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The features marked with a star (*) are based entirely on material taken straight from standard research (and other Official and Therefore Always Correct) literature. Many of the other articles are genuine, too, but we don't know which ones.

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On the Front Cover
Photo of a frog that was thrust into the air during the launch of NASA's LADEE spacecraft in 2013. (See "Animals (and Moon Bits) Aloft", page 22)

On the Back Cover
A small dog attempting and failing to disprove Newtonian laws of motion.
Photo: A.S. Kaswell

Some Coming Events

The Covid-19 pandemic has introduced excitingly boundless uncertainty as to whether, when, and where public activities will happen in the near future.

(See IMPROBABLE.COM for details of these and other events.)

August 12th, 2024
— Worldcon
Glasgow, Scotland

September 12th, 2024
— The 34th First Annual Ig Nobel Prize Ceremony (and webcast).
MIT, Cambridge, Massachusetts, USA

September 14th, 2024
— Ig Nobel Face-to-Face,
MIT Museum, Cambridge, Massachusetts, USA

February 2025
— AAAS Annual Meeting,
Boston, Massachusetts, USA

Spring 2025
— Ig Nobel EuroTour

May 23rd-26th, 2025
— Balticon,
Baltimore, Maryland, USA

Where There's More

There's always new improbable — it's not what you expect! — stuff on the **Improbable Research blog** at IMPROBABLE.COM

Detangling, Whipping, Kicking, Walking, Telescoping

Physics of a variety of actions

compiled by Bentoni Liliquist, Improbable Research staff

The Rapid Detangling of Worms

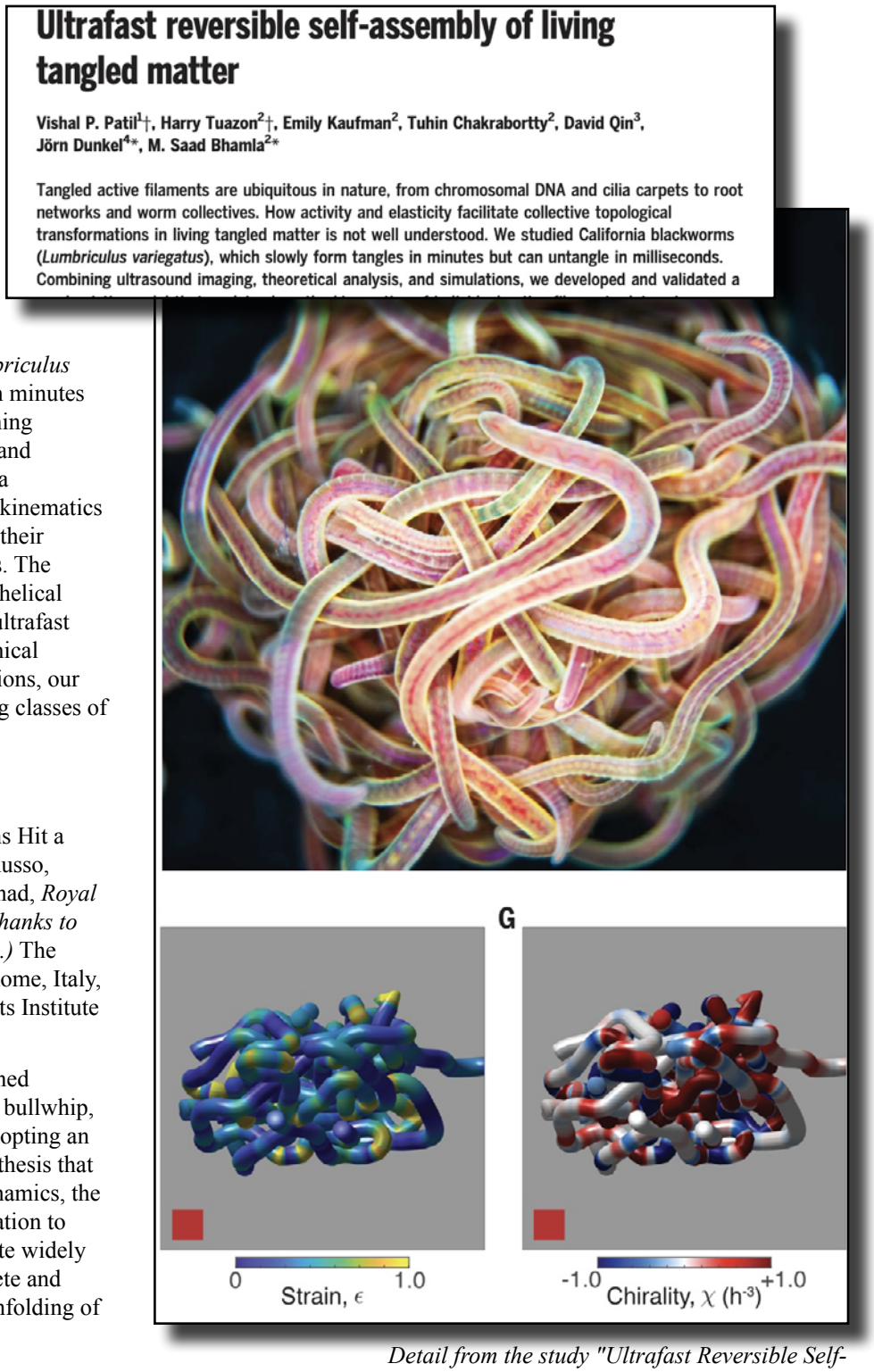
"Ultrafast Reversible Self-Assembly of Living Tangled Matter," Vishal P. Patil, Harry Tuazon, Emily Kaufman, Tuhin Chakrabortty, David Qin, Jörn Dunkel, and M. Saad Bhamla, *Science*, vol. 380, no. 6643, 2023, pp. 392-398. The authors, at Stanford University, Georgia Institute of Technology, and the Massachusetts Institute of Technology, report:

> We studied California blackworms (*Lumbriculus variegatus*), which slowly form tangles in minutes but can untangle in milliseconds. Combining ultrasound imaging, theoretical analysis, and simulations, we developed and validated a mechanistic model that explains how the kinematics of individual active filaments determines their emergent collective topological dynamics. The model reveals that resonantly alternating helical waves enable both tangle formation and ultrafast untangling. By identifying generic dynamical principles of topological self-transformations, our results can provide guidance for designing classes of topologically tunable active materials.

Physics of Whipping

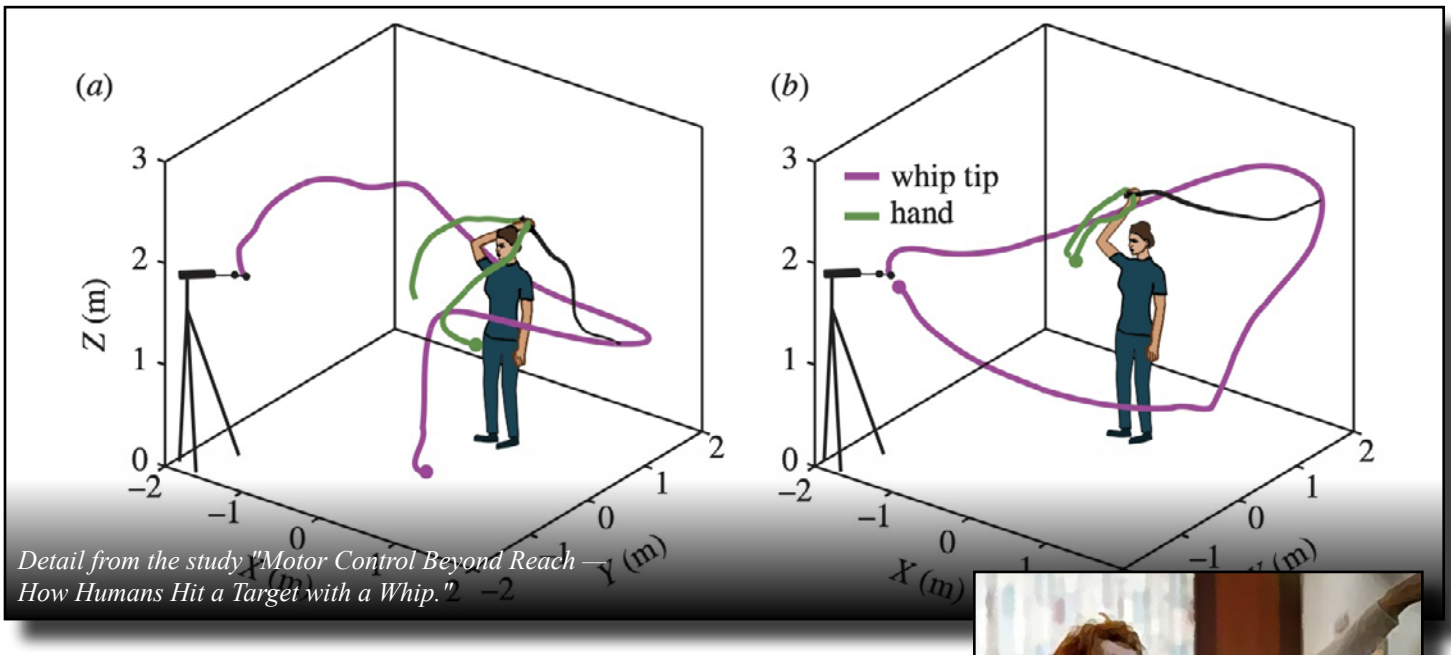
"Motor Control Beyond Reach—How Humans Hit a Target with a Whip," Aleksei Krotov, Marta Russo, Moses Nah, Neville Hogan, and Dagmar Sternad, *Royal Society Open Science*, vol. 9, no. 10, 2022. *(Thanks to Philip Rubin for bringing this to our attention.)* The authors, at IRCCS Fondazione Santa Lucia, Rome, Italy, Northeastern University, and the Massachusetts Institute of Technology, report:

> This study embraced the fully unconstrained behaviour of hitting a target with a 1.6-m bullwhip, both in rhythmic and discrete fashion. Adopting an object-centered approach to test the hypothesis that skilled movement simplifies the whip dynamics, the whip's evolution was characterized in relation to performance error and hand speed. Despite widely differing individual strategies, both discrete and rhythmic styles featured a cascade-like unfolding of the whip.



Detail from the study "Ultrafast Reversible Self-Assembly of Living Tangled Matter."

Detangling, Whipping, Kicking, Walking, Telescoping [cont'd]



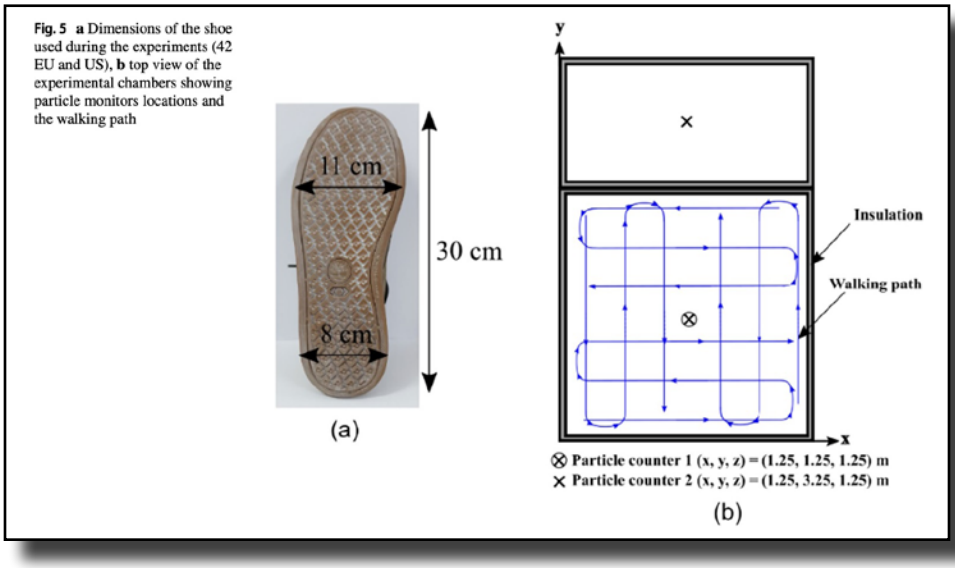
Detail from the study "Motor Control Beyond Reach — How Humans Hit a Target with a Whip."

Dagmar Sternad, co-author of the study "Motor Control Beyond Reach — How Humans Hit a Target with a Whip." Drawing by Nan Swift.

How Much Dust is Kicked Up by Walking

"PM10, PM2.5, PM1, and PM0.1 Resuspension Due to Human Walking," Ahmed Benabed and Amir Boulbair, *Air Quality, Atmosphere and Health*, vol. 15, 2022, pp. 1547–1556. *(Thanks to Tom Gill for bringing this to our attention.)* The authors, at ESTACA, Universite Polytechnique Hauts-de-France, and the University of La Rochelle, France, report:

> Particle resuspension has been identified as a major indoor particle matter (PM) source in indoor environments. The present work investigated the human walking-induced PM resuspension in a full-scale laboratory experimental chamber. The PM mass concentration was monitored using a Miniwras Grimm counter. The floor of the test chamber was covered with a tufted synthetic carpet and uniformly loaded with neutralized alumina dust. Using the mass-based balance equation and the well-mixed condition hypothesis, resuspension rates were estimated after 10 min of walking activity. Results show that human walking significantly increases the indoor PM10, PM2.5, PM1, and PM0.1 concentrations.



Detail from the study "PM10, PM2.5, PM1, and PM0.1 Resuspension Due to Human Walking."

Fluid Physics of Telescoping Cardboard Boxes

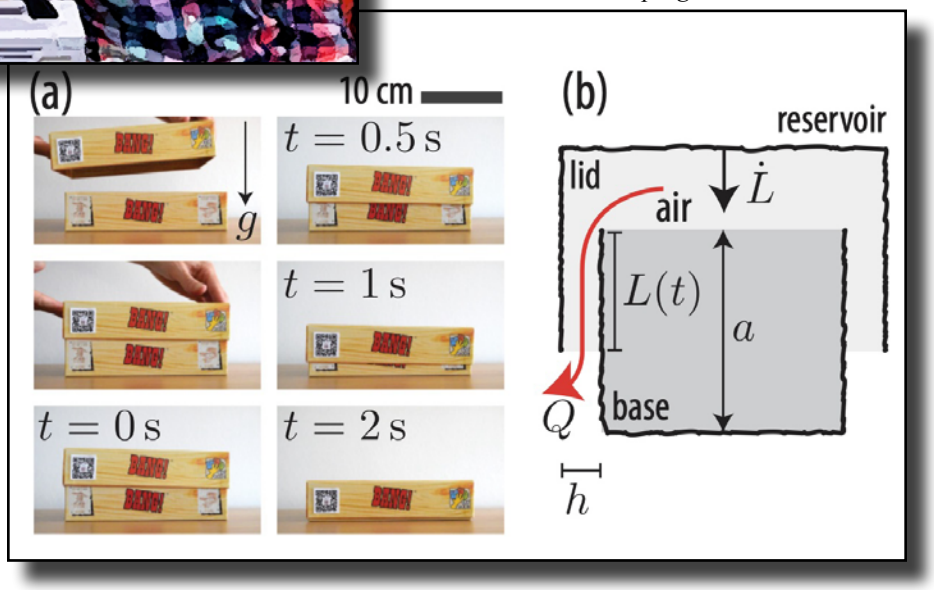
"Fluid Physics of Telescoping Cardboard Boxes," Jolet de Ruiter, Emil Visby Østergaard, Sean Marker, and Kaare H. Jensen, *Physical Review Fluids*, vol. 7, no. 4, 2022, article 044101. The authors, at Technical University of Denmark, report *(cont'd next page)*:

Detangling, Whipping, Kicking, Walking, Telescoping [cont'd]

This paper outlines the main effects associated with the closing and opening of telescoping boxes which are used, for instance, to store and transport board games, footwear, mobile phones, and tablet computers. The sliding motion of the lid is controlled by the flow in a thin film of air in the gap separating the lid and the base of the box. Based on a broad comparison between theory and experiments on real and synthetic boxes, we find that the process is primarily controlled by the shape of the gap between the base and the lid. We derive a master equation for the lid motion and identify the origin of three distinct experimental regimes. Finally, an optimal design for a rapidly closing box is identified.

Jolet de Ruiter, lead author of the study "Fluid Physics of Telescoping Cardboard Boxes." Drawing by Nan Swift.

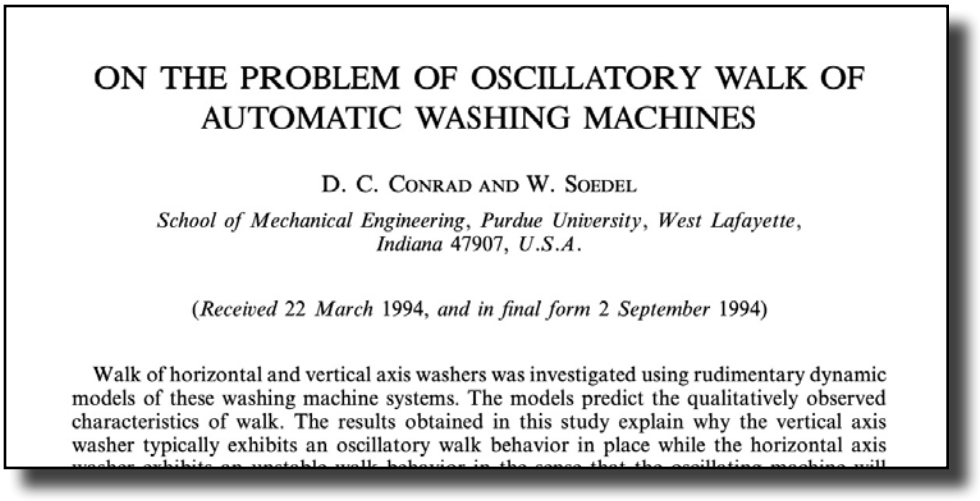
Detail from the study "Fluid Physics of Telescoping Cardboard Boxes."



Oscillatory Walk of Automatic Washing Machines 1

"On the Problem of Oscillatory Walk of Automatic Washing Machines," Daniel C. Conrad and Werner O. Soedel, *Journal of Sound and Vibration*, vol. 188, no. 3, 1995, pp. 301-314. The authors, at Purdue University, report:

> Walk of horizontal and vertical axis washers was investigated using rudimentary dynamic models of these washing machine systems. The models predict the qualitatively observed characteristics of walk. The results obtained in this study explain why the vertical axis washer typically exhibits an oscillatory walk behavior in place while the horizontal axis washer exhibits an unstable walk behavior in the sense that the oscillating machine will move steadily in a direction dictated by the rotational direction of the basket.



ON THE PROBLEM OF OSCILLATORY WALK OF AUTOMATIC WASHING MACHINES

D. C. Conrad and W. Soedel

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(*Received* 22 *March* 1994, *and in final form* 2 *September* 1994)

Walk of horizontal and vertical axis washers was investigated using rudimentary dynamic models of these washing machine systems. The models predict the qualitatively observed characteristics of walk. The results obtained in this study explain why the vertical axis washer typically exhibits an oscillatory walk behavior in place while the horizontal axis

Oscillatory Walk of Automatic Washing Machines 2

"Basic Vibration Design to Which Young Engineers Can Relate: The Washing Machine," Lieutenant Colonel Wayne E. Whiteman and Colonel Kip P. Nygren of the United States Military Academy, presentation at the 1999 ASEE [American Society for Engineering Education] annual conference.