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PidgeyPost: A Gamified Maze Task for Online Experimental Research in Second Language Acquisition

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Abstract

Experimental tasks used in Second Language Acquisition (SLA) research can be repetitive and cognitively demanding, particularly in online data collection contexts where maintaining participant engagement can be challenging. This interactivity paper presents *PidgeyPost*, a gamified design of the Maze task, which is a well-established self-paced reading task in psycholinguistics and SLA research. We present this alongside a traditional, non-gamified version for comparative demonstration. The prototype enables attendees to directly compare traditional and gamified task experiences while exploring the design trade-offs involved in balancing playful interaction with psycholinguistic data collection. By situating *PidgeyPost* within existing experimental workflows, this work contributes to ongoing discussions surrounding gamification, participant experience, and the design of gamified experimental systems for research contexts.

CCS Concepts

• **Human-centered computing** → **User centered design**.

Keywords

Game Design, Gamification, Experimental Design, Second Language Acquisition, User Experience

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1 Introduction

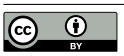
Gamification and game design have been extensively explored within Second Language Acquisition (SLA), particularly in relation to learner motivation [3], linguistic learning outcomes [7, 22, 34], and self-regulated learning behaviours [21, 26]. Beyond language learning contexts, gamification has also been investigated as a means of supporting participation and engagement during cognitive experiments and data collection [8, 16, 24]. Comparatively little work has explored the role of game design within experimental SLA research, particularly in studies investigating the cognitive processing and mental representations underlying second language acquisition.

Experimental SLA studies are commonly administered to both native speakers and second language learners of the target language, depending on the research question under investigation. Participant recruitment often involves stricter inclusion criteria than studies involving monolingual populations, including specific language proficiency levels, language backgrounds, and learning histories. Consequently, online data collection has become increasingly attractive as it enables researchers to recruit participants from wider geographical areas and access populations that may be difficult to reach through laboratory-based studies alone [9, 12]. However, online participation can also introduce challenges relating to participant engagement, attention, and task completion [1]. Furthermore, participant populations in SLA research can be highly diverse, varying in age, educational background, linguistic proficiency, prior experience with experimental studies [35, 38]. These factors make participant experience an important consideration when designing and deploying online experimental tasks.

Because experimental SLA research frequently employs within-subject designs, participants must typically complete a large number of trials to ensure adequate statistical power [11, 37]. For instance, the Maze Task experiment in Rami et al. [31] required 96 trials and lasted approximately 20 minutes per participant—a duration that excludes additional tasks such as language proficiency testing, demographic questionnaires, and complementary experimental paradigms. Consequently, SLA experimental tasks are often repetitive, cognitively demanding, and highly controlled in order to produce reliable behavioural data.

Prior research has suggested that gamification can improve participant engagement and motivation in both educational and experimental contexts [8, 16, 24], making it a promising approach for addressing the overall participant experience. While there are experimental platforms that have introduced limited support for gamified interaction (e.g. Gorilla [2]), many existing systems either impose technical barriers to entry or place the burden of designing gamified experiences onto researchers with limited expertise in game design. This creates challenges for SLA researchers interested in exploring playful approaches to experimental design while maintaining compatibility with existing research workflows and methodological constraints.

This interactivity paper presents a Unity-based [40] applied game, *PidgeyPost*, that allows researchers to deploy both a gamified and traditional implementation of the Maze task, a widely used self-paced reading task in psycholinguistics and SLA research. The design and development were informed through a collaboration between researchers in Human-Computer Interaction (HCI) and SLA.



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The first author brings experience in gamification, game design, and psycholinguistic SLA research, the second author contributes expertise in psycholinguistic experimentation in SLA, and the third author contributes expertise in HCI research and interactive system design. By approaching the Maze task from a combined gamification and psycholinguistic perspective, this work explores how gameful elements can reshape participant experience while preserving the experimental task itself.

This interactivity paper contributes:

(1) An open-source research tool that can run gamified and traditional versions of a self-paced reading paradigm - the Maze task - for web-based SLA research.
(2) A side-by-side comparison between traditional and gamified experimental experiences, enabling discussion surrounding the benefits, limitations, and ethical considerations of incorporating game design into experimental SLA research.
(3) A deployable Unity-based system with a low technical barrier to entry that can be integrated into existing web-based research workflows for SLA experiments.

2 Background

2.1 Gamification & Game Design in SLA

Research on gamification in SLA has predominantly examined language learning and educational contexts, particularly the use of game elements to support learner engagement and motivation [4, 10, 39, 42]. Existing work has also investigated the impact of gamification on learning gains and learner performance, particularly within foreign language education [3, 7, 22]. These approaches have been implemented in both classroom-based learning environments [5, 18, 25] and app-based language learning platforms [27, 28], including commercial systems such as Duolingo [15, 20, 29]. However, comparatively little work has explored how game design may be applied within psycholinguistic experimentation and behavioural data collection in SLA research.

Although limited, some recent work has begun exploring gamified experimental tasks within psycholinguistic contexts. Wei et al. [41] compared non-gamified and gamified versions of a picture-word interference (PWI) task framed as a "Whack-A-Mole" game to investigate linguistic processes during word retrieval. Their findings suggested that, while introducing gamified elements resulted in some trade-offs between speed and accuracy, the underlying linguistic findings remained robust. Building upon this work, Hu et al. [16] used the same Whack-A-Mole framework to investigate the effects of reward structures and game difficulty across multiple cognitive tasks. They found that speed-accuracy trade-offs primarily emerged during more difficult tasks, while some reward conditions encouraged participants to maintain accuracy rather than sacrifice it for speed. While these studies were situated within monolingual psycholinguistic research rather than SLA specifically, they provide valuable insight into how gameful framing may influence participant behaviour, engagement, and experimental performance in language-related cognitive tasks. Many psycholinguistic tasks are shared across monolingual and SLA research contexts, making these findings particularly relevant when considering the design of gamified experimental systems for SLA research.

Experimental SLA research increasingly relies on digital tools for web-based data collection and participant management. Platforms such as PCIbex [33], PsyToolkit [36], Gorilla [2], OpenSesame [23], and Qualtrics [30, 35] are commonly used to deploy psycholinguistic, SLA experiments online. These systems vary in timing precision, audiovisual support, usability, and platform compatibility [19], with researchers often selecting tools based on experimental complexity, deployment requirements, and technical expertise. While these platforms provide accessible infrastructures for online experimentation, support for more elaborate game interaction design remains limited. Some systems allow limited multimedia integration or lightweight gamification features, while more complex gamified systems often require substantial programming or game development expertise. As a result, researchers interested in exploring playful approaches to experimentation may face technical and design barriers when integrating gamified experiments into existing online research workflows.

2.2 The Maze Task

The Maze task (Figures 1– 2) is a self-paced reading task commonly used in psycholinguistics and SLA research to investigate real-time language processing during sentence comprehension [11]. Participants are presented with sentences incrementally and must select the correct continuation from two simultaneously displayed options. One option represents the intended continuation of the sentence (the "target" word) while the other acts as a distractor. Reaction times between participant responses are recorded in order to investigate processing difficulty during sentence comprehension. Unlike more passive reading tasks, the Maze task requires participants to actively commit to interpretations throughout sentence progression [11]. Incorrect selections abruptly terminate the current sentence, providing participants with immediate correctness feedback throughout the task. An exception arises when participants make an incorrect selection on the final word of a sentence. In this case, participants receive no feedback on whether they have successfully completed the trial as the trial would end at this stage regardless of the input.

There are two common forms of the Maze task: the L-maze and the G-maze [11]. In the L-maze, participants choose between the target word and a non-word. In the G-maze, participants choose between the target word and a grammatically incompatible distractor. Both the traditional and gamified versions presented in this demo use the G-maze format.

Although the Maze task is not traditionally framed as a game, the interaction structure contains several game-like characteristics. Participants progress incrementally through sequential decision-making challenges, receive immediate implicit feedback on correctness (in that the trial terminates when they make a mistake), and engage in rapid interaction loops throughout sentence processing. These characteristics make the task particularly suitable for a gameful reinterpretation while preserving the underlying experimental structure.

This demo includes both a traditional and gamified implementation of the Maze task. The traditional implementation preserves the conventional presentation commonly used in online psycholinguistic studies. Participants progress through sentences using keyboard

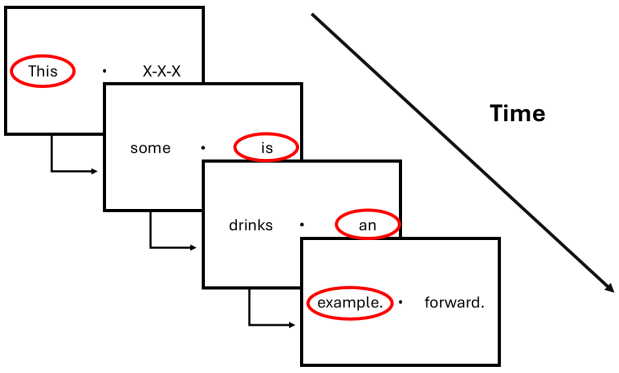


Figure 1: An example of a trial sentence in a Maze task.

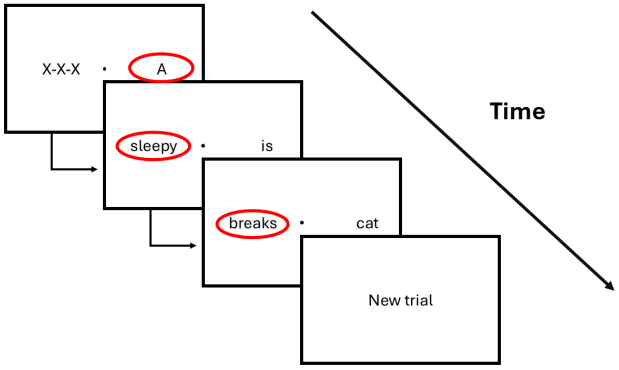


Figure 2: A maze task trial where the participant has made a mistake, causing the task to move onto a new trial.

inputs until they either complete the sentence or select an incorrect response. Optional comprehension questions appear intermittently throughout the procedure. Presenting the traditional and gamified versions side-by-side allows attendees to directly compare different approaches to framing the same experimental interaction. Figure 3 illustrates the interaction flow in the gamified version of the task.

3 Design and Prototype of a Gamified Maze Task

A central design consideration involved balancing participant engagement with experimental control. Previous work has highlighted tensions between gameful interaction and data validity in research contexts [13, 14]. To minimise potential interference with sentence processing and reaction time measurements, no additional mechanics were introduced during Maze task trials themselves; participants completed the same actions as they would in the traditional version of the task. Game elements were positioned before and after each trial, allowing the core experimental interaction to remain unchanged. Figure 4 illustrates how the gameplay loop was built around the existing structure of the task.

The design process was iterative and informed by ongoing playtesting throughout development. Design decisions were regularly reviewed by the research team to identify potential sources of distraction, cognitive load, or unintended gameplay strategies. The prototype was also informed by a previous codesign study with SLA researchers exploring opportunities and concerns surrounding the gamification of experimental tasks (to be reported separately). Insights from these discussions reinforced the importance of preserving the underlying experimental procedure while allowing game elements to provide context and motivation around the task.

In *PidgeyPost*, participants assume the role of a courier pigeon delivering letters throughout a small neighbourhood environment. The experience begins with a short comic sequence depicting the pigeon being caught in a storm, causing letters to become torn and scattered throughout the neighbourhood (Figure 6). Participants are tasked with locating these damaged letters, repairing them by completing Maze task trials, and delivering them to nearby mailboxes. The courier theme was selected because it provides a narrative explanation for reconstructing fragmented sentences while remaining sufficiently flexible to be adapted to different languages and research contexts. Participants navigate the environment using either WASD or arrow-key controls, interact with objects using the space bar, and progress dialogue through mouse clicks. The inclusion of arrow-key controls was informed by playtesting, where participants with limited gaming experience reported greater familiarity with this control scheme. When participants interact with a damaged letter, they are presented with instructions framed as part of the game narrative before beginning the Maze task. The presentation of stimuli, timing procedures, and response options during the Maze task itself remain identical to those used in the traditional condition.

3.1 Game features

Several game features were introduced to support narrative framing and provide feedback without substantially increasing task complexity. The visual presentation adopts a simple 2D pixel-art style featuring the pigeon protagonist, damaged and repaired letters, neighbourhood environments, and mailboxes (Figures 5–8). A 2D presentation was selected to minimise visual complexity, reduce computational demands for browser deployment, and create a smoother transition between the game world and the comparatively minimal Maze task interface.

Feedback mechanisms were designed to build upon those already present in the traditional Maze task. While incorrect responses continue to terminate the current sentence immediately, participants now receive a visibly damaged letter rather than a fully repaired one. Correct responses result in a repaired, sparkling letter. In both cases, participants continue the delivery process, ensuring that mistakes provide meaningful feedback without interrupting progression. During tutorial trials, additional dialogue from the pigeon explains these outcomes and reassures participants that making mistakes will not prevent them from completing the task. After all deliveries have been completed, participants receive further feedback through a games of how many letters were repaired successfully and how many remained damaged. This design was intended to support feelings of accomplishment and competence [32] while avoiding the introduction of performance information during the task itself, which could influence participant behaviour and encourage speed-accuracy trade-offs.

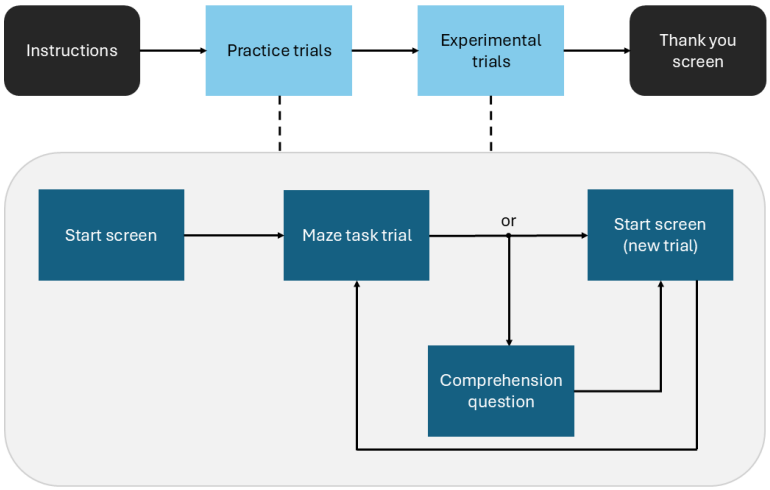


Figure 3: Interaction flow for the traditional version of the Maze task.

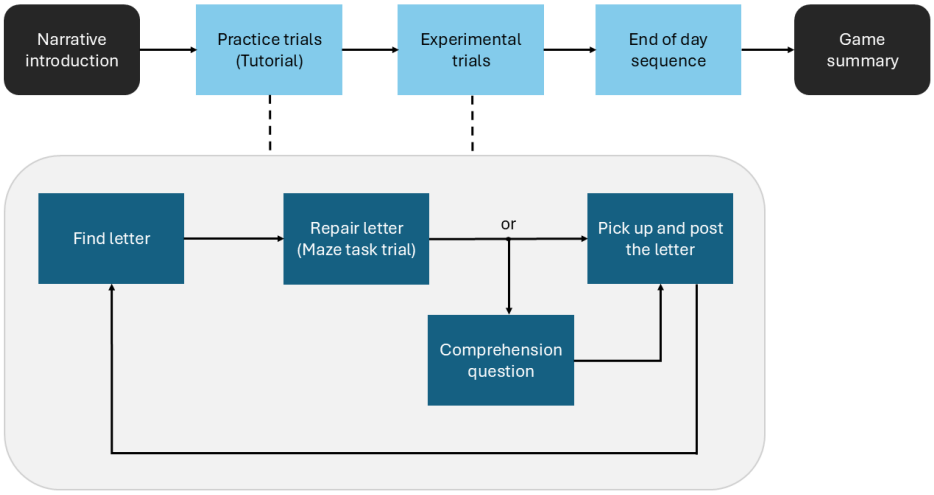


Figure 4: Interaction flow for the gamified version of the Maze task.

To reduce unnecessary cognitive demands, several interface elements were included to support navigation and game awareness. After collecting a letter, an icon appears to indicate that participants have completed the current Maze task, while an on-screen arrow continuously guides them towards their next destination. These features were introduced to minimise navigational uncertainty and potentially reduce frustration.

Finally, audio was incorporated to enhance atmosphere and reinforce player actions. Sound effects accompany dialogue, letter collection, letter repair, letter delivery, and character movement, while background music and environmental sounds help establish the game world and enhance the overall experience [6]. However, all audio ceases once participants enter a Maze task trial in order to minimise distractions during sentence processing. Several sound effects also serve a functional purpose by providing immediate confirmation that an interaction has been successfully completed, regardless of a participant's prior familiarity with digital games.

4 Web-Based Deployment and Qualtrics Integration

We designed both the traditional and gamified task for integration within Qualtrics, a survey platform commonly used in online linguistics research. Maze tasks are frequently administered alongside participant recruitment procedures, demographic questionnaires, consent forms, and additional linguistic measures (e.g. acceptability judgement tasks) [17]. Embedding the prototype within Qualtrics therefore allows the gamified and traditional tasks to operate within

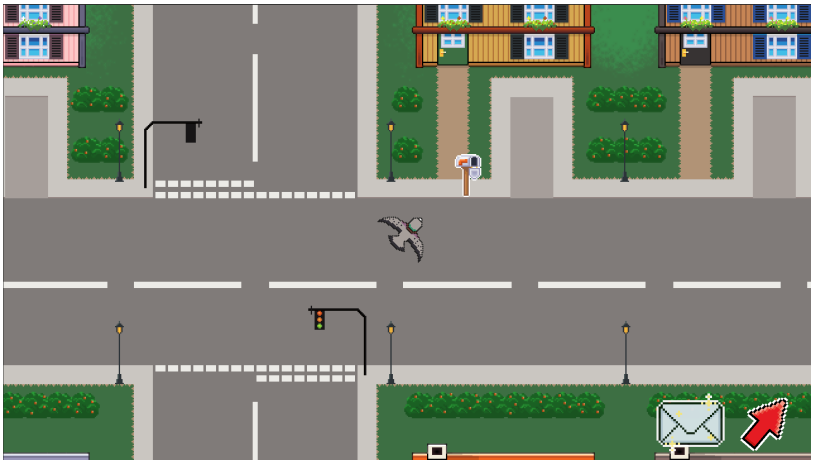


Figure 5: Screenshot of gameplay during the gamified Maze task.



Figure 6: A comic panel depicting the narrative for the gamified condition.

established online research practice rather than as a stand-alone application.

The prototype was developed using the Unity engine and exported as a WebGL application for browser-based deployment. During the Maze task trials, the application records participant reaction times between key presses, incorrect selections within sentence regions, and responses to any comprehension questions included in the study. Experimental stimuli are loaded through external CSV files, allowing researchers to replace sentence sets without modifying the underlying game logic or interface design. This should increase the usability for researchers who may be unfamiliar with the Unity engine.

Communication between Qualtrics and the Unity WebGL build was implemented using custom JavaScript and embedded variables within Qualtrics. This allows participant identifiers and experimental data to be transferred between systems and aggregated alongside additional survey responses collected within Qualtrics, such as demographic data and responses to other survey questions. The WebGL build is currently hosted through itch.io using private and unlisted deployment settings. For ease of use, we have provided detailed operational instructions describing how researchers can configure experimental materials, modify stimuli files, and deploy the task within their own Qualtrics studies. This can be found on the demo's Github page[1].

5 Future work & Limitations

Future work will investigate the impact of gamification on both participant experience and experimental data quality. Planned studies will compare the traditional and gamified versions of the Maze task across measures including participant experience, perceived task load, fatigue, motivation, task completion behaviour, and reaction-time consistency. These evaluations will help determine whether gameful framing influences participant engagement while maintaining the validity of the behavioural measures collected.

Although the Unity-based system was informed by design requirements identified through collaboration with SLA researchers,

[1]https://github.com/pawlyglot/pidgey-post

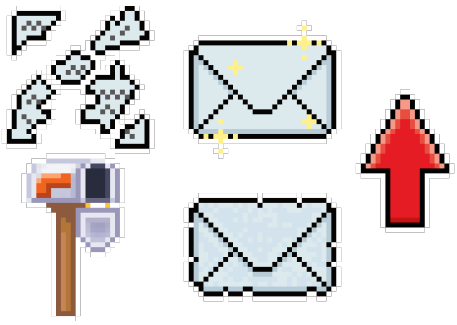


Figure 7: 2D Pixel art assets involved in the game.



Figure 8: Sprites of the player character.

the usability of the system to create Maze tasks has not yet been tested with people outside of the research team. Additional user testing is therefore needed to assess whether the process of creating, configuring, and deploying Maze tasks within the experiment builder is intuitive, accessible, and suitable for researchers with varying levels of technical expertise.

Finally, the current demonstration focuses exclusively on a G-maze implementation. The narrative framing of *PidgeyPost* is closely tied to the idea of reconstructing damaged sentences, making the task a natural fit for G-maze stimuli. It remains unclear whether the same narrative and gameplay structure would translate as effectively to L-maze tasks, where participants select between words and non-words. Future iterations of the prototype may, therefore, explore the feasibility of adapting the system to support L-maze stimuli while preserving the coherence of the game experience.

6 Conclusion

This interactivity paper presented *PidgeyPost*, a gamified implementation of the Maze task designed for online Second Language Acquisition research, alongside a traditional non-gamified version for comparative demonstration. By embedding narrative framing, audiovisual feedback, and lightweight gameplay interactions around a conventional psycholinguistic paradigm, the system explores how game design can reshape participant experiences of experimental research while preserving the core interaction structure required for behavioural data collection.

Through its integration with Qualtrics using browser-based Unity WebGL builds, the prototype also demonstrates how gamified experimental tasks can remain compatible with existing online research workflows and infrastructures. By presenting both versions of the task side-by-side, the demo invites discussion around the opportunities, challenges, and trade-offs involved in introducing game design into tightly controlled experimental settings.

More broadly, this work contributes to growing conversations at the intersection of games, HCI, and behavioural research by demonstrating how playful interaction design may support new ways of engaging participants in cognitive experiments. We hope the demo encourages further collaboration between game designers, HCI researchers, and SLA researchers exploring the future of gamified experimental methods.

Acknowledgments

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