

ABSTRAK

Industri *Game* 3D dituntut menghadirkan kualitas visual realistis, namun *direct lighting* tidak mampu menghasilkan efek *indirect lighting* seperti *color bleeding*, *soft shadow*, dan *ambient occlusion*, serta membebani performa *rendering* karena kalkulasi pencahayaan berulang setiap *frame*. Bukti empiris pengaruh *Baked Global Illumination (Baked GI)* terhadap performa *rendering* dan *player experience* pada *Game* 3D *Adventure* berbasis *Unity* masih terbatas. Penelitian bertujuan mengimplementasikan *Baked GI* pada prototipe *Game* 3D *Adventure* bertema reruntuhan *medieval*, serta menganalisis pengaruhnya terhadap performa *rendering* dan *player experience* dibandingkan kondisi *real-time*, dibatasi pada *frame rate*, *CPU usage*, *GPU usage*, *rendering time*, dan tiga dimensi *player experience* (kualitas pencahayaan, kelancaran *Gameplay*, imersi visual) pada *environment* statis *genre Adventure*. Metode menggunakan eksperimen komparatif desain *pre-test/post-test*; data performa direkam via *Unity Profiler* selama 5 menit per kondisi pada perangkat dan jalur kamera identik, sedangkan *player experience* diperoleh via kuesioner Likert 5 poin terhadap 30 responden, dianalisis deskriptif dan korelasional (Pearson). Hasil menunjukkan rata-rata *frame rate* meningkat dari 281,19 menjadi 333,26 FPS (naik 18,52%), disertai penurunan *CPU usage* dari 94,02% menjadi 8,00% (turun 91,49%) akibat pengalihan kalkulasi pencahayaan ke tahap *baking*, serta kenaikan *GPU usage* dari 15,01% menjadi 19,08% (naik 27,12%) akibat *sampling* tekstur *lightmap*. Skor rata-rata *player experience* 4,07 (kualitas pencahayaan), 4,03 (kelancaran *Gameplay*), dan 4,12 (imersi visual) dari skala 5, dengan preferensi responden dominan terhadap *Baked GI* (79,3%, 65,5%, 82,8%), serta korelasi kuat antara imersi visual dengan kualitas pencahayaan ($r=0,752$) dan kelancaran *Gameplay* ($r=0,712$). *Baked Global Illumination* terbukti efektif meningkatkan performa *rendering* sekaligus kualitas pengalaman bermain pada *Game* beraset statis dominan.

Kata kunci: *Baked Global Illumination*, *performa rendering*, *player experience*, *Unity*, *Game* 3D *Adventure*.

ABSTRACT

The 3D Game industry demands realistic visuals, yet direct lighting cannot produce indirect effects such as color bleeding, soft shadow, and ambient occlusion, and burdens rendering performance through repeated per-frame lighting calculations. Empirical evidence on Baked Global Illumination's (Baked GI) influence on rendering performance and player experience in Unity-based 3D Adventure Games remains limited. This study implements Baked GI in a 3D Adventure Game prototype in a medieval ruins setting, analyzing its effect on rendering performance and player experience versus a real-time condition, limited to frame rate, CPU usage, GPU usage, rendering time, and three player experience dimensions (lighting quality, gameplay smoothness, visual immersion) in a static Adventure environment. Using a comparative pre-test/post-test experiment, performance data were recorded via Unity Profiler for 5 minutes per condition on identical hardware and camera paths, while player experience data came from a 5-point Likert questionnaire of 30 respondents, analyzed descriptively and correlationally (Pearson). Results show average frame rate rose from 281.19 to 333.26 FPS (up 18.52%), with CPU usage dropping from 94.02% to 8.00% (down 91.49%) from shifting lighting computation to baking, and GPU usage rising from 15.01% to 19.08% (up 27.12%) from lightmap texture sampling. Average player experience scores were 4.07 (lighting quality), 4.03 (gameplay smoothness), and 4.12 (visual immersion) of 5, with dominant preference for Baked GI (79.3%, 65.5%, 82.8%), and strong correlation between visual immersion and lighting quality ($r=0.752$) and gameplay smoothness ($r=0.712$). Baked GI proved effective in improving rendering performance and play experience in Games with dominant static assets.

Keywords: Baked Global Illumination, rendering performance, player experience, Unity, 3D Adventure Game.