Putting models to work.
A comparison between user- and research driven projects

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Getting advanced computer models accepted as instruments of analysis and learning can be an intricate task. Our experience indicates that the acceptance of the models depends on the active participation of the receiving organisation in the development and implementation process. On the other hand, some of the objectives of an advanced model may not be achieved with the users as the major driving force.

In this paper, two models and the process of their development and implementation with the Swedish Navy will be discussed and compared. The first model, a distributed system for simulation of anti-submarine warfare, was initiated at our research institute and is now used by the Navy as a development tool for new tactics. The other model, displaying registered ship movements, is an instrument for analysing military manoeuvres. This model had its origin in a request from the Navy and has successively been modified to meet new fields of applications.

Keywords: military application, development, implementation, models

Operation research in the Swedish Navy

The work described in this paper has been performed by a group that works towards the Naval Warfare Centre in the Swedish Navy. The role of this group is to act as consultants in the incorporation of operation research in the development and evaluation of tactics. When a tactical concept is to be developed or modified, the Navy forms a group consisting of officers and one or two researchers from our group. The officers have the military experience and are also the persons that will use the tactic in a later stage. Our obligation is to ensure that the creative process is done in a well-reasoned and logical way and that all relevant factors are considered. It is also our responsibility to make calculations, handle computer models and to make evaluations when necessary.

One of our main fields the last years has been anti-submarine warfare tactics. Since the Swedish Navy operates in the Baltic, which has an archipelago and shallow

water that differs substantially from that in the Ocean, it requires a unique thinking in anti-submarine warfare questions. The military scenario in the surrounding world changes from year to year and so does the technical equipment of the warships. Consequently, there is a continuos need for modification of the tactical concepts.

In this work, computer models for simulation, analysis and learning are often needed, and it is mostly our responsibility to develop and evaluate these models. In most cases it is preferable that the officers use the models, if necessary with our guidance, since it is their experience that should form the input to the model. They are also the ones that should use the result when the study is ready. By that reason I will in this paper call the officers the "users" and our group the "researchers".

Two models will be discussed in this paper, one that was initiated by our group and one that had its origin in a request from the Navy. The differences in their development- and implementation processes will be discussed below and some conclusions will be drawn.

The research driven project -

A distributed system for simulation of anti-submarine warfare

The process of tactic development includes activities such wargaming, training in simulation establishments and manoeuvres at sea. When we started to work with these questions, our group was lacking a level where to play more simple games focused on the tactical concepts without being caught into problems such commanding or sonar skill. We wanted to have a simulation model where the computer made the decision if the warships had contact with the submarine or not. The idea was also that it should be easy to use the model for one or a group of persons that hadn’t much time for preparations.

Our group initiated the development of this model a few years ago and modifications are still undertaken. The model allows several people to play the game on different computers. All participants have the same map on the screen and they can chose if they want to see the other participants or not. The game is updated with a time interval between which the ships can change direction, speed and parameters of the sonar’s. The computer displays the ships positions and the sonar contacts both for the ships and the submarine.

The result of the simulation largely depends on the experience of the officers and it is therefore of great importance that the officers are involved and engaged in the simulations. Our intention was that we in the beginning should use the model together with the officers and that they after some period should be able to use it on their own.

This model was driven through by us, the officers were only marginally involved during the development. They where participating first when the model was almost ready and it was time to do the first test simulations. At that stage most of them had a lot of viewpoints on the model and wishes about other features that should be implemented. The most frequent criticism was that they wanted a similar model but with another purpose, more aimed at, for example, geographical studies or sonar training. We then had to argue for our point of view and in some cases to implement their wishes in the model. The entire process of implementation therefore took a long time, going on for several months.

The user driven project -

An analysis instrument for evaluating of manoeuvres

During the spring -94 we were asked to help the Navy to evaluate some of their manoeuvres when training anti submarine warfare in the archipelago. At that time they were lacking an analysis instrument to be used during the manoeuvre to help them to rapidly take decisions about where to search for the submarine after that they had had a short contact. We were asked to have viewpoints on such an instrument and later on we took the responsibility of the realisation of such a computer model. Before we started to programme the model we had several discussions with the officers guiding us to which features that should be included in the model.

The model, which now is completed, shows a map of the area where the manoeuvre takes place. It also shows the positions of the ships that have been registered automatically by GPS as a function of time. Besides the ship's positions it is possible to show the ranges of the sonar’s, the area that has been searched for, submarine contacts and sonar buoy positions. From that information and from assumptions on the speed of the submarine, the model gives an apprehension of where the submarine may or may not be at the moment.

In this case, there were no problems to get the model accepted. The users were involved in the development from the beginning and we had frequent discussions during the development. When the model was ready, it was very well received and it was also used for other purposes than was thought of from the beginning, wherefore new features were implemented afterwards. The entire process from the first idea until the model was ready and distributed took no more than half a year.

Conclusions

There are major advantages when the project is initiated by the user. The user has then a large interest in the model from the beginning and is naturally involved in the development process. Thereby, it will probably be no problem to get the model

accepted when it is ready. At the same time, it is possible for the researcher to influence the contents of the model.

But models are not always initiated by the users. In our position, having the responsibility for that a study is driven in a correct way, it is our obligation to take the initiative to new methods and computer models when needed. If one's intention is to teach a new way of thinking, a computer model can be a good instrument for that purpose. It could be done, for example, by letting the computer force the user to take decisions in a given sequence that differs from the way by routine. In such cases it is a necessity that the model is initiated and driven by those persons who want to teach something, which in our case often is the researcher.

Whatever the reason is for the researcher to initiate a new model, our experience tells us that it is extremely important to make the participation of the receiver as active as possible in an early stage. It is also necessary to present the model in a way that convince the user about it's justification and to deposit time for that process.

It must also be remembered that there are lots of other factors that will influence the acceptance, such as if the model is small or comprehensive, if it acts as a black box or is transparent to the user, which platform (Mac/PC) it is implemented on, the interface to the user and the amount of data that will be needed as input to the model..