Figure 1: Rendering of a football field covered by 627 million virtual grass blades, at different viewing distances. Note the absence of repetition artefacts normally associated with the tiling of grass patches. The last image shows the projection of shadows that change when the light source moves. The shadows are present on the ground and on the grass blades. No aliasing artefacts appear on these images due to the use of texture filters, a customized mipmapping filter and adaptive antialiasing.
Figure 2: Rendering of the three levels of detail in false colors. Red is full geometry with textured quadrilateral strips. Blue corresponds to the vertical slices of the volume rendering technique. Green is the horizontal slice used for far grass, and used along with volume rendering for grass at intermediate distances. Note that the transitions are smooth from a level to another one, which is made possible using our management of grass density.

Figure 3: Rendering of a scene using variable density. A hand-drawn map defines the grass density as well as the shape of grass patches. In front of the bench, the density is lower, there are some clumps of grass around the legs. The density management works for any distance from the camera, the grass under the bench is rendered with a BTF based volume approach.
Figure 4: Textures used to define the grass parameters of the scene of Figures 3 and 5. From left to right: density map (white is the maximum density), ambient occlusion map (the black spots are mainly created by the trees), modulation of the grass color along the terrain (used mainly for painted grass), texture of the ground under the grass.

Figure 5: Different views of the scene using a density map to define the grass distribution over the ground.