IS THERE A TECHNOLOGICAL IMPERATIVE IN HEALTH CARE?

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Abstract

The question in the title will be addressed by first answering the question: What is a technological imperative? A review of the literature makes it clear that there are many descriptions and explanations of the technological imperative in health care, and that not all of them are important to consider. One conception of the technological imperative that is important is the one that implies that technology reduces our responsibility toward our actions. I argue that that this conception cannot be justified. That is, there is no imperative that frees us from our responsibility for developing, producing, advertising, assessing, implementing, using, and banishing technology in health care. On the contrary, the increased possibilities provided by technology result in an increased responsibility. That is, there is no technological imperative, but technology promotes a moral imperative; in particular, it promotes a moral imperative to proper assessment.

Keywords: Technological imperative, Responsibility, Philosophy of assessment

In a colloquium on medicine and technology held in 1980, it was argued that there was a technological imperative in medicine:

What began as simple tools and purely effective extensions of the physician's personal approach to the patient have, especially in the last 80–100 years, become intrinsic, self-propagating, requisite and almost autonomous elements of today's biomedicine. (43, 125)

Medical technology has grown from being a tool to becoming a companion and, in some cases, the master of physicians (43, 126). The conclusion of the colloquium and its prognosis, however, was rather optimistic:

I would guess that by 1990 we will be proceeding in a more rational way in the practice of medicine and the distribution of health care. (43, 136)

However, there is no indication that the issue of technological imperative has become less topical or that technology is applied in health care in a more rational way in the 21st century than it was in the 1980s. On the contrary, it is argued that the application of technology has become rampant (8) and that health professionals are obsessed with technology (13;18). There is a technological possession and impetus, and a mandate and momentum of technology in health care. Moreover, it is claimed that there is an excessive inquisitiveness about technology, and that physicians appear to be wedded to technology (23). There seems to be a pathological reliance on technology (20, 155), as technology has become the bias of our culture (19, 13).

To be able to discuss the technological imperative in health, we have to know what a technological imperative is. The first part of the article addresses this issue by discussing the descriptions and explanations of the technological imperative that are to be found in the literature. This shows that the term does not refer to one thing but to a wide range of phenomena, and that there are a vast variety of explanations. This poses the question: In what way does the technological imperative matter? In other words: Is the technological imperative important to consider? This question will be addressed in the second part of the article. It is argued that any conception of the technological imperative that reduces our responsibility for technology matters. It is concluded, however, that no such imperative can be identified. On the contrary, technology expands our responsibility, imposing a moral imperative to assess it properly.

What, then, is this technological imperative, and how do we encounter it in health care?

THE TECHNOLOGICAL IMPERATIVE IN HEALTH CARE

First, note that the term *imperative* appears to have many meanings: a) it relates to or constitutes the grammatical mood that expresses the will to influence the behavior of another; b) it is expressive of a command, entreaty, or exhortation; c) it expresses having the power to restrain, control, and direct; and d) it expresses what is not to be avoided or evaded, what is necessary. All these aspects are present in the notion of technological imperative in health care, which will be clear from the various interpretations of the imperative.

The technological imperative appears to be integrated in our reasoning in a wide variety of ways. This paper will not discuss all conceptions of the technological imperative in depth but will try to illustrate the variety of these conceptions. The descriptions of the technological imperative that will be discussed are the following:

• The imperative of possibility and action;
• The imperative of commitment;
• The imperative of procedure;
• The imperative of demand;
• The imperative of the unknown;
• The imperative of means as ends;
• The imperative of implementation;
• The imperative of proliferation; and
• The imperative of inappropriate use.

The Imperatives of Possibility and Action

There appears to be an *imperative of possibility* in health care. That which is possible to do has to be done. Since it is possible to treat mild hypertension, we "have to" do so. Because we are able to sustain life by means of a respirator and advanced medication, we ought to do it. This is characterized by statements such as: "We have to try (everything possible)." Healthcare professionals are expected to try everything possible and in this way they are "held hostage" by the possibilities provided by technology (29). Furthermore, technology increases the number of possibilities for action, and this is regarded as a good in itself (13). Thus, the imperative of possibility can also be recognized in the commonplace thesis that "more choices are better than few" (12).

Moreover, there is an *imperative of action*. Passivity appears to be a vice, and we often encounter this imperative in the form: "Don't just stand there—do something!" or "We do

not want to be accused of not having tried, do we?" There seems to be an imperative of active response, and technology has become the paradigm of effective action. In particular, there is a wish to respond positively in situations where patients are critically ill, have distressing symptoms, or have a dreaded diagnosis (23, 865). This has also been called "bias in favour of active intervention" (17).

The Imperative of Commitment

Jennett (23) analyzes the technological imperative as a *cycle of commitment*, which is brilliantly expressed in the following quote:

Consider a severely head-injured patient who is transferred to a regional neurosurgical unit, perhaps with nurses and doctors and even police outriders. On arrival at the unit it is clear that the patient is irrecoverably injured, having regarded to the responsiveness of the patient and his age. The correct decision would be to accept this situation and not to embark on any further investigation or treatment. In practice such a patient is often submitted to a CT scan, and this may reveal a large intracranial haematoma, causing cerebral compression. This discovery should make no difference, it has already been decided that the patient's clinical state and age makes recovery impossible. Once this lesion has been found, however, it can be difficult to resist the "imperative" to operate to remove the compressing clot, perhaps because of concern that those involved in transferring the patient might feel that insufficient response had been made. There may also be a worry about what the coroner might say if a pathologist reported an untreated haematoma. (23, 866)

Once the decision to intervene has been made, it appears to be more difficult to resist further action. Decisions can be made that are incompatible with reasonable expectations of net benefit. This relates to what can be called the imperative of procedure.

The Imperative of Procedure

Technology appears to compel the physician's actions. Advanced technology is complex and requires that the operator follow a complicated set of procedures. If not, the consequences may be serious. Hence, the technology that should increase the amount of freedom that the physician has, instead represents a restraint (41). This can be called *the imperative of procedure*.

Furthermore, the specialization and high-technology training of personnel may make it difficult for professionals to restrict their action. In rescue medicine and intensive care, personnel are trained to use a wide range of technological equipment to save lives. It may thus be difficult for them to reduce the level of treatment and care they provide (23). Modern physicians are technological experts and are biased toward solving health problems with technology (30, 304).

The Imperative of Demand

Moreover, physicians are also under pressure from what might be called *the imperative of demand*. Patients have become more educated. They know more about medicine than ever before, and there is pressure from patients to apply the latest technological methods. More or less well-informed patients demand particular diagnostic tests or advanced procedures, and this affects the action of the healthcare professional.

Others have pointed out that demand is not patient-driven, but that suppliers control and even create demand.

The consumer of medical technology is, strictly speaking, not the patient, but the physician. He is the one who makes decisions about hospitalization, diagnostic tests, operative procedures, and use of drugs. (4, 127)

In any case, the demand for healthcare services itself is regarded as an imperative of technology.

The Imperative of the Unknown

We tend to desire the latest features of the technology we purchase, even though we do not know either how to use them or whether we will come to use them in the future. For example, many hospitals that purchased monitoring equipment also purchased advanced analysis software that they have never used. They ordered the software because they intended to use it, or because it appeared to be "the features of the future."

Additionally, when implementing new technology in health care, we are often faced with the claim that we need the latest equipment (43, 134). Correspondingly, it is often argued that "if we do not do it, someone else will," "others do it," or "we cannot stop progress." Questions such as "do we have any choice?" are often posed. Such statements reflect an imperative of technology.

There is also another way in which the unknown can result in a technological imperative. Because one does not know the prognosis of the patient with certainty, one has to continue the high-technology treatment: "We are not quite sure that the treatment is in vain," or "There might still be a possibility." Uncertainty induces us to apply high-tech treatment (23, 866) and causes technological tests to be applied beyond the level of diagnostic effectiveness (38;24). Hence, the imperative of the unknown relates to the imperative of action.

The Imperative of Means as Ends

Furthermore, we tend to seek technological solutions to all our problems; that is, there is a technological fix in health care (6, 18). Technology has changed from being a tool to being a companion, and ultimately to becoming the master of medicine (43, 126). "Technologies come into being to serve the purposes of their users, but ultimately their users redefine their own goals in terms of the technology" (8, 32). Technology has outpaced overall strategies of care (31). "[T]he conventional emphasis on the *means* of medicine—either economic technique (to organise health care systems) or scientific technique (to improve medical outcomes)—have come to obscure basic questions of *ends* and *purposes*." (7, 96). Or, as Reiser points out:

Technologies, history shows, can be imperative: We may be impelled to use the capacities they provide us without adequate reflection on whether they will lead to the humane goals of medical care. (34, 2,477)

Correspondingly, it is argued that technology has shifted the goal of medicine from caring for sick persons to merely diagnosing disease. "If you concentrate all efforts to diagnose disease, you have to use every technological advance available" (43, 132). That is, technology has made our means our ends.

The Imperative of Implementation

The technological imperative has also been identified in the introduction of new technology. Generally there have been no explicit restrictions on introducing new technological methods or procedures in the same way as there have been with, for example, introducing new drugs (23, 867). Drugs are subject to strict safeguards and rigid test protocols before they are allowed to be used. New technological methods or procedures, such as new diagnostic or therapeutic devices, may be introduced without the same test procedures as for drugs. An example of this is endoscopy and minimal invasive surgery that was introduced during the 1980s.

The surgical revolution set in train by the technological advances of the mid-1980s was largely uncontrolled, with few safeguards to protect patients from enthusiastic, but inadequately trained surgeons. . . . People took it up before it was proven, and before they acquired necessary skills. Some people have certainly tried in the past to do operations for which they were insufficiently trained. Some patients definitely died as a result." (9)

Thus, this eagerness to apply technology can be interpreted as a technological imperative in health care. There seems to be a premature acceptance of technology (43, 34). It is applied before it has been proven to be safe or effective. We tend to apply imperfect, costly, halfway technology that does not prevent, control, or cure disease (39, 37;4, 128) and we are inclined to ignore its negative side effects; that is, technology is applied "too much, too soon" (19). This can also be recognized in technology assessment in health care, where the dissemination of the results is a frequent issue. Why does the healthcare system use technological methods and procedures that have not been proven to be effective, or why does it not stop using technological methods and procedures that have proven to be inefficacious, ineffective, or inefficient? Even in the age of evidence-based medicine, it appears to be difficult to make the healthcare system implement the results of technology assessment. There is something that makes us implement technology despite the evidence against it.

The Imperative of Proliferation

The excessive application of technology has been interpreted as a surge of wild proliferation of technology (43, 136). This has caused some people to claim that there is a "technological cancer" in medicine (10). Technology appears to beget technology (43, 21). It is self-perpetuating (8;26), self-propagating (43, 125), self-augmenting, and compelling (23;40). Due to advanced technological methods, we arrive at excessive and often conflicting test results. This has been called a "glut of medical data" (33, 195) and "data pollution" (45). To be able to cope with the abundant data, one has to develop, implement, and use new technological methods and procedures. In other words, technology advances technology, which is frequently interpreted as a technological imperative.

The Inappropriate Use of Technology

One of the most influential notions of the technological imperative is that technology is applied inappropriately. Inappropriate application of technology might be identified in health care in many ways. Two such examples that are frequently referred to are excessive and unnecessary application of technology. High-technology methods are used when they are futile or even detrimental (11;16;36). Laboratory tests and x-rays are used far beyond that which is necessary (22;27;32, 37–52). Monitoring devices are used when the costs outweigh the benefits (28). This represents "over-use" of technology (43, 34).

Jennett points to five other ways in which technology is applied inappropriately in health care (23). First, technology is applied *unsuccessfully*. Technological methods are applied in conditions that are too advanced to respond to intervention. Second, there is an "unkind use" of technology; for example, when it is applied to prolong life of poor quality and thus it actually prolongs the process of dying. Third, technology is applied *unsafely* when it is used in situations where the expected complications outweigh the anticipated benefits. Fourth, technology is utilized *unwisely* when it diverts resources from alternative healthcare activities that have better results. A last type of inappropriate application of technology is *unwanted* use, when it is applied against the wishes of the patient, and when the autonomy of the patient is not respected. Hence, inappropriate use of technology is recognized in a variety of situations, all of which express a technological imperative.

Hence, the technological imperative can be described in a variety of ways. There is not one technological imperative, but many. This diversity of conceptions is further illustrated

by the manner in which the imperative has been explained. This is examined in more detail in the following section. The various explanations of the technological imperative reveal that not all imperatives are genuinely technological.

EXPLANATIONS OF THE TECHNOLOGICAL IMPERATIVE IN HEALTH CARE

How, then, can we explain and understand the technological imperative? How is it possible that although we develop and apply technology in health care ourselves, we can still feel that we are controlled by it? The technological imperative most frequently is explained in the following ways:

- By a technological monster;
- Deficiencies in human character;
- General belief in technology;
- Inappropriate assessment;
- The technological constitution of disease; and
- Individual and organizational motives for applying technology in health care.

The Technological Monster

One of the main features of the technological imperative appears to be that it reduces the autonomy of man. Normally we ascribe our abridged autonomy to the autonomy of other beings. Therefore, it appears to be natural to relate our heteronomy due to technology to the autonomy of an external subject. Some explanations of technology's imperative have thus been to compare it with a being such as Frankenstein's monster (42) or the sorcerer's broom (8). Technology is described as having a personality of its own with certain characteristics. Cassell describes technology as being reductive, oversimplifying, impatient, intolerant of ambiguity, and self-augmenting. "Technology, a thing unique unto itself . . . will confound most any attempt to change the health care system or redirect its fundamental goals" (8, 32). Others have also appealed to a personification of technology in claiming that "technologies can develop identities of their own. Human ingenuity, anxiety, and fantasy can transform technologies into independent creatures . . ." (33, 229). The personification of technology functions as a metaphoric explanation of the technological imperative.

Deficiencies in Human Character

Related to the metaphor of the monster, the compelling character of technology is explained by weaknesses in human nature. Cassell mentions five human characteristics that lead to the autonomous growth of technology (8). First, technology appears to appeal to human curiosity. It has come to be part of our rationality, appears to fascinate us, and we tend to apply technology because it satisfies our need for wonderment.

Second, we have difficulties with judgments of value, and we strive for facts and immediate results. For this purpose technology is perfect: We believe that laboratory results and results of the ECG give us direct access to the realm of disease.

Third, we are so dependent on technology because it compensates for our fear of the ambiguous. Because many of the dilemma's of health care appear to be challenging, technology is applied to solve dilemmas or to avoid them. Fourth, we appear to apply technology to avoid uncertainty. In order to be sure that we are doing the right thing, we apply technology to help us make decisions and to confirm them. Thus, technology compensates for our deficiency when we are uncertain about how to act. The last and fifth

human deficiency that Cassell mentions in order to explain the imperative of technology is our desire for power. Technology represents a new potential for action, and we appear to be attracted by its power.

Thus, one way to explain the imperative of technology is in terms of our defective nature. If our dependence on technology is the result of genuine deficiencies in human nature, it is an inevitable part of human existence and appears as an imperative.

General Belief in Technology

One of the reasons why technology is so widely applied in health care appears to be because of a general belief in technology. We tend to believe that the quality of healthcare services is improved by the application of new technology. Patients are satisfied if they are sent to have an MRI, CT, or PET scan or if they are subjected to advanced surgery. On the other hand they are discontented if the physician refuses to take laboratory tests or tells them to change their diet or to exercise. There is an unbridled optimism toward technology, and we are inclined to overestimate the degree of control and to underplay the negative side effects (17, 413).

This general belief in technology is reflected in the extensive application of technology in all aspects of life. Furthermore, it is connected to the myth of progress (44). We tend to believe that progress is an end in itself, and technology appears to be its prominent attribute. Technology has become the symbol of our culture and the symbol of progress. "The concept of progress in medicine is now defined almost exclusively in terms of its technological, curative functions, extending even to death itself" (18, 144).

Koenig argues that the technological imperative is a result of human habituation and "routinization" (25). By struggling with new technology, it is "tamed" and becomes part of the social structure of health care. Technology is so socially internalized that we do not reflect upon its use or its professional position. It has become the bias of our culture (13;18); thus, there appears to be a general belief in technology that predisposes us to apply technology in a wide range of activities. This belief might explain situations described as "a technological solution seeking a problem" and as excessive application of technology. Hence, the predominant faith in technology seems to be a crucial contribution to the imperative of technology, and technology is part of what has been called the "medically ritualized optimism."

Inappropriate Assessment

The utility of new technologies may be generally accepted before they have been proven either to be safe or efficient (4;39;43, 34). The lack of assessment of medical technology makes the process of application subject to beliefs and prejudices (23, 867). Technology is applied due to the aggregate decisions of physicians or because of pressure from product champions, healthcare politicians, patient advocate groups, or health authorities; that is, the lack of rational assessment of technology makes it appear to be an imperative.

The imperative aspects of technology can also be explained by the practice of evaluation of technology before it is applied. Although the aim of any diagnostic, therapeutic, and palliative activity is patient outcome, many product specifications of healthcare technology concern aspects such as technical performance, diagnostic accuracy, diagnostic impact, and therapeutic impact. Although new technology is documented to be technically, diagnostically, or therapeutically better than older methods, this does not guarantee that the outcome for the patient is better or that it is implemented appropriately. Hence, one of the explanations of the imperative that is characteristic of technology is that it is assessed on premises that diverge from the aim of healthcare activity: patient outcome.

The Technological Constitution of Disease

Another reason why technology is so intertwined in modern health care is because it constitutes the basic concept of modern health care: disease. Elsewhere I have argued that technology constitutes the concept of disease (21). First, technology provides the physiological, biochemical, and biomolecular entities that are applied in defining diseases; that is, the chemical elements, the physiological processes, and the bodily functions that constitute disease are defined by technological measures. Second, technology establishes the way we gain knowledge of disease and the way we recognize disease in practice. Technology constitutes the signs, markers, and endpoints that define disease entities, and it strongly influences both the explanatory models of disease and medical taxonomy. Third, technology establishes how we act towards disease: thorough diagnosis and treatment technology determines what is conceived of as disease. Hence, it is impossible to conceptualize, not to say detect or treat myocardial ischemia or hypercholesterolemia without technology.

Motives for Applying Technology in Health Care

There appears to be a wide range of motives for applying technology. Such motives may be more or less hidden, and hence may contribute to the imperative of technology to a variable degree. Some of the motives are individual, whereas others are associated with healthcare organization.

Relieving Anxiety and Avoiding Malpractice Suits. It has been pointed out that there appears to be an undue reliance on technology (43, 34).

In medicine they [machines] relieve the doctor's anxiety. Technology seems to offer answers that are more perfect than the mere human—the very extension of the senses through machines makes us want to believe they are better than the senses. (43, 131)

We appear to apply technology to avoid uncertainty and errors of clinical judgment (33;43, 43). Technology has come to pre-empt the judgment of the clinician (45;43, 34).

In modern health care, technology may to be applied to avoid litigation. Healthcare professionals sometimes document states or events, even though the documentation has no diagnostic or prognostic value. They sometimes follow procedures that have no curative effect, just to be sure that they did everything possible and that nobody will charge them. Thus technological overtreatment of patients may occur due to a fear of subsequent legal proceedings (23, 867). Technology is thus used as an assurance against malpractice suits and has led to *defensive medicine*. This can be another way of explaining the technological imperative.

Keeping the Customer Satisfied. It is argued that many technological procedures are performed because patients demand them. Accordingly, the technological imperative has been interpreted as "the belief that every physician in every hospital should have available for his patients all the technologies of medicine, regardless of cost, questions of priority, or the optimal allocation of resources." (4, 127).

On the other hand, patients also appear to be subject to the technological imperative, because they cannot refuse opportunities that are offered to them. They are afraid that they will regret turning down such a chance (40). Therefore, they may agree to advanced high-technology procedures. Patients, like doctors, appear to believe that they have to try everything possible. They believe that it is expected of them to ask for advanced diagnostic procedures and treatment. This is yet another way of explaining the technological imperative.

The Moral Imperative of Technology. Attending to the patient's demands is closely related to respecting the patient's autonomy. Healthcare professionals might apply

technology as a means of respecting patient autonomy. Correspondingly, they might apply technology for other ethical reasons, such as beneficence or Samaritan compassion. With reference to some kind of moral imperative, they may refuse to turn off the respirator and discontinue treatment, even though it is futile to continue.

Some people recommend the application of technology because they believe that life is sacred. Life is to be saved, regardless of the quality of the life that is saved (2;23, 870). It has also been argued that technology contributes to respect for moral principles; for example, in obstetrics the fetus has become a patient in its own right due to modern technology (20).

Technology may also be applied to avoid moral dilemmas. Reiser has pointed out that the introduction of the stethoscope was a response to moral concerns (physical examination of a young woman) (33), and Rothman argues that in the 1950s to 1970s, equipment such as respirators and dialysis machines were used in order to avoid the moral challenges of rationing (35). Hence, the technological imperative can be explained in terms of moral motivation.

Technology Promoting Power. It has also been argued that technology is applied because it preserves and promotes paternalism. Technology has enhanced the potency and exclusiveness of professionals in their dealings with life and death. Medical science and technology give the physician an objective account of disease, which makes it legitimate to ignore the perspective of the patient (3;14, 1,104;43, 34;45).

The physician's knowledge has become more and more exclusive. Laypersons cannot question their decisions: "We are the only ones dealing with life and death, and if we say we need a new echocardiograph in our hospital, we need it" (43, 136). The public healthcare system represents a complex organization of private and public agencies, institutions, individuals, and industries; however, the suppliers of health care both control and create demand (4, 127). The application of technology depends upon a disorganized series of decisions by individual physicians that leads to an allocation of resources that rarely coincides with optimal social benefit (4, 128).

Technology might also be a factor that has relevance for the healthcare professional's personal career. Technology has a high status in society in general and in health care in particular: high-technology specialties of health care appear to be held in higher esteem than low-technology specialties. Diseases that are detected and treated using high-technology equipment have a higher status than, for example, psychiatric disease and geriatric diseases, which require less use of high-technology equipment (1). Hence, mechanisms of power allocation have been proposed as explanations of the technological imperative.

Consequently, technology is a factor in competition between healthcare institutions. High-technology hospitals appear to be highly esteemed both by the public and by professionals. "The increasing commitment to more and more sophisticated technology has been stimulated by the hospital's concern with status and prestige and by the financial incentives of third party payers" (43, 96). Technology is a means of attracting patients. Likewise, technology is used as an important incentive for recruiting healthcare professionals.

The motives for applying technology may be organizational or societal, such as profit and marketing interests (43, 131, 136), professional and industrial interests (5;20), or particular class interests (35). In other words, the technological imperative can be explained in terms of particular interests.

Hence, there are many explanations of the technological imperative related to the motives and interests behind the application of technology.

Thus, there are both a vast variety of descriptions of the technological imperative and many explanations of it. This illustrates the fact that there is not only one conception of the technological imperative in health care, but many. Some of these are controversial, as will be discussed in the following section.

IS THERE A TECHNOLOGICAL IMPERATIVE IN HEALTH CARE?

The discussion so far illustrates the fact that in order to address the question of whether there is a technological imperative, we have to make some qualifications. In other words, we have to be explicit about which conception of the technological imperative we are addressing. For instance, if technological imperative is conceived of as technology being a powerful factor in the development of health care, it becomes hard to reject. Technology has clearly altered the possibilities as well as the practice of health care, and has become an important element in its change.

Even more, if the technological imperative is identified with the notion of the incomprehensibility of technology (26), then there certainly is a technological imperative. No single person understands every aspect of the wide range of technologies used in health care. In some way or another, even to the technological expert, technology is incomprehensible, and thus it can be conceived of as an imperative. If, however, technology is regarded as an inescapable necessity, we might be reluctant to conclude that we are subject to a technological imperative (37).

This demonstrates the fact that whether there is a technological imperative depends on our conception. Does this mean that the question of whether there is a technological imperative in health care is senseless? Not necessarily. What this demonstrates is that the question needs to be qualified. For the question to be meaningful, we have to know what the conception of the technological imperative is, i.e., we have to be explicit about which of the many descriptions and explanations we refer to.

Are, then, any of the connotations of the technological imperative particularly important? Does it matter whether we are subject to a technological imperative? Several of the abovementioned notions of the imperative are of little importance. If the technological imperative is conceived of as an apparently self-augmenting growth of technology, explained by our demand for and interest in technological solutions to our problems, then it only describes the sum of our preferences and does not affect human agency as such.

One aspect where it appears to be crucial whether we are subject to an imperative is with respect to responsibility. If there is a conception of the technological imperative that alters our responsibility for our actions, then this has important consequences. Can we identify such interpretations?

The Technological Imperative as Reduced Responsibility

Let us start with the case where the technological imperative is conceived of as something that reduces our responsibility. There appears to be only one of the accounts discussed above that qualifies for such a conception, and that is technology conceived of as a monster. If there were an autonomous technological monster directing our actions, it would certainly reduce our responsibility for our actions with regard to technology. We would be subject to a personified technological imperative.

This position, however, appears to be extremely difficult to defend. For example, we should expect that such an autonomous technology had some kind of subjectivity (apperception) or personhood. However, instead of identifying its subjectivity or outlining the character of technology, deficiencies in human nature have mainly been described. It might, of course, be claimed that the personhood and character of technology are unknown to us, and that technology controls us through its covert existence. This makes us governed by a ghost, and ghosts are dangerous and controversial in causal explanations.

One might argue that if technology imposed some law-like necessity on our actions, it would reduce our responsibility. However, it appears to be arduous to identify such a law-like necessity. It is difficult to confirm that a particular application of technology, or the historical development of technology in general, follows a law that contradicts the human agency.

Moreover, it appears to be impossible to falsify such a theory (12). We could always claim that there is an as yet unknown causal factor that necessitates our actions with technology (ad hoc hypothesis).

Is there no way, then, in which our actions regarding technology reduce our responsibility in health care? To answer this question, let us return to the various conceptions and explanations of the technological imperative discussed earlier. The explanations of a technological imperative appear to refer to different organizational levels: individual, institutional, and societal.

The Technological Imperative as Displaced Responsibility.

On the individual level, what has been conceived of as a technological imperative was explained by personal motives. This does not reduce the agent's responsibility, and in this sense, there is no imperative. Technology is applied as a means of achieving a specific result, such as relieving anxiety, avoiding litigation, or promoting one's own career. The individual might argue, however, that his or her actions related to technology are enforced. They are directed by the institution. For example, a particular physician might claim that the use of a particular type of technology is directed by hospital policy; hence, orders and directives reduce the physician's responsibility, and can as such be regarded as an imperative.

This, however, is an institutional imperative and not a technological one. The institution's policy is part of its overall strategy, and the reason to use a particular kind of technology might be because it is the most efficient technology available, because it is competitive, or because it increases the status of the institution. Again, technology in this case is only a means to an end, and it does not reduce the institution's responsibility.

It might be argued, however, that the institution's application of technology is controlled by social organizations, such as governments, national institutions, and insurance companies. Legal or economic measures that regulate technology might appear to be compelling to healthcare institutions. They reduce the institution's responsibility, and in relation to technology, this can be conceived of as a technological imperative. Here again, the responsibility is not removed, but is placed at a different societal level.

Can we then identify a corresponding technological imperative on a societal level? Is there an imperative where society at large is coerced by technology? Referring to the explanations discussed above, one could argue that a general belief in technology is such a compelling force. However, if there is a general belief that technology itself directs decisions about its application, it is not imperative. First, it appears to be difficult to explain how such a general belief in technology could reduce our responsibility toward technology. Second, if we believe in technology, it might be because it helps us to pursue the good life, i.e., it is a means to promote our ends. However, if we think that a general belief in technology is due to an authority that directs human will, we again seem to be chasing a ghost.

Hence, the various explanations reveal different conceptions of the technological imperative according to the organizational level: individual, institutional, and societal. The healthcare professional can regard an imperative in the context of his or her institution, reducing his responsibility toward technology. Correspondingly, a healthcare institution can be compelled by social organizations. This imperative can, however, be explained by a displacement of responsibility to the proximate organizational level, and is not a technological imperative. Thus, it appears to be difficult to identify situations where overall responsibility for man's actions with regards to technology is reduced. Therefore, there are no conceptions of the technological imperative that appear to defend a reduction of man's responsibility toward technology.

So far, the technological imperative has been discussed in relation to reduced responsibility. Are there other ways in which responsibility can be altered in relation to technology? Obviously, there might be situations where responsibility is increased.

The Technological Imperative as Increased Responsibility

Technology has become ever more powerful, in particular in health care. Basic physiologic functions can be controlled and manipulated. Technology facilitates diagnosis and treatment of conditions that previously were fatal. This increase in power appears to correspond to an increased responsibility. The possibility of technology appears to oblige, i.e., with technology *possibilis oblige*. What then, does this obligation mean with regard to the technological imperative?

First, if we do not recognize the increased responsibility, technology might become harmful to us, not because of an imperative but because of the irresponsible use of its powerful potential. In other words, regarding technology as "evil" or "imperative" can conceal our responsibility, and make us ignore its negative consequences. A self-imposed submission to a technological imperative in terms of neglected responsibility can be extremely dangerous.

This illustrates how technology influences our autonomy. It is argued that the technological imperative restricts our ability to choose and act; that is, it reduces human autonomy. However, as argued, technology expands our choice and agency. Hence, instead of diminishing our autonomy, technology increases it. Instead of reducing our responsibility (due to an autonomous or imperative technology), technology enhances it. Therefore, there is a moral imperative, and not a technological one.

Second, the increased responsibility that results from the greater possibilities provided by technology might induce restrictions on our choice of possibilities. We might not want to clone human beings or to develop all the possibilities provided by prognostic technology. In other words, there are some responsibilities we do not want. We are reluctant to accept responsibility for selecting lives, for example, by using sex-selective abortion, genetic predictive selection, and cloning. In other words, some possibilities raise moral dilemmas about choices that are repellent to us.

Third, obligations related to the extended possibilities provided by technology can be conceived of as a set of moral principles of how to act in relation to technology in health care. Corresponding to Jennett's categories of inappropriate use of technology (23), these principles could be:

1. We should apply technology when necessary, and not in cases where its application is futile or detrimental.

2. We should use technological methods only for conditions that respond to intervention.

3. We should not apply technology if its application only prolongs the process of dying.

4. The anticipated benefits should outweigh the costs.

5. We should apply technology only when its application does not divert resources from alternative healthcare activities that have better results. We should not use new costly technological methods for diagnosing conditions for which no treatment exists, at the expense of providing efficient treatment for other conditions.

6. We should apply diagnostic and therapeutic technological measures only in accordance with the wishes of the patient and in a manner that does not violate the patient's autonomy (except, perhaps, for certain psychiatric conditions).

7. We should apply technology in a safe manner. In order to achieve the intended results from our application of technology and in order to avoid negative consequences, we should follow specified procedures and perform specific actions.

These principles might appear obvious, but as has been illustrated in this article, they have not been followed. This has promoted the conception of a technological imperative.

Thus, in order to benefit from technology and in order to avoid any negative consequences, we must accept the responsibility that results from the puissant possibilities that

it provides. In order to apply technology for the benefit of patients, we must conform to certain norms and follow specific procedures. To be a good healthcare professional, one has to recognize one's responsibility and follow the correct procedures for the application of technology. In other words, one must follow the moral imperative (1–7). In addition, we must discuss the possibilities that technology provides and be explicit about which responsibilities we are prepared to accept. Desiring the possibilities but rejecting the responsibilities is a dangerous combination.

CONCLUSION

This article has presented a wide range of descriptions and explanations of the technological imperative in health care. Whether there is a technological imperative depends on what we mean by the technological imperative. When discussing the technological imperative, we should be explicit in terms of which conception we are referring to.

One important conception of the technological imperative is that it is something that alters human responsibility. It can be argued that there is no technological imperative in the sense that it reduces man's responsibility with regard to technology in health care. Human beings invent, construct, produce, commercialize, implement, and apply technology, and as such are responsible for all these aspects of technology. Hence, although there are many conceptions of a technological imperative in health care, none of them justifies a reduction in our responsibility. However, the individual healthcare professional and a specific healthcare institution can experience an imperative toward applying technology. Although such situations appear to reduce their responsibility, the responsibility is shifted, not diminished. There is an imperative, but not a technological one.

Additionally, it can be argued that the enhanced possibilities provided by technology lead to increased responsibility, and that this, although it can be conceived of as a technological imperative, actually is a moral imperative. There is reciprocity between technological possibility and moral responsibility. It is important for healthcare professionals and decision makers to recognize this increase in responsibility, and in particular to recognize the importance of assessing technology thoroughly.

Thus, the technological imperative can be a fruitful analytical tool to investigate our relation to the application of technology in health care. However, the imperative might become dangerous if it makes us believe that our responsibility toward technology is reduced. As has been argued, there is no technological imperative in terms of reduced responsibility; on the contrary, technology increases our moral responsibility.

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