

# A Novel Approach to Automatic Layout for User Interface Elements in Augmented Reality

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## 1. Motivation for an Automatic Layout System

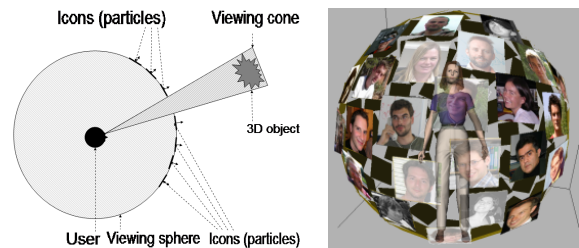
While most virtual objects in Augmented Reality systems are expected to be placed at fixed, stable positions within the real world, certain classes of objects, such as user interface elements, can be placed more flexibly in the 3D world. Such objects only need to stay within the vicinity of specified 3D positions. At the same time, these objects typically need to satisfy other sets of requirements, e.g., they should not occlude one another or important real objects in the user's current view.

Bell et. al. [1] have developed a label placement system which creates a relationship between the used and unused space, by representing it by rectangles. Due to the complexity of computing the inter-dependencies between all objects at every rendering step, the system is currently limited to a small number of labels. In addition, they can only be shown frontally.

Particle systems [2] provide a concept for the dynamic placement of a large number of inter-related objects into a three-dimensional world. We are exploring options towards using a particle system for presenting virtual objects in AR applications. To this end, new AR-related constraints have to be added to the energy functions that determine the placement of particles relative to 3D surfaces and other particles.

## 2. Demo Description

In this demonstration we present first results towards the use of a particle system for augmented reality. In the demonstration, a user is surrounded by a virtual fixed sphere on which icons, texts and windows are placed as textured particles. By moving her head, the user is able to navigate in the sphere. When a real object that should not be occluded



**Figure 1. a) A schematic top view of a user surrounded by icons on a personal viewing sphere, with an area related to a 3D object being kept free. b) A 3D view of a user surrounded by particles representing icons on a personal viewing sphere.**

moves in the environment, the respective viewing cone [3] is kept unobstructed: particles on the sphere are automatically repositioned to fulfill the imposed constraints.

The demonstration will be placed in a 2m by 4m area. It will use an ART tracking system to track a camera on the user's head and a 3D object. On a monitor, the user's camera view will be shown, augmented with icons (e.g.: pictures).

## References

- [1] B. Bell, S. Feiner, and T. Höllerer. View management for virtual and augmented reality. In *Proceedings of User Interface Software and Technology (UIST) 2001*.
- [2] M. Meyer, P. Georgel, and R. Whitaker. Robust particle systems for curvature dependent sampling of implicit surfaces. *Shape Modeling International (SMI)*, MIT, June 2005.
- [3] V. Novak, C. Sandor, and G. Klinker. An AR workbench for experimenting with attentive user interfaces. In *Proc. of IEEE and ACM International Symposium on Mixed and Augmented Reality (ISMAR)*, November 2004.