

# Madhur Mangalam, Ph.D.

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## STATEMENT OF RESEARCH INTERESTS

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Movement is considered a sixth vital sign. It can provide valuable information about neurological disease, cognition, risk of injury, and many other aspects of health. Movement is also one of the few behaviors that can be objectively measured and quantified, allowing rigorous, personalized, and reproducible assessment. Therefore, I study movements to decipher the “choreography” of physiological fluctuations associated with complex behaviors and functions in tasks as complex as perceiving the length of a handheld rod by wielding in the absence of vision and even making sense of the voice of text-to-speech synthesizers. My research primarily relies on statistical modeling of multimodal human movement data longitudinally collected in healthy and clinical populations. Instrumentation used to collect this data include motion capture system, eye tracking, force plates embedded in the floor, electromyography, FLIR/RGBD video camera, inertial measurement units, and virtual reality setup. My work uses cutting-edge analytical techniques such as “multifractal analysis” and “multiscale probability density function analysis” borrowed from statistical physics and fluid dynamics to probe the temporal structure of physiological data. My work further develops these approaches to study how complex psychological phenomena unfold across multiple space and timescales (from individuals to groups to populations, and from seconds to minutes to weeks). My research program promises to identify and model the nonstationary, far-from-equilibrium processes that characterize the creativity and emergence of biological and psychological behavior.

**Keywords:** *Biomechanics | Embodied Cognition | Ergodic Theory | Fractal/Multifractal Analysis | Human Factors & Tool Use | Motor Control | Movement Science | Multiscale Analysis | Multiplicative Cascade Processes | Nonlinear Dynamics | Perception & Action | Posture | Proprioception | Sensorimotor Neuroscience*

## BIBLIOGRAPHY

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PubMed  
Open Researcher and Contributor ID (ORCID)  
Google Scholar  
ResearchGate

## WORK EXPERIENCE

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**UNIVERSITY OF NEBRASKA AT OMAHA** | RESEARCH ASSOCIATE  
NONLINEAR ANALYSIS CORE, DEPARTMENT OF BIOMECHANICS  
01 August 2022 – Present | Omaha, NE

**NORTHEASTERN UNIVERSITY** | POSTDOCTORAL RESEARCH ASSOCIATE  
MOVEMENT NEUROSCIENCE LABORATORY, DEPARTMENT OF PHYSICAL THERAPY, MOVEMENT AND REHABILITATION SCIENCES  
07 January 2019 – 31 July 2022 | Boston, MA  
w/ Prof. Eugene Tunik

**UNIVERSITY OF GEORGIA** | TEMPORARY TECHNICAL/PARAPROFESSIONAL  
DEPARTMENT OF PSYCHOLOGY  
28 January 2019 – 26 February 2019 | Athens, GA  
w/ Prof. Dorothy M. Fragaszy

**UNIVERSITY OF MYSORE** | RESEARCH ASSISTANT  
DEPARTMENT OF PSYCHOLOGY  
11 July 2012 – 31 July 2014 | Mysore, KA, India  
w/ Prof. Mewa Singh

## EDUCATION

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### UNIVERSITY OF GEORGIA | PH.D.

BEHAVIOR AND BRAIN SCIENCES PROGRAM, DEPARTMENT OF PSYCHOLOGY

18 August 2014 – 12 December 2018 | Athens, GA

*Dissertation:* The biomechanics of multi-joint posture and movement control in wild bearded capuchin monkeys using stone hammers.

w/ Prof. Dorothy M. Fragaszy, Prof. Karl M. Newell, & Prof. Dean Sabatinelli

### INDIAN INSTITUTE OF SCIENCE EDUCATION AND RESEARCH PUNE | DUAL DEGREE B.S.–M.S.

LIFE SCIENCES

20 August 2007 – 15 May 2012 | Pune, MH, India

*Thesis:* Strategies in novel food extraction tasks and responses to perceived threats in urban free-ranging dogs, *Canis familiaris*.

w/ Prof. Mewa Singh

## FUNDED RESEARCH PROPOSALS

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2020–21 **Facebook Technologies LLC | USD 79,423**

“Virtual reality and neuroplasticity”

*Role:* Co-I (PI: Eugene Tunik; Co-I Mathew Yarossi)

2017–19 **Committee for Research and Exploration, National Geographic Society | WW-051R-17 | USD 29,226\***

“Nut-cracking in wild bearded capuchin monkeys: Patterns of coordination in movements”

*Role:* Co-I (PI: Dorothy M. Fragaszy; Co-Is: Patrícia Izar & Elisabetta Visalberghi)

\*UGA policy does not permit graduate students to serve as PIs

2016 **Innovative and Interdisciplinary Research Grant | USD 1,000**

Graduate School, University of Georgia

## PENDING RESEARCH PROPOSALS

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2023–26 **Joint DMS/NIGMS Initiative to Support Research at the Interface of the Biological and Mathematical Sciences (DMS/NIGMS), National Science Foundation | USD 562,678**

“Is non-ergodicity a cause of the reproducibility crisis?”

*Role:* Co-I (PIs: Aaron Likens & Damian G. Kelty-Stephen; Co-PI: Nick Stergiou)

2023–26 **R21, National Institute of Aging | USD 500,370**

“Leveraging an Augmented Reality (AR)-based virtual walking companion to reduce fall risk in older adults”

*Role:* Co-PI (Co-PI: Spyridon Mastorakis; Co-Is: Aaron Likens & Nick Stergiou)

## UNFUNDED RESEARCH PROPOSALS

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2022 **R21, National Institute of Neurological Disorders and Stroke | USD 425,876**

“Parietal contribution to sensorimotor updating for object perturbations during tool-assisted grasping”

*Role:* PI (Co-I: Mathew Yarossi, Mariusz P. Furmanek, & Eugene Tunik)

2021 **Perception, Action & Cognition (PAC), National Science Foundation | USD 599,877**

“How embodiment contributes to motor coordination”

*Role:* Co-I (PI: Eugene Tunik; Co-PIs: Lisa B. Feldman, Karen Quigley, & Sarah Ostadabbas; Co-Is: Mariusz P. Fumanek & Mathew Yarossi)

2021 **K99/R00, National Institute of Neurological Disorders and Stroke | USD 939,098**

“Premotor contributions to online updating, learning, and consolidation during tool-assisted grasping with novel fingers-to-tool mappings”

*Role:* PI (Mentor: Eugene Tunik; Co-mentor: John W. Krakauer; Collaborator: Jon S. Matthis)

## MANUSCRIPTS IN PREPARATION

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**Mangalam, M.** & Kelty-Stephen, D. G. The meaning of various multifractal estimates.

**Mangalam, M.** & Karve, S. M. The folly of fools: Nonergodicity in the statistics of COVID-19 pandemic.

**Mangalam, M.** Completely reversible metabolically caused cognitive dysfunction and encephalopathy in a renal cell carcinoma patient with brain metastasis.

**Mangalam, M.** & Kelty-Stephen, D. G. Ergodicity breaking in physiological measurements.

**Mangalam, M.** & Kelty-Stephen, D. G. Multiplicative cascade processes generate neural avalanches.

Xygalatas, D., **Mangalam, M.**, & Kelty-Stephen, D. G. Multiplicative cascades support physiological synchronization within and across individuals in an ecstatic Sufi ritual.

**Mangalam, M.**, Wilkinson, T., Chemero, McClelland, T., Jones, M., A., Thomas, B., Osiurak, F., Federico, G., Wagman, J. B., Duffrin, T., Stoffregen, T., Nonaka, T., Favela, L., Hajnal, A., Pacheco, M. M., Harrison, S. J., Kinsella-Shaw, J. M., Shaw, R. E., Nguyen, T. D., Amazeen, P. G., Seifert, L., Araujo, D., Davids, K., Andries, M., Jamone, L., Piater, J. A., Şahin, E., Schwab, S., Silva, P. L., Escribano, M. H., Travieso, D., Lobo, L., Kiverstein, J. D. de Wit, M., Raja, V., Anderson, M. L., & Kelty-Stephen, D. G. On affordance and its entailment in organisms and autonomous systems.

**Mangalam, M.**, Likens, A., & Kelty-Stephen, D. G. Multifractal nonlinearity grows independent of multifractality in binomial multiplicative cascades.

Furmanek, M. P., Lockwood, K., Asghari-Esfeden, S., Bicer, Y., Zhu, T., **Mangalam, M.**, Yarossi, M., Padir, T., Erdogmas, D. & Tunik, E. A multi-sensor kinematic and gaze dataset on human-to-human object handover for human-robot interactions.

**Mangalam, M.**, Furmanek, M. P., Yarossi, M., & Tunik, E. A control law governs online updating of reach-to-grasp movements to visual perturbations of object size and distance.

**Mangalam, M.**, Yarossi, M., Furmanek, M. P., Buckingham, G., Borst, C. W., & Tunik, E. Bio-inspired collision handling for naturalistic virtual grasping.

Furmanek, M. P.<sup>1</sup>, Schettino, L. F.<sup>1</sup>, Yarossi, M.<sup>1</sup>, **Mangalam, M.**<sup>1</sup>, Lockwood, K., Adamovich, S. V. & Tunik, E. Frontoparietal involvement in online updating of reach-to-grasp to mechanical perturbations of hand transport.

**Mangalam, M.**<sup>1</sup>, Furmanek, M.<sup>1</sup>, Lookwood, K., Tunik, E., & Yarossi, M. Control of aperture closure as a unifying goal for coordination between reach and grasp.

**Mangalam, M.**, Likens, A., Stergiou, N., & Kelty-Stephen, D. G. Is non-ergodicity a cause of the reproducibility crisis?

**Mangalam, M.**, Wiles, T. M., Stergiou, N., Likens, A., & Kelty-Stephen, D. G. Nonlinear modeling strategies to explain and predict variability in human performance.

**Mangalam, M.** & Kelty-Stephen, D. G. Multiplicative cascade dynamics supports perturbation responses during walking.

## MANUSCRIPTS IN PIPELINE

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**Mangalam, M.**, Kelty-Stephen, D. G., Sommerfeld, J., Stergiou, N., & Likens, A. (2023). Intermittent sensorimotor control of walking. *eLife* (Submission pending).

Kelty-Stephen, D. G., Cisek, P., De Bari, B., Dixon, J., Favela, L., Hasselman, F., Keijzer, F., Raja, V., Thomas, B., Wagman, J. B., Pacheco, M. M., & **Mangalam, M.** (2023). In search for an alternative to the computer metaphor of the mind and brain. *Neuroscience & Biobehavioral Reviews* (Under review).

**Mangalam, M.**, Yarossi, M., Furmanek, M. P., Krakauer, J. W. & Tunik, E. (2023). Investigating and acquiring motor expertise using virtual reality. *Trends in Cognitive Sciences* (Resubmission pending).

Wiles, T. M., **Mangalam, M.**, Sommerfeld, L., Kim, S. K., Brink, K., Charles, A. E., Grunkemeyer, A. Manifrenti, M. E. K., Stergiou, N., Mastorakis, S., and Likens, A. (2023). NONAN GaitPrint—A multimodal gait database of healthy adults for accessing gait patterns unique to individuals. *Nature Scientific Data* (Under review).

**Mangalam, M.**, Metzler, R., & Kelty-Stephen, D. G. Ergodic characterization of non-ergodic anomalous diffusion processes.

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<sup>1</sup>Equal contributions.

**Physical Review E** (Under review).

**Mangalam, M.**, Kelty-Stephen, D. G., Hayano, J., Watanabe, E., Seleznov, I., & Kiyono, K. (2023). Quantifying cascade-like interactivity in physiological signals using an estimator of non-Gaussianity. **Physical Review X** (Under review).

Gupta, A., Kelty-Stephen, D. G., **Mangalam, M.**, McKindles, R. J., & Stirling, L. A. (2023). Walking speed and dual task input modality impact performance on a self-paced treadmill. **Applied Ergonomics** (Revision pending).

**Mangalam, M.** & Avci, P. (2023). Author CRediT score (ACS): An order independent measure of author contribution based on CRediT statement. **Science and Engineering Ethics** (Under review).

## PEER-REVIEWED RESEARCH ARTICLES\*

\*Undergraduate mentees.

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Kelty-Stephen, D. G., Lee, J., Cole, K. R., Shields, R. K., **Mangalam, M.** (2023). Multifractal nonlinearity in torque production moderates both feedforward and feedback responses to unpredictable perturbation. **Perceptual and Motor Skills** XXX, XXX-XXX.

Kelty-Stephen, D. G. & **Mangalam, M.** (2022). Multifractal descriptors restore ergodicity broken by multiplicative cascade processes. **Physical Review E** XXX, XXXXXX.

Aiempichitkijkarn, N., Eshchar, Y., **Mangalam, M.**, Izar, P., Resende, B., Visalberghi, E., & Fragaszy, D. M. (2022). What predicts expertise at cracking palm nuts by wild bearded capuchin monkeys (*Sapajus libidinosus*)? **Animal Behaviour** XXX, XXXXXX.

**Mangalam, M.**, Skiadopoulos, A., Siu, K.-C., Mukherjee, M., Likens, A., & Stergiou, N. (2022). Leveraging a virtual alley with continuously varying width modulates step width variability during self-paced treadmill walking. **Neuroscience Letters** XXX, XXXXXX.

Kelty-Stephen, D. G. & **Mangalam, M.** (2022). Fractal and multifractal descriptors restore ergodicity broken by non-Gaussianity in time series. **Chaos, Solitons & Fractals** 163, 112568.

Kelty-Stephen, D. G., Lane, E., Bloomfield, L., & **Mangalam, M.** (2022). Multifractal test for nonlinearity of interactions across scales in time series. **Behavior Research Methods** XXX(X), XXX-XXX.

Lockwood, L., Bicer, Y., Asghari-Esfeden, S., Zhu, T., Furmanek, M. P., **Mangalam, M.**, Strenge, G., Imbiriba, T., Yarossi, M., Padir, T., Erdogmus, D., & Tunik, E. (2022). Leveraging submovements in prediction and trajectory planning for human-robot handover. **PETRA '22: Proceedings of the 15th International Conference on Pervasive Technologies Related to Assistive Environments** 247-253.

**Mangalam, M.** & Kelty-Stephen, D. G. (2022). Ergodic descriptors of non-ergodic stochastic processes. **Journal of the Royal Society Interface** 19(189), 20220095.

**Mangalam, M.**, Ross, C. F., Izar, P., Visalberghi, E., & Fragaszy, D. M. (2022). Capuchin monkeys use their semi-prehensile tail as a cantilever. **Current Science** 122(2), 195-200.

Furmanek, M. P.<sup>1</sup>, **Mangalam, M.**<sup>1</sup>, Yarossi, M.<sup>1</sup>, Lockwood, K., & Tunik, E. (2022). A kinematic and EMG dataset of online adjustment of reach-to-grasp movements to visual perturbations. **Nature Scientific Data** 9, 23.

Fragaszy, D. M., Lukemire, J., Reynoso-Cruz, E. R., Villareal, S., Sheheane, S., Quinones, M., & **Mangalam, M.** (2021). How tufted capuchin monkeys (*Sapajus* spp.) and humans (*Homo sapiens*) handle a jointed tool. **Journal of Comparative Psychology** 135(3), 382-393.

Bloomfield, L., Lane, E., **Mangalam, M.**, & Kelty-Stephen, D. G. (2021). Perceiving and remembering speech depend on multifractal nonlinearity in movements producing and exploring speech. **Journal of the Royal Society Interface** 18(181), 20210272.

Furmanek, M. P., **Mangalam, M.**, Lookwood, K., Smith, A.\*, Yarossi, M., & Tunik, E. (2021). Effects of sensory feedback and collider size on reach-to-grasp coordination in haptic-free virtual reality. **Frontiers in Virtual Reality** 2, 648529.

**Mangalam, M.** & Kelty-Stephen, D. G. (2021). Hypothetical control of postural sway. **Journal of the Royal Society Interface** 18(176), 20200951.

**Mangalam, M.**, Yarossi, M., Furmanek, M. P., & Tunik, E. (2021). Control of aperture closure during reach-to-grasp movements in immersive haptic-free virtual reality. **Experimental Brain Research** 239(5), 1651-1665.

Kelty-Stephen, D. G., Lee, I-C., Carver, N. S., Newell, K. M., & **Mangalam, M.** (2021). Multifractal roots of suprapostural dexterity. *Human Movement Science* 76, 102771.

**Mangalam, M.**, Desai, N., & Kelty-Stephen, D. G. (2021). Proprioceptive afferents differentially contribute to effortful perception of object heaviness and length. *Experimental Brain Research* 239(4), 1085–1098.

Jacobson, N., Berleman-Paul, Q., **Mangalam, M.**, & Kelty-Stephen, D. G., Ralston, C. (2021). Multifractality in postural sway supports quiet eye training in aiming tasks: A study of golf putting. *Human Movement Science* 75, 102752.

Kelty-Stephen, D. G., Furmanek, M. P., & **Mangalam, M.** (2021). Multifractality distinguishes reactive from proactive cascades in postural control. *Chaos, Solitons & Fractals* 142, 110471.

**Mangalam, M.**, Lee, I-C., Newell, K. M., & Kelty-Stephen, D. G. (2021). Visual effort moderates postural cascade dynamics. *Neuroscience Letters* 742, 135511.

Furmanek, M. P., **Mangalam, M.**, Kelty-Stephen, D. G., & Juras, G. (2021). Postural constraints recruit shorter-timescale processes into the non-Gaussian cascade processes. *Neuroscience Letters* 741, 135508.

**Mangalam, M.**, Carver, N. S., & Kelty-Stephen, D. G. (2020). Multifractal signatures of perceptual processing on anatomical sleeves of the human body. *Journal of The Royal Society Interface* 17(168), 20200328.

**Mangalam, M.**, Carver, N. S., & Kelty-Stephen, D. G. (2020). Global broadcasting of local fractal fluctuations in a bodywide distributed system supports perception via effortful touch. *Chaos, Solitons & Fractals* 135, 109740.

**Mangalam, M.** & Kelty-Stephen, D. G. (2020). Multiplicative-cascade dynamics supports whole-body coordination for perception via effortful touch. *Human Movement Science* 70, 102595.

**Mangalam, M.**, Chen, R.\*, McHugh, T. R.\*, Singh, T., & Kelty-Stephen, D. G. (2020). Bodywide fluctuations support manual exploration: Fractal fluctuations in posture predict perception of heaviness and length via effortful touch by the hand. *Human Movement Science* 69, 102543.

**Mangalam, M.**, Roles, L. K. R.\*, & Fragaszy, D. M. (2020). Distinct perceptuomotor features of percussive tooling in humans (*Homo sapiens*) and wild bearded capuchin monkeys (*Sapajus libidinosus*). *Journal of Comparative Psychology* 134(1), 84–97.

Cutts, S. A.\*, Fragaszy, D. M., & **Mangalam, M.** (2019). Consistent inter-individual differences in susceptibility to bodily illusions. *Consciousness and Cognition* 76, 102826.

**Mangalam, M.**, Cutts, S. A.\*, & Fragaszy, D. M. (2019). Sense of ownership and not the sense of agency is spatially bounded within the space reachable with the unaugmented hand. *Experimental Brain Research* 237(11), 2911–2924.

**Mangalam, M.**, Conners, J. D.\*, Kelty-Stephen, D. G., & Singh, T. (2019). Fractal fluctuations in muscular activity contribute to judgments of length but not heaviness via dynamic touch. *Experimental Brain Research* 237(5), 1213–1226.

**Mangalam, M.**, Pacheco, M. M., Fragaszy, D. M., & Newell, K. M. (2019). Perceptual learning of tooling affordances of a jointed object via dynamic touch. *Ecological Psychology* 31(1), 14–29.

**Mangalam, M.**, Conners, J. D.\*, & Singh, T. (2019). Muscular effort differentially mediates perception of heaviness and length via dynamic touch. *Experimental Brain Research* 237(1), 237–246.

**Mangalam, M.**, Rein, R., & Fragaszy, D. M. (2018). Bearded capuchin monkeys use joint synergies to stabilize the hammer trajectory while cracking nuts in bipedal stance. *Proceedings of the Royal Society B: Biological Sciences* 285(1889), 20181797.

#### \*Cover Page Article

**Mangalam, M.**, Conners, J. D.\*, Fragaszy, D. M., & Newell, K. M. (2018). Location of a grasped object's effector influences perception of the length of that object via dynamic touch. *Experimental Brain Research* 236(7), 2107–2121.

**Mangalam, M.**, Wagman, J. B., & Newell, K. M. (2018). Temperature influences perception of the length of a grasped object via effortful touch. *Experimental Brain Research* 236(2), 505–516.

**Mangalam, M.**, Pacheco, M. M., Izar, P., Visalberghi, E., & Fragaszy, D. M. (2018). Unique perceptuomotor control of stone hammers in wild monkeys. *Biology Letters* 14(1), 20170587.

**Mangalam, M.**, Barton, S. A.\*, Wagman, J. B., Fragaszy, D. M., & Newell, K. M. (2017). Perception of the length of an object through dynamic touch is invariant across changes in the medium. *Attention, Perception, & Psychophysics* 79(8), 2499–2509.

**Mangalam, M.**, Newell, K. M., Visalberghi, E., & Fragaszy, D. M. (2017). Stone-tool use in wild monkeys: Implications for the study of the body-plus-tool system. *Ecological Psychology* 29(4), 300–316.

**Mangalam, M.**, Izar, P., Visalberghi, E., & Fragaszy, D. M. (2016). Task-specific temporal organization of percussive movements in wild bearded capuchin monkeys. *Animal Behaviour* 114, 129–137.

Classen, D., Kiessling, S. E., **Mangalam, M.**, Kaumanns, W., & Singh, M. (2016). Fission-fusion species under restricted housing conditions: A comparative study of inter-individual interactions and physical proximity in captive bonobos and Bornean orangutans. *Current Science* 110(5), 139–150.

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**Mangalam, M.**, Desai, N.\*, & Singh, M. (2016). Self-organization of laterally asymmetric movements as a consequence of space-time optimization. *Journal of Theoretical Biology* 390, 50–60.

Zaunmair, P., **Mangalam, M.**, Kaumanns, W., Singh, M., & Slotta-Bachmayr, L. (2015). Patterns of dominance relationships among the females of a captive female-only group of lion-tailed macaques (*Macaca silenus*) during the course of the introduction of a new adult male. *Current Science* 109(4), 803–807.

**Mangalam, M.** & Karve, S. M. (2015). Comment on “Number-space mapping in the newborn chick resembles humans’ mental number line.” *Science* 348(6242), 1438–b.

**Mangalam, M.** & Fragaszy, D. M. (2015). Wild bearded capuchin monkeys crack nuts dexterously. *Current Biology* 25(10), 1334–1339.

**Mangalam, M.**, Desai, N.\*, & Singh, M. (2015). Division of labor in hand usage is associated with higher hand performance in free-ranging bonnet macaques, *Macaca radiata*. *PLoS One* 10(3), e119337.

Sfar, N., **Mangalam, M.**, Kaumanns, W., & Singh, M. (2014). A comparative assessment of hand preference in captive red howler monkeys, *Alouatta seniculus* and yellow-breasted capuchin monkeys, *Sapajus xanthosternos*. *PLoS One* 9(10), e107838.

**Mangalam, M.**, Desai, N.\*, & Singh, M. (2014). Do right-handed monkeys use the right cheek pouch before the left? *PLoS One* 9(5), e97971.

**Mangalam, M.**, Desai, N.\*, & Singh, M. (2014). Division of labor in hand usage in free-ranging bonnet macaques, *Macaca radiata*. *American Journal of Primatology* 76(6), 576–585.

**Mangalam, M.** & Singh, M. (2013). Flexibility in food extraction techniques in urban free-ranging bonnet macaques, *Macaca radiata*. *PLoS One* 8(12), e85497.

**Mangalam, M.** & Singh, M. (2013). Differential foraging strategies: Motivation, perception and implementation in urban free-ranging dogs, *Canis familiaris*. *Animal Behaviour* 85(2), 763–770.

**Mangalam, M.** & Singh, M. (2013). Sex and reproductive state influence the rate of resource acquisition and monopolisation in urban free-ranging dogs, *Canis familiaris*. *Behaviour* 150(4), 199–213.

Das, S., Dutta, S., **Mangalam, M.**, Verma, R., Rath, S., Singh, M., & Kumara, H. (2011). Prioritizing remnant forests for the conservation of Mysore slender lorises (*Loris lydekerianus lydekerianus*) in Karnataka, India through estimation of population density. *International Journal of Primatology* 32(5), 1153–1160.

## PEER-REVIEWED REVIEW / PERSPECTIVE ARTICLES\*

\*Undergraduate mentees.

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Kelty-Stephen, D. G. & **Mangalam, M.** (2022). Turing's cascade instability supports the coordination of the mind, brain, and behavior. *Neuroscience & Biobehavioral Reviews* 141, 104810.

**Mangalam, M.**, Fragaszy, D. M., Wagman, J. B., Day, B. G., Kelty-Stephen, D. G., Bongers, R. M., Stout, D. W., & Osieurak, F. (2022). On the psychological origins of tool use. *Neuroscience & Biobehavioral Reviews* 133, 104521.

Yarossi, M., **Mangalam, M.**, Naufel, S., & Tunik, E. (2021). Virtual Reality as a context for adaptation. *Frontiers in Virtual Reality* 2, 733076.

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**Mangalam, M.**, González, C., & Singh, T. (2021). Sensory redundancy and perceptual invariance in force production and object manipulation. *Current Opinion in Physiology* 19, 148–155.

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**Mangalam, M.**, Desai, N.\* , & Singh, M. (2016). Division of labor in hand usage: A democratic approach to explaining manual asymmetries in non-human primates. *Current Science* 110(9), 1630–1638.

## BOOK CHAPTERS

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**Mangalam, M.** (2022). Simpson's paradox in psychology. In Dunn, D. S. (Ed.), *Oxford Bibliographies*. New York, NY: Oxford University Press.

**Mangalam, M.** (2022). Nonergodicity in psychology and neuroscience. In Dunn, D. S. (Ed.), *Oxford Bibliographies*. New York, NY: Oxford University Press.

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**Mangalam, M.** & Fragaszy, D. M. (2015). Quantifying affordances. In Weast-Knapp, J., Malone, M., & Abney, D. (Eds.), *Studies in Perception and Action XVIII* (pp. 199–202). New York, NY: Psychology Press.

## EDITORIALS & OTHERS\*

\*Undergraduate mentees.

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Nettimi, R. P.\* , **Mangalam, M.**, & Singh, M. (2015). Why not be an early bird researcher? *Current Science* 108(6), 1027–1028.

## PUBLISHED ABSTRACTS\*

\*Undergraduate mentees.

**Mangalam, M.**, Roles, L. K. R.\* , & Fragaszy, D. M. (2018). Identifying distinguishing features of perceptuomotor control of stone tools in humans and bearded capuchin monkeys. *American Journal of Primatology* 80(S1), 39–40.

**Mangalam, M.** (2018). Haptic perception in motor control, at land, in water, in air, and in space, of a fish's fin, a flamingo's neck, a monkey's tail, a snake's spine, and a bat's wing. *Integrative & Comparative Biology* 58(suppl\_1), e143.

**Mangalam, M.** & Fragaszy, D. M. (2018). Joint synergies in nut cracking in wild bearded capuchin monkeys. *Integrative & Comparative Biology* 58(suppl\_1), e371.

**Mangalam, M.**, Matheus, M. M., & Fragaszy, D. M. (2017). How wild bearded capuchin monkeys crack nuts. *Integrative & Comparative Biology* 57(suppl\_1), e337.

**Mangalam, M.**, Roles, L. K. R.\* , & Fragaszy, D. M. (2017). Wild bearded capuchin monkeys outperform humans in cracking nuts. *Integrative & Comparative Biology* 57(suppl\_1), e104.

**Mangalam, M.** & Fragaszy, D. M. (2016). Embodied foundations of stone tool use shared by humans and bearded capuchin monkeys. *American Journal of Physical Anthropology* 159(S62), 218.

**Mangalam, M.** & Fragaszy, D. M. (2015). Wild bearded capuchin monkeys crack nuts dexterously. *Proceedings of the XVIII International Conference on Perception–Action* 86.

## INVITED PRESENTATIONS

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- 2022 **Brain, Learning, Animation, and Movement Lab, Johns Hopkins Neurology** Baltimore, MD | April 29  
Using Turing's cascade instability to knit together the mind, brain, and behavior.
- 2022 **CESPA, Department of Psychological Sciences, University of Connecticut** Storrs, CT | April 01  
Using Turing's cascade instability to knit together the mind, brain, and behavior.
- 2021 **Department of Psychology, University of Tennessee** Knoxville, GA | December 8  
Using Turing's cascade instability to knit together the mind, brain, and behavior.
- 2021 **Department of Cognitive Science, Indian Institute of Technology** Kanpur, India | November 9  
Multifractal signatures of perceptual processing on anatomical sleeves of the human body.
- 2016 **American Association of Physical Anthropologists** Atlanta, GA | April 13–16  
Embodied foundations of stone tool use shared by humans and bearded capuchin monkeys.

*Symposium: **Hands, Brains, and Tools: Integrating concepts in human evolution** organized by Dr. Dietrich W. Stout*

## ORAL PRESENTATIONS

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- 2023 **Ergodicity Economics** Cascais, Portugal | February 2–3  
Is non-ergodicity a cause of the reproducibility crises?
- 2023 **Ergodicity Economics** Cascais, Portugal | February 2–3  
Non-ergodic, intermittent sensorimotor control of walking.
- 2023 **Ergodicity Economics** Cascais, Portugal | February 2–3  
Multifractal descriptors restore ergodicity broken by multiplicative cascade processes.
- 2022 **North American International Society for Ecological Psychology** Hattiesburg, MS | June 23–25  
Exploring multifractal roots of suprapostural dexterity using ergodic descriptors of nonergodic postural fluctuations.
- 2022 **North American International Society for Ecological Psychology** Hattiesburg, MS | June 23–25  
Multifractal nonlinearity in movements producing and exploring speech supports perceiving and remembering speech.
- 2018 **North American International Society for Ecological Psychology** Normal, IL | June 27–28  
Wild monkeys structure motor variability to stand bipedally while using stone hammers.
- 2018 **Department of Organismal Biology and Anatomy, University of Chicago** Chicago, IL | March 12  
What stone tool-using wild monkeys can tell us about prehistoric toolmakers and cyborgs.
- 2018 **Society for Integrative & Comparative Biology** San Francisco, CA | Jan 3–7  
Haptic perception in motor control, at land, in water, in air, and space, of a fish's fin, a flamingo's neck, a monkey's tail, a snake's spine, and a bat's wing.
- 2017 **American Society for Primatologists** Washington, DC | Aug 25–28  
Identifying distinguishing features of perceptuomotor control of stone tools in humans and bearded capuchin monkeys.
- 2017 **7th Annual Graduate Students & Postdocs in Science Day**, University of Georgia, Athens, GA | April 17  
Perceptual-motor control of stone tools in wild monkeys: Implications for the origins of stone-tool manufacture in hominins.
- 2017 **40th Annual Psi Chi Convention**, University of Georgia, Athens, GA | April 14  
Perceptual-motor control of stone tools in wild monkeys: Implications for the origins of stone-tool manufacture in hominins.
- 2017 **Society for Integrative & Comparative Biology** New Orleans, LA | Jan 4–8  
How wild bearded capuchin monkeys crack nuts.



- 2016 **North American International Society for Ecological Psychology** Clemson, SC | June 20–22  
Biomechanical analysis of the affordances of anvil-and-hammer tools in wild bearded capuchin monkeys.
- 2015 **XVIII International Conference on Perception–Action** Minneapolis, MN | July 14–18  
Wild bearded capuchin monkeys crack nuts dexterously.

## POSTER PRESENTATIONS

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- 2022 **Psychonomic Society 63rd Annual Meeting** Boston, MA | November 17–20  
Nonlinear temporal structure provides a common substrate for production, perception, and memory of language.
- 2022 **Society for the Neural Control of Movement** Dublin, Ireland | July 25–29  
An immutable control policy governs fingers closure during reach-to-grasp coordination.
- 2022 **Society for the Neural Control of Movement** Dublin, Ireland | July 25–29  
Frontoparietal involvement in online updating of reach-to-grasp to mechanical perturbations of hand transport: A TMS study.
- 2021 **Society for Neuroscience** Global Connectome | Jan 11–13  
Involvement of dorsal and ventral premotor cortices in online updating to reach and grasp perturbations.
- 2019 **Boston Area Neuroscience Group** Boston, MA | November 7  
Grasp responses to mechanical perturbations of reach.
- 2019 **Society for Neuroscience** Chicago, IL | October 19–23  
Grasp Response to transport perturbation during reach-to-grasp in virtual environment.
- 2018 **International Society for Ecological Psychology** Normal, IL | June 27–28  
Point of percussion influences perception of the length of a wielded object via dynamic touch by striking.
- 2018 **Society for the Neural Control of Movement** Santa Fe, NM | April 30–May 4  
Wild monkeys structure motor variability to maintain a stable bipedal stance while using stone hammers.
- 2018 **Society for Integrative & Comparative Biology** San Francisco, CA | Jan 3–7  
Joint synergies in nut cracking in wild bearded capuchin monkeys.
- 2017 **Society for Integrative & Comparative Biology** New Orleans, LA | Jan 4–8  
Wild bearded capuchin monkeys outperform humans in cracking nuts.
- 2016 **International Society for Ecological Psychology** Clemson, SC | June 20–22  
Wild bearded capuchin monkeys use their semi-prehensile tail as a cantilever of adjustable length.
- 2015 **XVIII International Conference on Perception–Action** Minneapolis, MN | July 14–18  
Quantifying affordances.

## MEDIA COVERAGE OF RESEARCH\*

\*Undergraduate mentees.

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**Mangalam, M., Rein, R., & Fragaszy, D. M.** (2018). Bearded capuchin monkeys use joint synergies to stabilize the hammer trajectory while cracking nuts in bipedal stance. *Proceedings of the Royal Society B: Biological Sciences* 285(1889), 20181797.

**Featured in:**

**The Franklin Chronicles** Up on two feet

**The Royal Society** A hard nut to crack...

**Mangalam, M., Pacheco, M. M., Izar, P., Visalberghi, E., & Fragaszy, D. M.** (2018). Unique perceptuomotor control of stone hammers in wild monkeys. *Biology Letters* 14(1), 20170587.

**Featured in:**

**The Franklin Chronicles** New primate behavior study: Perceiving kinetic energy

**Mangalam, M.**, Barton, S. A. \*, Wagman, J. B., Frigaszy, D. M., & Newell, K. M. (2017). Length of an object perceived through dynamic touch remains invariant across changes in the medium. *Attention, Perception, & Psychophysics* 79(8), 2499–2509.

**Featured in:**

**Psychonomic Society** The eigenvalues of lightsabers and submerged golden hammers

**Mangalam, M.**, Izar, P., Visalberghi, E., & Fragaszy, D. M. (2016). Task-specific temporal organization of percussive movements in wild bearded capuchin monkeys. *Animal Behaviour* 114, 129–137.

**Featured in:**

**Animal Behaviour** On tool use, and becoming human

**Journal of Experimental Biology** Monkeys alter tool use for different tasks

Zaunmair, P., **Mangalam, M.**, Kaumanns, W., Singh, M., & Slotta-Bachmayr, L. (2015). Patterns of dominance relationships among the females of a captive female-only group of lion-tailed macaques (*Macaca silenus*) during the course of the introduction of a new adult male. *Current Science* 109(4), 803–807.

**Featured in:**

**Current Science** Society of lion-tailed macaques

**Mangalam, M.** & Fragaszy, D. M. (2015). Wild bearded capuchin monkeys crack nuts dexterously. *Current Biology* 25(10), 1334–1339.

**Featured in:**

**BBC Radio** Monkey nuts

**Daily Mail** This is how you should be cracking nuts!

**Der Spiegel** Raffinierte technik: So knacken affen nüsse

**Discovery News** Monkeys show how to perfectly crack a nut

**EurekaAlert!** Wild bearded capuchin monkeys really know how to crack a nut

**Huffington Post** Clever monkey demonstrates the proper way to crack a nut

**Mental Floss** These monkeys wield makeshift hammers and anvils

**National Geographic** Nut-bashing monkeys offer window into human evolution

**Nature World News** These nut cracking monkeys would make great blacksmiths - use a hammer and anvil with deft

**New Scientist** Capuchin monkeys rival chimps as highly skilled nut-crackers

**Pacific Standard** Monkeys with talented hands

**Science News** Rock-wielding monkeys make adjustments when cracking nuts

**Science Shot** Clever monkeys adjust how hard they hammer nuts

**The New York Times** Monkeys provide clues to how tool use developed

Nettimi, R. P. \*, **Mangalam, M.**, & Singh, M. (2015). Why not be an early bird researcher? *Current Science* 108(6), 1027–1028.

**Featured in:**

**The Indian Express** Education system does not foster the spirit of inquiry

Das, S., Dutta, S., **Mangalam, M.**, Verma, R., Rath, S., Singh, M., & Kumara, H. (2011). Prioritizing remnant forests for the conservation of Mysore slender lorises (*Loris lydekerianus lydekerianus*) in Karnataka, India through estimation of population density. *International Journal of Primatology* 32(5), 1153–1160.

**Featured in:**

**The Hindu** Loris clings on precariously here

**The Times of India** Study moots conservation of slender loris' habitat

## PROFESSIONAL MEMBERSHIPS

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International Society for Ecological Psychology (ISEP)  
Society for Neuroscience (SfN)  
Society for the Neural Control of Movement (NCM)

## AD-HOC REVIEWERSHIPS

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*Animal Cognition*  
*Attention, Perception, & Psychophysics*  
*Behavioural Processes*  
*Behavioural Brain Research*  
*Biology Letters*  
*BMJ Open*  
*Consciousness and Cognition*  
*Current Science*  
*Ecological Psychology*  
*Entropy*  
*Human Movement Science*  
*International Journal of Primatology*  
*Journal of Biosciences*  
*Journal of Comparative Psychology*  
*Journal of Motor Behavior*  
*Journal of the Royal Society Interface*  
*Journal of Visualized Experiments (JoVE)*  
*Nature*  
*NeuroImage*  
*Neuroscience*  
*Physiology & Behavior*  
*PLoS One*  
*Psychological Studies*  
*Quarterly Journal of Experimental Psychology*  
*Research Quarterly for Exercise and Sport*  
*Scientific Reports*  
*Sensors*  
*Virtual Reality*

## AWARDS, FELLOWSHIPS, & GRANTS

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- 2019 **Herbert Zimmer Award for Outstanding Research | USD 500**  
Department of Psychology, University of Georgia
- 2018 **Departmental Teaching Assistantship | USD 15,642**  
Department of Psychology, University of Georgia
- 2018 **Graduate School Travel Grant | USD 775**  
Graduate School, University of Georgia
- 2017–18 **Departmental Teaching Assistantship | USD 21,660**  
Department of Psychology, University of Georgia
- 2017 **Graduate School Travel Grant | USD 775**  
Graduate School, University of Georgia
- 2017 **Walter Isaac Travel Award | USD 300**  
Department of Psychology, University of Georgia

- 2015 **Honorary Domestic Travel Assistance | INR 11,000**  
Biopsychology Laboratory, University of Mysore, India
- 2015 **Foreign Travel Assistance | USD 1,850**  
OVPR, University of Georgia
- 2015 **Walter Isaac Travel Award | USD 300**  
Department of Psychology, University of Georgia
- 2015 **Outstanding Publication Award**  
Department of Psychology, University of Georgia
- 2014-15 **Ph.D. Scholars of Excellence Assistantship | USD 21,000**  
Department of Psychology, University of Georgia
- 2015 **Education Related Travel Grant | INR 40,000**  
Sir Dorabji Tata Trust, India
- 2007-12 **Inspire Fellowship | INR 287,500**  
Department of Science & Technology, India
- 2010 **Summer Research Fellowship | INR 12,000**  
Indian Academy of Sciences, India
- 2010 **Spirit of Invention Award | INR 5,000**  
National Chemical Laboratory, India

## TEACHING EXPERIENCE

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**RESEARCH ANALYSIS IN PSYCHOLOGY | TEACHING ASSISTANT**  
August 2018 – December 2018 | University of Georgia

**COGNITIVE NEUROSCIENCE | INSTRUCTOR OF RECORD**  
July 2018 | University of Georgia

**RESEARCH ANALYSIS IN PSYCHOLOGY | TEACHING ASSISTANT**  
January 2018 – May 2018 | University of Georgia

**ANIMAL COGNITION & PERCEPTION | GUEST LECTURER**  
March 2018 | University of Georgia

**SENSATION & PERCEPTION | GUEST LECTURER**  
October 2017 | University of Georgia

**RESEARCH DESIGN IN PSYCHOLOGY | TEACHING ASSISTANT**  
August 2017 – December 2017 | University of Georgia

**COGNITIVE PSYCHOLOGY | TEACHING ASSISTANT**  
Jan 2017 – May 2017 | University of Georgia

**PHYSIOLOGICAL & COMPARATIVE PSYCHOLOGY | TEACHING ASSISTANT**  
August 2016 – December 2016 | University of Georgia

**PSYCHOPHARMACOLOGY | TEACHING ASSISTANT**  
June 2016 – July 2016 | University of Georgia

**ANIMAL COGNITION | GUEST LECTURER**  
January 2016 – May 2016 | University of Georgia

**ELEMENTARY PSYCHOLOGY | TEACHING ASSISTANT**  
August 2015 – May 2016 | University of Georgia

**STATISTICS | GUEST LECTURER**  
January 2013 – May 2013 | University of Mysore

## GRADUATE MENTORSHIP

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- 2022 **Kolby Brink, Anaelle E. Charles, Alli Grunkemeyer, Seung Kyeom Kim, Maria E. K. Manifrenti, & Tyler Wiles**  
Biomechanics, University of Nebraska at Omaha
- 2022 **Hana Chahid & Peining Li**  
Doctor of Physical Therapy (DPT), Northeastern University

## UNDERGRADUATE MENTORSHIP

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- 2019-20 **Andrea Smith**  
Bioengineering Major, Northeastern University
- 2019 **Holden Lalor**  
Bioengineering Major, Northeastern University
- 2019 **Yael Lissack**  
Bioengineering Major, Northeastern University
- 2018-19 **Sarah Cutts**  
Psychology & Neuroscience Major, University of Georgia
- 2018 **Pakeeza A. Hafeez**  
Psychology & Biology Major, University of Georgia
- 2018 **Peyton Niebanck**  
Fisheries and Wildlife Major, University of Georgia
- 2018 **Ryan Chen**  
Kinesiology Major, University of Georgia  
Ryan received **Michael E. Penland Family Award** for his research project
- 2018 **Terrence R. McHugh**  
Kinesiology Major, University of Georgia
- 2017-18 **James D. Connors**  
Psychology & Communications Major, University of Georgia  
James received **William T. James Award** given to an Outstanding Senior Major in Psychology
- 2017 **Carlos R. Corea**  
Linguistics & Psychology Major, University of Georgia
- 2017 **Lillian A. Stamps**  
Psychology Major, University of Georgia
- 2017 **Tinikki C. Gibbs**  
Psychology Major, University of Georgia
- 2016 **Sophie A. Barton**  
Psychology & Neuroscience Major, University of Georgia
- 2015-16 **Ashley Myers**  
Biology & Psychology Major, University of Georgia
- 2015-16 **Hiba Hafeez**  
Psychology Major, University of Georgia
- 2015-16 **Lindsey K. R. Roles**  
Psychology & Neuroscience Major, University of Georgia
- 2015 **James Y. Hammers**  
Psychology Major, University of Georgia

- 2015 **Leslea G. Motley**  
Psychology Major, University of Georgia
- 2012-15 **Ravindra P. Nettimi**  
Biology Major, Indian Institute of Science Education and Research Pune
- 2012-15 **Nisarg Desai**  
Biology Major, Indian Institute of Science Education and Research Pune

## REFEREES

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**NICK STERGIU** | PROFESSOR AND FOUNDING CHAIR  
Biomechanics, University of Nebraska at Omaha  
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