A Rationale for a Science Museum

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There is an increasing need to develop public understanding of science and technology. The fruits of science and the products of technology continue to shape the nature of our society and to influence events which have a world-wide significance. Yet the gulf between the daily lives and experience of most people and the complexity of science and technology is widening. Remarkably few individuals are familiar with the details of the industrial processes involved in their food, their medicine, their entertainment or their clothing. The phenomena of basic science which have become the raw material of invention are not easily accessible by the direct and unaided observation of nature yet they are natural phenomena which have, for one segment of society, become as intriguing and as beautiful as a butterfly or a flower.

There have been many attempts to bridge the gap between the experts and the laymen. The attempts have involved books, magazine articles, television programs and general science courses in schools. But such attempts, although valuable, are at a disadvantage because they lack props; they require apparatus which people can see and handle and which display phenomena which people can turn on and off and vary at will. Explaining science and technology without props can resemble an attempt to tell what it is like to swim without ever letting a person near the water. For many people science is incomprehensible and technology frightening. They perceive these as separate worlds that are harsh, fantastic and hostile to humanity.

There is thus a growing need for an environment in which people can become familiar with the details of science and technology and begin to gain some understanding by controlling and watching the behavior of laboratory apparatus and machinery; such a place can arouse their latent curiosity and can provide at least partial answers. The laboratory atmos-

phere of such an "exploratorium" could then be supplemented with historical displays showing the development of both science and technology and its roots in the past.

The purpose of a science museum and exploration center would be to satisfy this need. It could be valuable and entertaining for the general public and would serve as a resource for schools and existing adult education programs.

The demonstrations and exhibits of the museum should have an aesthetic appeal as well as pedagogical purpose and they should be designed to make things clearer rather than to cultivate obscurantism or science fiction. The museum cannot be a mere hodge-podge of exhibits but should be conceived with some basic rationale that can provide a flexible frame work.

A POSSIBLE FORM OF ORGANIZATION FOR SUCH A SCIENCE MUSEUM

A form of organization which could help fulfill the underlying purpose of the museum would involve introducing the various areas of science and technology with sections dealing with the psychology of perception and the artistry associated with the various areas of perception. One might, for example, have five main sections based respectively on hearing, on vision, on taste and smell, on the tactile sensations (including perception of hot and cold) and on proprio-sensitive controls which form the basis of balance, locomotion and manipulation.

The section on hearing might be introduced with a collection of musical instruments. The tonal qualities of the instruments could be demonstrated or reproduced. There could be a section on various musical scales, followed by a section on everyday sounds and noises which could make people aware of the problems of sound recognition and memory. The details of auditory perception could then be explored with experiments on the frequency and loudness response range and on the determination of sound direction, etc. The thread could then divide in two. One part would explore the physics of sound, that is the study of vibrations, oscillations, resonance, interference and reflections. The other part would be the physiology and histology of the ear and the associated central nervous system. The final section would then elucidate the technology and the industrial techniques involved in sound reproduction, (thus introducing electronics) speaker and microphone construction, the acoustics of auditoriums and various devices such as hearing aids, telephones, radio, sonar, and the like.

With the sense of vision one might start with painting and introduce the ideas of perspective and the effects involved in op-art and moiré patterns. One would move to experiments in the psychology of visual perception and then branch to the physics of light on the one hand and

to the biology of the eye on the other. These would each then lead to technology. The technology might include pigment manufacture, optical instruments, glass manufacture, television and photography, lighting, infrared and ultraviolet devices and lasers. It might even be appropriate to demonstrate the use of high energy radiation on biological tissue and other aspects of medical technology.

One would proceed in a similar fashion with taste and smell starting with food and perfume, then developing some aspects of chemistry and ending with the vast and mysterious technology of the food and cosmetic industries. The fourth section would start with clothing and housing, pass through a section on perception of hot and cold and roughness, and then develop the physics of heat and lead to the section on industrial production of fibers and building materials.

Finally, the section on control would involve dancing and athletics and various skills such as balancing rods on one's fingers or riding a bicycle. It would demonstrate the proprio-sensitive mechanisms of the body and would then branch to the mathematics of feedback mechanisms and the physiology of muscles and nerves and the semicircular canals, etc. and end up with the sophisticated technology of control mechanisms in industry and technology.

This form of organization is but one of many possible plans for a museum. I believe it would capture the interest of many people and might provide a pattern which museums might wish to follow. However, although it seems essential that the museum be structured according to some underlying plan such as the one suggested above, it is also important that the people who use the museum not be forced to follow some preconceived pattern. In the proposed organization some people might be interested in following the domain of perception from one area to another. Some might remain rooted in just one area such as in the physics of sound or in food technology, whereas others may want to wander around the halls at random.

IMMEDIATE PROGRAMS

The design and building of elegant, clear and reasonably public-proof experiments and exhibits will proceed slowly. It might easily take many years to complete the type of displays for the program outlined above. There are, however, some programs which could be initiated within a short time and which should be continuing features of the museum. These are outlined below.

1) School science fairs have become established institutions. At present, however, the projects are displayed for only two or three days and are then dismantled or returned to some storage place. They could well be displayed for much longer periods and the students who have built them

could occasionally be on hand to explain them to the public. In the future, the talent and effort involved in these projects might well be marshalled to make more integrated displays for the museum.

2) The apparatus used in educational television science programs could be displayed in the museum after the television program had been shown. With competent supervision, this apparatus could be demonstrated again, and in at least some cases, the public might be able to work with it. In time, a television studio could be incorporated into the museum and a symbiotic relation between the museum and educational television could be developed.

3) There is a need for a central location in which to display the laboratory apparatus which has been developed for use in schools and colleges. This apparatus could be displayed in such a fashion that teachers and their pupils could work with it. Support for this activity might come both from the manufacturers of this apparatus and from the National Science Foundation which have invested heavily in its development.

4) There are many objects of industry and science which are themselves quite beautiful even when displayed with no pedagogical motive. The art department at Stanford University recently put together an exhibit using instrumentation for the Stanford Linear accelerator. Such exhibits would be worth displaying and would fit quite naturally with a practice of having displays of sculpture in the gardens and buildings which are adjacent to the museum building.

A museum should not be a substitute for a school or a classroom but it should be a place where people come both to teach and to learn. Visitors should be able to find it refreshing and stimulating. Above all it should be honest and thus convey the understanding that science and technology have a role which is deeply rooted in human values and aspirations.