Space Perception and Spatial Memory

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Applications, suggestions and influences.

589 words

Humans live in a three-dimensional world. But most displays are confined to portraying two-dimensional images. Designers can employ different *depth cues* to give a sense of a 3-D space to the viewer. Such a 3-D representation of information can be useful in helping humans judge the morphology of surfaces and identify the spatial ordering of objects. Sometimes, this also gives an aesthetic impression of depth and spaciousness to visual designs. In the first section of this essay, I shall describe the use of motion parallax cues in smartphones. In the second section, I discuss the various depth cues used in most modern windowing systems. Finally, in the third section, I outline the use of head-tracking to simulate motion parallax effects in desktop interfaces.

1 Motion Parallax and Smartphones

Motion parallax [1] is a strong depth cue for judging 3-D structure from motion. An example of motion parallax occurs when we look sideways out of a car or train window. Objects nearby appear to move much faster than farther objects. Another example is the effects of *dolly left* and *dolly right* camera movements described in Block's book [2].

Many smartphones today have a series of "home screens" populated with application icons, like in the Apple iPhone. Users typically swipe their fingers left or right to move from one screen to another. Some smartphones[1] mimic the motion parallax effect on this screen. The icons are in the *foreground* and the wallpaper image is in the *background*. As the user swipes to move to another screen, the wallpaper image moves a shorter distance compared to the icons (which move by a whole screen width) as in Figure 1. This separates the icons and the wallpaper into two spatial layers at different distances. It also gives an often aesthetic feeling of depth to the design. Some plugins (like the QML Parallax UI[2]) take this even further in implementing multi-layer wallpapers and icons placed at different "depths".

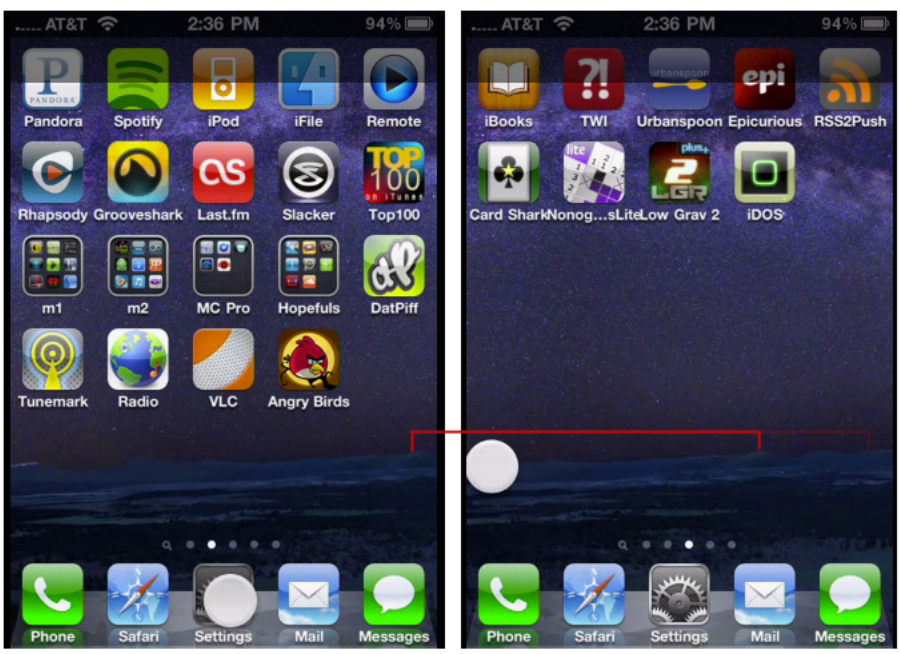

Figure 1: The *Parallax* plugin at work in a jailbroken iPhone.

[1] Many Sony Ericsson and HTC models offer this out-of-the-box. Others, like the iPhone, have apps or plugins that implements this functionality.

[2] *http://www.cybercomchannel.com/category/mobile-media*

2 Depth cues in floating windows and tabs

Most modern operating systems use floating window managers. These arrange different applications windows spatially as objects, with a sense of depth in *flat-space* (as described in Block's book [2]) — some windows can be "above" others. This sense of layering is achieved through different depth cues. The most important is *occlusion*. Windows occlude the parts of other windows that are directly below them. Other common cues are shadows and the use of dull coloring for background windows (see Figure 2.1). The dull coloring mimics *aerial diffusion* observed in real life [2]. These cues helps users maintain a spatial map of windows both in terms of the two-dimensional positions as well as the ordering of window layers. A similar (but more restricted) set of cues are used in the tab metaphor. The active tab is has brighter colors and occludes part of other inactive tabs (Figure 2.2).

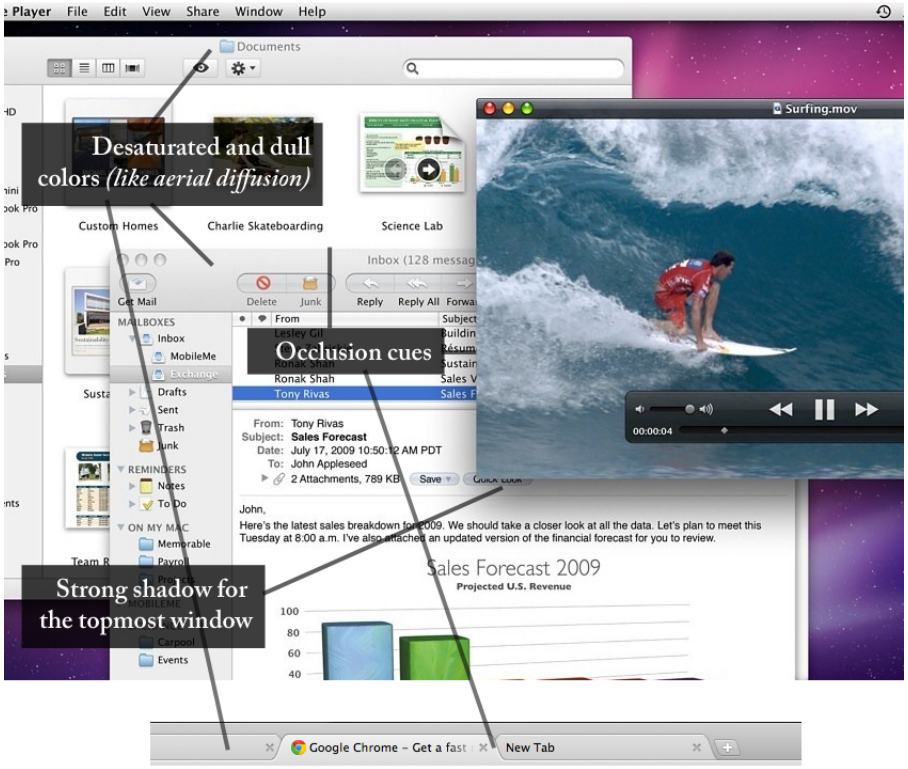

Figure 2: (1) A screenshot of windows from OS X. (2) Tabs in Google Chrome.

3 Motion Parallax for Floating Windows

Motion parallax effects, as described in the Section 1, can be used by floating window managers for depicting floating windows at different depths. The motion effects should correspond to the movements of the viewers head, which is identified through head-tracking techniques [3]. The head-tracking is achieved through a camera, or a tracking device worn on the head. As a viewer moves his head, the windows move to simulate motion parallax [4]. See Figure 3 for an illustration of this effect. Windows in the foreground move farther, while windows in the background remain almost stationary with respect to the user. This gives an near-stereoscopic effect to the tradition windows UI[3]. This gives as a strong depth cue that complements the cues described in Section 2. Such a system also allows for new behavior, like *peeking* across a window to look at another occluded window.

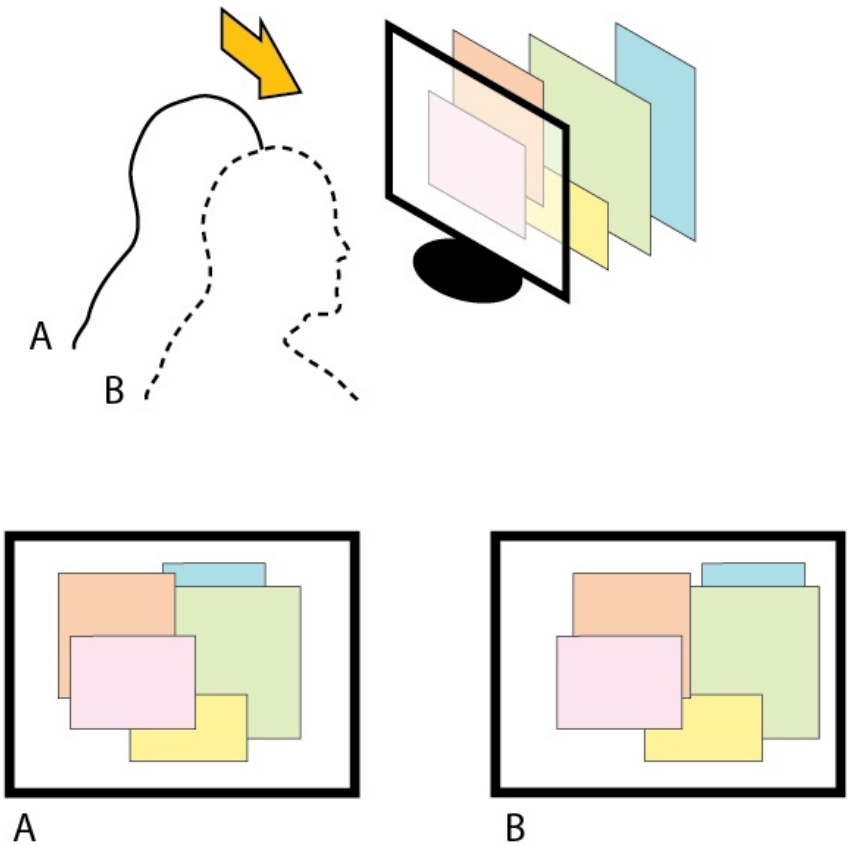

Figure 3: An illustration of the parallax UI for Windows.

[3]Watch a demonstration at *http://www.youtube.com/watch?v=vi_5NwOVTd8*

Conclusion

In this essay, I have illustrated three applications of spatial perception for visual design. In the first and third section, motion parallax effects were used in communicating depth cues in interfaces. In the second section, I have outlined the use of occlusion, shadow and color cues in floating window managers.

References

[1] WARE, C. Information Visualization: Perception for Design. *Elsevier Inc., 2004*.

[2] BLOCK, B. The Visual Story: Seeing the Structure of Film, TV and New Media. *Focal Press*.

[3] BRADSKI, G. R. Computer video face tracking for use in a perceptual user interface. *Intel Technology Journal*, Q2 1998.

[4] MONTAG, M. Head Tracking for Parallax Motion in the Windows UI. *http://www.mattmontag.com/projects-page/simulating-ui-depth*