

# Interacting with Spatial Augmented Reality

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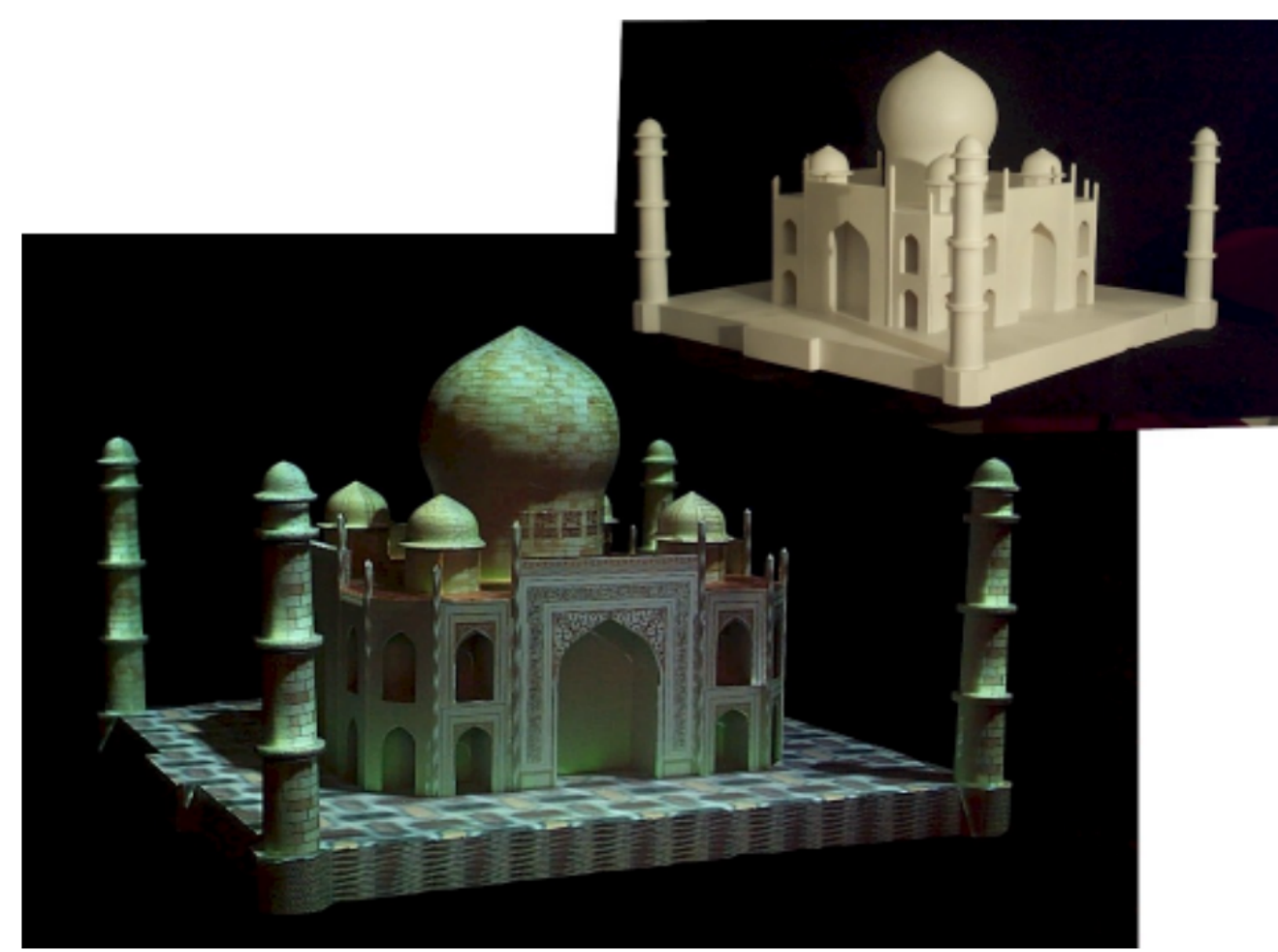
## Context

### Spatial Augmented Reality

Spatial Augmented Reality (SAR) [2] uses projectors to augment the real world with computer generated graphics. SAR does not require to instrument the user, and enables a direct interaction with the augmented world.



The office of the future [1]



Dynamic texture on real object [2]

### Interacting with SAR

Heterogeneous interaction techniques can be found in the literature. A subset were explored so far, while part of them will be studied in the future.

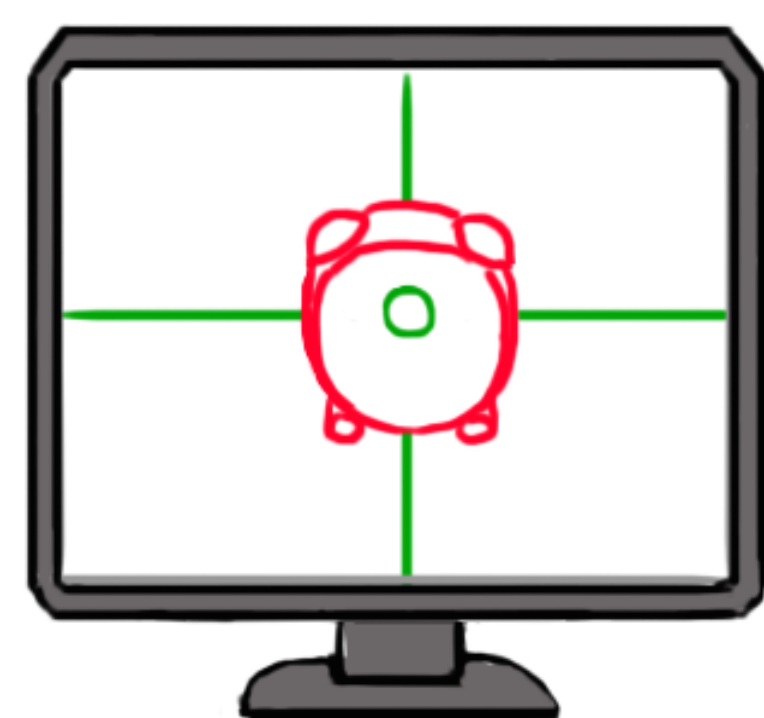
		Location		
Abstraction Inspired by Bruner		On User or hand held	Middle air	On the object
Virtual tools	Mouse	✓	Pointing tools ✓➔	Direct Pointing ✓➔
Real tools	Gestual tools	➔		Direct operation ➔
Direct manipulation	On body gestures		Touchless Gestures ➔	Direct manipulation ✓➔

✓ Done ➔ Next step

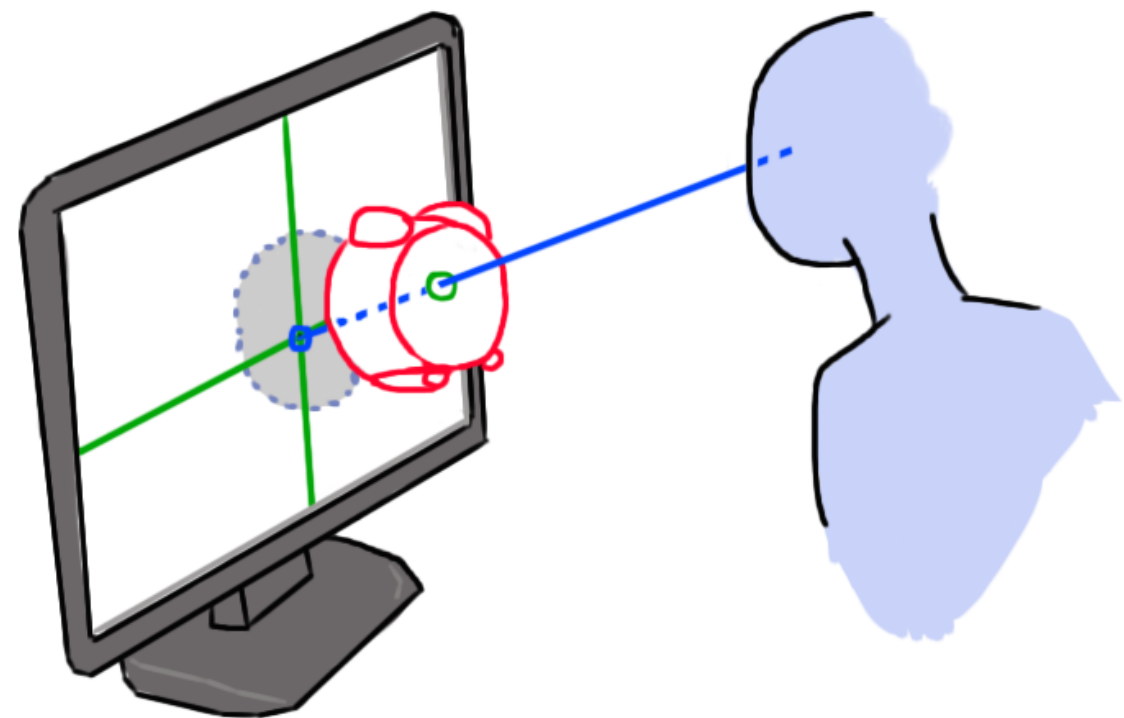
## First results and work in progress

### Tangibles and desktop computers

We designed *Tangible viewports* [4], a system that enables the use of tangible objects as if they were part of the screen. This interaction was inspired by *the office of the future* [1] and the *perspective cursor* [3]. As a result, both tangible and traditional on-screen operations are supported, while also enabling novel hybrid interactions.



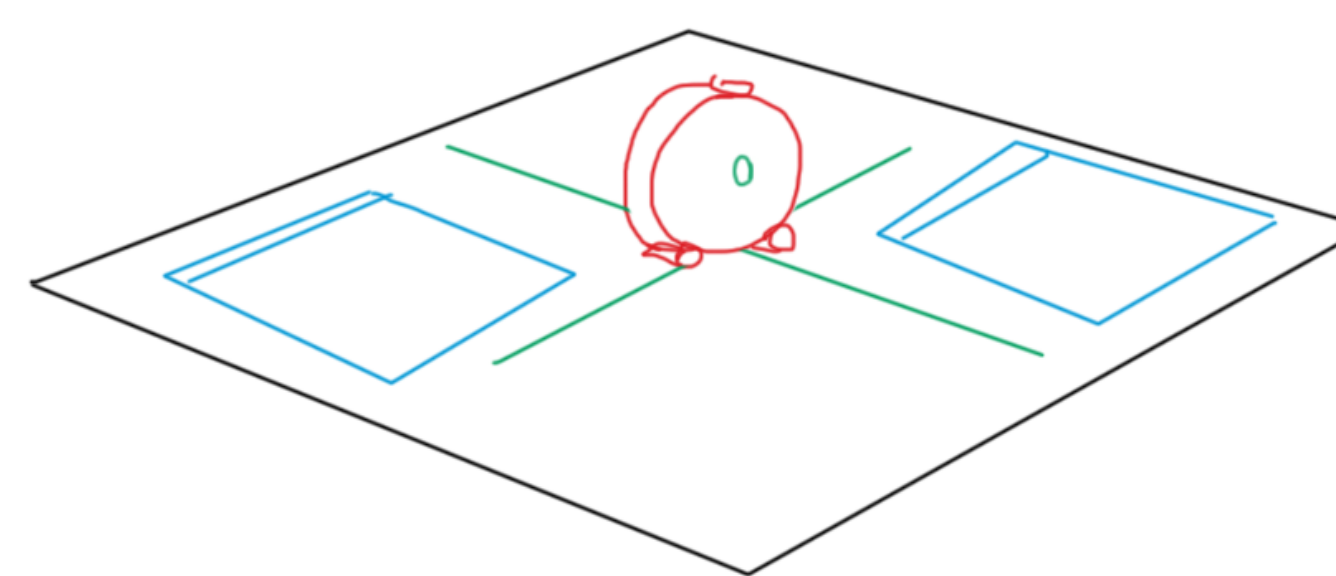
User's view



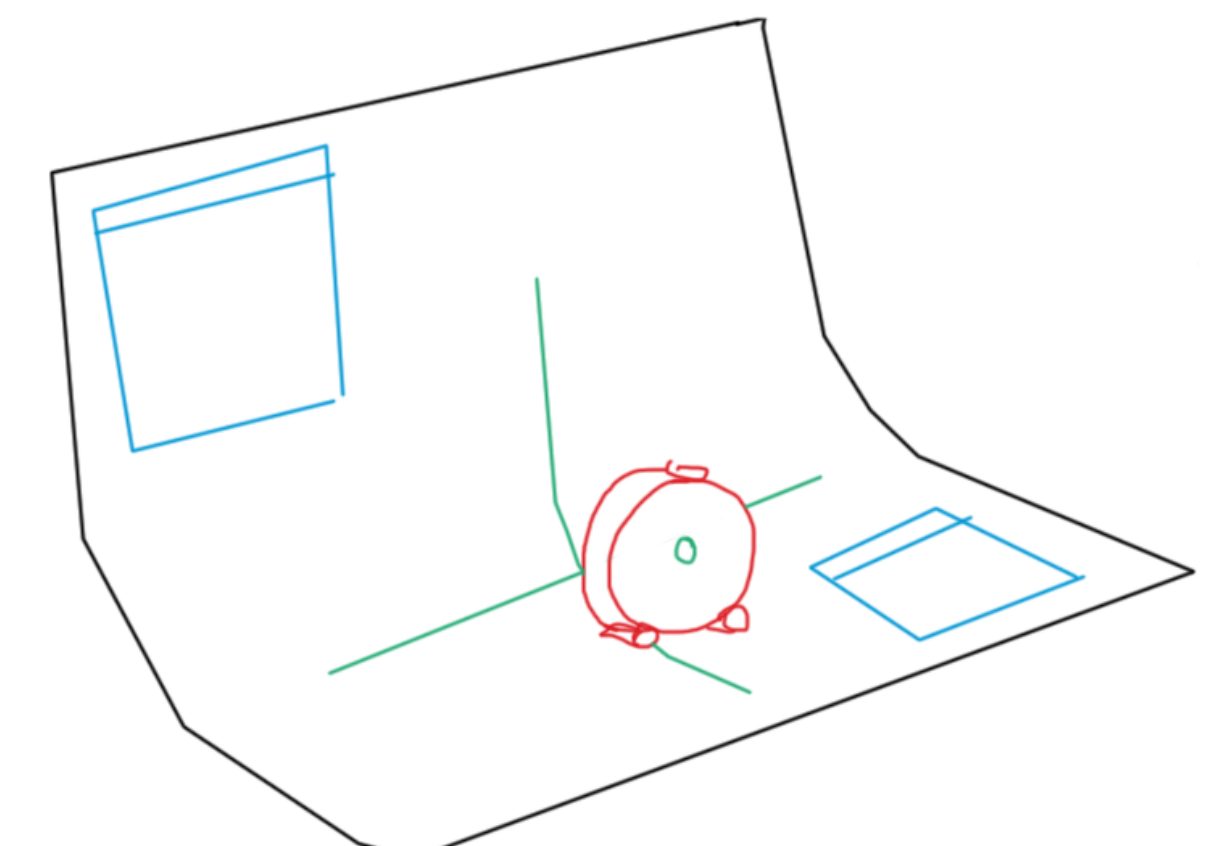
Side view

### Towards an organic workspace

The tangible viewport metaphor can be extended to the desk, or a specifically design surface. This way, traditional I/O devices can be used outside of the desktop environment. Widgets can be presented to the user as 1) flat elements on the surface, or 2) 3D virtual objects. The second technique requires taking into account the user head's position, using *anamorphosis*.

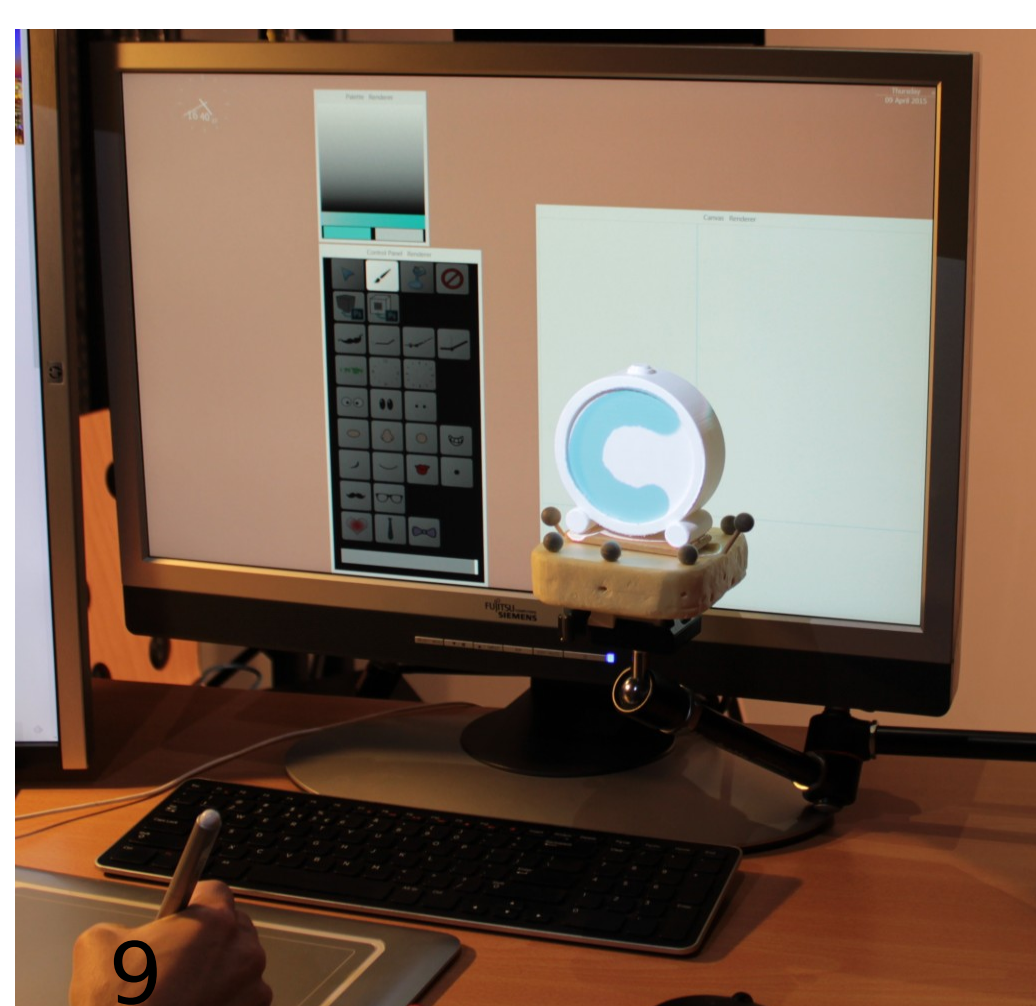


Flat surface

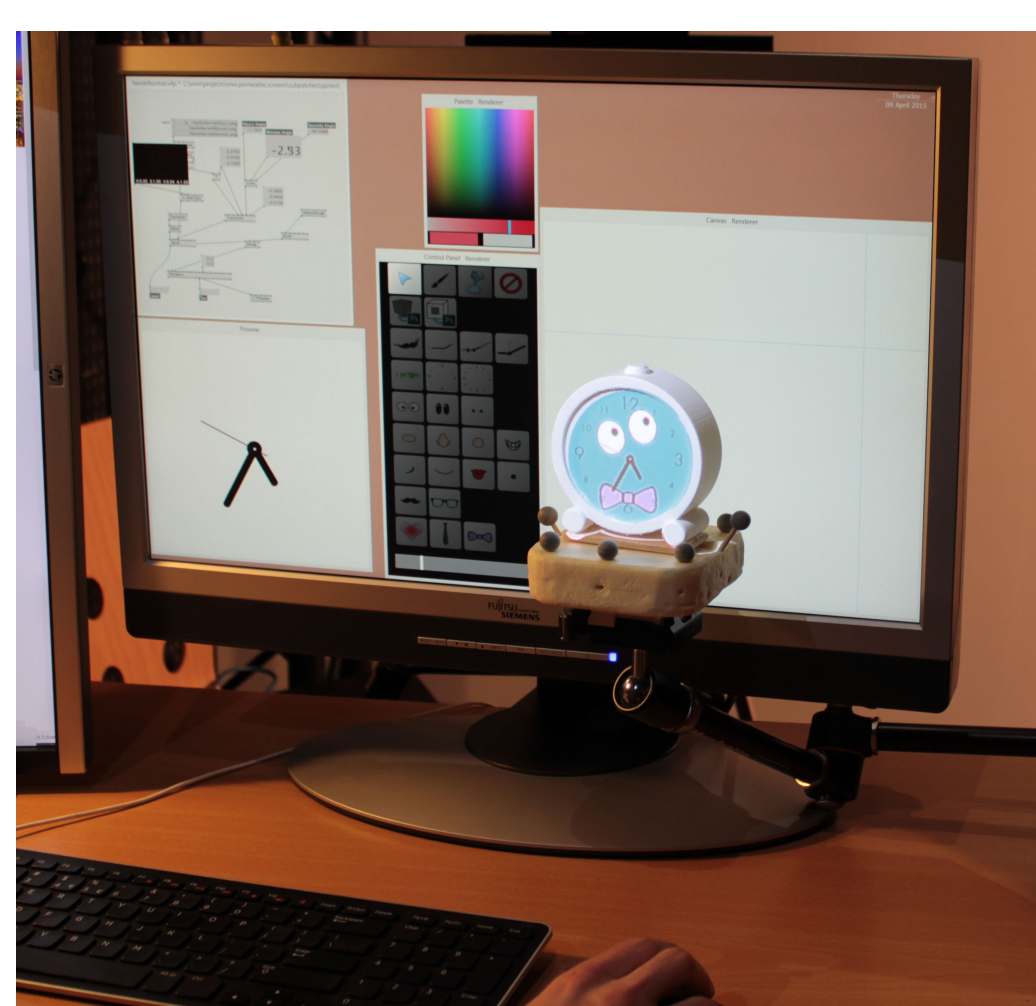


Curved surface

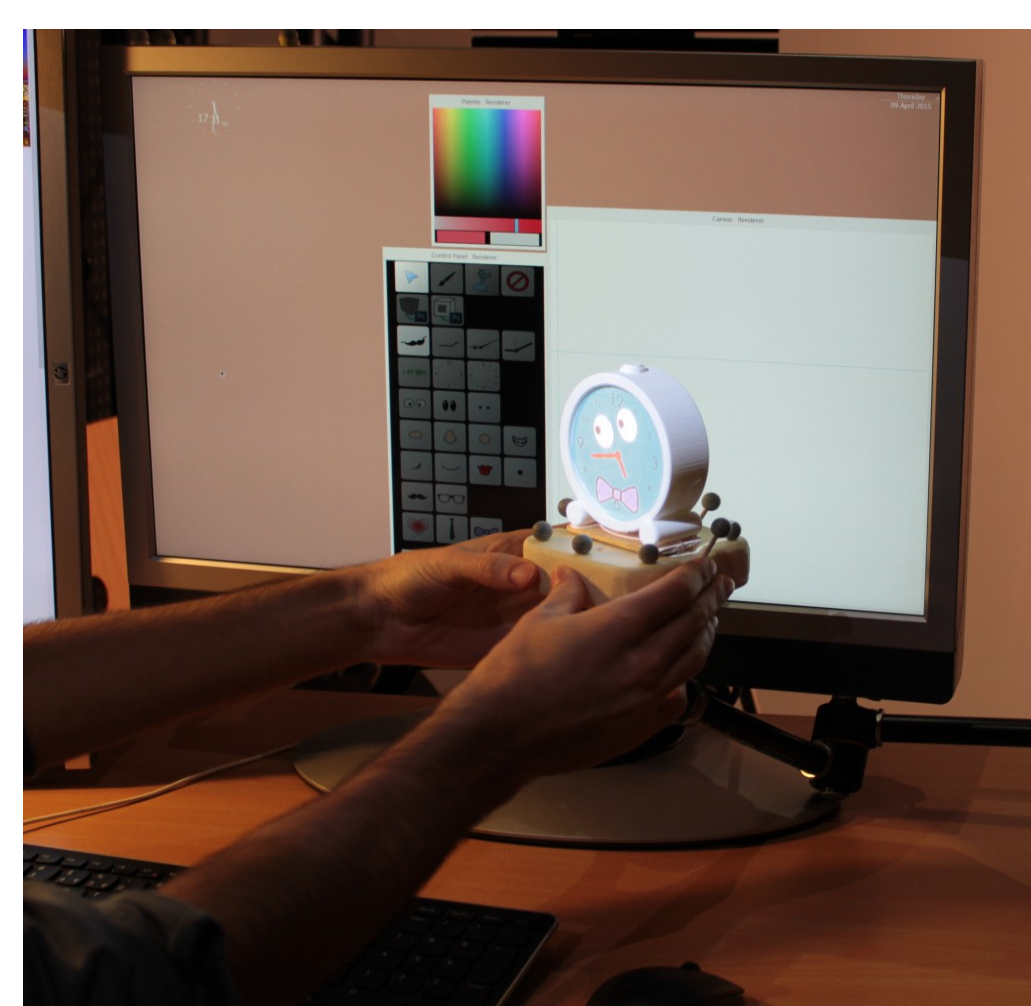
### Expored interactions



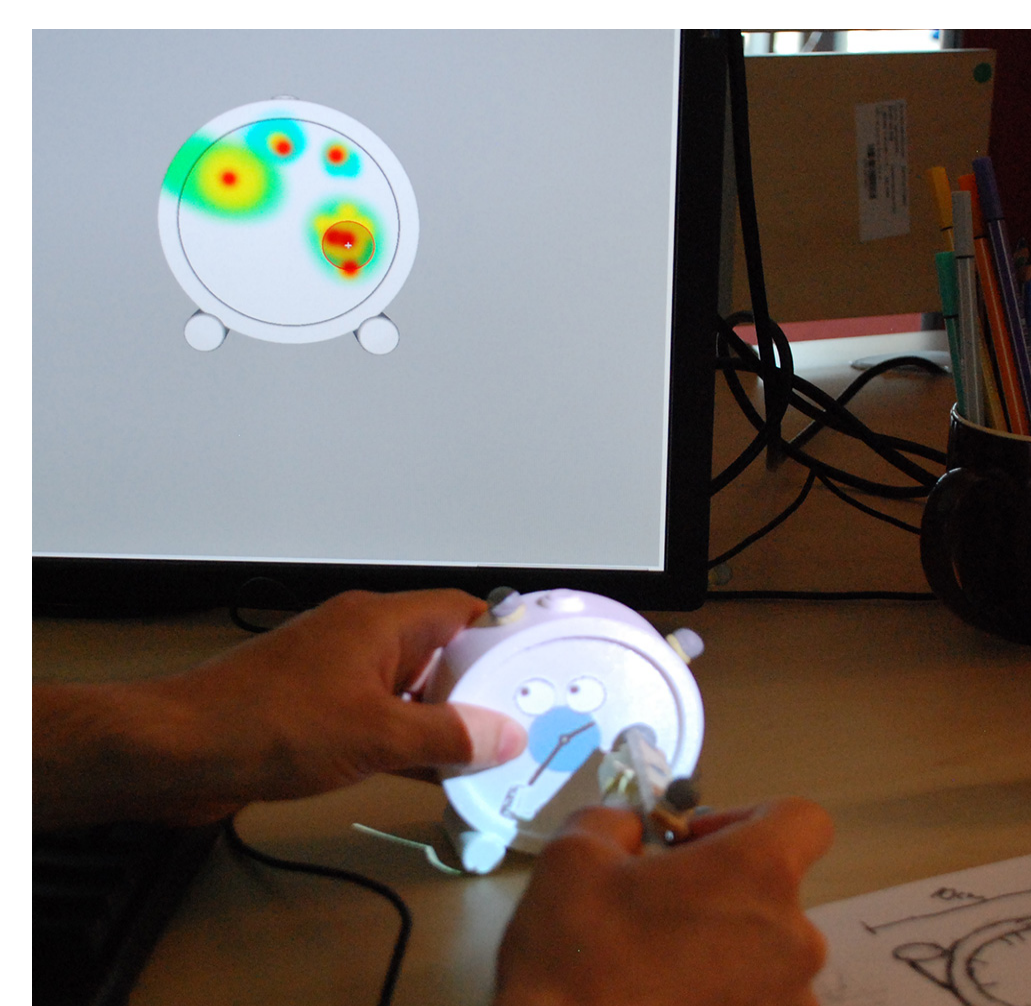
Native tools for painting



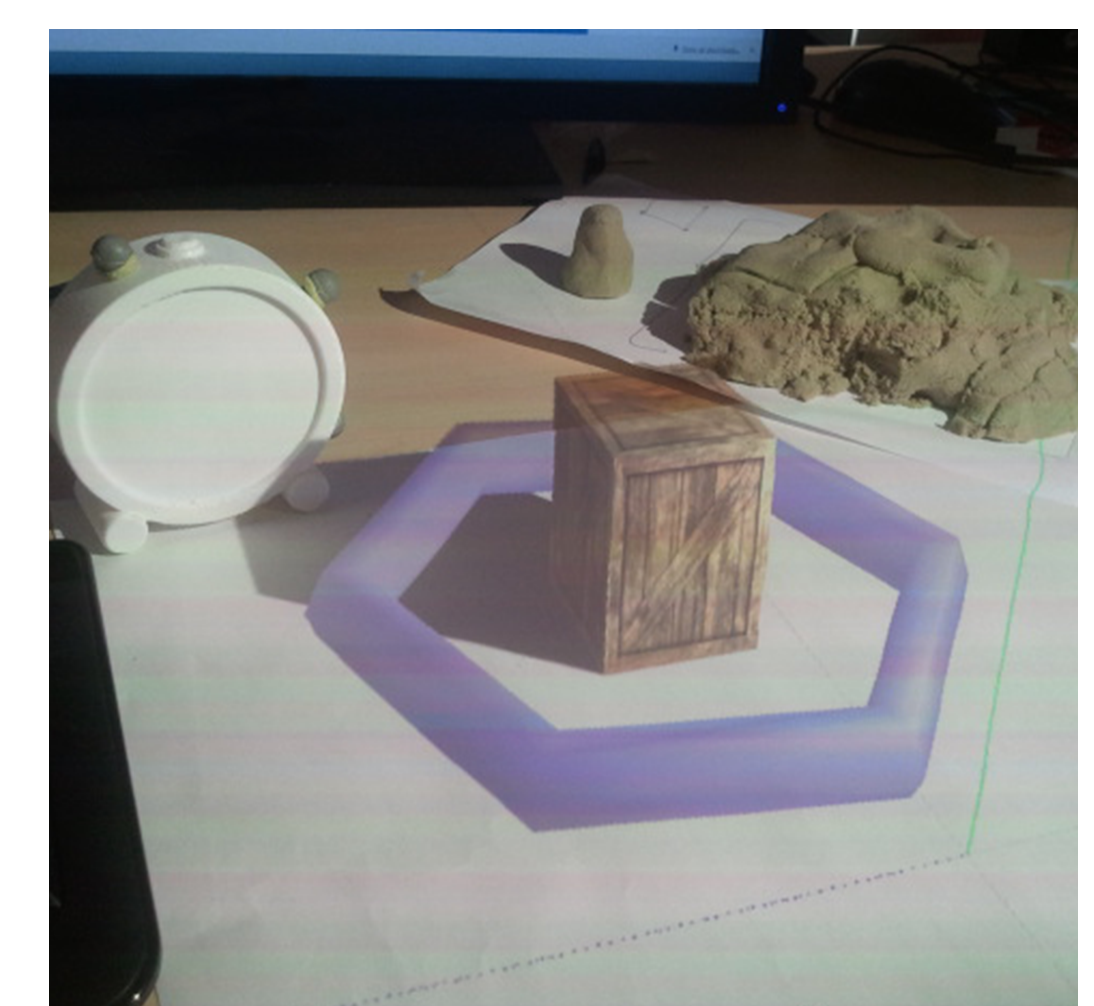
Programming dynamic elements



Direct manipulation



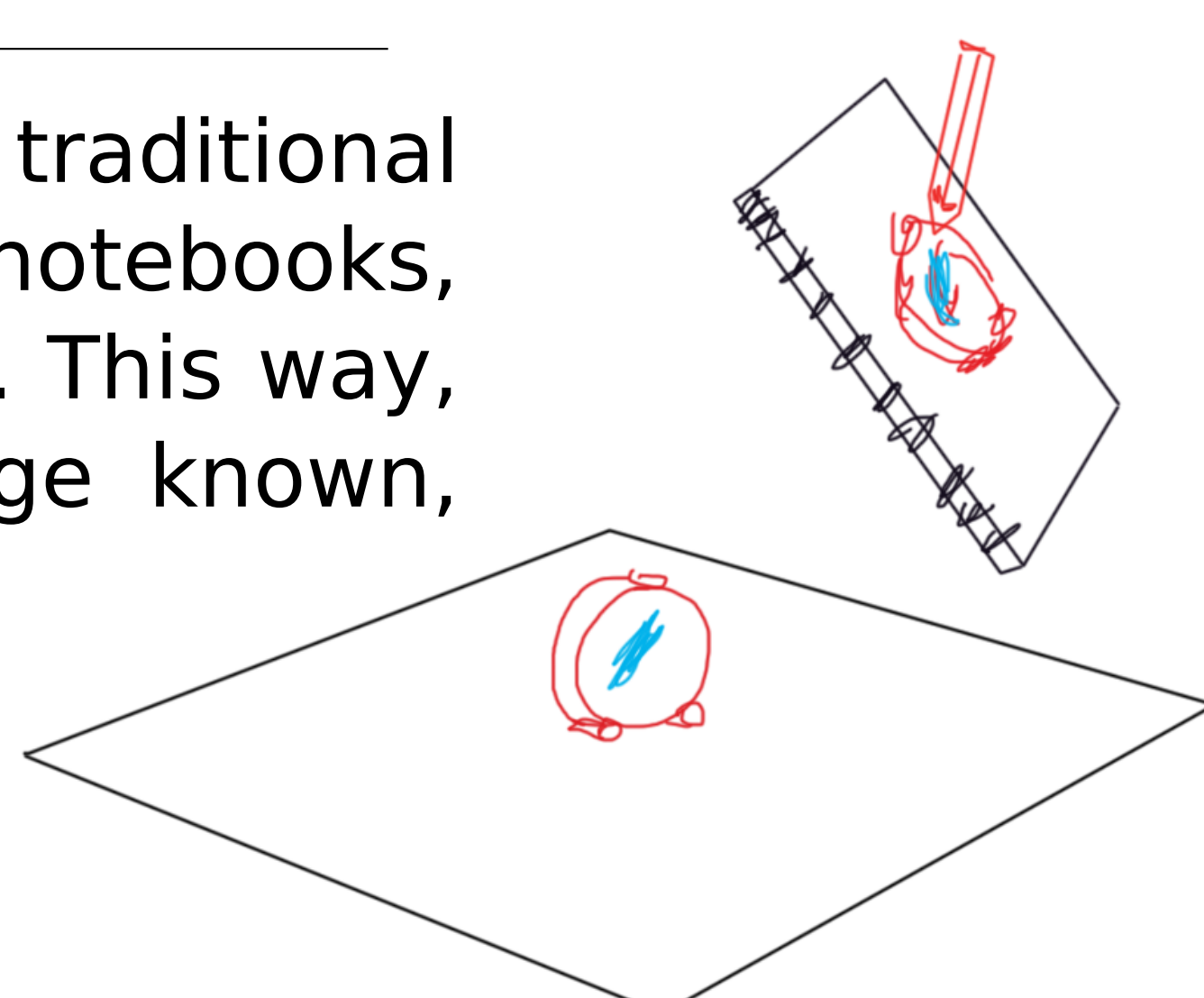
Real - virtual synchronization



Anamorphic interfaces

## Future work

The next step is to include traditional desk tools, such as pens and notebooks, to the augmented workspace. This way, it will be possible to leverage known, expressive real tools with the enhanced capabilities of computational devices.



## References

- [1] Raskar, Ramesh, et al. "The office of the future: A unified approach to image-based modeling and spatially immersive displays." SIGGRAPH, 1998.
- [2] Raskar, Ramesh, and Kok-Lim Low. "Interacting with spatially augmented reality." Proceedings of the 1st international conference on Computer graphics, virtual reality and visualisation, 2001.
- [3] Nacenta, Miguel A., et al. "Perspective cursor: perspective-based interaction for multi-display environments." Proceedings of the SIGCHI conference on Human Factors in computing systems, 2006.
- [4] Gervais, Renaud and Sol Roo, Joan and Hachet, Martin. "Tangible Viewports: Getting Out of Flatland in Desktop Environments". Appearing at TEI'16. 2016.