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Pliable Display Technology for the Common Operational Picture

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ABSTRACT

The need to present an effective Common Operational Picture to international and joint forces is clear. However, the preponderance of data that is available from multiple geo-spatial and imagery intelligence sources, stove-piped applications, plus other critical sources such as human and signals intelligence, presents significant problems. Time is of the essence, and accuracy is crucial, first in identifying threats and hazards, and second, in communicating key information to first responders and warfighters within a location context. We introduce the use of Pliable Display Technology for the presentation of data on computer displays to support the Common Operational Picture.

1.0 THE NEED FOR NEW VISUALIZATION TECHNIQUES

First responders, warfighters, analysts, and key decision makers are all faced with the conflicting demands of rapid response and the need to minimize civilian and friendly force casualties. This requirement for fast and effective response is made more complex by cluttered urban environments and the preponderance of data gathered from multiple sources. Capturing, processing, displaying, and understanding this information in order to support the decision making process is a daunting task. Recent research in visualization interfaces and in new display technologies is pertinent to the problem of information overload.

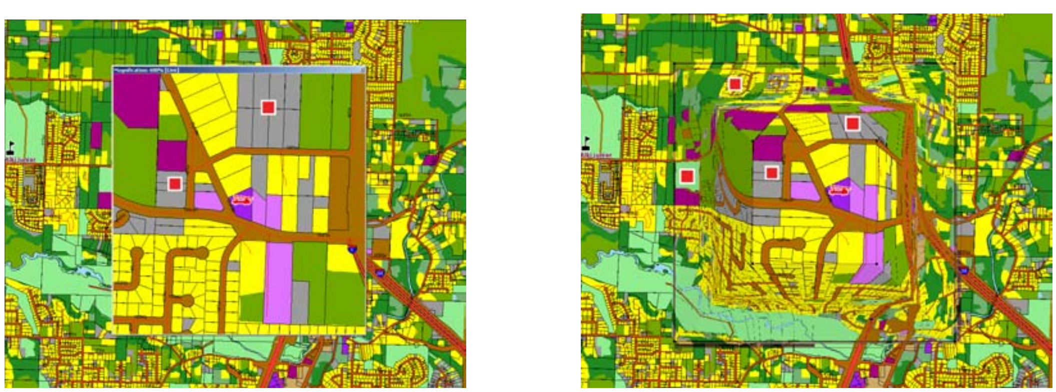

Figure 1: Comparison of inset magnifier and PDT. In the left hand image, a classic inset magnifier makes data disconnected and hides hostile entities. On the right, PDT maintains continuity and doesn't hide data.

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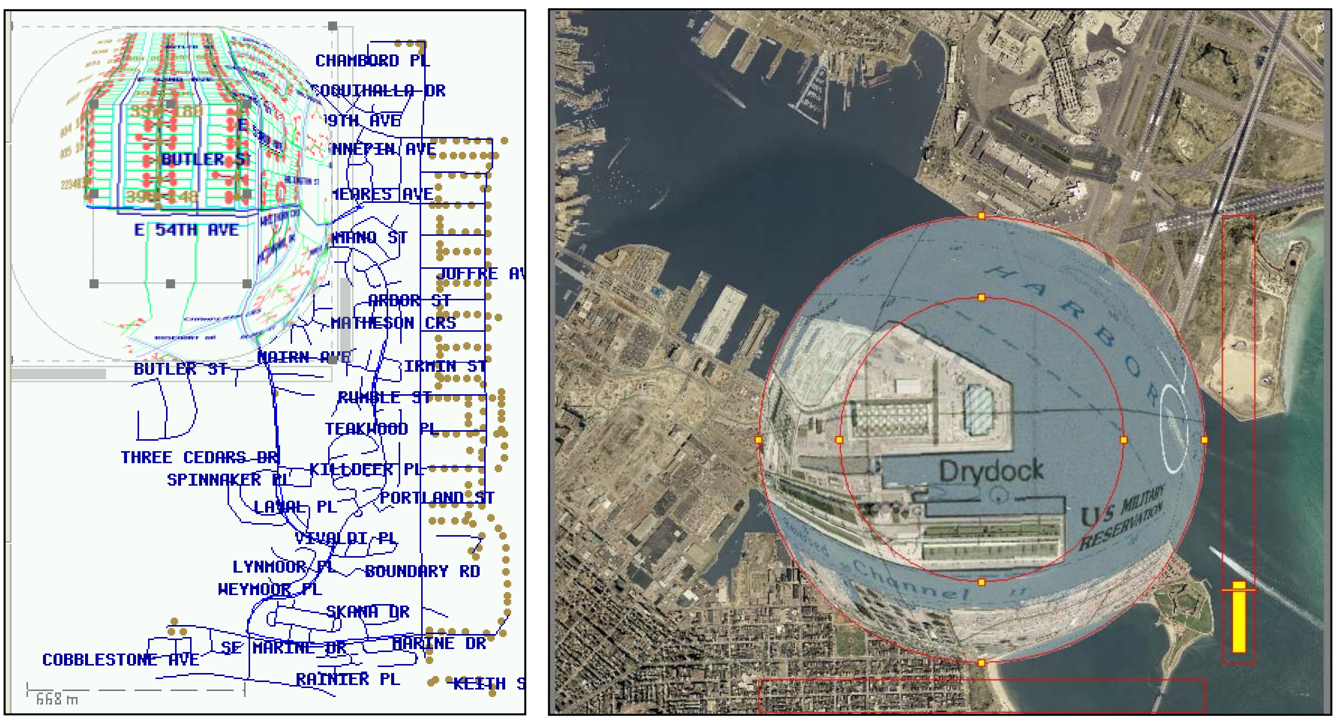
One important visualization technology that has great relevance to the defence community is detail-in-context, or fisheye visualizations. This method of displaying and navigating information has been a topic of research in the world of computer visualization and human computer interaction for decades, and in several quantitative empirical studies has been shown to improve user performance in certain circumstances [2, 3, 4, 5]. IDELIX Software Inc. has developed its own implementation of fisheye lenses, known as Pliable Display Technology (PDT), which is provided in a software development kit (SDK) that can be integrated into new or existing computer software applications. IDELIX is in the process of investigating how PDT can help in promoting understanding of the Common Operational Picture for analysts, first responders/warfighters, and decision makers.

2.0 DATA FUSION: DE-CLUTTERING AND BLENDING

One way in which PDT lenses can be used to de-clutter a visual scene is by displaying different content in the high magnification focal region as compared to the low-magnification contextual region. Using this technique, less cluttered data can be presented in the context to provide global scene awareness, whereas detailed data can be shown in the lensed region to provide a more precise understanding. Furthermore, data from multiple sensors can be "fused" or blended independently in either the contextual region or the lensed region to provide desired effects. Figure 2 presents de-cluttering and blending situations.



(a) (b)

Figure 2: (a) Multilayer GIS data presentation with de-cluttering and increased local detail, and (b) Blending of a vector map layer and aerial photograph in the lens region.

3.0 EDITING AND MARK-UP THROUGH THE LENS

PDT lenses not only enhance one's ability to view data, they can also improve how a user interacts with data. For a user to accurately mark key navigation points, communicate battlefield details such as troop positioning, identify civilians, and detect unique landmarks, it helps for the user to be able to "see through the clutter." Current viewing tools such as inset views and separate views occlude data and result in a visual disconnect that makes it very difficult to accurately and efficiently perform measurements and annotations. On the other hand, PDT provides a seamless connection between different scales of data, potentially minimizing errors and increasing accuracy and efficiency in editing tasks.

4.0 AUTOMATED TARGET RECOGNITION

Another area of interest in the application of PDT is in the target recognition process. In cases where automated target detection and selection are employed, there still remains a need for intervention by a human decision-maker as a critical accept/reject filter. Depending on the tolerance of the automated target recognition algorithm, there may be a large number of false positives that a human operator must investigate. The use of detail-in-context lens visualizations allows a user to quickly check a large number of potential hits while maintaining an awareness of where these potential hits are in relation to one another, and in relation to the scene as a whole. Furthermore, by coupling the lens creation and positioning to the automated algorithm in the application, the lens can be made to automatically reconfigure itself to show potential hits to the user. This can greatly reduce the amount of effort required to manually navigate through the scene to find potential hits.

5.0 FIELD USE WITH MOBILE DEVICES

For field use, and other mobile deployments, PDT also presents a means of addressing screen real estate issues and conserving bandwidth usage on wireless PDA and other small footprint devices. Detail-in-context visualizations have been shown to be a good fit for handheld devices for the task of sketching [5], and the technology is also highly complementary to data compression technologies and standards such as JPEG2000[6]. JPEG2000, which allows for particular regions of interest to be decompressed and transmitted over the network, allows for very selective control over data. When coupled with PDT, only the required resolution image is transmitted and stored for any particular region, either inside or outside the lens. This allows for significant saving in both storage and bandwidth.

6.0 REMOTE COLLABORATION

In joint operations it is often the case that analysts, first responders/warfighters, and decision makers must work together while being physically removed from one another. This raises the question of how to best enable remote collaboration to promote a shared understanding of the Common Operational Picture. PDT can be used as a sort of "awareness widget" to promote such an understanding. When lenses are coupled between remote applications over a network, not only do they provide the advantage of detail-in-context data presentation, they also offer cues to aid collaborating users in forming a shared understanding of what they are discussing. Research in the human computer interaction community has discussed how detail-in-context enhanced remote collaboration may be beneficial to navigating and editing text data [1], and it is expected that similar benefits will become apparent when dealing with geographic data.

Figure 3: PDT can be used to enhance the usability of handhelds with limited screen real estate.

7.0 ONGOING PROJECTS

IDELIX is currently actively working with Defence Research and Development Canada (DRDC/RDDC) on a project to develop the concept of "PDT Smart Lenses," lenses that are data aware and can dynamically adjust or constrain themselves to accommodate scene data. Recent commercial partnerships include integrations into Black Coral GIS, a new situational analysis tool showcased at the 2004 Joint Warrior Interoperability Demonstration (JWID) trials, as well as an integration into Paragon Imaging ELT software. IDELIX is also working closely with the NGA's InnoVision Directorate and is also a partner in the Eastman Kodak Company consortium for the NGA's Softcopy Search Program.

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