

CURRICULUM VITAE – TODD COLIN PATAKY

CONTACT INFORMATION

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I am an Associate Professor in the Department of Bioengineering at Shinshu University (Ueda, Nagano, Japan) and am Director of the Applied Biomechanics Laboratory in Shinshu University's Institute for Fiber Engineering. My research focuses on the analysis and simulation of stochastic processes in biomechanical systems. I am especially interested in spatiotemporally complex human movement variability and how it may be leveraged for advanced sports and medical applications.

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RESEARCH INTERESTS

statistical parametric mapping, random field theory, computational biomechanics, probabilistic simulation, open source software development

EMPLOYMENT

Associate Professor Department of Bioengineering Institute for Fiber Engineering, Shinshu University, Japan	2013-
Assistant Professor , Research Tenure Track Department of Bioengineering, Shinshu University, Japan	2009-2013
Postdoctoral Research Associate School of Biomedical Sciences, University of Liverpool, UK	2006-2009
Postdoctoral Research Fellow Department of Cognitive Neuroscience, ATR Research, Kyoto, Japan	2004-2006

EDUCATION

Ph.D. , Department of Kinesiology, The Pennsylvania State University, USA Minor: Mechanical Engineering	2001-2004
M.S. , Department of Kinesiology, The Pennsylvania State University, USA	1999-2001
B.Sc.(Hons) , Department of Kinesiology, University of Western Ontario, Canada Minor: Mathematics	1995-1999

AFFILIATIONS

International Society for Biomechanics
International Society of Biomechanics in Sports

LANGUAGES

English, Japanese

HONORS AND AWARDS	William Evans Fellow (NZD \$6,850)	2014
	“Implementing advanced statistics for biomechanics research” University of Otago, New Zealand (three-week research fellowship).	
	Young Investigator Award (bronze) (SGD \$400)	2010
	“Topological statistics for probabilistic finite element simulations”. 6th World Congress on Biomechanics, Singapore.	
COMPETITIVE GRANTS (PI)	Nike Award for Athletic Footwear Research (USD \$25,000)	2009
	D’Août K, Pataky TC , De Clercq D, Aerts P.	
	“The effects of habitual footwear use: foot shape and function in native barefoot walkers” 9th International Footwear Biomechanics Symposium, Stellenbosch, South Africa.	
COMPETITIVE GRANTS (CO-I)	JSPS Young Researcher Grant (Wakate A) (JPY ¥17,290,000)	2015–2017
	“Using neuroimaging statistics to model randomness in complex biomechanical systems”	
	JSPS Challenging Exploratory Research Grant (JPY ¥3,770,000)	2015–2017
	“Development of a randomness training system to improve golf putting performance”	
COMPETITIVE GRANTS (CO-I)	JSPS Young Researcher Grant (Wakate B) (JPY ¥3,880,000)	2010–2012
	“Development of biomechanical imaging techniques based on neuroimaging statistics”	
	Royal Society International Short Visit Grant (GBP £2474)	2009
	Department of Mechanical Engineering, University of Porto, Portugal	
COMPETITIVE GRANTS (CO-I)	International Strategic Partnership Fund (NZD \$86,250)	2014–2017
	“Combining novel sensors, computational modeling, advanced statistics and robots.” Promoting robotic assistive device research collaborations between New Zealand and Japan. Ref: INTNZJS-38379	
	Royal Society International Exchange Grant (GBP £11,850)	2014–2015
	“Hypothesis testing of bone loading via probabilistic finite element simulation” Joint-grant with Dr. Philip Cox of Hull-York Medical School. Ref: IE131030	
COMPETITIVE GRANTS (CO-I)	Royal Society International Exchange Grant (GBP £12,000)	2012–2013
	“The role of foot pressure in directional control and turning” Joint-grant with Prof. Robin Crompton of the University of Liverpool.	
INTERNAL GRANTS	University of Liverpool Proof of Concept Grant (GBP £41,500)	2011
	“Pedobarographic Statistical Mapping” Business development and software engineering towards commercialization.	
	University of Liverpool Reach Out Travel Grant (GBP £600)	2008
	To attend EMED Scientific Meeting, Dundee, Scotland	
INVITED TALKS (CONFERENCES)	Applications of continuum statistics [in Japanese]	2014.09.19
	Invited Lecture Society of Instrument and Control Engineers, Central Symposium Center for Science and Technology Advancement, Nagano, Japan	
	Analysis and application of foot pressure distribution data [in Japanese]	2011.11.19
	Keynote Lecture 6th Japanese Symposium on Biological Measurement Koriyama College of Applied Health, Japan	
INVITED TALKS (CONFERENCES)	Functional biomechanical continuum analysis and applications	2010.10.22
	Invited Lecture 6th International Conference on Technology and Medical Sciences University of Porto, Portugal	
	Footprint-based gait reconstruction of the 3.75 Ma Laetoli hominin	2010.09.17
	Invited Lecture 2nd Congress of the International Foot and Ankle Biomechanics Community	

University of Washington, USA

INVITED TALKS (OTHER)	Mysteries of human walking	2016.04.05
	Royal Society of New Zealand, Hawkes Bay Holt Planetarium	
	Statistical Parametric Mapping: bridging the gap between classical statistics and human locomotion datasets. Consortium for Human Locomotion Assessment Technology, AIST, Tokyo, Japan	2015.12.07
	Continuous human movement data analysis with statistical parametric mapping	2015.02.27
	School of Sport Science, Exercise and Health, University of Western Australia	
	Random field theory applications in biomechanics	2014.08.29
	School of Biomedical Sciences, University of Queensland, Australia	
	Valid statistics for scalar and vector trajectories and continua	2013.03.20
	Liverpool John Moores University, UK	
	Topological statistics for the analysis of biomechanical continua	2013.03.11
	Hull-York Medical School, York, UK	
	The importance of foot pressure: from evolution to energy harvesting	2012.04.17
	Institute of Sport, Exercise and Active Living	
	Victoria University, Melbourne, Australia	
	Foot pressure imaging: analysis and applications	2011.03.24
	Kinesiology Department Graduate Colloquium	
	The Pennsylvania State University, State College, USA	
WORKSHOPS	Topological statistical analysis of plantar pressure images	2010.09.14
	Nike Sport Research Laboratory, Portland, USA	
	Discrete vs. continuous analysis of n-dimensional biomechanical data	2010.10.19
	University of Salford, Manchester, UK	
	Continuous analysis of continuous curves	2010.10.08
	Liverpool John Moore's University, Liverpool, UK	
	Recent advances in plantar pressure imaging for animal applications	2009
	Royal Veterinary College, London, UK	
	Pedobarographic statistical parametric mapping (pSPM)	2009
	Chemnitz University of Technology, Germany	
	Gait simulation and pressure image processing in human evolution	2009
	University of Porto, Portugal.	
	1D Statistical Parametric Mapping	
	University of St. Andrews, Scotland	2016.07
	Amsterdam Free University, Netherlands (in negotiations)	2016.07
	Liverpool John Moores University, UK	2016.03
	RSScan, Paal, Belgium	2016.01
	Liverpool John Moores University, UK	2015.06
	University of Leuven (KUL), Belgium	2015.03
	Ghent University, Belgium	2014.07
	University of Otago, New Zealand	2014.03

1. **Pataky TC** (2012). Plantar pressure distribution analysis and applications [in Japanese]. *Seitai Ohyoh Keisoku [Journal of Applied Bio-metrology]* 3: 1–10.
2. Crompton RH, **Pataky TC** (2009). Stepping out. *Science* 323: 1174:1175.

1. Malfait B, Dingenen B, Staes F, **Pataky TC**, Robinson M, Vanrenterghem J, Verschueren S (2016) Knee and hip kinematics predict neuromuscular (co-)activation in drop jump landings. *PLoS ONE*, in press.
2. **Pataky TC**, Vanrenterghem J, Robinson MA (2016). The probability of false positives in zero-dimensional analyses of one-dimensional kinematic, force and EMG trajectories. *Journal of Biomechanics*, in press.
3. Nieuwenhuys A, Papageorgiou E, **Pataky TC**, De Laet T, Molenaers G, Desloovere K (2016). Literature review and comparison of two statistical methods to evaluate the effect of botulinum toxin treatment on gait in children with cerebral palsy. *PLOS One*, in press.
4. Panagiotopoulou O, Spyridis P, Abraha HM, Carrier DR, **Pataky TC** (2016). Architecture of the sperm whale forehead facilitates ramming combat, *PeerJ* 4:e1895.
5. **Pataky TC** (2016). RFT1D: smooth one-dimensional random field upcrossing probabilities in Python. *Journal of Statistical Software*, in press.
6. de Castro MP, **Pataky TC**, Sole G, Vilas-Boas JP (2015). Pooling genders when assessing ground reaction forces during walking: statistical parametric mapping versus traditional approach. *J Biomech* 48(10): 2162-2165.
7. **Pataky TC**, Vanrenterghem J, Robinson MA (2015). Zero- vs. one-dimensional, parametric vs. non-parametric, and confidence interval vs. hypothesis testing procedures in one-dimensional biomechanical trajectory analysis. *Journal of Biomechanics* 48(7): 1277–1285. ***Featured as an Issues Highlight at www.jbiomech.com.**
8. Robinson MA, Vanrenterghem J, **Pataky TC** (2015). Statistical Parametric Mapping (SPM) for alpha-based statistical analyses of multi-muscle EMG time-series. *Journal of Electromyography and Kinesiology* 25(1): 14–19.
9. **Pataky TC** (2015). Correlation between maximum in-shoe plantar pressures and clubhead speed in amateur golfers. *Journal of Sports Sciences* 33(2): 192–197.
10. **Pataky TC**, Robinson MA, Vanrenterghem J (2015). Two-way ANOVA for scalar trajectories, with experimental evidence of nonphasic interactions. *Journal of Biomechanics* 48(1): 186-189.
11. **Pataky TC**, Robinson MA, Vanrenterghem J, Savage R, Bates KT, Crompton RH (2014). Vector field statistics for objective center-of-pressure trajectory analysis during gait, with evidence of scalar sensitivity to small coordinate system rotations. *Gait and Posture* 40(1): 255-258.
12. Phethean J, **Pataky TC***, Nester CJ, Findlow AH (2014). A cross-sectional study of age-related changes in plantar pressure distribution between 4-7 years: a comparison of regional and pixel-level analyses. *Gait and Posture* 39(1): 154–160. ***Corresponding author.**
13. **Pataky TC**, Savage R, Bates KT, Sellers WI, Crompton RH (2013). Short-term step-to-step correlation in plantar pressure distributions during treadmill walking, and implications for trackway analysis. *Gait & Posture* 38(4): 1054-1057.
14. De Ridder R, Willems T, Vanrenterghem J, Robinson MA, **Pataky TC**, Roosen P (2013). Gait kinematics of subjects with ankle instability using a multisegmented foot model. *Medicine & Science in Sports & Exercise* 45(11): 2129-2136.
15. **Pataky TC**, Slota GP, Latash ML, Zatsiorsky VM (2013). Is power grasping contact continuous or discrete? *Journal of Applied Biomechanics* 29(5):554-62.
16. **Pataky TC**, Robinson MA, Vanrenterghem J (2013). Vector field statistical analysis of kinematic and force trajectories. *Journal of Biomechanics* 46(14): 2394-2401.
17. Bates KT, Collins D, Savage R, Webster E, **Pataky TC**, McClymont J, D'Aout K, Sellers WI, Bennett MR, Compton RH (2013). The evolution of compliance in the human lateral mid-foot. *Proceedings of the Royal Society B - Biological Sciences* 280: 20131818.

18. Bates KT, Savage R, **Pataky TC**, Morse SA, Webster E, Falkingham PL, Ren L, Collins D, Bennett MR, McClymont J, Crompton RH (2013). Does footprint depth correlate with foot motion and pressure? *Journal of the Royal Society Interface* 10(83): 2013.0009.
19. Vanrenterghem J, Venables E, **Pataky TC**, Robinson MA (2012). The effect of running speed on knee mechanical loading in females during side cutting. *Journal of Biomechanics* 45(14): 2444-2449.
20. **Pataky TC** (2012). Spatial resolution in plantar pressure measurement revisited. *Journal of Biomechanics* 45(12): 2116-2124.
21. Giacomozzi C, Keijsers N, **Pataky TC**, Rosenbaum D (2012). International scientific consensus on medical plantar pressure measurement devices: technical requirements and performance. *Annali dell'Istituto Superiore di Sanità* 48(3): 259-271.
22. Cox PG, Rayfield EJ, Fagan MJ, **Pataky TC**, Jeffery N (2012). Functional evolution of the feeding system in rodents. *PLoS One* 7(4): e36299.
23. Panagiotopoulou O, **Pataky TC**, Hill Z, Hutchinson JR (2012). Statistical parametric mapping of the regional distribution and ontogenetic scaling of foot pressures during walking in Asian elephants (*Elephas maximus*). *Journal of Experimental Biology* 215(9): 1584-1593.
24. **Pataky TC**, Mu T, Bosch K, Rosenbaum D, Goulermas JY (2012). Gait recognition: highly unique plantar pressure patterns amongst 104 individuals. *Journal of the Royal Society Interface*. 9(69): 790-800.
25. Crompton RH, **Pataky TC**, Savage R, D'Août K, Bennett M, Day M, Bates K, Morse S, Sellers WI (2012). Human-like external function of the foot, and fully upright gait, confirmed in the 3.66 million year old Laetoli hominin footprints by topographic statistics, experimental footprint-formation and computer simulation. *Journal of the Royal Society Interface*. 9(69): 707-719.
26. **Pataky TC** (2012). One-dimensional statistical parametric mapping in Python. *Computer Methods in Biomechanics and Biomedical Engineering* 15(3): 295-301.
27. **Pataky TC**, Slota GP, Latash ML, Zatsiorsky VM (2012). Radial force distribution changes associated with tangential force production in cylindrical grasping, and the importance of anatomical registration. *Journal of Biomechanics* 45(2): 218-224.
28. **Pataky TC**, Maiwald C (2011). Spatiotemporal volumetric analysis of dynamic plantar pressure data. *Medicine & Science in Sports & Exercise*. 43(8): 1582-1589.
29. **Pataky TC**, Bosch K, Mu T, Keijsers NLW, Segers V, Rosenbaum D, Goulermas JY (2011). An anatomically unbiased foot template for inter-subject plantar pressure evaluation. *Gait & Posture* 33(3): 418-422.
30. Oliveira FPM, **Pataky TC**, Tavares JMRS (2010). Registration of pedobarographic image data in the frequency domain. *Computer Methods in Biomechanics and Biomedical Engineering* 13(6): 731-740.
31. Caravaggi P, **Pataky TC**, Gunther M, Savage R, Crompton R (2010). Dynamics of longitudinal arch support in relation to walking speed: contribution of the plantar aponeurosis. *Journal of Anatomy* 217(3): 254-261.
32. **Pataky TC** (2010). Generalized n-dimensional biomechanical field analysis using statistical parametric mapping. *Journal of Biomechanics* 43(10): 1976-1982.
33. Sellers WI, **Pataky TC**, Caravaggi P, Crompton RH (2010). Evolutionary robotic approaches in primate gait analysis. *International Journal of Primatology* 31(2): 321-338.
34. Mu T, **Pataky TC**, Findlow AH, Goulermas JY (2010). Automated nonlinear feature generation and classification of foot pressure lesions. *IEEE Transactions on Information Technology in BioMedicine* 14(2): 418-424.
35. Keijsers NLW, Stolwijk NM, **Pataky TC** (2010). Linear dependence of peak, mean, and pressure-time integral values in plantar pressure images. *Gait and Posture* 31(1): 140-142.
36. D'Août K, **Pataky TC**, De Clercq D, Aerts P (2009). The effects of habitual footwear use: foot shape and function in native barefoot walkers. *Footwear Science* 1(2): 81-94.

37. Oliveira FPM, Tavares JMRS, **Pataky TC** (2009). Rapid pedobarographic image registration based on contour curvature and optimization. *Journal of Biomechanics* 42(15): 2620-2623.
38. Caravaggi P, **Pataky TC**, Goulermas JY, Savage R, Crompton R (2009). An anatomically based inverse dynamic model of the windlass mechanism of the foot: evidence for early stance phase preloading of the plantar aponeurosis. *Journal of Experimental Biology* 212: 2491-2499.
39. **Pataky TC**, Keijsers NLW, Goulermas JY, Crompton RH (2009). Nonlinear spatial warping for between-subjects pedobarographic image registration. *Gait and Posture* 29(3): 477-482.
40. **Pataky TC**, Goulermas JY, Crompton RH (2008). A comparison of seven methods of within-subjects rigid body pedobarographic image registration. *Journal of Biomechanics* 41(14): 3085-3089.
41. **Pataky TC**, Caravaggi P, Savage R, Crompton RH (2008). Regional peak plantar pressures are highly sensitive to regional boundary definitions. *Journal of Biomechanics* 41(12): 2772-2775.
42. **Pataky TC** (2008). Assessing the significance of pedobarographic signals using random field theory. *Journal of Biomechanics* 41(11): 2465-2473.
43. **Pataky TC**, Goulermas JY (2008). Pedobarographic statistical parametric mapping: a pixel-level approach to foot pressure image analysis. *Journal of Biomechanics* 41(10): 2136-2143.
44. **Pataky TC**, Caravaggi P, Savage R, Parker D, Goulermas JY, Sellers WI, Crompton RH (2008). New insights into the plantar pressure correlates of walking speed using pedobarographic statistical parametric mapping (pSPM). *Journal of Biomechanics* 41(9): 1987-1994.
45. **Pataky TC**, Latash ML, Zatsiorsky VM (2008). Multi-finger ab-/adduction strength and coordination. *Journal of Hand Therapy* 21(4): 377-385.
46. **Pataky TC**, Savescu AV, Latash ML, Zatsiorsky VM (2007). A device for testing the intrinsic muscles of the hand. *Journal of Hand Therapy* 20(4): 345-350.
47. **Pataky TC**, Latash ML, Zatsiorsky VM (2007). Finger interaction during maximal radial and ulnar deviation efforts: experimental data and linear neural network modeling. *Experimental Brain Research* 179(2):301-312.
48. **Pataky TC** (2005). Soft tissue strain energy minimization: a candidate control scheme for intra-finger normal-tangential force coordination. *Journal of Biomechanics* 38(8): 1723-1727.
49. **Pataky TC**, Latash ML, Zatsiorsky VM (2005). Viscoelastic response of the finger pad to incremental tangential displacements. *Journal of Biomechanics* 38(7): 1441-1449.
50. Jordan K, **Pataky TC**, Newell K (2005). Grip width and the organization of force output. *Journal of Motor Behavior* 37(4): 285-294.
51. **Pataky TC**, Latash ML, Zatsiorsky VM (2004). Prehension synergies during nonvertical grasping. II. Modeling and optimization. *Biological Cybernetics* 91(4): 231-242.
52. **Pataky TC**, Latash ML, Zatsiorsky VM (2004). Prehension synergies during nonvertical grasping. I. Experimental observations. *Biological Cybernetics* 91(3): 148-158.
53. **Pataky TC**, Latash ML, Zatsiorsky VM (2004). Tangential load sharing among fingers during prehension. *Ergonomics* 47(8): 876-889.
54. **Pataky TC**, Zatsiorsky VM, Challis JC (2003). A simple method to determine body segment masses in vivo: reliability, accuracy, and sensitivity analysis. *Clinical Biomechanics* 18: 364-368.
55. Sternad D, DeRugy A, **Pataky TC**, Dean WJ (2002). Interaction of discrete and rhythmic movements over a wide range of periods. *Experimental Brain Research* 147(2): 162-174.

SOFTWARE
PROJECTS

- SPM1D: one-dimensional statistical parametric mapping.
Open-source Python package for the topological analysis of 1D datasets.
<http://www.spm1d.org>
- RFT1D: one-dimensional random field theory.
Open-source Python package for simulating random 1D continua and exploring random field theory predictions.
<http://www.spm1d.org/rft1d>
- MUN104: plantar pressure foot template.
Morphologically average plantar pressure profile of 104 individuals.
<http://www.tpataky.net/Datasets/mun104>

PRESS
(SELECTION)

- Popular Science “Science says sperm whales could really wreck ships” 2016.04.09
- Huffington Post “Moby Dick May Be More Than Just A Whale Of A Tale” 2016.04.09
- Washington Post “Science shows how Moby Dick could totally have sunk that whaling ship” 2016.04.07
- Heritage Daily “Hard whale heads sink ships – or can they?” 2016.04.07
- Christian Science Monitor “Fact-checking Moby Dick: Can whale foreheads sink ships?” 2016.04.06
- Business Insider “Science says Moby Dick may actually have been able to sink ships” 2016.04.06
- Science Magazine “Sperm whale foreheads may be specialized for ramming” 2016.04.05
- Daily Mail “Male sperm whales DO use their massive foreheads to ram love rivals” 2016.04.05
- Live Science “Real-Life Moby-Dick? Testing Sperm Whales’ Ramming Ability” 2016.04.05
- PLOS Ecology Community Blog “Sperm Whale Heads May Serve as Battering Rams” 2016.04.05
- Discovery News “Real Moby Dick: Some Whales Ram With Their Heads” 2016.04.05
- Gizmodo “Sperm Whales Are the World’s Largest Battering Rams” 2016.04.05
- Phys.org “Hard whale heads sink ships – or can they?” 2016.04.05
- Improbable Research “Head butting in whales – explanations for junk” 2016.04.05
- New Zealand Herald “Robot help for victims” 2015.12.06
- Shinano Mainichi (newspaper) “Elephant foot disease identification” [in Japanese] 2013.01.14
- CBC Spark “Gait fingerprinting” 2012.01.13
- Wired Magazine “Unique gait can give crooks away” 2011.09.22
- New Scientist.com “Why you are identifiable after just a few steps” 2011.09.15
- Gizmodo “Watch how you walk if you want to remain anonymous”, 2011.09.08
- Bioscholar “Footprints can help identify people just like fingerprints” 2011.09.08
- Discovery News “Footprints ID people like fingerprints” 2011.09.07

OTHER
PROFESSIONAL
ACTIVITY

- Editorial Board, [Footwear Science](#) 2014–
- A subsidiary of the International Foot and Ankle Biomechanics Community
- Co-founder, i-FAB Pedobarography Group 2010–2015
- A subsidiary of the International Foot and Ankle Biomechanics Community

SOFTWARE

Python, MATLAB, Blender, LabView, C, C++, R, L^AT_EX