WATARU TOYOKAWA, PHD

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EMPLOYMENT HISTORY

Unit Leader (PI)   1 April 2023 -
Computational Group Dynamics Unit
RIKEN CBS Toyota Collaboration Centre (BTCC), Japan

Research Scientist   1 March 2019 -
Department of Psychology: Social Psychology and Decision Sciences
University of Konstanz, Germany

JSPS Postdoctoral Research Fellow   1 April 2017 – February 2019
University of St Andrews, Scotland
The Graduate University of Advanced Science, Japan
A joint appointment

JSPS Overseas Research Fellow   1 April 2015 – 31 March 2017
School of Biology, University of St Andrews, Scotland

JSPS Doctoral Research Fellow (DC1)   1 April 2012 – 31 March 2015
Department of Behavioral Science, Hokkaido University, Japan
Doctoral student fellow

EDUCATION

Ph.D. Behavioural Science   1 April 2012 - March 2015
Department of Behavioral Science
Graduate School of Humanities and Human Sciences
Hokkaido University, Sapporo
(Supervisor: Professor Tatsuya Kameda)

M.Sc. Behavioural Science   April 2010 - March 2012
Department of Behavioral Science
Graduate School of Humanities and Human Sciences
Hokkaido University, Sapporo
(Supervisor: Professor Tatsuya Kameda)

B.Sc. Theoretical Ecology and Fisheries Science   April 2006 - March 2010
Department of Marine Biology
School of Fisheries Sciences
Hokkaido University, Hakodate
(Supervisor: Dr Kinya Nishimura)

HONOURS AND AWARDS

JSPS Postdoctoral Research Fellowship (PD)	2017
JSPS Overseas Research Fellowship	2015
Young Researcher's Presentation Award 6th conference of Human Behavior and Evolution Society Japan	2013
Research Incentive Award Hokkaido Psychological Society	2013

The Best-Poster Award	2012
31st conference of Japan Ethological Society (JPY 5,000)	
Young Researcher's Presentation Award	2012
5th conference of Human Behavior and Evolution Society Japan	
JSPS Doctoral Research Fellowship (DC1)	2012

RESEARCH GRANTS

Association of Psychological Science William K. and Katherine W. Estes Fund "Computational Summer school on Modelling Social and collective behaviour (COSMOS) in Konstanz 2023" Co-organising with Dr Charley M. Wu (University of Tübingen) (USD 11,000)	2023
Association of Psychological Science William K. and Katherine W. Estes Fund "COSMOS Konstanz 2022" Co-organising with Dr Charley M. Wu (USD 16,000 / EUR 13,810 from the Estes Fund) (EUR 9,290 from the CASCB small Project grant)	2022
The CASCB 2021 Large Project "Collective foraging and social search in vast decision-making spaces" Co-PI with Professor Wolfgang Gaissmaier and Dr Hansjörg Neth (EUR 216,305)	2022 - 2024
The CASCB Small Project grant "A Computational Approach to Information-Sharing and Social Generalization in Collective Risky Decision-making" (EUR 9,600)	2020 - 2021
The Committee on Research (AFF) research grant Internal grant of University of Konstanz (EUR 5,000)	2019
JPSP KAKENHI Grant-in-aid for JSPS Postdoctoral Fellows 17J01559 (GBP 28,100/JPY 4,090,000)	2017-2020
JSPS Overseas Research Fellowship (JPY 5,256,000 (GBP 32,000) per year)	2015-2017
The Suntory Foundation Grant-in-Aid for Young Scientists (GBP 7,000/JPY 1,000,000)	2016
JPSP KAKENHI Grant-in-aid for JSPS Doctoral Student Fellow 24004583 (GBP 21,000/JPY 3,000,000)	2012-2015
Student Travel Award, European Human Behaviour and Evolution Association Annual Meeting 2013 (GBP 100)	2013
Hokkaido University Conference Travel Grant (GBP 1,400/JPY 200,000)	2011
Hokkaido University Conference Travel Grant (GBP 700/JPY 100,000)	2010

RESEARCH EXPERIENCE

Research Scientist in Konstanz
March 2019 – Present

· Using both mathematical modelling and large-scale online behavioural experimentation, I study conformist influence social learning under risk and uncertainty (e.g. Toyokawa & Gaissmaier, 2022, eLife), trying to bridge a theoretical gap between the individual-level computational mechanisms and the emergent patterns of collective animal behaviour. I have obtained two research grants for my ongoing research.

Japan Society for the Promotion of Science (JSPS) Research Fellow in St Andrews
April 2015 – March 2019

· During this time, I was a post-doctoral research fellow collaborating with Professor Kevin N. Laland, looking at computational bases of human social learning strategies and collective intelligence (Toyokawa et al. 2019, Nature Human Behaviour). I am also a theoretical ecologist using population dynamics and evolutionary games, interested in socio-cultural influences on ecological sustainability (e.g., Toyokawa, 2017, Roy Soc Open Science).

PhD research project in Hokkaido
April 2012 – March 2015

· Utilising behavioural laboratory experiments combined with eye-tracking techniques, I investigated (1) human information gathering behaviour in a collective learning situation (Toyokawa et al. 2014, PLoS ONE) and (2) individual differences in learning strategies (Toyokawa et al. 2017, Evol Hum Behav).

TEACHING EXPERIENCES

I take a hybrid approach where home-works and assignments are uploaded online, while discussions and seminars are done on the university campus (if the situation allows). In past years, I have developed a step-by-step tutorial for computational modelling and agent-based simulation for psychology undergraduate students (the code is available online). I have also developed an online course "Data handling and visualisation in R" for psychology undergraduate students in Konstanz. All the courses I have taught so far was in English.

The list of the course I have done so far is as follows:

University of Konstanz

Seminar on Motivation and Emotion	SS 2019, 2020
Seminar on Social Psychology	WS 2021, 2022
Individual based modelling using R [Materials]	SS 2020
Practical training on experimental psychology	SS 2019, 2020, 2022
Introductory data science and visualisation for psychology	WS 2019, 2020
Seminar on social learning, collective behaviour, and cultural evolution	WS 2019, 2020

As a guest lectureer

Computational mechanisms of social learning, CHAIN winter school	Hokkaido University 2021

RELEVANT RESEARCH SKILLS

Computer-based behavioural lab experimentation
Toolkit: z-Tree, Python (PsychoPy) and Tobii eye-tracker

Large-scale online multi-player behavioural experimentation
Toolkit: Node.js + express with Phaser game engine

Advanced statistical analysis
(e.g. Bayesian GLMMs, hidden Markov process models, and reinforcement learning)
Toolkit: R and Stan

Mathematical modelling
(e.g. population dynamics and reinforcement learning models)
Toolkit: Mathematica, R, and Python

PUBLICATIONS

Peer reviewed journal articles

1. **Toyokawa W** and Gaissmaier W. (2022) Conformist social learning leads to self-organised prevention against adverse bias in risky decision making. *eLife*, 11:e75308 (doi: 10.7554/eLife.75308). [Press Release]

2. Kameda T, **Toyokawa W** and Tindale RS. (2022) Information Aggregation and Collective Intelligence beyond the Wisdom of Crowds. *Nature Reviews Psychology*. (doi: https://doi.org/10.1038/s44159-022-00054-y)

3. Laland KN, **Toyokawa W** and Oudman T. (2019) Animal Learning as a Source of Developmental Bias. *Evolution and Development*. (doi: 10.1111/ede.12311)

4. **Toyokawa W**, Whalen A and Laland KN. (2019). Social learning strategies regulate the wisdom and madness of interactive crowds. *Nature Human Behaviour*, 3: 183-193. (doi: 10.1038/s41562-018-0518-x). [Press Release] [Behind the Paper] [The Conversation]

5. Kim H, **Toyokawa W** and Kameda T. (2019). How do we decide when (not) to free-ride? Risk tolerance predicts adaptation of cooperation levels in new settings. *Evolution and Human Behavior*, 40: 55-64. (doi:10.1016/j.evolhumbehav.2018.08.001)

6. Cimino A, **Toyokawa W**, Komatsu M, Thomson R, and Gaulin S J (2019). Cross-Cultural and Cross-Organizational Evidence for an Evolved Hazing Motivation. *Evolutionary Psychology*, 17(4), 1474704919887943.

7. Muthukrishna M, Henrich J, **Toyokawa W**, Hamamura T, Kameda T, and Heine S J. (2018). Overconfidence is Universal? Elicitation of Genuine Overconfidence (Ego) Method Reveals Systematic Differences Across Domain, Task Knowledge, and Incentives in Four Populations. *PLoS ONE*, 13(8): e0202288. (doi: 10.1371/journal.pone.0202288)

8. **Toyokawa W**. (2017). Scrounging by foragers can resolve the paradox of enrichment. *Royal Society Open Science*, 4: 160830. (doi:10.1098/rsos.160830)

9. **Toyokawa W**, Saito Y and Kameda T. (2017). Individual differences in learning behaviours in humans: Asocial exploration tendency does not predict reliance on social learning. *Evolution and Human Behavior*, 38 (3): 325-333. (doi:10.1016/j.evolhumbehav.2016.11.001)

10. Gregory A. Bryant, Daniel M.T. Fessler, Riccardo Fusaroli, Edward Clint, Lene Aarøe, Coren L. Apicella, Michael Bang Petersen, Shaneikiah T. Bickham, Alexander Bolyanatz, Brenda Chavez, Delphine De Smet, Cinthya Díaz, Jana Fančovičová, Michal Fux, Paulina Giraldo-Perez, Anning Hu, Shanmukh V. Kamble, Tatsuya Kameda, Norman P. Li, Francesca R. Luberti, Pavol Prokop, Katinka Quintelier, Brooke A Scelza, Hyun Jung Shin, Montserrat Soler, Stefan Stieger, **Toyokawa W**, Ellis A. van den Hende, Hugo Viciana-Asensio, Saliha Elif Yildizhan, Jose C. Yong, Tessa Yuditha, and Yi Zhou (2016). Detecting affiliation in co-laughter across 24 societies. *Proceedings of the National Academy of Sciences*, 113 (17), 4682-4687. (doi: 10.1073/pnas.1524993113)

11. **Toyokawa W**, Kim H and Kameda T. (2014). Human collective intelligence under dual exploration-exploitation dilemmas. *PLoS ONE* 9(4): e95789. (doi: 10.1371/journal.pone.0095789)

12. **Toyokawa W** and Kameda T. (2014). Experimental study on social learning and swarm intelligence effect in the 'exploration-exploitation dilemma'. *Hokkaido Psychological Research*, 36, 1-14. (in Japanese, pdf)

13. **Toyokawa W** and Kameda T. (2013). Toward a synthetic understanding of collective decision-making by humans and non-human animals. *The Japanese Journal of Animal Psychology*, 63, 2, 107-122. (in Japanese, Link)

14. Kameda T, Wisdom T, **Toyokawa W** and Inukai K. (2012). Is consensus-seeking unique to humans? A selective review of animal group decision-making and its implications for (human) social psychology. *Group Processes & Intergroup Relations*, 15, 673-689. (doi: 10.1177/1368430212451863)

Book chapters

1. Laland KN, Oudman T, and **Toyokawa W**. (February 2022) How Learning Affects Evolution. In M. A. Krause, K. L. Hollis, & M. P. Papini (Eds.), Evolution of Learning and Memory Mechanisms, Cambridge University Press.

2. Kameda, T, Inukai, K, Wisdom, T and **Toyokawa W** (2015). Herd behavior: Its psychological and neural underpinnings. In S. Grundmann, F. Moeslein & K. Riesenhuber (Eds.), Contract governance. (Pp. 61-71). Oxford, UK: Oxford University Press.

Papers submitted or in preparation

1. **Toyokawa W**. (in prep). Collective behavioural rescue emerging from positive and negative feedback.

2. **Toyokawa W** and Giese H. (in prep.). Cooperative information sharing can undermine the accuracy of risky decision-making.

3. **Toyokawa W**, Ito M, Ohtsuki H, Fogarty L, and Laland K (in prep.). The evolution of cooperative information giving and following in risky environments.

4. Witt A, **Toyokawa W**, Gaissmaier W, Laland K, and Wu C. (in prep.). Social learning strategies among heterogeneous value functions.

CONFERENCE PRESENTATIONS, WORKSHOPS, AND SEMINARS

Invited keynotes and seminar talks

- Invited talk: "Computational modelling of the frequency-based social learning and its connection to the group dynamics". The nEuro-economics seminar series at the ENS in Paris. March 2023.

- Invited talk: "Conformity among biased individuals". Strategic Organization Design group at the University of Southern Denmark. March 2023.

- Invited talk: "Understanding combined decision making & cultural transmissions through a reinforcement learning framework". CASCB Seminar Series, Konstanz (online). Hosted by the Centre for the Advanced Study of Collective Behaviour. June 2021.

- Keynote talk: "Large-scale online experimentation and computational modelling approach to human collective behaviour" at Strategic Social Learning – An EHBEA 2020 Satellite Meeting, 1 April 2020, Krakow (postponed due to COVID-19).

- Invited talk: "Social learning leads to collective behavioural rescue". Max Planck Institute for Evolutionary Anthropology, Leipzig. Hosted by Professor Richard McElreath. January 2020.

- Invited talk: "Human social learning, collective intelligence and herding". University of Exeter, Cornwall. Hosted by Dr Alex Mesoudi. September 2017.

- Invited talk: "Social learning can shape collective behaviour and macro-ecological dynamics". ARC group, Max Planck Institute, Berlin. Hosted by Dr Ralf Kurvers. November 2017.

- Invited talk: "Can human show swarm intelligence through word-of-mouth?" The 7th Inuyama Comparative Social Cognition Symposium, Primate Research Institute, Kyoto University. Hosted by Professor Masaki Tomonaga. March 2012

Peer-reviewed conference presentations

- Conformist social learning leads to self-organised prevention against adverse bias in risky decision making. CES meeting 2022. September 2022, Aarhus. [lightning talk]

- Dynamics of risk regulates cooperation in an incomplete-information game with bandit payoff feedback. EHBEA annual meeting 2022. April, Leipzig (online due to COVID-19). [talk]

- Collective behavioural rescue: social reinforcement learning promotes adaptive behavioural-shift in risky decision-making. EHBEA annual meeting 2021. 27 March, Krakow (online due to COVID-19). [talk]

- Collective rescue: social reinforcement learning promotes adaptive behavioural-shift in risky decision-making. Collective Information Processing Workshop. 4-6 March, Berlin. [talk]

- Social learning strategies regulate collective intelligence. ALIFE 2019 Workshop Computational Approaches to Social Dynamics. 2 August 2019, Newcastle upon Tyne. [talk]

- Collective decision-making in a multi-player multi-armed bandit. ASAB Summer Meeting, Konstanz, August 2019. [poster]

- Social learning strategies regulate the wisdom and madness of interactive crowds. ICPS2019, Paris, 7-9 March 2019 [poster]

- Social learning strategies and word-of-mouths regulate human collective intelligence. CBEN2018, Antwerp, 22-23 November 2018. [talk]

- Social learning can regulate the wisdom and madness of interactive crowds. Culture Conference 2018. 12-13 July, 2018, Stirling, Scotland. [Poster]

- From social learning to collective human behaviour. Inaugural Cultural Evolution Society Conference. 13-15 September, 2017, Jena, Germany. [Short talk]

- Independence and interdependence in human social learning. 31st International Congress of Psychology 2016. 24-29 July, 2016, Yokohama, Japan. [talk]

- Asocial learning performance, but not exploration tendency, predicts the decrease of social learning use in humans. European Human Behaviour and Evolution Association Annual Meeting 2016. 5-8 April, 2016, London. [talk]

- Social foraging resolves the paradox of enrichment. British Ecological Society Annual Meeting 2016. 11-14 December, 2016, Liverpool. [poster]

- Advice sharing and collective intelligence under exploration-exploitation trade-off in humans. SWARM2015. 28-30 October, 2015, Kyoto University, Japan. [poster]

- Less-is-more in a 5-star rating system: an experimental study of human combined decisions in a multi-armed bandit problem. Proceedings of Collective Intelligence 2014, June 10-12 at MIT. [poster]

- 3 more international presentations

- 7 more presentations at Japanese domestic meetings

AD-HOC PEER REVIEW EXPERIENCES

Link to Publons

- Nature Human Behaviour

- Collective Intelligence

- Journal of Theoretical Biology

- Physica A: Statistical Mechanics and Its Applications

- Palgrave Communications

- Frontiers in Applied Mathematics and Statistics

- Current Zoology

- New Ideas in Psychology

- PLoS ONE

- Royal Society Open Science

- Scientific Reports

- Human Agent Interaction

REFERENCES

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School of Biology, University of St Andrews
Sir Harold Mitchell Building, St Andrews
knl1@st-andrews.ac.uk

Professor Wolfgang Gaissmaier
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University of Konstanz, P.O. Box 43, D-78457 Konstanz
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