Project for New-Type Simulators **Working Paper Series**

Working Paper No.15

World Systems and Integration: A Model Built on the Agent Based Simulator (ABS)

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"Project for New-Type Simulators" is developing a multi-agent based simulator and a simulator of iterated cognitive games, among others, for scientific and/or educational purposes. This working paper series aims at disseminating interim but interesting outcomes of this on-going project. Back numbers of this series are available in the PDF format through the web site shown below.

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Introduction

In the working papers No.13 and 14 of this series, the models of the classical European international system and the Chinese tribute system are introduced. In this paper, using these basic models, the model to see how two different systems interact and integrate together is considered.

After Immanuel Wallerstein published his landmark work *The Modern World-System*[1], the concept of world system has more interested many students of international relations or social scientists. However, the early Wallerstein's works consider the modern Western European system only and he seemed to have little interest in the other types of world systems in time and space.

The recent interest in postmodernism or the rethinking of modern European experience encourage many world system theorists to see the modern European world as just one part of world history and consider modern European history in terms of large or macro scope in human history. In the world system school, the transformationists, who think the modern European system unique and there was a critical transformation when Western system was born in the 16th century, and the continuationists, who argue human history has only one continuous system, dispute on this subject[2].

Apart from world system theorists, world historians and international theorists also argue the modern expansion of Europe to other world (or system), though their approaches and perspectives are quite different from world system theorists'. The British school of international relations have ever been interested in the expansion of Western Europe and the *socialization (or westernization)* of other areas in the modern history. On the other hand, the recent Asian studies criticize this kind of linear *western impact* on the eastern world and argue that the interaction between two worlds is more complicated and the reverse process of the western involvement with the eastern system can be also observed[3].

World historians also have argued the relationship between the western world and other worlds from distinct perspectives. For example, some arguments emphasize the rapid progress of the military technology in modern Europe. Some argue that the

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[1] Immanuel Wallerstein, *The Modern World-System*, vol.1 (New York: Academic Press, 1974).

[2] For example, Christopher Chase-Dunn and Thomas Hall, *Rise and Demise* (Boulder: Westview Press, 1997); Andre Frank and Barry Gills, eds., *The World System* (London: Routledge, 1993).

[3] Takeshi Hamashita, *Kindai Chugoku no Kokusai-teki keiki (China-Centered World Order in Modern Times) (*Tokyo: University of Tokyo Press, 1990).

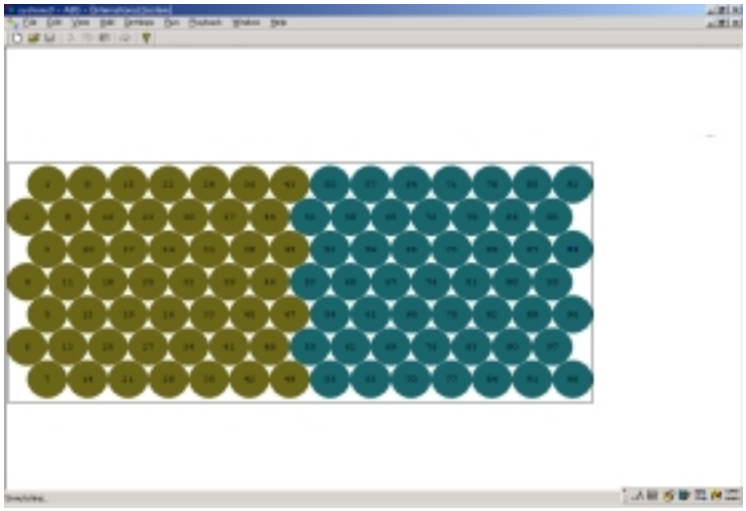
ecological diversity and concomitant diverse immunity in Western Europe are of importance to the European expansion[4].

Though these studies have shed light on the complicated process of the interaction between many systems or the systemic change, this kind of process is so intricate that it is quite difficult for positivism alone to unravel the macro-level phenomena. On the other hand, the computer simulation can control the myriads of factors in world systems and model the simplified world systems that include only a few factors for systemic process. Running this simplified world system by the computer, the collected data tell us which factor is important or ignorable and might notice us the counter intuitive results otherwise never found.

This paper consists of two sections. The first section describes the simulation rules of this integration model. The second section shows the model built on Agent Based Simulator (ABS)[5].

The rules of the integration model

At the initial stage, two world systems co-exist in the virtual globe (see picture 1). At west side of the globe is Western European system or Sovereign state system and at east side is Tribute system. About 50 states exist within each system and each state acts according to the rules of the system to which they belong.



Picture 1 Initial screen of the simulation

[4] Michael Howard, *War in European History* (Oxford: Oxford University Preess,1976); William McNeill, *The Pursuit of Power* (Chicago: The University of Chicago Press,1982); Geoffrey Parker, *The Military Revolution* (Cambridge: Cambrige University Press,1988).
[5] About Agent Based Simulator, see http://www2.kke.co.jp, and this working paper series.

The basic rules of this model consist of the rules of both Danno-tanaka model and Axelrod model that are introduced in No. 13 and 14 of this working paper series. Therefore, in this paper the details about the rules are omitted and only the different rules from the two models are explained.

Figure 1 shows the flow of each turn. At first, the initiator --- who intends to wage war if it is sovereign state or demands tribute if it is tribute state --- is chosen. Then, the initiator searches for a target that might be sovereign state or tribute state. Therefore, four combinations of the initiator and target are possible --- sovereign/sovereign, tribute/tribute, sovereign /tribute, and tribute/sovereign. The rules of each combination are shown as figure 2,3,4,and 5.

The rules of sovereign/sovereign and tribute/tribute are the same rules as Dannno-Tanaka model and Axelrrod model. The rules of other two types of the interaction (sovereign/tribute and tribute/sovereign) are also the same rules basically, but, as the interaction includes the contact between two different types of states, some additional explanation is needed.

The main difference from the original two models is the rules concerning war consequence.

1-1. If sovereign state defeats tribute state and the defeated state cannot maintain its old foreign behavior any longer, then the defeated tribute state turns to be a sovereign state --- this means that the defeated tribute state recognizes the superiority of the sovereign type of state and is enforced to change to the foreign behavior that it thinks more secure.

1-2. If sovereign state defeats tribute state and still the defeated state is so powerful that it maintain its regime but cannot have enough power to govern whole the state territories, then some territories of the defeated become independent as a new sovereign state.

2-1. If tribute state defeat sovereign state and the defeated state cannot maintain its old foreign behavior any longer, then the defeated sovereign state turns to be a tribute state --- this means that the defeated sovereign state recognizes the superiority of the tribute type of state and is enforced to change to the foreign behavior that it thinks more secure.

2-2. If tribute state defeats sovereign state and still the defeated state is so powerful that it maintain its regime but cannot have enough power to govern whole the state territories, then some territories of the defeated become independent as a new tribute state.

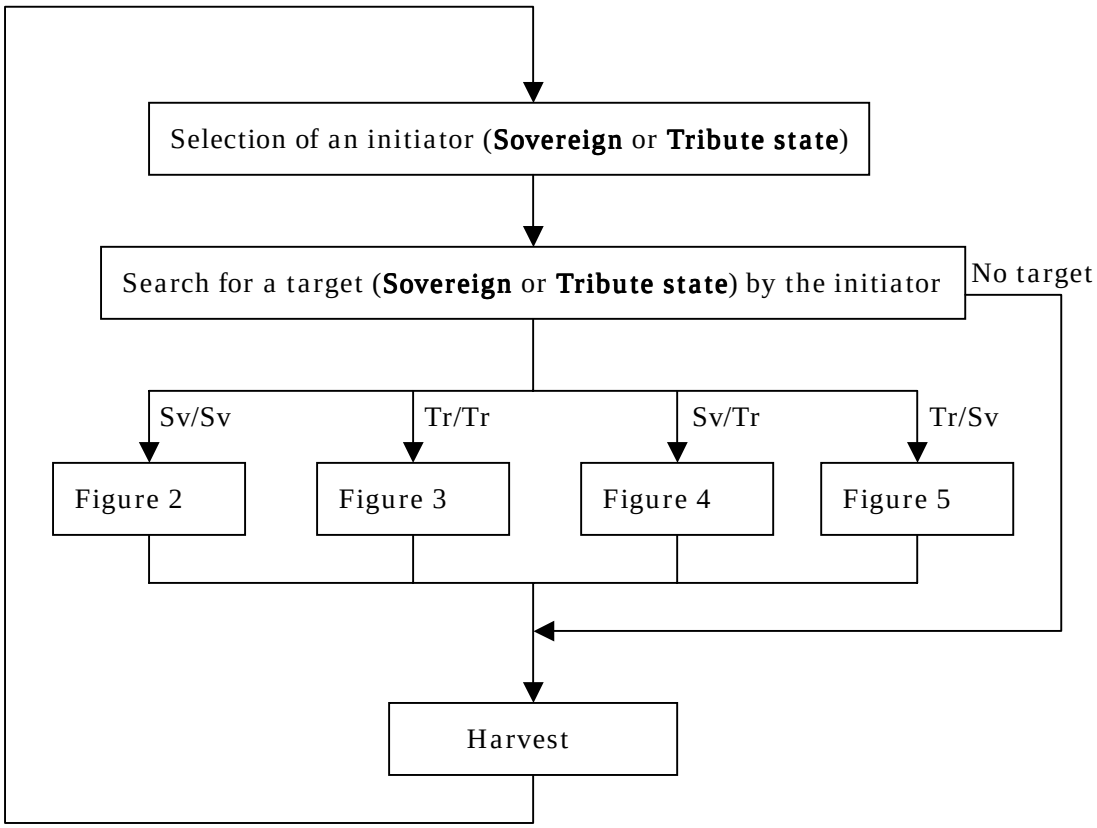


Figure 1. A cycle of the integration model

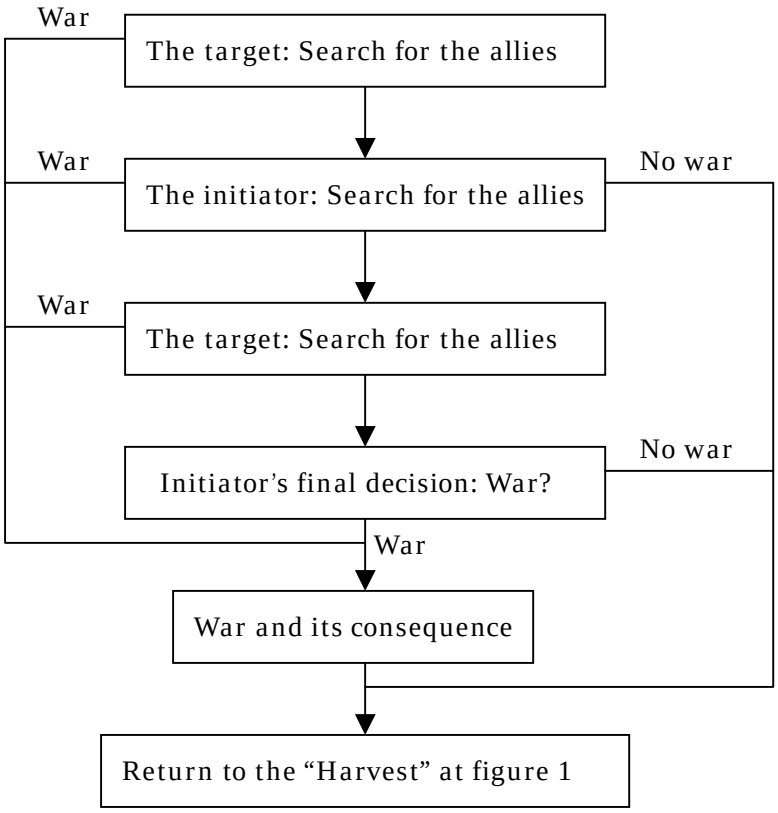


Figure 2. sovereign/sovereign

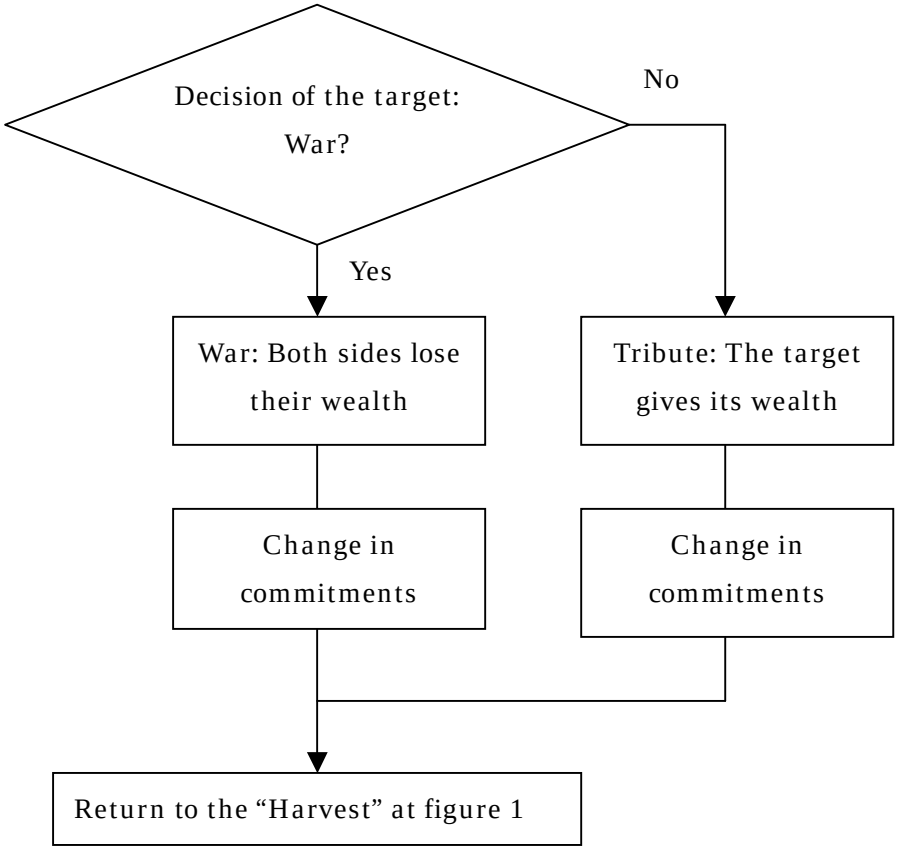


Figure 3. tribute/tribute

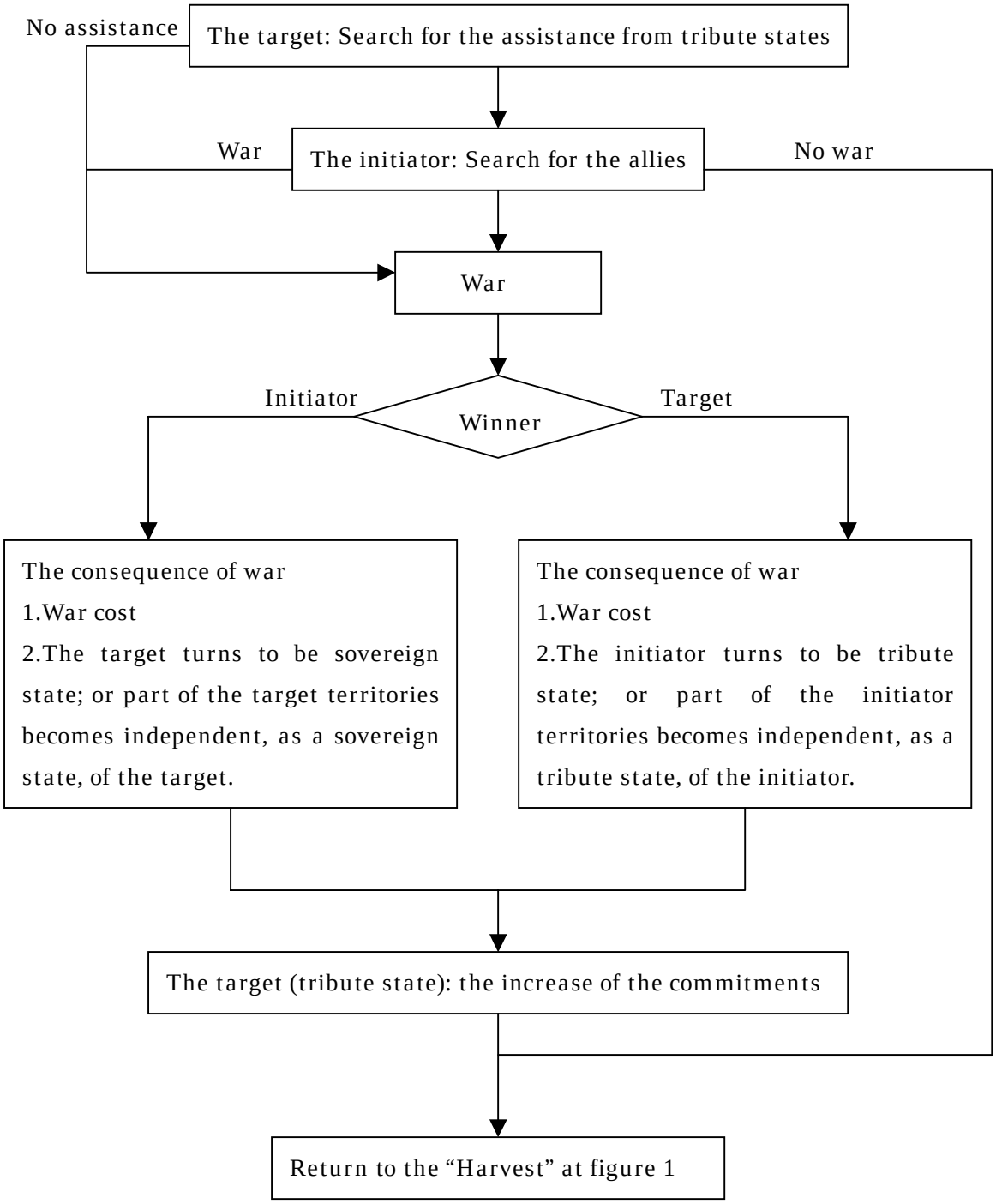


Figure 4. sovereign/tribute

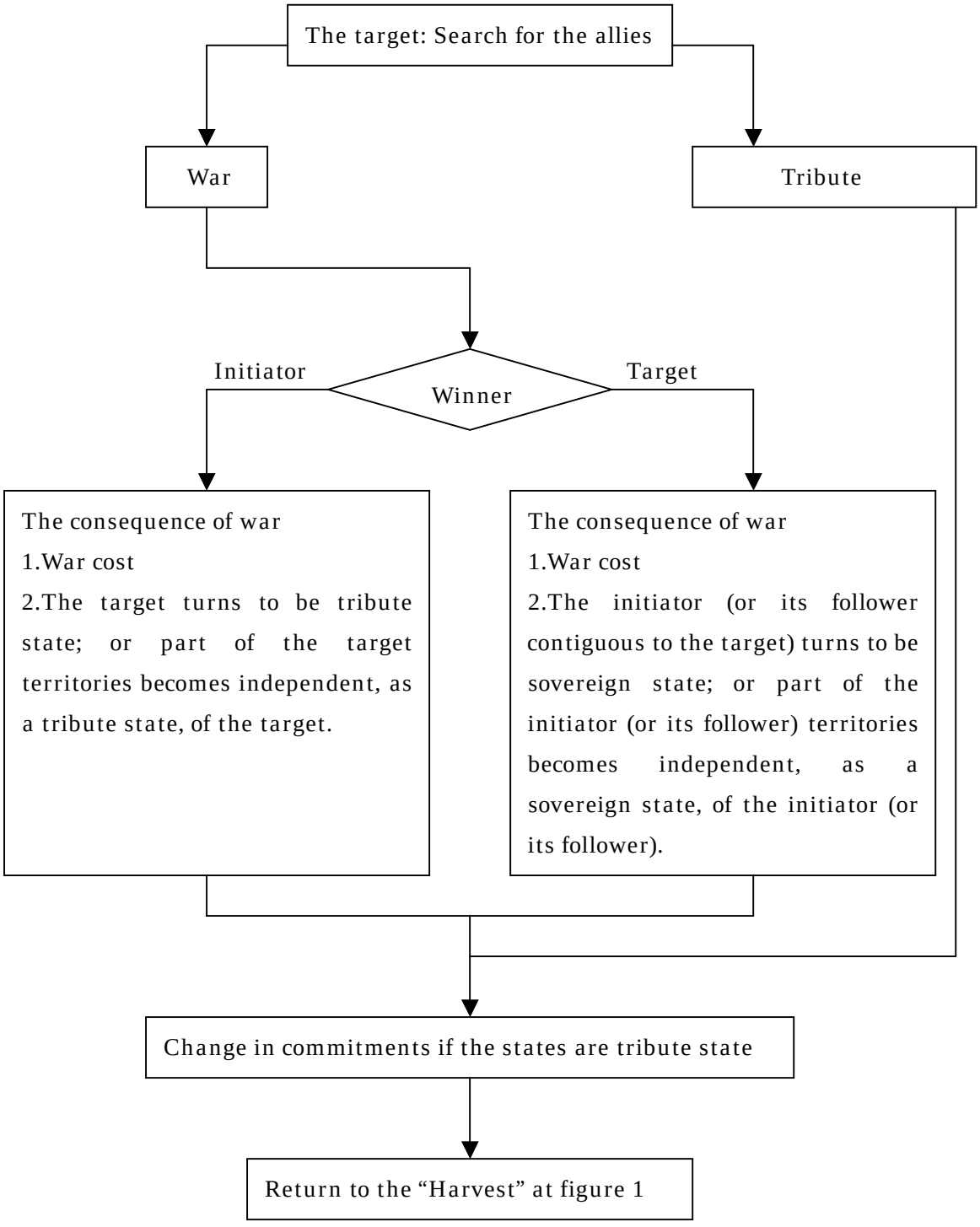


Figure 5. tribute/sovereign

An example of the simulation

In this section, one example of simulation runs is shown to demonstrate how the integration process proceeds in the model. The process shown below is tribute/sovereign type of the interaction.

At Figure 6, state No.55 (tribute state) was selected as initiator.

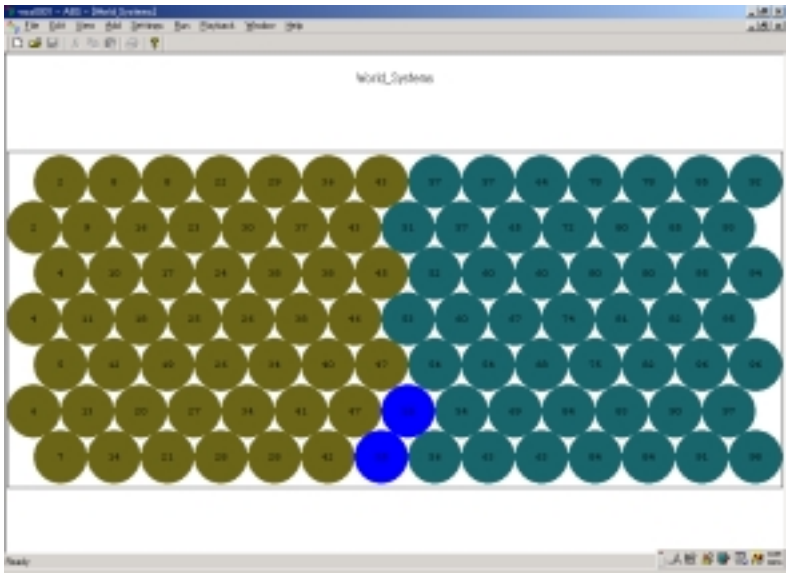


Figure 6. Tribute state selected as the initiator

The initiator searched for its target and in this case state No.42 (sovereign state) was chosen.

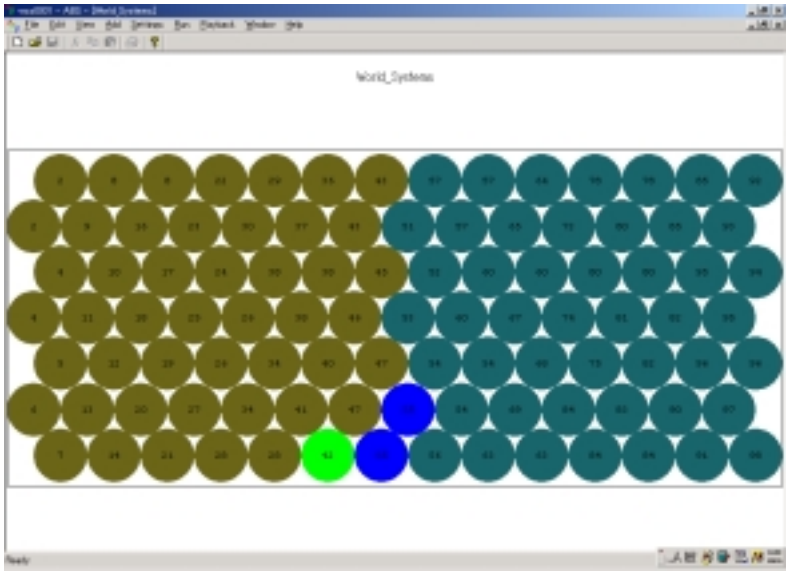


Figure 7. Sovereign state chosen as a target

As the target belonged to sovereign state system, it searched for their allies to

confront the initiator and, in this case, found state No.47 as an ally.

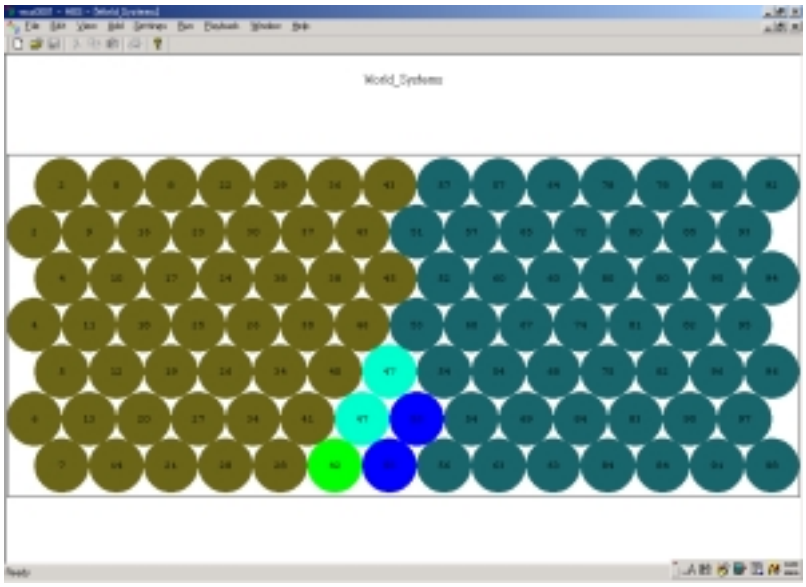


Figure 8. Sovereign target found its ally

In this case, the target defeated the initiator. The initiator perceived its foreign behavior inefficient in terms of survival and decided to adopt the sovereign style of foreign behavior. This means the expansion of sovereign state system.

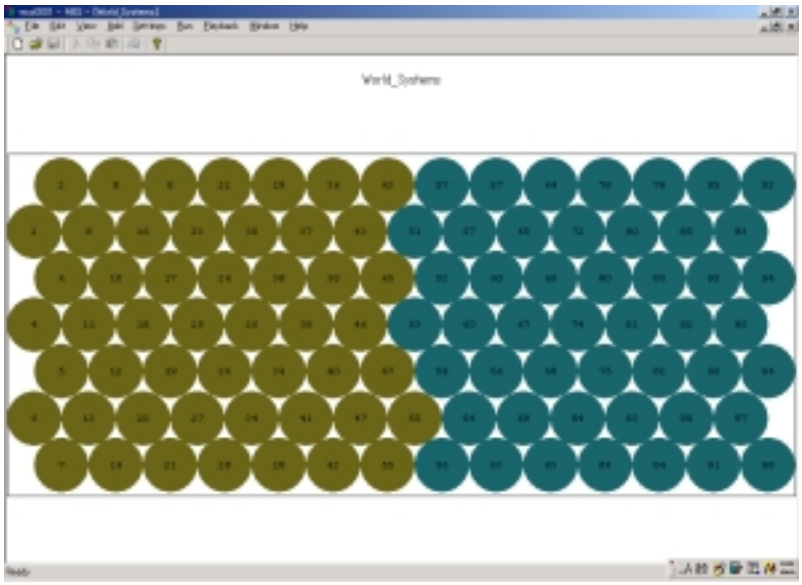


Figure 8. The expansion of sovereign system

After 267 turns, the sovereign system covered the whole globe. Though the

whole globe became sovereign system in this case, the tribute system might also occupy the whole globe according to the parameters[6].

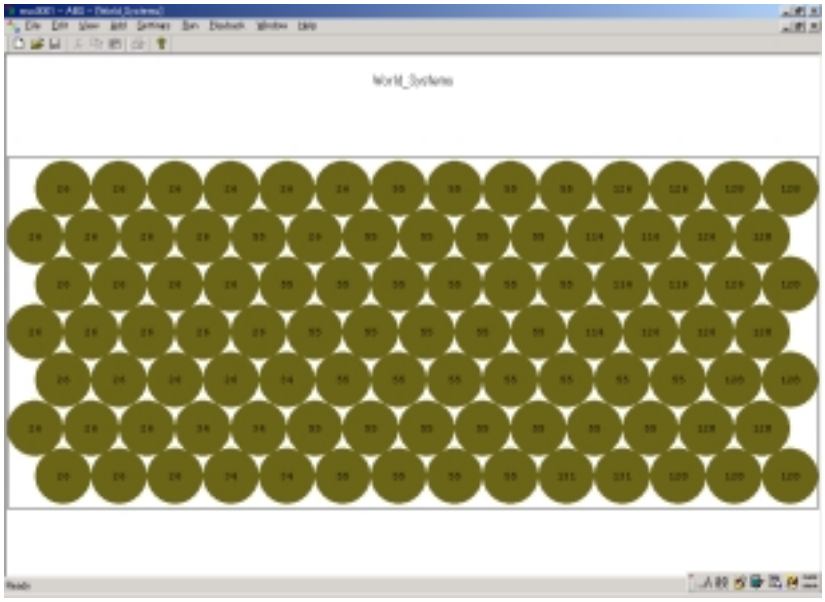


Figure 9. The globe occupied with sovereign states

Conclusion

The model presented in this paper is the tentative one. We can add factors or modify rules to develop the model. More complicated tribute rule may be more appropriate rule. Economic factors or ecological factors might shed light on deeper implications to understand the history of the modern systems contacts. The computer simulation, with modeling various factors and analyzing the effects of these, can advance the study of the complicated macro-history.

[6] About parameters, see Kazuya Yamamoto and Susumu Yamakage, *Simulating the Classical International System* (this working paper series No.13, 2001).

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