The Effects of Delay on Game Actions: Moving Target Selection with a Mouse
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Abstract
- User input in computer games is affected by local systems, networks and servers and can create a negative impact on player performance and quality of experience

- Problem: Unaware of how to quantify impact of delay on specific player actions when a delay is present

- Proposed Solution: User study created to gather data using a range of delay and game conditions for selecting a moving target with a mouse

- Result: Derived an analytic model to understand and compensate for delay in games and interactive applications

Methodology
- Short demographic survey
- The game and incentive options were described
- Two practice rounds
- 5 iterations of all shuffled combinations of delay & puck speed (Table 1 and Table 2)
- One QoE question for each delay-speed combination
- One forced pause every 30 rounds

Results
- Figure 4: Player performance – Hit time versus delay, grouped by puck speed.
- Figure 5: Player performance – Hit time versus speed, grouped by added delay.

Conclusion
- Increase in the time it takes to select a moving target for all delays
- A sharper increase in time taken is measured for higher delays and fast targets
- Subjective opinions show that users are sensitive to modest amounts of delay
- Analytic model derived to provide a fit for the mean time to select a moving target using terms for delay and interaction

Future Work
- Models and analysis for mouse clicks and quality of experience
- Study target selection with a wider range of speeds and screen sizes
- Study different types of physical delay within other forms of player input involving target selection

Moving Target Selection
- Selecting a moving target with a mouse is common to many PC games
- Most notably, the popular first person shooter (FPS) genre (e.g., Call of Duty, Activision, 2003) has moving target selection with the mouse as the primary method of aiming and shooting
- Likewise, the newer multiplayer online battle arena (MOBA) genre (e.g., League of Legends, Riot Games, 2009) uses moving target selection with a mouse for casting spells

Measuring Base Delay
- A bread board with an led was connected via a wire soldered to a mouse
- A high frame rate camera (a Casio EX-ZR200) filmed the player clicking on the QoE prompt
- The frame number when the light appeared with the button click is subtracted from the frame number when the QoE prompt shows the input, giving the base delay.

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\text{Base system delay} = \text{frame with input and light displayed} - \text{frame with light and without input}
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