

VARIOUS THOUGHTS AND CALCULATIONS ON THE PROBABILITY OF NUCLEAR WAR

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A proper assessment of the probability of nuclear war is a job for a multidisciplinary team with access to a great deal of secret information about the control of nuclear forces, Soviet politics and similar subjects. Failing which, we are forced to speculate as best we can on the information available.

Frequentists estimate the probability of nuclear war, an event which has not happened, as zero - or at least as "remote" (according to Foreign Office pamphlets). The growth of our might, argued Major-General Tyushkevich in 1981, "has saved humanity from the conflagration of world war for more than 36 years". The Arms Control and Disarmament Unit of the British Foreign Office (1982) display a skill in subtraction no less impressive than that of the Soviet general: "Deterrence has kept the East/West peace for 37 years". (1981 - 1945 = 36; 1982 - 1945 = 37.)

But, even though there has not as yet been a nuclear war, there have been many events reasonably regarded as having some potential, singly or in combination, for generating nuclear war. At the technical level, accidents involving nuclear forces are frequent: 1500 false alarms in the US in 1979 alone. At the political level, there have been many more or less acute international crises which might have escalated out of control. Accidents coinciding with crises represent the most dangerous combination, as safety precautions are removed during nuclear alerts. The way to study the probability of nuclear war is to model accidents and crises on the basis of past experience and new trends, in order to project how future accidents and crises might develop under various possible conditions.

Let us consider first the possibility of accidental nuclear war under non-crisis conditions, and then that of the unintended escalation of a crisis into nuclear war.

1. Accidental nuclear war

"Accidental nuclear war is not a possibility", the Foreign Office (1982) assures us, "because the arrangements

for its prevention are now very effective" (so in the past they were not so effective?). But safety arrangements can never be made absolutely effective; there is a certain level below which the risk cannot be reduced:

(a) Safety procedures are limited by military concern that they not prevent deliberate as well as accidental use of nuclear weapons. US Vice-Admiral Miller has complained that "the real danger may be that so many checks, constraints and verification procedures are established that the US will actually be unable to release and launch nuclear weapons if it decides to do so". The aim therefore is only to attain the highest safety standards compatible with operational dependability (Britten 1983).

(b) Methods of checking for unexpected faults in complicated machinery have inherent limitations. The predictive models of Smith (1981) for the behaviour of inspectors searching for unlikely faults give probabilities of detection dramatically smaller than the probabilities derived from the usual "naive" assumption that inspectors check efficiently all the time. This helps explain why events which are extraordinarily improbable according to conventional calculations of risk (for example, in nuclear power stations) "actually seem to occur with monotonous regularity".

In general, argues Smith, the "safer" a system is made the less effort will be put into a search for any faults in that system. We cannot guarantee to increase the safety of a system by (say) increasing the number of fault detectors or the number of inspectors. This may decrease the probability of detecting a fault.

Professor Frei of the University of Zurich and Dr Sonntag of the Science Centre Berlin have estimated the probability of nuclear war arising from different causes (Frei 1983 pp 222-3). They describe their calculations as "tentative... taking into account the partly interdependent and partly independent nature of the risks, based on very crude and subjective estimates that cannot be confirmed or refuted by any empirical evidence". Nevertheless, adoption of the subjective probabilities of experts familiar with these problems may be the most sensible course we can take.

Frei and Sonntag assess the probability of nuclear war over a five-year period as a consequence of technical failure

(nuclear accident or false alarm) as 0.0001 under "normal" conditions and as 0.003 under "crisis" conditions. They also assess the probability of nuclear war over a five-year period as a consequence of human failure ("mainly due to shortcomings of men-machine systems and the effects of stress") as 0.0003 under normal and 0.001 under crisis conditions. The total probability of nuclear war from technical or human accident is then 0.008 per century under normal or 0.08 per century under crisis conditions (a more convenient measure to think with).

While many people would be loath to dismiss risks of this magnitude as negligible, it does seem likely that the danger of nuclear war by pure accident is a minor one compared with the danger of nuclear war by crisis escalation.

2. Nuclear war by crisis escalation

In an international crisis, one or both sides are likely to raise the level of alert of their nuclear forces. For example, in 1973 the US called a strategic nuclear alert in the final stages of the Middle East war (Chomsky 1983). Such an alert could generate a nuclear war (a) as a result of one or more accidents during the crisis; (b) by political leaders losing control over events, with automatic pre-programmed reactions taking over; or (c) by one or both sides deciding to attempt a pre-emptive decapitating strike, this seeming to offer the best chance of survival once war looked virtually inevitable (Bracken 1983).

According to the Palme Commission, there have been about thirty incidents in which at least one nuclear power indicated a preparedness to escalate a confrontation beyond the nuclear threshold (Britten 1983). There may well have been other incidents of which we have no knowledge.

The most dangerous episode is widely agreed to have been the Cuban missile crisis of 1962. Robert Kennedy (1969), brother and colleague of President Kennedy, reports that the President himself assessed the probability of nuclear war during the last week of the crisis as between one-third and one-half. He believed that a Soviet rejection of his ultimatum would probably have led to a massive nuclear exchange. There is evidence that both Kennedy and Khrushchev came under heavy pressure to act more aggressively than they did.

In addition to such crises, there have been many incidents which did not develop into nuclear crises but could easily have done so. For example, during the June 1967 war Israeli planes and torpedo boats attacked the US Liberty. The identity of the attackers was at first unclear to the US forces, and nuclear-armed F-4 Phantom jets were dispatched from a Sixth Fleet aircraft carrier to defend the ship. They were recalled only by a direct order from Secretary of Defence McNamara (Chomsky 1983). What would have happened had the confusion lasted longer?

More recently we have seen Soviet forces shooting down the Korean plane. Fedor Burlatsky (1983), a top Soviet adviser on international affairs, commented:

I fear to say this, but it seems to me that in the present incident with the intruder-aeroplane we have seen a possible model of the beginning of a nuclear conflict. Such a conflict may occur as the result of unforeseen escalation of a chance incident.

Knowledgeable observers often express fears of possible crises which may or may not materialise. There has been anxiety that one or both great powers might intervene in the Iran-Iraq war if oil installations and supply routes are seriously jeopardised. In NATO circles there has been speculation about armed resistance to a possible Soviet invasion of Poland spilling over into East-West conflict if rebel Polish planes take refuge in Western airspace and are then attacked there.

Present world conditions are more perilous than ever in the past in a number of respects. Highly integrated systems of nuclear command and control have only recently come into full operation, and nobody understands how they work. Moreover, past crises have been damped down by the relatively passive posture of Soviet forces; even in the Cuban missile crisis there was a nuclear alert only on the Western side. With the installation of Pershing-2 missiles, Soviet forces are being put on higher levels of alert, so that in the near future we face the danger of mutually interacting alerts for the first time. There is an atmosphere of confrontation, with East-West communication in a very poor state and a number of regions - especially the Middle East - wracked by complicated conflicts.

It would be a very useful exercise for people expert

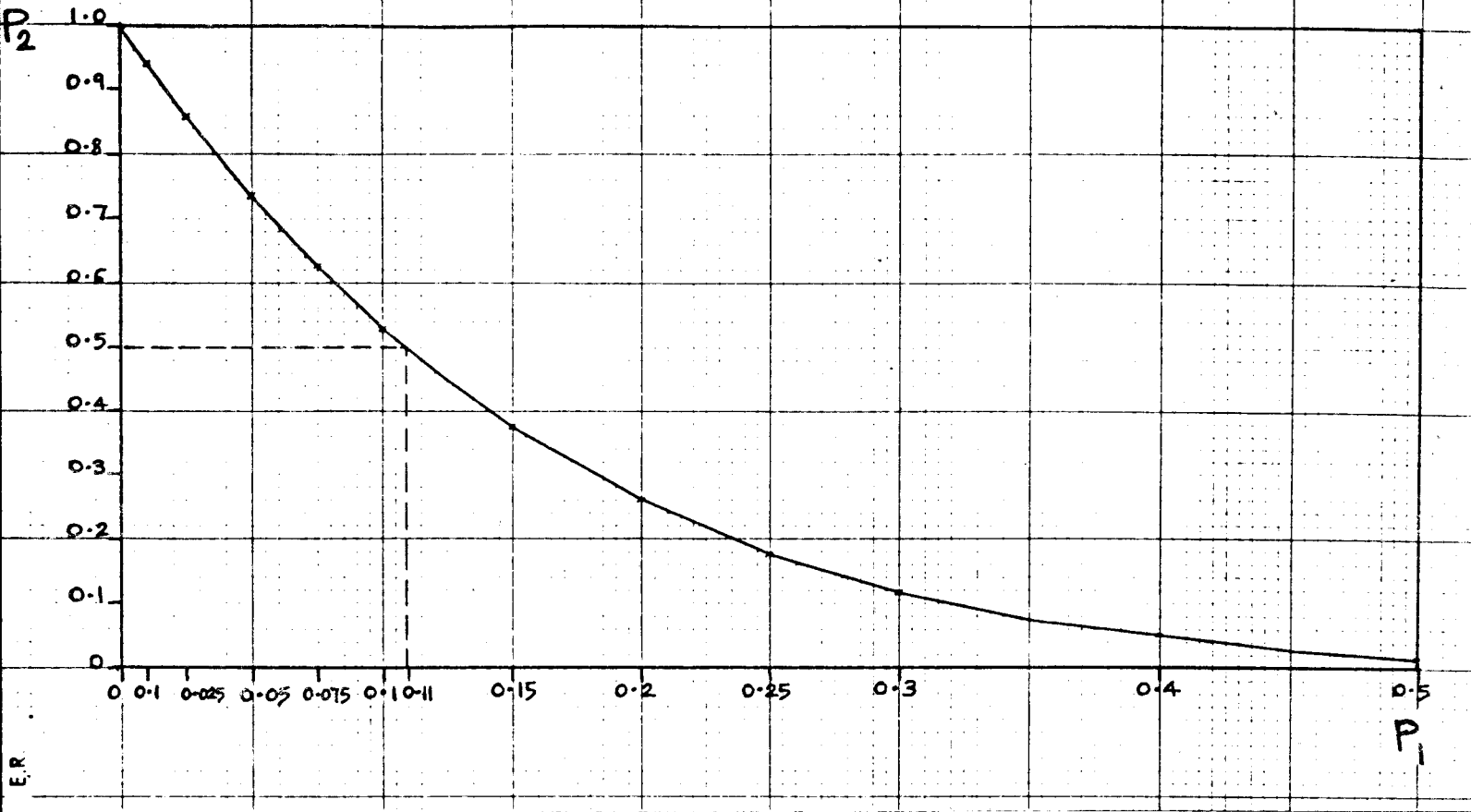
in international politics and military systems to explore what the likely outcomes of past crises and potential crises would have been, if they had taken place under the more dangerous conditions of the period we are now entering. With what probability would there already have been a nuclear war?

Frei and Sonntag estimate the probability of nuclear war in a five-year period as a result of the urge to pre-empt as 0.0001 in normal conditions and as 0.001 in crisis conditions. They suggest an additional probability attributable to the aggravating impact of nuclear proliferation of 0.0001 in normal conditions and 0.0003 in crisis conditions. Far greater is their figure, taken from Erhard Rosenkranz, for the probability of nuclear war within five years from a chain-reaction of different kinds of mishaps in an acute international crisis - 0.01 to 0.05. That is, half a century of East-West confrontation may be as likely to produce a nuclear war as not. Further study will be needed to check whether these analysts have taken full account of imminent exacerbating factors such as the rise in Soviet alert levels.

It is of interest to carry out some exploratory calculations based on the surely fairly conservative assumption that a nuclear crisis occurs once every five years, starting from 1985. In the graph we plot, from the perspective of 1945, the probability of surviving six crises between 1945 and 1983 as a function of the probability of any one crisis leading to nuclear war. It appears from the graph that our survival to date is quite compatible with a wide range of probabilities of a crisis leading to war. Even if the probability is as high as 0.25, we have needed only mildly good luck to survive. A probability of about 0.11 corresponds to our having survived a 50-50 risk. Let us also recall Rosenkranz' five-year crisis probability of 0.05, and President Kennedy's assessment of probability of nuclear war in 1962 of 0.33 - 0.50. It seems reasonable to set the probability of a future major crisis leading to war in the range 0.05 - 0.20.

In the Table we show the chances of avoiding nuclear war until different dates for three probabilities within this range, assuming a crisis every five years. Even on the most optimistic assumption, the chance of avoiding nuclear war until 2050 is less than one-half. On the medium assumption it is less than one-quarter, and on the most pessimistic

THE RELATIONSHIP BETWEEN P_1 , THE PROBABILITY THAT ANY ONE CRISIS LEADS TO NUCLEAR WAR, AND $P_2 = (1-P_1)^6$, THE PRIOR PROBABILITY IN 1945 THAT NUCLEAR WAR WOULD BE AVOIDED UP TO 1983, ASSUMING SIX EQUALLY DANGEROUS CRISES BETWEEN 1945 AND 1983



PROBABILITIES OF AVOIDING NUCLEAR WAR ON THE ASSUMPTION OF SERIOUS CRISES EVERY FIVE YEARS

	Optimistic assumption	Medium assumption	Pessimistic assumption
Probability that any one crisis leads to nuclear war	0.05	0.10	0.20
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Probability of avoiding nuclear war until			
1985	0.95	0.90	0.80
1990	0.90	0.81	0.64
1995	0.86	0.73	0.51
2000	0.81	0.66	0.41
2005	0.77	0.59	0.33
2010	0.74	0.53	0.26
2015	0.70	0.48	0.21
2020	0.66	0.43	0.17
2025	0.63	0.39	0.13
2030	0.60	0.35	0.11
2035	0.57	0.31	0.09
2040	0.54	0.28	0.07
2045	0.51	0.25	0.05
2050	0.49	0.23	0.04

assumption it is less than 5%.

Fedor Burlatsky, visiting Britain in December 1982, told me that his son was a mathematician and had made calculations of the probability of nuclear war. His conclusion was that the probability of humanity surviving until 2050 was 5%.

Calculations of the probability of nuclear war are inevitably highly hypothetical, but more thorough attempts at such calculations would be well worth while as a way of substantiating the magnitude of the threat. One conclusion of very great political importance can quite easily be reached: the probability of nuclear war in the next few years is neither extremely low (say, less than 0.05) nor extremely high (say, more than 0.9). The complacency of those who regard the likelihood of nuclear war as remote is unjustified, but so is the despair of those who believe that time is now too short and there is no hope left. The probability of nuclear war is a medium one. As the Soviet historian Grigoryan (1982) puts it, history is open and depends on human action, which makes the prospects of annihilation and of survival equally real.

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