**Paul R. Hibbing**

***Doctoral Student and Graduate Research Assistant***

***Applied Exercise Physiology Lab***

***Department of Kinesiology, Recreation, and Sport Studies***

***University of Tennessee, Knoxville***

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*Knoxville, TN 37996*

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# Education

## Doctor of Philosophy

*University of Tennessee, Knoxville (expected completion May 2020)*

Major: Kinesiology and Sport Studies

Specialization: Exercise Physiology

Cognate: Statistics

Program of Study Committee:

Scott E. Crouter (Major Professor)

David R. Bassett

Dawn P. Coe

Haileab Hilafu

## Master of Science

*Iowa State University, July 2016*

Major: Kinesiology

Thesis: Estimation of physical activity intensity using triaxial ActiGraph accelerometers in youth populations: Impact of data type, attachment site, and modeling approach, including adaptations of the Sojourn method for varied use in youth

Program of Study Committee:

Gregory J. Welk (Major Professor)

Laura D. Ellingson

Philip M. Dixon

## Bachelor of Science

*Iowa State University, August 2014*

Major: Kinesiology and Health

Minors: German Language

Music Technology

# Professional Experience

## Teaching

### Undergraduate Teaching Assistant *(Fall 2013)*

Iowa State University

BIOL 255L (Undergraduate Human Anatomy Laboratory)

Department of Biololgy

Course Director: Barbara Krumhardt, Ph.D.

### Graduate Teaching Assistant *(May Term, 2017)*

University of Tennessee, Knoxville

KNS 414 (Undergraduate Fitness Testing and Exercise Prescription Laboratory)

Department of Kinesiology, Recreation and Sport Studies

Course Director: Lyndsey Hornbuckle, Ph.D, RD

### Graduate Teaching Assistant *(Fall 2017)*

University of Tennessee, Knoxville

KNS 532 (Graduate Exercise Physiology Laboratory)

Department of Kinesiology, Recreation and Sport Studies

Course Director: Scott Crouter, Ph.D.

### Guest Lecturer

University of Tennessee, Knoxville

* “Current Research in the Applied Physiology Laboratory”  
   *Presented 04/20/2017 in KNS 350 (Physical Activity Epidemiology)*
* “Physical Activity and Wellness”  
   *Presented 09/13/2017 in FYS 129 (Wellness: The Art and Science)*
* “Cardiovascular Physiology I”  
   *Presented 10/18/2017 in KNS 532 (Graduate Exercise Physiology)*
* “Cardiovascular Physiology II”  
   *Presented 10/23/2017 in KNS 532 (Graduate Exercise Physiology)*

## Research

### Undergraduate Research Assistant *(September 2013 - August 2014)*

Iowa State University

Physical Activity and Health Promotion Lab

Department of Kinesiology

Lab Director: Greg Welk, Ph.D.

### Summer Research Intern *(May 2014 - August 2014)*

Iowa State University

Neurophysiology Lab

Department of Kinesiology

Lab Director: Elizabeth Stegemöller, Ph.D.

**Research (Cont.)**

### Graduate Research Assistant *(August 2014 – July 2016)*

Iowa State University

Physical Activity and Health Promotion Lab

Department of Kinesiology

Lab Director: Greg Welk, Ph.D.

### Graduate Research Assistant *(August 2016 – Present)*

University of Tennessee, Knoxville

Applied Exercise Physiology Lab

Department of Kinesiology, Recreation, and Sport Studies

Lab Directors: David Bassett, Ph.D., and Scott Crouter, Ph.D.

### Data Processing Consultant *(Fee-for-Service, Summer 2017)*

Youth Physical Activity Measurement Study

Iowa State University, and Edge Hill University (United Kingdom)

Project supervisors: Greg Welk, Ph.D.; Stuart Fairclough, Ph.D.

Description: Processing, annotation, and aggregation of free-living activity monitor data in youth

# Publications

## Peer-Reviewed Publications

1. Stegemöller EL, Radig H, **Hibbing P**, & Wingate J, Sapienza C. (2016) Effects of singing on voice, respiratory control, and quality of life in persons with Parkinson’s Disease. *Disability and Rehabilitation*. 39(6), 594-600. doi: 10.3109/09638288.2016.1152610.
2. **Hibbing P**, Kim Y, Saint-Maurice PF, & Welk GJ. (2016) Impact of activity outcome and measurement instrument on estimates of youth compliance with physical activity guidelines: A cross-sectional study. *BMC Public Health* [internet]. 16(1). Available from: <https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-016-2901-8>. doi: 10.1186/s12889-016-2901-8.
3. Stegemöller EL, **Hibbing P**, Radig H, & Wingate J. (2017) Therapeutic singing as an early intervention strategy for swallowing in persons with Parkinson’s Disease. *Complementary Therapies in Medicine*. 31, 127-133. doi: 10.1016/j.ctim.2017.03.002.
4. Ellingson L, **Hibbing P**, Kim Y, Frey-Law L, Saint-Maurice P, & Welk G. (2017) Lab-based validation of different data processing methods for wrist-worn ActiGraph accelerometers in adults. *Physiological Measurement*. 38(6), 1045-1060. doi: 10.1088/1361-6579/aa6d00.  
     
   \*Selected as a Highlight of 2017 by *Physiological Measurement*. See <http://iopscience.iop.org/journal/0967-3334/page/Highlights_of_2017>.
5. Kim Y, **Hibbing P**, Saint-Maurice PF, Ellingson LD, Hennessy E, Wolff-Hughes DL, Perna FM, & Welk GJ. (2017) Surveillance of youth physical activity and sedentary behavior with wrist accelerometry. *American Journal of Preventative Medicine*. 52(6), 872-879. doi: 10.1016/j.amepre.2017.01.012.
6. Saint-Maurice PF, Kim Y, **Hibbing P**, Oh A, Perna FM, & Welk GJ. (2017) Calibration and Validation of the Youth Activity Profile: The FLASHE Study. *American Journal of Preventative Medicine*. 52(6), 880-887. doi: 10.1016/j.amepre.2016.12.010.
7. Bai Y, **Hibbing P**, Mantis K, & Welk GJ. (2018) Comparative evaluation of heart rate-based monitors: Apple Watch vs Fitbit Charge HR. *Journal of Sports Sciences*. 36(15), 1734-1741. doi: 10.1080/02640414.2017.1412235.
8. Dixon PM, Saint-Maurice PF, Kim Y, **Hibbing P**, Bai Y, & Welk GJ. (2018) A primer on the use of equivalence testing for evaluating measurement agreement. *Medicine and Science in Sports and Exercise*. 50(4), 837-845. doi: 10.1249/MSS.0000000000001481.
9. **Hibbing PR**, Ellingson LD, Dixon PM, & Welk GJ. (2018) Adapted Sojourn models to estimate activity intensity in youth: A suite of tools. *Medicine and Science in Sports and Exercise*. 50(4), 846-854. doi: 10.1249/MSS.0000000000001486.
10. **Hibbing PR**, LaMunion SR, Kaplan AS, & Crouter SE. (2018) Estimating Energy Expenditure with ActiGraph GT9X Inertial Measurement Unit. *Medicine and Science in Sports and Exercise*. 50(5), 1093-1102. doi: 10.1249/MSS.0000000000001532.
11. Stegemöller EL, Tatz JR, Warnecke A, **Hibbing P**, Bates B, & Zaman A. (2018) Influence of music style and rate on repetitive finger tapping. *Motor Control*. Advance online publication. doi: 10.1123/mc.2017-0081.
12. Toth LP, Park S, Pittman WL, Sarisaltik D, **Hibbing PR**, Morton A, Springer CM, Crouter SE, & Basset DR. (2018) Validity of Activity Tracker Step Counts during Walking, Running, and Activities of Daily Living. *Translational Journal of the American College of Sports Medicine*. 3(7), 52-59. doi: 10.1249/TJX.0000000000000057.

## Manuscripts in Review

1. Shaghayegh G, Yeh CM, Ding Y, Ding W, **Hibbing P**, LaMunion S, Kaplan A, Crouter SE, & Keogh E. (in Review) Domain Agnostic Online Semantic Segmentation for Multi-Dimensional Time Series. *Data Mining and Knowledge Discovery*.
2. Ellingson L, **Hibbing PR**, Welk GJ, Dailey D, Rakel B, Crofford LJ, Sluka KA, & Frey-Law LA. (in Review) Influence of processing method for wrist-worn accelerometers on interpretation of physical activity data collected under free-living conditions in a chronic pain population. *PLoS One*.
3. Toth LP, Park S, Pittman WL, Sarisaltik D, **Hibbing PR**, Morton AL, Springer CM, Crouter SE, & Bassett DR. (in Review) Effect of brief intermittent walking bouts on step count accuracy of wearable devices. *Gait and Posture*.
4. **Hibbing PR**, Bassett DR, & Crouter SE. (in Review) Modifying accelerometer cut-points affects criterion validity in free-living youth and adults. *Journal of Science and Medicine in Sport*.
5. Crouter SE, **Hibbing PR**, & LaMunion SR. (in Review) Use of objective measures to estimate sedentary time in youth. *Journal for the Measurement of Physical Behaviour.*
6. Stegemöller EL,Izbicki P, & **Hibbing P** (in Review). The Influence of Moving with Music on Motor Cortical Activity. *Neuroscience Letters*.

## Non-Peer-Reviewed Publications

1. Welk GJ, Saint-Maurice PF, Kim Y, Ellingson E, **Hibbing P**, Wolff-Hughes D, & Perna PM. (2017) Understanding and interpreting error in physical activity data: Insights from the FLASHE study. *American Journal of Preventative Medicine*. 52(6), 836-838.
2. **Hibbing P**, LaMunion S, & Toth L. (2017) Fitness Trackers Can Be Fashionable and Functional. *ACSM Fit Society Page*. 19(3):3-4. Available from: <http://www.acsm.org/public-information/fit/health-and-fitness-technology/fitness-trackers-can-be-fashionable-and-functional>.

## Manuscripts in Preparation

1. Park S, Toth LP, **Hibbing PR**, Kaplan AS, Feyerabend MD, Crouter SE, Springer CM, & Bassett DR. Dominant versus non-dominant wrist placement of activity monitors: Effects on steps per day. Target Journal: *Journal for the Measurement of Physical Behaviour*.

## National/International Abstracts and/or Presentations

1. Stegemöller EL, **Hibbing P**, Brinkman A, Tatz J, Kinedinst B, & Frick P. (2015) The influence of activating versus relaxing music on repetitive finger movement and associated motor cortical activity. Poster presented at the Society for Neuroscience 45th annual meeting, Chicago, IL.
2. Stegemöller EL, **Hibbing P**, & Radig H. (2015) Effects of singing on speech and swallow in patients with Parkinson’s disease. Poster presented at the Movement Disorders Society 19th annual meeting, San Diego, CA.
3. **Hibbing PR**, Kim Y, Saint-Maurice PF, & Welk GJ. (2015) Activity monitor agreement in assessing compliance with Step and physical activity guidelines in youth. *Medicine and Science in Sports & Exercise*, 47(5 Suppl 1), 921. Poster presented at the American College of Sports Medicine 62nd annual meeting, San Diego, CA.
4. Saint-Maurice PF, **Hibbling P**, Bai Y, & Welk GJ. (2016) Agreement between print and online versions of the Youth Activity Profile. *Medicine and Science in Sports and Exercise*, 48(5 Suppl 1), 313. Slides presented at the American College of Sports Medicine 63rd annual meeting, Boston, MA.
5. Kim Y, **Hibbing P**, Ellingson LD, Saint-Maurice PF, Hennessy E, McClain J, & Welk GJ. (2016) Comparison of outcomes between raw acceleration and counts-based methods for processing wrist-worn accelerometers: the FLASHE study. *Medicine and Science in Sports and Exercise*, 48(5 Suppl 1), 812. Slides presented at the American College of Sports Medicine 63rd annual meeting, Boston, MA.
6. **Hibbing P**, Ellingson L, Dixon P, & Welk G. (2017) Estimating physical activity intensity in youth with accelerometers: A flexible suite of tools. *Medicine and Science in Sports and Exercise*, 49(5 Suppl 1), 475. Poster presented at the American College of Sports Medicine 64th annual meeting, Denver, CO.
7. Bai Y, Welk G, **Hibbing P**, & Mantis K. (2017) Which heart rate-based monitor is better: Apple Watch or Fitbit Charge HR? Slides presented at the 5th International Conference on Ambulatory Monitoring of Physical Activity and Movement, Bethesda, MD.
8. Toth L, **Hibbing P**, Park S, Morton A, Pittman W, Sarisaltik D, Kaplan A, Crouter S, & Bassett D. (2017) Criterion validity of consumer and research grade activity monitors during brief, intermittent walking. Slides presented at the 5th International Conference on Ambulatory Monitoring of Physical Activity and Movement, Bethesda, MD.
9. **Hibbing P**, LaMunion S, Bassett D, & Crouter S. (2017) Impact of inertial measurement unit on activity recognition using ActiGraph GT9X. Poster presented at the 5th International Conference on Ambulatory Monitoring of Physical Activity and Movement, Bethesda, MD.
10. Kaplan A, Toth L, **Hibbing P**, Morton A, Park S, Pittman W, Sarisaltik D, Bassett D, & Crouter S. (2017) Sources of error for wearable step counters. Poster presented at the 5th International Conference on Ambulatory Monitoring of Physical Activity and Movement, Bethesda, MD.
11. LaMunion S, **Hibbing P**, Bassett D, & Crouter S. Application of the ActiGraph GT9X IMU to estimate energy expenditure. (2017) Slides presented at the 5th International Conference on Ambulatory Monitoring of Physical Activity and Movement, Bethesda, MD.
12. Crouter S, **Hibbing P**, LaMunion SE, & Bassett DR. (2017) Use of the ActiGraph GT9X IMU to predict energy expenditure. Slides presented at the 5th International Conference on Ambulatory Monitoring of Physical Activity and Movement, Bethesda, MD.

## Regional Presentations

1. **Hibbing P** & Devick R. (2014) The validity of an online tool for the assessment of physicalactivity behaviors in youth. Slides presented at the 8th Symposium on Undergraduate Research and Creative Expression,Ames, IA.
2. **Hibbing PR**, Bassett DR, & Crouter SE. (2018) Modifying accelerometer cut-points affects criterion validity in free-living youth and adults. Poster presented at the 46th annual meeting of the Southeast Chapter of the American College of Sports Medicine, Chattanooga, TN.
3. LaMunion SR, **Hibbing PR**, Kaplan AS, Bassett DR, & Crouter SE. (2018) Predicting energy expenditure with the ActiGraph GT9X IMU using artificial neural networks. Poster presented at the 46th annual meeting of the Southeast Chapter of the American College of Sports Medicine, Chattanooga, TN.
4. Kaplan AS, LaMunion SR, **Hibbing PR**, Bassett DR, & Crouter SE. (2018) Activity classification with the ActiGraph GT9X IMU using artificial neural networks. Poster presented at the 46th annual meeting of the Southeast Chapter of the American College of Sports Medicine, Chattanooga, TN..
5. Park S, Toth LP, **Hibbing PR**, Springer CM, Kaplan AS, Feyerabend MD, Crouter SE, Bassett DR. (2018) Dominant vs non-dominant wear: A comparison of steps per day. Poster presented at the 46th annual meeting of the Southeast Chapter of the American College of Sports Medicine, Chattanooga, TN.

# Other Scientific Contributions

## Manuscript Reviewer

*Medicine and Science in Sports and Exercise*

*Journal for the Measurement of Physical Behaviour*

## Software Packages

1. **Paul R. Hibbing** (2018). TwoRegression: Process Data from Wearable Research Devices Using Two-Regression Algorithms. R package version 0.1.2. URL:  
   <https://cran.r-project.org/package=TwoRegression>.
2. **Paul R. Hibbing** (2018). AGread: Read Data Files from ActiGraph Monitors. R package version 0.1.2. URL: <https://cran.r-project.org/package=AGread>.
3. **Paul R. Hibbing** (2018). Observation: Collect and Process Physical Activity Direct Observation Data. R package version 0.2.0. URL: <https://cran.r-project.org/package=Observation>.

## Published Acknowledgments

1. Kim Y & Welk GJ (2015). Criterion validity of competing accelerometry-based activity monitoring devices. *Medicine and Science in Sports and Exercise*, 11, 2456-2463.
2. Ellingson LD, Schwabacher I.J, Kim Y, Welk GJ, & Cook DB. (2016) Validity of an integrative method for processing physical activity data. *Medicine and Science in Sports and Exercise*, 48(8), 1629-1638.
3. Kalvelage K, Dorneich MC, Seeger CJ, Welk GJ, Gilbert S, Moon J, Jafir I, & Brown P. (2017) Assessing the validity of facilitated-volunteered geographic information: comparisons of expert and novice ratings. *GeoJournal*, 1-12

# Professional Societies

## American College of Sports Medicine

Student Member (02/2016-present)

## International Society for the Measurement of Physical Behaviour

Student Member (03/2017-present)

## American College of Sports Medicine, Southeast Regional Chapter

Student Member (01/2018-present)

# Honors and Awards

## Iowa State University

Dean’s list *(College of Human Sciences; Fall ’10 – Spring ’14\*)*

Dean’s Scholarship *(College of Human Sciences; ’10-’11 academic year)*

Academic Recognition Award *(’10-’11 academic year)*

Academic Recognition Award (Renewal) *(Fall ’11\*)*

Barbara E. Forker Leadership Award *(Department of Kinesiology; 2014)*

Top 20 Graduating Senior Scholar *(Department of Kinesiology; 2014)*

Graduate Magna Cum Laude *(2014)*

Outstanding Master’s Student Award *(Department of Kinesiology; 2016)*

Nominee: American Kinesiology Association

Master’s Scholar Award *(Department of Kinesiology; 2016)*

\*No classes taken Spring ’12

## University of Tennessee, Knoxville

Chancellor’s Fellowship *(’16-’17 academic year; $10,000)*

Chancellor’s Fellowship (Renewal) *(’17-’18 academic year; $10,000)*

Shipley-Swann Graduate Fellowship *(’18-’19 academic year; $5000)*

# Research Projects

## Validating a set of novel activity monitors in adults

*Fall 2013*

Description: Lab-based validation of energy expenditure estimates from various activity monitors

Role: Data collection

## Validation of a newly-developed activity monitor

*Winter 2013 - Spring 2014*

Description: Lab-based validation of energy expenditure estimates from an adhesive activity monitor

Role: Data collection

## Youth physical activity measurement study

*Spring 2014 - Fall 2014*

Description: Field validation of a survey with repeated assessments in spring, summer, and fall

Role: Data collection, processing, and analysis

## The influence of music on repetitive movement and associated brain activity

*Summer 2014 - Winter 2014*

Description: Examination of finger tapping neurophysiology and mechanics under the influence of varied musical stimuli

Role: Recruitment, data collection, processing, and analysis

## Effects of singing on speech and swallow in patients with Parkinson’s Disease

*Summer 2014*

Description: 8-week music therapy intervention targeting speech and swallow outcomes

Role: Pre- and post-testing data collection, processing, and analysis

## Calibration of the online youth activity profile for school-based evaluation

*Fall 2014 – Summer 2017*

Description: Multi-phase, multi-site field validation of a survey to assess youth physical activity

behavior (NIH R21 grant award)

Role: Recruitment, data collection and processing

## Family Life, Activity, Sun, Health, and Eating Motion Study (FLASHE)

*Summer 2015 – Summer 2017*

Description: Far-reaching project conducted by the National Cancer Institute including outcomes related to physical activity – work draws on data from national surveillance, previous studies, and planned additional data collections

Role: Data analysis, study design, data collection and processing

## Master’s Thesis Project: Cross-validation of the Sojourn method for processing ActiGraph accelerometer data in free-living children and adolescents

*Spring 2016 – Summer 2016*

Description: Exploration of contemporary issues and techniques in accelerometer signal processing for youth, in the context of adapting an adult method to suit children and adolescents

Role: Study design, data collection, processing, and analysis

## Novel approaches for predicting unstructured sort periods of physical activities

*Fall 2016 – Present*

Description: Development and cross-validation of machine learning techniques for processing accelerometer data in youth (NIH RO1 grant award)

Role: Recruitment, data collection and processing

## "Ground truth" validation of wearable step counters

*Fall 2016 – Summer 2017*

Description: Free living criterion validation of step counting devices

Role: Limited data processing and analysis

## Sources of error in wearable step counters

*Fall 2016 – Present*

Description: Structured criterion validation of step counting devices

Role: Limited data processing and analysis

## Use of wearable physical activity monitors to predict energy expenditure

*Fall 2016 – Present*

Description: Laboratory validation of various objective physical activity monitors

Role: Recruitment, data collection and processing

## Validation of the Cosmed K5 Portable Metabolic System

*Fall 2017 – Present*

Description: Laboratory validation of a new portable indirect calorimetry system

Role: Data collection and processing

## Physical Activity in Pregnancy for Intergenerational Obesity Prevention

*Spring 2018 – Present*

Description: Intervention study assessing physical activity in a pregnancy population

Role: Data analysis