CHAPTER 5

International Tension and Trust

Roughly speaking, international tension is a shared worry about an imminent conflict. This chapter shows how tension can be influenced by focal symbols. It gives a strategic account of how trust-building events carried out before a crisis, like arms control agreements, can have symbolic value in reducing tension. Finally, the chapter derives principles that would help governments reduce tension during a crisis. One principle, of course, is that leaders should attend to the symbolism of their actions. Another is that if leaders take an action that might increase tension, they should avoid making it a "public" one, in a certain defined sense.

The model of tension is based on three ideas:

tension involves worry shared by adversaries about an imminent war;
the worry itself may contribute to starting a war;
tension is spoken of as a single feature of the current situation.

An aim of the model is to include these three features. The last point means that tension does not vary from one country to the next. One speaks of the tension between two parties, not "Serbian tension" versus "Austrian tension." A metaphor of chapter 3 saw war as a disease, and if a war is about to "break out" in the international body, tension is the system's temperature.

The chapter starts with somewhat inadequate models of tension based on continuous versions of Chicken and reaches a full-fledged model using a continuous Stag Hunt. Chicken-type games are representative of the crisis models that have appeared in the literature and are included as a contrast with the present approach. In Chicken-based models each state is hoping the other will back down as tension rises. By staying in, a state may gain the prize, but that keeps the crisis going and risks the outbreak of a war. Chicken models do not show

the full concept of tension, since they do not portray it as a reason that war starts. In fact, worry about a war promotes peace in these models because it induces the states to back down.

In contrast to a Chicken model, the continuous Stag Hunt makes tension the cause of war. The states decide whether to start a war, not whether to back down. The ideal outcome for both is that they both remain patient until the crisis ends; the only motive for starting a war is fear that the other is about to attack. The threshold for attack is determined partly by the focal symbolism of random events happening during the crisis.

Symbolic Events and International Tension

Unexpected events can raise or lower the worry about war, and their connection to tension is often a symbolic one. During the 1962 Cuban missile crisis, a U-2 reconnaissance plane took off from Alaska to collect radioactive samples from a Soviet nuclear test. Near the North Pole, the pilot was unable to use his magnetic compass, and a bright aurora borealis prevented him from navigating by the stars. Thinking he was returning home, he flew into the Soviet Union. Soviet radar station operators took the plane to be on reconnaissance preliminary to a strategic bombing attack, and MiG fighters took off to shoot it down. The U-2 pilot realized his error and turned around, but by then U.S. fighters had scrambled. Because of the crisis, the interceptors took off with nuclear air-to-air missiles installed. The U-2's fuel was spent, but it made visual contact with the U.S. fighters and glided back to its base. Khrushchev complained of the incident in a letter to Kennedy, "What is this, a provocation? One of your planes violates our frontier during this anxious time we are all experiencing, when everything has been put into combat readiness." Sagan (1993) uncovered the story by locating and interviewing the pilot of the stray U-2, and received further information from Soviet sources.

When incidents like this happen, they are said to "increase tension," or "deepen the crisis," or "move the world closer to war." Sometimes an event is both a result of tension and a cause of it. In the Dogger Bank incident of 1904, a Russian warship was so edgy about the Japanese navy that it mistakenly attacked and sank a British fishing trawler. The action was obviously a misunderstanding, but it led to public meetings in Trafalgar Square and induced the Admiralty to "put the Home Channel and Mediterranean fleets on a war footing." According to Connaughton (1988), "War between Britain and Russia appeared imminent."

This cannot be message symbolism if the parties recognize that no message is being sent. The genre at work is the focal variety, based on analogy involving structural similarity. In the Dogger Bank incident, the sinking of the British trawler was analogous to the kinds of events that would happen in a naval war, and the U-2 flying over the Soviet Union was like a war where hostile aircraft fly into each other's country and are engaged by the defenses. Some economics models involve an arbitrary extraneous event influencing actions through mutual expectations, so-called sunspot phenomena, and in principle, international tension could rise and fall as leaders watch sunspots, but in fact they go by those events that are symbolically connected to war. Leaders alter their expectations of each other's actions based on the inference that the other is doing the same.

Often the symbol does more than raise tension symbolically. It changes other aspects of the situation, as when a state mobilizes its army or takes an action that provokes another's anger. Perhaps this is why one can search historical sources on events like the stray U-2 and the Dogger Bank incident and find no suggestion that symbolism was involved. Historical explanations have focused on other aspects. The thesis here is that while objective military or emotional factors may be involved, there is more, and to judge a symbolic explanation, one first needs an account of how it might operate. The full-fledged model (example 4) will involve "pure" tension, without objective or emotional elements. The mutual alarm comes from external symbolic events, randomly generated and commonly known to be undeliberate.

Tension as an Explanation in International Relations Theory

Tension is common in everyday talk about conflict, but it is rare in current international relations theory. It was more frequent thirty years ago, and one can speculate about why it has waned. From the late 1950s to the early 1970s, systems thinking was influential, spread by the writings of Karl Deutsch, David Singer, Morton Kaplan, Anatol Rapoport, David Easton, and others. The approach was congenial to one feature of tension—that it pertains to the whole situation. Several authors included tension as an explanatory variable for war (Singer 1958; Osgood 1962, 114; Holsti 1962; Bergeron 1971; Newcombe and Wert 1972; Goldmann 1974), and others used system-level concepts that seemed very close, like Quincy Wright's "international atmosphere" (1957), or Klingberg's nondirectional measures of friendship or hostility between pre–World War II governments (1941, 1965). Tension's focus on the whole system

was attractive to 1960s peace-oriented researchers, because it ascribed the arms race largely to interactions more than individual states, counterbalancing the Cold War attitudes that blamed the adversary.

The early work on peace research saw interaction among those using mathematics, quantitative analysis and systems theory. Systems theory declined, and the other two strains separated, each putting less emphasis on tension. The quantitative researchers emphasized data, and at first some generated "barometric" measures to study the progress of a crisis, like the rate of exchange of dipomatic messages, the number of hostile acts back and forth, or physiological indices of the stress in leader's voices (Wiegele 1973, 1985). Holsti (1972) looked at the sense of time pressure expressed in diplomatic measures, and consistent with the notion of tension, he graphed it not just for individual states but for the whole system (fig. 7). More recently, however, crisis intensity measures like Leng's (1993) presented data only for each state. It would have been easy to aggregrate the single values to get a tension measure for the entire system, but without systems theory hypotheses behind their research, researchers kept their analysis at the level of individual states.

The formal modelers used game and decision analysis to study the outbreak of war. They looked at individual choices, and the notion of tension "in the atmosphere" was unappealing. The concept also seemed bound up with emotions, like anxiety and fear, which were not congenial to their method.

In the last two decades crises have been studied increasingly using the psychology of decision behavior. A conceptual cousin of tension is "stress," which is thought to lead to conflict by distorting leaders' decisions (Brecher 1980, 1993; Holsti and George 1975). Unlike tension, stress is not a decision variable—leaders do not weigh it in as a reason for or against war. It is an outside influence on decision quality (Lebow 1981; Janis 1989).

Those researchers who have discussed tension by name have treated it as noncognitive and have not focused on it. Snyder and Diesing talked about the "*feeling* of tension" between states (1977, 9) but referred to tension itself as the "intensity of conflict *behavior*" (1977, 15, my emphasis). Neither concept involved the probability of war. In defining a crisis, some writers required a high probability of war (e.g., Snyder and Diesing 1977, 7; Brecher, Wilkenfeld, and Moser 1988, 4; Brecher and Wilkenfeld 1997), but did not analyze that probability further.

The present theory is meant to go back to the original conception. Tension is a certain probability, a kind of entity familiar in decision theory, and it is a property of the whole system. The different parties may have special knowledge of how far they can be pushed before acting, and so they may assess different in-

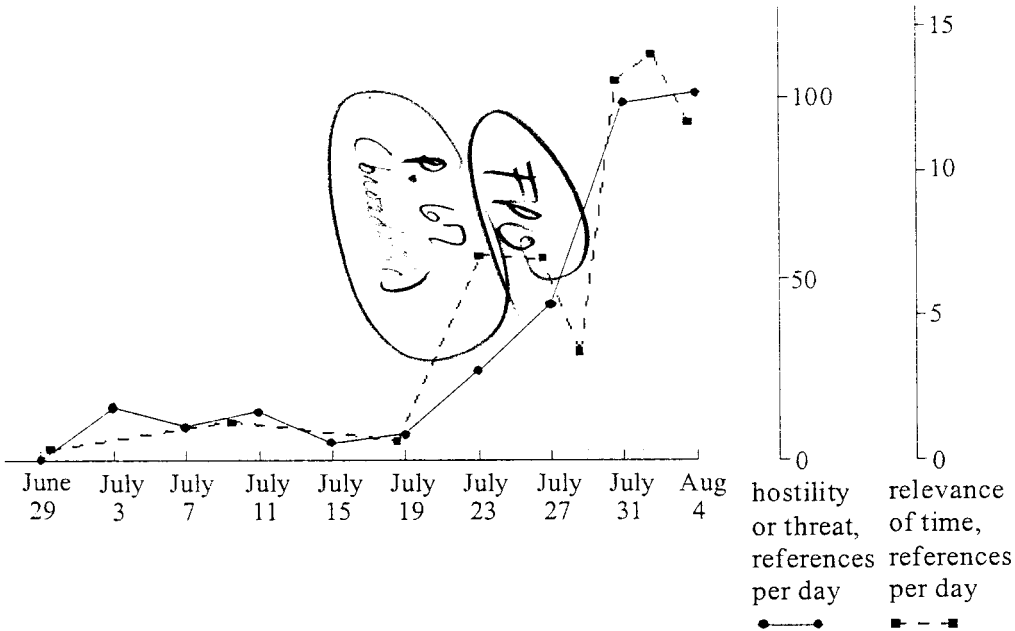

Fig. 7. Two measures of factors in crisis tension from the Stanford studies. From written communications of decision makers before World War I, the daily rates of references to time as a factor in decision making (Holsti 1969), and to hostility or threat (Zinnes 1972).

dividual probabilities of war, but "tension" is used for the probability held by an outside observer.

The model allows two definitions of the term. Tension can be *the probability at a certain time that the crisis will eventually end in war.* This is the conditional probability of ultimate war, given that the crisis is in its current state. An alternative meaning is *the relative likelihood of an immediate war at a certain time.* This could be called the "hazard rate," or what an actuary might call the "force of mortality." To distinguish the two, the probability of eventual war is called *prospective tension,* and the other is *instantaneous tension.* Both are functions of time, changing as the crisis progresses.

Although the model focuses on cognitive aspects, tension is more than that. Calling it "worry" about war associates it with preoccupation, aversive feeling and a distortion of judgment that might prompt someone to act rashly. Holsti (1962) quotes the Japanese war minister, who wanted to go ahead in 1941 despite the United States' great advantage: "Once in a while it is necessary for one to close one's eyes and jump from the stage of the Kiyomizu Temple." These emotional and performance components are important, but here a major part of the message is that tension has a strategic basis.

Tension in Chicken-Based Crisis Models

Past game models of crises could often be seen as basically games of Chicken (matrix 1 and appendix B) sometimes extended to two or more stages. Two simple examples of this general kind are given now.

Example 1: Continuous-time brinkmanship with complete information

Two players face each other, and one will gain a prize if the other backs down. Each has value 1 for the prize and 0 for backing down. At some unknown time uniformly selected between 0 and 1, a war will start if neither player has backed down by then. Neither knows when a war will send them "over the brink."[1] A war gives -1 to both.

An equilibrium is a rule telling each player when to back down if the other has not done so already. The game has exactly one equilibrium that is symmet-

1. Still the game is termed *complete information* because the rules do not give a player any private information unknown to the other.

	Give in	Stay
Give in	3, 3	*2, 4*
Stay	*4, 2*	1, 1

Chicken

	Stay at peace	Attack
Stay at peace	*4, 4*	1, 3
Attack	3, 1	*2, 2*

Stag Hunt

Matrices 1 and 2. Chicken and Stag Hunt representations of crises. Outcomes from pure strategy Nash equilibria are italicized.

ric.[2] It is in mixed strategies (defined in appendix B), that direct each player to choose a backdown time uniformly between 0 and 1.

The value of tension according to each definition can be calculated for this equilibrium. While the game is on, the prospective tension is a constant ⅓, since there are three events that happen at random times with the same uniform distribution: a war breaking out and one or the other player dropping out. The probability that a war will be the first of these is ⅓. As long as the crisis is on, the instantaneous tension is $1/(1-t)$. War initially breaks out at rate 1 per unit time, but as the crisis proceeds, it becomes increasingly likely to happen in the next moment. Since war is not a consequence of the players' strategies, this formula holds whether players are using the equilibrium strategies or not.

Example 2: Continuous-time brinkmanship with incomplete information

The second model requires a more complicated calculation to determine the tension, but it is closer to the crisis models in the literature. A version of Powell's analysis of "brinkmanship with two-sided information" (1988, 1990) is used. In his model, three events occur in a sequence: each of two players chooses whether to give in; then war has a chance to break out. This sequence makes up one stage of the game, and it is repeated a certain number of times. To represent the idea that the crisis deepens the longer it continues, Powell postulates that at each stage, war's probability increases in constant increments: δ, 2δ, 3δ, ... This assumption puts a bound on the number of stages, since if no one capitulates, war becomes certain. Each of Powell's players can be of two types, with

2. Derivations of this and the other equilibria are in appendix C.

High or Low Resolve, as determined by their relative payoffs for the outcomes. The High Resolve type is more motivated to risk war rather than to give in, so each time a player opts to stay in the crisis, the other will raise its estimate that the player has High Resolve.

In Powell's model, prospective tension can change only at those discrete times when something can happen, and instantaneous tension is zero except at the times when a war could break out. Here his model will be made continuous in time and in players' types. Each player's private value for the prize is chosen independently from a uniform distribution on (0, 1), and a player gets 0 for quitting and -1 for a war. As in example 1, war will occur at some time between 0 and 1, and this is parallel to Powell's model, in that war breaks out at an increasing rate: in a small interval time $(t, t + t)$ the likelihood of war breaking out is $t/(1 - t)$. If two or more events happen simultaneously, players get the average of the payoffs, although the exact rule will not matter much, since at the equilibrium the likelihood of simultaneous events will be zero. The game is then played as follows.

Stage 1: The players learn their own respective values v_1 and v_2 in (0,1) for the prize; each holds a uniform distribution on (0,1) for the other's value.

Stage 2: At some time in [0,1], a war may start or either player can drop out, and such an event ends the game.

Payoffs: If a war starts, each gets -1, or if player i drops out, player i gets 0 and the other player j gets v_j. Simultaneous events yield the average of the payoffs.

A Nash equilibrium for this game takes the form of a pair of strategies, each telling a player what to do as a function of that player's prize value (appendix B). The only symmetrical equilibrium is that both players do the following: for a prize value v, plan to quit at time $(v - 1)\, e^v + 1$. Figure 8*a* graphs this function. The equilibrium is strict, in the sense that deviating from it would lead to a nonzero expected loss. The function rises over time, meaning that those who value the prize more highly will hold out longer. Still, no matter how low a player values the prize, the player should stay in the crisis for some positive time, since the other possibly values it even less. Those with a low value give up very quickly: if a player holds value .1, that is, at the 10th percentile, and a war happens over a period of one year, the player should wait two days and then give in.

The instantaneous tension is $1/(1 - t)$ for as long as the crisis is on. This starts at 0 and goes off to infinite tension as the time approaches 1. The prospec-

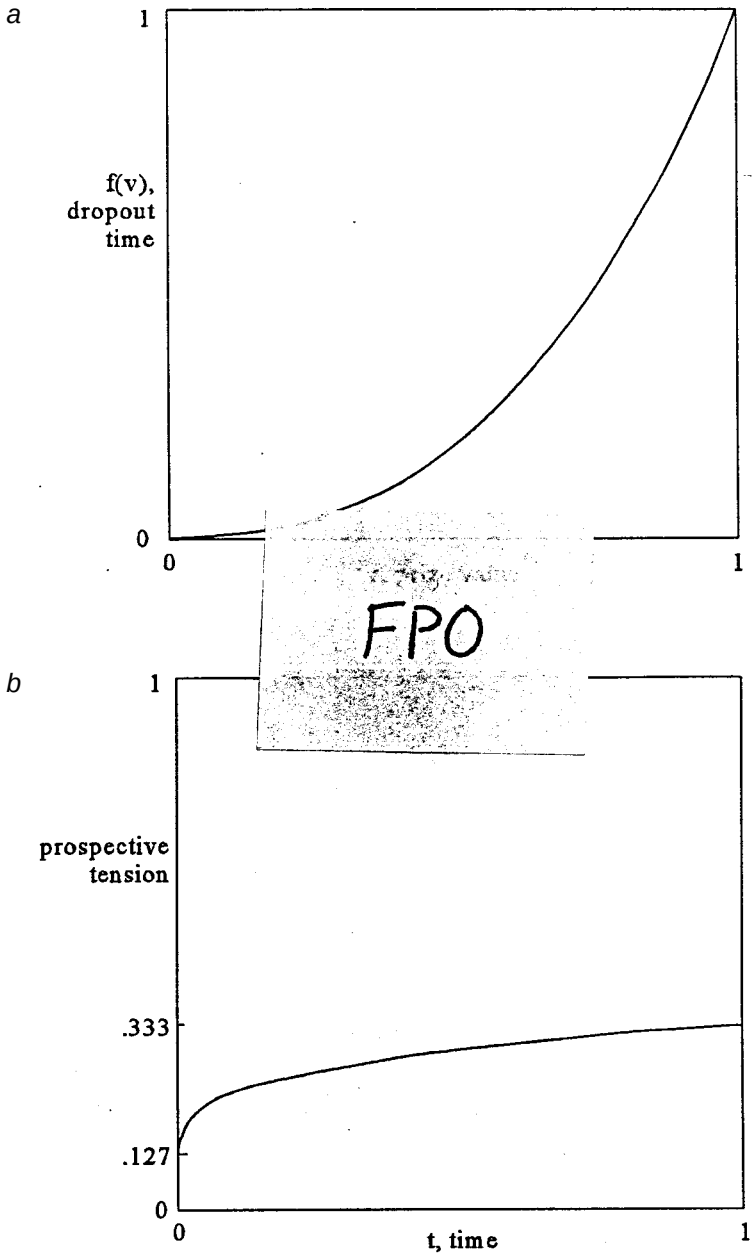

Fig. 8. Continuous-time brinkmanship with incomplete information: *a*, the symmetrical equilibrium strategy; *b*, prospective tension

tive tension over time is graphed in figure 8*b*. This is the probability of eventual war. At the start it is only .127. The world is optimistic, since it expects that one player or the other will drop out in the first half of the interval. The median dropout time for a player is .176 (found by substituting $v = .5$ in the formula for the strategy), so one or the other ought to end the crisis before a war. If neither drops out, prospective tension rises toward an asymptote of ⅓. Near the end, the three events that would end the crisis become equally likely.

Tension in Stag Hunt–Based Crisis Models

The Chicken models yield measures of tension, but they do not embody the concept's full character since worry has no role in causing the war. In the Stag Hunt–based games, it is peace that comes probabilistically, and it is the players who start the war. They do it in response to tension.

Matrix 2 shows the payoffs of a single-play Stag Hunt where players have complete information about each other's payoffs. A Chicken game corresponding roughly to the previous example is added for comparison. In the Stag Hunt models, tension is produced by a first-strike advantage. Each fears that the other is about to attack and, if there is a war, knows it is better to be the one starting it (in the matrix, a payoff of 3 is better than 1). The less hope one holds that the crisis will end peacefully, the greater the incentive to attack. If both knew the other would not attack, each would prefer to refrain—this would yield the ideal outcome of 4 for both. However, they would be consistent in their beliefs if they both expected an attack. The Stag Hunt game embodies the notions of trust and distrust, which are central to war and peace. The fact that Chicken-type games predominate in game literature on crises may be due to theorists' traditional feeling that the Stag Hunt is trivial, that the inefficient equilibrium is somehow irrational. In my view, this has been a mistake, for reasons presented in appendix B.

Matrix 2 is not quite the game that players face in the next two examples. They do not choose actions at a single time—they choose when to preempt from a continuum. Another difference is that in the simple Stag Hunt models, both know what the other gets from striking first, but in these models they are unsure of that value.

Example 3: A continuous-time Stag Hunt without symbolism

Stage 1: The players learn their respective values a_1 and a_2 for striking first; each holds a uniform distribution on (0,1) for the other's value.

TABLE 1. Payoffs for the Outcomes of the Continuous-Time Chicken and Stag Hunt

Both drop out $v_1/2, v_2/2$	1 drops out $0, v_2$		Peace $1, 1$	2 attacks 1 $0, a_2$
2 drops out $v_1, 0$	War $-1, -1$		1 attacks 2 $a_1, 0$	Both attack $a_1/2, a_2/2$

STAGE 2: The crisis starts at time $t = 0$; peace comes randomly at constant rate 1; each player can attack at any time during the game; peace or an attack ends the game.

PAYOFFS: Peace gives each 1, or if player i attacked j, the payoffs are a_i to i and 0 to j. When events happen simultaneously, players get the average payoffs.

Table 1 *(right)* summarizes the payoff information, again comparing it with the Chicken model *(left)*. Note that it is not a game matrix since neither side knows all the values in it and neither chooses a row or column. They choose a time from a continuum.

An equilibrium in this game is a pair of functions giving the time when each player is to attack, if peace has not come and if the other player has not attacked. This time is a function of the player's first-strike payoff a_i. It might be infinity, meaning never attack at all. There is a continuum of equilibria determined by the choice of a parameter c in the interval [.693, 1] (fig. 9).[3] They are ordered by peacefulness, in the sense that an equilibrium with higher c will tell a player with a given first-strike payoff to wait at least as long before striking.[4] Figure 9 also shows that the higher a_i is, the earlier the player's patience runs out. This

3. It may seem odd that the continuous Stag Hunt has an infinity of equilibria, but the single equilibrium described for the continuous Chicken was an artifact of requiring symmetry. The basic Stag Hunt and Chicken games have three (pure or mixed strategy) equilibria, but for Chicken only one of these is symmetrical (appendix B). Nalebuff and Riley (1985) discuss the asymmetrical equilibria in a Chicken game somewhat similar to the one defined here.

4. The value of c is interpretable as the time the person with the lowest value for striking first would wait.

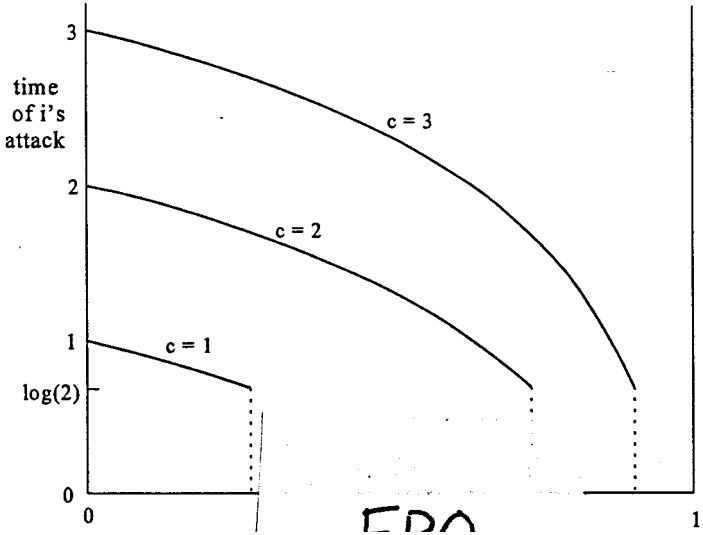

Fig. 9. Three members of the family of symmetrical equilibrium strategies in the continuous-time Stag Hunt without symbolism (example 3)

makes sense—the less the player has to lose by striking first compared to getting to a peaceful outcome, the more readily the player will strike. An unexpected result is that a substantial set of individuals give peace no chance and attack immediately. Finally, the figure shows that if neither player attacks as soon as the crisis starts, there is a period of .693 time units during which no one strikes. This is the eye of a storm, and if the peace does not arrive, the danger of an attack resumes.

Sample curves in figures 10 and 11 show the prospective and instantaneous tensions at various equilibria. Both are rising. That prospective tension should increase makes sense since the only reason that someone would strike now rather than waiting and hoping for peace is that the situation will be getting more dangerous.

Example 4: A continuous-time Stag Hunt with symbolism

This model adds a variable symbolic of war, which fluctuates randomly during the crisis. The actors use its value and perhaps its history to decide at each moment whether to strike. At the initiation of the crisis, the cue event takes some positive value, which can be set arbitrarily at 1, and then makes small equal steps up and down equiprobably in a random walk. Here the limit of the process

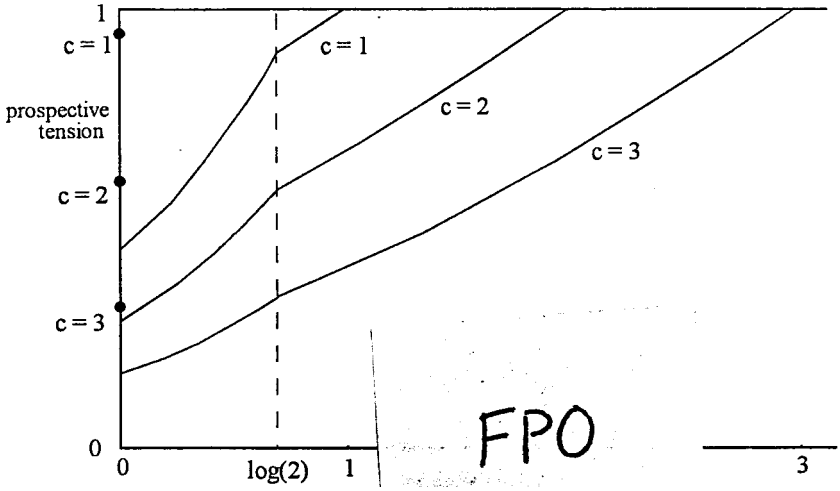

Fig. 10. Prospective tension, the probability of ultimate war, in the continuous-time Stag Hunt without symbolism

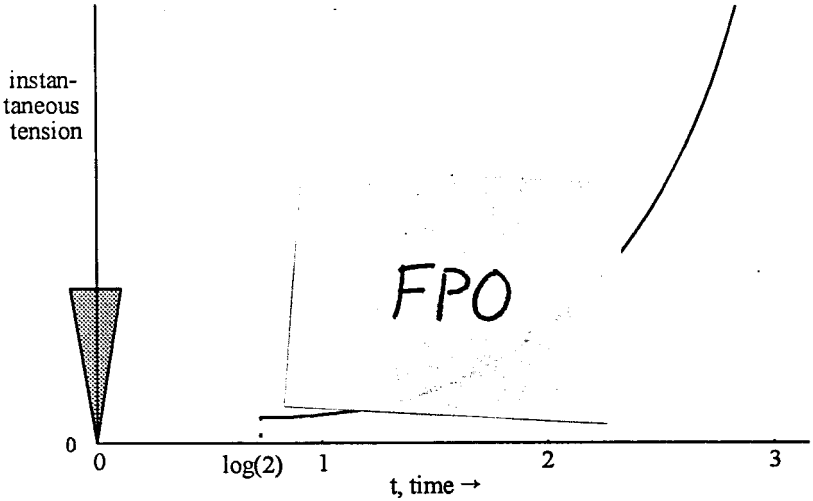

Fig. 11. Instantaneous tension in the continuous-time Stag Hunt without symbolism (example 3), for the equilibrium $c = 3$. There is an atom at $t = 0$, whose probability is indicated by the area of the triangle.

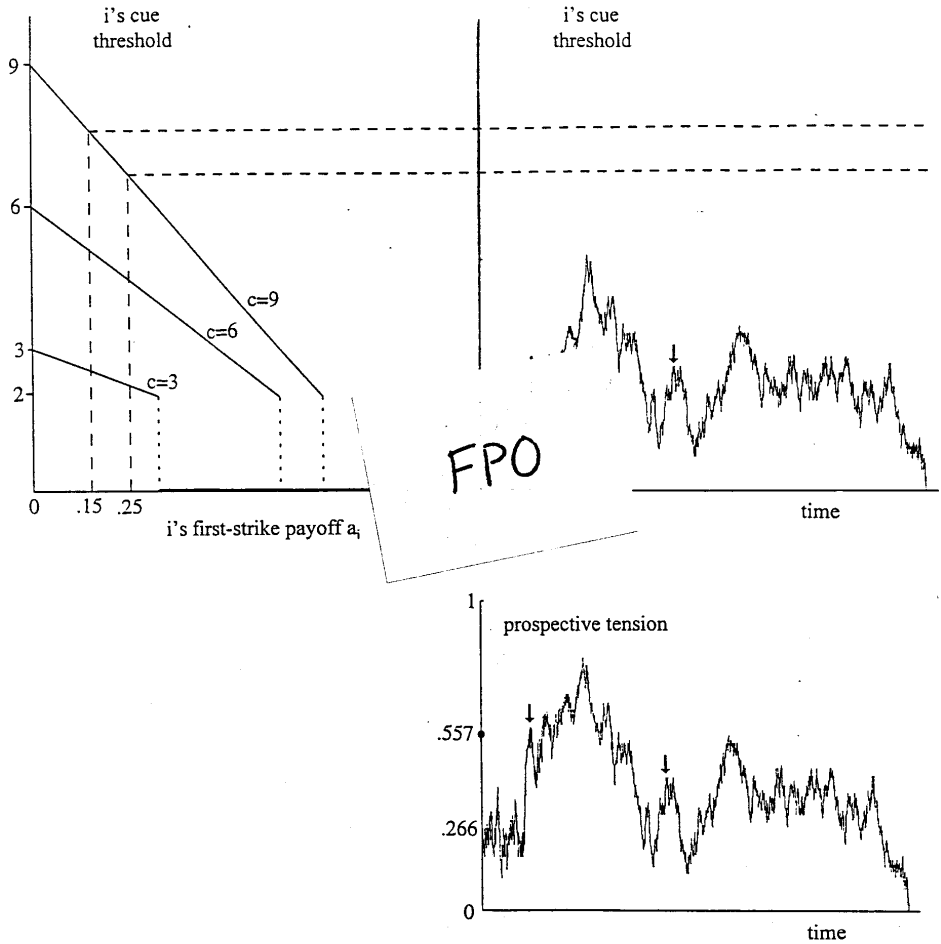

Fig. 12. Examples of symmetrical equilibrium strategies *(upper left)* in the continuous-time Stag Hunt with symbolism (example 4). The course of a game is shown for the equilibrium $c = 9$ and the first-strike payoffs $a_1 = .15$ and $a_2 = .25$. The cue variable *(upper left)* does not reach the threshold of either player. Prospective tension *(lower left)* is slightly different from the cue.

is taken, as the rate of stepping grows and the step size shrinks keeping the standard deviation of the movement after a unit of time constant at 1. In real crises, it would be discrete events that influence tension, but for simplicity here the cue variable changes continuously over time. This is standard Brownian motion as would be produced by random changes of direction that are infinitely many and

infinitely small. The cue variable is sure to reach zero at some point, and then the crisis is assumed to be over.[5] Figure 12 *(upper right)* shows a sample path that terminates when the process arrives at zero.

The difference with the last example is that the players are not looking at their watches to decide to attack but at the symbolic cue variable. A Nash equilibrium takes the form of a pair of functions, each of which tells its player to attack when the cue reaches a certain threshold. Here a family of equilibria arises, as shown in figure 12 *(upper left)*, again depending on the parameter c. A player sets the threshold at a linear decreasing function $c(1 - a_i)$ of the first-strike payoff a_i, and a player whose threshold would be below 2 sets it at 0. Since the cue starts at 1, some players will strike immediately, but if there is no war at the opening of the crisis, there is sure to be none until the cue variable rises above 2. Again there is an eye of the storm. A higher value of c means that players are more trusting of each not to strike and that peace is more likely. Setting c to infinity is the equilibrium of both ignoring the cue and simply waiting for peace.

Figure 12 *(upper left)* takes a sample path of the cue variable, and shows the dynamics of play for the equilibrium $c = 9$ and first-strike payoffs $a_1 = .15$ and $a_2 = .25$. These payoffs determine the threshold values for the cue variable shown, and if the latter rises above the lower of those thresholds, the player will start a war. The crisis is very dramatic, with events happening that greatly increase tension, but the first-strike advantage is low and both players stay at peace.

Instantaneous tension cannot be defined in the model, for reasons discussed in appendix C. Figure 12 *(lower right)* also shows the prospective tension, the likelihood at each time of eventual war. It is a function of the cue variable up to that point. It starts high at $t = 0$, then drops if neither attacks immediately. It then follows a path somewhat similar to the cue variable's, but there is a slight difference. The tension is a function not only of the cue's current value but of its history. Note that in the top right-hand graph of figure 12, the cue variable reaches an early peak, then a very high value, then a second peak. (The first and third peaks are indicated by arrows.) At the latter peak, the cue has a slightly higher value than at the first, but the tension, in the bottom graph, is lower than it was at the first. The world is less worried the latter time, because it has already seen tension climb higher with neither player attacking. It has lowered its estimate of each player's first-strike payoff.

5. The time for this random process to touch zero is exponential, so the event of the crisis ending behaves probabilistically in a way identical to the constant rate of ending in example 3.

Precrisis Symbolism: The Value of Arms Agreements

The full-fledged model of tension, example 4, has two outside, nonstrategic factors that influence the outcome. One is the random cue event that the players are watching, and the other is the trust parameter *c* that sets the equilibrium. How are these determined? As to the random cue event, the argument has been that it is chosen for its symbolism. The U-2 overflight during the Cuban missile crisis, being analogous to war, would mean a jump in the cue.

To determine *c*, if symbolism is in play it must involve events before the crisis that set the overall atmosphere of trust. An example would be the symbolism created by an arms treaty. The literature on arms control has debated whether arms control should be promoted for its symbolism. Some writers have derided this idea, holding that agreements are worthless unless they limit dangerous weapons. Jervis (1989, 221–23) countered that the symbolism of agreements is as least as important as the content, noting that during the Reagan administration, the military were supportive of strategic arms treaties but the civilian officials in the Pentagon saw them as lowering the country's guard. Some of them might have been happier to have seen the United States behind in weapons in an unconstrained competition than equal in an arms control regime. An interpretation is that the civilian hawks were more concerned about symbolism. Another example of the symbolic importance of an arms treaty was the Rush-Bagot agreement of 1817, which limited naval armaments on the Great Lakes (O'Neill 1991a). It has been seriously violated over most of its duration but constantly praised. Various incoming Canadian prime ministers intended to renegotiate it and bring it into accord with practice, but realized it was more prudent not to raise the history of its violation, since its value was what it meant symbolically. "Confidence-building measures" (Krepon 1995), agreements to share knowledge and build trust, are another example. Proposals like notification of exercises and accommodation of observers seem to suggest cooperation over weaponry. If the two sides are able to do this in peacetime, each is slow to believe that the purely technical preemptive advantage of their weaponry will start a war.

The full-fledged model gives a natural way to interpret the symbolic value of arms control (fig. 13). Its precrisis symbolism selects an equilibrium with a higher value of *c*, one for which a given tension-producing crisis event is less provocative. This combines with events during the crisis (the cue variable) and players' private first-strike payoffs to determine war or peace. The model does not prove that symbolic treaties will help states get through a crisis, but it shows that a strategic argument can be constructed to support the idea, without appeals to irrationality or "psychology."

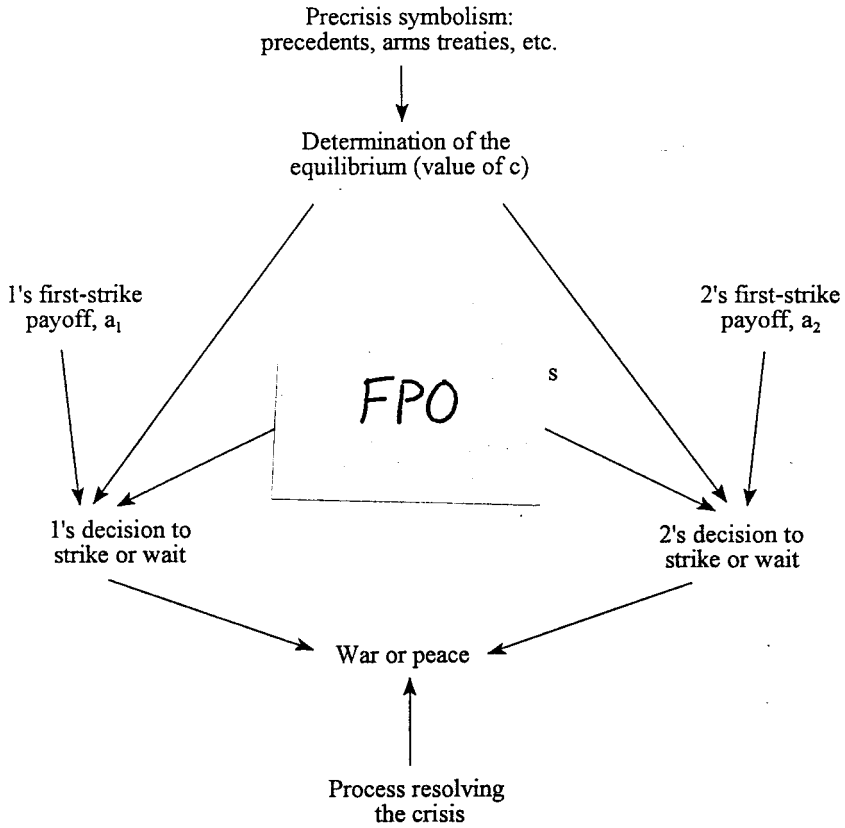

Fig. 13. Interactions among the components of the continuous-time Stag Hunt with symbolism (example 4)

The Tension Metaphor

Crisis tension is part of a conceptual metaphor, and like other metaphors, it clarifies and distorts the truth. Where it is accurate or misleading can be gleaned by comparing it with the model. The metaphor of tension can be seen as part of a broader metaphor that maps a harmonious state into a physical object.[6] It could be called A-MENTAL-STATE-AS-AN-OBJECT. Ending the harmonious state corresponds to destroying the object. The point of the metaphor is that the destruction of harmony is not easy to reverse. Just as it is hard to put a broken object back together, hostilities that have started are hard to stop.

6. People also talk about feeling "tense." This too seems to come from the idea of physical stretching, according to the historical citations in the *Oxford English Dictionary.*

The general metaphor has two subgroups. One maps within-an-individual mental conditions into an object that gets smashed or breaks apart. Accordingly, a person is said to be "together" or to be "fragile," to "fall apart," "fall to pieces," be "crushed," or "shattered" by a bad experience. The other subgroup deals with relations among two or more parties and maps them into physical connections—an individual is said to be "well-connected," to have "close ties" to another. The relation between a pair of people here becomes an elongated object, sometimes stringlike, and rather than getting crushed or broken into pieces, it is stretched and snaps. A situation is "taut," relations are "strained," nations "sever diplomatic ties."[7] The metaphor of international tension is in the second group.

The model's definition of tension as a whole-system property fits the metaphor, since the tension in a string or rod is the same at either end. The formal definition of tension that is closest to the mechanical metaphor is the instantaneous variety. The prospective variety would have a string break not in response to the force at the moment but by looking ahead to a coming increase and preemptively breaking now. Strings do not do this, but national leaders do. The analysis suggests that, in spite of the metaphor, leaders can compensate for a current tense time by announcing steps now that would increase trust, even if these become operative only later on in the crisis. Another element left out of the metaphor is that leaders use private knowledge that may lead them to different probabilities than an outside observer holds. The tension metaphor does not capture all the aspects of the decision to preempt, but it does contain the important idea that worry is mutual to a significant degree and can itself cause war.

The Role of Public Events

The opposite of crisis tension is trust, the belief that the other side will be patient. Trust is represented by the mutually beneficial outcome of a Stag Hunt game. The logic of the game shows the connection between tension, trust, and common knowledge. If the two governments hold high probabilities that the other side will stay at peace, this confidence can be unstable in that each player may start to worry. Each will worry not just about the other's actions but about whether the other is starting to worry, since worry may lead to preemption. What the situation requires is confidence at higher levels of knowledge: player A should believe that B believes that A will stay at peace, and so on up the lad-

7. Sometimes the metaphor involves an object but is nonspecific about the "shape" of a social relationship: "Distrust wrecked their marriage."

der of beliefs about beliefs. Trust is stabilized by the common knowledge of trust; one might even define it as requiring common knowledge of trust.

Some events influence only the lowest order of knowledge, and some have consequences up the hierarchy. The importance of symbolic events is that they change beliefs at various levels. Some tension events operate only at the lower levels of belief. Sagan's investigations (1993) revealed that during the Cuban missile crisis, in the predawn hours of October 26, 1962, an Atlas intercontinental missile was launched from Vandenberg Air Force Base in California. It was a test firing, part of a program that had been laid out before the crisis, which, evidently, no official had thought to cancel. Its reentry vehicle contained only instruments, but missiles at adjacent launch facilities carried nuclear warheads. Sagan speculates that a Soviet base watcher might have seen the firing and called home an alarming report. From the viewpoint of this analysis, the missile launch is an event that may have altered beliefs about U.S. actions but probably not higher-order beliefs about beliefs. Although the Soviet decision makers might have learned of it, the United States could not know that they had the information, the Soviet Union could not know that the United States knew that the Soviet Union knew it, and so on.

This distinction can be made by defining a *public event,* one whose very occurrence in the context makes it common belief among the decision makers.[8] The Atlas launch was not a public event, and so its interactive epistemology was different from the U-2 overflight, the signing of an arms treaty, or a friendly visit by a national leader. When the latter occur, they are known to have happened, and known to be known, and so on. Other things equal, this gives them more impact on trust or tension than the Atlas launch. Getting through a crisis may mean paying special attention to those public events that are liable to increase tension.

8. This definition of public event is conceptually identical to the one used in the literature on common knowledge (Geanakoplos 1994), although there, for formal reasons, it is not defined as relative to a context.