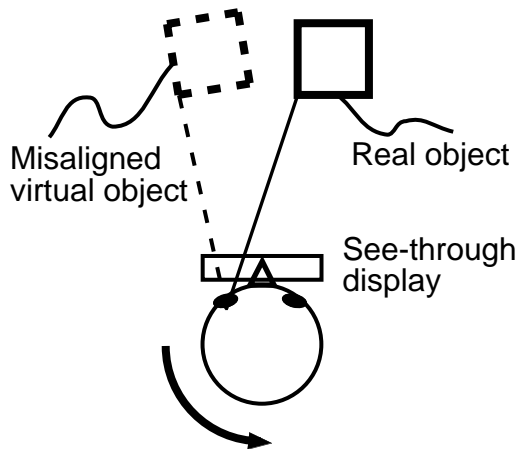# Accurate merging in Augmented Reality

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Introduction

This poster discusses two main problems with AR: accurate alignment and correct display of overlapping real and virtual objects.

Accurate alignment

The accuracy with which virtual objects can be added to the real environment depends on the latency of the total system. In this picture the observer rotates his head to the left. We want the virtual object aligned with a real object. Because of latency the virtual object is projected in a direction where it was a short time ago. This misalignment depends on the latency of the system and the speed with which the observer rotates his head. We expect maximum acceptable latencies of about 10 ms.

Overlapping objects

Problems also occur with shadows and overlapping objects. Shadows are hard to create with a see-through display since the display can only add light, not subtract light to create darker parts. With overlapping virtual and real objects there are two problems:
1. When the virtual object is closest to the viewer, the real object should become invisible.
2. When the real object is closest, the virtual object should not be displayed.

A normal situation with proper overlap and shadow handling

Without shadows the virtual bottle seems to float above the table.

Current displays can only display transparent virtual objects, which degrades the spatial impression further.

Without accurate knowledge about the environment the virtual object may be rendered incorrectly