Bridging Empirical Analysis in International Politics and Multi-Agent Simulation:
Substituting Basic Norms in International Society[1]

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Introduction

Analysis of international politics utilizing multi-agent simulation, although gradual, has steadily progressed in Japan and internationally. This approach had been criticized for its lack of relevance to reality. But efforts have been made to narrow its distance with empirical analysis. Researches of multi-agent simulation have been carried out under the positivist premise in Japan.

This paper first surveys potentials of analyzing international politics using multi-agent simulation by reviewing relevant researches. We then explore the degree of complimentary of multi-agent simulation in relations to empirical analysis by examining the central theme of international relations, the dynamics of international norms. Theoretically, we construct a model of international normative changes by incorporating variables derived from

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constructivist approach into the threshold model. For the analytical case, we selected the substitution of norms that occurred from the 1950s to the 1960s in the international society. During this period, the traditional norm of trusteeship was replaced by the new norm of early-independence, which emerged as a concomitant of anti-colonialism. The final part of this paper discusses the comparability between results of the simulation and reality.

I. MAS-Compatibilities and Obstacles

Multi-agent simulation is a technique that uses computer to dynamically track changes of characteristics of the entire system. This is made possible by allowing multiple constituents, what is called "agent", in a simulated system to interact[4]. The simulation begins by rendering behavioral rules in the micro-level (agent) and actually allowing for interaction. As a result, characteristics of the macro level (system) can be observed. MAS is therefore considered a bottom-up method or technique to capture the emergent properties.

The main subject of analysis for the studies of international relations had been the dynamics, especially the formation and collapse of international orders, of the international society, whose constituent units are states. There exists no supra-state agent to bring about comprehensive order in international society. How state as the most upper agent interacts and as the result, the emergence of international order, is the unique aspect of international relations analysis. This characteristic is shared by the MAS hence MAS as an analytical method of international relations provides immense possibilities yet to be explored. In fact, before the birth of MAS as a term, Stuart Bremer and Michael Mihalka had been conducting simulation analysis of international order in the 1970s. To execute the simulation using the computer technology available then made the tasks extremely troublesome. Similar attempts were made in Japan. Nevertheless, such analytical method had mostly remained stagnated[5].

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[4] Multi-agent simulation is also called agent-based simulation. This paper uses the former one. System or modeling is also used instead of simulation.

[5] Stuart A. Bremer and Michael Mihalka, "Machiavelli in Machina," in Karl W. Deutsch, et al. eds., *Problems of World Modeling*, Ballinger, 1977, pp.303-337. Eiji Danno and Akihiko Tanaka, "Stability of International System," in Yoshinobu Yamamoto and Akihiko Tanaka eds., *War and the International System (in Japanese)*, University of Tokyo Press, 1992, pp.173-211.

In contrast, MAS gained popularity rapidly in the fields of natural sciences and engineering. By the 1990s, such analysis began to appear, while still sporadically, in social science researches. The less then smooth adaptation of such methodology in social science researches is the result of two factors. One was the rather demanding competence in computing skills. The other was the criticism against the principle of "KISS."

In terms of computing skills, this methodology was originally developed by researchers of natural sciences and engineering fields, hence required high-level knowledge and skills in object-based programing to conduct meaningful MAS. This was the first obstacle for social scientists to adopt MAS as a viable research method[6]. Few were willing to overcome such obstacle and conduct MAS by learning programing skills. In fact, in the international relations related fields, only a handful of researchers such as Robert Axelord, Lars-Erik Cederman, and Ian Lustick utilized such method[7]. To overcome this problem, especially applying MAS to social phenomena, a more versatile simulator that does not require high-level programing skills, is needed. Indeed such a simulator was developed and now MAS can be easily executed[8].

The second obstacle was the much criticized "KISS" principle. KISS means "keep it simple, stupid" and derived from military jargon. In social science research using MAS, it implies the strong preference for building a simple model. Axelord is well-known for emphasizing such principle[9]. KISS is an extremely important principle in demonstrating through MAS that simple mechanism (logics, rules, and causal-effect) can bring about complex social phenomena. In fact, there exits countless examples in which a few simple behavioral rules can cause extremely complex interactions among agents[10].

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[6] Susumu Yamakage, "New Approach to Society," in Susumu Yamakage and Shouta Hattori eds., *Artificial Society in Computer (in Japanese)*, Kyouritsu Shuppan, 2002, pp. 2-23.

[7] For a comprehensive review on MAS application in international politics, see Kazuya Yamamoto, "Simulations in International Politics," in *The Memoirs of the Institute for Advanced Studies on Asia　(in Japanese)*, 2003, pp. 391-432.

[8] See Susumu Yamakage (2007) *Guidance to Construct Artificial Society (in Japanese)*, Shoseki Koubou Hayama on the developed simulator. Since it is an analytical tool to analyze artificial society, the simulator is named "artisoc" and has become a standard tool for researchers to conduct MAS. Artisoc is also used in this paper. See Susumu Yamakage "Social Science and Multi-Agent Simulation" *(in Japanese)*, *Jouhou Kagaku*, Sapporo Gakuin Daigaku, No.27, 2007, pp.1~10.

[9] Robert Axelrod, *The Complexity of Cooperation*, Princeton University Press, 1997, p.5.

[10] Ibid; Also see Susumu Yamakage and Shouta Hattori eds., *Artificial Society in Computer (in Japanese)*, Kyouritsu Shuppan, 2002.

However, over abstraction can lead to arbitrary interpretation hence brings into question the appropriateness of MAS in reproducing social phenomena. For example, Axelord used the results of a single MAS model named cultural transformation to explain phenomena of different levels such as the process of national integration, the survival of a heterogeneous minority surrounded by overwhelming majority, and regional integration seen in Europe[11]. Researchers skeptical of MAS often heavily criticize this problem. MAS researches in essence need to address this criticism against the KISS principle to become more persuasive.

II. Attempting Tier-Dependent MAS

In order to overcome the criticism on the KISS principle and demonstrate the effectiveness of MAS, it is necessary to reflect in MAS certain specific attributes of the analytical subjects. This means instead of incorporating prevalent or abstract attributes that can be interpreted as researchers see fit, specific attributes in line with the analytical targets should be built-in. For example, the possibility of MAS as a whole can be differentiated into three tiers to analyze the phenomena of international politics. Attributes of agents can be incorporated into the relevant tier hence intentionally lowers the level of abstraction.

The first tier is the policy making process of external policies. It focuses on the individual communications of those who participate in policy-making. This is a subject that has comparatively more research accumulations as simulation analyses on the process and results of crisis and conflicts were often undertaken[12]. The most well-known and well-studied subject is perhaps the Cuban missile crisis of October 1962. Close attention was given to the process of decision-making of the American side during the Cuban missile crisis as an empirical MAS case[13]. Agents in this case are modeled after President Kennedy

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[11] See Axelrod, *op.cit.*, pp.145~177.
[12] See Yamamoto, *op.cit.*
[13] See Takuto Sakamoto and Hiroyuki Hoshiro, *Simulation of Policy Decision: Cuban Missile Crisis as a Case Study (in Japanese)*, Gakujutsu Sousei Project Research of Social Order Changes through Multi-Agent Simulator, Working Paper Series No.9, 2005, pp.1~24; Takuto Sakamoto and Hiroyuki Hoshiro, Policy Decision Process Simulation II: Watershed in Avoiding the Cuban Missile Crisis *(in Japanese)*, Gakujutsu Sousei Project Research of Social Order Changes through Multi-Agent Simulator, Working Paper Series No.12, 2006, pp.1~33; Takuto Sakamoto, Hiroyuki Hoshiro and Susumu Yamakage, *Cuban Missile Crisis of the Whitehouse:*

and the high-ranking members of the government who participated in the ExCom meeting. Each agent has unique preferences and a cognitive map. Each agent makes attempt to persuade other agents, or in the process alters its own opinions. MAS is used to analyze how varied opinions converge as a whole. Identifying rules for interactions between individuals can then be quite useful for analyzing small-scale groups and organizations.

The second tier is the dynamics of the nation-state. This is a typical dynamic phenomenon brought about by the divergence between national community, acting as a collective decision making system, and state, acting as a territorial ruling entity. MAS models are built so that the interactions of areal communities and that of areal communities with political organizations can be formularized. Agents are groups that can possess culture, effect cultural transformation, and be mobilized. Various types of models are conducted using MAS based on the principle of KISS[14]. Japanese researchers have made similar attempts by building original models to examine and critique theories on competing nationalisms. This was however not meant to explain individual case[15]. In contrast, there also exists analysis that attempts empirical analysis of actual case by reconstructing the civil war of Sudan[16]. By utilizing geographical information system of Sudan to reconstruct population, religion, and linguistic attributes, it was then possible to create a virtual Sudan through MAS in which interactions of community agents political agents can be observed.

The third tier is inter-state relations. In this tier, the state is the agent and each agent possesses power. Agents can ally or antagonize and seek power expansion. Danno and Tanaka had further developed the model of Bremer and Mihalka but it was MAS based on abstract characteristics of the state[17]. It

Searching for the Watershed in Avoiding Nuclear War through Multi-Agent Simulation (in Japanese), Shoseki Koubou Hayma, 2012.

[14] See Lars-Erik Cederman, *Emergent Actors in World Politics: How States and Nations Develop and Dissolve*, Princeton University Press, 1997; Ian S. Lustick, an Miodownik, and Roy J. Eidelson, "Sucessionism in Multicultural States: Does Sharing Power Prevent or Encourage It?" American Political Science Review, Vol. 98, Issue 2, 2004, pp.209~229.

[15] See Takuya Yamamoto, *The Complexity of Nation (in Japanese)*, ShosekiKoubouHayama, 2008.

[16] See Takuto Sakamoto, "*War and Mobilization,*" *(in Japanese)* Kokusai Seiji 140, pp.73~89, 2005.

[17] See Danno and Tanaka, op.cit.; Kazuya Yamamoto, Masaki Tamada and Akihiko Tanaka, "International Society of War and Alliance," *(in Japanese)* in Susumu Yamakage and Shouta Hattori eds., *Artificial Society in Computer*, Kyouritsu Shuppan, 2002, pp.160~175.

serves the purpose to compare and criticize part of the realist theories but not sufficient in answering the criticism on the KISS principle. Perhaps a rather atypical case but Mitsutsuji had re-examined the political process of the founding of the Meiji state of Japan[18]. The model posits large "*hans*", including the Tokugawa clan, as independent agents and allowed for interaction. This research demonstrated that when "*bakuhan*" regime is treated as a sovereign states regime, the process of "national unification" can be reconstructed as that of a "regional integration". The MAS on the formation of international norms dealt in this paper belongs to this third tier of MAS.

Other than the tier-specific model, model can also be built by transplanting a two-tier game into MAS. For example, foreign policy is determined by the interaction of the multiple individual agents, the first tier, and the international relations, the third tier, is then determined by the interactions of multiple government agents which behave based on the organizational decisions of the first tier. However, researches and model building by incorporating such ideas rigorously remain to be seen.

Regardless of the individual, collective or the state, agents modeled for MAS need not always be rational decision-making agents. Because MAS does not seek to mathematically analyze the results of interactions between agents, it is extremely flexible in formulizing agents. In other words, even by following the KISS principle in modeling, its simple preconditions can still be much more realistic than that of the analytical model. This is a strength of MAS that the KISS-principle critics often fail to notice. Empirical analysis of MAS is carried out by making the best of the flexibilities on modeling.

III. Approaching Transformation of International Norms

Analyses of norms have become increasingly important in the field of international relations. The importance of norms in international relations has been emphasized by many researches[19]. Past research such as that of Rapoport stressed the importance of debates in transforming interests and what is at

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18 Katsuma Mitsutsuji, "BAKUMATSU in Computer: Modeling Meiji-Reformation with Multi-agent Methodology," (*in Japanese)* paper presented in the Symposium on the Possibilities of Artificial Society, 2007, can be downloaded from http://citrus.c.u-tokyo.ac.jp/mas/20071201.html.
19 See Robert Axelrod and Robert Keohane, "Achieving Cooperation under Anarchy," in Kenneth Oye ed, *Cooperation Under Anarchy*, Princeton University Press, 1986, pp.226~254.

stake, and sharing understandings, rather than fights and games[20]. Rapoport's work was unusually systematic and mathematical then, but important discussions on the normative researches seemed prosaic. There were constraints since the basic theories and modeling were still underdeveloped.

In recent years, rigorous researches have been carried out on the subject of international norms espousing constructivist approach in Japan[21]. Norm is an important analytical subject since the constructivist approach focuses on conceptual factors, such idea, belief, and cognition in international politics, and their effects. Constructivism is unique in the sense that it pays close attention to how international agents, by possessing conceptual factors such as norm, can effect international structure. Constructivism attaches great importance to the aspect in which norm, as a manifest of international structure, is shaped, sustained and transformed by the actions of international agents[22]. When a norm is shared inter-subjectively as common knowledge by the international agents, such norm becomes international structure and effects the actions of agents.

The life cycle approach on norm advocated by Finnemore and Sikink has been the basic framework to address the issue of normative transformation[23]. Within this framework, normative transformation is depicted as a three-phase process that consists of emergence, in which norm entrepreneurs advocate a new norm, diffusion, in which the norm spreads widely, and internalization, in which agents considers the norm self-evident. During the phase of emergence, a norm gradually becomes prevalent for agents due to the persuasion of the norm entrepreneurs. When the states that accept a certain norm reaches a certain level both qualitatively and quantitatively, the norm diffuses into the entire international society at once and the "normative cascade" takes place. However, it remains unclear when, that means the specific level of critical mass and tipping point, the cascade could occur. The hypothesis is that empirically,

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[20] See Anatol Rapoport, *Fights, Games and Debates*, University of Michigan Press, 1960.
[21] For examples, see papers included in Kokusai Seiji No.143 (Norms and Theories of International Politics), 2005.
[22] See Satoshi Ooyane, "Viewpoint and Analysis of Constructivism," *(in Japanese)* Kokusai Seiji No.143, 2005, pp.124~140.
[23] See Martha Finnemore and Kathryin Sikkink, "International Dynamics and Political Change," International Orginazation, Vol.52, No.4, 1998, pp.887~917; Takahiro Yamada, "Complex Governance and the Changing Global Public Order," *(in Japanese)* Kokusai Seiji, No 137, 2004, pp.45~65.

cascade does not occur when less than one-third of the total number of states accept the norm. Or, for the cascade to take place, agreement by if not all, at least a few of the key states concerning a particular issue must be attained.

It is sufficiently convincing that when agents that accept the norm increases, the social trend to accept the norm intensifies, and as a result more states come to accept that norm. In actual normative transformation, tipping point can be observed when cascade takes place. Nevertheless, the presumed relationship between the acceptance of the norm by the agents, individual norm, and the normative formation of the entire system, social norm, is too linear and simplistic. The discussion in the next section shows that the threshold model, often used in these researches by focusing on concepts of the tipping point, threshold, critical mass, demonstrates a more complex relationship between the individual and the social norm. Normative transformation is also a collective action hence individual motives, or micro-motives, and behavior of the entire society, or collective results/macro-behavior, require further analysis[24].

IV. Threshold Model

In addressing the complex and yet intricate relationship between the individual norm and the social norm, Granovetter proposed the threshold model, or the critical mass model, that is succinct and theoretically acute[25]. We will analyze the normative transformation in international society by constructing an expanded MAS model by using the threshold model as the basis[26].

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[24] See Mark Granovetter, "Threshold Model of Collective Behavior," American Journal of Sociology, Vol. 83, No.6, 1978, pp.1420~1443; Thomas C. Schelling, Micromotives and Macrobehavior, W.W. Norton and Company, 1978.

[25] Other than Granovetter *op.cit.* and Schelling *op.cit.*, see the following works for explanations of the threshold model. Toshio Yamagishi, *Mechanism of Social Dilemma: Things Brought about by "Maybe Just I Alone", (in Japanese)* Saiensusha, 1990; Kouji Matsuda, "Threshold Model as Collective Behavior," *(in Japanese)* Junichi Kobayashi, et al. eds., Social Mechanism 2nd Edition, Nakanishiya Shuppan, 2000, pp.67~82. Gaku Doba, et al. eds., *Seeing Society Through Models: An Invitation to Mathematical Sociology (in Japanese)*, Keisou Shobou, 2004. See Kenichi Ishii, "Threshold Model of the Popular Opinion: Formalization of the Spiral of Silence," *(in Japanese)* Riron to Houhou, Vol.2 No.1, 1987, pp.15~28 for a transformed version in popular opinion studies. See Masaya Yamaguchi, *Introduction to Chaos (in Japanese)*, Asakura Shoten, 1996, pp37~53 for an attempt to apply the threshold model to trendy phenomena by making threshold two-dimensional.

[26] Axelrod's model of evolutionary approach to norms is also well-known in using the MAS to analyze norm formation in international relations. See Axelrod, *op.cit.*, pp.40~68. While this

Threshold model consists of multiple agents and each agent possesses two mutually exclusive choices. The choices are "yes/no" towards certain behavior, and "yes/no" towards certain collective behavior. Each agent can choose "yes" or "no" but for the choice of "yes", a threshold of more than zero and less than one is assigned. Agents with lower thresholds allows for, or has the tendency to allow for, that particular behavior. In contrast, agents with higher thresholds do not, or have the tendency not to allow for, that particular behavior. An agent would choose "yes" when the threshold of other agents choosing "yes" is higher than its own.

Agent's choice of "yes" upon recognizing the choices of other agents must be carefully treated so that it is not given a definitive interpretation. It can be a conditioned reflexive imitation regulated by the threshold. Or the threshold can be a reflection of the evaluation criteria of the choice's appropriateness by the agent. It can also be the result of social pressure, or a decision (self-setting of threshold) based on rational calculation of gains and losses of self-interests. The threshold model can, in such sense, derive from behaviorist approach, hence not necessarily a model only applicable to constructivist approach. The next section will show that the model for this paper explicitly incorporates ideas of the constructivist approach into the threshold model.

Activities of the threshold model, or the entire systemic behavior, especially whether the cascade occurs or not, depends heavily on the distribution of thresholds[27]. To demonstrate such behavioral pattern, we constructed a system that consists of 100 agents and a few rather simple distributions of the thresholds. In case one, each agent assumes in order the threshold value of 0.00, 0.01, 0.02, 0.03, 0.04, … and all begin with the choice of "no." In this case, if the first agent with 0.00 threshold choses "yes", the agent with 0.01 threshold would choose "yes", and the agent with 0.02 threshold would follow. Eventually, all agents would choose "yes" and the cascade takes place. However, in case two, even if the only difference in distribution is that the third agent's threshold is 0.03, not 0.02, then the agents after the third one

model is in fact MAS but this paper did not adopt the model because the authors feel the model is too utilitarian by assuming the rule of evolutionarily imitating behavior with the highest score as norms. Yamada, op.cit., categorizes this model as liberalist.

[27] See Yamagishi *op.cit.,* for whether the cascade takes place within various distributional patterns.

would not choose "yes" and such behavior does not expand within the system. In case three, thresholds for all agents are set at 0.5 and choices of "yes" or "no" for all agents are randomly assigned. In this case, if the agents choosing "yes" exceed that of 50, then eventually all agents would choose "yes." Conversely, if less then 50 chose "yes", then eventually all would choose "no."

Even the above simple cases can reveal two important characteristics of the threshold model. First, slight difference in the distribution of thresholds among individual agents can have tremendous impact on the behavior of the entire society. Another is that even when all the agents of the group have the same threshold values, the choices of agents can alter the result completely. This demonstrates that changes in the behavior of an extremely small group within the system can possibly lead to large-scale changes in the entire society.

The concept of "equilibrium" in the threshold model is meant to capture such characteristic in the systemic behavior. It is a concept to show　what kind of end stage (how many agents result in choosing "yes") agents would reach from various initial stage (how many agents choose "yes" in the very beginning) when the threshold distribution is given. In case one, there is only one equilibrium in which all chose "yes." In case two, there are two equilibriums, one being only two agents choosing "yes", and the other being all agents choosing "yes." More or less than three agents choosing "yes" in the initial state would determine on which equilibrium the system settles. In case three, there are two equilibriums of all choosing "no" or all choosing "yes."

　Others researches such as the epidemiology (epidemic, contagion, transmission) model also uses the threshold concept on which our model depends. The theme for both models is the cascade as a systemic behavior hence can be easily confused. Threshold in the epidemiology implies a value with which one can determine whether the cascade occurs or not in the initial stage. It manifests the macro condition of the system[28]. In contrast, the

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[28] The lesson of the epidemiology model is that the spread of an epidemic disease, cascade, depends not on the number of the infected subjects, but that of susceptible subjects in the initial stage. The limits of the number of the susceptible subjects that would bring about wide-spread infection is the threshold of the epidemiology model. Threshold theorem also appears in the epidemiology model. To understand basics of the epidemiology model, see Masaaki Yoshida, *Spread of Information (in Japanese)*, Kyouritsu Shuppan, 1971, pp.172~217; Fusao Satoh, *Mathematics of Nature and Mathematics of Society II (in Japanese)*, Nihon Hyouronsha, 1989, pp.165~210. In the epidemiology model, factors such as recovery, immunity, death, and birth are included hence the model is more complicated than that of threshold model. To see the

threshold is an attribute of the agent and the emphasis for all agents is on the distribution of the threshold.

V. From Threshold Model to the International Norm Transformation Model

Threshold model is considered useful for analyzing collective behavior such as riots or trends. It can also be adopted to analyze normative formation within society[29]. We will construct an international normative transformation model by incorporating constructivist approach on norm and integrating persuasion as an interaction between agents.

Within the international norm transformation model, we do not begin with a new norm being formed in a system without pre-existing norm. Rather, the focus is on whether an alteration of norm takes place or not when the pre-existing norm is challenged by the new norm[30]. In other words, our objective is to create a model on the process of whether and how a new norm can replace a traditional and pre-existing social norm, and accepted by most members, is challenged by a new norm advocated by minority members.

Agents of the model constitute the members of the international society. Each member has two behavioral choices of accepting the new norm or obeying the pre-existing norm. Individual member possesses norm consciousness, the individual norm. Member with stronger inclination to accept the new norm has lower threshold and those with stronger inclination of obeying the pre-existing norm is assigned higher threshold. Whether the pre-existing norm is preserved, or not preserved, or the new norm could expand, or not expand, depends on what kind of norms the members possess in the system. In other words, the threshold distribution determines the formation of social norms. The social norm might converge towards either choice and yet it might not. It is important to make clear the distribution of thresholds in the empirical analysis executed

differences between the two models, see Doba, *op.cit.* Chap.17 and Chap.18.

[29] Granovetter *op.cit.*; Doba, *op.cit.*

[30] Changes of international norms do not necessarily occur through replacement, or substitution. It is generally formalized by the confrontations, hence conflicts, and adjustment process between multiple norms. See Ooyane, *op.cit.* This paper focuses on whether the substitution, or replacement, occurs or not in a certain field (e.g. the standards of membership in international society). We do not examine cases in which norms of different fields conflict (e.g. free trade versus environmental conservation).

through the model of the international normative transformation, an expanded threshold model,

The original threshold model is a static analysis that seeks to find the equilibrium within a given distribution of threshold. Within the international normative transformation model, threshold of each member, hence the distribution of thresholds, changes dynamically[31]. The dynamic changes of threshold distributions occur for the following reasons. First, member's entrance or exist brings about the adding or deleting of certain threshold and as a result alters the distribution of thresholds in the entire society. Secondly, interactions amongst members can alter the threshold of individual member and results in the changes in the entire distribution.

This second reason shares affinity with the constructivist approach. This means that the mechanism of "persuasion" is incorporated into the model so that member can make attempt to persuade other members[32]. This is expressed in the changes in threshold rule in which a member, the sender, sends messages based on its position to other members, the receivers, and alters the receivers' thresholds. But this is not necessarily effective to all other agents. Certain shared prerequisites or proximity in ideas are required for the persuasion to cause effect[33]. In our model, modes of influences are expressed through two parameters. One is the "commensurable range" which defines the scope of influences, in other words, the maximum value of the threshold difference between the sender and the receiver when the influence takes place. The other is "persuasiveness" with which the legitimacy, or the plausibility, of the pre-existing or new norm is expressed. Further details on these two parameters will be provided later.

Further, each member is assigned a weight according to its importance, presence, in the issue of international normative transformation. In other words, larger weight is set for members that are considered important for the concerned issue. For example, if a member with weight 5 chooses the new norm,

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[31] See Yamagishi, *op.cit.* Chap. 7, for thought experiment on dynamic threshold distributions.
[32] See Thomas Risse, " 'Let's Argue': Communicative Action in World Politics," International Organization, Vol.54, No.1, 2000, pp.1~39, Jeffrey Checkel, "Why Comply? Social Learning and European Identity Change," International Organization, Vol.55, No.3, 2001, pp.553~588; Alastair Iain Johnston, "Threating International Institutions as Social Environment," International Studies Quarterly, 45, 2001, pp.487=515.
[33] See Alexander Wendt, Social Theory of International Politics, Cambridge University Press, 1999, pp.313~369; Risse, *op.cit.*

then that member alone is considered to be equivalent of 5 members, with weight 1, choosing the new norm.

The entrance/exit of members with differentiated degrees of importance, or the interactions amongst members, whether persuasion succeeds, lead to the changes of threshold distribution for the entire system. Numbers of the equilibrium or value may also change accordingly.

VI. International Norm Transformation Model on Colonial Issue

International norm has been shaped at various levels, for example illegality of war or non-intervention in the domestic affairs, and fields, for example ocean or space. Among them, the norm of anti-colonialism that came to existence in the mid-twentieth century is considered an extremely important normative change and has profound impact on the nature of the international society today because it concerns the standards for membership in the international society, or even the basic understanding for the very issue of state sovereignty. Some actually insist that this is the single most important revolutionary change in the system of the sovereign states that has a history of a few hundred years[34].

After WWII, the colonial powers insisted that the dealings concerning the dependent territories should fall under domestic jurisdiction and subject of serious debates in the United Nations only involved trust territories. In the 1950s, however, the Eastern Bloc countries, the Asian-African newly emerged countries, and the Latin American countries intensified their argument of anti-colonialism which then became an "international public opinion." The fact that the Declaration on the Granting of Independence to Colonial Countries and Peoples was carried by an overwhelming majority in the General Assembly of the United Nations in December of 1960 is a symbol of the transformation of international norm concerning colony issues. Even colonial powers did not vote against this declaration. As the result, retaining colony, or trusteeship, to provide guardianship in developing abilities for self-reliance (meaning self-support and self-governance) came to be seen as "inappropriate" instead of

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[34] See Daniel Philpott, Revolutions in Sovereignty: How Ideas Shaped Modern International Relations, Princeton University Press, 2001. See Youichi Kibata, *The Development of International Regime (in Japanese)*, Yamakawa Shuppansha, 1997, pp.49~51, for the importance of decolonization with regards to the history of international system.

"appropriate" behavior. It was demanded that the dependent territories were to be given independence immediately[35].

The international normative transformation model is created as the following by selecting the case of normative changes in international society on colonial issues from the 1950s to the 1960s as described above.

The general framework begins with the focus on the United Nations which served as the central arena for shaping anti-colonialism norm[36]. The pre-existing norm takes the position that it is appropriate for the colonial administrating power to continue governing until colonies (the dependent territories) can become sufficiently self-reliant. In other words, this was the international norm in the international society in the 1950s[37] and it is referred to here as "trusteeship-ism." In contrast, the new norm argues that the retaining of colony itself is inappropriate and is referred to here as the "early -independence ideology." This emerged as the substituting norm challenging the pre-existing norm. The two choices agents have in this model are accepting the trusteeship-ism, or accepting early-independence ideology.

The initial condition of the system is set-up so that it recreates what constitutes the United Nations member countries as of 1950[38]. In terms of the position, the equilibrium closest to the actual history is chosen so that only three communist countries are explicit in their positions of early-independence ideology and all others take the position of trusteeship[39].

The initial values of members' threshold are designated based on the

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[35] See Robert Jackson, *Quasi-States: Sovereignty, International Relations, and the Third World*, Cambridge University Press, 1990; Robert Jackson, "The Weight of Ideas in Decolonization: Normative Change in International Relatinos," in Judith Goldstein and Robert O. Keohane eds, *Ideas and Foreign Policy: Beliefs, Institutions and Political Change*, Cornell University Press, 1993, pp.111~138; Asahiko Hanzawa, "The United Nations and the Demise of the British Empire: 1960~63," *(in Japanese)* Kokusai Seiji, No.126, 2001, pp.81~101; and Neta C. Crawford, *Argument and Change in World Politics*, Cambridge University Press, 2002.

[36] See Edward T. Rowe, "The Emerging Anti-Colonial Consensus in the United Nations," Journal of Conflict Resolution, Vol. 8, No.2, 1964, pp.209~230; Jackson, Quasi-States; Hanzawa, *op.cit.* for analyses focusing on the political process of decolonization in the United Nations.

[37] See Jackson, *Quasi-States*, pp.71~74; Crawford, *op.cit.*, pp.249~290.

[38] Although Belarus and the Ukraine are UN member countries, this paper does not count them as members.

[39] When the United Nations adopted the first resolution regarding the contents of the trusteeship in 1946, only the three communist countries voted against it. In other words, The Soviet Union and the Yugoslavia voted against all trusteeship agreements. Poland voted against six and abstained from two. In the model, the Soviet Union, Czechoslovakia and Poland take the position of early independence. Further details on the equilibrium will be provided later.

voting behavior in the General Assembly on colonial issues[40]. First, we aggregated all the cases concerning colonial issues that were submitted for open-ballot voting by designating 0 for anti-colonialism voting behavior, 1 for the opposite and 0.5 for abstention. We then normalized the data by setting the initial threshold for those who chose the position of anti-colonialism for all cases at 0.0, and those who chose the position of pro-colonialism for all cases at 1.0. Table 1 is the result of grouping the members and showing the average values and standard deviation. Each group demonstrates strong characteristics with very little scattering in thresholds (also see Fig.1). This recaptures very closely the positions adopted by member countries in 1950[41].

The next is setting the weight for agents. In terms of colonial issues, the colonial administrating power and the permanent members of the UN Security Council were designated members of the UN Trusteeship Council hence their relative importance was accepted by other member countries. Further, the provision for the Trusteeship Council was that it should consists of the same number of colonial administrative and non-administrative powers (UN Article 86). The Special Committee on Information founded in 1946 also made up by the same number of colonial administrative and non-administrative countries. Considering these facts, colonial administrating powers and permanent members of the UN Security Council are given the weight of 5.0 and others 1.0. We also adjusted the total sums of the weight for both colonial administrative and non-administrative power so that they are equal then.

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[40] The initial values were calculated from the voting behaviors of the member countries on the colonial issues in the 3rd (1948) and 4th (1949) session of the UN General Assembly. There were 51 roll call votes concerning the colonial issues during these sessions. Representatives of member countries voted for, against, or abstained from various reports, resolutions, and revisions by committees and sponsor countries. Contents covered a wide variety of issues on non-self-governed territories or trusteeship territories. Representatives voted on issues such as a certain paragraph, or revisions on certain nuanced expressions. These voting provided very appropriate data set to measure what position each country took concerning the colonial issue. See Row, *op.cit.* for a pioneering study on the norm formation of the anti-colonialism using analysis of the voting behavior at the UN. Data in this paper was re-compiled since Rowe only published aggregated results. In compiling the data, we referred to the data set provided by Erik Voeten (http://www9.georgetown.edu/faculty/ev42/UNVoting.htm, accessed in August 2008), Tatsuo Urano, *Changing International Society and the Voting Behavior in the United Nations 1946-1985 (in Japanese)*, Kokusai Chiiki Siryou Senta, 1987, and Inter-University Consortium for Political and Social Research. We also referred to the Yearbook of the United Nations and UN official reference materials to select data, confirm contents of the proposals, and check for possible mistakes.

[41] See Antonio Cassese, *Self-Determination of Peoples: A Legal Reappraisal*, Cambridge University Press, 1995, pp.11~66.

The equilibrium for the system is the intersection of the cumulative frequency distribution curve (the staircase function) and the 45 degree line. However, when the initial values of threshold and weight possessed by the members are as described above, there exists multiple equilibriums in the system (Figure 1). Four types of results emerged. First is the one in which all members take the position of trusteeship (the left end). Second is the one in which only three of the communist countries take the position of early independence. Third is the one in which most countries take the position of early independence except a part of European American countries. Fourth is the one in which all take the position of early-independence (right end)[42].

The simulation proceeds by using each UN General Assembly session as one turn. One country per turn is chosen randomly and activated once each year. The activated member would act as described in the next two paragraphs. When this action ends, the next member would be chosen randomly again and activated. All members would be activated once and the year ends when the action ends for the last member.

New member countries would be added before the new fiscal year begins. During the period that the model recreated, UN had many new member countries, in reality it increased from 59 (in the beginning of the 1950 fiscal year) to 126 (at the end of the 1969 fiscal year) member countries. In the model the member increased from 57 to 124. New member countries are added exogenously as it occurred in real world. New member country is allocated into one of the four groups in Figure 1. The initial threshold (default) for the new member is set at the average value of other members in the same group[43].

When a member is activated, it would first define its position. It would verify to what degree other agents are following the new norm, considering the number of the agents and their weights. If ratio for the new norm exceeds that of the threshold, the agent would choose the new norm. Conversely, if the ratio falls below that of the threshold, the agent would then choose the pre-existing norm. Next, the agent persuades other members from the position of the norm

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[42] In the third pattern of equilibrium, which only part of the European countries and the United States support trusteeship, there could be two subcategories depending on the norm that Iceland chooses. Whichever side Iceland chooses, the system stabilizes. Therefore, strictly speaking, there are five equilibriums.

[43] The average value of thresholds for all agents was applied as thresholds for those new member countries that do not belong to either group (and other category).

it follows at the moment (sending message). For the persuasion concerning a certain norm to be effective, the differences of the threshold between the sender and the receiver must be within a commensurable range. In other words, in the case of sending a message based on trusteeship, threshold of the receiving member (receiver) rises as much as the persuasiveness of that ideology only when the threshold of the receiver is lower (meaning more pro-early-independence) and within the commensurable range of the sender. Conversely, in the case of sending a message based on early-independence, threshold of the receiving member (receiver) decreases as much as the persuasiveness of that ideology only when the threshold of the receiver is higher (meaning more pro-trusteeship) and within the commensurable range. The persuasiveness of norms, and the commensurable range are exogenously defined. The next section will discuss their actual values.

VII. Summarizing the Results of the Simulation

We began by using the replication of the international society in 1950s as the initial value, constructed a model on international normative change concerning colonial issues from the 1950s to the 1960s, and executed the simulation[44]. In order to comprehend the characteristics of this model, four scenarios are prepared to observe the systemic behavior[45]. Scenario one to four will be explained successively as we bring the preconditions of the model closer to what actually took place.

(1)   Scenario 1- no persuasion takes place among members

Within this model, although persuasion does not take place among members, total distribution of the threshold changes as new members join. Such changes might be able to bring about transformation in social norm. In

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[44] The model of international normative changes constructed using artisoc in this paper can be downloaded at http://citrus.c.u-tokyo.ac.jp/mas/models/models.htm. It can then be simulated through the artisoc player downloadable at the MAS community http://mas.kke.co.jp/. It can also be simulated by using the artisoc textbook within the attached CDROM of Yamakage's *Construction Guaidance (in Japanese)* (Kouchiku Shinan). Persuasion, the parameter of the model, and commensurable range can be manipulated and defined.

[45] The documented result here is the changing average of the five trials for each pattern. Probability variable is extremely limited, since probability only effect the order of which member is revitalized. It shows very limited fluctuations.

fact, from the 1950s to the 1960s, newly independent countries joining the UN drastically changed the its power relations. How was social norm effected by such changes?

When executing the simulation, the distribution of threshold changes exogenously because of the large number of new members such as the newly independent countries. Figure 2 shows the total distribution of the threshold in 1961 in the simulation. In addition to the communist countries, more than half of the former colonial and Latin American countries supported early-independence and a new equilibrium was born. There were altogether 72 to 77 countries whose ratio was 0.54 to 0.60 according to the sum of their weight. But this does not bring about obvious change in social norm. Variable of transition from the initial equilibrium to the new equilibrium does not exist in this model. The large number of new member countries was not as radical as the communist countries in supporting early-independence. Not enough communist countries newly joined to alter the position of the former colonial countries. As a result, former colonial countries and the Latin American countries do not shift to early-independence.

(2) Scenario 2- both trusteeship and early-independence possess persuasiveness

The time period examined by this model was an era in which colonial issues were discussed in many forums including the UN. Colonial issues were discussed among the colony holders when the UN was established. Colonialism was also a major topic in the Asian-African Conference (the Bandung Conference) and the None-Aligned Movement Summit. Heated debates also took place in the Trusteeship Council, and the General Assembly (the Fourth Committee and the Plenary Meeting). What kind of changes in social norm can be observed, then, when members with both old and new position on the norm sent messages to persuade and influence positions concerning the colonial issue?

When both trusteeship and early-independence are set to possess persuasiveness in this simulation, the social norm converge into trusteeship. Even when the persuasiveness for the early-independence is set at much higher value (for example 0.008 being ten times of 0.0008), the result is the same. It is

still the same when the commensurable range is either narrowed (0.666 or 0.333) or widened (1.0)[46]. It is because at the initial stage of the simulation, overwhelming amount of members took the position of trusteeship and even those communist countries that supported early-independence were easily persuaded and weakened their positions.

(3)   Scenario 3- only early-independence possess persuasiveness

The 1950s was an era in which dominance by the imperial power rapidly lost its legitimacy and anti-colonialism became legitimate. Such trend had begun during WWII[47]. The colonial powers searched for ways to retain the colonies and maintain the empire but this could not deter the trend towards anti-colonialism. The fact that UK and France attempted to realign their ruling regime of the dependent territories through the Common Wealth or the French Union indicated that imperial rule could no longer be justified[48]. Therefore, there would seem to be a large gap in the persuasiveness of trusteeship and early-independence. To capture such historical condition, this scenario presumed that only early-independence possessed persuasiveness.

The commensurable range is set at 1.0 and the message sent from the position of the early-independence is allowed to influence all agents including those with the position of trusteeship. Then the persuasiveness for early-independence is given various values (0.006~0.010) exogenously for the simulation to be conducted (see Figure 3). Since only early-independence possesses persuasiveness, sooner or later the transition to the new norm will eventually take place in form of an extreme cascade. Persuasion from the position of early-independence influences all members but most countries appear not to have altered their positions. But when it reaches a certain point, they alter their positions all at once to early-independence. At what point such a change takes place depends on the value given to the persuasiveness of early-independence.

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[46] If the commensurable range is set at 0.666, it becomes a situation in which messages of the communist countries can persuade former colonial and Latin American countries. If it is set at 0.333, the it becomes the situation in which messages of the communist countries can only persuade the former colonial countries (see Table 1).

[47] See Dov Ronen, *The Quest for Self-Determination*, Yale University Press, 1988; Cassese, *op.cit.*; Crawford, *op.cit.*.

[48] See Raymond Betts, *Decolonization*, Routledge, 1998, pp.30~37.

(4)   Scenario 4- effects of persuasion limited to members with close threshold

In scenario 3, the presumption for the simulation was that persuasion by early-independence proponents had effects on all members. In considering the fact that positions regarding colonial issues often vary greatly from communist countries to the colonial power, it would seem natural to presume ideas of "common fate", "homogeneity", "common lifeworld", or "similarities as preconditions"[49] that are needed for persuasion should exist only among members who share similar position.

This simulation was carried out by setting a narrow commensurable range (0.333) and various values (0.006~0.101) for the persuasiveness of early independence, much like scenario 3 (see Figure 4). Since only early-independence proponents possess persuasiveness, eventually the transition to the new norm occurs[50]. However, the transition process is phased and complicated. First because of the persuasion of the communist countries, former colonial countries came to support early-independence. While both communist and former colonial countries both came to support early-independence, other countries would not be convinced by the messages sent by these two proponents of early independence. But those taking the positions of trusteeship and yet demonstrates understandings for early-independence (meaning lower threshold) would begin to alter their positions and try to persuade others taking the position of trusteeship when the number of countries accepting early-independence position increases. Countries considering early-independence appropriate would then increase because of such persuasion and eventually the last few former colonial powers would change their position to early-indepenence.

VIII. Prospects-Recapturing History through Simulation

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[49] Many have asserted that for the persuasion to take place, it is important to have some sort of commonalities. See Wendt, *op.cit.*; Risse, *op.cit.*; Rapoport, *op.cit.*, Cha.17, Ch.20, for the idea of "common destiny" or "homogeneity" by Wendt, "common lifeworld" by Risse, or similarities as a precondition by Rapoport.

[50] Actually, if the commensurable range is too narrow, the persuasion by the communist countries will not be able to even influence the former colonial countries, and as a result, substitution of norms do not occur (see Table 1).

In reality, how did the international norm concerning colonial issues change? Initially, only the communist countries opposed the trusteeship agreement citing it being against the purport of the UN Charters. Let's turn to the discussion concerning trust territories in the UN in the 1950s[51]. From the 6th session (1951) to the 10th session (1955), timetable on how to achieve the objective of trusteeship, "self-government or independence", was demanded of the colonial powers and a series of UN resolutions were adopted[52].

Then, at the 11th session of the General Assembly, representative of the Soviet Union submitted the resolution to urge the trust territories administrating countries to implement necessary measures to insure that the trust territories can become "self-governing or independent" in "three to five years." This was revised during the discussion in the Trusteeship Council so that the deadline of "three to five years" was changed to "at an early stage" and "in the near future." This "in the near future" was again deleted in the General Assembly and at last gained the two-thirds majority[53]. During the discussion process, 36 countries agreed to the proposal of trusteeship area achieving "self-governing or independent" in "in the near future" while 33 (abstention 13, opposition 20) found it unacceptable. For the proposal of "at an early stage", 45 countries agreed while 30 (abstention 16, opposition 14) found it unacceptable. Since the stated objective was "self-governing or independence", and not "independence", we should be careful in granting too much meaning this resolution. Still, the ideology of early-independence had permeated and contenting with that of trusteeship.

Four years later in the 15th session of the General Assembly (1960), the *Declaration on the Granting of Independence to Colonial Countries and Peoples* advocating that "immediate steps shall be taken, in all territories which have not yet attained independence, to transfer all powers, without conditions or

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[51] Before the Declaration on the Granting of Independence to Colonial Countries and Peoples of 1960, most of the dependent areas (colonies), that were the main subjects of discussions in the United Nations, were trust territories, not non-self-governing territories. See Kokusai Rengo Kouhoukyoku ed., *The United Nations and the Liberations of Colonies (in Japanese)*, Kokusai Rengou Kouhou Senta, 1970.

[52] See United Nations, *Yearbook of the United Nations 1955*, United Nations Publications, 1956, pp.312~316.

[53] See United Nations, *Yearbook of the United Nations 1956*, United Nations Publications, 1957, pp.331~333.

reservations" was approved without opposition[54]. This allows us to conclude that early-independence contending with trusteeship emerged as an international norm within the 4 years after 1956.

Let's now examine how closely matched the international normative change model on colonial issues is to the historical facts. The model began with a faithful recreation of the distribution of the individual norm in the international society regarding colonial issue. The total distribution of threshold then dynamically changed as members joined and exited in accordance with the historical facts. However, members' joining alone did not bring about transition in social norm (scenario 1). By incorporating the interaction of persuasion among members, transition of social norms became possible. But in contradiction to the actual history, the minority (the new norm) was persuaded (scenario 2). Then, by assuming that trusteeship was losing legitimacy and early-independence came to possess apealingness unilaterally, the transition would occur (scenario 3). Further, by incorporating condition in which only agents with close attitudes could the persuasion have effects, the model was able to reproduce social normative changes quite closely to the actual history (scenario 4).

This model concerning the international normative changes was constructed by recreating the case of colonial issues from 1950s to 1960s. As a result, suffice to say the model was able to attain high degree of replication by faithfully approximating historical facts (through initial conditions and setting parameters) and inserting a few simple interactions.

Conclusion

As stated in the beginning of this paper that MAS method is quite compatible with the case that the overall order emerges as a result of the interactions of constituents. This allows us to build a model by assuming the sovereign state as an agent and analyze how the position of individual agent (individual norm) is maintained (or altered) through different modes of persuasive communication (commensurable range and persuasiveness) and eventually the international norm as its entirety (the distribution of the

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[54] See United Nations, *Yearbook of the United Nations 1960*, United Nations Publications, 1961, pp.44~50.

individual norms). By applying this model to the anti-colonialism that became salient after WWII, we are able to analyze, through simulation, normative change concerning qualifications to participate in the international society (conditions of being a sovereign state). This enabled us to recreate and white-box the internal conditions of the agent and move beyond the threshold model as a mere metaphor concerning the cascade phenomenon on which many scholars of international norm focus.

MAS model can be extremely complex if one is willing to tolerate the computing speed. For example, within the model of international normative change, individual state can possess separate list concerning the importance of different state (weight) hence allows each state to possess different recognition on the importance of other states. Or choices of states' behavior can be made rather complex by providing more than three choices or multiple thresholds[55]. For the purpose of this paper, membership for the international society consists only of sovereign state but non-state agent can also be added to the system. Providing non-state agent with appropriate threshold and weight, and international system participated by state and non-state agents can be created. Further, while we described the model of international normative change as a transitional process from the pre-existing norm to the new norm within this paper, the established and new norm within the model have no differences other than that of the parameters. This means that it is rather simple to express through the model two competing norms, or expanding that to more than three competing norms.

The complex modeling described above can perhaps allow us to render the model more realistic. If appropriate operationalization can be achieved, it is perhaps more preferable. However, the KISS principle is not to be neglected. Even interactions of simple mechanisms (logics, rules, and cause and effect) can bring about complex phenomenon. The greatest advantage of MAS is to be able to carry out thought experiment that was not possible through the assistance of computer. For the readers, as well as the model builder, to comprehend the result of the simulation (systemic behavior), it is more preferable to have simple models. The model in this paper serves as an example. The agents behave according to common rules and behavior of the entire society depends

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[55] See Granoetter *op.cit.*; Yamaguchi *op. cit.*

on the initial condition and values of two parameters. Thus the analysis for causing complex phenomena is rather uncomplicated.

Obviously there are limitations to the method of trying to comprehend social phenomena through highly abstract models because of excessive compliance with the KISS principle. The MAS technique is capable of doing more than that because it can easily incorporate individual attributes into variables of a model. Appropriate modeling can help to build a model that incorporates specific characteristics of the subject under analysis. By building a system (model) that constitutes agents with rich characteristics and thought-experiment their interactions, we are able to move beyond abstract level and administer thought-experiment on individual social phenomenon.

Table 1　Threshold of Member Countries（By Groups）

Group Name (Number of Members)	average value	standard deviation
All Countires(57)	0.509	0.221
Communist Countries (4)	0.054	0.029
Former Colonial Countries (13)	0.315	0.045
Latin American Countries (20)	0.522	0.094
European Countries (16)	0.774	0.071
─Colonial Powers (9)	0.792	0.066
Other Countries (4)	0.476	0.079

Table 1　Threshold of Member Countries（By Groups）

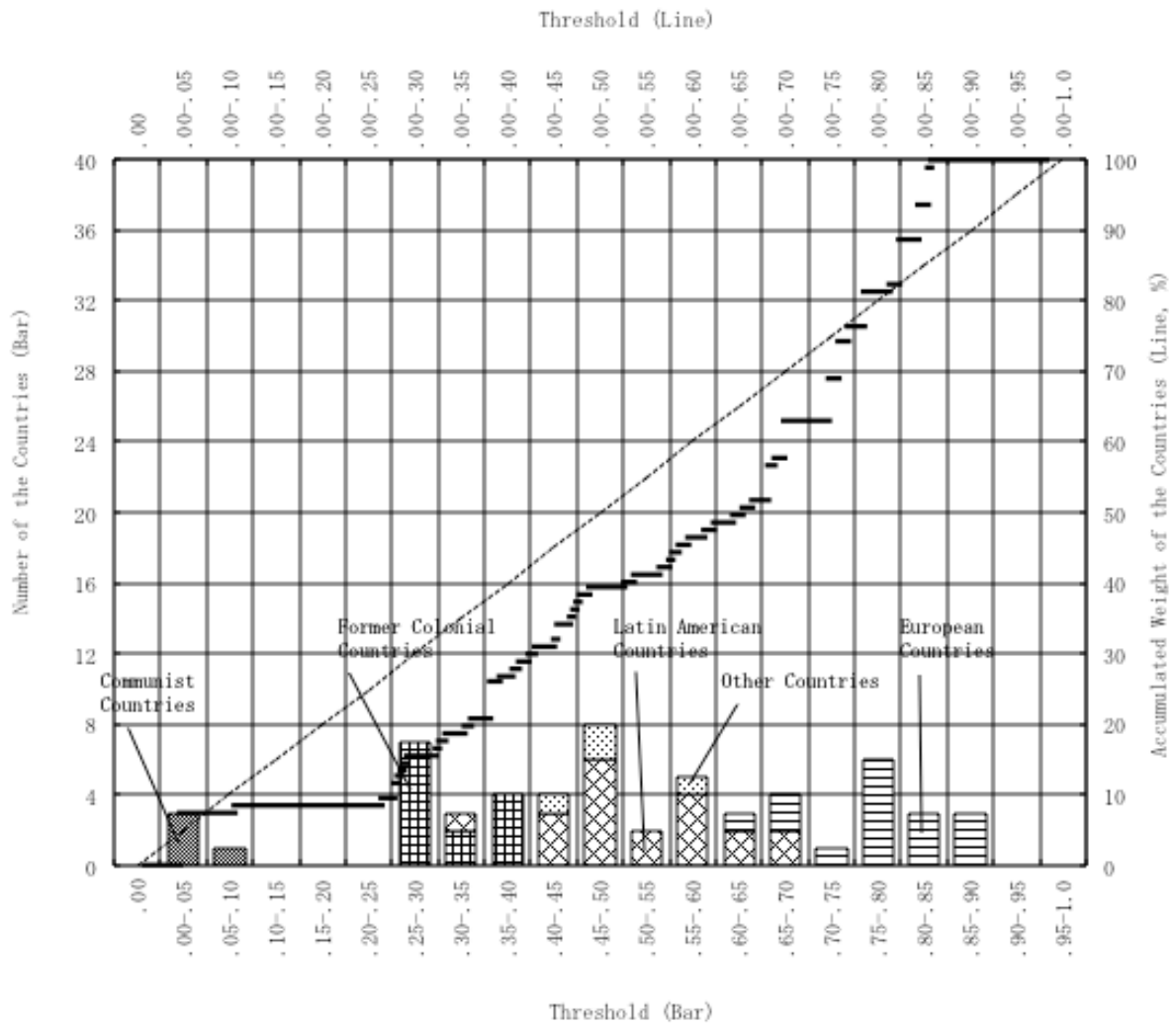Figure 1 The Distribution of tne Member Countries' Threshold at 1950

Figure 2 The Distribution of tne Member Countries' Threshold at 1961

Figure 3 Transition From Old to New Norm in Scenario 3

The Rate of Countries Accepting Earl-independencee Position

Year

persuasiveness0.002   persuasiveness0.004
persuasiveness0.006   persuasiveness0.008

Figure 4 Transition From Old to New Norm in Scenario 4

The Rate of Countries Accepting Earl-independencee Position

Year

"Persuasiveness0.006"   "Persuasiveness0.008"
"Persuasiveness0.010"   "Persuasiveness0.012"