



HERL Quarterly Newsletter

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SEPTEMBER/OCTOBER
2004

LETTER FROM THE EDITOR

It is hard to believe the fall semester has arrived already! As new graduate students join the lab, classes begin, and it begins to feel a little cooler outside, we at HERL have a brief chance to relax after our whirlwind of summer activity.

Our students and staff volunteered their time to participate in several community activities over the summer. The "HERL Panthers" team walked again this year on June 27th to help raise money for Easter Seals of Western PA in Pittsburgh's Schenley Park at their "Walk with Me" event. On July 19-22, HERL students/staff Erin Aghamehdi, Beth



This summer's "HERL Panthers" participated in Easter Seals' "Walk with Me." (L to R): Amanda Reinsfelder, Presley Kelleher, Sasha Stankovic, Annmarie Kelleher, India Stankovic, Paula Stankovic, Dave Stankovic

Ann Kaminski, Stephanie Martin, Mark McCartney, Jeremy Puhlman, Amanda Reinsfelder, and Erik Wolf all participated in the Three Rivers Adaptive Sports Annual Water Ski Clinic at Conneaut Lake.

We were fortunate to work with an exceptional group of undergraduate interns over the summer months. This year's group brought a broad spectrum of abilities to the lab and advanced the progress of several research projects as well many clinical and administrative projects. I would like to specifically thank our front office intern Samantha Goldstein (who is unfortunately not in the picture on the right), who wrote several articles for the HERL newsletter and created the summer intern webpage. You can read about the different summer intern projects and view their final presentations on our website at www.herlpitt.org.

HERL investigators Alicia Koontz, Ph.D., ATP and Donald Spaeth, Ph.D., ATP, both received Rehabilitation Engineering Technologist (RET) credentialing from RESNA (Rehabilitation Engineering Society of North America). HERL Clinical Coordinator Annmarie Kelleher received RESNA Assistive Technology Practitioner (ATP) certification and also completed her masters' degree in Occupational Therapy over the summer.

Yusheng Yang, M.A., a HERL/Department of Rehabilitation Science and Technology graduate student, received the American Society of Biomechanics (ASB) travel award, which provided \$150 in travel funding to attend the 2005 ASB annual meeting in Portland, OR, September 8-11.

United Cerebral Palsy of Pittsburgh chose The Center for Assistive Technology (CAT) to receive their 2004 Advocacy and Awareness Award. The award will be presented on September 29th at their 12th Annual Community Heroes Awards Dinner, a ceremony to honor those who help make UCP's mission a reality for people with disabilities. CAT's Clinical Director Mark Schmeler will be accepting the award on behalf of the clinic.

This year's FIRST Lego League Tech-Link robotics competition is underway. For our new readers, this is a yearly event we participate in to encourage kids with disabilities towards interests and careers in math and science. This year's Challenge is themed, "No Limits." Teams will build and program robots that address the specific needs of people with physical disabilities. The Challenge 2004 kickoff is Sept. 15th. You can read more about the event on the following website: www.firstlegoleague.org/default.aspx?pid=13420



*The 2004 HERL Summer Interns. Back: row (left to right): Jaideep Karnawat, Mike Masuga, A.J. Malkiewicz, Joe Ulerich, Scott Novich
Front Row (left to right): Sarah Wyszomierski, Katie Weber, Brooklynn Drake, Alexandra Jefferds, Dewey Black*

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We hope that all of our new readers find something of interest or benefit in this issue of our newsletter. Keep an eye out for our winter issue, due to be published in December.

-Christine Heiner,
HERL newsletter editor

CURRENT RESEARCH ABSTRACTS

Durability, Value, And Reliability Of Selected Electric Powered Wheelchairs

J. Megan Vitek, MS, Rory A. Cooper, PhD, Shirley G. Fitzgerald, PhD,
Mark Schmeler, MS, OTR/L, ATP, Michael L. Boninger, MD, S. David Algood, BS,
William A. Ammer, BS, Andrew J. Rentschler, MS, John Duncan, BS

Full article published in **Archives of Physical Medicine and Rehabilitation**,
Vol. 85, No. 5, pp. 805-814, May 2004.

Purpose of Work: To compare the durability, value, and reliability between different brands of electric powered wheelchairs.

Procedures: Fifteen electric powered wheelchairs were tested: three each of the Jazzy, Quickie, Lancer, Arrow, and Chairman. Using established tests for testing durability and a controlled laboratory environment, the wheelchairs were tested for durability.

Results: For the most part, the five brands differed significantly in durability, value, and reliability, except in terms of supplier repairs. The Arrow had the highest durability and value, and the highest reliability in



A power wheelchair endures durability testing on the double drum machine in our wheelchair testing lab.

terms of consumer failures, supplier failures, repairs, failures, consumer repairs/failures, and supplier repairs/failures. The Lancer had the lowest durability and reliability. The Chairman had the lowest value.

Relevance to Wheelchair Users:

These findings can be used as a guide for suitable wheelchair selection, alongside other relevant selection criteria. Care should be made when making comparisons, as the Chairman had extra features not available in the other wheelchairs.

-Shirley Fitzgerald, Ph.D.

Manual Wheelchair Pushrim Dynamics in People with Multiple Sclerosis

Brian T. Fay, PhD, Michael L. Boninger, MD, Shirley G. Fitzgerald, PhD,
Aaron L. Souza, PhD, CPT, Rory A. Cooper, PhD, Alicia M. Koontz, PhD, ATP

Full Article Published in **Archives of Physical Medicine and Rehabilitation**,
Vol. 85, No. 7, pp. 1141-1145, July 2004.

Purpose of the Work. To compare manual wheelchair propulsion biomechanics at different speeds and with fatigue in three groups: 1. People with multiple sclerosis (MS), 2. People with a spinal cord injury (SCI), and 3. People with no disability (ND).

Subjects/ Procedures. A total of 42 people, 8 men and 6 women per group, were included in this study. Forces and moments at the pushrim were calculated using a SMART^{Wheel}, developed in our laboratory. Arm motion during wheelchair propulsion was analyzed using a 3-camera system on both sides of the subject. The wheelchair was secured with belts onto a roller system in the laboratory. Subjects were asked to push the chair on the roller system first at a self-selected speed, and then at 1m/s while data were collected. The MS and ND groups were also asked to complete a 5-minute fatigue trial.

Results. The MS group pushed the wheelchair

with an arcing pattern more than the other groups.

In this pattern, as the hand follows the pushrim of the wheel during wheelchair propulsion, it creates an arc. The MS group also pushed the wheelchair at a much slower self-selected speed, pushed the wheelchair with a smaller push angle, and actually demonstrated a braking effect when grasping and releasing the pushrim. The group with MS was also unable to maintain a steady propulsion speed throughout the 5-minute fatigue trial. Finally, the group with MS was more likely to demonstrate asymmetry between the right and left sides during propulsion.

Relevance to Wheelchair Users. Manual wheelchair users with MS demonstrate ineffective propulsion patterns, and have difficulty grasping and releasing the pushrim during wheelchair propulsion. They are also unable to maintain their speed for an extended period of time. Clinicians should consider these findings when prescribing manual wheelchairs to people with MS. *-Fabrisia Ambrosio, M.S., M.P.T.*

CURRENT RESEARCH ABSTRACTS

A Pilot Study on Community Usage of a Pushrim Activated Power Assisted Wheelchair

Shirley G. Fitzgerald, PhD, Julianna Arva, MS, Rory A. Cooper, PhD,
Michael J. Dvorznak, MS, Donald M. Spaeth, PhD, Michael L. Boninger MD

Full article published in *Assistive Technology Journal*, Vol. 15.2, pp. 113-119, Winter 2003.



A pushrim activated power assist wheelchair (PAPAW)

Purpose of work: Manual wheelchair propulsion combined with other stresses to the upper extremities (such as arms and shoulders), may result in secondary injury. Possible solutions would be to devise other methods of wheelchair propulsion, such as a pushrim activated power assist (PAPAW)

wheelchair. The goals of this study were to examine the usage of the PAPAW in a real world setting and to describe the driving habits of manual wheelchair

users.

Subjects/Procedures: Subjects were provided with a PAPAW for two weeks. Usage was tracked for both the PAPAW and the subjects' own wheelchair using dataloggers. Significant differences in usage were not seen between the personal wheelchairs or the PAPAW.

Results: As a result, weeks were combined to provide an overall examination of driving characteristics. The total distance traveled over an average day was 2310.1 ± 695.9 meters with an average velocity of 0.44 ± 0.09 . The total average time spent in propulsion in a given day was 85.3 ± 18.9 minutes.

Relevance to Wheelchair Users: This study provides an idea of manual wheelchair usage in a population of individuals with spinal cord injury.

Evaluation of Selected Electric Powered Wheelchairs Using the ANSI/RESNA Standards

Andy Rentschler, MS, Rory Cooper, PhD, Shirley Fitzgerald, PhD, Michael Boninger, MD, Songfeng Guo, PhD, William Ammer, B.S., J. Megan Vitek, MS, S. David Algood, MS

Full article published in *Archives of Physical Medicine and Rehabilitation*, Vol. 85, No. 4, pp. 611-619, April 2004.

Objectives: The purpose of this study was to compare the performance of a group of electric powered wheelchairs using the American National Standards Institute (ANSI) and Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) standards. Our goal was to identify differences useful to clinicians and wheelchair users. Five different electric powered wheelchairs were selected and tested from five manufacturers.

Main Outcome Measures: The variables that were of greatest interest were the static tipping angle (e.g., the steepest ramp that the wheelchair could rest on without tipping), dynamical tipping score (i.e., a rating of how the wheelchair tipped while driving on different slopes), braking distance, energy consumption (i.e. a type of fuel mileage test), strength, durability, and response to heat, cold and rain.

Results: The testing showed that there were differences among the 5 types of wheelchairs for static stability when facing uphill and downhill, as well

as for the dynamical tipping scores. Differences were also found for braking distances and energy consumption (fuel mileage). Several of the wheelchairs experienced failures during the strength, durability, and climate tests.

Conclusions: The results showed that electric powered wheelchairs can vary greatly with respect to their performance on both safety and performance tests. Consumers and clinicians should be aware of the differences between electric powered wheelchairs and balance their activities with the performance characteristics of the wheelchair. Test results for many wheelchairs are available upon request from manufacturers, and they may be helpful when selecting a wheelchair.



Power wheelchair being tested for static stability

-Rory Cooper, Ph.D.

RECENT HERL PUBLICATIONS

Ohnabe H, Cooper RA, Trend of Wheelchairs, **Journal of The Japan Society for Welfare Engineering**, Vol. 6, No. 1, pp. 7-13, May 2004.

Fay BT, Boninger ML, Fitzgerald SG, Souza AL, Cooper RA, Koontz AM, Manual Wheelchair Pushrim Dynamics in Persons with Multiple Sclerosis, **Archives of Physical Medicine and Rehabilitation**, Vol. 85, No. 6, pp. 935-942, June 2004.

Boninger ML, Impink B, Cooper RA, Koontz AM, Relation Between Median and Ulnar Nerve Function and Wrist Kinematics During Wheelchair Propulsion, **Archives of Physical Medicine and Rehabilitation**, Vol. 85, No. 7, pp. 1141-1145, July 2004.

Trefler E, Fitzgerald SG, Hobson DA, Bursick T, Joseph R, Outcomes of Wheelchair Systems Intervention with Residents of Long-Term Care Facilities, **Assistive Technology**, Vol. 16.1, pp. 18-27, Summer 2004.

Cooper RA, Boninger ML, Cooper R, Fitzgerald SG, Kelleher A, Preliminary Assessment of a Prototype Advanced Mobility Device in the Work Environment of Veterans of Spinal Cord Injury, **Neurorehabilitation**, Vol 19, No. 2, pp. 161-170, 2004.

Crane BA, Holm MB, Hobson D, Cooper RA, Reed MP, Stadelmeier S, Development of a Consumer-Driven Wheelchair Seating Discomfort Assessment Tool (WcSDAT), **International Journal of Rehabilitation Research**, Vol. 27, No. 1, pp. 85-90, 2004.

Boninger ML, Powered up for Wheelchair Access, **The Washington Times**, August 4, 2004.
<http://www.washingtontimes.com/commentary/20040803-082037-9078r.htm>

Boninger ML, The Art of Wheelchair Propulsion, **SCI Life**, Vol. 1, No. 1, p. 7, Summer 2004.

Cooper RA, Cooper R, Schmeler M, Kelleher A, Innovations in Design: Advances in Wheelchair Technology Make for an Easy-Access World, **Advance for Directors in Rehabilitation**, Vol. 18, No. 8, pp. 25-28, August 2004.

If you know of a current event or have an ad that you would like to post in the HERL Quarterly Newsletter, please contact Christine Heiner at (412) 365-4854 or by e-mail at heinercm@pitt.edu

HERL IN THE MEDIA

Paraplegia News, July 2004: Pp 16-21: The Promise of Research

VA Research Currents, July 2004: Page 4: Career Milestones: Rory Cooper
<http://www.va.gov/resdev/about/wn.cfm>

VA Research Currents, May 2004: Page 4: Career Milestones: Michael Boninger
http://www1.va.gov/resdev/prt/va_research_currents_may_04.pdf

RR&D Update, May/June 2004: Page 2: 2004 HERL RESNA Winners/Human Engineering Research Laboratories Turn 10

SCI Life, Summer 2004: Page 4: Wheelchair Users Registry

CURRENT EVENTS

Every election year, millions of Americans with disabilities are unable to participate in the political process. Americans with disabilities often cannot exercise their right to vote because either polling places or voting machines are inaccessible to them. In fact, millions of Americans with disabilities did not vote in the 2000 elections.

United Cerebral Palsy has just launched DontBlockMyVote.org, a national campaign to guarantee equal access to the polls to all Americans. Go to DontBlockMyVote.org today and send a free letter to your Members of Congress asking them to back up HAVA with adequate funding to ensure that all Americans have equal access to the polls!

United Spinal Association, in partnership with the New York Times Foundation, has developed an Internet based veterans message board where veterans of all ages, their families, and anyone in general can post questions, comments, or advice on a variety of veteran-related issues. The message board, which can be accessed via the United Spinal website: www.unitedspinal.org, as well as the New York Times Foundation's The Next Step Website: www.nytc.com/foundation/vets, is divided into conferences. Each conference has a main topic for discussion: Veterans Benefits, Veterans health care, Wounded Warrior Project

If you have any questions related to the veterans forum, please e-mail vetsfirst@unitedspinal.com or call 800-404-2898.

FEATURED HERL STUDENT: Beth Ann Kaminski

Beth Ann Kaminski first began working at HERL in the summer of 2002 as an undergraduate intern. During her internship, Beth Ann assisted with many projects, especially in our machine shop and wheelchair testing lab. She graduated from Case Western University, Cleveland, OH in May 2002 with a B.S. in Biomedical Engineering.

Beth Ann decided to return to HERL that summer to work on a Masters degree in Rehabilitation Science and Technology. Her masters thesis research project is entitled, "Application of a Commercial Datalogger to Electric Powered and Manual Wheelchairs of Children." In this study, Beth Ann collects information about how far, fast, and often children propel or drive their wheelchairs. This data can be useful in wheelchair and wheelchair component design for children.

She also dedicates her time to many other projects both within and outside HERL. This past summer, Beth



Beth Ann Kaminski, B.S.E.

Ann was included in our 2004 National Veterans Wheelchair Games research team. She helped recruit new wheelchair users for HERL research studies and assisted with data collection for the studies conducted in St. Louis. She also works as a Rehabilitation Engineer at the UPMC Center for Assistive Technology. Beth Ann also volunteers at the Three Rivers Adaptive Sports water ski clinic, the Harmarville Healthsports Hope Network ski clinic, and at the Tech-Link Robotics competition.

This summer Beth Ann won a Rehabilitation Engineering Society of North America (RESNA) student design award for her work on adapting a baby seat for attachment to a wheelchair.

Beth Ann is also known for her inclination to bake delicious treats for the HERL staff and students to celebrate everything from a fellow students' graduation to a holiday. She expects to graduate in December 2004 and hopes to work as an Assistive Technology Evaluator in seating and wheelchairs.

-Christine Heiner

Wired on Wheels: a Growing Restaurant Accessibility Resource

Recently the HERL student representatives asked my advice about where we could hold this year's Department of Rehabilitation Science and Technology (RST) new student orientation/reception. This yearly social event is an opportunity for us to meet the incoming grad students and enjoy some food and drinks. For the past couple of years, its been held at Cumpies, a bar/restaurant directly across the street from RST on Pitt's Oakland campus. However, many people have commented that Cumpies' restrooms are not wheelchair accessible.

I'm a former Pitt student and used to live on campus for many years, so I know just about every bar and restaurant in Oakland. When actually forced to sit down and think about it, I couldn't think of any restaurants on campus that aren't cramped and tiny, or don't have steps at the entrance or providing the only path to the restrooms. I decided to get on the internet and see if I could find some more information about accessible restaurants and discovered a potentially helpful resource for rating



restaurant accessibility: www.wiredonwheels.org.

On the site you can search for restaurants in many U.S. cities, rate restaurants, and add listings for restaurants that aren't yet on the site. The rating criteria address parking, front entrance, restroom, and dining room accessibility, and service and communication for people with visual and hearing impairments. The overall accessibility ratings are represented by icons for no access, poor access, OK access, good access, and WOW! access.

What makes Wired on Wheels a "potentially helpful resource" is the fact that many restaurants in the Pittsburgh area are not yet listed or rated on the site. The site encourages people to submit reviews and restaurant listings. You don't need any special credentials to submit a restaurant review, and the site provides useful tips for rating restaurants. By sharing your restaurant accessibility experiences with Wired on Wheels, you can help build a valuable informational resource for people with accessibility needs.

-Christine Heiner

Ian Rice Competes in 2004 Paralympics

Ian Rice, M.S., OTR/L, a HERL/Department of Rehabilitation Science and Technology doctoral student, will be competing in this year's Paralympic Games in Athens, Greece as this issue of the newsletter goes to press. He will be competing in the 100m, 200m, 400m and 800m wheelchair races. The Paralympics is the most elite international wheelchair sports competition in the world, second only in magnitude

to the Olympics. About 4,000 athletes, representing 140 countries in 19 sports, will participate in the this year's Paralympic Games. The Paralympics opening ceremony is September 17th and the games commence on September 28.

Ian is an accomplished athlete who has won many wheelchair racing competitions, leading to his qualification for the Paralympics. Among the races Ian has championed are the Chicago Marathon (1996, 1999), the Cleveland 10K (4 times), the Long Island 10K (twice), the Columbus Marathon



Ian Rice will race in the 100m, 200m, 400m, and 800m distances in the 2004 Paralympic Games in Athens, Greece

(1999), the Pittsburgh Marathon (open quad division, 2003) and the Pittsburgh Great Race (2003). He broke a course record for the 12th fastest marathon time in the T2 division, finishing 1:55:40 in the 1999 Chicago Marathon. He also raced in the 2000 Paralympic Games in Sydney, Australia and made it to the finals in the 100m, 200m, and 400m distances.

Ian achieved elite status in the 100m, 400m, 800m, 1500m, and 5000m track distances in March at the Olympic training camp in Warm Springs, Georgia.

Information and coverage of the games is available at www.usparalympics.org. The website www.wheelpower.com has posted information about television coverage of the Paralympics.

We will be sure to announce Ian's results in the upcoming issue of the newsletter.

-Christine Heiner

HERL Mourns Passing of William Hens

We were very shocked and upset this fall when we learned of the sudden death of one of our associates, Bill Hens. Bill passed away suddenly on July 1st at the age of 55.

Mr. Hens was the officiator at the 2004 St. Louis National Veterans Wheelchair Games and generously gave his time to participate in the HERL research studies conducted there.

A resident of Levittstown, PA, Bill was a member of the United Spinal Association (formerly known as the Eastern Paralyzed Veterans Association). He was also a Vietnam era veteran who served in the U.S. Navy.



Bill Hens was a national and world weightlifting champion

Bill played semi-professional football in his early twenties. Later he became an enthusiastic wheelchair athlete, well known for weightlifting. He was the president of the U.S. Wheelchair Weightlifting Federation from 1986-2004 and coached powerlifting at the 1992 and 1996 Paralympics. Bill also devoted much effort to various other wheelchair sports and coaching younger athletes.

Bill will be sadly missed by those of us at HERL who were fortunate to know him.

-Christine Heiner

FACULTY PROFILE: Rosemarie Cooper, MPT, ATP

Rosemarie Cooper received a Bachelor of Arts in International Business from California State University (Sacramento) in 1994. In 1998 she earned her Masters Degree in Physical Therapy (MPT) from the University of Pittsburgh. She obtained RESNA Assistive Technology Practitioner (ATP) certification in 1998. Rosi has worked as a Clinical Coordinator at the Human Engineering Research Labs since 2000.

As a HERL Clinical Coordinator, Rosi oversees subject involvement in many of our research studies as well as lab tours and staff attendance at required Institutional Review Board (IRB) educational seminars. Rosi coordinates subject recruitment and submission and approval of research protocols to Pitt's IRB and the VA's Research and Development Committee. Rosi is the study coordinator for the projects on one of our biggest grants, the University of Pittsburgh Model Center on Spinal Cord Injury (UPMC-SCI).



*Rosemarie Cooper, MPT,
HERL Clinical Coordinator*

Rosi also works two days a week at UPMC's Center for Assistive Technology (CAT) as a Physical Therapist/Evaluation Specialist / ATP. In the clinic she evaluates clients' seating and mobility needs and works with physicians and rehabilitation technology suppliers to ensure those clients receive the most appropriate seating and mobility devices. Rosi also trains and instructs clients in the use of their new mobility devices and works alongside CAT physicians and rehabilitation engineers to make sure the clients' seating systems are fitted correctly.

Since December of 2000, Rosi has also worked as a Clinical Instructor in Pitt's School of Health and Rehabilitation Sciences. She teaches and co-lectures several graduate classes, including an Introduction to Assistive Technology course, a Pressure Management course, and a Seating and Mobility class.

Prior to working at HERL, Rosi worked as a Physical Therapist at the UPMC Rehabilitation Hospital Outpatient clinic.

-Christine Heiner

RECENTLY FUNDED GRANTS



Erik Wolf, M.S., was awarded a VA Predoctoral Fellowship

"Evaluation of Electric Powered Wheelchairs with Suspension and Exposure to Whole-Body Vibration." Erik Wolf, M.S., Pre-Doctoral Research Fellowship. Program Director: Rory Cooper, Ph.D. U.S. Department of Veterans Affairs. October 1, 2004-September 30, 2005, \$18,750.

CORRECTIONS

Please note the following 2 errors that were printed in the summer issue of our newsletter:

In "A Newsletter Reader Shares her Personal Story," Rosemarie Benecke resides in Wildwood, Missouri (not Montana)

In "Featured HERL Student: Yusheng Yang," Yusheng's masters degree is in occupational therapy with a focus on biomechanics and ergonomics. Also, the correct title of Yusheng's ASB Grant-in-Aid award is "Effects of Trunk Stimulation on Seated Wheelchair Function After Spinal Cord Injury."

Human Engineering Research Laboratories

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the newsletter to the editor, Christine Heiner at:
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VA Center Of Excellence For
Wheelchairs and Associated
Rehabilitation Engineering

University of Pittsburgh Model
Center on Spinal Cord Injury

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Director

Michael L. Boninger, M.D.
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Shirley G. Fitzgerald, Ph.D.
Associate Director of Research,

Donald M. Spaeth, Ph.D., ATP
Associate Director of Engineering

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website, www.herlpitt.org.**



ARE YOU INTERESTED IN WHEELCHAIR RESEARCH?

The Human Engineering Research Laboratories is recruiting individuals interested in participating in research studies for the **WHEELCHAIR USERS REGISTRY**. If you would like to be notified of Wheelchair related Research Studies for which you may be eligible to participate, contact The Human Engineering Research Laboratories and join the Wheelchair Users Registry. This is an informational resource and notification of a study does not obligate you to participate. You do not need to be located in nor are you required to travel to Pittsburgh in order to participate in research studies. If you are at least 18 years of age, and use a wheelchair or scooter, please contact **Rosi** or **Annamarie** for more information.

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