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TOLERANCE AND TECHNOLOGICAL CULTURE

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Throughout the last two centuries most industrialized countries have exported to the others three goods packed on the same wrapping. The goods are technology, capitalism and political democracy, and the wrapping is western culture. My purpose is to undo the package and to propose some ideas to help sell and buy the lot by parts. In short I think that democracy and technology are indispensable for a society to reach bigger material well-being and a fairer social orde something that does not apply to capitalism. But there are problems for democracy and modern technology in cultural atmospheres alien to the western culture. These problems are twofolded although they have a common root. On the one hand the anticapitalist ideas inspiring some political movements in the third world sometimes go together with certain forms of fanaticism. This is not only incompatible with democracy but also with technological efficiency. On the other hand the owners of most advanced technologies only accept the possibility to transfer them as packages key in hand. This means that they will only work appropriately if the social and cultural environment in which they are applied is actually identical to that for which they were designed and developed. The common root is integrism: cultural, political or religious integrism in one case, and what we could call technological integrism, in the other one. And the remedy to any form of integrism is tolerance.

Indeed, tolerance is a virtue that consists of respecting and accepting values, beliefs, attitudes and behaviors different to our own. In other words, tolerance is respect and recognition of cultural diversity. The opposite of tolerance is integrism. As a civic virtue tolerance is essential for democratic social life, although in order to be effective it should be rational. This means that there exist certain restrictions on tolerance. The

most important is that one cannot be tolerant with the attitudes, behavior, ideas and values that can put in danger the most basic moral principles. These are, in the first place, the right to life and to the satisfaction of everybody's basic needs (Bunge, 1989). In the second place, the right and the duty of tolerance.

What I intend to argue in these pages is that a climate of tolerance is not only important for the development of democracy, but also for technological development. As I will discuss, the later makes it also important for the material well-being of society.

Certainly, it can be thought that civic virtues have little to do with technology. Some examples can be given of important technological achievements within repressive and integrist cultural environments. I do not seek to deny it, but just wish to argue that technological development is sensitive to the cultural environment, at least in two ways:

1. Cultural diversity can be a source of technological innovation.
2. Technological culture can enrich other cultures, without destroying them.

The first thesis is opposed to what we have called technological integrism. The second is usually rejected by the political and cultural integrism that puts capitalism, democracy and modern technology in the same sack of western culture.

To defend both theses, I have to explain first some significant relationships between culture and technology.

1. Culture and cultural systems

First of all it is necessary to distinguish culture from cultural systems. Given a social group, its culture is the information that the members of that group share and that they have acquired by social learning. This information can be representational, operational or axiological (Mosterin, 1993). In a less abstract terminology, we can say *that the culture of a group is the set of beliefs, practices and values shared by its members.* Culture is then an abstract entity: it is information. On the other hand, *the cultural subsystem of a given society is formed by the set of individuals and activities that produce and transmit the beliefs, practices and values of that society.* In this sense cultural systems are specific social systems (Bunge, 1979) that exist in particular spatial and temporal con-

ditions.

The culture of a social group can be described in an intensional or in an extensional way. From the intensional point of view, what characterizes a culture is the set of cultural features or units of information composing it. From the extensional point of view, a culture is characterized by the set of individuals composing the cultural subsystem of that society and the activities they carry out. For example, the religious culture of a society can be described reporting the beliefs, ritual rules and moral norms that characterize that religion. But we can also learn many interesting aspects of that religion by knowing how many people practice it and with what intensity, who are their priests, what relationships exist among people and priests, etc.

We can distinguish different types of features and cultural configurations, according to the type of information we consider. The scientific and the religious cultures differ in the type of beliefs, and rules of behavior. The legal culture refers to beliefs, practices and values captured in the codes of right. And the political culture consists of the beliefs, practices and values present in political activities. The scientific study of culture shows two important findings:

1. Cultural systems are dynamic: *not only different cultural configurations change with time but the basic array of cultural features is ever changing as new cultural features appear (and other disappear) at any time.*
2. Cultures are not holistic entities: *the same cultural features can be embedded in completely different cultural configurations.*

Both phenomena are clearly present along history and they are specially evident (although not exclusively) in science and technology, an essential part of modern western culture. Indeed, scientific discoveries are a constant source of new beliefs and representations of reality. Moreover, technical inventions are a decisive factor for the appearance of new patterns of behavior and new values in many different cultures.

We have just introduced science and technology as cultural entities that are an essential part of modern western culture. Let us discuss this cultural dimension of technology in more detail now.

2. The cultural dimension of technical systems

The concept of technique can also be understood in two senses. A *techni-*

que is, on the one hand, a set of skills and performance rules that allow the solution of a class of practical problems. Considered in this way, a technique is a type of practical information and constitutes a cultural entity.

On the other hand, a *technical system* can be characterized as a *system of actions instentionally oriented to transform particular objects in order to efficiently obtain a valuable result* (Quintanilla, 1989). A technique can be understood now as a class of equivalent technical systems. From this point of view, technical systems are specific systems that can be characterized by their composition and their structure. They are composed of intentional agents (operators and users) and non intentional entities (materials, energy, machinery, etc.). Their structure is arranged by the operations of transformation of specific objects made in the system. Such operations are characterized in turn by the subject agents and the patient objects, the results and, in case of being intentional, the goals they intend to reach.

This notion of technical system is more comprehensive and wider than the traditional notion of technique as a cultural element. In fact technical systems are *hybrid socio-technical systems.* They incorporate physical, economic, organizational and cultural components. They also work in an environment formed by other wider social systems that influence them and, in turn, are influenced by them. A part of the social environment of any technical system is the cultural system that includes scientific and technological knowledge, but also other cultural components related to values, abilities, representations or beliefs, etc..

It is possible to summarize all of this in the following claims: *techniques are a part of culture and culture is a part of the technical systems.* The constructivist metaphor in which technology-society-culture are seen as a *seamless web* (Bijker, 1996) could be easily interpreted that way. From these considerations we can *define technological culture as a specific culture,* formed by all cultural features that refer to technical systems. Some of these cultural features are techniques and technologies themselves. But technological culture includes many other elements. These can be classified in two big groups: cultural elements *incorporated to technical systems,* and cultural elements *not incorporated to technical systems. We* consider the first ones as elements of *technological culture in strict sense,* and the second as elements of *technological culture in lax sense.*

Indeed, technical systems incorporate cultural contents. A technical system is partly composed by human agents who act intentionally. They can be operators, agents or users of the system. To act in the technical system these agents need certain information that belongs to their own culture. They especially need knowledge about the components, structure and operation of the system. The agents also need to have certain practical abilities and to follow certain performance rules to operate with the system. Lastly, they should assume a set of values, referred to the objectives and results of each one of their actions, as well as of the whole system, and to the relationship between them. All these cultural elements can be considered incorporated to every technical system through their human operators. Obviously the cultural content of each particular technical system can be (and it generally is) different, as different is also the culture of the different human agents. The *intersection* (i.e. shared part) of the cultural contents incorporated to a class of equivalent technical systems, is the stricto sensu *cultural content of that technique.*

It is also possible to speak of *technical-cultural contents not incorporated to any technical system.* We have said that technical systems work in a wider social context. In the social context of a technical system there may be individuals who are not agents neither users of the system, but whose culture includes representations, rules and valuations about those technical systems. For example they may have a mythical representation of the technique, or may share a given view of technological development. They may keep an antitechnologic ideology or, on the contrary, a technocratic one. They may have religious or moral ideas that take them to reject certain technical goals (artificial insemination, nuclear power stations, etc.). They may adopt behavior norms that forbid them to use certain techniques (blood transfusion, for example). In short, they may simply have interests, economic, political or aesthetic motivations, etc., in favor or against a technique or all the techniques. All these cultural features can also be considered part of the technical culture of a social group, although they are not part of the strict cultural content of any technical system.

The frontiers between the cultural contents incorporated to technical systems and the technical culture in the lax sense are not fixed. The development and the diffusion of the technologies has a double effect: on the one hand it enlarges the spectrum of cultural contents incorporated to technical systems; on the other hand it contributes to the appearance of

new technical-cultural features in lax sense. A well-known example of the first effect is the incorporation of some cultural features from Japanese society to the organization of industrial production. An example of the second effect is the extension to the public of technological controversies about the suitability, risk, environmental impact or social consequences of certain systems or technological projects.

On the whole the transference of cultural contents from technical systems to their social environment can explain what Bijker calls the *interpretive flexibility* of techniques (or artifacts). In fact, one of the mechanisms that can generate significant variations in technical systems has a purely cultural character. Different social groups with different cultural resources can conceive and evaluate in a different way the objectives and results of a technical system. As a consequence, they can introduce modifications and variations that would not be functional in other contexts.

However there are objective limits to these processes of cultural transfer. There are cultural features that are not compatible with the operation of certain technical systems. For example, members of some religious sects can not be efficient surgeons and an illiterate operator cannot manage a system of complicated control. Similarly there are technical systems that can not spread in a society in which certain cultural features prevail. A high valuation of the hierarchical organization can make impossible the introduction of new production techniques that entrust the operator a good part of the administration of the system. The sorcerers of a tribe cannot substitute the engineers of an industrial factory.

In summary, cultural diversity can be a source of creativity and technological innovation, but technological culture imposes certain restrictions or the rest of culture.

Let us leave our reflections here. Technology is a culturally sensitive reality. A climate of tolerance towards diversity is required for its development. For technology transfer to other cultures to be effective, it is also necessary to be willing to incorporate to the technological culture itself elements coming from other cultures and to abandon integrist attitudes. Tolerance is not only a civic and political virtue it is also a technological advantage.

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