Ilker Yildirim
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Positions	**Yale University** Department of Psychology Department of Statistics & Data Science (secondary) Assistant Professor, 2019-present. **Massachusetts Institute of Technology** Department of Brain & Cognitive Sciences **The Rockefeller University** Laboratory of Neural Systems Postdoc/Research Scientist 2014-2019.
Education	2014, Ph.D., Brain & Cognitive Sciences and Computer Science (joint), University of Rochester. **Thesis:** From Perception to Conception: Learning Multisensory Representations 2011, M.A., Brain & Cognitive Sciences, University of Rochester. 2009, M.S., Computer Science, Bogazici University, Istanbul, Turkey. 2007, B.S., Computer Science, Bogazici University, Istanbul, Turkey.
Honors and grants	AFOSR Young Investigator Program Award. 2022-2025. NIH R21 "Identifying neurocognitive fingerprints of adolescent development"; co-PI (PI: Arielle Baskin-Sommers). 2023-2025. Outstanding dissertation prize, University of Rochester. 2015. Best paper award, Engineering Societies in the Agents' World X, 2009, for "Cooperative sign language tutoring: A multiagent approach."

Publications

Recent conference abstracts

Calbick, D., Kim, J., Sohn, H., Jazayeri, M., & Yildirim, I. (2023). A new multi-level modeling framework provides evidence for the simulation of object dynamics in the dorsomedial frontal cortex. *Cognitive Computational Neuroscience Conference (CCN)*

Calbick, D., Kim, J., & Yildirim, I. (2023). Exploring a basis set of intrinsic functions underlying neural computation by symbolically programming recurrent neural networks. *Cognitive Computational Neuroscience Conference (CCN)*

Belledonne, M., Geller, C., & Yildirim, I. (2023). Goal-conditioned world models: Adaptive computation over multi-granular generative models explains human scene perception. *Cognitive Computational Neuroscience Conference (CCN)*

Yilmaz, H., Muellner, M., Tenenbaum, J.B., Dobs, K., & Yildirim, I. (2023). Efficient inverse graphics with a differentiable generative model explains robustness of perception to unusual viewing angles. *Cognitive Computational Neuroscience Conference (CCN)*

Bi, W., Lin, Q., Peng, K., Shah, A., & Yildirim, I. (2023). Spontaneous visual processing of non-rigid materials recruits intuitive physical inference regions and activates physics-based representations in the human brain. *Society for Neuroscience (SfN), nanosymposium on Representations of Objects and Scenes.*

Manuscripts in preparation

Yilmaz, H., Shah, A. D., Letrou, A., Kumar, S., Vogels, R., Tenenbaum, J. B., & Yildirim, I. (in preparation). Efficient inverse graphics as a canonical computation for object perception in IT cortex.

Bi, W., Shah, A., Wong, K., Scholl, B.J., & Yildirim, I. (in preparation) Revealing computational constituents of human perception by formalizing visual generalization of soft objects.

Belledonne, M. & Yildirim, I. (in preparation) "Get me out of here!": Spontaneous processing of exit paths influences perceived scene geometry.

Shah, A., Saeed, B., Tenenbaum, J.B., Gerstenberg, T., Gweon, H., & Yildirim, I. (in preparation). Humans reason about object manipulation by planning with embodiment and intuitive physics.

Zhang, Y., Bi, W., & Yildirim, I. (in preparation). Computational evidence for generalizable, physics-based representations in liquid perception.

Under review articles

Belledonne, M, Butkus, E., Scholl, B.J., Yildirim, I. Adaptive computation as a new mechanism of human attention. (revised and resubmitted).

Lin, Q.*, Li, Z.*, Lafferty, J., & Yildirim, I. From seeing to remembering: Images with harder-to-reconstruct representations leave stronger memory traces. (in revision)

Yildirim, I. & Paul, L. From task structure to world models: What do LLMs know? (in revision).

Yates, T., Yasuda. S, & Yildirim, I. Temporal segmentation and 'look ahead' simulation: Physical events structure visual perception of intuitive physics. (under review).

Yamada, Y.*, Bao, Y.*, Lampinen, A.K., Kasai, J. & Yildirim, I. Evaluating spatial understanding of large language models. (under review)

Refereed journal articles

Yildirim, I.*, Siegel, M.*, Soltani, A.A.*, Chadhuri, S.R., & Tenenbaum, J.B. (accepted). Perception of 3D Shape Integrates Intuitive Physics and Analysis-by-Synthesis. *Nature Human Behaviour*

Wong, K. W., Bi, W., Soltani, A. A., Yildirim, I. & Scholl, B. J. (2023) Seeing soft materials draped over objects: A case study of intuitive physics in perception, attention, & memory. *Psychological Science, 34(1)*, 111-119.

Yamada, Y.*, Tang, Y.*, Zhang, M., & Yildirim, I. (2023). When are lemons purple? The concept association bias of vision-language models. *Empirical Methods in Natural Language Processing (EMNLP)*.

Yildirim, I., Belledonne, M., Freiwald, W. F., & Tenenbaum, J.B. (2020). Efficient inverse graphics in biological face processing. *Science Advances, 6(10),* eaax5979.

Yildirim, I., Wu, J., Kanwisher, N., & Tenenbaum, J.B. (2019). An integrative computational architecture for object-driven cortex. *Current Opinion in Neurobiology, 55*, 73-81.

Bates, C.J., Yildirim, I., Battaglia, P.W., & Tenenbaum, J.B. (2019). Modeling human intuitions about liquid flow with particle-based simulation. *PLoS Computational Biology, 15(7),* e1007210.

Janner, M., Wu, J., Kulkarni, T., Yildirim, I., Tenenbaum, & J.B. (2017). Self-

supervised intrinsic image decomposition. *Neural Information Processing Systems (NeurIPS).*

Yildirim, I.*, Wu, J.*, Lim, J., Freeman, W.T., & Tenenbaum, J.B. (2015). Galileo: Perceiving physical object properties by integrating a physics engine with deep learning. *Neural Information Processing Systems (NeurIPS).*

Erdogan, G., Yildirim, I., & Jacobs, R. A. (2015). From sensory signals to modality-independent conceptual representations: A probabilistic language of thought approach. *PLoS Computational Biology, 11(11),* e1004610.

Yildirim, I. & Jacobs, R.A. (2015). Learning multisensory representations for auditory-visual transfer of sequence category knowledge: A probabilistic language of thought approach. *Psychonomic Bulletin & Review, 22,* 673-686.

Yildirim, I., Degen, J., Tanenhaus, M. K., & Jaeger, T. F. (2015). Talker-specificity and adaptation in quantifier interpretation. *Journal of Memory and Language, 87,* 128-143.

Transfer of object category knowledge across visual and haptic modalities: Experimental and computational studies. Yildirim, I. & Jacobs, R. A. (2013). *Cognition, 126(2),* 135-148.

Yildirim, I. & Jacobs, R.A. (2012). A rational approach to the acquisition of multisensory representations. *Cognitive Science, 36(2),* 305-332.

Yildirim, I. & Yolum, P. (2009). Hybrid models for achieving and maintaining cooperative symbiotic groups. *Mind & Society, 8,* 243-258.

Book chapter Yildirim, I., Siegel, M., & Tenenbaum, J.B. (2020). Physical object representations for perception and cognition. *The Cognitive Neurosciences,* 6th *edition,* Gazzaniga, Mangun, Poeppel (Editors).

CogSci proceedings (6-page papers) Zhang, Y., Belledonne. M, Yates, T. & Yildirim, I. (2023). Where does the flow go? Humans automatically predict liquid pathing with coarse-grained simulation. *In* 44th *Annual Conference of the Cognitive Science Society (CogSci).*

Belledonne, M. & Yildirim, I. (2021). Automatic computation of navigational affordances explains selective processing of geometry in scene perception: behavioral and computational evidence. *In* 42th *Annual Conference of the Cognitive Science Society (CogSci).*

Yilmaz, H., Singh, G., Egger, B., Tenenbaum, J.B., & Yildirim, I. (2021). Seeing in the dark: Testing deep neural network and analysis-by-synthesis accounts of 3D shape perception with highly degraded images. *In* 42th *Annual Conference of the Cognitive Science Society (CogSci).*

Bi, W., Shah, A., Wong, K. W., Scholl, B., & Yildirim, I. (2021). Perception of soft materials relies on physics-based object representations: Behavioral and computational evidence. *In* 42th *Annual Conference of the Cognitive Science Society (CogSci).*

Butkus, E.*, Belledonne, M.*, Scholl, B.J., Yildirim, I. (2020). Modeling temporal attention in dynamic scenes: Hypothesis-driven resource allocation using adaptive computation explains both objective tracking performance and subjective effort judgments. *In* 41th *Annual Conference of the Cognitive Science Society (CogSci).*

Yildirim, I.*, Saeed, B.*, Bennett-Pierre G., Gerstenberg, T., Tenenbaum, J.B., &

Gweon, H. (2019). Explaining intuitive difficulty judgments by modeling physical effort and risk. *In 40th Annual Conference of the Cognitive Science Society (CogSci).*

Smith, K.*, Belledonne, M.*, Wu, J., Tenenbaum, J.B., & Yildirim, I. (2019). Real-time inference of physical properties in dynamic scenes. *In 40th Annual Conference of the Cognitive Science Society (CogSci).*

Yildirim, I.*, Gerstenberg, T.*, Saeed, B., Toussaint, M., & Tenenbaum, J.B. (2017). Physical problem solving: Joint planning with symbolic, geometric, and dynamic constraints.*In 39th Annual Conference of the Cognitive Science Society (CogSci).*

Yildirim, I.*, Janner M.*, Belledonne, M., Wallraven, C., Freiwald, W., & Tenenbaum, J.B. (2017). Causal and compositional generative models in online perception. *In 39th Annual Conference of the Cognitive Science Society (CogSci).*

Yildirim, I.*, Siegel, M.*, & Tenenbaum, J.B. (2016). Perceiving Fully Occluded Objects via Physical Simulation. *In 38th Annual Conference of the Cognitive Science Society (CogSci).*

Allen, K.R., Yildirim, I., & Tenenbaum, J.B. (2016). Integrating Identification and Perception: A case study of familiar and unfamiliar face processing. *In 38th Annual Conference of the Cognitive Science Society (CogSci).*

Yildirim, I., Kulkarni, T.D., Freiwald, W.A., & Tenenbaum, J.B. (2015). Efficient analysis-by-synthesis in vision: A computational framework, behavioral tests, and comparison with neuronal representations. *In 37th Annual Conference of the Cognitive Science Society (CogSci).*

Bates, C. J., Yildirim, I., Tenenbaum, J.B., & Battaglia, P.W. (2015). Humans predict liquid dynamics using probabilistic simulation. *In 37th Annual Conference of the Cognitive Science Society (CogSci).*

Erdogan, G., Yildirim, I., & Jacobs, R. A. (2014). Transfer of object shape knowledge across visual and haptic modalities. *In 36th Annual Conference of the Cognitive Science Society (CogSci).*

Yildirim, I. & Jacobs, R.A. (2010). A Bayesian nonparametric approach to multisensory perception. *In 32nd Annual Conference of the Cognitive Science Society (CogSci).*

Conference abstracts

Lin, Q., Li, Z., Lafferty, J., & Yildirim, I. (2022). Images that are harder to reconstruct are more memorable and benefit more from longer processing time. *Vision Science Society (VSS).*

Belledonne, M. & Yildirim, I. (2022). Navigational affordances are automatically computed during scene perception: Evidence from behavioral change blindness and a computational model of active attention. *Vision Science Society (VSS).*

Zhang, Y., Bi, W., & Yildirim, I. (2022). Perception of liquids relies on generalizable, physics-based representations. Abstract presented at the *Annual Meeting of the Cognitive Science Society (CogSci).*

Yasuda, S., Yates, T., & Yildirim, I. (2021). Physical event representations: Observers spontaneously impose discrete temporal structure in intuitive physical scene understanding. *Virtual Vision Science Society (VSS).*

Belledonne, M, Butkus, E., Scholl, B.J., Yildirim, I. (2021). Attentional dynamics during multiple object tracking are explained at subsecond resolution by a new 'hypothesis-driven adaptive computation' framework. *Virtual Vision Science Society (VSS).*

Bi, W., Shah, A., Wong, K. W., Scholl, B., & Yildirim, I. (2021). Perception of soft materials relies on physics-based object representations: Behavioral and computational evidence. *Virtual Vision Science Society (VSS).*

Yilmaz, H., Shah, A. D., Letrou, A., Kumar, S., Vogels, R., Tenenbaum, J. B., & Yildirim, I. (2021). Inverse graphics explains population responses in body-selective regions of the IT cortex. *Computational and Systems Neuroscience (Cosyne).*

Wong, K. W., Bi, W., Yildirim, I., & Scholl, B. J. (2021). Seeing cloth-covered objects: A case study of intuitive physics in perception, attention, and memory. *Virtual Vision Science Society (VSS).*

Yildirim, I.*, Smith, K.*, Belledonne, M.*, Wu, J., & Tenenbaum, J.B. (2018). Neurocomputational modeling of human physical scene understanding. *In 2nd Cognitive Computational Neuroscience Conference (CCN).* [Selected as a talk.]

Yildirim, I., Aran, O., Yolum, P., & Akarun, L. (2009). Cooperative Sign Language Tutoring: A Multiagent Approach. *In Proceedings of Engineering Societies in Agents' World X.*

Yildirim, I. & Yolum, P. (2008). Hybrid Models for Achieving and Maintaining Collaborative Symbiotic Groups. *In 5th European Social Simulation Association Conference.*

Invited talks   CIFAR Workshop on Foundation Models for Neuroscience, Montreal. Oct, 2022.

Optica Fall Vision Meeting, Rochester NY. Oct, 2022.

AFOSR Cognitive Computational Neuroscience Review. Oct, 2022.

Kickoff event for the Institute of the Foundations of Data Science, Yale University. Oct, 2022.

Albert Einstein College of Medicine, Department of Systems and Computational Biology, May 2022.

Dartmouth College, fMRI Brown Bag, February 2022.

Invited speaker at the Cognitive Computational Neuroscience Generative Adversarial Collaboration titled "How does visual experience shape representations and transformations along the ventral stream?", September, 2021.

Invited speaker at the Cognitive Computational Neuroscience Generative Adversarial Collaboration titled "How does the brain combine generative models and direct discriminative computations in high-level vision?", September, 2021.

University of California San Diego (UCSD) Sensation and Perception Series, February 2021.

SUNY Optometry Colloquium, New York, December 2020.

Cognition, AI, and Society: Status and Perspectives. Boston, 2020 *(to be rescheduled).*

Boston College, Department of Psychology, Summer Postbacs Seminar Series. Boston, June 2019.

Columbia University, Zuckerman Mind Brain Behavior Institute. New York, March 2019.

University of Toronto, Departments of Psychology and Department of Statistics. Toronto, March 2019.

Yale University, Department of Statistics & Data Science. New Haven, January 2019.

Princeton University, Princeton Neuroscience Institute. Princeton, January 2019.

Yale University, Department of Psychology. New Haven, November 2018.

Columbia University, Center for Theoretical Neuroscience. New York, February 2018.

Cognitive Neuroscience Society (CNS) Invited Symposium, Boston, March 2018.

Hierarchical Multisensory Integration Workshop, Barcelona, June 2017.

University of Toronto, Department of Computer Science Seminar, April 2017.

Vision seminar, MIT, March 2017.

Brown University, Perception and Action Seminar Series, December 2016.

Physical and Social Scene Understanding Workshop, CogSci Conference, August 2016.

University Electro-Communications, Tokyo; Workshop on Object vision, November 2015.

RIKEN Institute, Tokyo; Special seminar, November 2015.

Face ID Challenge Workshop, MIT, September 2015.

Students and Postdocs

Wenyan Bi. Postdoc. 2020-present.

Mario Belledonne. PhD student. 2019-present. (Psychology)

Yutaro Yamada. PhD student. 2021-present. (Statistics & Data Science)

Yuting Zhang. PhD student. 2021-present. (Psychology)

Aalap Shah. PhD student. 2021-present. (Psychology)

Hakan Yilmaz. PhD student. 2022-present. (Psychology)

Yihan Bao. PhD student. 2022-present. (Statistics & Data Science)

Daniel Calbick. PhD student. 2022-present. (Interdepartmental Neuroscience Program)

Postbacs (RAs with a college or Masters degree). Chloe Geller (2022-present); Eivinas Butkus (2019-2021; now Ph.D. student at Columbia Zuckerman Institute); Aalap Shah (2020-2021; now Ph.D. student at Yale); Shannon Yasuda (2020-2021; now Ph.D. student NYU Psychology); Hakan Yilmaz (2019-2021; now Ph.D. student at Yale).

Yale Undergraduates. Serena Wang (2023-present; WTI undergrad fellowship); Lily Lassiter (2023-present; WTI undergrad fellowship [declined]); Raagav Malik (2023-present; Dean's undergrad fellowship); Fred Zhang (2022-present; S&DS senior thesis); Matt Muellner (2022-present; Neuroscience senior thesis); Adhya Beesam (2021-present; Neuroscience senior thesis), Emir Akdere (2020-2021; Cognitive Science senior

thesis), Masa Stanisavlijevic (2020), Shannon Yasuda (2020-2021; Psychology senior thesis), Marc Harary (2020-present), Ariadne Letrou (2019-present; S&DS Senior thesis), Jeffrey Ma (2019-2020), Karim El Adl (2019-2020), Onyedikachi Uche (2019), Gargi Singh (2019-2021), Katherine Sylvester (2020-2022).

Postbacs and undergrads elsewhere. Amir Soltani (2016-2020); Basil Saeed (2016-19); Mario Belledonne (2017-19); Michael Janner (2015-18); Shraman Chaudhiri (2016-18); Pallavi Mishra (2016-17); Wendy Wei (2015-16).

Teaching	PSYC 261/561: Algorithms of the Mind (Fall 2023), Yale University

PSYC 200: Statistics (Spring 2021, Spring 2022), Yale University.

PSYC 479: Computational Basis of Seeing and Thinking (Spring 2020, Fall 2021), Yale University.

Teaching Assistant for: Cognition (Spring 2011), Foundations of Cognitive Science (Fall 2011), Neural Foundations of Behavior (Fall 2012) at University of Rochester.

Service

Student committees (Yale): Sylvia Blackmore (first year reader); John Muchovej (first year reader); Aurelien Fermo (first year reader); Alec Sheffield (INP reader; thesis committee); Peiyu Liu (INP reader; thesis committee); Hui Liang Peng (prospectus); Cameron Ellis (thesis committee), Clara Colombatto (thesis committee), Tristan Yates (prospectus, thesis committee), Viola Mocz (thesis committee), Marlene Berke (first year reader, pre-dissertation, theme essay), Kimberly Wong (first year reader, pre-dissertation, theme essay), Erica Busch (first year reader, pre-dissertation), Hanna Hillman (first year reader, pre-dissertation, prospectus), Merve Erdogan (first year reader, pre-dissertation).

Organizer and service committees (Yale). Member, Committee on Racial Justice and Equity, Department of Psychology (2023-); Colloquium series faculty organizer, Department of Psychology (2023-); Yale Workshop on Object Cognition (June 2021); Current Works in Cognitive and Developmental Areas (2020-2021); Department of Psychology Senior Thesis Award Committee (2020); STEM Dean's Undergraduate Fellowship Committee (2020); GPAC for Cognitive Area (2020-21).

Organizer (international conferences). Cosyne 2022 workshop titled "Linking phenomena across levels of analysis: The need for a new multi-level reverse-engineering toolkit". Perception as Generative Reasoning, NeurIPS 2019. Deep Learning in Computational Cognitive Science, CogSci 2017.

Reviewer for Science Advances, Cell Reports, Journal of Experiment Psychology: General, Trends in Cognitive Science, Human Brain Mapping, Journal of Vision, COSYNE conference, PLoS Computational Biology, Nature Communications Biology, Psychological Review, Proceedings of the National Academy of Sciences, Attention, Perception & Psychophysics, IEEE PAMI, IET Computer Vision, Annual Conference of the Cognitive Science Society (CogSci), Cognitive Computational Neuroscience Conference (CCN).

Associate Editor Open Mind.

Grant reviewer Israeli Science Foundation; Fund for Scientific Research – FNRS (Belgium); NWO Veni talent program (Netherlands); National Science Foundation Panel on Integrative Neural Cognitive Systems.

Press coverage	MIT News, "A New Model of Vision", 2020.

WIRED magazine, "MIT Researchers Want to Teach Robots How to Wash Dishes", 2015.

VICE magazine, "How to Teach a Robot to Build a Rube Goldberg Machine", 2015.

Boston globe, "MIT system makes human-like predictions about how objects move through the world", 2015.