ASPECTS: A Support Tool for Collaborative Strategic Planning and Asset Allocation Tasks

Phillip J. McClelland, Simon J. Whitmell, Khaled Tangao, and Stacey D. Scott
Department of Systems Design Engineering
University of Waterloo
Waterloo, Ontario, Canada
{ pjmcclel, swhitmel, ktangao, s9scott }@engmail.uwaterloo.ca

ABSTRACT
In order to begin developing more sophisticated, next generation surface computing application interfaces that are capable of supporting complex, real-world collaborative tasks, such as strategic planning, a better understanding is needed of the design tradeoffs between window and content management interaction techniques and data manipulation interaction techniques. In order to explore this issue, and gain experience developing application interfaces for more complex collaborative task scenarios, we are developing a series of tabletop application interface prototypes to support naval planning task scenarios. This paper describes the first application prototype developed in this project, called ASPECTS, A Support Tool for Collaborative Strategic Planning and Asset Allocation Tasks. This application prototype is designed to demonstrate interface design and interaction mechanism to support collaborative asset allocation and negation in the context of joint mission planning among NATO member states.

AUTHOR KEYWORDS
digital tabletop, co-located collaboration, naval planning

ACM CLASSIFICATION KEYWORDS
[H.5.3]: Collaborative computing — Computer-supported cooperative work.

INTRODUCTION
As surface computing platforms and software architectures and interfaces mature through growth in surface computing research and development, more standardized methods are available to manage surface computing issues, such as orientation and multi-user interaction. The maturation of fundamental system aspects introduces opportunities to begin developing more sophisticated system functionality, in order to better support realistic collaborative task scenarios, such as strategic planning.

Progress has already been made in the design of such next generation surface computing systems. Wigdor et al.[1] proposed new interface mechanisms for interacting with geospatial data and related information sources across multiple large surfaces including a tabletop and several nearby wall displays. Their design prototype was build around emergency response planning and decision making task scenarios, however, it was limited by a relatively small and low-resolution tabletop display which limited its ability to provide stakeholders with sufficient access to the volumes of information that are often needed in such planning situations. More recently, Jiang, et al.'s [2] WeSpace multi-surface system was developed to support groups of scientists performing collaborative data analysis of various large, complex datasets. Similarly, Isenberg et al. [3] have explored the use of large, high-resolution tabletop interfaces to support collaborative data analysis of large datasets.

These projects highlight key design issues that arise when surface interfaces begin to incorporate more complex application functionality and data types beyond the prototypical photo manipulation prevalent in many early surface computing systems. For instance, window and content management interaction techniques can conflict with established computer interaction methods for different data types. For example, the Rotate 'N Translate (RNT) integrated reorientation and repositioning method can interfere with a user's ability to directly interact with application data: how should the system respond to a user's touch and drag action on a map? Should the map window be moved or reoriented, or should the map view pan? The trend in surface interaction toward more physics-based interactions to provide "intuitive" interactions can potentially limit how users interact with virtual data that are not bound by physics principles. More research is needed to better understand how to provide effective interaction mechanisms to access, manipulate, and share complex application data, while still providing users with simple intuitive mechanisms for window and content management.

To explore these design issues, and to ultimately move toward the development of sophisticated surface computing interfaces that support real-world planning and decision-making tasks, we are collaborating with experts in the military naval domain to develop a series of tabletop application prototypes to support different naval planning task scenarios. ASPECTS (Asset Planning Employing Collaborative Tabletop Systems) is the first application prototype developed under this project. It supports strategic planning and negotiation of asset allocation of member states involved in joint international missions. The application allows users to track their available assets, such as military vessels, and to work cooperatively to commit some of those assets to a joint mission plan.

THE ASPECTS SCENARIO

ASPECTS is designed to support a representative NATO-based collaborative military planning scenario. In this scenario, a NATO joint task force has been formed to police the waters off the coast of Yemen to deter piracy in offshore shipping lanes. To accomplish this joint mandate, military personnel from several NATO member nations must work together to form a one-year schedule of assets committed to the patrolling task. At any time during the year-long period, the available assets must satisfy a minimum set of capabilities.

ASPECTS APPLICATION INTERFACE

The ASPECTS application interface (Figure 1) provides a group of users with map views, asset lists, and other relevant information displays to support the above task scenario. The program tracks the combined specifications of already assigned assets, naval vessels in this case, and outlines the outstanding unfulfilled requirements of the proposed patrol schedule.

To support the collaborative task, ASPECTS provides each user with information tailored to that user's associated member nation, including available assets. Personal and shared interactive maps, along with other task-related windows, facilitate simultaneous data interaction among users. User-specific views are opened, closed, and managed from anchor, or "home," points, in the form of interactive menus. If desired, a user may dock views to this anchor point and reorient all docked items as a group. New views will automatically be oriented to align with the current orientation of the anchor point, ensuring that all views have a consistent orientation, controlled by the associated user. Finally, the anchor point is itself moveable; the views can be collapsed, the anchor point relocated and reoriented to a different side of the table, and any subsequently opened views will be restored relative to the new anchor point orientation.

ASPECTS also uniquely identifies input from each user, enabling customization and tailoring of application functionality and views based on their identity. This capability is ideal for naval planning, or other defence and security task scenarios, as it allows for security measures and information compartmentalization to be implemented even in a multi-user environment.

ASPECTS SYSTEM DESIGN

Our current system prototype consists of a top-projected interactive tabletop that provides multi-user interaction based on Anoto's digital ink pen technology [4]. Each pen is uniquely identified, allowing the ASPECTS software to associate specific user roles and security settings with each pen. The APSECTS application software was developed using the Windows Presentation Foundation (WPF) for the C# language and uses the InterMAPhics geospatial mapping library from Gallium Visual Systems Inc.

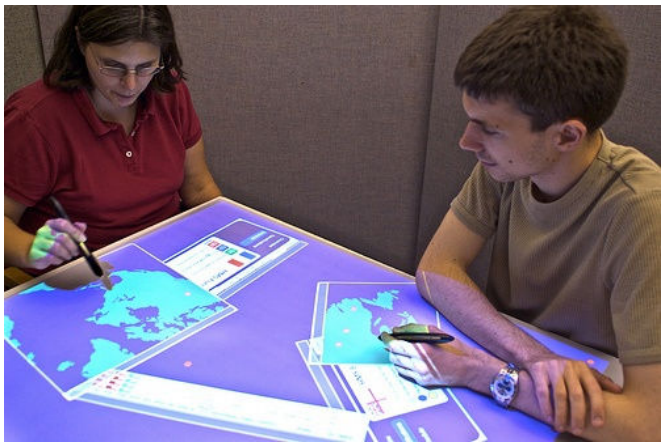

Figure 1. The ASPECTS tabletop application prototype.

CONCLUSIONS AND FUTURE WORK

The ASPECTS application prototype serves as an aid for key stakeholders to come together to discuss the allocation of resources to meet defined objectives. In addition to presenting information relevant to each participant's task role, it acts as an interactive workspace in which users may experiment with ideas separately or as a group, supporting a number of planning and decision making processes.

We are currently refining our application interface to explore some of the design issues discussed above related to providing both window and content management capabilities along with interaction with application data. Another area of interest for further research is to expand the hardware platform to include private displays, such as tablet computers, in order to provide users with private display areas to view sensitive material and explore uncertain ideas prior to sharing them with the group.

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