Chapter 137
Research on the Modeling Method of Wargaming for Equipment Support on Computer

Xiao-ming Du, Gui-qi Wang, Ping Gu and Lu Gao

Abstract The study of modeling is a core problem to actualize the function of wargaming for equipment support on computer. The chessman is an information carrier to show the situation of support force and also an assignment carrier to implement the support activity in the wargaming system based on the computer. Firstly, the method of modeling which is based on the period of chessman's life is put forward on the basis of analyzing the state of chessman's life. Then, the method is described, and the framework of model for wargaming is established by the method. Finally, a case is introduced to explain the application of the method.

Keywords Chessman · Equipment support · Modeling · Wargaming

137.1 Introduction

The wargaming (Peter 1990) for equipment support on computer is the application of wargame's principle in equipment support, by using which, the commander using the wargame map and units representing the real battle field and military or using the computer simulation model (Yang 2007; Peng et al. 2008) in terms of the rule and the principle of probability theory to command the activity of equipment support in the war for verifying and improving the equipment support project.

The activity of equipment support is a complex system, and how to study the model for wargaming is a core problem to carry out the function of wargaming based on computer. The scientific property of model connects with the capability of wargaming flow and result. In the text, the method of modeling which is based on the period of chessman's life is firstly put forward on the basis of analyzing the state of chessman's life to establish the system of model for wargaming.

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137.2 The Analysis for the State of Chessman's Life

137.2.1 The Concept of Chessman

The function of chessman is to show different classes of army and weapons, and the commander who uses the system of wargaming could inquire the ability parameters which are evaluated by the level of the army's training or the capability of the unit's equipment through the chessman (James 1997). The chessman's parameters of the wargaming for equipment support are composed of the value of movement, defense, support, attack, and are composed of the information of support object and unit's code, and so on, as shown in Fig. 137.1.

The chessman is an information carrier to show the situation of military and is an assignment carrier to implement the action in the wargaming system which is based on computer (Liu et al. 2008). The forms and movements of chessman are basically function achieved for the system working.

137.2.2 The Analysis for the Cycle of Chessman's Life

Anything has a process from produce to perish. The chessman's process which involves produce change perishes; illuminate the flow of the wargaming. The chessman's movement is the carrier for wargaming (Ross 2006).

Firstly, the chessman's entity is made by experts in military affairs through generalizing the information and the attribute of equipment support forces and combat forces. When the wargaming begin, the chessman is working on the purpose of commanders who operate the command platform on computer and working under the trigger conditions. The movements of chessman involve mobility deployment maintenance regress, and so on. At the same time, the chessman's status messages are changing along with the movements of chessman, and are displaying on the situation display platform for the commanders who want to know it on real-time. In course of wargaming, if the chessman is exposed to the firepower strike from enemy force, then the damage or perishes of the chessman is coming, as shown in Fig. 137.2.

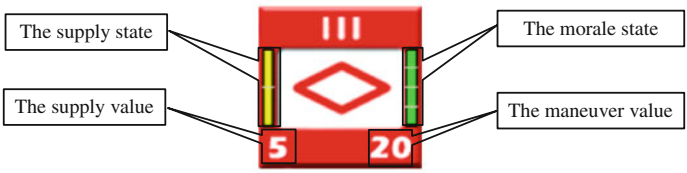

Fig. 137.1 The chessman

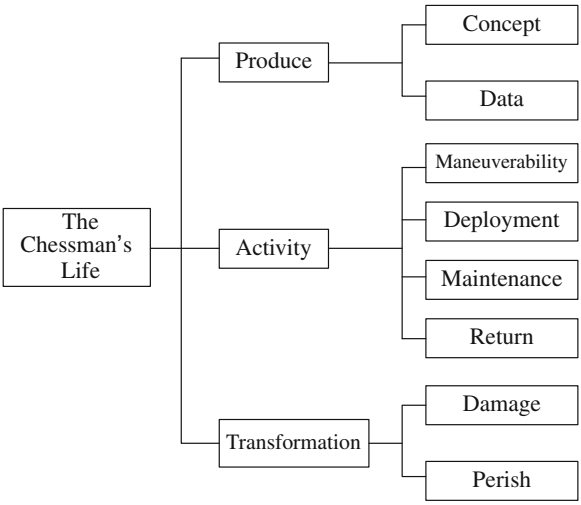

Fig. 137.2 The chessman's life

137.3 The Development of the Model System for Wargaming

137.3.1 The Method of Modeling

The activity of wargaming for equipment support is a complex system; include the support entity, the combat entity, the interactive relationship between the entity and the correlation of the entity. So we need an effective method of modeling to describe the entity, operating modes of system, complicate battlefield environment, relationship between the entity and the arbitrage formulae.

The method of modeling which is based on the period of chessman's life is put forward on the basis of analyzing the state of chessman's life to establish the system of model for wargaming. In course of modeling process, the chessman is a main. The relevant model is established by analyzing the chessman's life and the variation state of chessman in different phases, and the homonymic model architecture is developed to describe the wargaming from the chessman's life based on the method. The entity model is coming with the produce of the chessman, to describe the static and dynamic attribute of the entity, to model the support force and the combat force. The structuring model is coming with the trigger conditions of the chessman's business activities, to describe the subjection relationship and correlation relationship between the chessmen, to ascertain the support relationship so as to the chessman's business activities is under the right order. The behavior model which is the core in the modeling is coming with the development of the chessman's business activities; it is composed of maneuverability model

deployment model and so on. The information model and the interactive formulae model are coming with the change of the chessman's state, to describe the process how the chessman's state is changed and how the message and information is transferred when the chessman is working. Otherwise the probability model and the terrain environment model are developed to describe the haphazard and the environment.

137.3.2 The Development of the Model

- The entity model is described the structure of entity, the attribute of entity and the correlation of the entity (Xin et al. 2010). The wargaming entity model is usually composed of the ability parameter, the structure and the state of the military force. For example the support force entity model include the information of the support units, such as the ability to maneuver support recovery, the object and the range of operation, to be grounded on the realization of the dispatching order. The combat force entity model is the object of the support force, and it isn't central model relative to the support force entity model, so the model is simply described the equipment information, the comeback parameter of combat, the real-time state and so on. Otherwise the equipment entity model is developed to describe the equipment information, such as maintenance type, mean time to repair.
- The structuring model is developed to describe the subjection relationship and the correlation relationship between the chessmen, and to build up the organizational relations of the chessman, the support force correlation, and the rights of wargaming seat (Peng et al. 2009). The model's function is to establish a relationship between the commander's order and the chessman's movement. The model is described the rights formulae for the wargaming seat to develop the maneuver relationship between the wargaming seat and the chessman, is defined the trigger conditions to develop the order's produce and implement. The subjection relationship and the correlation relationship are developed by defining the relationship of chessman and the attribute of chessman to implement the dispatching order and the return order.
- The maneuverability model is developed to describe the process, the chessman's movement to the destination after incepting the relevant order. It is based for quantifying the maneuverability ability of the chessman, synthetically referring to the influencing factors of environment and enemy's situation, to estimate the case of chessman's maneuver on the road. The model of wargaming is described the attribute of force, the type of maneuver, the geography information, the formulae to manage the haphazard. The attribute of force is composed of the entity's type, the force's level, the maneuver ability, the real-time state, etc. The type of maneuver is composed of the maneuver mode, the beginning

rapidity, the destination coordinate, the real-time point information. The function of geography information is to provide the battlefield environment data for the maneuverability model, it include the weather parameter and the landform influencing factors. The formulae to manage the haphazard is developed to describe the case, when the haphazard happen, the chessman automatically manage it, for example when the chessman is attacked, the formulae may operate to tell the chessman to remain in concealment firstly, and retaliate upon, then wait for the commander's order, but not to sequentially move on the road.

- The deployment model is described when the chessman's state accord with the trigger.
- Composed of the support force attribute, the deployment formulae, the deployment time, the information of operation site, etc.
- The model is the most important model in the behavior model, it is described the maintenance business process (Xu 2008). When the degree of damage equipment and the level of maintenance unit are accordant the chessmen which substitute the force begin a maintenance activity to the damage equipment. According to the class and the amount of damage equipment, the hours of maintenance task is counted, then the value of maintenance force ability is established by integrating the utilization of time and the grade of enemy force. The chessman take turns to maintain the damage equipment until the list of task is clear. If all of the tasks are achieved, then the maintenance model is over, if not the wargaming is going on while the formulae judge the grade of enemy force and the availability of the equipment.
- The information model is developed to describe the process, the information transmitting and exchanging in the wargaming activity, the logic relation between the chessmen and the data. The function of the model is to manage the data transmitting between the entity models, the structuring model, the behavior model, the interactive formulae model on the computer. In the wargaming the information includes the command message, the feedback message, state change message, etc.
- The interactive formulae model is developed to describe the process, the chessman's state changing when the chessman's state accord with the trigger conditions and the interaction effect happen (Liu et al. 2011). The interactions in the wargaming for equipment support mostly include the value translation between support and combat, the value of the support force change under the enemy force. The model's parameter is composed of the correlation type, the trigger formulae, the support value, the combat value, the coefficient translation.
- The probability model is described the haphazard in the battlefield. In the traditional handwork wargaming, the designer makes use of the probability number list and the dice to simulate the effect of the haphazard. But in the modern wargaming system based on computer, the haphazard is simulated by establishing the probability model through the probability function.

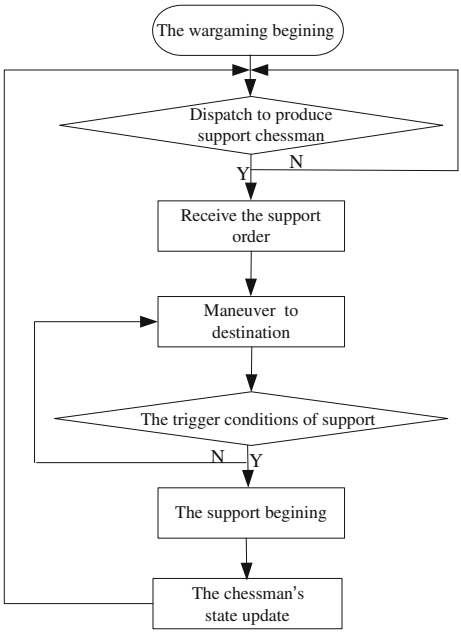

Fig. 137.3 The flow of wargaming with focus on chessman's life

137.4 A Case

There is a case which is an equipment support activity in the wargaming to verify the method for establishing the framework of the model integrality.

The flow of an equipment support activity: the commander assign a maintenance unit to maintain many damage equipments after judging the situation in the battlefield. When the chessmen arrive at the destination, the activity is operated according to the trigger conditions, and the value of the chessman's state is changing at the same time (Fig. 137.3).

The analysis for modeling: after the commander make the dispatching order, the chessmen are produced by distilling the state of the support units and the combat units, the process is making the entity model. The commander make the task order to the unit chessman to arrive at the combat unit chessman which one needs support, the process is making the structuring model. After the unit chessman receives the task order, and maneuvers, deploys, maintains, returns, the process is making the behavior model. When the unit chessman begin the support activity, the transfer of the value between the chessmen is doing, the process is making the interactive formulae model. In the whole activity, the data and information are transferring at all times; the process is making the information model (Fig. 137.4).

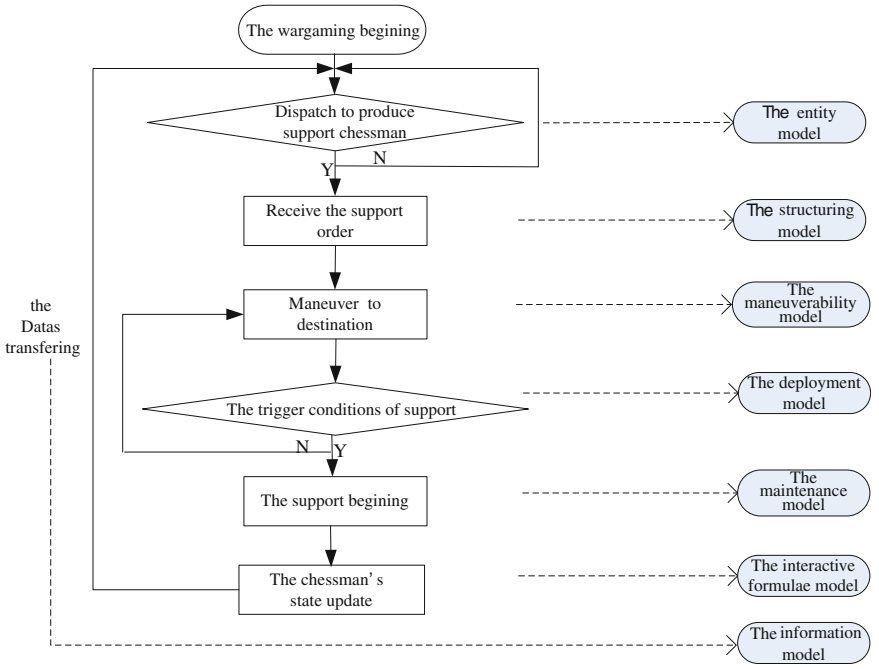

Fig. 137.4 A corresponding relationship between the flow of wargaming and the framework of model

137.5 Conclusion

The method modeling which is based on the period of chessman's life is put forward in the text, we establish the framework of the model for wargaming on computer, and a case is introduced to explain the application for the method. But the method has limitations, we should summarize the other methods on modeling technique at home and abroad to amply design the models for the wargaming system under the framework system of model based on computer.

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