COMMAND MODELLING LANGUAGES AND THE REDUCTION OF DISPLAY FIXATION

Geoffrey N. Hone[1], Robert Ayres[1] and Lynne Martin[2]

Abstract. This paper considers a number of themes, and seeks to show that they should be considered jointly rather than severally. First the historical aspect of technology is considered as applied to data transmission, particularly for command and control (C2) data. Next, the paper discusses a standard language for modelling command and control in combat situations, and how this could be extended from use in synthetic environments to the modern network-enabled forces. It is argued that a command or battlespace modelling language intended to ensure compatibility between simulation platforms can be developed for practical use in the modern digitized force. The object of this would be to minimise the "display fixation" which has already been shown to occur with battle management displays. The paper then considers C2 messaging in the fields of civil aviation and ground combat and considers lessons learned on the effect of changes in aircrew workload and behaviours brought about by the use of data link displays for message transmission. The paper concludes that modern battlefield command systems can potentially be improved by the use of techniques borrowed from other domains.

AN HISTORICAL PERSPECTIVE

In historical terms, the first advanced technology to be employed for command and control (C2) was the electric telegraph. This technology saw exponential expansion during the 1860s and 1870s, and was used by the High Command in Berlin during the Franco-Prussian War. The round-trip message time of about 24 hours was far better than could be obtained using teams of "gallopers", and was considered preferable to moving the High Command forward to a position of potential danger. Of course, High Command was not concerned with the transmission cost of each message.

In commercial terms, the telegraph facilitated C2 by Head Office. A Company Board in London could receive news from (say) India or Singapore on one day, consider their response, issue an instruction to their local manager that was received the next day. The Board of Directors was very much concerned with the transmission cost of each message.

The electric telegraph transmitted letters and a string of letters made up a word. The telegraph company charged by the word—and charged a rate that the telecommunication companies of today must envy! The rate-per-word was frequently equal to the weekly pay of a skilled workman in the home country. The response of those concerns engaged in multi-national commerce was to use codes. These codes were either dedicated or were standard commercial codes, and, in either case, one single word sent represented a longer string of words (a sentence). The success of this type of commercial C2 rested on the fact that both ends of the message transmission system used the same code, and thus the full message as initiated was the same message received.

The advent of radio sets that were man-portable (in practical terms) during and after WWII saw a similar use of codes—usually referred to as Voice Procedure or WT Procedure. There was of course a security component to these procedures, but a transmission that went:

"Sunray here. Sunray to set"

represented a substantial compression factor over the true content of the message:

"This is the Commanding Officer. I want to talk to your Officer Commanding, now!"

or something very similar (and which would have been highly context-dependent).

The current digital C2 system is usually considered as one having a "secure fax facility" that will enable the rapid transmission of written orders down the command hierarchy, and initial trials in the UK have indicated that a side effect has been to reduce the number of pages transmitted. We argue later that the old principles for the use of the telegraph can also be applied to further reduce the transmission volume.

MESSAGE BREVITY AND BATTLE MANAGEMENT LANGUAGES

A Battle Management Language (BML) is any notation that can be used to express commands for military operations. Such languages range from ordinary language extended with a set of special terms, as have been traditionally used for command and control in real battles, to highly formalised notations for expressing commands in a form that can be interpreted by machine.

The expense of running simulation exercises in which operators are required to translate orders expressed in ordinary language into a set of directions or updates to the simulator has led to considerable interest in the possibility of developing a battle management language (see, for example, the work by Carey et al, [1,2]) satisfying the following two criteria:

- sufficiently detailed, structured and unambiguous that it could be directly interpreted by simulation software; and
- sufficiently expressive and "natural" that it could be used to express commands in real operations.

Were such a language to be developed, it would provide the benefit of bridging the current mismatch between real operations and training exercises. This would allow simulations to be used seamlessly in operation rehearsal and in training exercises.

Although such languages would undoubtedly have enormous potential for enabling interoperability of simulation and C2 systems they have another potential application in battlefield communication. This possibility arises from having a small,

1 CISE Group, Department of Informatics and Simulation, Cranfield University, Shrivenham, SN6 8LA, UK.
2 SJSUF, NASA Ames Research Centre, California, USA.

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