

An Agent-based Simulation of Military Headquarters

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Abstract: Military headquarters (HQ) are large specialist organisations that plan and manage military operations. The headquarters is staffed by experienced military professionals that work together to process information and make decisions. The response speed and quality of these processes and decisions depend not only on the explicit procedures and organisation structure, but many other factors such as staff experience, social networks, trust, information technology uptake, communications support, the situation complexity, and the interactions with external stakeholders.

This presentation describes an ongoing research program that aims to support the analysis of HQ organisation performance, and provide a capability to predict the effect of proposed changes. An agent-based simulation of the HQ is under development, and this will be used to model significant aspects of HQ work, and simulate the information work and decision making that the HQ performs. The inputs to the simulation include staff attributes, organisation structure and roles, internal process guidelines, external agency interfaces, typical concerns of individual staff members (such as family time, fitness activities, social events, and personal appointments), developing situations of interest to the HQ, a scenario of work requests and incidents for HQ attention, and what information resources are available. Every staff member is modeled by an agent, and each action and message is logged during the weeks or months of the simulation period as staff perform work and make decisions. The output logs can then be analysed and compared, showing critical nodes, efficiency, effectiveness, and risks.

The interactions between agents, external agencies, and the information stores over time provide a rich data set which can be linked to the scenario to uncover non-obvious relationships and patterns. By varying the input data sets and comparing the output, we are also able to estimate the effects of the changes on the performance of the HQ. The performance attributes we are interested in measuring over time include staff workload, information quality, benefits of information technology use, external interaction patterns, critical points in the workflow, the causes of stress, the effect of staff skills and experience, and the ability of the HQ to handle multiple complex operations.

One of the more innovative aspects of the simulation is the abstraction of staff skills, knowledge representation, information work, and quality. In this simulation, knowledge, information, and skills are all modeled the same way: by a list of knowledge elements called a knowledge set (KS). Each element has a name (such as air-transport or armour-combat) and a magnitude (a number from 1-10) indicating the extent or depth of knowledge. During the simulation, the agents use their skills (modeled by a static KS) and information resources (each modeled by a KS) to build documents (each modeled by a KS too). During the HQ work processes, the planning and conduct of operations will attempt to move a situation to a state defined by the requirements as supplied in the scenario. The progress (and quality) of staff work is assessed by a comparison of the developing KS with a hidden goal KS related to the situation. As the situation can change over time, the goal KS can change, requiring further staff work to ensure the plans and operation control are effective in optimally resolving the situation. This use of the KS construct within the simulation provides a useful model of information work in the HQ, while remaining computationally feasible for interactions between hundreds of agents.

In future work, we aim to extend the simulation to include information transfer (by telephone, email, database storage, and briefings), information exchange in meetings and discussions, and information properties such as certainty, depth, accuracy, and currency. We are also interested in human factors as they affect staff work in the HQ. The effects of fatigue, stress, multi-tasking, learning, and awareness may be significant factors in the performance of staff within the HQ.

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Abstract only