

so quickly that the fossil record is poor; and it has not been clear until recently that the theoretical rates of natural selection could actually work fast enough to account for them.

It is important to note that such *self-restructuring* of a system, to emergent new forms and levels of organization that were not in it before, is very different from the assembly of a watch by an external watchmaker. In current biological language, it is not *teleology* or purpose, but *telenomy* or the appearance of purpose. It is also different from the emergence of a flower and fruit from a green plant; because, for the individual plant, the information needed to make the new structure was already present in the seed, having been selected by a long history of survival of such plants. The classical Greek analyses and the theological and philosophical analyses of "emergent evolution" have often confused these three cases, of external design (the watchmaker), of internal developmental design from information built into the chromosomes (the plant), and of genuine self-transformation, that is, time-emergence of better-organized patterns at a new level of organization that did not exist before, either externally or internally. *Evolutionary jumps may actually be much more common than we have supposed, with evolution in general not taking place so much by steady change as by small saltatory steps of this kind which reorganize one sub-system after another.*

The restructuring of individual personality may also take this sudden form, as in the case of flashes of understanding or psychotic episodes or sometimes in reorganizational crises in response to therapy. Learning to ride a bicycle is such a sudden restructuring of skills. Falling in love, and religious and political conversions, are likewise sudden and often permanent restructurings of emotions, goals, and activities. And there are sudden experiences of "ecstasy," which have the same character, with a moment of insight leading to a new awareness, a new simplicity, or a new organizational pattern for the rest of one's life. The accounts range from the conversion of St. Paul and the experiences of the mystics to the unitary and world-changing experiences reported by such non-religious philosophers as Ernst Mach and Bertrand Russell. It is not entirely false or even mystical to say that in these restructurings, as in the evolutionary and other restructurings, the system is "going beyond what it knows how to do," and the organisms or individuals are in the grip of "a power beyond themselves."

Finally, the area of social evolution exhibits the most dramatic and large-scale restructurings of this kind that we know about, such as the sudden collective restructurings that occurred in the Reformation and in the Industrial Revolution. These changes go deeper than ordinary political revolutions because they are not simply an exchange of power from one small group to another, but a thorough-going change in philosophy, personal attitudes, and ways of work and economic organization in every part of society. The democratic revolutions, starting with the United States, and the communist revolutions also represent this kind of sudden thorough-going self-restructuring, with whole populations united in the creation of change at every level. And the largest of all these changes, in its speed and scale and its long-range evolutionary implications, is the world transformation through which all human society is now passing.

Thinking of the parallels to the other types of restructuring mentioned earlier, we see that it is no distortion to speak of this world reorganization of all our patterns as a 'quantum jump,' or as a sudden collective change of awareness or flash of understanding for the human race.

If we are to understand these changes today, or if we are to have hope of channeling men in the direction of a more democratic and humane future, we must begin to study this whole phenomenon of hierarchical restructuring in much more depth and detail than we have so far.

Characteristics of the Jumps

As a beginning on such a study, we may note that these self-generated jumps in a hierarchical organization have several common characteristics that stand out. One is that the jumps are always preceded and accompanied by "cognitive dissonance," as Gardner Querton has emphasized in discussing these questions.

Thus, Kuhn describes in considerable detail the scientific dissonance that precedes his scientific revolutions. *First, there are accumulating bits of data that do not fit the old predictions, or rules of thumb in certain areas that seem to be justified only by odd assumptions.* In the beginning, these difficulties are dismissed as trivial, or as errors of measurement or crack-pot arguments, but they do not go away, and they get more numerous. After a time, the confrontation with the old system comes to be recognized as fundamental, and various proposals for a reconciliation are brought forward. Then suddenly a simplification from some entirely different point of view makes big parts of the problem snap into new and clearer relationships. There is a collective sense of relief and achievement, even though a long period of working-out may lie ahead.

Similarly in the restructuring of personality. Cognitive dissonance is now supposed to be the precondition for any kind of personal learning—that is, reorganization—experience. Who can doubt that Paul's violence against the Christians before his conversion—as with many persecutors—was based in part on beating down his own internal dissonance and self-doubt about what he was doing? Conversely, to prevent a restructuring, the paranoiac is fearful of any cognitive dissonance, and tries to fit everything he sees—an open window or a subway scrawl—into his general persecution theory. Strong cognitive dissonance, personal or social, has many side effects (system instabilities) such as anxiety, anger, over-assertion or aggression (pro- or anti-status-quo), or counter-responses such as withdrawal, nausea, and melancholy—which accounts for the sense of relief when it is resolved.

In the area of social change, the first stages of the Reformation were attempts to reform the church from within because of the feeling of dissonance between its ideals and its practice. Today, the transformation of our economic system or of the nation-state toward more humane structures is likewise heralded by a general realization that pollution, the ghettos, the military-industrial complex, or the Vietnam war, do not even fit the system's own goals or images of itself. These divergences can only be gotten rid of by forcing them either into a rigid delusional system like the paranoiac's, that redefines them as somehow "intended" and "good"; or else by a restructuring of the whole system toward better integrated higher-order patterns.

