# A NON-BARGAINING MODEL

All the models examined up to now have been bargaining models. They have assumed that a real process of bargaining takes place in crisis, and have described some aspect of this process. More specifically, a bargaining model assumes: 1) there is an actor in a social situation. An actor is a decision-making unit with goals, positive or negative, and a diagnosis of the situation, who acts, that is tries to change the situation in such a way as to achieve his goals to some extent. A social situation is one or more other actors in communication with the first actor. 2) the actor acts on the other actors by transmitting or asking for factual information and by some mix of accommodation and coercion. 3) the other actors respond by acting on the first actor and on each other. Bargaining is a series of such actions.

In this (chapter) (section) we examine a non-bargaining model. We assume that the bargaining that seems to take place during a crisis is an appearance only, an illusion, and that the reality is different. Since bargaining consists of actions, we assume that there are no actions during a crisis and therefore no actors, and that the appearance of action is an illusion. A crisis consists rather of an interaction among two or more reactors. A reactor is an input-output system that is activated by a signal, and that sends out a signal when activated. There are three kinds of reactors, deterministic, probabilistic, and mixed. For a deterministic reactor each type of input signal is associated with a single type of output signal; for a probabilistic reactor each type of input signal is associated with two or more types of output signals with a probability less than one for each. For a mixed reactor some outputs are deterministic and some probabilistic. We consider probabilistic reactors in this (chapter) (section).

The components of an actor in a bargaining model are: 1) information receptors and processors, 2) a diagnosis or estimate of the situation based on present and past misinformation, 3) goals, positive or negative, absolute or limited, comparable or unique, 4) a set of possible tactics for changing the situation, 5) a decision unit for selecting tactics and combining them into a strategy,

6) an executive for carrying out the strategy. A reactor is simpler; its components are: 1) information receptors and processors, 2) a reaction function or a set of reaction coefficients which transforms inputs into outputs, 3) an executive or output mechanism.

The classic reaction model was devised by Richardson, and as a consequence all such models can be called "Richardson process models," Richardson assumed a system composed of two reactors in which the reactions of each unit could be measured on a single dimension. This produced a two-dimensional or two-equation model. We will construct the same kind of model, and since this is to be a non-bargaining model the reaction dimension will be the accommodation-coercion dimension. We will arbitrarily make coercion positive and accommodation negative on this dimension. Each reaction can be described by a point on one dimension, which measures its level of coerciveness. The state of the two-reactor system can be described by a point on two dimensions, which measures the current level of coerciveness for both reactors.

Richardson constructed several similar models, but the most general one is as follows:

(1) $\frac{dx}{dt} = ky - \alpha x + g$

(2) $\frac{dy}{dt} = lx - \beta y + h$

where x, y are outputs of the two reactors; k, l are reaction coefficients which are here assumed to be constants; $\alpha$, $\beta$ are self-reaction coefficients; and g, h are constants. These equations say that for both reactors, their change of output depends partly on the output of the other reactor, partly on their own past output, and partly on neither. In addition the signs say that the effect of the other reactor is positive, so that x increases when y increases; the effect of self is negative, so that x's increase shows itself down and may eventually stop itself as it gets higher; and finally there is an autonomous push that drives x, y always a little higher.

Our model will be very similar to Richardson's model.

Where would we find such a process in our cases? What we need are cases in which the bargaining units are reactors rather than actors. Our study of crisis decision-making has clarified the nature of actors; they are always majority coalitions. A majority coalition is one that is strong enough to get its way against the combined opposition of the non-coalition members. In voting systems a majority coalition is one that has enough votes to "pass" a measure--$\frac{1}{2}$+1 vote, 2/3, 3/4, etc. In action systems a majority coalition is one that has enough resources to carry out a policy or strategy against the abstention or opposition of the remaining members. We are dealing here with action systems.

Putting the point more simply, a majority coalition is one that is strong enough to act, and therefore only majority coalitions can be actors among governments.

To say that a majority coalition can act implies that it has a range of freedom, which may be broad or narrow. Within this range it can choose, that is, select and combine tactics into a bargaining strategy. Its range of freedom is limited both externally and internally. Externally, the non-coalition members have resources which block certain areas of action or which are essential for certain strategies. For example, the President needs Senate leaders in his coalition to make a treaty but can make an executive agreement without them. Also of course the resources of the non-coalition members block some strategies or make them pointless. Internally the majority coalition has been formed by agreeing on a general strategy, and any substantial change of strategy constitutes a renegotiation of the coalition agreement. The internal limit of freedom is the point at which attempted renegotiation causes a pivotal member to desert the coalition so it becomes non-winning and can no longer act. A reduction of payoff (GDR 1961) or elimination (Bulgaria 1913) of a non-pivotal member uses up some internal freedom, but elimination of a pivotal member destroys freedom entirely.

On this basis it is easy to define a reactor. A reactor is a bargaining unit

that contains no majority coalition. Such a unit has no internal freedom, no power to act. This is a negative definition, a residual category, and therefore too broad. To specify "reactor" more exactly we examine a borderline case, Germany 1904-6, which was neither an actor nor a reactor but something in between. There was no majority coalition in the German government but there were two minority coalitions, one centered on the Kaiser and one on Holstein. Each coalition could intermittently block the other, but could also to some extent be bypassed by the other. The Kaiser could bypass the foreign office by dealing directly with the Tsar, though the details would eventually have to be worked out by the Foreign Office which could undo the Kaiser's plans. The Foreign office could bypass the Kaiser by getting general approval of a policy whose details they could work out later, or by advising him to go take a cruise, though there might be a tremendous commotion once he returned from the cruise and found out what was happening. There were two actors in this bargaining unit, each with enough internal freedom to decide on and initiate a bargaining strategy but not enough freedom to carry it out fully. A similar case which we did not study in detail is the U.S. 1944-April 1945.

A reactor is a bargaining unit composed of two or more continuous blocking coalitions. Such a unit cannot even decide on and initiate a strategy; it cannot act at all. It is always deadlocked. When it is activated by incoming signals, each minority coalition proposes a tactical response that fits its favored strategy, and is blocked by some other minority coalition. The output is always a compromise that reflects the relative strengths of the component coalitions. In other words the output expresses directly only the internal state of the bargaining unit. The output of an actor is always to some little extent a rational response to the estimated state of the bargaining opponent; it can be interpreted and understood by reference to the actor's estimates of the opponent's position, his set of goals, and his preferred strategy. But the output of a reactor must be understood by reference to the distribution of blocking power within the reactor

## REACTORS

Our examples of reactors are France, Sept. 1923 - April 1924, Britain intermittently during Sept. 1938, France 1938, Japan 1940-41, U.S. 1940-41, and NATO Nov. 1961 - May 1962 over Berlin. These are not many cases; but once we are sensitized to the characteristics of reactors by examining these cases, we can find a blocking component in many bargaining units--England, 1904-14, Russia, 1908, Austria, 1909, Bulgaria, 1913, U.S., 1961, Iran, 1946 and others. The component consists of blocking and potential blocking by minority coalitions, and it defines the limits of freedom of the majority coalition. Some majority coalitions have a good deal of freedom, enough to choose and carry out and revise a whole bargaining strategy. These coalitions can be conceived simply as actors. Others have a little freedom, and their attempts to choose or revise a strategy keep running into blocks and debilitating compromises. These units can also be conceived as actors, but with a reactor component. The importance of the few cases of nearly pure reactors is that they sensitize us to the reactor component, the non-bargaining component, in much crisis bargaining.

Most of our reactors were classified as type 5, divided government, in the previous chapter, and this suggests that in future work we redefine Type 5 more formally as "reactors." The remaining instances were classified as Type 4, cabinet or presidium government. This suggests that when we investigate the internal processes of our reactors empirically we can best clarify their workings by contrast with Type 4 actors, the actors most similar to reactors. In the following analysis, therefore, "actor" always means "Type 4 actor."

Both actors and reactors are characterized by internal bargaining, compromising, and coalition formation. There is however a sharp difference between the kind of compromising and coalition formation that occurs in the two. An actor is constituted when a majority or dominating coalition is formed. Such a coalition is held together by an agreement on a strategy, and this agreement in turn is based on an agreed diagnosis of the situation and an agreement on goals.

Compromise therefore occurs at the level of diagnosis and goals. A compromise on goals might consist of including the most important goals of each coalition member in a list of goals; the list would be arranged in an order of importance or priority which reflects the relative weight of the coalition member associated with each goal. This list then states the expected payoff of a successful strategy for each coalition member. In forming such a list the central decision-maker compromises by accepting goals other than his own or goals of minor importance to him, while other members compromise by accepting a subordinate ranking and the possible later elimination of their primary goal. For example the NATO coalition on Berlin about 1958-61 had as its goals the U.S. goal of secure military access to West Berlin, the British goal of avoiding war, the German goals of civilian access to West Berlin and eventual reunification of Germany, and the French goal of maintaining NATO resolve reputation. Each country accepted all of these goals but ranked them differently, and the eventual joint ranking established in 1961 reflected the U.S. ranking and to a lesser extent the British ranking: military access first, reunification last.

A compromise on diagnosis could consist of including the diverse expectations of coalition members as alternative possibilities to be anticipated in the coalition strategy. The rank order of probability would then reflect the relative weight of the coalition member associated with each goal. For example the 1958 Soviet diagnosis was that NATO pressure on East Germany might be a special project of extremists like Defense Minister Strauss, mildly tolerated by higher-ups, or it might be part of a fixed aggressive plan of the whole NATO leadership. Consequently NATO might agree to negotiate a settlement ending pressure on East Germany or it might not. The Soviet strategy was mixed, CD, to take account of both possibilities, though the primary emphasis was on the expectation of negotiations reflecting the dominance of the Khrushchev group.

A reactor is constituted by the failure to form a majority coalition, that is the failure to agree on bargaining strategy. The failure might be due to a

wide divergence of goals or goal rankings or a strong disagreement in diagnosis and expectations, or both. In our examples of reactors, divergence of goals appeared in France 1923, Japan 1940, and NATO 1962 Berlin; disagreement on diagnosis and expectations appeared in Britain and France 1938 and U.S. 1940; both divergence of goals and disagreement of expectations appeared in Germany 1904-06. It may be that the failure to form a majority coalition in some of these cases was also due to the particular distribution of weights which prevented a central decision-maker from collecting a majority around him. Since there is no majority, the coalition that forms is a grand coalition composed of all blocking coalitions (of one or more members) in the government.

Compromising in reactors always occurs at the tactical level. There is no agreement on strategy; components of the reactor may favor strategies ranging from C to E (France 1923, Japan 1941) or more usually C to D and therefore favor opposite tactics at every move. Whenever a tactical move is necessary a new compromise must be worked out, reflecting the relative blocking weights of coalition members. Alternatively, one coalition may try to sneak a tactic past a blocker (Konoye-Tojo sending a secret emissary to the U.S. Jan. 1941) or secretly veto an agreed tactic (Chamberlain-Henderson failing to deliver British warnings Sept. 1938) or openly veto a minority coalition tactic (Adenauer rejecting the U.S. bargaining position May 1962).

Insofar as the distribution of weights within a reactor remains constant, the series of resultant compromises will also be constant, and thus will <u>appear</u> externally as a consistent strategy. Internally there is a sharp difference: the consistent strategy of a majority coalition is derived rationally from agreed diagnosis, expectations, and goals, while the consistent series of tactical compromises in a grand coalition has no such basis. This makes it essential to define strategy subjectively, as a plan of action, rather than objectively as a consistent set of outputs. Here is another deficiency of learning and Markov models of bargaining: since they define strategy by output plus hypothetical

"propensities" to play C or D they cannot distinguish between actors and reactors.

The tactical compromises in a reactor occur through a process of mutual veto, since the weights of members are blocking weights, while the compromise producing a majority coalition occurs through a process of mutual acceptance and inclusion. In other words, tactical compromise is a minimax process, the search for the tactic that is least dangerous from all points of view, while strategic compromise tends to be integrative in Walton and McKersie's sense. Consequently the tactics of a reactor are normally ineffective from all points of view within the reactor; their justification is not effectiveness but avoidance of disaster.

For example the several timid warnings sent to Germany by Britain and France in Aug.-Sept. 1938 were tactical compromises. They avoided provoking Hitler (Chamberlain's and Bonnet's veto) but also avoided appeasing him (Halifax-Cooper's and Mandel's veto) and in fact accomplished nothing. Hitler ignored them.

A more elaborate example is the disposition of the U.S. fleet in 1941. Britain several times requested that a portion of the U.S. fleet be stationed at Singapore to deter a Japanese move south. This was supported by the U.S. hard-line group based on a hard-line diagnosis that Japan was bluffing, but vetoed by ML and SL members as it would provoke Japan. The Navy also vetoed it on grounds of unpreparedness. Roosevelt proposed that some of the fleet be moved forward to the Philippines for patrol duty in the area; this would continue preparing public opinion for the possibility of war, while a move to Singapore would frighten people and provoke a negative public reaction. This was vetoed by other ML-SL as it might provoke Japan and spread the Navy too thin. Admiral Stark suggested that the fleet be moved back to San Diego for training if war was coming; this was vetoed by HL as reducing our inadequate deterrent posture in the Pacific even more. The compromise was to secretly reinforce the Philippine defenses; this would neither provoke Japan (though in fact it did provoke Japan) nor reduce deterrence nor frighten public opinion nor postpone war preparedness, but it accomplished nothing positive either.

Since tactical compromises are ineffective, and are expected to be ineffective by all components of a reactor, they provide no opportunity to test a strategy and correct deficiencies in it. The ineffectiveness of a tactic can always be blamed on the debilitating compromises forced by an opposing faction, and each faction can continue to believe that its strategy would work if it could only be tried for a long enough time. For example in the U.S. 1940-41 case both HL and SL expectations were quite mistaken, but neither faction made any corrections. A move of the fleet to Singapore might have corrected some HL delusions and a Konoye-Roosevelt meeting might have corrected some SL delusions, but neither was permitted to occur.

Having distinguished actors and reactors, we must now add that an actor can at any time turn into a reactor and vice versa, and some units can even vacillate between the two. An actor becomes a reactor when a minority coalition gains veto power over a majority coalition; a reactor becomes an actor when a majority coalition forms within it. In our cases Japan 1941 was in process of becoming an actor and NATO 1958-62 changed from actor to reactor. France late 1923 was a transition period between a majority coalition of the Right and one of the Left, and Britain 1938 was a soft-line majority coalition in which HL components intermittently managed a weak veto.

## A NON-BARGAINING MODEL

Non-bargaining occurs when both bargaining units are reactors. We have one such case, U.S.-Japan, 1940-41. We shall first examine this case empirically to locate the components of our model, and then state the model formally.

Both bargaining units in 1940-41 were continuously deadlocked. The deadlocks were between two forces, a "push" or accelerator and a "drag" or brake. The push was the dominant minority coalition which generally proposed actions, and the drag was the weaker minority coalition or coalitions which blocked and forced a compromise. In between were waverers who would sometimes push and sometimes

drag or who might shift definitely from one side to the other. In 1941 both "push" groups were pushing for increased coercive measures, with the drags wanting as little increase as possible. In 1938 both "push" groups, the Chamberlain Inner Cabinet in England and the Bonnet group in France, wanted greater accommodation, and the drags such as Cooper, Reynaud, and Mandel, wanted to stop the increase of accommodation. In 1961 the NATO "push" coalition, Kennedy ML and Macmillan SL, wanted increased accommodation, and the drags, Adenauer and DeGaulle HL, wanted as small an increase of accommodation as possible.

The Japanese lineup was as follows, reading from push to drag: 1) Foreign Minister Matsuoka, representing the German ally and supported by extreme militarists outside the government. Matsuoka wanted immediate attacks, first on Singapore and later on Siberia, in accord with Hitler's desires. 2) The army, represented by Tojo. The army wanted especially to complete the conquest of China, and supported any strategy that would lead to that goal whether coercive or accommodative. Its inclinations were coercive. 3) The navy, represented by Oikawa. The navy position is difficult to describe because it in turn was a reactor with its own push and drag components. Some Navy men favored coercion, and some accommodation, but Oikawa favored a drag on coercive measures because of doubts about outcome of a U.S.-Japan war. The Navy was less interested in China than in the oil and raw materials of the Indies. 4) Premier Konoye SL representing various SL elements such as Nomura, Kido. Konoye strongly opposed coercive measures against the U.S. Public opinion largely supported the Government, but there were also extreme groups that slightly limited its freedom. On the push side were extreme militarists who continuously plotted and occasionally attempted to assassinate Konoye and Kido and who were represented by Matsuoka. On the drag side were pro-business and somewhat anti-militarist politicians, the "Shidehara politicians," who had lost power by 1936.

The U.S. lineup from push to drag was as follows, 1) The British, Dutch, and Chinese allies who pushed for more U.S. involvement and military aid.

2) The HL deterrent officials, especially Hornbeck, Stimson, Morgenthau, Ickes, who believed that a firm strategy would deter the Japanese bluffer and eventually force him to back down. 3) Roosevelt, who was sensitive both to the British push and to the drag of anti-war public opinion and anti-war congressmen. 4) The military, represented by Adm. Stark and Gen. Marshall, who dragged on coercive measures because of military unpreparedness, but who pushed domestic ally for military production and military preparedness. 5) Foreign Secretary Hull ML who worried about provoking Japan and who hoped that the Japanese SL might capitulate in negotiations. 6) Walker and Grew SL who saw Japan as a potential good neighbor or ally and who sympathized and wished to strengthen the Japanese SL.

Each move by both sides was a compromise between push and drag forces, and its degrees of coerciveness expressed the balance of forces at that time. Now if we connect two such reactors so that the output of A is the input of B we get a static or equilibrium system. Reactor A makes a move of a certain degree a of coerciveness; this activates B, which responds with a move of degree b. This activates A, which responds with a move of degree a, and so on.

The system is dynamic if move a shifts the balance of forces in B slightly so its output is $b \mp \Delta b$, and if $b \mp \Delta b$ shifts the balance of forces in A so its response is $a \mp \Delta a$, and so on. We can see exactly how this works in our case. Move a strengthens the "push" component of B and/or weakens the "drag" component so the output is $b+\Delta b$. This increase of coercion strengthens A's push and/or weakens his drag, so A's output is $a+\Delta a$, and so on. The Japanese push is strengthened by a U.S. move which weakens Japan's future war potential, say an oil or scrap iron embargo; this makes the military more desperate so they push harder for coercive measures to secure alternate sources of war materials. The U.S. push, the HL group, is strengthened by a Japanese military move. They interpret this as a Japanese bluff based on a weakened U.S. resolve reputation, and push harder for a firm stand which will improve U.S. reputation and thereby deter Japan from further aggression. Both Japanese and U.S. drags are weakened by a

move of increased coerciveness; it falsifies their prediction that an accommodative attempt will be reciprocated, thereby weakening their prestige in their unit, and it also discourages them so they do not try as hard to resist the push component. For example, at Bad Godesberg 1938, when Chamberlain triumphantly told Hitler he was authorized to accept Hitler's terms, and when Hitler responded by increasing his demands, this so discouraged Chamberlain that he offered little resistance to the HL drag group in the Cabinet, which proposed to put a stop to British concessions.

The opposite kind of cycle also occurs: a-$\Delta$a triggers b-$\Delta$b which triggers a-$\Delta\Delta$a, and so on. That is, a less coercive move encourages the SL negotiators: their expectations are being confirmed and their proposed accommodative strategy would work if it were accepted. A coercive response now would spoil everything, so they try very hard to block coercive proposals. For Japan a less coercive move also weakens the push. The U.S. is beginning to act reasonably; perhaps war can be avoided after all. The SL negotiators may be right, and should be given a chance to reach agreement. For U.S. a less coercive move does not weaken the HL push and may even strengthen it. Japan is starting to back down; the U.S. firm stand, even though weakened by foolish concessions to the "drags," is working a little, and a firmer stand would work even better. Note that both accommodative and coercive moves strengthen the U.S. "push."

So far we have sketched in outline a classic Richardson process. The state of the two-reactor system is described by a point in the two-dimensional space composed of the level of coerciveness of the two outputs. There is an equilibrium point E which is unstable. In any system state NE of this point there is a positive-feedback cycle which moves the system to ever higher levels of coercion and eventually war. In any system state SW of this point a positive-feedback cycle moves the system to lower levels of coercion for a while. In other words, for both reactors the reaction coefficient R=1 at E, while NE of E R $>$1 and SW of E R $<$1. This kind of system may be diagrammed as follows:

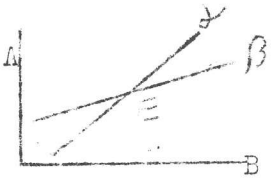


Fig. 1

The lines $\alpha$ and $\beta$ are partial equilibrium lines or reaction functions for A and B.

A and B take turns moving; A always moves vertically to line $\alpha$ and B then moves horizontally to line , and so on. The zigzag arrows represent possible system paths toward either war (NE) or detente (SW).

Unfortunately for the cause of mathematical simplicity, the real system is more complex and messy than this simplified first approximation. To begin with, the two reaction functions or partial equilibrium lines are curved, approximately so:

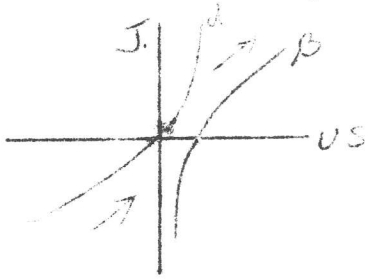


Fig. 2

For the U.S. there is a minimum level of coerciveness below which it will not move even if Japan surrenders, so the reaction function is practically vertical at the bottom. At the top, the U.S. matches Japanese escalation step by step. For Japan, there is a maximum level of U.S. coercion beyond which Japan will go to war, so the reaction function is vertical at the top. Below this, it is willing to match a U.S. concession with its own concession, at a rapidly declining rate. Since the lines do not touch there is no equilibrium point, but there is a short stretch where the lines are close together and movement is slow. The 1940-41 system remained in this area until it broke out the top in Oct.-Nov. 1941. The possibility of detente is shown to be non-existent, and occurs only in the dreams of the drags on both sides, dreams in which the pushes and the opponent have suddenly become reasonable.

Note that Fig. 2 is a dynamic interpretation of a Deadlock game played by reactors, with the four quadrants representing DD, DC, CC, and CD respectively.

But even Fig. 2 is a simplification. There is strong evidence to suggest that both countries reacted not only to the other's position but also to his change of position, a second order reaction. This was especially true for the U.S. Moreover, the U.S. second order reaction function had a sharp break in it, sharper than that in Fig. 2 The U.S. reacted to increased coercion with increased coercion, but it reacted to decreased coercion with no change. Increased coercion weakened the U.S. SL-ML drags by discouragement: Japan is not responding to our peace overtures. It strengthened the determination of the HL pushes: Japanese aggressiveness demonstrates the weakness of the U.S. deterrent posture, which must be strengthened. Decreased coercion confirmed both SL and HL predictions which cancelled each other out. For the SL, Japan is getting more reasonable and negotiations have a better chance of success. For the HL, U.S. deterrence is starting to succeed and will succeed even better if it is increased.

In addition, both units reacted partly to their own past states, especially the U.S. We can distinguish three additional mechanisms here.

1) In the U.S. unit only there was a component of steadily decreasing drag independent of interaction. This was a) the military component, Stark and Marshall, who dragged proportionate to the state of military unpreparedness. As war production increased military unpreparedness decreased, and in January 1942 this decreasing drag would have just barely shifted to push. Also b) public opinion, operating through Roosevelt, was steadily decreasing its opposition to war. This decrease was the effect of U.S. coercive acts, such as the occupation of Iceland, which conditioned people to accept more coercion. Roosevelt's policy was to stay slightly ahead of public opinion and thus gradually lead it to war, should war be necessary. This component by itself would counteract any possible movement toward detente.

In Japan only there was a component of increasing push after July, 1941. This was a consequence of the U.S. total embargo of July 26, which caused the Japanese military position to worsen daily. As a result the army pushed ever

harder and the navy shifted gradually from drag to push.

In terms of Fig. 2 this component can be represented by a gradual shift of both reaction functions, upward for Japan and right for the U.S.

2) In Japan only it was possible to eliminate either a push or drag component by forming a temporary united front against it. One instance was Matsuoka's forced resignation July 16, 1941, which eliminated the German push completely. A second was, Konoye's resignation Oct. 16. This eliminated the last drag component, which had in any case become completely discouraged by then. The principle here seems to be that when one component gets too far from the center of gravity of the reactor it imposes an intolerable strain and is expelled.

3) Random factors can interfere with any of the other factors. The most prominent example was the Japanese misinterpretation of the U.S. note of April 9. This proposal was actually written by a Japanese army officer as a basis for discussion and was quite close to Konoye's SL position, but Japan thought it represented a U.S. offer. Thus the U.S. output as received was much less coercive than as sent. Richardson would not have liked that. Cf also Boulding, 1962, p. 35. Another instance was the German attack on the SU., combined with a request that Japan join the attack. This sudden push increase, transmitted through Matsuoka, made him an extremist and cost him his cabinet post.

Factors 2 and 3 can be treated as random factors relative to the rest, as they originate in different systems than the one under consideration.

We now combine all the above factors. Let A be Japan, B the U.S., RA and RB the two reactions. Then:

1) $RA_t = RA_{t-1} + f\,(RB_t - RB_{t-1}) \pm Q$

2) $RB_t = RB_{t-1} + k + g\,(RA_t - RA_{t-1})$

Where k is a constant $> 0$.

$f \simeq 1$ till a coercion threshold is reached, above which it increases rapidly.

g is a step-function, = 1 when the operand is positive, zero when the operand is negative.

Q is a random variable which is usually near zero.

f and g are the two reaction functions, which operate on the change of position of the opponent. They are roughly equivalent to the two reaction functions in Quadrant 1 of Fig. 2, k represents the self-reacting increased push, and Q represents the occasional influence of other systems (Germany-S.U.) or of misperceptions.

Inspection of (1) and (2) shows that the only factor that could ever reduce RA is Q, and nothing could reduce RB. Given the internal composition of the two reactors as of July, 1940 war was inevitable.

We now illustrate the reactor system by describing the major moves from July 1940 to Nov. 1941. We begin arbitrarily with the U.S. embargo, which itself was a reaction to earlier moves and in no way a new start.

1. July 25, 1940. U.S. embargo. Push, HL. U.S. should prohibit export of oil and scrap iron to Japan. This will deter Japan from further aggression.

Drag: State Dept., Dutch, British. Embargo may provoke Japan into attack on Dutch East Indies.

Compromise: limit embargo to aviation fuel and top-grade scrap iron. The question of extending the embargo came up at intervals after that; gradual extension

Effect on Japan: Army push increased, Navy drag reduced. War may be necessary eventually.

2. August. Japan economic and military demands on Indo-China; increased demand for oil from Dutch East Indies. Push: Army. J. must secure a supply of war materials in case of a complete U.S. embargo.

Drag: Navy is neutral on demands, but opposed to war to enforce them. Navy needs oil, but some Navy men fear the move will provoke U.S. countermeasures.

Compromise: Demands are presented, but Dutch delays and low counteroffers are tolerated; demands are reduced $\frac{1}{2}$. Compromise agreement reached November 12.

3. September 27, Japan treaty with Germany. Push: Matsuoka HL. Treaty will deter U.S. Army. Treaty will neutralize S.U. and free army for the China war.

Drag: Navy, in part; Konoe, Kido. Treaty may provoke U.S.

Compromise: assurance to Navy that Japan is not automatically bound by the treaty; agreement to try not to provoke U.S. in the future.

Effect on U.S.: a) public opinion drag reduced. b) HL more anxious, propose tightening embargo. Drag: military, State Department. No action taken.

4. October 5 British want part of U.S. fleet moved to Singapore. Push: British, U.S. HL. This will deter Japan from its expected attack on Singapore. FDR: some sort of symbolic forward move needed, perhaps a naval patrol of Pacific waters, to keep public opinion moving forward.

Drag: Hull. A move to Singapore might provoke Japan. Navy: it would also divide and weaken the Navy. Fleet should return from Hawaii to San Diego for training.

Compromise: a) quietly reinforce Philippines. Fleet stays at Hawaii. b) secret U.S.-British military discussions to co-ordinate military defense of Malaya and Dutch E. Indies. This issue came up again November 25 and February 10 with the same result.

Effect on Japan: Fear of encirclement; Matsuoka HL becomes more vigorous in urging military moves southward, including attack on Singapore. Drag: Navy.

5. December 10 should U.S. license iron and other exports to Japan? HL: yes (effect of move 3). Hull: No, may provoke Japan.

Compromise: make licenses unobtrusive, gradually extend them to new categories. State dept. resistance to licensing gradually disappears.

Effect on Japan: January 1941 Japan reopens trade talks with Dutch East Indies with increased demands.

6. December, Konoye SL, with Army support, sends a secret negotiating proposal to U.S. via U.S. missionaries. This bypasses Matsuoka. Its general terms are reported to FDR in January. Details are worked out by U.S.-Japan private

citizens, presented to Hull April 9. Hull forwards the proposal to Japan, asking whether it is acceptable to Japan as basis for negotiation.

Effect on Japan: Proposal interpreted as a U.S. offer. Offer is reasonable. Konoye is correct, negotiations are promising. Konoye's influence on Army-Navy goes up, Matsuoka isolated.

7. Japan response to U.S. offer. Discussed April 21, sent May 7-12. Push: Matsuoka, reject offer and attack Singapore as Hitler is requesting.

Drag: Army, Navy, Konoye. U.S. reasonableness should be tested in negotiations. Navy: unprepared to attack Singapore. Note: this is a majority coalition against Matsuoka. Tightened May 9.

Compromise: Offer is conditionally accepted, but two U.S. concessions are necessary. Loyalty in principle to Axis agreement is reaffirmed. Effect on U.S.: Hull despondent, shifts to neutral.

8. U.S. reply. HL: April 9 draft calls for U.S. surrender, and May 12 addition is still worse, Proposal is unacceptable.

Drag: Grew SL. Konoye and others are trying to overcome the Matsuoka militarists and should be supported. FDR, U.S. needs time to build up the navy. Part of the Pacific fleet must be diverted to the Atlantic for convoy duty.

Neutral: Hull, note should be rejected but negotiations should be kept open in hopes of Japanese shift.

Compromise: gently reject Japan response.

Effect on Japan: SL group discouraged. U.S. is getting less reasonable.

9. Several moves which harden U.S. position and discourage Japan SL. Dutch reject Japan trade demands; negotiations broken off. June 6, 20 U.S. partial oil embargo. June 21 firmer U.S. rejection of Japan proposals. Increased U.S. aid to China.

10. June 22 Germany invades S.U., invites Japan to attack Siberia. Push: Matsuoka, A great opportunity.

Drag: Army, Japan army is still inferior to Siberian army, was defeated by

it in '38-'39. China is the main Japanese problem. Konoye, attack would unite S.U., U.S., Britain against Japan. Navy, necessary oil is in the Indies, not Siberia.

Decision July 2: Japan must move south.

Effect on Japan: Matsuoka isolated, eliminated from power. New lineup: strong push, Army. Neutral, Navy. Weak drag, Konoye group.

11. July 14 Japan demands air and naval bases in south Indo-China. This expresses the July 2 decision which eliminated Matsuoka and the German push.

Effect on U.S.: FDR, Hull shift to push. New Lineup: push, British, Dutch, HL, FDR, Hull, Weak drag: Navy, Grew.

12. July 26 U.S. freezes Japan assets in U.S.

Push: HL, FDR, Hull. Japan has decided to attack the Indies and must be stopped.

Drag: Navy. Not ready for war yet. Do not provoke Japan.

Compromise: Though assets are frozen, Japan can still apply for export licenses, which in practice will not be acted on. FDR assures Japan that no embargo has been imposed.

Effect on Japanese: War is almost inevitable. Navy shifts to push; U.S. oil embargo means disaster for Japan in 1½ to 2 years.

13. Japanese proposal, sent August 5, September 6, September 22, September 25. Push: Army. Japan must prepare for war. Navy: Japan must act quickly, whatever it decides to do.

Drag: Konoye. Japan should make one more try for peace.

Compromise: Konoye given one more chance, with deadline of early October. Meanwhile, war preparations.

Effect on U.S.: HL strengthened. Japan is backing down. Firmness now will preserve peace. SL discouraged. Situation is hopeless.

14. U.S. rejection, October 2.

Push: HL. Japan will now back down. FDR, Hull, war is inevitable but U.S.

is not quite ready. Neutral: navy. Navy is almost ready for war now.

Drag: Grew SL. Last chance for peace; try to continue negotiations somehow.

Compromise: U.S. stalls, then rejects Japan's proposal without breaking off negotiations.

Effect on Japan: Konoye gives up, resigns.

15. October 31. Japan decides for war.

Push: Army, part of Navy. Though war is a desperate gamble, situation is deteriorating daily and the alternative to war is national ruin.

Drag: Part of Navy. Japan will probably lose this war, but the Navy will do its duty and fight.

Decision: Emperor commands Tojo to neglect no chance for peace. And since Japan will not be in position to attack until early December, U.S. will be given one more chance to accept Japan's terms. On December 1, Japan will decide on war. Revised Japanese offer sent to U.S., November 7.

Effect on U.S.: negotiations are hopeless, to be continued only "For the record." Offer rejected.

Note that the Japanese reactor became an actor in October with Konoye's resignation. There was now no effective drag left, so the unit had internal freedom. However, the external system so limited Japan that the only free choice Japan could make was to commit suicide.