

NDM8

Designing Large Scale Decision Support Environments to Enable Effective Team Decision Making

Topic: Beyond the Individual Decision Maker:
NDM in Teams and Organizations

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EXTENDED ABSTRACT

Current approaches to the design of collaborative work spaces do not exploit the potential of the environment. Rather, they tend to focus on the physical layout and aesthetics of the room. Design concepts to enhance the decision support for Operations Centers (OC) or Command and Control (C2) environments are needed. These environments generally include multiple decision-making agents (both human and software) and multiple representation devices (artifacts). Decision-makers are constantly faced with making key decisions utilizing massive amounts of information, which is not only dynamic, but originating from multiple sources, and which must be coordinated across decision-making agents. An overarching decision-centered framework is paramount to achieving effective performance and satisfying information management requirements. While advances in display technologies have provided a means for presenting this information, there exists little theoretical basis or research to help guide how that information should be presented.

The decision maker's role must not to be adversely impacted by the mechanics of utilizing the available decision-aiding artifacts; rather the artifact must facilitate better information management and decision-making. Providing support for the entire team in an OC or C2 environment is needed to actively foster collaboration and participation among a collection of decision making agents. Multiple users need to be able to simultaneously interact with, and not just merely view, the suite of displays, including those in co-located environments.

Across a variety of work domains, five unique requirements have emerged for achieving highly effective multi-human plus decision support system teams (Woods, D. and Hollnagel, E. 2006; Elm et al., 2005). Discovered while focused on designing effective decision support systems, these generic support requirements apply to cognitive work by any cognitive agent or any set of cognitive agents, including teams of people and machine agents in OC and C2 work environments. These five requirements discussed in this paper are Observability, Directability, Directed Attention, Resilience, and Teamwork with Agents.

This paper will set forth a theoretical framework for how information should be presented to decision-making agents in an environment. Specifically this paper will explore how cognitive analysis can be utilized to describe the nature of decision making at the team level. This approach is scalable and accounts for variables such as team size, team composition, and the level and type of team interaction by mapping these variable back on to the analytic artifacts in order to design decision-support artifacts that are tailored to the naturalistic decision-making environment.

Because decision-making teams require communication and coordination among its members, the decision support environment cannot simply be a series of individual workstations. Rather, the support environment needs a set of display devices that present results of the various decision-making processes in the context of the team's

goals and their current level of achievement. In addition, the decision support environment must address the generic CSE support functions. We propose that the decision-support workspace should contain the following types of displays:

- **Group Functional Displays** – provide a holistic, high-level view of the state and direction of team missions. These displays help increase Observability by providing common ground (i.e., a shared frame of reference) and making agents' intent and activities observable to all team members.
- **Individual Functional Displays** – for each team member; tailored to the specifics of their function within the overall mission
- **Alert Panels** – provide support for the re-direction of human attention to anomalies. They also support coordination functions by seeding other team member activities (i.e., structure & kick start initial activity) and reminding each role member of alternative possibilities as activity progresses.

For these three classes of displays, key decision support results from providing:

- **Multi-perspective Views** – support decision making and diagnostic processes. Workspace coordination is concerned with shifting among multiple perspectives on the underlying processes in the work domain.
- **Activity Overlays** – support coordination and collaboration between team members. Enable each team member to, at a glance, determine the pattern of activity across the team and identify regions that are being neglected or over-worked.

While the current state of the practice tends to focus on technology improvements (e.g., increased size and resolution of large-scale displays) without explicit support for decision-making, this design effort utilized unique design features that resulted from the mission of satisfying these five requirements. This approach influenced the command team organization, the collaboration role of group displays, the attention-direction role of specialized group displays, and the need for coordination between individual workstations and group displays. All of these design concepts are expected to have a significant impact on team decision making effectiveness.

REFERENCES

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