PARALLAX MAPPING

Only texture

Normal mapping

Parallax Mapping

Height map visualization

This heightmap visualization - visualizes the defined heights in the heightmap on the texture. The brighter the colour the 'further up' the pixels is to be placed.
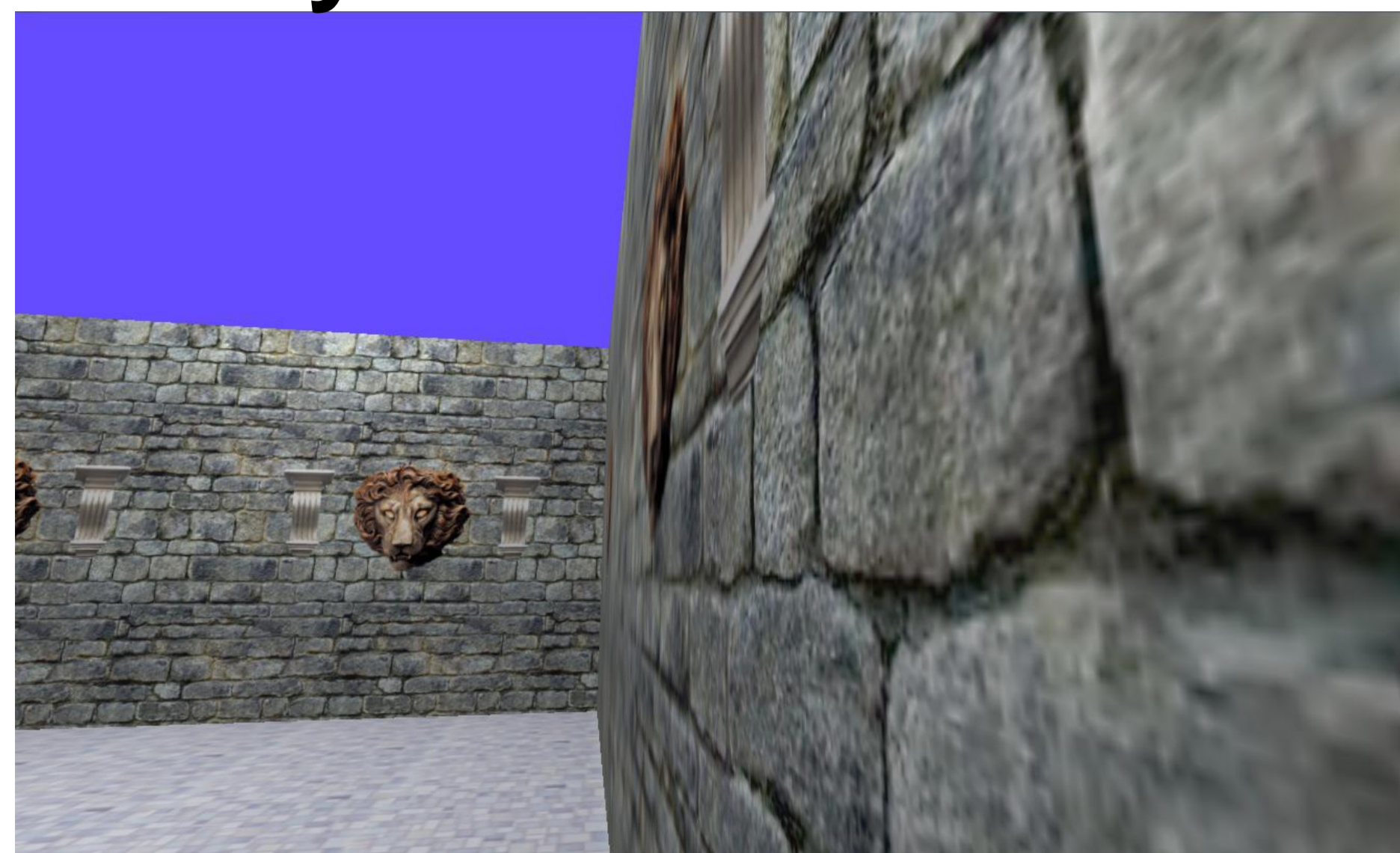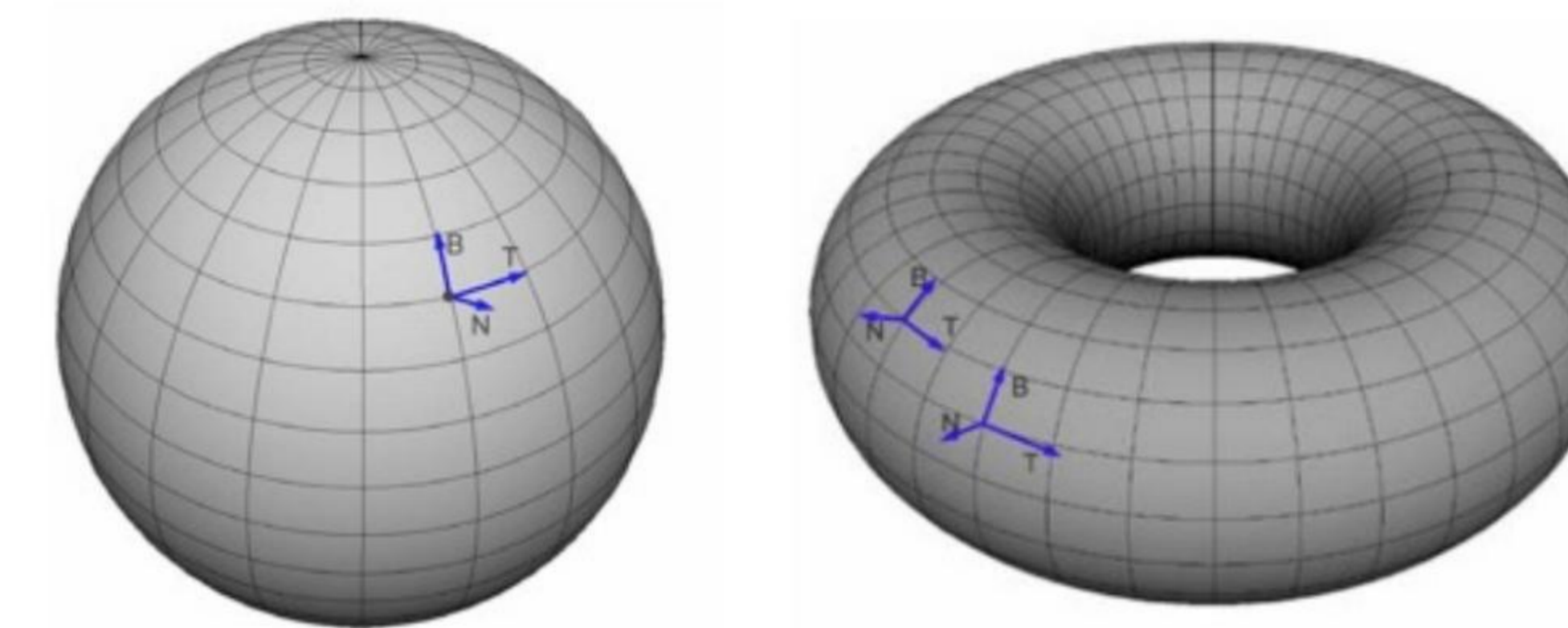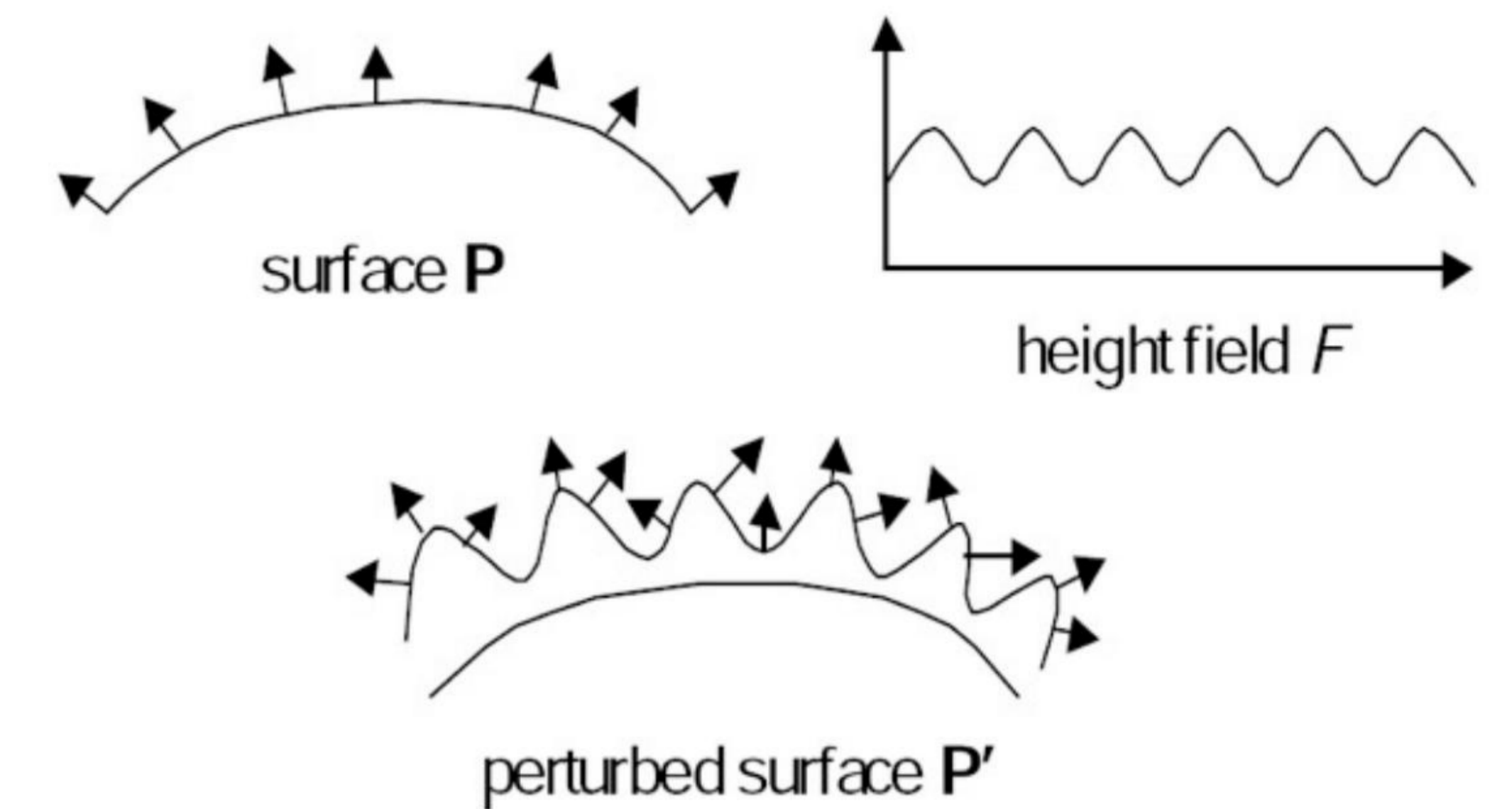
The **texture only** images have no shaded shadow or depth. The texture looks flat. There are only the shadows that have been drawn in the texture itself.

The **normal mapping** gives shaded shadows which really adds to the immersion. Using a heightfield texture, the normals on the surface is perturbed and these new normals are used in the per pixel shading. The texture looks like it has depth however this illusion fails somewhat when the viewing angle is shallow. This can be helped using parallax mapping with little extra cost.

At each vertex a coordinate is defined in Tangent Space. The tangent space is used to transform the lights to a surface location's space to compute the effect of perturbing the normal. The heightmap displacements is defined in tangent space coordinates.

The perturbed normal n' is computed with:

$$\mathbf{N'} = \mathbf{N} + \mathbf{D} \qquad \mathbf{D} = -\frac{\partial F}{\partial u} k \mathbf{T}_n - \frac{\partial F}{\partial v} k \mathbf{B}_n$$
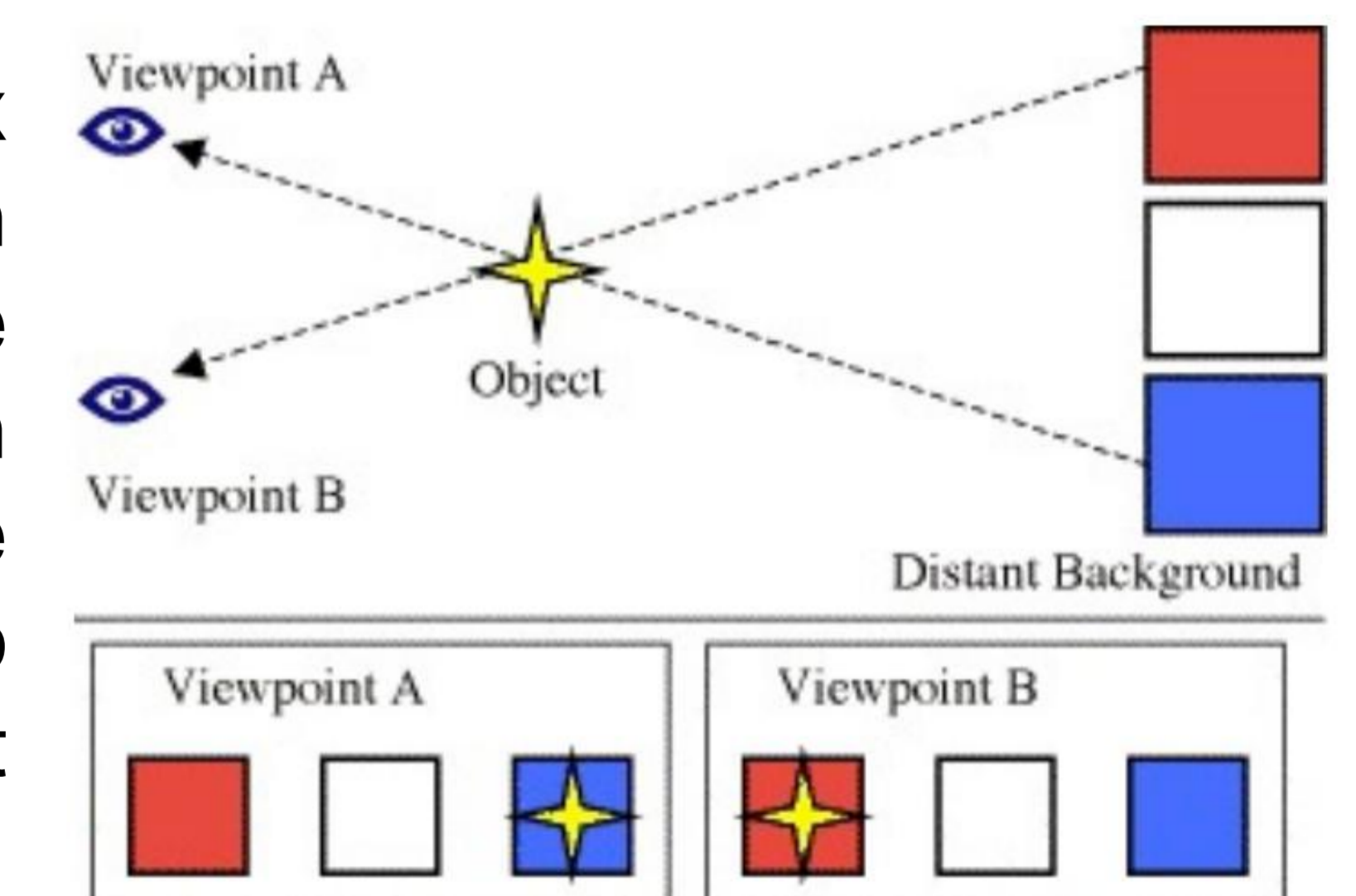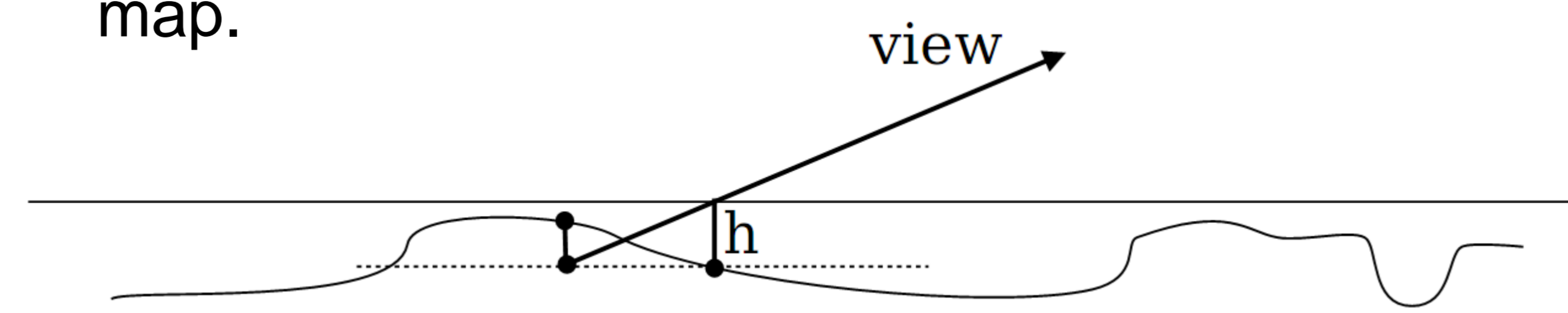
where the derivatives are computed by:

$$\frac{\partial F}{\partial u} \approx \frac{F(u + \Delta u, v) - F(u - \Delta u, v)}{2\Delta u}$$
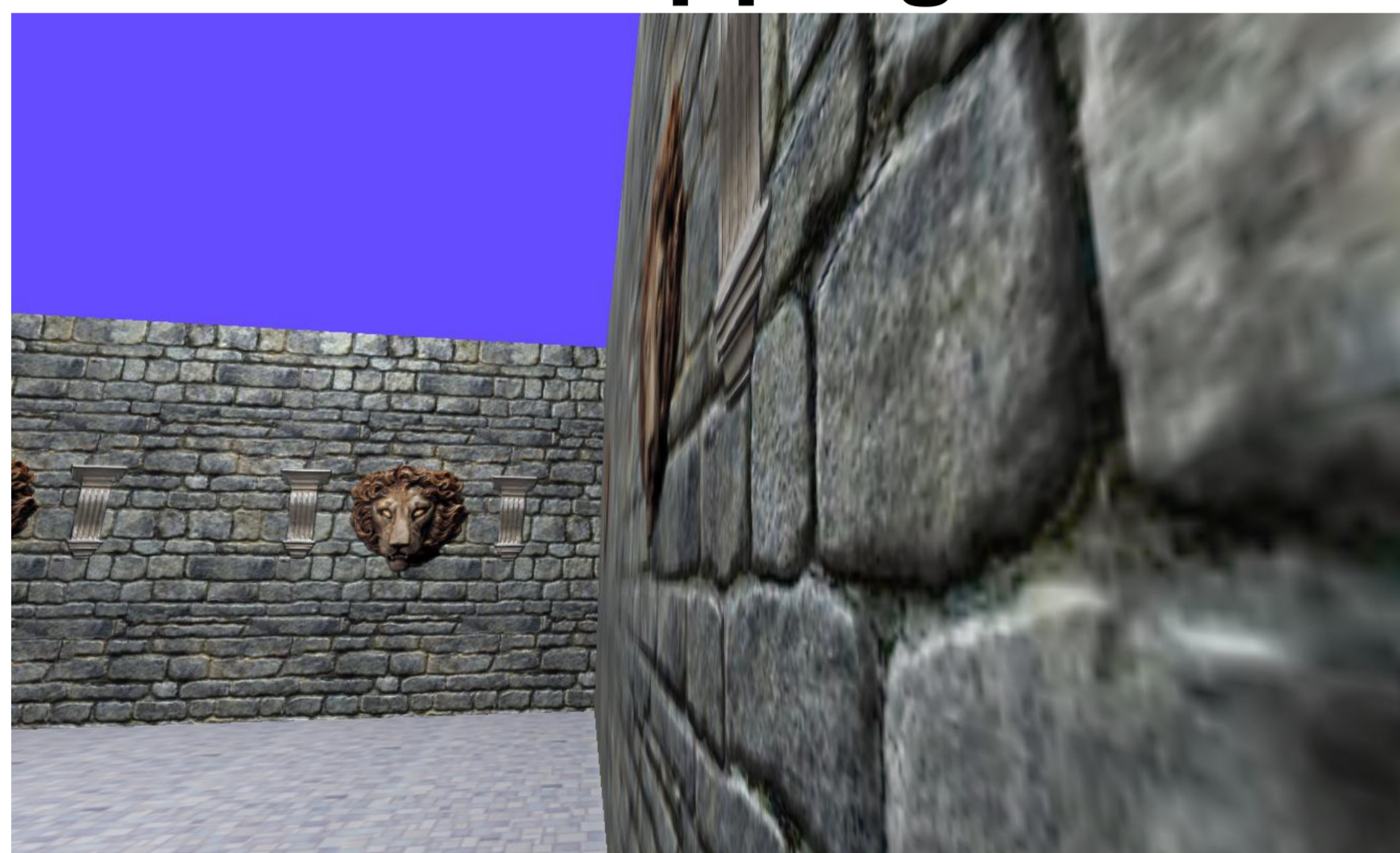
The normal mapping does not do self shadowing and there is no self occlusion from the displacements. There is no parallax. We get all of these good parts with parallax mapping.

Parallax is the shift in angle between objects that happens when the observer moves.
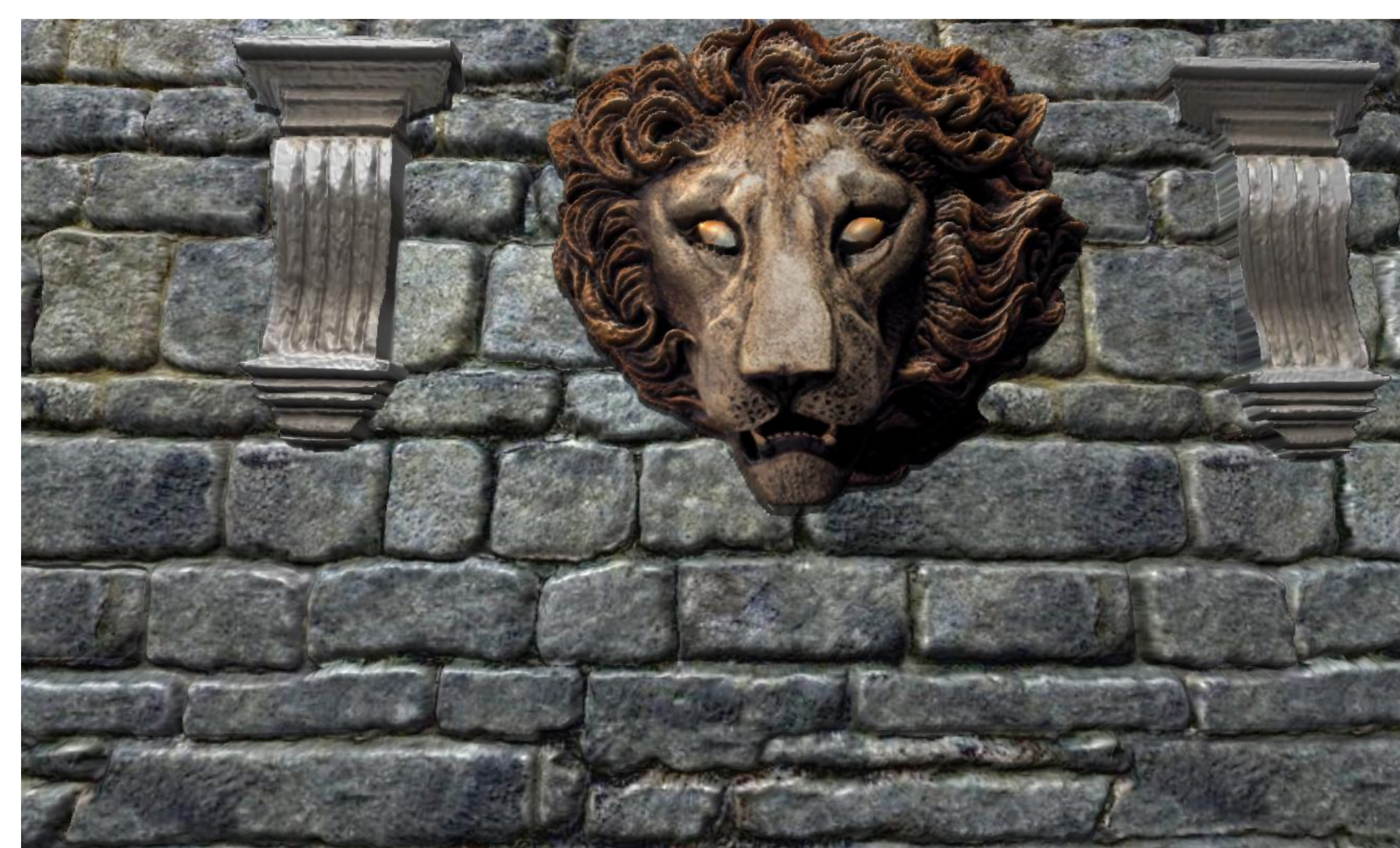
Parallax is what makes us perceive depth. To use **parallax mapping** we have to take both the texture point position and the heightfield into account. This means that the intersection point, the texture coordinate is not the spot in the height map that the correct height is located. We multiply view.xy/view.z by h to get a new position closer to the true intersection of the view direction and the height map.
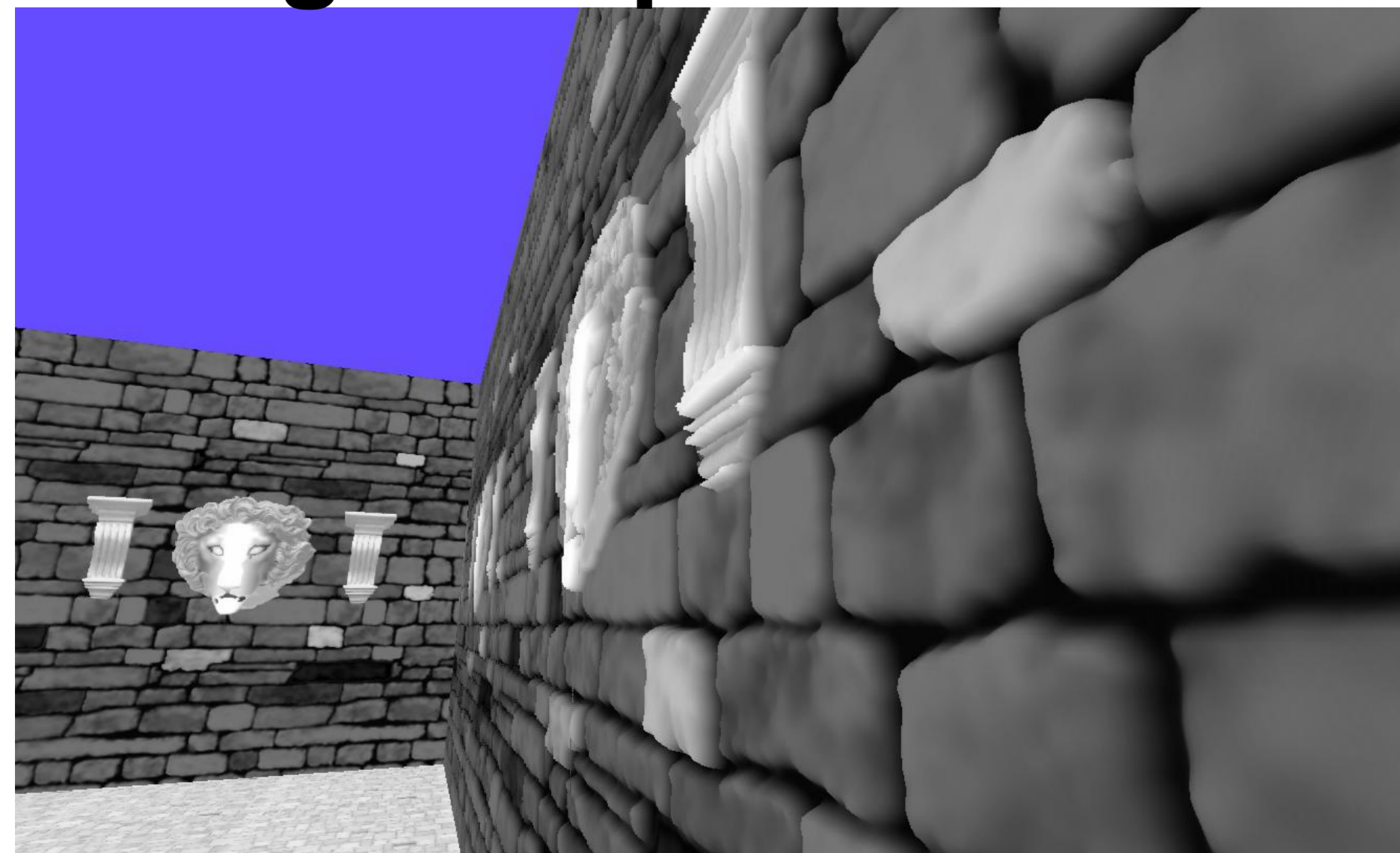

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