Focus Plus Context Screens: Displays for Users Working with Large Visual Documents

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ABSTRACT
Users working with documents that are too large and detailed to fit the user's screen (e.g. chip designs) have the choice of zooming or applying appropriate visualization techniques. In this demonstration, we will present focus plus context screens—wall-size low-resolution displays with an embedded high-resolution display region. They allow users to view details of a document up close, while simultaneously seeing peripheral parts of the document in lower resolution. Unlike overview plus detail, focus plus context screens do not require users to visually switch between multiple views. Unlike fisheye views, focus plus context screens do not introduce distortion.

Keywords
Focus plus context screens, overview + detail, zooming.

INTRODUCTION
Many professional computer users today work with visual documents that are too large and detailed to fit on their screen. Examples can be found in chip design (blueprints of a semiconductor wafer), architecture, graphic design, geographic information systems, etc. [1].

Several solutions have been proposed for handling such documents. The most basic approach is zooming and panning [3]. Overview plus detail [7] is an approach that uses two windows, i.e. one showing the entire document and one showing a close-up of a portion of the document. However, this approach requires users to visually switch between windows and to reorient themselves every time they do. Focus plus context visualization techniques, e.g. fisheye views [5], avoid using a second window, but introduce distortion, which interferes with any task that requires judgments about scale, distance, or alignment.

As an alternative approach, *focus plus context screens* (f+c screens) were introduced in [2]. Focus plus context screens are wall-size low-res displays with an embedded hi-res display. **Figure 1** shows the display prototype that is currently in use in one of our offices. The frame holds a piece of foam core that serves as a projection surface (4x3 feet). A projector that is located behind the user projects onto it, turning the foam core into a large low-resolution display, the *context display*. The foam core has a hole in the center directly behind which an LCD monitor is located, the hi-res *focus display*. Customized software is used to display image content across both display regions, such that the scaling of the image is preserved, while its resolution varies across the two display regions. Content panned into the focus region is viewed in higher detail. In Figure 1, the focus region allows seeing individual cars on a satellite image of San Francisco.

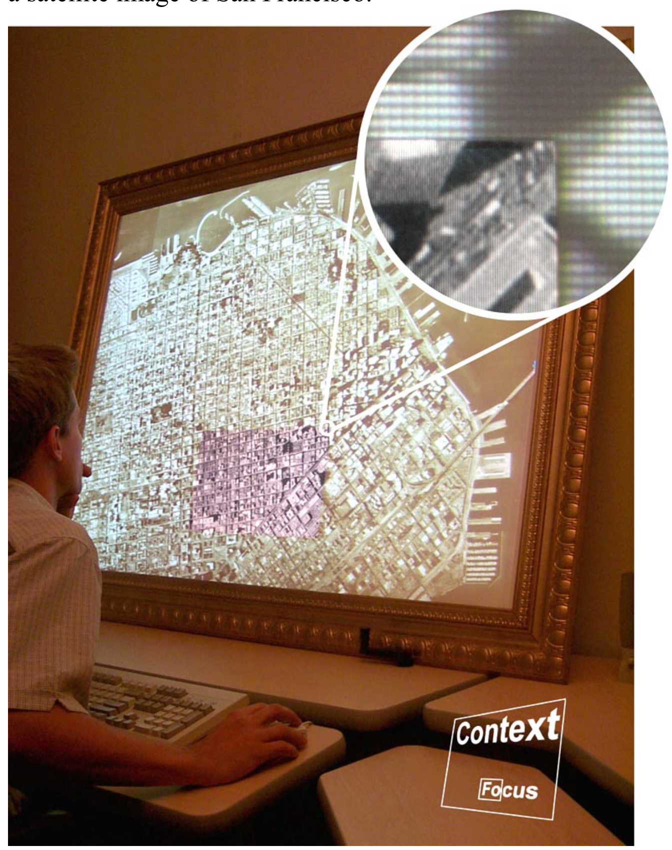

Figure 1: Focus plus context screen prototype. The callout shows the different resolutions of focus and context area. The iconic illustration (bottom right) shows the location of the focus screen.

Since only a portion of f+c screens is actually hi-res (similar to [4]), they are more than an order of magnitude cheaper than currently available projection array-based systems [6] and also require less space.

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APPLICATIONS AND TASKS ON F+C SCREENS

In the following, we will briefly present some of the applications we have adapted to run on f+c screens.

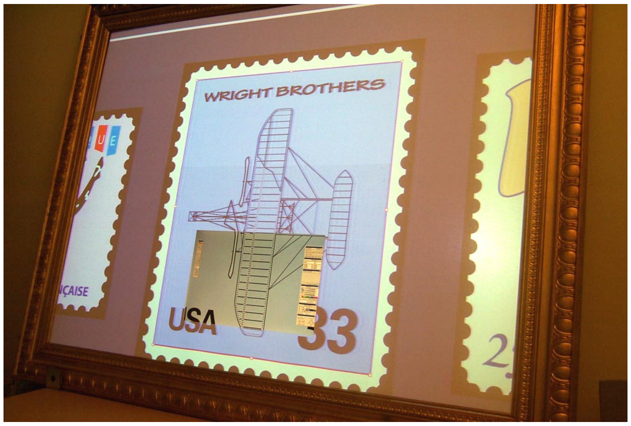

Figure 2: Focus plus context screens allow editing details of a drawing "in context" (Adobe Illustrator).

To obtain a print product that looks perfect from a distance as well as up-close, editors have to work with their artwork at many different zoom levels. On an f+c screen, editors of print products can work on details while constantly being aware of the detail's context, making it easier to judge how a detail modifications will affect the overall impression (**Figure 2**, Adobe Illustrator, enabled using a plug-in). Other visual applications (e.g. the image editor GIMP, Star Office, Netscape. etc.) can be run on our adaptation of the Linux operating system (using VNC http://www.uk.research.att.com/vnc) [2].

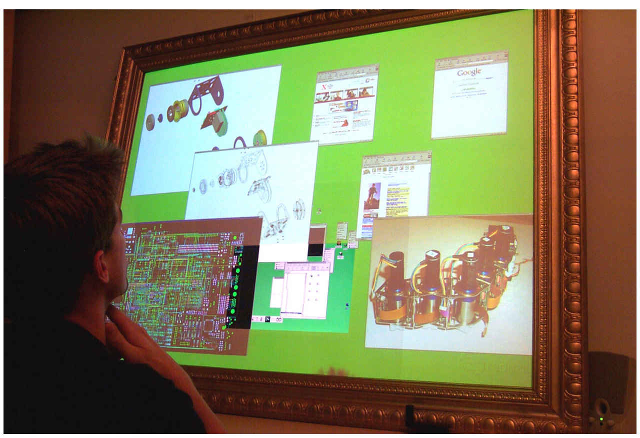

Figure 3: Working with large images and drawings on a focus plus context screen under Linux.

F+c screens are equally useful for a large variety of tasks dealing with *dynamic* content. In a videoconference scenario, f+c screens allow simultaneous display of the remote partner *and* the detail information that this person presents, e.g. readable text (**Figure 4**a). F+c screens allow users to *simultaneously* perceive the periphery while focusing on a detail. Such scenarios can be found in real-world situations, such as the control of remote operated vehicles via a video connection [1], as well as in simulation games. The first person shooter, Unreal Tournament (http://www.unrealtournament.com), requires players to be constantly focused on the crosshair at the screen center (**Figure 4**b). Since human vision in the peripheral regions is limited to low-res, an f+c screen produces the same user experience as if the entire display was hi-res.

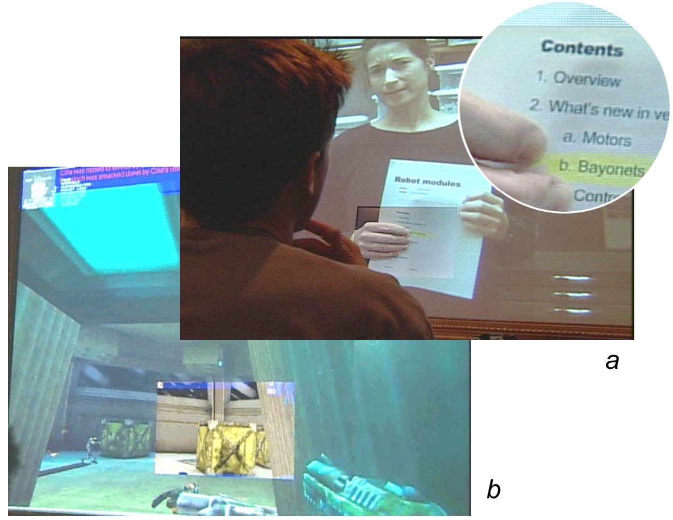

Figure 4 (a) A videoconference on an f+c screen. The higher resolution in the focus region allows communicating relevant details, such as text. (b) F+c screens allow players of 3D games to perceive their surrounding through peripheral vision.

CONCLUSIONS

In this paper, we presented focus plus context screens as a means for supporting users working with large visual content. By using a new type of hybrid display setup, f+c screens can outperform existing visualization techniques, such as overview plus detail and zooming/panning [1]. In future work, we plan to carry out a long-term study evaluating f+c screens as a habitat.

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