

# In-Chang Baek

Applied Research Engineer in Game AI  
+82 10-9367-4907 | [inchang.baek@gm.gist.ac.kr](mailto:inchang.baek@gm.gist.ac.kr)  
[scholar.inchang.dev](https://scholar.inchang.dev) | [github.inchang.dev](https://github.com/inchangdev)

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## SUMMARY

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I am an applied research engineer building interactive AI agents that interpret human intent, adapt to new objectives, and generalize across tasks and domains. My research combines reinforcement learning, language-conditioned representations, and large language models to make agent behavior controllable at inference time without reward redesign or task-specific retraining. Games and procedural content generation provide controlled, measurable testbeds where I turn these ideas into working systems and evaluate whether agent behavior matches the intended objective. My long-term goal is to create agents that engage in transparent, two-way communication with people, explain their behavior, learn from human feedback, and continually expand their capabilities through open-ended learning.

Keywords: reinforcement learning, large language models,  
procedural content generation, language-conditioned policy learning

## EDUCATION

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### Gwangju Institute of Science and Technology (GIST)

Gwangju, South Korea

Integrated M.S./Ph.D. Program, AI Graduate School (Expected graduation: Feb. 2027)

*2021–Present*

Advisor: Prof. Kyung-Joong Kim

Proposed Dissertation Title: *From Instructable to Generalizable Agents: Multi-Domain Reinforcement Learning for Procedural Level Generation*

### Sejong University

Seoul, South Korea

B.S. in Computer Engineering (*cum laude*)

*2017–2021*

## PUBLICATIONS

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### International Publications

- [I16] **I.-C. Baek\***, J. Jung\*, S.-H. Kim, G.-H. Hwang, and K.-J. Kim, “Multiverse: Language-Conditioned Multi-Game Level Blending via Shared Representation,” *2026 IEEE Conference on Games (CoG)*, pp. 1–8, 2026 (\* Equal contribution).
- [I15] S.-H. Kim, G.-H. Hwang, **I.-C. Baek**, S.-Y. Lee, and K.-J. Kim, “Multi-Objective Instruction-Aware Representation Learning in Procedural Content Generation Reinforcement Learning,” *2026 IEEE Conference on Games (CoG)*, pp. 1–8, 2026.
- [I14] **I.-C. Baek\***, S. Lee\*, S.-H. Kim, G. Hwang, and K.-J. Kim, “Human-Aligned Procedural Level Generation Reinforcement Learning via Text-Level-Sketch Shared Representation,” *IEEE Transactions on Games*, pp. 1–14, 2026 (\* Equal contribution).
- [I13] **I.-C. Baek**, S.-H. Kim, S. Earle, Z. Jiang, J.-H. Noh, J. Togelius, and K.-J. Kim, “PCGRLLM: Large Language Model-Driven Reward Design for Procedural Content Generation Reinforcement Learning,” *IEEE Transactions on Games*, pp. 1–14, 2026.
- [I12] S. Ahn, **I.-C. Baek**, K.-J. Kim, K. N. Truong, and J.-H. Hong, “µCap: Instrumental Music Captions for Deaf and Hard-of-Hearing Individuals,” *ACM CHI Conference on Human Factors in Computing Systems (CHI '26)*, 2026 (Best Paper Award, Top 1%).
- [I11] I.-T. Jung, C.-H. Lee, **I.-C. Baek**, D.-I. Oh, Y.-J. Choi, K.-J. Kim, D.-J. Kong, and J.-H. Hong, “GPTalk: LLM-Based Virtual Companions for Metacognitive Growth in Self-Directed E-Learning Environments,” *International Journal of Human-Computer Studies*, Art. no. 103754, 2026.
- [I10] **I.-C. Baek**, T.-H. Park, and K.-J. Kim, “Seamless Tutorial: Contextual State Transition Generation Based on Player Internal Knowledge,” *IEEE Transactions on Games*, 2025.

- [I9] E.-J. Kwon, S.-W. Oh, **I.-C. Baek**, Y.-C. Park, G.-B. Kim, J.-Y. Moon, Y.-H. Choi, and K.-J. Kim, “A Humanoid Visual-Tactile-Action Dataset for Contact-Rich Manipulation,” *IROS 2025 Workshop on Robotic Fine Manipulation: Integrating Tactile, Visual, and Intelligent Control*, 2025.
- [I8] **I.-C. Baek\***, S.-H. Kim\*, S.-Y. Lee, D.-H. Kim, and K.-J. Kim, “IPCGRL: Language-Instructed Reinforcement Learning for Procedural Level Generation,” *2025 IEEE Conference on Games (CoG)*, pp. 1–8, 2025 (\* Equal contribution).
- [I7] **I.-C. Baek**, T.-H. Park, J.-H. Noh, C.-M. Bae, and K.-J. Kim, “ChatPCG: Large Language Model-Driven Reward Design for Procedural Content Generation,” *2024 IEEE Conference on Games (CoG)*, pp. 1–4, 2024.
- [I6] H.-C. Jeon\*, **I.-C. Baek\***, C.-M. Bae, T. Park, W. You, T. Ha, H. Jung, J. Noh, S. Oh, and K.-J. Kim, “RaidEnv: Exploring New Challenges in Automated Content Balancing for Boss Raid Games,” *IEEE Transactions on Games*, 2023 (\* Equal contribution).
- [I5] **I.-C. Baek**, T.-G. Ha, T.-H. Park, and K.-J. Kim, “Toward Cooperative Level Generation in Multiplayer Games: A User Study in Overcooked!” *2022 IEEE Conference on Games (CoG)*, 2022.
- [I4] **I.-C. Baek**, T.-H. Park, T.-G. Ha, and K.-J. Kim, “Turing Test Framework for Cooperative Games,” *2022 IEEE Conference on Games (CoG)*, 2022.
- [I3] H.-T. Joo, **I.-C. Baek**, and K.-J. Kim, “A Swapping Target Q-value Technique for Data Augmentation in Offline Reinforcement Learning,” *IEEE Access*, vol. 10, 2022.
- [I2] **I.-C. Baek** and K.-J. Kim, “Efficient Multi-Agent Reinforcement Learning Using Clustering for Many Agents,” *AIIDE-19 Workshop on Artificial Intelligence for Strategy Games*, 2019.
- [I1] **I.-C. Baek** and K.-J. Kim, “Web-Based Interface for Data Labeling in StarCraft,” *IEEE Conference on Computational Intelligence and Games (CIG)*, 2018.

## Domestic Publications

- [D5] J.-H. Noh, **I.-C. Baek**, S.-W. Oh, J.-Y. Moon, S.-M. Oh, and K.-J. Kim, “Object Characteristics Classification-Based State Representation Method for Match-3 Game playtesting,” *Korea Software Congress*, 2022.
- [D4] B.-H. You, T.-G. Ha, T.-H. Park, **I.-C. Baek**, and K.-J. Kim, “Automatic Build of Large Game Maps from Small Concept Maps using Wave Function Collapse Algorithm,” *KIISE Transactions on Computing Practices*, 2022.
- [D3] B.-H. You, T.-G. Ha, T.-H. Park, **I.-C. Baek**, and K.-J. Kim, “Automatic Build of Large Game Maps from Small Concept Maps using Wave Function Collapse Algorithm,” *Korea Software Congress*, 2022.
- [D2] **I.-C. Baek**, T.-G. Ha, and K.-J. Kim, “An Evolutionary Approach for Procedural Content Generation in Cooperative Game Overcooked,” *Korea Software Congress*, 2021.
- [D1] H. Park, I. Han, **I.-C. Baek**, and K.-J. Kim, “Physics-Based 3D Maze Game Environment for the Generalization of Deep Reinforcement Learning,” *Korea Software Congress*, 2021.

## Preprints

- [PP1] **I.-C. Baek**, G. Hwang, Z. Jiang, J. Togelius, and K.-J. Kim, “ReWARD: Cross-Domain Reward Estimation with Aligned Representation Directions for Level Generation via Reinforcement Learning,” 2026 (Under review at the *AAAI Conference on Artificial Intelligence (AAAI ’27)*).

## Patent

- [PT1] K.-H. Kim, K.-J. Kim, D.-H. Park, T.-H. Park, **I.-C. Baek**, and W. S. You, “Apparatus and Method for Transforming Style of Sketch Image,” 2023.

## AWARDS, HONORS, AND FUNDING

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**Award:** Best Paper Award (Top 1%) — ACM CHI Conference on Human Factors in Computing Systems, 2026  
**Award:** Second Place, 2nd ChatGPT4PCG Competition — IEEE Conference on Games, Aug. 2024 (\$300)  
**Scholarship:** GIST Graduate International Research Experience Fellowship (GIST-IREF) — Aug. 2024 (\$6,200)  
**Scholarship:** Full M.S./Ph.D. Scholarship — Tuition and stipend, Mar. 2021–Present  
**Funding:** GIST Innopolis Campus Program — Aug. 2021 (\$10,000)  
**Funding:** GIST Sprint for Startup (GSS) Program — Aug. 2021 (\$5,000)  
**Funding:** GIST Entrepreneurship Club Program — Apr. 2021 (\$2,000)  
**Travel Grant:** IEEE Conference on Computational Intelligence and Games — Aug. 2018  
**Scholarship:** Academic Excellence Scholarship, Sejong University — Aug. 2017 and Aug. 2018

## EXPERIENCE

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| <b>KRAFTON AI</b><br>Research Intern — LLM-Based Game Agent Policy Generation                                                         | Aug. 2025–Oct. 2025<br><i>Seoul, South Korea</i> |
| <b>Game Innovation Lab, New York University</b><br>Visiting Researcher — LLM-Based Reward Generation for Reinforcement Learning [I13] | Aug. 2024–Nov. 2024<br><i>New York, NY, USA</i>  |
| <b>Game Innovation Lab, New York University</b><br>Research Intern — Game AI Research (Director: Prof. Julian Togelius)               | Feb. 2023–Mar. 2023<br><i>New York, NY, USA</i>  |
| <b>YP Labs</b><br>Research Intern — Large-Scale Data Analysis with BigQuery                                                           | Jul. 2020–Aug. 2020<br><i>Seoul, South Korea</i> |
| <b>Cognition and Intelligence Lab, Sejong University</b><br>Undergraduate Researcher — StarCraft AI                                   | Jun. 2017–Oct. 2019<br><i>Seoul, South Korea</i> |
| <b>Pinnacle Investment</b><br>Full-Stack Web Developer                                                                                | Mar. 2017–Jul. 2020<br><i>Seoul, South Korea</i> |

## SELECTED RESEARCH COLLABORATIONS

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**NYU Game Innovation Lab:** Lead an ongoing international research collaboration, producing PCGRLLM [I13] and ReWARD [PP1].

**PuzzleOne Studio and GIST:** Led the research team alongside the game development team, conducting applied Game AI research in a commercial production environment [D5, I10].

**HCI and Accessibility:** Co-designed the study with HCI researchers; led  $\mu$ Cap’s system design and development for Deaf and hard-of-hearing users [I12]; CHI ’26 Best Paper Award (Top 1%).

**HCI and Learning Sciences:** Co-designed the study with HCI researchers; led GPTalk’s system design and development [I11], now commercialized through AICADEMY, led by the paper’s first author.

## RESEARCH PROJECTS

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**Generative AI for Human-Robot Collaboration with Home Humanoids**  
*Korea Institute for Advancement of Technology (KIAT)*

*Mar. 2025–Present*

- Developing language-instructed RL agents for robot control with tactile sensing

**AI-Based Game Simulation for Online Content Production**

*Korea Creative Content Agency (KOCCA), Ministry of Culture, Sports and Tourism*

*Apr. 2022–Dec. 2024*

- Built a Unity- and Gymnasium-based multiplayer game simulation environment [I6]
- Developed an LLM-driven reward generation and feedback framework for RL agents [I7]

**Human-Centered Game AI Research Lab**

*National Research Foundation of Korea (NRF)*

*Jun. 2021–Feb. 2024*

- Developed genetic-algorithm-based cooperative level generation for multiplayer games [I5]
- Conducted a crowdsourced user study on level generation for adaptive game tutorials [I10]

**Intelligent Authoring Tools for Accessible Social Communication**

*Korea Creative Content Agency (KOCCA), Ministry of Culture, Sports and Tourism*

*Mar. 2021–Dec. 2021*

- Deployed a GAN-based sketch style-transfer model and built an accessible authoring tool [PT1]

**Reinforcement Learning-Based Path Planning**

*Agency for Defense Development (ADD)*

*Mar. 2021–Jul. 2021*

- Developed an RL-based driving agent and simulation environment

## TECHNICAL SKILLS

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**Programming Languages:** Python, C#, JavaScript

**ML/RL Frameworks:** PyTorch, JAX

**Game Engines and Simulation:** Unity, Unreal Engine, Gymnasium

**Infrastructure and Tools:** Docker, Slurm

## ACADEMIC SERVICE

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**Invited Participant:** Dagstuhl Seminar 25292: New Frontiers in AI for Game Design (Jul. 13–18, 2025)

**Reviewer:** IEEE Conference on Games (CoG) (2024–2026)

**Reviewer:** IEEE Transactions on Games (ToG) (2025–2026)

**Reviewer:** AAAI Conference on Artificial Intelligence (AAAI) (2025–2026)