

Chapter 1

Transformations of the twenty-first century: transitions to greater sustainability

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Murray Gell-Mann, born in 1929 in New York City, obtained his PhD in physics in 1951 at the Massachusetts Institute of Technology. He was awarded the Nobel Prize for Physics in 1969 for ‘his contributions and discoveries concerning the classification of elementary particles and their interactions’. Gell-Mann had found that subatomic particles such as neutrons and protons are composed of building blocks that he called ‘quarks’. As Distinguished Fellow at the Santa Fe Institute and Professor Emeritus at the California Institute of Technology, Gell-Mann conducts theoretical research in several fields of science.

A great deal of research and teaching in the sciences and the humanities, especially at universities, is confined to individual departments representing particular fields of knowledge. While specialization and sub-specialization are inevitable and necessary, they need to be supplemented by research and teaching that transcend sometimes narrow disciplinary boundaries. Many institutions, within or outside of universities, carry out such transdisciplinary activities (e.g., Hirsch *et al.*, 2008). The Santa Fe Institute, which I helped to found more than twenty years ago, and where I now work, is a place where it is the rule rather than the exception to have transdisciplinary problems studied by self-organized teams of people originally trained in many different specialties. These teams recognize and exploit similarities and connections between topics in very different fields. Similarly, the participants of the Potsdam Nobel Laureate Symposium may have started out as specialists in very different fields – in the physical sciences, the life sciences, the social and behavioural sciences, or history – but they convened at the symposium to discuss a common concern for the future.

I have often spoken in public about the need for such research and about institutional arrangements for making it happen. What I have to say here may sound similar, but it really concerns a very different topic, one not concerned with academic disciplines in pure research and teaching, but rather with policy solutions that will affect the future of human societies. The Potsdam Symposium was largely concerned with policy-relevant studies, not only in relation to energy and global climate change but more generally in relation to the future of the human race and the biosphere of Planet Earth including all other species with which we share that biosphere.

In considering any very complex system, we tend to break it up into more manageable parts or aspects and to study these more or less separately. For example, when looking at the longer-term human future, we might divide the various issues into military and diplomatic issues (some might say security and foreign affairs); political issues, including domestic politics in each country or region; ideological issues; environmental issues, including those related to water, air, energy and biological diversity; human health and wellness issues; family issues; demographic issues; economic issues, including the crucial socioeconomic challenge of relieving extreme poverty; technology issues; scientific research issues; institutional or governance issues; issues of democracy and human rights; and so forth.

Other items might be added to such a list, but the general idea is clear. In each of these categories we have experts who have built their careers around the issues involved. Likewise, we have NGOs, promoting, for example, environmental protection, human rights, arms control, or child health. In many cases, there are government departments or UN specialized agencies devoted to these issues.

As mentioned above, it is natural, when faced with a very complex system, to

try to break it up into subsystems or aspects defined in advance, such as the categories just listed. The difficulty is that any attempt to understand a nonlinear system, especially a complex one, by assembling descriptions of various parts or aspects will work only if those parts or aspects interact weakly, so that the whole system is decomposable. But that is not true of the *world problématique*. In that sense there is truth in the old adage that the whole is more than the sum of its parts.

A look at the listed categories reveals the problem of isolated analysis. Can we really separate environmental issues from those involving population growth? Can we consider these issues in isolation from technological change or from economic policy? Can we think about the attempts to alleviate extreme poverty without considering the unwise, environmentally destructive projects that are sometimes carried out in the name of that worthy cause? Can we discuss issues of global governance without considering politics in the various countries and regions, or without looking at the competition and conflict between differing ideologies? If military and diplomatic policies fail and mankind is plunged into a hugely destructive war, can our other objectives be attained? Is economic growth not threatened by the widespread prevalence of fatal or debilitating diseases? Can we omit questions about democracy and human rights?

And what if democratic processes bring to power elements of society hostile to human rights and to tolerance or elements that favour environmental destruction or aggressive war? While separate consideration of the various aspects of the world situation is necessary and desirable, it very badly needs to be complemented by integrative thinking that not only combines studies of those aspects but also takes into account the strong interactions among them.

We must rid ourselves of the notion that careful study of a problem based on a narrow range of issues is the only kind of work to be taken seriously, while integrative thinking is to be relegated to cocktail party conversation. This prejudice exists in a great many places in our society, including academia and most bureaucracies. Some of my remarks on this subject were quoted near the beginning of Thomas Friedman's book *The Lexus and the Olive Tree* (1999). He came to a similar conclusion through his work for the New York Times. Before he became a columnist, he was assigned to cover first one set of issues, then a different set, and then yet another set. Each time he was reassigned he observed that the issue he was reporting was intimately connected with issues he had covered earlier.

What we need then, is not just detailed work on separate issues, but also the efforts of teams of brilliant thinkers, many of them specialists, devoted to considering the 'whole ball of wax'. It can, of course, be argued that this is too big a job for any single group of people, no matter how talented or erudite. This is true. Of course such an ambitious aim can be accomplished only crudely, and that is why I refer to it as taking a 'Crude Look at the Whole' (CLAW).

The chief of an organization – for example, a head of government or a CEO – has to act as if he or she is taking into account all aspects of policy, including the interactions among them. It is not easy, however, for the chief to take a ‘CLAW’ if everyone else in the organization is concerned only with a partial view. Even if some people are assigned to look at the big picture, it doesn’t always work. A few years ago the CEO of a major corporation told me that he had a strategic planning staff to help him think about the future of the whole business, but that members of that staff suffered from three defects: they seemed largely disconnected from the rest of the company; no one could understand what they said; and everyone else in the company seemed to hate them. Unfortunately, this negative response to an attempt at integration seems to be the norm throughout our modern societies.

Despite such experiences, it is vitally important that we supplement our specialized studies of policy problems with serious attempts to unite them. For such an effort to succeed, some kind of simplification is naturally required. Certain things have to be treated in a cursory fashion and others in more detail. But that process (physical scientists would call it ‘coarse graining’) cannot be accomplished through pre-defined categories. It must follow from the nature of the world system itself. The required form of coarse graining must first be discovered.

Let us take, for example, the relationship between weather and climate: no clear results will emerge from examining the weather at each isolated location and each short interval of time, and if we ignore the strong interaction with other phenomena. But much can be learned from a study of weather suitably averaged over space and time and examined in tandem with certain information about ocean currents, the nature and quantities of atmospheric pollutants, fluctuations in solar radiation, and so forth. That is a simple example of a non-trivial form of coarse graining.

In trying to investigate future scenarios, however, it is necessary to go beyond averaging processes that produce relatively smooth trends. It is necessary to allow as well for less smooth effects, stemming from situations where chance plays a huge role or where major transitions may occur, like the interlinked transitions or transformations that will have to take place if anything like sustainability is to be achieved.

Sustainability is one of today’s favourite catchwords. It is rarely defined in a careful or consistent way, so perhaps I can be forgiven for attaching to it my own set of meanings. Broadly conceived, sustainability refers to quality of human life and of the environment that is not gained at the expense of the future. But I use the term in a much more inclusive way than most people: sustainability is not restricted to environmental, demographic and economic matters, but refers also to political, military, diplomatic, social and institutional or governance issues. Ultimately, sustainability depends on ideological issues and lifestyle choices. As used here, the term sustainability refers as much to sustainable peace, sustainable global security

arrangements, sustainable democracy and human rights, and sustainable communities and institutions as it does to sustainable population, economic activity, and ecological integrity. All of these are closely interlinked, and security in the narrow sense is a critical part of the mix. In the presence of highly destructive war, it is impossible to protect nature effectively or to keep certain human social ties from dissolving. Conversely, if resources are abused and human population grows rapidly, or if communities lose their cohesion, conflicts are more likely to occur. If great and conspicuous inequalities are present, people will be reluctant to restrain quantitative economic growth in favour of qualitative growth, as would be required to achieve a measure of economic and environmental sustainability. At the same time, great inequalities may provide the excuse for demagogues to exploit or revive ethnic or class hatreds, and to provoke deadly conflict.

In my book *The Quark and the Jaguar* (Gell-Mann, 1994) I suggest that we study possible paths towards sustainability (in this very general sense) during the course of this century, in the spirit of taking a ‘CLAW’. The idea of such studies would be to seek out paths towards sustainability even if they may appear rather improbable. It is, of course, important that we not take these studies of possible future developments too seriously, but rather treat them as ‘prostheses for the imagination’.

I employ a modified version of a scheme introduced by my friend James Gustave Speth, then President of the World Resources Institute, later head of the United Nations Development Program, and now Dean of the School of Forestry and Environmental Studies at Yale University (Speth, 2008). The scheme involves a set of interlinked transitions that must occur if the world is to switch from present trends to greater sustainability:

1. *A demographic transition* to a roughly stable human population worldwide and in each broad region. Without this, talk of sustainability seems pointless.
2. *A technological transition* to methods of supplying human needs and satisfying human desires with much lower environmental impact per person at a given level of conventional prosperity.
3. *An economic transition* to a situation where growth in quality gradually replaces growth in quantity, while extreme poverty, which cries out for quantitative growth, is alleviated. The economic transition must, of course, involve what economists call ‘the internalization of externalities’. Prices will have to come much closer to reflecting true costs, including damage to the future.
4. *A social transition* to a society with less inequality, which, as pointed out earlier, should make the shift from quantitative to qualitative growth more acceptable. The social transition includes a successful struggle against large-scale corruption, which can vitiate attempts to regulate any human activity through law.

5. *An institutional transition* to more effective means of coping with conflict and with the management of the biosphere in the presence of human economic activity. We are now in an era of simultaneous globalization and fragmentation, in which the relevance of national governments is declining somewhat, even though the power to take action is still concentrated largely at that level. Most of our problems involving security – whether in the narrow or the broad sense – have global implications and require transnational institutions for their solution. We already have a wide variety of such institutions, formal and informal, and many of them are gradually gaining in effectiveness. However, they need to become far more effective. Meanwhile, national and local institutions need to become more responsive and, in many places, much less corrupt. Such changes require the development of a strong sense of community and responsibility at many levels, within a climate of political and economic freedom. Achieving the necessary balance between cooperation and competition and stabilizing commitments in the long run are difficult challenges at every level.
6. *An informational transition* in the acquisition and dissemination of knowledge and understanding. This will allow us to better cope at local, national, and transnational levels with technological advances, environmental and demographic issues, social and economic problems, questions of international security, and the strong interactions among all of them. Only if there is a higher degree of understanding, among ordinary people as well as elite groups, of the complex issues facing humanity is there any hope of achieving sustainability. But so far most of the debate on the new digital society focuses on the dissemination and storage of information, much of which is extremely useful but some of which is false or badly organized. We need to support and better reward the difficult work of converting that raw information into knowledge and understanding. This point illustrates particularly well the pervasive need for a ‘Crude Look at the Whole’.
7. *An ideological transition* to a world view that combines local, sectarian, national, and regional loyalties with a ‘planetary consciousness’, a sense of solidarity with all human beings and, to some extent, all other living beings. Only by acknowledging the interdependence of all people and, indeed, of all life can we hope to broaden our individual outlooks so that they reach out in time and space to embrace vital long-term issues and worldwide problems in addition to immediate concerns close to home. This transition may seem even more utopian than some of the others. However if we are to reduce and eliminate conflict based on destructive particularism it is essential that groups of people that have traditionally been in conflict with one another acknowledge their common humanity. Such a progressive extension of the concept of ‘us’ has, after all, been

a theme in human history from time immemorial. One dramatic manifestation of this is the greatly diminished likelihood of armed conflict in Western Europe. That achievement has been aided by the long process of creating and developing European institutions, from the Coal and Steel Community to the European Union.

When studying these transformations, which are closely connected to the issues debated at the Symposium, it is especially important to devote considerable effort to integrative work. What actually happens in the world will depend not only on studies but on the behaviour of a huge multitude of human actors all over the globe, and in the end it is the nature of those actors that matters most. What will happen to human nature in the long-term future? Will it be changed artificially through the application of science and technology? Will it rather just continue to be gradually modified by culture and, if so, how? Will devotion to one's own country, ethnic group, religion or class really be supplemented by a planetary consciousness that defines 'us' as part of the entire human race and, to some extent, the other organisms with which we share the biosphere? Or will human cussedness lead us into disasters made ever worse by our advancing technology?

It is possible that disciplined yet imaginative speculation about the longer-term future can be of some help in seizing opportunities and in avoiding some of the worst catastrophes. But in thinking about the future let us take seriously the idea of a 'Crude Look at the Whole'.

References

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