Ruyi Liu

Curriculum Vitae

<u>**Personal information**</u>

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Date of the CV: 28 May 2025

<u>**Degrees**</u>

Doctor of Philosophy in Cognitive Neuroscience 1.8.2024 – 31.10.2026 (planned)

- Cognitive Neuroscience, Department of Psychology at University of Jyväskylä (JYU), Finland

- Dissertation title (planned): "Dual effect of attention in the visual working memory maintenance" (supervisors: Dr. Chaoxiong Ye, Jarmo Hämäläinen; member of the Dissertation Support Group: Miriam Nokia). The dissertation contains four studies focusing on the interaction of internal attention and the visual working memory (VWM). Study I examines the effect of internal attention on VWM representation integration in terms of real-world spatial regularities (published). Study II assesses the requirment of removing unfocused information when the internal attention enhances dimension-based information storage in VWM (published). Study III investigates whether the cognition process of targets influences the resistance of internal attention against delayed distractors in VWM (under sencond-round review). Study IV explores the resistance effect of internal attention guided by a dimension-based retro-cue against delayed distractors in VWM (published). VWM acts as a bridge between fragile perceptual information and advanced cognitive processes, ranging from long-term memory to fluid intelligence. These studies aid in teaching method improvement to exchange crutial information in the real-world environment with numerous distractors.

Master of Education 1.9.2021 – 28.6.2024

- Psychology, Sichuan Normal University (SCNU), China

- Dissertation title: "Negative emotional state impairs individuals' ability to filter out distractors from VWM: An ERP study" (supervisor: Dr. Chaoxiong Ye). In this study, we induced participants' neutral (as baseline) or negative emotional state to manipulate individual differences in a visual learning task with distractors and recorded the EEG data. The contralateral delay activity (CDA) was analysed to directly observe the amount of information held in mind. Results showed that the CDA amplitude was higher in the distractor condition with two targets & two distractors to learn than in the low-load condition with two targets when participants were induced into a negative emotion state, but this difference disappeared when they were in a neutral emotional state. These results indicate that the negative emotional state impairs distractor filtering in visual learning of simple information.

- GPA: 3.5/4

Bachelor of Law 1.9.2015 – 28.6.2019

- International Relations, Peking University (PKU), China

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- GPA: 3.54/4

Language skills

English: Fluent (IELTS 7.5/9; L8.5, R9, W6, S6)

Mandarin Chinese: Native

Research experience

Research Assistant of Ye's Lab, SCNU (1.7.2022 – 28.6.2024)

- Focus on visual working memory and its interaction with attention or emotion.

- Act as main member of four projects (details shown in following parts).

- Assist in an ERP study on memorability. Responsible for program coding in E-prime, data collection (60+), EEG data analysis via Matlab, visualization via OriginLab, and Method writing.

- Assist in a behavioral study on familiarity. Responsible for data collection (50+), analysis via JASP, and visualization.

- Have extensive experience in manuscript writing and revising according to reviewers' suggestion. Finish five manuscripts (four published and one under review).

Main Member of Attention Improvement on Visual Working Memory of Integrated Information Project, SCNU & JYU (PI: Dr. Chaoxiong Ye, 1.3.2022 – 20.8.2024)

- Manipulate the number of retro-cues (0 - 2) and the task difficulty to examine the effect of top-down attention on visual working memory of integrated information. Results support for the memory improvement of attention on part of integrated information exclusively, and furthermore, the improvement of refocused attention shows no difference from that of focused attention.

- Assist in experiment design and data collection (40+). Responsible for data analysis, visualization, conceptualization, original draft writing, review and editing. Organize the accomplishment of Introduction & Discussion parts of manuscripts with two collaborators.

- Complete a scientific article under review in *Frontiers in Psychology* (JUFO 1)as the first author.

- Attend Working Memory Symposium 2023 (online) to present a talk on this research.

Main Member of Delayed Distractor Effect Project, SCNU & JYU (PI: Dr. Chaoxiong Ye, 1.3.2024 – present)

- Manipulate the appearance phase of distractors (encoding vs. delayed vs. both) and the memoranda display duration to examine the effect of target process on delayed distractor resistance. Results indicate that early process of targets in VWM is stable to encoding distractors but susceptible to delayed distractors.

- Design and program experiments. Monitor data collection. Responsible for data analysis, visualization and conceptualization.

Main Member of Negative Emotional State Effect on Filtering Project, SCNU (PI: Dr. Chaoxiong Ye, 1.4.2022 – 31.12.2023)

- Manipulate participants' emotional state and the memory condition (2 targets vs. 2 targets and 2 distractors vs. 4 targets) with recording of EEG data to examine the influence of negative emotional state on distractor filtering in visual working memory.

CDA (an ERP component) results indicate that the negative emotional state impairs distractor resistance.

- Responsible for formal data analysis, visualization, conceptualization, original draft writing, supplementary writing and revising, review and editing.

- Finish Master's dissertation (supervisor: Dr. Chaoxiong Ye, in Chinese).

- Publish a paper in *Cognitive, Affective, and Behavioral Neuroscience* (2024.03, JUFO 1) as the second author.

Main Member of Requirement of Sustained Attention to Improve Visual Working Memory Project, SCNU (PI: Dr. Chaoxiong Ye, 1.12.2022 – 30.4.2023)

- Manipulate the appearance of interruption after retro-cues, the cue-to-interruption stimulus onset asynchrony, and the type of interruption (masks, a secondary task) to examine the requirement of sustained attention on memorized targets to improve their working memory performances. Results indicate that sustained attention is necessary to effectively prioritize representations in memory.

- Assist in experiment design and data collection (20+). Responsible for formal data analysis, model fitting of data via Matlab, visualization, conceptualization, original draft writing, supplementary writing and revising, review and editing.

- Publish a paper in *Journal of Vision* (2023.05, JUFO 2) as the co-first author.

Main Member of Integration Phase of Real-world Object Project, SCNU (PI: Dr. Chaoxiong Ye, 1.11.2021 – 31.8.2022)

- Manipulate the spatial regularity and the presentation condition (sequential vs. simultaneous) to examine whether the integration of real-world objects based on experience happens in the maintenance phase. Results indicate that representations of real-world objects are grouped according to spatial regularities in the encoding phase rather than in the maintenance phase in working memory tasks.

- Assist in experiment design, experiment coding and data collection (20+). Responsible for formal data analysis, visualization, conceptualization, original draft writing and revising, supplementary writing and revising, review and editing.

- Publish a paper in *Journal of Vision* (2022.09, JUFO 1) as the co-first author. Attend Visual Science Society 2022 (online) to present a talk on this research.

Research output

Number of first- or co-first-authored published papers: 3

Number of other co-authored papers: 4

1. Ren, G., **Liu, R.,** Guo, L., Nie, D., Chen, J., & Ye, C. (2025) Presentation duration modulates working memory disruption by encodingand delay-stage distractors., preprint: https://doi.org/10.31234/osf.io/jrhs3 (under review in *Scientific Reports*; Study III of my doctoral dissertation)

2. Guo, L., Park, H.-B., Ren, G., Liu, P., **Liu, R.,** Nie, D., & Ye, C. (2025). All identical objects reduce memory load at the late maintenance stage in working memory. *Scientific Reports*, 15, 16700. https://doi.org/10.1038/s41598-025-00433-4 (JUFO 1)

3. **Liu, R. (co-first author)**, Guo, L. (co-first author), Lin, X., Nie, D., Astikainen, P., & Ye, C. (2024). Dimension-based retro-cue benefit in working memory does not require unfocused dimension removal. *Frontiers in psychology*, 15, 1433405. https://doi.org/10.3389/fpsyg.2024.1433405 (JUFO 1; Study II of my doctoral dissertation)

4. Ye, C., **Liu, R.**, Guo, L., Zhao, G., & Liu, Q. (2024) A negative emotional state impairs individuals' ability to filter distractors from working memory: an ERP study. *Cognitive, Affective, & Behavioral Neuroscience. 24*(3):491-504. https://doi.org/10.3758/s13415-024-01166-z. (JUFO 1)

5. **Liu, R. (co-first author),** Guo, L. (co-first author), Sun, H., Parviainen, T., Zhou, Z., Cheng, Y., Liu, Q., & Ye, C. (2023). Sustained attention required for effective dimension-based retro-cue benefit in visual working memory. *Journal of Vision, 23*(5), 13. https://doi.org/10.1167/jov.23.5.13. (JUFO 2; Study IV of my doctoral dissertation)

6. Liu, X. (co-first author), **Liu, R. (co-first author),** Guo, L., Astikainen, P., & Ye, C. (2022). Encoding specificity instead of online integration of real-world spatial regularities for objects in working memory. *Journal of Vision, 22*(9), 8. https://doi.org/10.1167/jov.22.9.8. (JUFO 2; Study I of my doctoral dissertation)

7. **Liu, R.,** Guo, L., Cheng, Y., Li, Q., & Ye, C. (2022). The Representation Unit of Visual Working Memory. *Advances in Psychology, 12*(3), 868-875. https://doi.org/10.12677/AP.2022.123103 (in Chinese with English abstract)

8. Pan, Z., **Liu R.,** Guo, L., Ye, C. (2024) The Effect of Interference on Retro-cue Benefit in Visual Working Memory. *Journal of Sichuan Normal University (Natural Science), 47*(02):179-187. https://doi.org/10.3969/j.issn.1001-8395.2024.02.004 (in Chinese with English abstract)

9. Cheng, Y., Guo, L., Zhou, Z., **Liu, R.,** Li, Q., & Ye, C. (2022). The Influencing Factors of Retro-Cue Effect in Visual Working Memory. *Advances in Psychology, 12*(04):1079-1087. https://doi.org/10.12677/AP.2022.124128 (in Chinese with English abstract)

10. Li, Q., Guo, L., Zhou, Z., **Liu, R.,** Cheng, Y., & Ye, C. (2022). The Performance Difference of Visual Working Memory between Various Emotional Faces. *Advances in Psychology, 12*(05):1638-1646. https://doi.org/10.12677/AP.2022.125196 (in Chinese with English abstract)

Research supervision and leadership experience

- Leadership experience in the Attention Improvement on Visual Working Memory of Integrated Information Project in SCNU (1.8.2023 – 28.6.2024): responsible for experiment design and implementation, instructing graduate researchers in data collection, organizing conceptualization and article writing among graduate and doctoral researchers.

Teaching merits

- Present lectures on visual working memory experimental studies and cognitive models in seminars of Ye's Lab (in Chinese, 9.2021 – present).

- Present lectures on visual attention and working memory. Organize discussions in Prof. Hong-jin Sun's online Attention Bias Summer Camp (in English, 5.2023 – 6.2023).

- Teach English weekly to children of migrant workers in a junior high school as voluntary work (11.2015 – 5.2019).

Awards and honours

- Third-class Academic Scholarship (for 20% graduate students), funded by Sichuan Education Department , CNY 6,000 (~€760), 2021.

- President's List (for 20% graduate students) & Merit Student (for top 5% students), funded by Sichuan Normal University, CNY 10,000 (~€1270), 2022.

- President's List (for 20% graduate students), funded by Sichuan Normal University, CNY 6,000 (~€760), 2023.

Other key academic merits

Visual Science Society 2022, online (6.2022)

- Present a talk claiming that real objects are grouped according to spatial regularities in the encoding rather than maintenance phase of visual working memory.

Attention Bias Summer Camp, online (5.2023 – 6.2023)

- Assist Prof. Hong-jin Sun (Associate Professor, Department of Psychology, Neuroscience & Behaviour, McMaster University) for this summer camp.

- Present three lectures on attention and its interaction with visual working memory, and organize the symposium among attendees, including undergraduate students in McMaster University and graduate students in several universities in China.

Working Memory Symposium 2023, online (6.2023)

- Present a talk claiming that the refocused information is memorized not worse than the focused information in visual working memory, and therefore probably without an attention shift cost, examined with a double retro-cue paradigm.

- Exchange ideas on possible explanations and potential revision of experiments with attendees.

Psychonomic Society's 64th Annual Meeting, California, USA (11.2023)

- Prepare posters and manuscripts for presentation of our experiments showing that the sustained focused attention on target representations in mind benefits the improvement of top-down attention on visual working memory, but not necessarily.

Reviewer for journals: *PLOS ONE, BMC Psychology*

Other skills

- E-prime: Coding two behavioral experiments with recall tasks and one EEG experiment with a change detection task.

- PsychoPy: Coding one experiment with a rating task and a dot probe task.

- SPSS & JASP: Conducting ANOVA, classical or Bayesian t-test, correlation, and Logistic regression analysis.

- Matlab: Using eeglab to analyze EEG data. Using and upgrading the model fitting procedure of recall task results.