# Chenxi Liao

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**Research interest:** Visual perception and cognition, Visual psychophysics, Computational models of perception, Human-machine alignment, Multimodal learning

## Education

**Ph.D Neuroscience**, American University, Washington, DC — Expected Dec 2025
- Advisor: Prof. Bei Xiao, Department of Computer Science

**M.S. Neuroscience**, American University, Washington, DC — 2020 – 2023
**M.S. Industrial Engineering**, Columbia University, New York, NY — 2018 – 2020
**B.S. Mechanical Engineering**, George Washington University, Washington, DC — 2014 – 2018

## Technical Skills

**Languages:** Python, TensorFlow, PyTorch, Git, R, Matlab, SQL, JavaScript, P5.JS

**Deep learning** CNNs, RNNs, Autoencoders, GANs, StyleGANs, Transformers, Vision-language Models, Stable diffusion models, NeRFs
**Modeling Paradigms** Self-supervised Learning, Transfer Learning, Few-shot Learning, Unsupervised Representation Learning

**Statistical modeling:** Generalized Linear Model, Bayesian Multilevel Models

## Selected Research Experience

**Visual adaptation of material appearances**, Bei Xiao Lab — 2024 – Present
- Designed image stimuli with generative models to investigate mechanisms of visual adaptation.
- Applied Bayesian multilevel models to analyze adaptation effects.

**Material categorization using deep learning feature representations** , Bei Xiao Lab — 2023 – Present
- Constructed self-supervised learning models (e.g., SimCLR) to examine category representations between humans and models.
- Quantified human-model alignment via statistical analysis and data visualizations.

**Probing the vision-language connection in material perception**, Bei Xiao Lab — 2023 – 2024
- Built a deep-learning-based image morphing pipeline using a hybrid of generative model (StyleGAN) and transfer learning for high-quality stimulus synthesis.
- Applied latent space interpolation to generate controlled image stimuli for psychophysical experiments.
- Implemented vision-language models (e.g., OpenCLIP) for multimodal embedding analysis, quantifying human individual differences in vision-semantic alignment across material perception tasks.

**Unsupervised learning of translucency perception**, Bei Xiao Lab — 2021 – 2023
- Curated a large-scale image dataset tailored for training machine learning models of translucency perception.
- Built an encoder-decoder image generative model to synthesize photorealistic material appearances.
- Integrated human behavioral data into model evaluation to discover perceptual dimensions aligned with human judgments of material properties.

**Probing the effect of color on translucency perception**, Bei Xiao Lab — 2020 – 2021
- Designed and deployed online experiments for crowdsourcing human behavioral data over Pavlovia.
- Used image statistics to quantify visual attributes underlying translucency perception.

## Fellowships & Awards

**Center for Neuroscience and Behavior Summer Research Award**, American University — 2024
**Center for Neuroscience and Behavior Travel Award**, American University — 2022
**College of Arts and Sciences Graduate Student Research Award**, American University — 2021

## Summer School

**Visual Neuroscience From Spikes to Awareness**, Hesse, Germany 2024

## Publications

Xiao, B & **Liao, C.** (2025). Material perception connects vision, cognition and action. *Nature Reviews Psychology*.

**Liao, C.**, Sawayama, M., & Xiao, B. (2024). Probing the link between vision and language in material perception using psychophysics and unsupervised learning. *PLOS Computational Biology*, 20(10), e1012481.

Reinisch, M., He, J., **Liao, C.**, Siddiqui, S., & Xiao, B. (2024). CTP-LLM: Clinical trial phase transition prediction using large language models. *In 2024 IEEE International Conference on Bioinformatics and Biomedicine (BIBM)* (pp. 3667-3672). IEEE.

**Liao, C.**, Sawayama, M., & Xiao, B. (2023). Unsupervised learning reveals interpretable latent representations for translucency perception. *PLOS Computational Biology*, 19(2), e1010878. (Issue cover story)

**Liao, C.**, Sawayama, M., & Xiao, B. (2022). Crystal or jelly? Effect of color on the perception of translucent materials with photographs of real-world objects. *Journal of Vision*, 22(2), 6-6.

## Conference Proceedings

**Liao, C.**, Sawayama, M., & Xiao, B. (2024). Probing the link between vision and language in material perception. *Cognitive Computational Neuroscience Conference*. Boston, MA.

**Liao, C.**, Sawayama, M., & Xiao, B. (2022). Translucency perception emerges in deep generative representations for natural image synthesis. *Cognitive Computational Neuroscience Conference*. San Francisco, CA.

## Abstracts

**Liao, C.**, Cheeseman, J., Schmidt, F., Fleming, R. W., & Xiao, B. (2025). Visual adaptation of complex material appearances. *Vision Sciences Society*. **Poster**. St. Pete's Beach, FL.

**Liao, C.**, Sawayama, M., Cheeseman, J., Schmidt, F., Fleming, R. W., & Xiao, B. (2024). Probing the relationship between material categorization and material property estimation using ambiguous visual stimuli. *Vision Sciences Society*. **Poster**. St. Pete's Beach, FL.

**Liao, C.**, Sawayama, M., & Xiao, B. (2023). Probing the link between vision and language in material perception using machine learning and psychophysics. *Society for Neuroscience Annual Meeting*. **Poster**. Washington, DC.

**Liao, C.**, Sawayama, M., & Xiao, B. (2023). Shared representation of different material categories: transfer learning from crystals to soaps. *Vision Sciences Society*. **Talk**. St. Pete's Beach, FL.

**Liao, C.**, Sawayama, M., & Xiao, B. (2022). A perceptual evaluation of the StyleGAN2-ADA generated translucent objects. *Vision Sciences Society*. **Talk**. St. Pete's Beach, FL.

Sawayama, M., **Liao, C.**, Nishida, S. Y., & Xiao, B. (2022). Replaceability of two deep generative models trained with a pair of translucent objects with different geometries. *Vision Sciences Society*. **Poster**. St. Pete's Beach, FL.

**Liao, C.**, Sawayama, M., & Xiao, B. (2021). Individual differences in the classification of translucent materials using photos of real-world objects. *Vision Sciences Society*. **Poster**. Virtual Meeting.

## Teaching

**Teaching Assistant**, Computer Vision 2024
**Teaching Assistant**, Cognition and Perception 2023-2024
**Teaching Assistant**, Introduction to Deep Learning, Applied Natural Language Processing, Introduction to Programming. 2021-2023