Dr. Ping and Dr. Pong: Rethinking Writing and Work with Playful Embodied AIs

Ahmet Börütecene
ahmet.borutecene@liu.se
Division of Media and Information Technology
Linköping University
Norrköping, Sweden

Oğuz 'Oz' Buruk
oguz.buruk@tuni.fi
Gameful Futures Lab
Research Center of Gameful Realities
Tampere University
Tampere, Finland

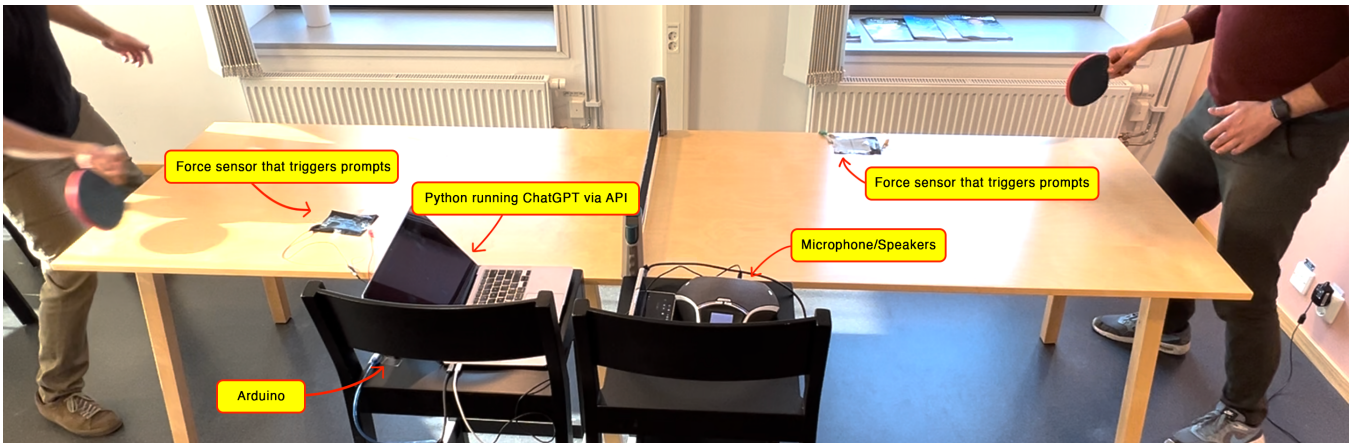

Figure 1: PingPonGPT setup. Two force sensors driven by an Arduino connected to a laptop running a Python script to use ChatGPT via API. A sound system plugged into the computer acting both as a speaker for ChatGPT responses and microphone to capture the players' voices. The screen shows when ChatGPT is listening and displays a transcription of its responses.

ABSTRACT

What if artificial intelligence (AI) could transform academic writing into an exhilarating game of table tennis? This paper explores AI's potential to foster creativity, enjoyment, and play. We challenge the view of AI as merely a tool for efficiency, showcasing its capacity for embodied interaction and intellectual engagement. We introduce an AI-infused table tennis setup, where two people can co-author a paper while playing ping pong. Using ChatGPT and an Arduino-driven system, this environment generates writing prompts based on gameplay, blending physical play with intellectual practice. Through PingPonGPT, we demonstrate AI's role in reflective practices, enriching overall work and creative processes.

CCS CONCEPTS

• **Computing methodologies** → **Natural language generation**; • **Human-centered computing** → **Natural language interfaces**; **Interaction design theory, concepts and paradigms**.

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KEYWORDS

AI, ChatGPT, Games, Play, Table Tennis, Embodied Interaction, More-than-human

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1 INTRODUCTION

As AI technologies proliferate, their integration into our daily lives often emphasizes efficiency and output, overshadowing the potential for these systems to foster creativity, enjoyment, and play. In the public and industrial imagination, GenAI seems to be perceived as a technology that will eventually remove the need for cognitive and bodily engagement of humans with work, except for typing in a few words or uttering phrases while looking at some form of screen. This screen-based, desk-bound, and mobile-yet-stationary future envisioned for human-AI interactions appears as a remnant of the outdated ideals of interaction design [18]. This kind of future might be interpreted as the only way that will move us towards utility and productivity. But does it really have to be so?

We argue that GenAI can actually be a valuable tool to explore novel ways of embodied interaction through play where body and mind act as a whole [14]. In this paper, we propose an unconventional reflective practice with AI, focusing on the concept of play.

We designed and conducted a study that combines physical play with intellectual engagement through AI. More specifically, we used ChatGPT to transform table tennis into an activity where two people can simultaneously play pingpong and write an academic paper. In this setup driven by Arduino, the positioning of the ball on the table generates various prompts for ChatGPT, thus creating a dynamic and interactive experience as two "players" bounce ideas back and forth. This system enabled us to engage, using our whole body, in creative dialogues with ChatGPT, influenced both by intentional prompts and spontaneous ones triggered by our gameplay [3]. Through this playful and embodied approach, we seek to reflect on the potential of AI to reshape our work environments and challenge conventional methods of academic writing. Our study contributes to the ongoing discourse on reflective practices in Human-Computer Interaction (HCI) and design, particularly by examining how AI can cultivate a playful and engaging work atmosphere.

2 WRITING, PLAYFUL WORK, AND REFLECTIVE PRACTICES WITH AI

Writing is usually associated with desks and sedentary positions, with silence and immobility considered necessary [9]. Writing on smartphones while walking or driving is both difficult and unsafe [22, 30]. While a non-distracting environment and comfortable positions help for some parts of writing, they do not necessitate stillness or completely isolated environments free from distraction [6]. Historically, writing has involved the whole body in expressive motion, as seen in some Asian cultures. [11, 12, 16, 31]. This shows writing can be dynamic, merging physical movement with cognitive effort.

The role of playfulness in work and creative processes has been explored across various disciplines. Play is recognized as crucial for human development, creativity, and well-being [1, 15]. Integrating play into professional environments is increasingly important today, as playful activities foster a state of flow, enhancing creativity and productivity [17]. Digital technologies and AI-driven play environments further create opportunities for playful interactions, enhancing work contexts and challenging conventional notions of writing and productivity [21, 32].

Building on this background, integrating table tennis with academic writing serves as a case study for embodied interaction through AI. This innovative approach merges playfulness with the productivity demands of academic work, pushing traditional boundaries. Donald Schön's concept of reflective practice [27], involving self-dialogue during an activity, is relevant here, and his ideas of "reflection-in-action" and "reflection-on-action" are particularly meaningful. By engaging in playful, embodied activities like table tennis while doing intellectual work supported by AI, participants continuously reflect and adapt, deepening understanding and yielding innovative outcomes.

3 BOUNCING IDEAS: PINGPONGPT

To explore AI's potential to infuse play into work practices, we integrated a physical game with an AI conversation agent in our study. We transformed a ping-pong table into PingPonGPT with an Arduino-driven sensor system interacting with ChatGPT (see Figure 1 above). Table tennis (an activity previously studied in HCI from a different perspective [19]), chosen for its playfulness, had sensors detecting the ball's position and triggering prompts. Two force sensors placed in each player's zone on the table activated pre-programmed prompts, such as "Be critical about the topic we are currently discussing" As we played and brainstormed, ChatGPT continuously listened to our conversation and joined in as well as responded to these prompts when triggered, ensuring our discussions remained dynamic and intellectually stimulating. The ChatGPT output was shown on the laptop screen and read out loud via external speakers as it was generated. Although our conversation got disrupted or deviated time to time because of turn-taking challenges due to sensor activation and the technical fidelity of our prototype, this did not prevent us from engaging in an inspiring and fruitful conversation through this AI-driven system.

In the PingPonGPT system, hitting the ball intertwined with idea exchange, with each rally enhancing both physical engagement and brainstorming. When the ball landed on designated spots, ChatGPT verbally posed probing questions or new perspectives, integrating the game into our writing workflow. This setup redefined table tennis from a physical activity into a key element of our collaborative intellectual endeavor. During an approximately two-hour pilot session around the theme "Reflective practices with AI", we generated a 25-page transcript [4], later used by a ChatGPT assistant to help craft this paper[1]. PingPonGPT allowed intentional and spontaneous interactions, fostering a continuous feedback loop and demonstrating AI's potential to create engaging, playful work environments. Here we report on our firsthand experience with this system [8], which aims to share impressions and learnings from this non-idiomatic interaction [23].

4 OBSERVATIONS AND INSIGHTS

Our interaction with ChatGPT, while engaging in a physical game of table tennis, yielded rich insights into the dynamics of integrating playfulness with intellectual tasks:

Integration of Physical Play and Intellectual Work: Our experience from the PingPonGPT setup suggested that physical play and intellectual work can be mutually reinforcing. In playing table tennis, we generated ideas and writing prompts inspired by our gameplay, enhancing creativity and dynamism (even after a sleepless night of developing PingPonGPT). This setup challenged the sedentary nature of academic writing, indicating that physical activities can coexist with high mental focus tasks. It also allowed us to express and share our ideas more freely, avoiding the usual constraints of formal, sedentary academic discussions and prolonged screen focus: Author 1 (and the player 1 in our case) noted that while one person was speaking, the other could focus on the ball, creating a dynamic and graceful conversational environment. This engaging method enhanced conversational depth and collaborative synergy while preventing screen fatigue and stifled spontaneity.

Embodied and Playful Experiences: In our experiment, we experienced an intriguing blend of physical and cognitive engagement with our PingPonGPT setup. This approach challenged the conventional work environment, transforming writing into an activity that was both physically invigorating and intellectually stimulating. The physicality of the game, combined with AI-generated

[1] See the transcript of our session here: https://tinyurl.com/httf24transcript

responses, created a multi-sensory experience that was refreshing and thought-provoking. The playful nature of the study enhanced motivation, making the intellectual task of writing more enjoyable. One author noted that using pressure sensors on the table introduced an extra challenge, enhancing the game's fun. This gamified element, requiring us to hit sensors to trigger prompts, kept us motivated and intrigued, fostering heightened engagement and creativity. This approach made the writing process both physically and intellectually exhilarating.

Enhancing Creativity through Random Prompts: Integrating table tennis with ChatGPT added an element of serendipity to the writing process—like the title that comes from a whimsical ChatGPT story about Dr.Ping and Dr.Pong writing a paper while playing table tennis. Random prompts, generated by the ball's position, often led us to think outside the box and fostered creativity. The unpredictability of these prompts encouraged us to explore new ideas and perspectives, breaking free from conventional thought patterns. One author noted that ChatGPT receiving a prompt from the table generated immediate responses, which provided compelling moments for reflection and redirection during the game. These sensor-triggered interruptions prevented us from getting too entrenched in a single line of thought, facilitating a dynamic and adaptive creative process.

AI as a Collaborative Entity: The interaction with ChatGPT evolved from simply receiving information to collaborating with an AI entity. Initially, the AI's responses were generic, but over time, they became more nuanced, showcasing its potential as a creative partner. One of the authors noted the extended interaction duration due to the game, which allowed the AI to provide more tailored and interesting responses as the conversation deepened. Additionally, the engagement with PingPonGPT kept us involved in the creative process for a longer time than traditional writing methods would. One author emphasized that without the game component, the prolonged and enriched interaction with the AI would not have been possible, highlighting that the experiment has potential for further exploration of AI-enhanced embodied play for more enjoyable work environments. By transforming from a mere information source to a dynamic collaborator, ChatGPT significantly enriched the creative process.

5 DISCUSSION

Our exploration with PingPonGPT reveals a broad spectrum of insights connecting physical play, intellectual tasks, and AI-driven reflective practices. This experiment demonstrates that the integration of physical activities with intellectual efforts has potential to foster engagement and creativity within the work environment. However, it also highlights several critical reflections about the feasibility, cognitive load, and the balance required for effectively harnessing such hybrid systems.

5.1 Engagement and Creativity Boosted through AI-Supported Embodied Play

The physical act of playing table tennis while engaging in academic writing introduced a unique form of embodied cognition. This interplay between a dynamic physical activity and a reflective intellectual task leveraged multiple sensory modalities, the joint action of mind and body, and random input for serendipity, thereby fostering a richer creative process [25]. Previous studies substantiate that engaging in physical activities can stimulate cognitive functions, such as concentration, memory, and problem-solving skills [24, 26]. Our findings align with this, as we experienced a comfortable flow of creative ideas, facilitated by the spontaneous prompts generated through gameplay, which broke conventional thought patterns and led to fresh perspectives.

5.2 Balancing Intellectual and Physical Demands

Integrating pressure sensors with varying sensitivity into the table could enhance interaction, feedback, and input while writing a paper. For example, light ball taps could signal to ChatGPT or the other player which topic or section to discuss or ideate on, without displaying visual content. While the study underscores the potential for synergy between physical activity and intellectual work, it also exposes inherent challenges. The primary concern revolves around cognitive load and the risk of fragmentation of thought processes. Writing an academic paper demands deep, sustained focus and critical thinking. Simultaneously playing a high-energy game like table tennis potentially disrupts this flow, that might lead to to cognitive overload and a decrease in overall productivity when diverse conditions and different cognitive abilities of different people are taken into account [29].

5.3 Critical Evaluation of Reflective Practices with PingPonGPT

Donald Schön's ideas on reflective practice—"reflection-in-action" and "reflection-on-action"—offer an apt framework for examining this study's outcomes [28]. Engaging in PingPonGPT allowed for real-time reflection ("reflection-in-action"), where the prompts during play provided immediate feedback and encouraged ongoing adaptation. This setup also facilitated post-session reflection ("reflection-on-action"), where the dynamic interplay between play and work offered a space for "inquiry" [2] where we reviewed and enhanced our understanding of both academic writing and physical play. From a slow technology point of view, PingPonGPT might be considered as a piece of reflective design that amplifies time, extending the duration of interaction with ChatGPT through a physical and spatial structure based on repetitive and gradual steps [13].

However, a crucial critical observation is the potential for interruptions to stifle deep reflective processes due to the disjointed nature of frequent prompts. Initial interactions with pre-defined prompts were mundane and slightly disruptive to the creative flow. Over time, as the context evolved, even repetitive prompts began to yield meaningful dialogue. Through the dimensions of reflective informatics, these disruptions might be interpreted as "breakdowns" that marks moments for reflection [2]. It became evident that the quality and relevance of these AI-generated prompts critically influenced the overall quality of the reflective practice. This paper is an artefact of what such engagement with PingPonGPT, and with other similar playful systems, might produce in one session of play and writing. However, iterating on this by feeding our current work into the system and continuing our collaboration with PingPonGPT

over a longer period (e.g., weeks or months) would most probably produce a paper that engaged more deeply with the topic and resulted in a higher quality outcome.

5.4 AI and More-Than-Human Ways of Writing

Our study also highlighted transformative potentials for AI as a collaborative entity in intellectual tasks. Initially, the AI's responses were generic, but as the session progressed, and deeper engagement ensued, the AI's contributions became more nuanced and contextually relevant. This evolution underscores AI's potential as a dynamic partner in the creative process [7] when allowed to engage fully, building on previous work which used ChatGPT for producing academic papers in limited time [4]. While ChatGPT as a non-human actant in this setup reduces human players' control over the ideation and writing process, this might result in fruitful creative thinking as it offers a sort of balance between structural connectedness (ordered thinking) and imaginative divergence (chaotic thinking) [10]. An intriguing aspect of PingPonGPT is that it comprises two completely different spheres of activities/realities but still produces a meaningful outcome in both (i.e., having a ping pong match and producing a draft paper), which indicates a possible use of GenAI for sublime, almost magical cross-reality work experiences [5].

Nevertheless, integrating AI prompts into an interactive physical environment raises substantial questions about the balance between assistance and disruption. Poorly timed or excessive prompts could become intrusive rather than constructive, highlighting the need for systems that are context-aware and capable of providing adaptive and personalized prompts [20]. For example, PingPonGPT resulted in a fruitful conversational interaction by voice, but turn-taking appeared as a challenge because ChatGPT's responses were getting interrupted by the ball hitting on the sensors. This created some frustration on our side at times (especially when wanted to hear more about an aspect ChatGPT was talking about) and disruption in the conversation flow, which is something that we plan to address in the next iteration of the prototype.

6 CONCLUSION

This study illustrates AI's potential to transform traditional writing methods by integrating physical play with intellectual work. Our PingPonGPT setup demonstrates how AI can enhance creativity, engagement, and reflective practices through non-verbal communication and coordinated movement. By merging table tennis with academic writing, we showed that AI-driven environments can revitalize work processes, making them more dynamic and enjoyable.

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REFERENCES

[1] Patrick Bateson and Paul Martin. 2013. *Play, Playfulness, Creativity and Innovation.* Cambridge University Press.

[2] Eric P.S. Baumer. 2015. Reflective Informatics: Conceptual Dimensions for Designing Technologies of Reflection. In *Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems (CHI '15).* Association for Computing Machinery, New York, NY, USA, 585–594. https://doi.org/10.1145/2702123.2702234

[3] Ahmet Börütecene and Eleanor Alexandra Byrne. 2023. QuillGPT: Embodied Interaction with ChatGPT. https://vimeo.com/883962406. Presented at the Data-Centric Design Symposium at Delft University, 7 December 2023.

[4] Oğuz 'Oz' Buruk. 2023. Academic Writing with GPT-3.5 (ChatGPT): Reflections on Practices, Efficacy and Transparency. In *Proceedings of the 26th International Academic Mindtrek Conference* (<conf-loc>, <city>Tampere</city>, <country>Finland</country>, </conf-loc>) *(Mindtrek '23).* Association for Computing Machinery, New York, NY, USA, 144–153. https://doi.org/10.1145/3616961.3616992

[5] Lung-Pan Cheng, Sebastian Marwecki, and Patrick Baudisch. 2017. Mutual Human Actuation. In *Proceedings of the 30th Annual ACM Symposium on User Interface Software and Technology (UIST '17).* Association for Computing Machinery, New York, NY, USA, 797–805. https://doi.org/10.1145/3126594.3126667

[6] Kory Lawson Ching. 2023. The uses—and limits—of distraction-free writing. *Computers and Composition* 69 (2023), 102793.

[7] Paul Coulton and Joseph Galen Lindley. 2019. More-Than Human Centred Design: Considering Other Things. *The Design Journal* 22, 4 (July 2019), 463–481. https://doi.org/10.1080/14606925.2019.1614320 Publisher: Routledge _eprint: https://doi.org/10.1080/14606925.2019.1614320.

[8] Audrey Desjardins, Oscar Tomico, Andrés Lucero, Marta E. Cecchinato, and Carman Neustaedter. 2021. Introduction to the Special Issue on First-Person Methods in HCI. *ACM Transactions on Computer-Human Interaction* 28, 6 (Dec. 2021), 37:1–37:12. https://doi.org/10.1145/3492342

[9] Jacquelyn Elizabeth Hoermann Elliott. 2018. *Writers Get Physical: A Grounded Theory Study to Understand the Relationship between Writing Activity and Physical Activity.* Texas Christian University.

[10] Ronald A. Finke. 1996. Imagery, Creativity, and Emergent Structure. *Consciousness and Cognition* 5, 3 (Sept. 1996), 381–393. https://doi.org/10.1006/ccog.1996.0024

[11] Rodica Frentiu. 2023. *Japanese Calligraphy as a Way to Make the Invisible Visible* (1st edition ed.). Cambridge Scholars Publishing.

[12] Stephen J Goldberg. 2004. The primacy of gesture: Phenomenology and the art of Chinese calligraphy. In *Metamorphosis: Creative imagination in fine arts between life-projects and human aesthetic aspirations.* Springer, 175–186.

[13] Lars Hallnäs and Johan Redström. 2001. Slow Technology – Designing for Reflection. *Personal and Ubiquitous Computing* 5, 3 (Aug. 2001), 201–212. https://doi.org/10.1007/PL00000019

[14] Kristina Höök. 2018. *Designing with the Body: Somaesthetic Interaction Design.* The MIT Press. https://doi.org/10.7551/mitpress/11481.001.0001

[15] J. Huizinga. 1950. *Homo ludens, a study of the play-element in culture.* Roy, Oxford, England. Pages: 220.

[16] Ruyu Hung. 2024. Self-Cultivation through Art: Chinese Calligraphy and the Body. *Educational Philosophy and Theory* 56, 7 (June 2024), 621–625. https://doi.org/10.1080/00131857.2021.1977624

[17] Kai Huotari and Juho Hamari. 2012. Defining Gamification: A Service Marketing Perspective. In *Proceeding of the 16th International Academic MindTrek Conference (MindTrek '12).* Association for Computing Machinery, New York, NY, USA, 17–22. https://doi.org/10.1145/2393132.2393137

[18] Kristina Höök and Jonas Löwgren. 2021. Characterizing Interaction Design by Its Ideals: A Discipline in Transition. *She Ji: The Journal of Design, Economics, and Innovation* 7, 1 (2021), 24–40. https://doi.org/10.1016/j.sheji.2020.12.001

[19] Hiroshi Ishii, Craig Wisneski, Julian Orbanes, Ben Chun, and Joe Paradiso. 1999. PingPongPlus: design of an athletic-tangible interface for computer-supported cooperative play. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems (CHI '99).* Association for Computing Machinery, New York, NY, USA, 394–401. https://doi.org/10.1145/302979.303115

[20] Max Kreminski and John Joon Young Chung. 2024-03-18/2024-03-21. Intent Elicitation in Mixed-Initiative Co-Creativity. In *Joint Proceedings of the ACM IUI Workshops 2024.* Greenville, South Carolina, USA.

[21] Mina Lee, Katy Ilonka Gero, John Joon Young Chung, Simon Buckingham Shum, Vipul Raheja, Hua Shen, Subhashini Venugopalan, Thiemo Wambsganss, David Zhou, Emad A. Alghamdi, Tal August, Avinash Bhat, Madiha Zahrah Choksi, Senjuti Dutta, Jin L.C. Guo, Md Naimul Hoque, Yewon Kim, Simon Knight, Seyed Parsa Neshaei, Antonette Shibani, Disha Shrivastava, Lila Shroff, Agnia Sergeyuk, Jessi Stark, Sarah Sterman, Sitong Wang, Antoine Bosselut, Daniel Buschek, Joseph Chee Chang, Sherol Chen, Max Kreminski, Joonsuk Park, Roy Pea, Eugenia Ha Rim Rho, Zejiang Shen, and Pao Siangliulue. 2024. A Design Space for Intelligent and Interactive Writing Assistants. In *Proceedings of the CHI Conference on Human Factors in Computing Systems (CHI '24).* Association for Computing Machinery, New York, NY, USA, 1–35. https://doi.org/10.1145/3613904.3642697

[22] Ming-I Brandon Lin and Yu-Ping Huang. 2017. The impact of walking while using a smartphone on pedestrians' awareness of roadside events. *Accident Analysis & Prevention* 101 (2017), 87–96.

[23] Jonas Löwgren. 2016. On the Significance of Making in Interaction Design Research. *Interactions* 23, 3 (April 2016), 26–33. https://doi.org/10.1145/2904376
[24] Christopher R. Madan and Anthony Singhal. 2012. Using actions to enhance memory: effects of enactment, gestures, and exercise on human memory. *Frontiers in Psychology* 3 (Nov. 2012). https://doi.org/10.3389/fpsyg.2012.00507 Publisher: Frontiers.
[25] Maarit Mäkelä. 2016. Personal Exploration: Serendipity and Intentionality as Altering Positions in a Creative Process. *FormAkademisk* 9, 1 (June 2016). https://doi.org/10.7577/formakademisk.1461
[26] Christian Rominger, Andreas Fink, Bernhard Weber, Ilona Papousek, and Andreas R. Schwerdtfeger. 2020. Everyday bodily movement is associated with creativity independently from active positive affect: a Bayesian mediation analysis approach. *Scientific Reports* 10, 1 (July 2020), 11985. https://doi.org/10.1038/s41598-020-68632-9 Publisher: Nature Publishing Group.
[27] Donald A Schön. 2003. *The Reflective Practitioner: How Professionals Think in Action.* Ashgate, Aldershot.
[28] Donald A Schon and Vincent DeSanctis. 1986. The reflective practitioner: How professionals think in action.
[29] Stoo Sepp, Steven J Howard, Sharon Tindall-Ford, Shirley Agostinho, and Fred Paas. 2019. Cognitive load theory and human movement: Towards an integrated model of working memory. *Educational Psychology Review* 31 (2019), 293–317.
[30] Tianyu Wang, Giuseppe Cardone, Antonio Corradi, Lorenzo Torresani, and Andrew T Campbell. 2012. Walksafe: a pedestrian safety app for mobile phone users who walk and talk while crossing roads. In *Proceedings of the twelfth workshop on mobile computing systems & applications*. 1–6.
[31] Yanning Wang. 2017. Gendering the Planchette: Female Writer Qian Xi's (1872–1930) Spiritual World. *Journal of Chinese Literature and Culture* 4, 1 (2017), 160–179.
[32] Daijin Yang, Erica Kleinman, Giovanni Maria Troiano, Elina Tochilnikova, and Casper Harteveld. 2024. Snake Story: Exploring Game Mechanics for Mixed-initiative Co-creative Storytelling Games. In *Proceedings of the 19th International Conference on the Foundations of Digital Games (FDG '24)*. Association for Computing Machinery, New York, NY, USA, 1–11. https://doi.org/10.1145/3649921.3649996