Network Science Institute,
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October 9, 2021.

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Brennan Klein

research	complex systems || causal emergence || free energy principle || teleology || networks

current position

Postdoctoral researcher, 2020 – 2023, Northeastern University. Boston, Massachusetts.
  at the Network Science Institute, with professors Alessandro Vespignani and Samuel Scarpino.

education

PhD in *Network Science*, 2015 – 2020, Northeastern University. Boston, Massachusetts.
  Advisor: Professor Alessandro Vespignani – Director, Network Science Institute.
  Dissertation: *Constructing, comparing, and reconstructing networks*. Nov. 19, 2020.
  Committee: Alessandro Vespignani, Samuel Scarpino, Tina Eliassi-Rad, Laurent Hébert-Dufresne.

B.A. with a double major in *Cognitive Science* and *Psychology*, 2009 – 2014, Swarthmore College. Swarthmore, Pennsylvania.
  Advisor: Professor Frank Durgin – Professor of Psychology, Perception and Cognition Laboratory.
  Thesis: *Angular expansion and the large-scale horizontal-vertical illusion*. Apr. 24, 2014.

grants & fellowships

current, John Templeton Foundation: *Toward a teleology of complex networks*. **Klein, B.** (Co-I), Vespignani, A. (PI), & Scarpino, S.V. (Co-I); Dec. 1, 2020 – Nov. 30, 2023.

current, Tides Foundation (managed for Google.org): *COVID-19 Global.health*. **Klein, B.** (PI; previous PI: Scarpino, S.V.); Oct. 1, 2020 – Sep. 30, 2022.

previous, National Defense Science & Engineering Grant; **Klein, B.**; Sep. 1, 2017 – Dec. 1, 2020.

preprints & publications

Working papers & preprints (* = corresponding author, [1] = first author, blue text = hyperlink)

Klein, B.[*][1], Generous, N.[1], Chinazzi, M., Bhadricha, Z., Gunashekar, R., Kori, P., Li, B., McCabe, S., Green, J., Lazer, D., Marsicano, C., Scarpino, S.V., & Vespignani, A.* (submitted). Higher education responses to COVID-19 in the United States: Evidence for the impacts of university policy. medRxiv: 10.1101/2021.10.07.21264419v1

Klein, B.[*][1], Swain, A., Byrum, T., Scarpino, S.V., & Fagan, W. (under revision, *Methods in Ecology and Evolution*). Exploring noise, degeneracy and determinism in biological networks with the `einet` package. CRAN.R-project.org/package=einet.

Hoel, E.[*][1], **Klein, B.**, Swain, A., Griebenow, R., & Levin, M. (under revision, *Integrative Biology*). Evolution leads to emergence: An analysis of protein interactomes across the tree of life. bioRxiv: 10.1101/2020.05.03.074419v1.

Klein, B.[1], LaRock, T.[1], McCabe, S.[1], Torres, L.[1], Friedland, L.[1], Kos, M.[1], Privitera, F., Lake, B., Kraemer, M.U.G., Brownstein, J.S., Gonzalez, R., Lazer, D., Eliassi-Rad, T., Scarpino, S.V., Vespignani, A., & Chinazzi, M.* (preprint). Quantifying collective physical distancing during the COVID-19 outbreak. Dashboard url: `covid19.gleamproject.org/mobility`. Previous reports: Mar. 31 & May 11, 2020.

Griebenow, R.[1], **Klein, B.**, & Hoel, E.* (2019). Finding the right scale of a network: Efficient identification of causal emergence in preferential attachment networks through spectral clustering. arXiv: 1908.07565.

Published works

<u>2021</u>:

Klein, B.[*1], Holmér, L., Smith, K.*, Johnson, M., Swain, A., Stolp, L., Teufel, A., & Kleppe, A.* (in press, *Communications Biology*). A computational exploration of resilience and evolvability of protein-protein interaction networks. bioRxiv: 10.1101/2020.07.02.184325v2.

Balietti, S.[1], **Klein, B.**, & Riedl, C.* (2021). Optimal design of experiments to identify latent behavioral types. *Experimental Economics*. 24, 772–799. doi: 10.1007/s10683-020-09680-w.

Kraemer, M.U.G.[*1], Hill, V.[1], Ruis, C.[1], Dellicour S.[1], Bajaj, S.[1], McCrone, J., Baele G., Parag, K.V., Lindstrom Battle, A., Gutierrez, B., Jackson, B., Colquhoun, R., O'Toole, Á., **Klein, B.**, Vespignani, A., The COVID-19 Genomics UK (CoG-UK) consortium, Volz, E., Faria, N.R., Aanensen, D., Loman, N.J., du Plessis, L., Cauchemez, S., Rambaut A.*, Scarpino, S.V.*, & Pybus, O.G.* (2021). Spatio-temporal invasion dynamics of SARS-CoV-2 lineage B.1.1.7 emergence. *Science*. 368 (6490), 493–497. doi: 10.1126/science.abj0113.

McCabe, S.[*1], Torres, L., LaRock, T., Haque, S.A., Yang, C-H., Hartle, H., & **Klein, B.*** (2021). `netrd`: A library for network reconstruction and graph distances. *Journal of Open Source Software*, 6(62), 2990. doi: 10.21105/joss.02990. Open review: joss-reviews/issues/2990.

Nande, A.[1], Sheen, J.[1], Walters, E.L., **Klein, B.**, Chinnazi, M., Gheorghe, A., Adlam, B., Shinnick, J., Tejeda, M.F., Scarpino, S.V., Vespignani, A., Greenlee, A.J., Schneider, D., Levy, M.Z.*, & Hill, A.L.* (2021). The effect of eviction moratoria on the transmission of SARS-CoV-2. *Nature Communications*. 12 (2274) 1–13. doi: 10.1038/s41467-021-22521-5.

<u>2020</u>:

Hartle, H.[1], **Klein, B.**[*1], McCabe, S., Daniels, A., St-Onge, G., Murphy, C., & Hébert-Dufresne, L. (2020). Network comparison and the within-ensemble graph distance. *Proceedings of the Royal Society A*, 476: 20190744. Included in special feature: *A Generation of Network Science* doi: 10.1098/rspa.2019.0744.

Klein, B.[1] & Hoel, E.* (2020). The emergence of informative higher scales in complex networks. *Complexity*. 8932526. doi: 10.1155/2020/8932526.

Kraemer, M.U.G.[*1], Yang, C-H., Gutierrez, B., Wu, C-H., **Klein, B.**, Pigott, D.M., du Plessis, L., Faria, N.R., Li, R., Hanage, W.P., Brownstein, J.S., Layan, M., Vespignani, A., Tian, H., Dye, C., Pybus, O.G.*, & Scarpino, S.V.* (2020). The effect of human mobility and control measures on the COVID-19 epidemic in China. *Science*. 368 (6490), 493–497. doi: 10.1126/science.abb4218.

<u>2017</u>:

Pilny, A.[*1], Poole, M.S., Reichelmann, A., & **Klein, B.** (2017). A structurational group decision-making perspective on the commons dilemma: Results from an online public goods game. *Journal of Applied Communication Research*. 45(4), 413–428. doi: 10.1080/00909882.2017.135 5559.

<u>2016</u>:

Klein, B.[1], Li, Z. & Durgin, F.H.* (2016). Large perceptual distortions of locomotor action space occur in ground-based coordinates: Angular expansion and the large-scale horizontal-vertical illusion. *Journal of Experimental Psychology: Human Perception and Performance*, 42(4), 581. doi: 10.1037/xhp0000173.

<u>2013</u>:

Li, Z.[1], Sun, E., Strawser, C.J., Spiegel, A., **Klein, B.**, & Durgin, F.H.* (2013). On the anisotropy of perceived ground extents and the interpretation of walked distance as a measure of perception. *Journal of Experimental Psychology: Human Perception and Performance*, 38(6), 1582. doi: 10.1037/a0029405.

<u>2012</u>:

Durgin, F.H.*[1], **Klein, B.**, Spiegel, A., Strawser, C.J., & Williams, M. (2012). The social psychology of perception experiments: Hills, backpacks, glucose and the problem of generalizability. *Journal of Experimental Psychology: Human Perception and Performance*, 39(2), 477. doi: 10.1037/a0027805.

awards & honors

recipient, Student Travel Award, Conference on Complex Systems; 2019.
recipient, PhD Network Travel Award, Northeastern University; 2019.
recipient, Huntington 100 Award, Northeastern University; 2019.
recipient, Best Talk Pitch 1st Prize ($500 for netrd), NetSci Society Young Initiatives; 2019.
member, Monash University *Networks of Excellence*; 2018 – .
recipient, Best Student Paper Award, Northeast Regional Conference on Complex Systems; 2018.
recipient, National Defense Science & Engineering Grant (NDSEG); 2017–2020.
honorable mention, NSF Graduate Research Fellowship Program (GRFP); 2016.
winner, SwatTank Business Competition ($3,000 for Wall.it), Swarthmore College; 2014.
recipient, Community Development Grant ($10,000 for SwatDeck), Swarthmore College; 2013.
recipient, Renssalaer Medal, for distinguished students in mathematics and science; 2009.
winner, College Prowler National Admissions Essay Competition; 2009.

selected invited talks

"Network science was the future (now we're playing catch up)". *Modeling with Discrete Dynamical Systems* class of 850 cadets at West Point; West Point, New York (Oct. 13, 2021).

"Data on the reach and disparities of COVID-19". Digital Humanities Office Hours; *NULab for Texts, Maps, & Networks*, Northeastern University; Boston, Massachusetts (Oct. 6, 2021).

"Large scale datasets of collective behavioral responses to the COVID-19 pandemic". *NULab for Texts, Maps, & Networks*, Northeastern University; Boston, Massachusetts (Nov. 18, 2020).

"Toward a teleology of complex networks". *Functional Imaging Laboratory*. Theoretical Neurobiology Meeting of Professor Karl Friston, University College London. London, United Kingdom (Nov. 14, 2019).

"The emergence of (informative) scaling in random networks". *Department of Evolutionary and Adaptive Systems*. Artificial Life Reading Group Lecture, University of Sussex. Brighton, United Kingdom (Nov. 13, 2019).

"Constructing, reconstructing, and comparing networks". *Department of Collective Behaviour.* Laboratory of Professor Iain Couzin, University of Konstanz & Max Planck Institute for Animal Behavior. Konstanz, Germany (Oct. 23, 2019).

"The structure is the story: How the right representation can bring forth new theories in complex systems". *Center for Research and Interdisciplinarity (CRI).* Paris, France (Oct. 17, 2019).

"Finding the characteristic scale of causation in biological systems". *Tufts Center for Regenerative and Developmental Biology.* Laboratory of Professor Michael Levin. Tufts University, Medford, Massachusetts (Dec. 12, 2018).

"Does minimizing surprise entail purposefulness? Emergent teleology and parallels to the philosophy of natural selection". Heins, C. & Klein, B. (joint). *Workshop on Causation & Complexity in the Conscious Brain.* Aegina, Greece (Sep. 30, 2018).

"Sufficient causes, necessary effects: Coarse-grained networks are often more informative models of complex systems". *Complex Systems Lab.* Laboratory of Professor Danielle Bassett, University of Pennsylvania, Philadelphia, Pennsylvania (Aug. 9, 2018).

"On getting a PhD in Network Science". *Network Science Institute.* Northeastern University, Boston, Massachusetts (Jul. 11, 2018).

"From network dynamics to algebraic topology in cortical microcircuits". *Princeton Neuroscience Institute.* Princeton University, Princeton, New Jersey (Mar. 15, 2018).

selected conference presentations

(Asterisk indicates presenter)

"Reshaping a nation: Mobility, commuting, and contact patterns during the COVID-19 outbreak". **Klein, B.***, LaRock, T., McCabe, S., Torres, L., Friedland, L., Kos, M., Privitera, F., Lake, B., Kraemer, M.U.G., Brownstein, J.S., Lazer, D., Eliassi-Rad, T., Scarpino, S.V., Vespignani, A., & Chinazzi, M. at the COVID-19 Satellite at Sunbelt. (virtual, Jul. 20, 2020).

"Optimizing the design of rugged landscapes to maximally distinguish models of search behavior in humans". (poster) Fulker, Z.*, **Klein, B.**, & Riedl, C. at the Northeast Regional Conference on Complex Systems (NERCCS). Buffalo, New York (Apr. 1, 2020).

"Local edge perturbations as a measure for community persistence in complex networks". (poster) **Klein, B.*** & McCabe, S. at NetSci. Burlington, Vermont (May 30, 2019).

"Comparing methods for reconstructing networks from time series data by comparing methods for measuring network similarity". **Klein, B.***, Hartle, H., Torres, L., McCabe, S., Yang, C-H., LaRock, T., Shugars, S., Gallagher, R., Sakharov, T., Davis, J., Robertson, R., Mattsson, C., St-Onge, G., Murphy, C., Saffo, D., Mistry, D., Heins, C., Almeida, L., Haque, S., Towlson, E., Zhang, Q., Shrestha, M., Ruf, S., Gates, A., Chinazzi, M., Coronges, K., Riedl, C., Dunne, C., Lippner, G., Eliassi-Rad, T., Vespignani, A., & Scarpino, S.V. at NetSci. Burlington, Vermont (May 29, 2019). *recipient*, 1st Prize: Best Talk Pitch.

"First Annual Collabathon at the Network Science Institute". **Klein, B.*** & Coronges, K.* (joint) at the NetSciEd satellite at NetSci. Burlington, Vermont (May 27, 2019).

"I would not be surprised...". **Klein, B.*** & Heins, C.* (joint) at the *Complexity from Cells to Consciousness: Free Energy, Integrated Information, and Epsilon Machines* satellite at the Conference on Complex Systems (CCS). Thessaloniki, Greece (Sep. 27, 2018).

"Causal structure as a network: Quantifying certainty in complex systems". **Klein, B.*** & Hoel, E. at the *Workshop on Causality & Information Flow* at the International Conference on Complex Systems (ICCS). Boston, Massachusetts (Jul. 26, 2018).

"Quantifying causal structure and causal emergence in complex networks". **Klein, B.*** & Hoel, E. at NetSci. Paris, France (Jun. 15, 2018).

"Modeling firms responses to information about illicit market activity". **Klein, B.*** & De Vries, I. at the *NetCrime* satellite at NetSci. Paris, France (Jun. 12, 2018).

"Quantifying the causal structure of complex networks". **Klein, B.*** & Hoel, E. at the Northeast Regional Conference on Complex Systems (NERCCS). Binghamton, New York (Apr. 13, 2018). *recipient*, Best Student Paper Award, sponsored by the journal *Complexity*.

"Dynamics of the opioid crisis in the United States". **Klein, B.***, Strong, K., Salvalaggio, G., Toba, L., & Cavanagh, M. at the Northeast Regional Conference on Complex Systems (NERCCS). Binghamton, New York (Apr. 13, 2018).

"Quantifying the causal structure of networks". (poster & lightning talk) **Klein, B.*** & Hoel, E. at CompleNet. Boston, Massachusetts (Mar. 7, 2018).

"Modeling firms responses to information about illicit market activity". De Vries, I.* & **Klein, B.** at CompleNet. Boston, Massachusetts (Mar. 6, 2018).

"Toward the optimal design of social network experiments". **Klein, B.***, Balietti, S., & Riedl, C. at CompleNet. Boston, Massachusetts (Mar. 5, 2018).

"Optimal design for online social experimentation". Balietti, S.*, **Klein, B.**, & Riedl, C., at Code@MIT. Boston, Massachusetts (Oct. 27, 2017).

"Uncertainty, satisficing, & optimal decision-making in complex landscapes". (poster & lightning talk) **Klein, B.*** & Riedl, C. at Code@MIT. Cambridge, Massachusetts (Oct. 15, 2016).

workshops & conferences	Conference on Complex Systems 2021, Oct. 25-29. Lyon, France.

Conference on Complex Systems 2021, Oct. 25-29. Lyon, France.
Sunbelt 2020 – COVID-19 Satellite, Jul. 20-22, 2020. *virtual*.
Northeast Regional Conference on Complex Systems 2020, Apr. 1-3. Buffalo, New York.
Complex Networks Winter Workshop 2019, Dec. 15-21. Québec City, Canada.
Santa Fe Institute Complex Systems Summer School 2019, Jun. 9-Jul. 5. Santa Fe, New Mexico.
NetSci 2019, May 27-31. Burlington, Vermont.
> Co-organizer: Society of Young Network Scientists pre-conference event.

Complex Networks Winter Workshop 2018, Dec. 15-21. Québec City, Canada.
Causality & Complexity in the Conscious Brain 2018, Sep. 29-30. Aegina, Greece.
Conference on Complex Systems 2018, Sep. 23-28. Thessaloniki, Greece.
> Satellite co-organizer with Conor Heins: *Complexity from Cells to Consciousness: Free Energy, Integrated Information, and Epsilon Machines*, featuring keynote speakers Professors Karl Friston and Jessica Flack, with invited speakers Professors Martin Biehl, Erik Hoel, William Marshall, Jayne Thompson, Mile Gu, Felix Pollack, Jakob Hohwy, and Rosalyn Moran.

International Conference on Complex Systems 2018, Jul. 22-27. Cambridge, Massachusetts.
> Co-organizer: Society of Young Network Scientists pre-conference event.

NetSci 2018, Jun. 11-15. Paris, France.
> Co-organizer: Society of Young Network Scientists pre-conference event; Design co-chair.

Northeast Regional Conference on Complex Systems 2018, Apr. 11-13. Binghamton, New York.
> Co-organizer: Society of Young Network Scientists pre-conference event.

CompleNet 2018, Mar. 5-8. Boston, Massachusetts.
> Co-organizer: Society of Young Network Scientists pre-conference event.

NECSI Winter School on Complex Systems 2018, Jan. 1-12. Cambridge, Massachusetts.

Code@MIT 2017, Oct. 27-28, Cambridge, Massachusetts.

NetSci 2017, Jun. 11-15. Indianapolis, Indiana.
> Co-organizer: first Society of Young Network Scientists Symposium.

Code@MIT 2016, Oct. 14-15. Cambridge, Massachusetts.

Simons Institute's Information Theory Boot Camp 2015, Jan. 13-16. Berkeley, California.

Neo4j's GraphConnect 2014, Oct. 22. San Francisco, California.

Vision Science Society Conference 2014, May 16-21. St. Pete Beach, Florida.

MIT Media Lab's Links 2013, Jul. 23. Cambridge, Massachusetts.

Vision Science Society Conference 2013, May 10-15. Naples, Florida.

Vision Science Society Conference 2012, May 11-16. Naples, Florida.

service to the profession

Software development and visualization, **Bayesian Models of Behavior**: Python code for generating the visualizations in a forthcoming Bayesian statistics textbook by Wei Ji Ma, Konrad Körding, and Daniel Goldreich.

Core developer, `einet`: an R software package for calculating effective information and causal emergence in networks (https://cran.r-project.org/package=einet).

Core developer, `netrd`: an open-sourced Python package that includes 20 techniques for reconstructing networks from time series data, 21 graph distance measures, and 7 ways to simulate dynamical processes on networks (https://github.com/netsiphd/netrd).

Member, **Northeastern University Response Team on COVID-19** (Jan. 2020 – present); analyzing data about human mobility in response to the COVID-19 pandemic. Mobility dashboard: https://covid19.gleamproject.org/mobility.

Co-author (with Dr. Cynthia Siew, *National University of Singapore*), proposal for the ⚛ (**network**) emoji to be included in Unicode's official list of emojis (under review, *Unicode Foundation*).

Co-founder, Chair (2017-2019), Outgoing Chair (2019 –), Society of Young Network Scientists (SYNS).

> Co-organizer: **"I'd like to learn from..."**, a nomination-network themed lecture series featuring presentations from six junior researchers in network science and a **Paper Unwind** with presentations from Professors Austin Benson, Puck Rombach, and Hyejin Youn (*NetSci 2019*).

> Co-organizer: **My Favorite Line of Code** featuring presentations from students and Professors Marta Gonzalez, Simon DeDeo, and Esteban Moro (*ICCS 2018*).

> Co-organizer: **Publishing in Network Science: Navigating the Maze** featuring a paper writing masterclass by Federico Levi (editor at *Nature Physics*) and a **Paper Unwind** with presentations from Professors Yamir Moreno, Sonia Kéfi, and Stefano Battiston (*NetSci 2018*).

> Co-organizer: **Learning, Teaching, and Doing Complex Systems for Young Researchers** featuring tutorials in data science and complex systems from Professors Bruno Gonçalves and Alfredo

Morales, as well as panel discussions from Professors Pamela Mischen, Andreas Pape, David Schaffer, Stephen Uzzo, and Hiroki Sayama (*NERCCS 2018*).

Co-organizer: **Paper Unwind** featuring presentations from Professors Tina Eliassi-Rad, Daniel Larremore, and Aaron Clauset (*CompleNet 2018*).

Co-organizer: **SYNS Symposium** featuring presentations from Professors Albert-László Barabási, Brooke Foucault-Welles, Peter Mucha, Kathryn Coronges, Patricia Mabry, Hiroki Sayama, Kevin Chan, Stephen Uzzo, Catherine Cramer, Roberta Sinatra, Alessandro Vespignani, Santo Fortunato, Danielle Bassett, Vittoria Colizza, and *Nature Physics* editor, Federico Levi (*NetSci 2017*).

Reviewer, for the following journals:

PLOS Computational Biology; *Proceedings of the Royal Society: A*; *PLOS One*; *New Journal of Physics*; *Communications Physics*; *Neural Computation*; *Network Neuroscience*; *Proceedings of the National Academy of Sciences*; *Scientific Reports*; *Frontiers in Applied Mathematics and Statistics*; *JMIR Public Health and Surveillance*; *Journal of Complex Networks*; *Nature Biotechnology*; *Journal of Open Source Software*; *Royal Society Open Science*; *Frontiers in Public Health*; *Journal of Combinatorial Optimization*.

advising & mentorship

Supervising

Zarana Bhadricha, **Rishab Gunashekar**, **Preeti Kori**, **Bodian Li**; master's students in the Khoury College of Computer Sciences at Northeastern University; Mar. 2021 – present; working on data collection and analyses for *Higher education responses to COVID-19 in the United States*.

Nitish Kaza, **Jim Sheldon**; research assistants; Jun. 2021 – present; working on data collection and analyses for work on mass-decarceration during the COVID-19 pandemic.

Mentorship

Chyelle Milgrom; undergraduate research assistant at the Parsons School of Design; Aug. 2, 2019 – Mar. 1, 2020; with Professor Jeongki Lim, working on *The emergence and maintenance of collective identity in the* r/place *experiment on reddit.com*.

Ewen Wang; undergraduate research assistant at Northeastern University; Sep. 1, 2017 – Aug. 26, 2018; working on *Advancing behavioral research through digital and optimally-designed experiments*.

Marissa Sumathipala; Research Science Institute (RSI) high school student from Ashburn, Virginia; Jun. 30 – Aug. 4, 2017; working on *Network-based miRNA-disease model for enhancing drug discovery*. I recommended Marissa for the National Center for Women & Information Technology Award for Aspirations in Computing, which she won in February, 2018.

Rucha Joshi; Research Science Institute (RSI) high school student from Austin, Texas; Jun. 30 – Aug. 4, 2017; working on *Evaluating the role of road networks on the onset of conflict in Africa*.

Berke Saat; Research Science Institute (RSI) high school student from Istanbul, Turkey; Jul. 1 – Aug. 5, 2016; working on *Applying random walks on probabilistic network topologies*.

teaching experience

Invited & guest lectures

Introduction to Complex Systems; invited lecturer at the Network Science Institute Bootcamp for incoming PhD students, Northeastern University (2017; 2018; 2019; 2020).

Network and Data Visualization; invited lecturer at the Network Science Institute Bootcamp for incoming PhD students, Northeastern University (Sep. 4, 2020).

Biostatistics; guest lecturer on hypothesis testing, test statistics, and data science for Professor Samuel Scarpino's course, Northeastern University (Oct. 2-4, 2019).

Networks, Network Science, and Python; guest lecturer at the Complex Systems Summer School, Santa Fe Institute (Jun. 23, 2018).

selected popular writing

Protect international students, flatten the curve. *Arizona Daily Star.* Jul. 8, 2020.

Closing schools will save lives. Keeping them open is a public health hazard. *Arizona Daily Star.* Mar. 15, 2020.

Swatties, surprise, and a new paradigm of interdisciplinary scientific thought. *Swarthmore College Alumni Magazine.* Spring, 2019.

SwatDeck, diversity, and the science of networks. *Behavioral Scientist.* 2015.

When a theory is too good to be true: Fallacies in perception research. *Behavioral Scientist.* 2013.

The ubiquity of metaphor. *Behavioral Scientist.* 2013.

miscellaneous & hobbies

Computer: Python/R expertise, MATLAB/Javascript/HTML proficiency.

Language: proficiency in spoken and written Spanish.

High school diploma, *valedictorian*, 2005 – 2009, Canyon del Oro High School. Tucson, Arizona.

Hobby: I make art under the pseudonym JK Rofling (jkrofling.com).

Exhibitions:

* *Networked*, a SciArt Initiative exhibition at The Nook Gallery || Los Angeles, California, from Jul. 14th – Aug. 29th, 2019.

* *Only Connections*, debut show at the Somerville Public Library || Somerville, Massachusetts, from Jul. 2nd – Jul. 30th, 2018.