on behavior," paper presented before the American Psychiatric Association, New York State Divisional Meeting, 1961.
30. H. Moltz, L. Rosenblum, N. Halikas, *J. Comp. Physiol. Psychol.* **52**, 240 (1959).
31. G. Gottlieb, *ibid.* **54**, 422 (1961).
32. J. P. Scott, *Psychosomat. Med.* **20**, 42 (1958).
33. B. M. Caldwell, *Am. Psychol.* **16**, 377 (1961).
34. R. A. Hinde, W. H. Thorpe, M. A. Vince, *Behaviour* **9**, 214 (1956).
35. D. G. Freedman, J. A. King, O. Elliot, *Science* **133**, 1016 (1961).
36. H. F. Harlow and R. R. Zimmermann, *ibid.* **130**, 421 (1959).
37. D. G. Freedman, *J. Child Psychol. Psychiat.* **1961**, 242 (1961).
38. R. A. Spitz, *Intern. J. Psychoanalysis* **31**, 138 (1950).
39. N. E. Collias, *Ecology* **37**, 228 (1956).
40. W. Craig, *J. Animal Behavior* **4**, 121 (1914).
41. J. L. Fuller and A. Christake, *Federation Proc.* **18**, 49 (1959).
42. J. L. Fuller, private communication.
43. F. Schutz, private communication.
44. C. C. Warriner, thesis, Univ. of Oklahoma (1960).
45. R. K. Enders, *Sociometry* **8**, 53–55 (1945).
46. P. H. Klopfer, *Behavioral Aspects of Ecology* (Prentice-Hall, New York, in press).
47. M. B. McGraw, *Growth: a Study of Johnny and Jimmy* (Appleton-Century, New York, 1935).
48. D. O. Hebb, *Am. Psychologist* **2**, 306 (1947).
49. D. G. Forgays and J. W. Forgays, *J. Comp. Physiol. Psychol.* **45**, 322 (1952).
50. D. G. Forgays, "The importance of experience at specific times in the development of an organism," address before the Eastern Psychological Association (1962).
51. D. K. Candland and B. A. Campbell, private communication (1962).
52. L. Bernstein, *J. Comp. Physiol. Psychol.* **50**, 162 (1957).
53. W. E. D. Scott, *Science* **14**, 522 (1901).
54. W. H. Thorpe, in *Current Problems in Animal Behaviour*, W. H. Thorpe and O. L. Zangwill, Eds. (Cambridge Univ. Press, Cambridge, 1961).
55. J. A. King and N. L. Gurney, *J. Comp. Physiol. Psychol.* **47**, 326 (1954).
56. J. A. King, *J. Genet. Psychol.* **90**, 151 (1957).
57. J. L. Fuller, "Proceedings, International Psychiatric Congress, Montreal," in press.
58. N. Tinbergen, *The Study of Instinct* (Oxford Univ. Press, Oxford, 1951).
59. J. A. King, *J. Genet. Psychol.* **88**, 223 (1956).
60. F. A. Beach, *ibid.* **60**, 121 (1942).
61. E. S. Valenstein, W. Riss, W. C. Young, *J. Comp. Physiol. Psychol.* **47**, 162 (1954).
62. H. Nissen, *Symposium on Sexual Behavior in Mammals, Amherst, Mass.* (1954), pp. 204–227.
63. J. Money, J. G. Hampson, J. L. Hampson, *Arch. Neurol. Psychiat.* **77**, 333 (1957).
64. H. Harlow, in *Determinants of Infant Behaviour*, B. M. Foss, Ed. (Wiley, New York, 1961), pp. 75–97.
65. J. L. Fuller, C. A. Easler, E. M. Banks, *Am. J. Physiol.* **160**, 462 (1950); A. C. Cornwell and J. L. Fuller, *J. Comp. Physiol. Psychol.* **54**, 13 (1961).
66. H. F. Harlow, M. K. Harlow, R. R. Rueping, W. A. Mason, *J. Comp. Physiol. Psychol.* **53**, 113 (1960).
67. S. Levine, J. A. Chevalier, S. J. Korchin, *J. Personality* **24**, 475 (1956).
68. T. Schaefer, thesis, Univ. of Chicago (1957).
69. S. Levine, M. Alpert, G. W. Lewis, *Science* **126**, 1347 (1957).
70. C. P. Richter, *Am. J. Human Genet.* **4**, 273. (1952).
71. T. Schaefer, Jr., F. S. Weingarten, J. C. Towne, *Science* **135**, 41 (1962).
72. W. R. Thompson and T. Schaefer, in *Functions of Varied Experience*, D. W. Fiske and S. R. Maddi, Eds. (Dorsey, Homewood, Ill., 1961), pp. 81–105.
73. V. H. Denenberg, in *The Behaviour of Domestic Animals*, E. S. E. Hafez, Ed. (Bailliere, Tindall and Cox, London), 109–138.
74. ——, *J. Comp. Physiol. Psychol.*, in press.
75. ——— and G. G. Karas, *Psychol. Repts.* **7**, 313 (1960).
76. J. Bowlby, *Intern. J. Psychoanalysis* **25**, 19, 107 (1944).
77. C. M. Heinicke, *Human Relations* **9**, 105 (1956).
78. H. R. Schaffer, *Brit. J. Med. Psychol.* **31**, 174 (1950).
79. P. H. Gray, *J. Psychol.* **46**, 155 (1958).
80. M. W. Kahn, *J. Genet. Psychol.* **79**, 117 (1951). A. Baron, K. H. Brookshire, R. A. Littman, *J. Comp. Physiol. Psychol.* **50**, 530 (1957).
81. G. Lindzey, D. T. Lykken, H. D. Winston, *J. Abnormal Soc. Psychol.* **61**, 7 (1960).
82. A. H. Riesen, in *Functions of Varied Experience*, D. W. Fiske and S. R. Maddi, Eds. (Dorsey, Homewood, Ill., 1961), pp. 57–80.
83. W. R. Thompson, *Science* **125**, 698 (1957).
84. C. H. Hockman, *J. Comp. Physiol. Psychol.* **54**, 679 (1961); R. Ader and M. L. Belfer, *Psychol. Repts.* **10**, 711 (1962).
85. K. Keeley, *Science* **135**, 44 (1962).
86. T. C. Schneirla and J. S. Rosenblatt, *Am. J. Orthopsychiat.* **31**, 223 (1960).
87. W. H. Thorpe, *Learning and Instinct in Animals* (Methuen, London, 1956).
88. E. H. Hess, in *Roots of Behavior*, E. L. Bliss, Ed. (Harper, New York, 1962), pp. 254–263.
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# Stockpiling to Survive a Nuclear Attack

## The second phase of a total defense system must bridge the gap until production facilities are restored.

Albert W. Bellamy

It is convenient to consider nonmilitary defense systems in two broad categories: (i) casualty prevention during the acute phase of an attack and (ii) casualty prevention and the acceleration of national recovery during the much longer postattack period. Both categories have the same objective, national survival, but I mention them separately as distinctive phases requiring quite different resposes from the people.

In the event of an attack the acute effects of blast and heavy radioactive contamination may last about two weeks. Preparation for this period is being emphasized officially. Shelters, emergency supplies, communications capability, instrumentation for detecting and measuring environmental pollutants, organization, and training are part of the program.

The second phase is likely to extend over a period variously estimated as from a few months to a number of years. For survival during this phase the defense system should include a reserve of supplies essential for bridging the gap between the destruction of critically important production facilities and their restoration. These supplies must be assembled in advance in selected locations, so that they will be available when and where they are needed, without having to be distributed by powered vehicles. The capability to maintain the surviving population in a state of physical and mental health and able to get ahead rapidly with the work of restoration is of overriding importance in any recovery program.

The best defense is, of course, the prevention of an attack. We must, however, consider the variables that would lessen casualties and facilitate the production of food and industrial goods if a heavy attack with nuclear weapons should be made on the United States. The total recovery operation would be highly complex and would call for systematic study of many factors, but here I am concerned primarily with the problem of food supply after an attack.

While giving much personal thought to the matter, I have drawn freely on the several studies that have been made of the estimated destructive and disruptive effects of a heavy attack (*1*). There is general agreement that such

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an attack would result in heavy damage to the nation's industrial plant and, possibly, in a considerable loss of skilled technical and professional workers, either from casualties or from disorganization. The several studies cited have indicated that the casualties and the degree of disorganization to be expected can be greatly reduced if certain measures are taken prior to the attack.

First, it should be noted that the weapons and strategies for inflicting damage will be chosen by the enemy. Consequently, a number of variables must be considered. They include the weight of attack, as delivered, and the targets hit; warning times; the season of the year; the time of day; and the weather during and after the attack. It should be emphasized, also, that it is in the context of lack of preparation that the probable postattack situation looks so black and discouraging; as many studies have revealed, the picture need not be so dark.

Let us suppose that an adequate shelter system has served to keep a large proportion of the population off the casualty lists. Emergence from shelters may begin in a matter of hours in some places, but for purposes of this discussion, let us assume that shelters are occupied for about two weeks, as the Office of Civil Defense Mobilization suggests they will be. After emergence from shelters, what then?

The surviving populations in and near our great cities and industrial centers are likely to be greeted with scenes not unlike those of Hiroshima and Nagasaki. However, people in rural areas and smaller communities are likely to emerge from fallout shelters into familiar and undamaged surroundings.

It must be assumed that a large proportion of the nation's industrial production and transportation facilities will be out of operation for varying lengths of time. Some of these facilities will be useless because of damage or destruction; others, because of the lack of available fuels. Our agricultural industry depends on trucks and tractors and thus will be particularly handicapped by a lack of petroleum fuels. We do not have enough draft animals to produce and transport great quantities of food. Through loss of refinery capacity, loss of skilled personnel, and loss of access to stockpiled supplies, the agricultural industry could come to a virtual standstill.

## Food and Fuel Reserves

People emerging from shelters will have exhausted much of their emergency food and many other supplies. They will have immediate need of food supplies and sources of power for operating machines of many kinds. An austerity program is to be expected. But as matters now stand, famine, or worse, is a definite possibility. The emphasis here is on the need to have a minimum amount of food accessible to sustain the people, enable them to work, and free them from the burden of having to hunt for food.

If, as has been assumed, the industrial damage is heavy or nearly complete, another question arises. How long will it be before mass food production is restored? Is it feasible to stockpile enough petroleum fuel to keep the agricultural machines and transport vehicles moving, and in locations where it will be accessible? Is it feasible to stockpile enough food within reach of our larger population centers to support the populations of those centers for an unspecified time? I suggest that the answer to each of these questions is an unqualified "yes." I believe that such stockpiling can be accomplished without undue economic strain. Through the implementation of plans for the postattack period we can sharply reduce the probability that a surviving population will have to contend with malnutrition and its associated diseases, or with starvation, or with the violence and disorder that are likely to accompany a period of extreme stress.

Practical preparation for living and working in the postattack period thus falls into two distinct but overlapping categories: (i) the storage of petroleum fuels where they will be available to run agricultural and transport equipment, and (ii) the stockpiling of essential foods where they will be accessible when they are needed. Except for the cost of redistribution, some processing, and possibly the augmentation of a few items in the food stockpiles, we are already underwriting the cost and have been doing so for a number of years in producing and storing a variety of surplus agricultural items.

During the study and planning stages, consideration should be given to the extent to which the stockpiling of petroleum fuels necessitates modification of the food-stockpiling program by increasing the probability that agricultural and transport equipment will be kept in operation. We should not rely on reserves in either stockpiling category alone for sustaining the population in the postattack phase but should strive for a judiciously balanced development of both categories. There are far too many unforeseeable variables involved for us to risk being too late with too little. In any case, systematic study, by experts, is required to advance these proposals to the implementation stages. It is worth noting that both types of preparation for the postattack phase can be made independently of, or concurrently with, the shelter program. Indeed, such preparations would be significant casualty-reducing measures even if an attack should come before a shelter program could be implemented.

I have not, thus far, mentioned fallout from nuclear weapons. While radioactive fallout will be a complicating factor and will produce casualties if no shelter is available, it now seems clear that, except in a very few food-producing areas of the nation, fallout will be a far less serious factor than damage to the industrial plant insofar as interruption of food production is concerned. We will avoid as much radioactive contamination as we can, accepting what we must.

The considerations presented, in the light of total planning for a nonmilitary defense system, suggest that even a heavy attack need not prostrate the nation for very long, though complete recovery may require a number of years. The means for coping with the recovery phases can be visualized and are within our reach economically, but they will be effective only if food is available throughout the postattack period. To summarize in broad terms, an adequate civilian defense system has two phases. The first phase demands special structures, including stocked fallout shelters throughout the country and a maximum number of blast-resistant structures in and near population centers, with adequate instruments for detecting and measuring air pollutants and maintaining communications. The second, or recovery, phase requires stockpiling of fuels for operating farm machinery; power sources (fossil or nuclear) for rebuilding the nation's industrial plant; and, above all, stockpiling of food to keep human beings alive and functioning.

**References**

1. A. W. Bellamy and S. L. Warren, *Bull. Atomic Scientists* **9**, 390 (1959); H. Kahn *et al.*, "Report on a study of non-military defense," *Rand Corporation Rept. No. R-322-RC* (1958); "The effects of nuclear weapons" (Government Printing Office, Washington, D.C., 1957); "Civil Defense for National Survival" (Hearings, Subcommittee of the Committee on Governmental Operations, House of Representatives) (1956), pts. 1–7; "The Nature of Radioactive Fallout and Its Effects on Man" (Hearings, Subcommittee of the Committee on Government Operations, House of Representatives) (1957), pts. 1, 2; *International Security. The Military Aspect* (Doubleday, Garden City, N.Y., 1958); "The National Plan for Civil Defense and Defense Mobilization," *Office of Civil Defense Mobilization Publ.* (Government Printing Office, Washington, D.C., 1958); "Radiological Defense Planning Guide," *Office of Technical Operations, Burlington, Mass., Rept. No. T01 58-26* (1958); P. R. Stout, "The Case for a National Food Cache," *U.S. Department of Agriculture Extension Service Publ.* (1961).


# News and Comment

## "Population Explosion": Bishops' Proposal for Study Conflicts with Some Popular Conceptions of Church

Among the major institutions of the Western world, the Catholic Church is perhaps least subjected to critical scrutiny by the press. There are various reasons for this, but a principal one appears to be that the Church hierarchy is well disciplined, and contending elements do not employ publicity as a tactical device; in addition, the press does not consider it good taste or good business to subject religious bodies to the sort of probing that is traditionally applied to nonreligious institutions. One result of this combination of factors is that controversy within the Church rarely comes to public attention and the Church therefore tends to take on a monolithic appearance that may not altogether reflect reality.

In the public mind, this image of the monolith applies to a broad range of issues with which the Church is concerned, but it is perhaps most widely and uncritically held on the subject of birth control. The official position of the Church is adamant opposition to any birth control technique but the rhythm method; and when the subject has arisen in the form of a public policy issue, the Church has contributed to its monolithic reputation by coming down hard against efforts to promote chemical or mechanical contraception. At the same time, however, considerable evidence has accumulated in recent years to indicate that many persons within the Church are dissatisfied with the official position.

The extent and potency of this dissatisfaction has been difficult to discern, since its manifestations have been limited to scholarly and theological journals, private conversations, and occasional speeches. Earlier this week, however, the rumblings came to the surface in conspicuous fashion when the Associated Press reported that a "number" of bishops of unspecified nationality at the Ecumenical Council were preparing a petition calling for the Church to establish a special group to study various problems of economic development, including population growth. The AP report, in quoting an unidentified source, said the proposed group would study steps the Church might take to meet "certain worrisome problems of the moment: the consequences of the population explosion, the existence of two-thirds of the world in a constant state of under-development and hunger, lack of true evangelization of the poor, and universal peace."

The prospects for this proposal should not arouse any large measure of optimism on the part of those who would like to see the Church revise its position. The petition is yet to be formally presented; when it is, it will be subject to study by a specially appointed commission of the Council, and the study will be made against a background of great investment of effort and emotion in opposing artificial birth control.

Nevertheless, the Church is not the rigid institution that it is popularly assumed to be, nor is it committed to a policy of unrestrained population growth, despite its consistent and furious battles against the use of public funds for family planning efforts in the United States and in American foreign aid programs. At issue, as far as the official Catholic position is concerned, is not the question of whether or not family growth should be limited, but rather the motivations for limitation and the techniques to be employed.

The sanction for limiting births was explicitly given in 1951 by Pope Pius XII, when he stated that "people can be relieved from this positive obligation (to procreate) over a considerable length of time and even for the whole duration of marriage, if there are adequate bases, which sometimes exist for medical, eugenic, economic and social reasons." The rhythm method, he added, is "compatible with the law of God," and he expressed the hope that "medical science will succeed in giving this permissible method a sufficiently safe basis and the most recent information seems to confirm this hope."

In recent years, in response to adverse public opinion, a number of Catholic theologians have been publicly addressing themselves to the question of birth control. Many of them have taken a cue from the late Pope's reference to "medical science" and have gone on to urge the quest for a solution that would be compatible with the positions of the other major religious groups. Outsiders' interpretations of their motives include the uncharitable view that the Church would be quite pleased to be provided with a gracious retreat from a position that is becoming increasingly untenable. But whatever the motivation may be, the fact is that leaders of the Church have been paying a great deal of attention to the misery and social unrest present in