- Weigh multiple people.
- Measure sleep length and quality.

Performance Improvement and Injury Reduction

Pressure Mapping



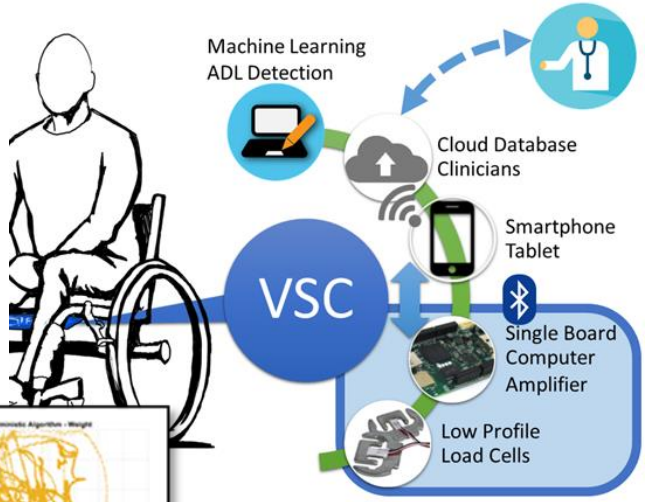
Disability and Rehabilitation: Assistive Technology

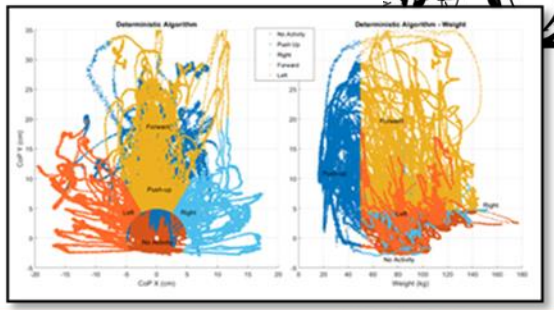
informa healthcare

RESEARCH PAPER

Pressure mapping to assess seated pressure distributions and the potential risk for skin ulceration in a population of sledge hockey players and control subjects

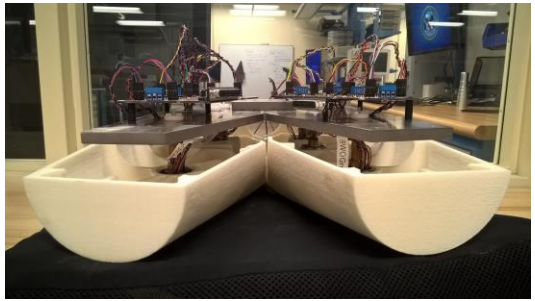
Monitoring Pressure Relief Activity

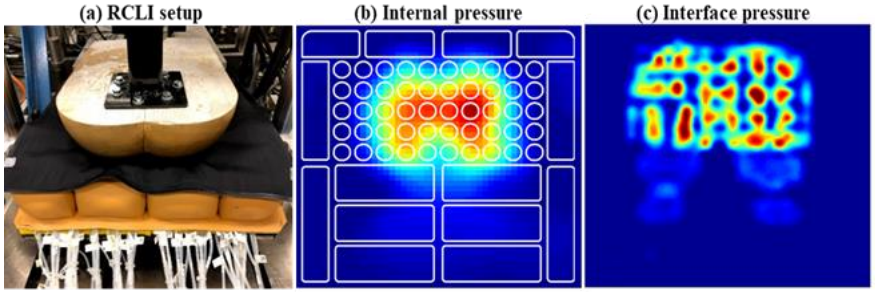


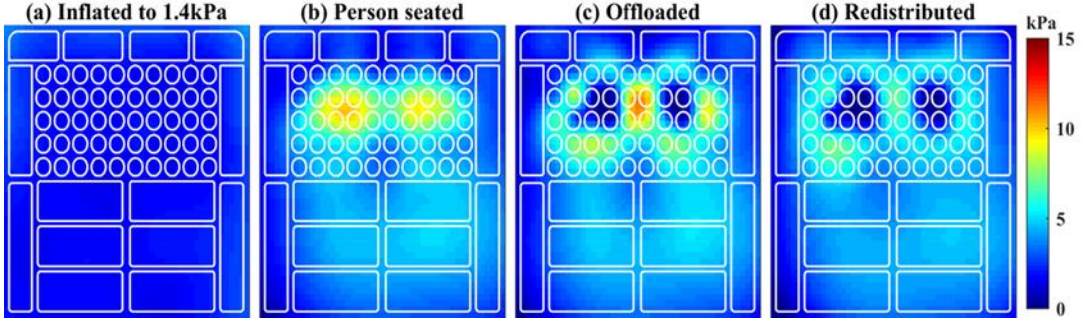


Coaching Safe Seating Behavior

Active Cushion (collaboration with UTARI)







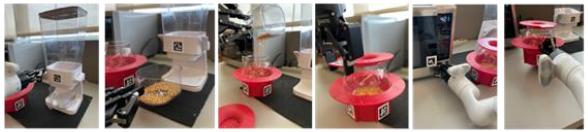
Robotic Arm Assist System

1. User moves to QR-like tag using joystick.

2. User selects circle on touchscreen for highlighted subtask.(i.e. push, pick)

3. System automatically moves robot through subtask then returns to user control.

Modular software architecture to create multi-step manipulation actions: Push, Pick, Pour.

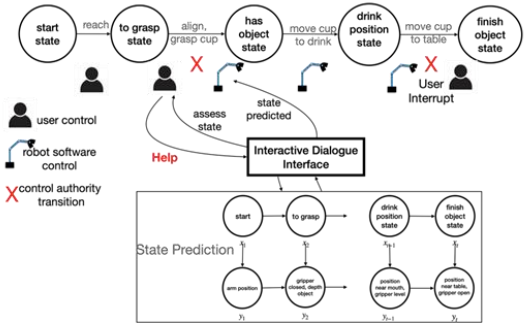


Dispense popcorn kernels.	Grasp cup.	Pour kernels.	Place lid.	Open microwave.	Move jug to microwave.
Push	Pick	Pour	Pick	Push	Pick

Ding, D., Styler, B., Chung, C.-S., & Houriet, A. (2022). Development of a Vision-Guided Shared-Control System for Assistive Robotic Manipulators. *Sensors*. doi:10.3390/s22124351

Flexible Control Authority: User initiated control authority at any point in a task.

State Estimation for seamless transitions.

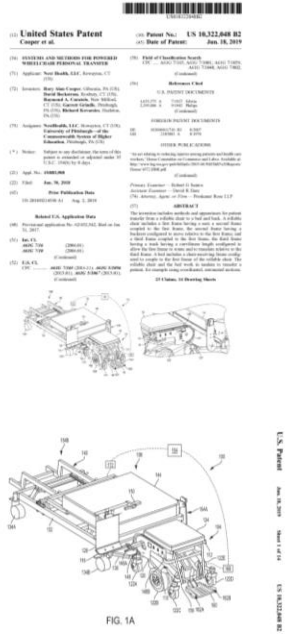



First Aid
KINOVA
Windex

Transformative Assistive Technologies

University of Pittsburgh

Powered Personal Transfer System

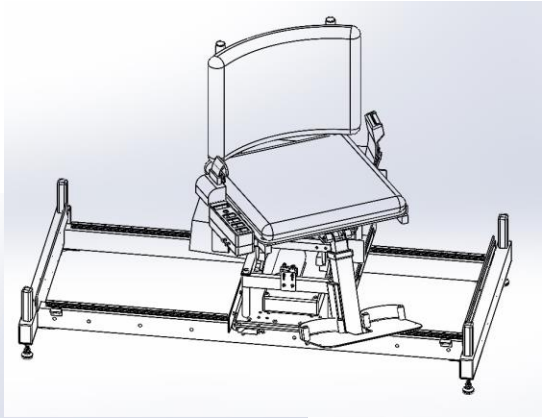


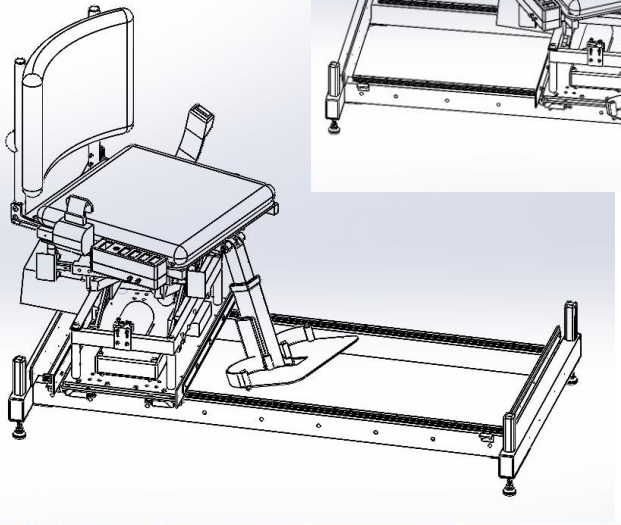
(12) **United States Patent**
Cooper et al.

(10) Patent No.: US 10,322,040 B2
(45) Date of Patent: Jun. 18, 2019

FIG. 1A

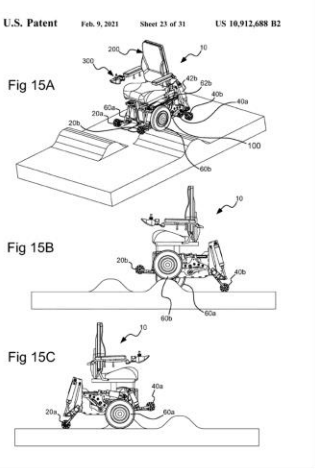
Robotic Workstation





OmniBot

Mobility Enhancement Robotic Wheelchair (MEBot)



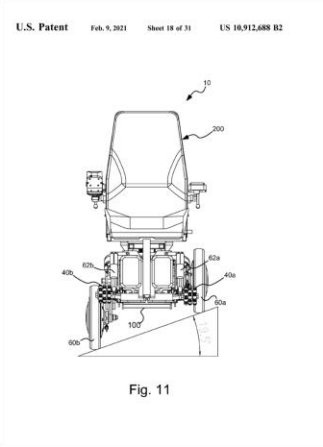
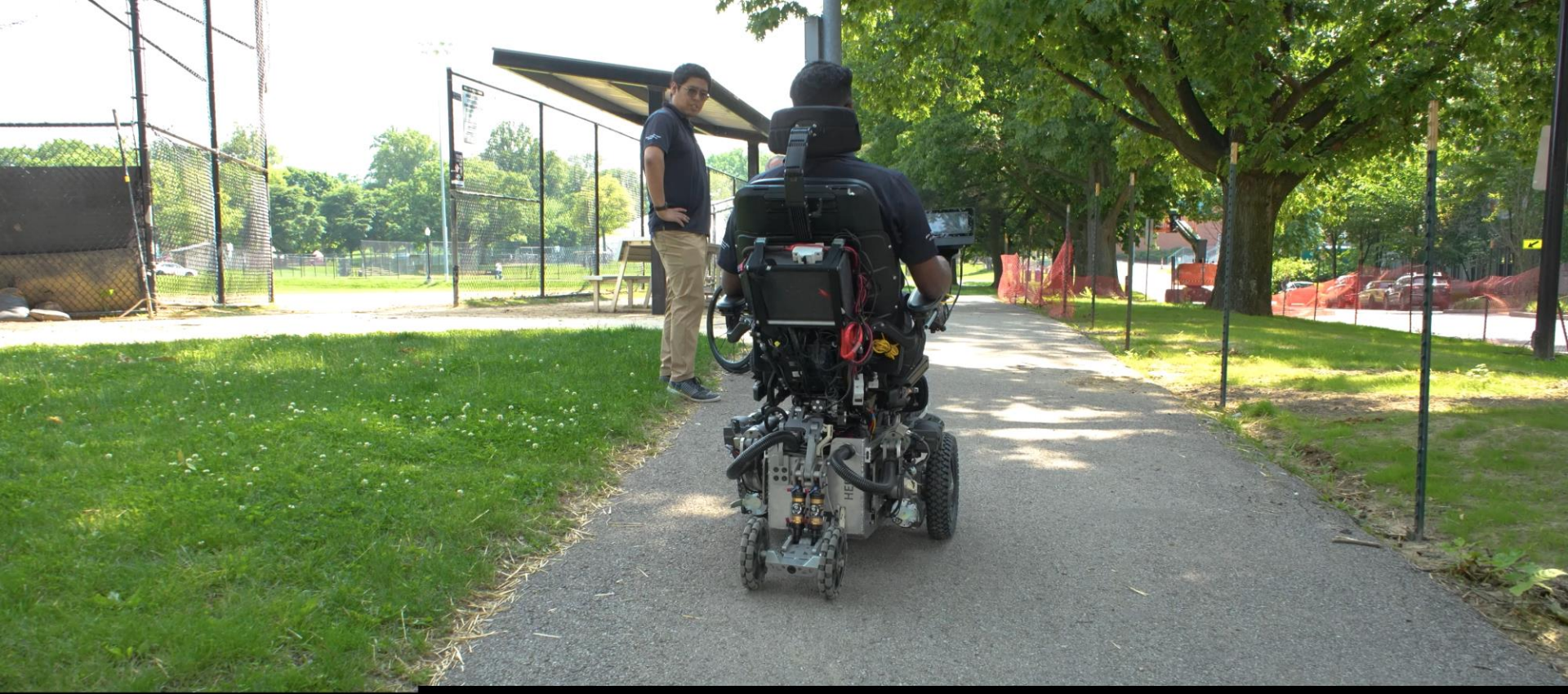
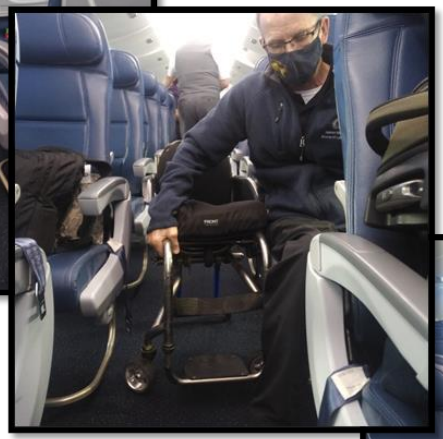


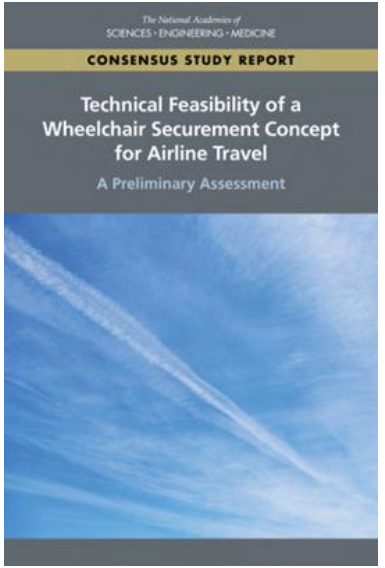
Fig. 11



Opening Water Sports/Games/Parks to Powered Mobility Device Users

Airline Travel





Transformative Assistive Technology Education

University of Pittsburgh

Inspiring Future Generations

Technology and Innovation, Vol. 22, pp. 1-15, 2022
Printed in the USA. All rights reserved.

ISSN 1949-8241 • E-ISSN 1949-825X
http://dx.doi.org/10.21300/22.3.2022.5
www.technologyandinnovation.org

INVENTORS WITH DISABILITIES – AN OPPORTUNITY FOR INNOVATION, INCLUSION, AND ECONOMIC DEVELOPMENT

Jonathan Duvall, Sivashankar Sivakanthan, Brandon Daveler, S. Andrea Sundaram, and Rory A. Cooper

1. Human Engineering Research Laboratories, VA Pittsburgh Healthcare System and University of Pittsburgh, Pittsburgh, PA, USA
2. School of Health and Rehabilitation Sciences, University of Pittsburgh, Pittsburgh, PA, USA

In the United States, about 26% of the population reports having some form of disability. However, people with disabilities (PwD) are under-represented in science, technology, engineering, and mathematics (STEM). The representation of PwD as patented inventors is unknown, but likely under-represented, given their limited numbers in STEM and the workplace. This study set the goal of identifying PwD with patented technologies that have also been introduced into the marketplace. Using web searches and patent awards/applications, 21 influential inventors with disabilities were identified. The impact of these inventors was assessed and is briefly described. Technologies that were invented for PwD that have had mainstream success were also identified. Inventors with disabilities have made important contributions, but further study is required, as the inclusion of PwD in the inventor community is a nascent field of study that is important for expanding the innovation community.

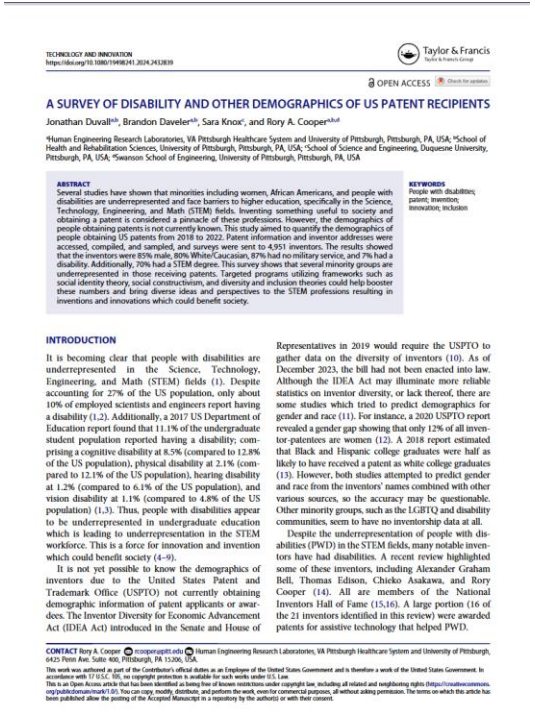
Key words: People with disabilities; Patent; Invention; Innovation; Inclusion; Employment

INTRODUCTION

Inventors are frequently known to address challenges they encounter in their daily lives. For inventors with disabilities, solving these problems can have a life-changing impact not just for themselves but also for others who benefit from their ingenuity. According to the U.S. Centers for Disease Control and Prevention (CDC), more than 26% of the U.S. population, about 61 million Americans, are living with disabilities (1). The most prevalent disability type in the U.S. adult population is mobility disabilities (13.7%) (1), but the CDC also classifies disabilities relating to cognition (10.8%), independent living (6.8%), hearing (5.9%), vision (4.6%), and self-care (3.7%). Many inventions are created by people with disabilities (PwD) who have, through their inventions and the resulting products, regained freedom previously unavailable due to their disabilities, made others' lives easier, and, in some cases, have had a much broader impact.

The inventor's journey often begins with an education in the science, technology, engineering, and mathematics (STEM) fields coupled with exposure to innovative and creative concepts (2). Building on experience, interest, and aptitude, it is important to provide inventors with opportunities and to channel their creativity into invention, which may ultimately be translated into intellectual property and, if desired, commercial or societal success (3,4). The pathways along which inventors with disabilities develop and enhance their skills, harness their ingenuity and experiences, and capitalize on their successes and failures are fraught with pitfalls. There are many traps along the path to invention, and the process is rarely linear. However, nearly all paths start with the cultivation of interests and talent along with the development of

Accepted: January 1, 2022.
Address correspondence to Rory A. Cooper, Ph.D. PLY, Human Engineering Research Laboratories, Suite 400, 6425 Penn Avenue, Pittsburgh, PA 15206, USA. Tel +1-412-822-3700.



TECHNOLOGY AND INNOVATION
https://doi.org/10.1080/19498241.2024.2432839

Taylor & Francis
Taylor & Francis Group

OPEN ACCESS

A SURVEY OF DISABILITY AND OTHER DEMOGRAPHICS OF US PATENT RECIPIENTS

Jonathan Duvall[a,b], Brandon Daveler[a,b], Sara Knox[c], and Rory A. Cooper[a,b,d]

[a]Human Engineering Research Laboratories, VA Pittsburgh Healthcare System and University of Pittsburgh, Pittsburgh, PA, USA; [b]School of Health and Rehabilitation Sciences, University of Pittsburgh, Pittsburgh, PA, USA; [c]School of Science and Engineering, Duquesne University, Pittsburgh, PA, USA; [d]Swanson School of Engineering, University of Pittsburgh, Pittsburgh, PA, USA

ABSTRACT

Several studies have shown that minorities including women, African Americans, and people with disabilities are underrepresented and face barriers to higher education, specifically in the Science, Technology, Engineering, and Math (STEM) fields. Inventing something useful to society and obtaining a patent is considered a pinnacle of these professions. However, the demographics of people obtaining patents is not currently known. This study aimed to quantify the demographics of people obtaining US patents from 2018 to 2022. Patent information and inventor addresses were accessed, compiled, and sampled, and surveys were sent to 4,951 inventors. The results showed that the inventors were 85% male, 80% White/Caucasian, 87% had no military service, and 7% had a disability. Additionally, 70% had a STEM degree. This survey shows that several minority groups are underrepresented in those receiving patents. Targeted programs utilizing frameworks such as social identity theory, social constructivism, and diversity and inclusion theories could help booster these numbers and bring diverse ideas and perspectives to the STEM professions resulting in inventions and innovations which could benefit society.

KEYWORDS
People with disabilities; patent; invention; innovation; inclusion

INTRODUCTION

It is becoming clear that people with disabilities are underrepresented in the Science, Technology, Engineering, and Math (STEM) fields (1). Despite accounting for 27% of the US population, only about 10% of employed scientists and engineers report having a disability (1,2). Additionally, a 2017 US Department of Education report found that 11.1% of the undergraduate student population reported having a disability; comprising a cognitive disability at 8.5% (compared to 12.8% of the US population), physical disability at 2.1% (compared to 12.1% of the US population), hearing disability at 1.2% (compared to 6.1% of the US population), and vision disability at 1.1% (compared to 4.8% of the US population) (1,3). Thus, people with disabilities appear to be underrepresented in undergraduate education which is leading to underrepresentation in the STEM workforce. This is a force for innovation and invention which could benefit society (4–9).

It is not yet possible to know the demographics of inventors due to the United States Patent and Trademark Office (USPTO) not currently obtaining demographic information of patent applicants or awardees. The Inventor Diversity for Economic Advancement Act (IDEA Act) introduced in the Senate and House of Representatives in 2019 would require the USPTO to gather data on the diversity of inventors (10). As of December 2023, the bill had not been enacted into law. Although the IDEA Act may illuminate more reliable statistics on inventor diversity, or lack thereof, there are some studies which tried to predict demographics for gender and race (11). For instance, a 2020 USPTO report revealed a gender gap showing that only 12% of all inventor-patentees are women (12). A 2018 report estimated that Black and Hispanic college graduates were half as likely to have received a patent as white college graduates (13). However, both studies attempted to predict gender and race from the inventors' names combined with other various sources, so the accuracy may be questionable. Other minority groups, such as the LGBTQ and disability communities, seem to have no inventorship data at all.

Despite the underrepresentation of people with disabilities (PWD) in the STEM fields, many notable inventors have had disabilities. A recent review highlighted some of these inventors, including Alexander Graham Bell, Thomas Edison, Chieko Asakawa, and Rory Cooper (14). All are members of the National Inventors Hall of Fame (15,16). A large portion (16 of the 21 inventors identified in this review) were awarded patents for assistive technology that helped PWD.

CONTACT Rory A. Cooper rcooper@pitt.edu Human Engineering Research Laboratories, VA Pittsburgh Healthcare System and University of Pittsburgh, 6425 Penn Ave. Suite 400, Pittsburgh, PA 15206, USA.

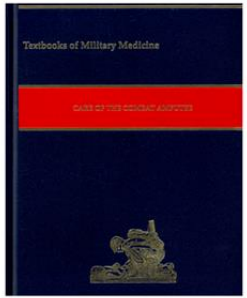
JMVFH JOURNAL OF MILITARY, VETERAN AND FAMILY HEALTH

Psychological strategies of Veterans and service members who participate in organized sports

Sara L. Peterson, Justin Z. Laferrier, Alicia M. Koontz, Hongwu Wang, Matthew Hannan, Rory A. Cooper
Correspondence should be addressed to Sara L. Peterson at speterson@pitt.edu.

Sara L. Peterson, CPO, MBA, is an instructor and certified Orthotist/Prosthetist and a doctoral student in rehabilitation science and technology at the University of Pittsburgh. She has worked in orthotics and prosthetics since 1993. Her research interests include

https://doi.org/10.3138/jmvfh.4316



Taylor & Francis Online

Journal
Disability and Rehabilitation ›
Volume 31, 2009 - Issue 5

Rehabilitation in Practice

Psychosocial impact of participation in the National Veterans Wheelchair Games and Winter Sports Clinic

Michelle L. Sporner, Shirley G. Fitzgerald, PhD, Brad E. Dicianno, Diane Collins, Emily Teodorski, Paul F. Pasquina & ...show all

Pages 410-418 | Accepted 01 Feb 2008, Published online: 07 Jul 2009
Download citation https://doi.org/10.1080/09638280802030923

D-Scholarship @ Pitt
Institutional Repository of the University of Pittsburgh

Investigation of the Effects of Sport, Exercise and Recreation (SER) on Psychosocial Outcomes in Individuals with Disabilities

Laferrier, Justin (2012) *Investigation of the Effects of Sport, Exercise and Recreation (SER) on Psychosocial Outcomes in Individuals with Disabilities.* Doctoral Dissertation, University of Pittsburgh. (Unpublished)

AMERICAN JOURNAL OF
Physical Medicine & Rehabilitation

Investigation of the Impact of Sports, Exercise, and Recreation Participation on Psychosocial Outcomes in a Population of Veterans with Disabilities: A Cross-sectional Study

Laferrier, Justin Z. PT, PhD, OCS, SCS, ATP, CSCS; Teodorski, Emily MSW; Cooper, Rory A. PhD

American Journal of Physical Medicine & Rehabilitation: December 2015 - Volume 94 - Issue 12 - p 1026–1034
doi: 10.1097/PHM.0000000000000263
Original Research Articles

Adaptive sports & recreation promotes mental health and community integration

Need to Expand Opportunities for Powered Device Users

Powered Soccer

Powered Wheelchair Field Hockey

DISABILITY AND REHABILITATION: ASSISTIVE TECHNOLOGY
https://doi.org/10.1080/17483107.2020.1767220

Taylor & Francis

REVIEW

A review of adaptive sport opportunities for power wheelchair users

Jonathan Duvall[a,b], Shantanu Satpute[a,c], Rosemarie Cooper[a,b,d,e] and Rory A. Cooper[a,b]

[a]Human Engineering Research Laboratories, US Department of Veterans Affairs and School of Health & Rehabilitation Sciences, University of Pittsburgh, Pittsburgh, PA, USA; [b]Department of Rehabilitation Science & Technology, University of Pittsburgh, Pittsburgh, PA, USA; [c]Department of Bioengineering, University of Pittsburgh, Pittsburgh, PA, USA; [d]Center for Assistive Technology, UPMC Health System and University of Pittsburgh, Pittsburgh, PA, USA

ABSTRACT

Purpose: To identify adaptive sports opportunities for individuals who use powered wheelchairs for their primary means of mobility, and to determine barriers and facilitators for new sporting opportunities.
Materials and methods: A structured literature review of the peer reviewed scientific literature and analysis of major adaptive sport competitions information. Pubmed and Scopus were searched for the phrases "Power wheelchair sports" and "complex disability sport" to identify articles discussing competitive sport opportunities for power wheelchair users. Also, the websites and instructional materials were searched to identify what sports exist for power wheelchair users in the Paralympics, the National Veteran Wheelchair Games, the Invictus Games and the Warrior Games.
Results: Eleven articles were found from Pubmed and Scopus which met the criteria, most of which were focused on power soccer. The search for sport opportunities from the four major competitions found few events where someone using a power wheelchair could participate, most of which involve a stationary chair during competition (e.g., archery, billiards).
Conclusions: This literature review identified few programs for sports for people who use power wheelchairs. Many challenges such as lack of appropriate technology, lack of programs, and challenging classification categories all interact to contribute to this problem. Opportunities exist for better and more appropriate technology to be developed and for new and innovative sports and rules to be adopted for these athletes to benefit more from sport and recreation.

ARTICLE HISTORY
Received 11 April 2020
Accepted 6 May 2020

KEYWORDS
Adaptive sports; power wheelchair; high support needs; disabled athletes

➤ IMPLICATIONS FOR REHABILITATION

- Athletes with complex disabilities and high support needs are not provided with the same opportunities as other athletes.
- Challenges such as insufficient technology, lack of programs, and challenging classification categories all interact to contribute to the lack of opportunities.
- Opportunities exist for better and more appropriate technology to be developed and for new and innovative sports and rules to be adopted for athletes with complex disabilities and high support needs to benefit more from sport and recreation.

Introduction

It is important for people with disabilities to have opportunities to participate in society and to pursue healthy life activities [1–4]. There is a growing population of people with disabilities and the technologies and approaches used by them are also growing [5–9]. Participation in society requires the physical environment to be accessible, the proper technology for their needs, and for people to have appropriate supports in place to succeed [10–15]. Having fun is important to wellbeing, to establish a positive perception of self, and to form healthy relationships [16–19]. Activities that many people with disabilities find attractive and beneficial are adaptive sports and recreation.

There have been several studies conducted on the benefits of adaptive sports and recreation activities and competitions [20–22]. Adaptive sports and recreation are among the most effective strategies for achieving higher outcomes during medical rehabilitation, for changing perceptions of self among people with disabilities, and for promoting greater inclusion of people with disabilities in society [1,23–29]. Studies related to adaptive sports and recreation also suggest that there are benefits to employment, education, and training [30–36]. Sports and recreation also help to change the perception of people with disabilities [37]. Technology plays an important role in creating sports and recreation opportunities [38]. People with disabilities are often drivers of innovation in adaptive sports and recreation [39–46]. There are growing opportunities and types of activities in which people with disabilities can participate [38,47–53].

The Paralympic movement started in 1946 and remains a catalyst for growing sports, recreation, and inclusion opportunities [54–57]. However, few opportunities exist within the thousands of adaptive sports and recreation organisations, schools and colleges for individuals with complex disabilities and high support needs [58–60]. The descriptor *"people with complex disabilities and high support needs"* is adopted from the definition used by the International Paralympic Committee, which has recognised the need to be more inclusive of this population [61]. The

CONTACT Jonathan Duvall jonathan.duvall@pitt.edu Human Engineering Research Laboratories, 6425 Penn Ave. Suite 400, Pittsburgh, 15206, PA, USA

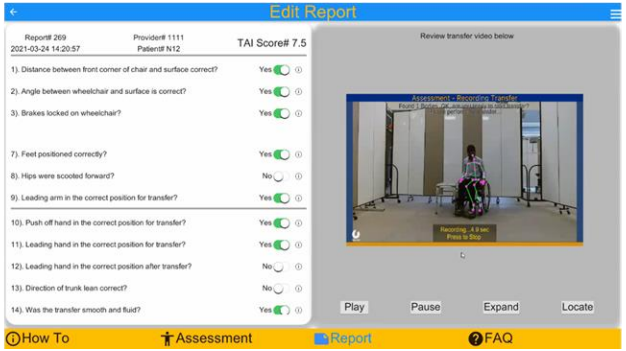
Transportation Board Game – “HERL-Town”


HERL TOWN
Rules for Players
Rules for Players
Rules for Players

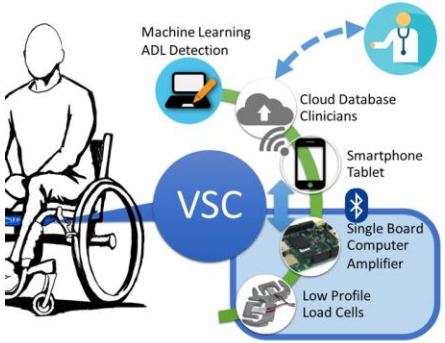
Transforming Clinical Education

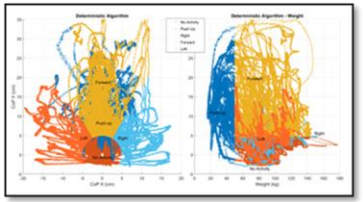
The Caregiver Assisted Transfer Technique Instrument (CATT)

TransKinect



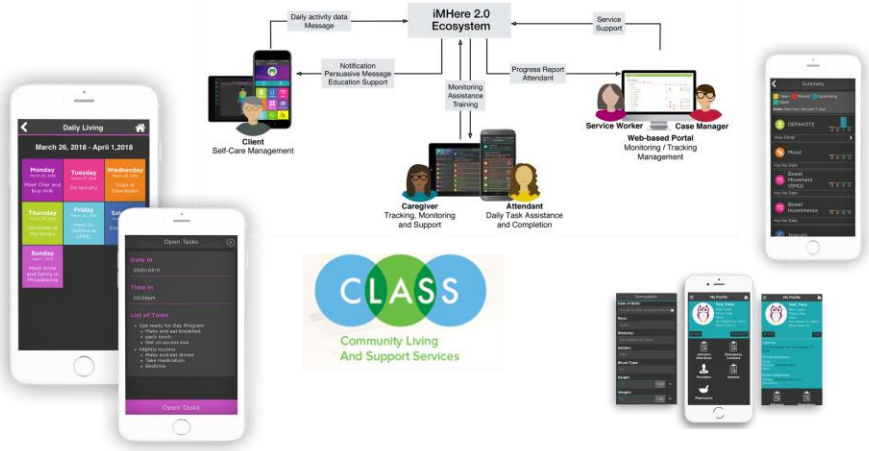
Virtual Seating Coach



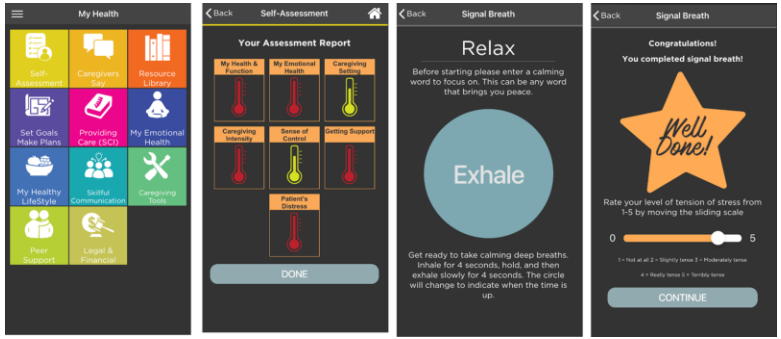


Community Based Support

Smart Organizational Connectivity



Caregiver Intervention & Support



Turn Adversity to Advantage

and

Action into Accomplishment

Rory A. Cooper, PhD
University of Pittsburgh
Suite 400
6425 Penn Avenue
Pittsburgh, PA 15206

For more info see: www.herl.pitt.edu