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Exploring ‘Instancing’ and Its Applications in 3D Programming

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Student Research & Creative Works SYMPOSIUM

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Introduction

’Instancing’ is a technique widely used in 3D programming to draw multiple copies of an object with a single drawing command. The conventional approach of drawing several copies of an object is to send a separate drawing command for each copy. However, instancing facilitates drawing several copies of an object with repeating patterns substantially quicker than conventional approaches.

The flow chart in Figure 1 demonstrates one of the primary advantages of instancing. With instancing, information regarding an object’s geometry is stored once facilitating faster and more efficient access of the data to the left of the flow chart to draw the flower fields in Figure 2 and Figure 3.

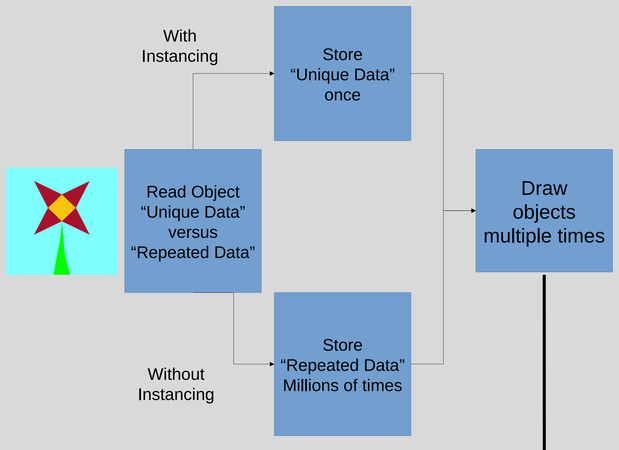

Figure 1. *Instancing visualization chart for creating flower fields in Figure 2 and Figure 3.*

Applications

Instancing is popular in film and animation for rendering forests, flower fields, crowd simulations, and more. Instancing makes better memory usage and faster execution of the program as it knows the geometry of an object before drawing multiple copies of it. Millions, or even billions of objects can be drawn in the blink of an eye because a Graphics Processing Unit (GPU) accelerates computation with its massively parallel architecture.

Implementation and Results

This research explores different applications of instancing. While drawing multiple copies of the same object, different patterns or characteristics are also incorporated.

In Figure 2, a flower field is generated from a single plant (shown in the inset of Figure 2) by instantiating an assortment of colors in different rows.

In Figure 3, a floral park with varied patterns of plants has been generated with instancing. In all cases, the data of a single flower is stored to draw millions of flowers with incredible efficiency.

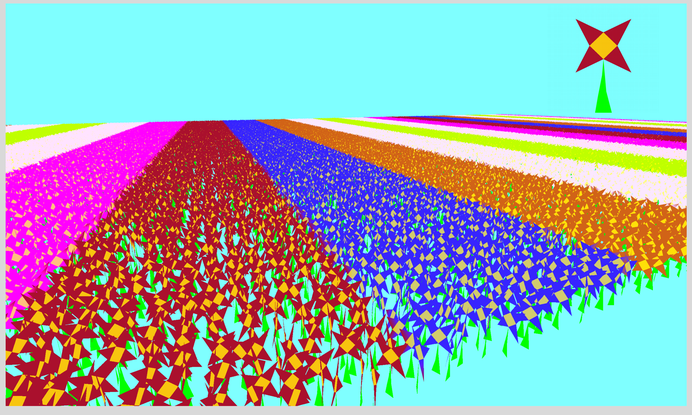

Figure 2. *A flower field created by instancing. The single plant used in instancing in shown in the inset.*

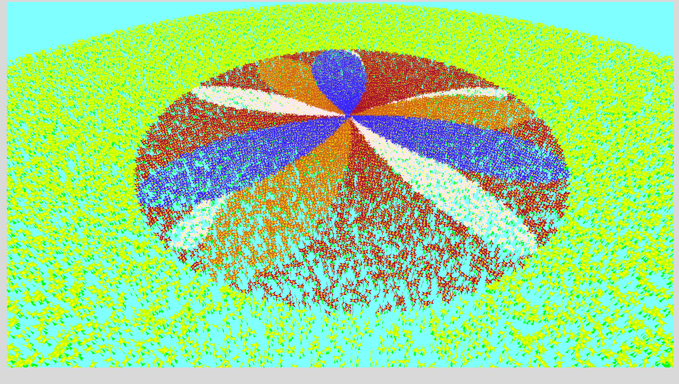

Figure 3. *A floral park with varied patterns of flowers created with instancing.*

Implementation and Results (cont’d)

Figure 4 demonstrates soldiers in a battle field. As shown in the figure, a model can contain much more data than a simple flower used in Figure 2 and Figure 3. This soldier model is made up of 15,000 points, and there are thousands of soldiers, which without instancing would be quite a trouble to draw, but with instancing can be drawn very quickly.

Figure 4. *A field of soldiers made by instancing*

Future Research

- One potential for future research in instancing is crowd simulation, in which both speed and efficiency of instancing can be combined with the complexity and seeming realism of a crowd. Such crowd simulations could use such artificial intelligence such as boids, where birds, animals, or people in the crowds could flock or navigate together, creating a seemingly realistic crowd very efficiently.

- Another potential for future research would be having forests with incredible detail, possibly down to seeing individual leaves, using instancing. This would have powerful uses because it could help bridge the gap between reality and virtual reality.