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Gray screens and loading delays cut gaming time by 30%

Japanese researchers find small design changes can brake excessive gaming in a global study of 80,000 players, call for design-led action to create healthier digital environments.

Fukuoka, Japan—You know it's time to put your phone down, but your thumb finds "Play Again" once more.

In an age where digital entertainment never sleeps, willpower alone isn't enough. As more players, especially the younger generations, face physical and mental health challenges from excessive gaming, ethical design that prioritizes human well-being during development has become more urgent.

A study from Kyushu University, published in the *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies*, shows that small design choices can help users naturally reduce their usage. Simple changes like grayscale or a few seconds of waiting can make a significant difference.

"The digital content industry has spent years building 'accelerators' to keep people engaged," says Yugo Nakamura, Assistant Professor at Kyushu University's Faculty of Information Science and Electrical Engineering and the paper's first author. "But technology also needs 'brakes' that support healthier habits, and we wanted to explore a gentle way to help players take breaks."

Nakamura's team conducted a month-long global experiment involving over 80,000 players of *Flying Gorilla*, a popular endless runner mobile game with around 200,000 active users worldwide. They introduced two design changes: a loading delay of 1, 5, or 10 seconds between rounds and a shift from full color to grayscale, testing either separately or in combination.

The results show that both ideas reduced how long and how often people play, with stronger interventions leading to greater declines. A one-second loading delay had little impact, but extending the wait to 10 seconds significantly reduced daily playtime and led to a steady drop in retention over two weeks. Switching the display to monochrome was even more effective.

Moreover, the combination of grayscale plus a 10-second delay proved most powerful, cutting average daily playtime by 30.8% compared to baseline. After a week, the number of people who kept returning to the game fell by 40.4%.

"A few seconds of waiting creates a mental pause," Nakamura explains. "When that pause is paired with reduced visual stimulation, players can step out of the flow more easily."

Researchers also observed regional differences. North America, Europe, and East Asia saw stronger reductions, while South America and West Asia showed more limited change. The team suggests this may be linked to the proportion of high-frequency players, who tend to be most affected by the changes.

The team hopes these findings will translate into real-world practice. Game developers could, for example, activate grayscale mode late at night or add friction after long sessions. This approach nudges without forcing, striking a balance between respecting user autonomy and gently discouraging excess.

"This doesn't have to hurt profits," Nakamura adds. "Those extra loading seconds could carry ads that monetize the pause. And with the right content, encouraging users to stretch or go outside, that gap can even become an opportunity for behavioral redirection." The same logic, he notes, extends to social media and video platforms, and that is where his team is headed. They will further advance their research on digital content consumption and contribute to shaping healthier online environments.

"Think of it like food," he adds. "Those of us who grew up before smartphones still remember what lower-stimulation information tasted like. But today's kids have only ever known high-calorie, intensely flavored content. They may never develop a taste for anything milder. If content providers consciously build in quieter, lower-stimulation experiences, it might help users rediscover what a balanced information diet feels like."

About Kyushu University
Founded in 1911, Kyushu University is one of Japan's leading research-oriented institutions of higher education, consistently ranking as one of the top ten Japanese universities in the Times Higher Education World University Rankings and the QS World Rankings. Located in Fukuoka, on the island of Kyushu—the most southwestern of Japan's four main islands—Kyushu U sits in a coastal metropolis frequently ranked among the world's most livable cities and historically known as Japan's gateway to Asia. Its multiple campuses are home to around 19,000 students and 8,000 faculty and staff. Through its VISION 2030, Kyushu U will "drive social change with integrative knowledge." By fusing the spectrum of knowledge, from the humanities and arts to engineering and medical sciences, Kyushu U will strengthen its research in the key areas of decarbonization, medicine and health, and environment and food, to tackle society's most pressing issues.
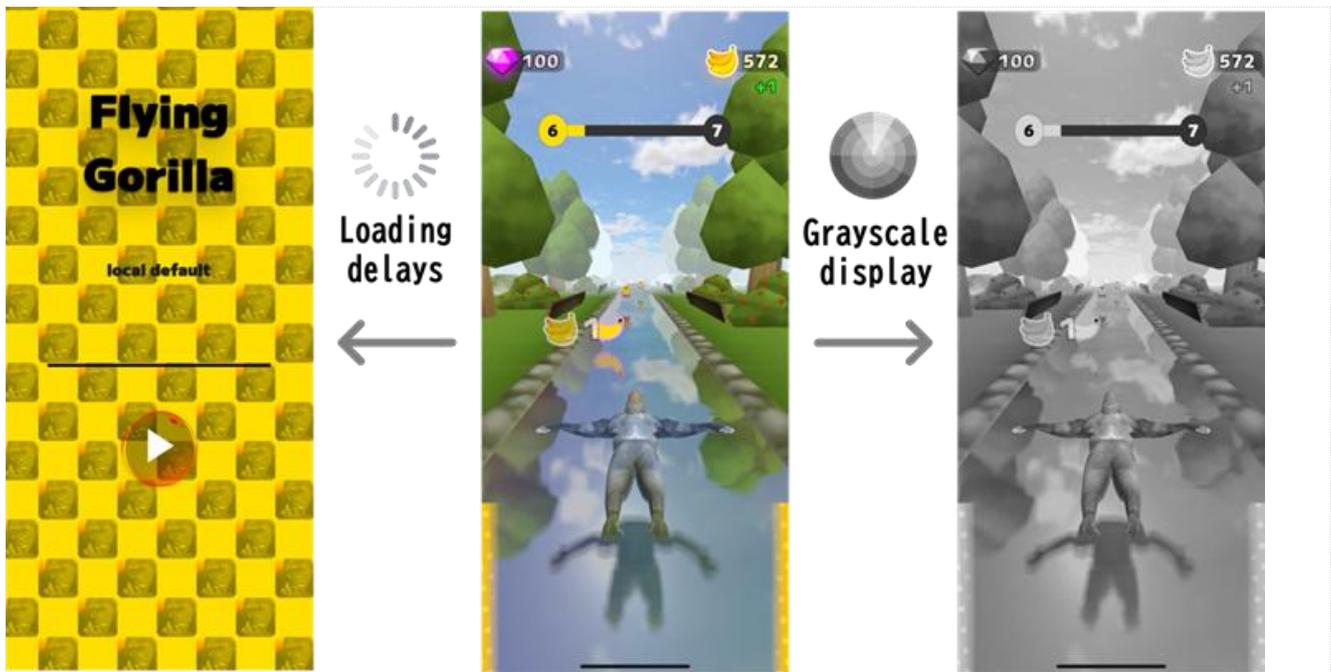
In a randomized experiment involving 84,324 participants who played *Flying Gorilla*, Kyushu University researchers found that loading delays and grayscale displays effectively reduced both player retention and average daily playtime. The most significant effect occurred when grayscale was combined with longer loading delays, reducing daily playtime by up to 30.8% and retention by 40.4% compared to the baseline.

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For more information about this research, see " Ethical Disengagement in Mobile Games: The Effects of Loading Delay and Grayscale on User Engagement," Yugo Nakamura, Ryota Takao, Shogo Fukushima, and Yutaka Arakawa, *Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies,* https://dl.acm.org/doi/10.1145/3712281

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