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CURRICULUM VITAE

EDUCATION

PhD, Information Technology 09/2013 - 03/2017
Monash University *Melbourne, Australia*

Thesis on self-organised infrastructure construction in leaf-cutter ants

Developed computational models of collective construction mechanism, energetics, and evolution

Dipl.Biol. (∼B.Sc. + M.Sc.), Behavioural Ecology 07/2004 - 10/2011
Ruhr-Universität Bochum - highest grade "sehr gut" *Bochum, Germany*

Thesis on collective nest-construction in weaver ants

Invented experimental system to analyse worker self-assembly into pulling chains; derived behavioural determinants

RESEARCH EXPERIENCE

Postdoctoral Fellow, Department of Physics 07/2020 - ongoing
Emory University *Atlanta, USA*

Explored of the interplay of ant nest construction and mechanical substrate properties in fire ants

Postdoctoral Fellow, Department of Engineering 07/2018 - 07/2020
Northwestern University *Evanston, USA*

Designed and built an X-ray Computed Tomography (CT) scanner; wrote analytical algorithms for tomographic data

Imaged the internal structure in temporary nest self-assemblies in *Eciton* army ants and derived growth dynamics and mechanical properties

Postdoctoral Research Assistant, School of Biological Sciences 10/2017 - 02/2018
Monash University *Melbourne, Australia*

Designed evolutionary models of sex allocation in basal plants

Research Assistant, SensiLab 06/2015 - 03/2017
Monash University *Melbourne, Australia*

Designed behavioural AI of palaeontological lifeforms for augmented reality teaching application

Research Assistant, Machine Learning Group 06/2015 - 09/2016
Monash University *Melbourne, Australia*

Annotated medical records for the training of a Natural Language Processing algorithm

Research Assistant, Behavioural Ecology Group 03/2011 - 11/2011
James Cook University *Townsville, Australia*

Collected and statistically analysed behavioural and spatial data on ant nest construction

TEACHING EXPERIENCE

Guest Lecturer, Department of Physics 04/2021
Emory University *Atlanta, USA*

Designed and delivered two guest lectures on collective behaviour in animals for the class "Collective behavior in living systems: the physics of animal groups"

Sessional Lecturer, Faculty of Information Technology 02/2018 - 06/2018
Monash University *Melbourne, Australia*

Primary lecturer of class "FIT3094: Artificial Intelligence, Artificial Life, and digital environments". Delivered lectures and lead practical coding classes, designed and graded exams and class assignments.

Teaching Associate, School of Biological Sciences 07/2014 - 10/2014
Monash University *Melbourne, Australia*

Supervised biology course BIO1022 and demonstrated laboratory techniques

Teaching Associate, Behavioural Biology Group 08/2009 - 02/2010
Ruhr-Universität *Bochum, Germany*

Designed and taught experiments in undergraduate course "Behavioural Ecology", and marked reports.

SUPERVISION EXPERIENCE

Phd Students	**Calvin Riiska** (Physics) – Snake microstructures and locomotion (Emory, 2021-ongoing) **Zach Germain** (Physics) – Agent-based simulation of fire ant construction (Emory, 2022) **Bingjie Xu** (CS) – Robust reconstruction phantom for an in-field CT scanner (NU, 2019-2020)
M.Sc. Students	**Sheethal Veepur** (Biology) – Adjustment of underground foraging tunnels in leaf-cutting ants (*Acromyrmex lundii*) through digging (NU/UJ, 2021) **Alexis Baudron** (CS) – Robust reconstruction phantom for an in-field CT scanner (NU, 2019-2020)
Undergrad Research Students	**Cyprian Dumas** (Biology) – Stridulation as organising factor in fire ant construction (Emory, 2022) **Zhao Chen** (Physics) – 2D construction in Fire ants (Emory, 2022) **Deanna Dimonte** (CS) – Convolutional neural nets to describe growth of army-ant bivouacs (NU, 2019) **James Tanner** (Biology) – Parallel foraging cycles in leaf-cutter ants. Published in Ecological Entomology (MU, 2016)
Undergrad Students	10 Students (2015-ongoing)

Acronym legend – CS: Computer Science; NU: Northwestern University, USA; MU: Monash University, AUS; UJ – University of Jena, GER;

JOURNAL PUBLICATIONS

Please visit Google Scholar for current list.
h-index: 5; Citations: 60

1. **Bochynek, T.**, Schiffers, F., Aichert, A., Cossairt, O., Garnier, S., Rubenstein, M. (2021) – Anatomy of a superorganism - structure and growth dynamics of army ant bivouacs. ArXiv. *In review at Proceedings of the National Academy of Sciences*.
2. **Bochynek, T.**, Burd, M., Kleineidam, C.J., and Meyer, B. (2019) – Infrastructure construction without information exchange: the trail clearing mechanism in *Atta* leafcutter ants. Proceedings of the Royal Society B: Biological Sciences 286: 20182539. IF: 4.459
3. **Bochynek, T.**, Tanner, J., Meyer, B., and Burd, M. (2017) – Parallel foraging cycles for different resources in leaf-cutting ants: a clue to the mechanisms of rhythmic activity. Ecological Entomology 42(6): 849-852. IF: 2.229
4. **Bochynek, T.**, Meyer, B., and Burd, M. (2017) – Energetics of trail clearing in the leaf-cutter ant *Atta*. Behavioral Ecology and Sociobiology 71: 14. IF: 2.523
5. **Bochynek, T.** and Robson, S.K.A. (2014) – Physical and biological determinants of collective behavioural dynamics in complex systems: pulling chain formation in the nest-weaving ant *Oecophylla smaragdina*. PLOS ONE 9(4): e95112. IF: 3.699
6. Ihlow, F., Rödder, D., **Bochynek, T.**, Sothanin, S., Handschuh, M., and Böhme, W. (2014) – Reinforcement as a conservation tool – assessing site fidelity and movement of the endangered elongated tortoise *Indotestudo elongata* (Blyth, 1854). Journal of Natural History 48: 39-40. IF: 0.942

CONFERENCE PUBLICATIONS

1. Schiffers, F., **Bochynek, T.**, Aichert, A., Wuerfl, T., Rubenstein, M., Cossairt, O. (2020) – Disassemblable fieldwork CT scanner using a 3D-printed calibration phantom. CT Meeting 2020
2. Macfarlan, B., Anderson, M., Boyce, J., Chandler, T., **Bochynek, T.**, Yeates, M., and Maynard, C. (2017) – Monash Rocks: The first step in an augmented reality journey through deep time. In H. Partridge, K. Davis, & J. Thomas. (Eds.), Me, Us, IT! Proceedings ASCILITE2017: 34th International Conference on Innovation, Practice and Research in the Use of Educational Technologies in Tertiary Education 138-141
3. Shmanina, T., Zukerman, I., Cheam, A.L., **Bochynek, T.**, and Cavedon, L. (2016) – Corpus of tables in full-text biomedical research publications. Conference on Computational Linguistics 2016 7079

CONFERENCE PRESENTATIONS

Use of a customizable, disassemblable X-ray CT scanner for in-the-field imaging of social insect-made structures	Tokyo, JP	DARS 2021
Mechanism of self-organised infrastructure construction	Amsterdam, NL	ECCS 2016
(Invited) Regulatory mechanism in leaf-cutter ant foraging	Amsterdam, NL	ECCS 2016
Concurrent foraging patterns in leaf-cutter ants *Atta*	Sydney, AUS	ASSAB 2016
Costs and benefits of clearing physical trails in leaf-cutter ants *Atta*	Cairns, AUS	Behaviour 2015
Dynamics of collective worksite selection in weaver ants	Cairns, AUS	IUSSI 2014

Acronym legend – DARS: Distributed Autonomous Robotic Systems; ECCS: European Conference on Complex Systems; ASSAB: Australian Society for the Study of Animal Behaviour; IUSSI: International Union for the Study of Social Insects

GRANT SUCCESS

Northwestern University Centre for Leadership Fellowship (USD 1000)	2018
Monash University Postgraduate Publication Award (USD∼3251)	2016
Faculty of IT Supplementary Funding Award, used for research visit (USD∼3600)	2016
Monash International Postgrad Research Scholarship (USD∼68,275)	2013
CSIRO Data61 / NICTA Top-up Scholarship (USD∼17,700)	2013
Monash University Faculty Scholarship (USD∼93,563)	2013
Total funds:	USD∼188,800

MEDIA COVERAGE

- Discover Magazine: How army ants build city-like nests using their own bodies
- Nature Research Highlights: Ants build superhighways without bosses or blueprints
- ABC The Science Show: Leaf-cutter ants - the ultimate egalitarian workforce
- Smithsonian Tropical Research Institute News: When is it optimal to build a trail?
- Swiss newspaper NZZ: Ameisenstrassen bleiben auch ohne koordinierte Putzkolonnen sauber *[Ant highways don't require cleaning staff]*
- Second largest German newspaper Süddeutsche Zeitung: Spezialisten der Straßenreinigung *[Specialists of Road construction]*

SKILLS

Computational skills: Agent-based and system modelling on high-performance clusters; entity tracking in images and videos; image processing and data extraction via computer vision; machine learning using artificial neural networks and genetic algorithms; analysis of tomographic data; evolutionary game theory simulation; cellular automata

Manufacturing experience: Experimental setup construction using Computer-assisted Design, 3D printing, and metal part machining; Arduino-based setup control; stereo-vision based 3D surface scanning; construction of light-based and X-ray based CT scanners.

Experimental experience: Behavioural experiments in the laboratory; field work experience across four continents, including extended stays in remote rainforests

PROFESSIONAL ACTIVITIES

- Reviewer for Nature Scientific Reports, Behavioural Ecology and Sociobiology, PLOS ONE, Insectes Sociaux
- Initiator, organiser, and moderator of two-day Monash IT Research Retreat. Event received USD∼50,670 in faculty funds. Led a team of ten PhD students for eight months, organising guest-speakers and research workshops. Event brought together PhD students from three Monash campuses (including from Malaysia) and is now repeated every two years.
- Contributed to organisational work as student representative in the Monash IT Graduate Research Committee and in an academic misconduct committee investigation
- Outreach work as repeated Open Day speaker at Monash IT and Science faculties and at CSIRO events; presenter in high school science classes at a Puerto Rican High School and through "Skype a Scientist"

VISITED INSTITUTIONS & COLLABORATORS

La Selva Research Station, Costa Rica	Field work on leaf-cutter ant trail clearing	2017
Dr. Duarte, Exeter University, UK	Modelling of leaf-cutter ant trail clearing	2016
Prof. Kleineidam, Konstanz University, Germany	Laboratory work on leaf-cutter ant trails	2014
Smithsonian Tropical Research Institute, Panama	Field work and modelling; CT scanning of army ant nests	2013 & 2019
Prof. Simon Robson, James Cook University, Australia	Field work and modelling of weaver ant nest construction	2010-2011 & 2017
Danum Valley Field Centre, Sabah, Malaysia	'Ant Course' field course	2010
Panay Eco-Social Conservation Project, Philippines	Field work on spiny ant aggression	2009