

Figure 2-13 Crude death rates versus GNP per capita, 1971
Source: USAID 1972.

	DEATH RATE	
	LOW 5-20 PER THOUSAND	HIGH 20-40 PER THOUSAND
LOW 13-25 PER THOUSAND	28% OF WORLD POPULATION 0.7% ANNUAL AVERAGE NET GROWTH RATE (EUROPE, NORTH AMERICA, U.S.S.R., OCEANIA, JAPAN)	0%
HIGH 30-60 PER THOUSAND	57% OF WORLD POPULATION 3.0% ANNUAL AVERAGE NET GROWTH RATE (ASIA, LATIN AMERICA)	15% OF WORLD POPULATION 2.0% ANNUAL AVERAGE NET GROWTH RATE (TROPICAL AFRICA, PARTS OF ASIA)

Figure 2-14 Percentage of world population at various stages of the demographic transition
Source: Keyfitz 1971b.

becomes hopelessly confusing. By definition, a model is a simplification. This population model simplifies the population system by grouping all the factors that might possibly influence birth and death rates into logical, comprehensible categories of functional significance. The organizational scheme used in the World3 population sector is described generally in this section. The next two sections (2.4 and 2.5) show how this scheme was incorporated into the world model, initially as a structure of interlocking feedback loops, then as precise mathematical equations.

First, we distinguish between the demographic and the external determinants of birth and death rates (Figure 2-15). The demographic determinants arise from the

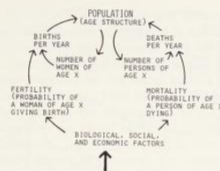


Figure 2-15 Demographic and external determinants of birth and death rates

population age structure, and thus they are themselves determined by past birth and death rates. The demographic determinant of the total number of births in any given year is the total number of women of each age in the population. The demographic determinant of the number of deaths each year is simply the number of persons of each age in the population.

Each demographic determinant is multiplied by an external determinant, the fertility or mortality, that reflects all the socioeconomic influences on the vital rates. The fertility is the probability that each woman of childbearing age will actually give birth. The mortality is the probability that a person of any given age will die.

What logical categories can be perceived in the many external determinants—biological, social, and economic—that affect fertility and mortality? It may be useful to distinguish between the voluntary factors that result from human intentions, desires, and goals and the involuntary factors that result from biological or physical constraints. For example, the fact that female fertility is essentially zero below age 15 and above age 50 is an involuntary, biological restraint on fertility. The fact that the Indian government disseminates literature and signs promoting the two-child family is a social input to the voluntary component of fertility. This simple voluntary-involuntary dichotomy is incomplete, however, because it gives no indication of the actual balance between the voluntary and the involuntary factors. Thus it is necessary to include a third category—the factors of control that a population can use to attain its fertility and mortality goals. Functionally, the control factors mediate between the voluntary and involuntary factors and determine how effectively a population can achieve its desired fertility and mortality rather than those imposed by nature. The factors of control are primarily technologies such as contraceptive techniques, public health services, and medical procedures.

The general classification scheme used in World3, shown in Figure 2-16, is based primarily on the voluntary-involuntary distinction just described, but with some significant modifications.

The three inputs to fertility in Figure 2-16 are the desired fertility (voluntary component), the maximum fertility (involuntary component), and the fertility control effectiveness (control factors). The desired fertility is that which would be observed if