

The Advance of Technoscience and the Problem of Death Determination: A Promethean Puzzle¹

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Abstract: Death determination has since long been a topic of intensive technoscientific and medical involvement. Due to advances in twentieth-century medical technology, the distinction between life and death has become less evident. Ambiguities appear when we start to use life-support technologies in order to save lives, bringing about “tragic artifacts” such as brain death and persistent vegetative state. In this paper we ask how this technoscientific and medical involvement shapes our understanding of death. We provide an overview of medical literature that has appeared on (brain) death determination, highlighting thereby the role that technologies played in its establishment. Subsequently, we develop three philosophical interpretations of technological death determination: With Agamben and Marcuse as the installation of political power; with Don Ihde as an existential choice for the inevitable; and with Jacques Derrida as an encounter with the ineradicable mystery of death. To conclude with, we argue that technological death determination reveals an intrinsic, paradoxical connection between human’s technicity and its ignorance of death.

Key words: death determination, brain death, philosophy of technology, technicity, responsibility

1. Introduction

In 1968, Martin Halley and William Harvey published an article in *The Journal of the American Medical Association* discussing unwanted discrepancies between legal and medical definitions of death (Halley and Harvey 1968). They described the case of a man with severe brain damage and skull fractures who was put on

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artificial respiration after he stopped breathing. The man cannot breathe on his own: he stops breathing again after he is taken off respiration. However, in the meantime—whilst on the respirator, that is—his kidneys are removed for transplantation. Was this person already dead when transplantation began? At the time, there was no legal or medical consensus about how to deal with this problem.² The editors of the journal wrote a commentary titled “What and When Is Death?,” ending with the following words:

[I]t seems ironic that the end point of existence, which ought to be as clear and sharp as in a chemical titration, should so defy the power of words to describe it and the power of men to say with certainty, “It is here.” (*Journal of the American Medical Association* 1968, 540)

In that same year, a committee specifically assigned to this problem described this kind of irreversible coma as *brain death*. This concept has been a major topic of debate for over fifty years. Brain death today, even if its criteria are almost universally adhered to, is considered “well settled, [but] still unresolved” (Truog, Pope, and Jones 2018, 336), as “medical, social, and legal controversies associated with determination of death by neurologic criteria persist” (Lewis et al. 2018, 425).

Technological developments have made brain death clearer and well-defined, but also more complex and contested. The established medical consensus about the neurological differences between life and death, for instance, does not remove our unease when confronted with “living cadavers,” or people that are “twice dead” (Lock 2002, 1). The boundary between life and death *ought* to be clear and sharp, so we intuit, because it is literally of vital importance. However, as the above story shows, ambiguities appear when we *ought* to use technologies in order to save lives. Although the ambiguous—or hybrid—nature of such technological involvements are often discussed in current continental strands of the philosophy of technology, little attention has been paid to the technological determination of death, and brain death specifically.³

In this paper we explicitly ask how technoscientific and medical involvements shape our understanding of death. We provide an overview of medical literature that has appeared on (brain) death determination and neighboring phenomena, highlighting thereby the mediating role that technologies played in their establishment. Subsequently, we provide three philosophical evaluations of technological death determination, understanding it as the installation of political power; as an existential choice for the inevitable; and as an encounter with the ineradicable mystery of death.

The paper is structured as follows: we begin by discussing two concrete examples of “tragic artifacts” that technologies have brought about: brain death and persistent vegetative state (2). Thereafter, we discuss three philosophical responses to such artifacts: one explaining the intricate connection between death and technology in terms of a political *ideology* such as defined by Marcuse and Agamben (3), another suggesting that technological developments make us face an increasingly large *existential responsibility* towards death, which is argued for by Don Ihde (4). We then turn to Derrida, arguing that the technoscientific objectification of death allows for a gradual unraveling of the secret of death, but at the same time envelops it in new *mysteries* (5). To conclude, we argue that the problematic encountered in the context of death determination reveals an intrinsic connection between human’s technicity and its ignorance of death, one that is already present in the myth of Prometheus (6).

2. The Technological Determination of (Brain) Death

Death determination has been a topic of intensive technoscientific and medical involvement for a long time. As will be shown in this section, the way death is determined and understood is mediated by such technoscientific involvements (cf. Ihde 1990; Verbeek 2005). The technological mediation of death brings about new definitions of death, and also specific problems that we encounter in our relation with death. This will be illustrated by two contemporary cases: brain death and (persistent) vegetative state. Though both are markedly different—generally, one patient is deemed dead, the other alive—the cases are comparable still, namely as “tragic artifacts” that appeared on opposite sides of the boundary between life and death.⁴

In many cases, it is relatively unproblematic to determine whether someone is dead. However, the question of what essentially is the difference between a dead and a living body has been discussed for centuries in medicine and philosophy. In retrospect, and somewhat anachronistically, one could say that the first representative of the brain death definition was the twelfth-century rabbi and physician-philosopher Moses Maimonides. He observed that a decapitated body could still move, that is: have convulsions. He argued this should not be considered a sign of life due to the lack of central integration and direction of movement.⁵ Descartes (who famously sought the neural connection between extended body and thinking soul in the pineal gland) made similar observations in his *Discourse on Method* (part V). Such discussions on where to locate the soul in the body became more

lively when the decapitation mechanism of the guillotine provided new subjects/bodies for observation and experimentation (cf. Chamayou 2008).

In the eighteenth and nineteenth centuries, a popular fear of being buried alive led to diverse technological inventions that sought to verify whether someone's signs of life were only temporarily absent, or still present in minimal degree (cf. Pernick 1987, 25). One can think of techniques such as smelling salts, or blowing a trumpet in the ears, or more gruesome: long needles with little flags stuck into someone's heart to detect its (lack of) movement. The fear of being buried alive surpassed for a while even the fear of death itself, which is why special regulations appeared to determine death on medical grounds, and coffins were designed with bells, levers, and other alarm mechanisms to allow for signaling if one was waking up buried and in need of help. Such fascination with the possibility of re-animation was likely fueled by timely experiments with vivisection, galvanism (the stimulation of dead tissue with electric current), and suspended animation (cf. Pernick 1999).

Advancement in medical technologies at the end of the nineteenth century and the beginning of the twentieth century created a different array of medical opportunities, grey zones, and moral difficulties. Absence of cardiopulmonary function was still the standard indicator of death (as is the case today). But techniques such as heart massage—aided by the development of the pacemaker and defibrillator—made the application of this criterion more complicated (Akselrod, Kroll, and Orlov 2009). Cardiopulmonary function—the circulation of oxygen-rich blood—could be restored granting that conditions permitted it. Whilst these resuscitation efforts still focused on the heart, neighboring technical developments called for a more radical shift in death determination. In 1959, French neurologists described a group of patients as being in a *coma dépassé*, a state “beyond” coma. These patients had lost all capacity to breathe due to excessive neural damage, though they were now sustained artificially by a new generation of positive pressure ventilators, originally devised by Bjørn Ibsen for combating the polio epidemic earlier that century. Without consciousness, and with no prospect of recovery, all treatment and support appeared futile for these subjects. However: as long as death was understood in cardiopulmonary terms only, stopping the respiratory machine would become tantamount to murder. Accordingly, technological developments in medicine constituted a need for the determination of death in neurological terms.

The landmark article defining criteria for determining such *irreversible comas* as a new type of death, (i.e., “brain death”) was published in 1968 by an Ad

Hoc Committee of the Harvard Medical School (1968). Right from the outset, the authors indicated that the need for establishing such criteria was prompted by not one, but in fact two, distinct technological developments. Firstly, the mentioned resuscitative and supportive first-aid technologies that supported circulatory function whilst the brain was irreversibly damaged. Secondly, great strides in organ transplantation techniques called for crystal-clear guidelines. For besides *ending* artificial respiration without being called a murderer, the technology also allowed for the *continuing* of respiration, facilitating the safe transplantation of vital organs, such as the heart and liver (Halley and Harvey 1968). By the public these new options were met with fascination, but also with distrust: it was feared that doctors might want to “hurry a death in order to complete a transplant,” adding so grave robbery to the charge of murder (Pernick 1999, 16). Developing brain death criteria should take away such sinister suspicions.

The proposed criteria for diagnosing brain death were: 1) Unreceptivity and Unresponsivity, 2) No Movements or Breathing, 3) No Reflexes, 4) Flat Electroencephalogram—the latter only being recognized as “of great confirmatory value” (Ad Hoc Committee of the Harvard Medical School 1968, 338). Presently, the consensus is that these criteria can still be reliably applied (Rosenberg 2009, 1173). Nonetheless, the concept of brain death has been a major topic of debate for over 50 years because it admits many nuances. When speaking of brain death as synonymous with the irreversible loss of functioning of the human organism as a whole—a most general description—it must be established, firstly, *what kind* of brain function loss provides us with a brain death *definition*. Secondly, reliable *criteria* are needed, indicating *that* this function is indeed lost (the criteria mentioned above). Also, thirdly, one should consider the question if, when, and how this loss is considered an *irreversible* affair (cf. Lynn and Cranford 1999). At all these levels, technological advances have been involved in varying degrees.

Regarding the specific function of the brain being lost, a difference appeared between *whole brain death* and *brainstem death* definitions after neuropathological studies confirmed the crucial role of the brainstem (Mohandas and Chou 1971; Pallis 1982). Both definitions consider the “irreversible cessation of the organism as a whole” as the ultimate criterion of death. However, they differ in their interpretation of where to locate this state of affairs, and how we can assess it most securely. In the 1970s, the *neocortical death* position was proposed by Robert Veatch. Veatch argued that brain death should be defined in terms of the irreversible loss of the capacity for consciousness and social interaction (Veatch 1975). Following this perspective, neural correlates of consciousness and personhood

should become the central criteria in defining death. This implies that patients currently diagnosed as in a permanent vegetative state and anencephalic babies would be classified as dead. Currently, this position has little practical appeal as we lack any clear criteria to discern what brain activity should be considered as signs of consciousness (Laureys 2005; President's Commission 1981; President's Council on Bioethics 2008). These so called *higher-brain approaches* are therefore of theoretical and philosophical interest (cf. DeGrazia 2016), though remain as of yet disconnected from medical practice.

Alan D. Shewmon has contested the legitimacy of brain-centered death definitions, arguing that the integration of the organism as a whole is not solely and crucially dependent upon the function of the brain (Shewmon 2011). While sustained by the respirator, the body remains oxygenated, feels warm, it appears sleeping, hairs and nails continue to grow, and if supported properly, the body can mature, and babies have even been delivered from brain dead mothers. That is: many crucial, integral functions of the “human organism as a whole” can remain present for increasing amounts of time with adequate artificial aid, so Shewmon argued, thereby casting doubt upon brain-centered definitions.

Then there is the issue of possible misdiagnoses. In medical literature—and contrary to popular belief—it is stressed that there has been “no evidence to date that anyone correctly diagnosed [with brain death] will ever regain consciousness[,] or breathe without a ventilator” (Truog, Pope, and Jones 2018, 335; see also Wijdicks et al. 2010).⁶ The unwavering hope of relatives contesting such medical expertise often stir public unrest and admiration. The already mentioned neurologist, Alan D. Shewmon, recently testified before court in the tragic case of Jahi McMath, a young girl declared brain dead in 2013 but kept on life support by her family until her “second” demise in 2018.⁷ From extensive video material, Shewmon deduced that Jahi McMath appeared as if reacting to voice commands. Also, she reportedly sexually matured over time and had three menstrual periods, which, if true, could imply activity of the hypothalamus and hence sustained (if minimal) intracranial blood flow. Dr. Shewmon declared therefore in 2017 that Jahi did not qualify as brain dead, but instead showed signs of a minimally consciousness state, suggesting that the diagnosis in 2013 must have been a false positive (Shewmon 2018). This whole matter is highly contested, though, since Jahi McMath was kept at an undisclosed location, limiting counter-expertise assessment (Lewis 2018). Jahi McMath's second demise has rendered all such discussions moot.

Still, although brain death is quite unanimously considered (and defined even) as an irreversible state of affairs, misdiagnoses have indeed occurred. For in-

stance, in 2002, a 19-year-old Danish woman named Carina Melchior was falsely diagnosed brain dead and made a full recovery. Her father, greatly upset, reportedly commented: “Those bandits in white coats gave up too quickly because they wanted an organ donor” (Hsu 2012). This shows that the alliance between organ donation and brain death remains a precarious one. Surprisingly, when Carina Melchior’s story was broadcasted as a documentary entitled “Pigen der ikke ville dø” (The girl who refused to die), organ donation rates briefly went up, instead of plummeting, according to a spokesperson of the Danish national organ donor register. Clearly, in the eyes of many, organ donation provides solace and a sense of meaning to what was otherwise perceived as a meaningless death (cf. Douglass and Daly 1995).

In the popular media coverage of stories such as those of Jahi McMath, crucial neurological distinctions between vegetative state, coma, and brain death have often been mixed up. Specialists respond to such confusions by underlining that “[b]rain death is simply death. It has nothing to do with being in a coma. It does not refer to a permanent vegetative state. It does not refer to being severely brain damaged” (Caplan and Magnus 2014; see also Magnus, Wilson, and Caplan 2015; and Burkle, Sharp, and Wijdicks 2014). And if “seeing is believing”: a PET or CT-scan of a brain dead body indeed shows a clear “hollow skull-sign,” a complete lack of activity “tantamount to a “functional decapitation”” (Laureys 2005, 903; see also: Wijdicks 2001, 1218–19).⁸ In comparison, in the case of vegetative state, brain-stem functioning is still intact and cerebral metabolism continues, even if at a decreased scale (cf. Owen et al. 2006).⁹ Vegetative state patients breathe and sometimes even swallow on their own; they can also make noises and move, open their eyes, and often the only life-support technology needed is a feeding tube. Though unaware of themselves and their surroundings, the patient in a vegetative state has also chances of revival of consciousness. But the latter is in fact rare after the first months have passed. For this reason, their prolonged unconscious survival is sometimes referred to in the literature as living “a fate worse than death”—not merely for the patient (who, after all, is presumed unconscious), but also for those people close to them (Freeman 1992; Lavrijsen et al. 2005).

Persistent vegetative state can be considered a second “tragic artifact” that was mediated by technological developments. We will now briefly illustrate this by reciting the famous case of Theresa Schiavo, a patient whose condition gave rise to a vivid public debate in the United States in the late 1990s and early 2000s.

On February 25th 1990, Theresa Marie Schiavo suffered cardiac arrest. She was resuscitated, intubated and ventilated, but severe brain damage had already

occurred. In the months thereafter, several tests were performed leading to the diagnosis of persistent vegetative state. Different treatments were pursued in order to bring Mrs. Schiavo back to consciousness, amongst which brain stimulation and an experimental thalamic stimulator implant, but none of these attempts succeeded.

In 1998, Mrs. Schiavo's husband and legal guardian Michael Schiavo appealed to the Florida court of law in order to let his wife's feeding tube be removed. He argued that she would not have wanted an artificially prolonged life. "I don't want to be kept alive on a machine," she purportedly had once said. Her parents opposed the husband in court, however. They felt that their daughter was still conscious, and, as she had been a devout Catholic, would not want other people deciding on her moment of death (Schindler Schiavo v. Schiavo 2005). There followed an extensive legal battle with enormous media-coverage that was pursued up to the highest courts, even letting president George W. Bush take a leave from his vacation in order to sign a legislation keeping Schiavo intubated. Fifteen years after the incident, in March 2005, the federal court ruled ultimately that the feeding tube should be disconnected. Mrs. Schiavo died later that month.

It was the conception of Mrs. Schiavo being in a persistent vegetative state, confirmed (and contested) by brain scans and other technological means of determination that gave rise to much of the debate. Whilst still on life-support, video-footage was gathered and presented before court, which, according to the parents, was showing that Mrs. Schiavo was still reacting to their voices. The court, aided by four neurologists, did not subscribe to the interpretation of the parents, and decided in favor of Michael Schiavo's appeal. (One of the medical doctors dissented though, and conveniently chosen excerpts of the video footage were later spread on the Internet causing uproar.) After Schiavo's death, brain scans were made once more, showing that a significant part of the inner brain tissue had withered away. The grave marker the husband designed surmises the strange nature of Mrs. Schiavo's and her family's ordeal. It states 1990 as the year of her "departure" from this earth, and 2005 as the year in which she found "peace." Obviously, her parents would have stated this differently: for them, their daughter had continued to be by their side somehow and was now put to rest unwillingly.

The Schiavo case shows once more that the line between life and death is not a clear-cut one, and that this indefiniteness is mediated by technologies. On top of that, it shows that the verdict through which the line between life and death is drawn—apart from not always being univocal itself—is also not univocally taken up by people (cf. Demertzi 2011; Kompanje et al. 2012). To put this differently: for the one person vegetative state might be approached as an illness from which

one might recover. For the other, that very same condition is a cruel and unnecessary extension of a person's inevitable struggle with death. As has been stressed above, brain death is neurologically something very different from vegetative state. However, without the development of first-aid and subsequent life support technologies neither brain dead bodies nor vegetative state patients would have existed (Laureys 2005). For this reason, both are comparable as "tragic artifacts" of medical technologies, neighboring so to speak on opposite sides of the boundary between life and death.

As for brain death, it remains odd to hear that people who have been declared brain dead consequently need to be uncoupled from *life-support* technologies, implying thereby that there is somehow *life* left to support. This odd feeling is not only present among the lay public, but also physicians and specialist nurses have a share in this (Youngner et al. 1989; Bardell et al. 2003).¹⁰ Furthermore, in Japan, brain death was for decades not accepted as synonymous with death, indicating the possibility of different cultural responses to neurological differentiations (Maruya 2008). Anthropologist Margaret Lock tried to explain this difference of reception, which in turn led her to question the readiness with which the rest of the world adopted brain death and its ensuing organ donation practices. Referring to both Bruno Latour and Donna Haraway, Lock suggests that the brain dead body should be considered a *hybrid*, a human-technology coupling, or cyborg, that resists our preconceived, modern, typically Western notions of either being "subject" or "object," either being "alive" and worthy of care, or already "dead" and material for others. The very existence of such hybrids, she argues "is a potential threat to the moral order" (Lock 2002, 41). In comparison, she concludes in her reflection:

Whereas in North America the thought of being attached in an unconscious state to a machine is humiliating and demeaning, quite different reactions are common in Japan. Rather than visualize the machine as doing the work for the human, as taking over the empty shell, in Japan some people may conceptualize machine and human as working in partnership, creating an animated hybrid that can overcome all odds. (Ibid., 371)

Such descriptions in terms of human-machine partnership are revealing indeed, inasmuch as they affirm the intimacy developed between life-sustaining technologies and the biological body, sustaining not so much life *or* death, but allow for new boundary cases and grey zones emerging in-between.

Then again, and both the Jahi McMath case the Schiavo case testify to this, what remains problematic is precisely the question whether or not to *uncouple*

this human-machine hybrid; when to “pull the plug” as it is sometimes crudely put. The separation of the human and technology, the dismantling of the cyborg, is part of the tragedy here. This is where contestation and different opinions arise and appeals to a higher authority are made, be it the second opinion, the public opinion, the ruling judge, commanders in chief, or religious power. Even though the boundaries between life and death become hybrid, blurred, moved, refined, and redefined by technological and medical expertise, in the final analysis, some other kind of arbitration seems needed, both on a political and individual level for the people involved, in order to say: “It is here” (*Journal of the American Medical Association* 1968, 540).

In the following three sections, we will look at three philosophical interpretations of the technological mediation of death that address the mentioned ambiguities and the simultaneous need for arbitration saying that death is indeed “here.” The first understands death determination as the installation of political power. The second in terms of an existential choice for the inevitable. And the third understands the ambiguities involved in death determination as an encounter with the ineradicable mystery of death. The first and the second response reflect on how the ambiguities can be resolved, while the third response tries to offer an explanation of the ambiguity itself.

3. Death as Ideology

The two “tragic artifacts” arising in the intertwining of death and technoscientific objectification point to the fact that there is a certain *arbitrariness* involved in coming to a scientific, biological definition of death. Because of this, Giorgio Agamben understands death determination as a form of biopolitics,¹¹ and goes so far as to say that because of the unclarity involved in the determination of brain death, “life and death are not properly scientific concepts but rather political concepts, which as such acquire a political meaning precisely only through a decision” (Agamben 1998, 164). According to Agamben, determining whether someone has died is not a mere biomedical assessment, but also clear stakes are involved. For him, this was indicated by the co-evolution of the possibility of organ donation and the increasing need to develop clear criteria for death determination. Only when understanding death as the product of a decision-making process can we see why brain death—“a stage of life beyond the cessation of all vital functions” (ibid., 160)—can be a category that is applicable to a body that is still breathing with the help of artificial respiration.¹² Accordingly, so Agamben argues, the categorization of a body as “brain dead” presupposes that the medical agreement about what

constitutes “a life that may be killed without the commission of homicide” (ibid., 165) is also politically determined.

A “killing without homicide” requires the presence of legislation stating that when medical doctors take a breathing body off artificial respiration they are not committing a homicide—and indeed this was precisely the purpose of the 1968 report of the Ad Hoc Committee of the Harvard Medical School. This, according to Agamben, turns the determination of death into a problem of the State, thereby suggesting that the determination of death is also contingent on decisions made on the level of political ideology. A more principled version of this argument that not only focuses on brain death, but understands death determination in general as the installation of political power can be found in the essay *The Ideology of Death* by Herbert Marcuse,¹³ who states that

the natural fact of death becomes a social institution. No domination is complete without the threat of death and the recognized right to dispense death—death by legal verdict, in war, by starvation. And no domination is complete unless death, thus institutionalized, is recognized as more than natural necessity and brute fact, namely, as *justified* and as *justification*. (2011, 128)

This has the consequence (1) that death is perceived as a natural condition while it is *actually* also a condition that is socially institutionalized, and (2) that because acceptance of death assumes a compliance with social institutions, it is implicitly assumed that the limits set on life by social institutions are justifiable in one way or another. From this perspective, the technoscientific quest for determining death witnessed in the last decades should be understood as a quest that searches to answer a question not only of scientific, but also of political relevance.

Acceptance of death always involves, for Marcuse, an acceptance of the societal status quo, affirming the limits set on human freedom by institutionalized power. This acceptance has political urgency because “the established civilization does not function without a considerable degree of unfreedom; and death . . . sustains unfreedom” (ibid., 129). Accepting that we are not free to choose when death is here becomes more urgent due to the entanglement of death and technology. As ambiguities increase, it becomes evident that the distinction between “alive” and “dead” is made on the basis of clear political and legal consensus. In the absence of such a consensus (i.e., when the viability of “brain death” is challenged, such as in the case of Jahi McMath), it becomes visible that the limits set on life are not always self-evident and provided by natural facts, but are socially institutionalized.

It is for the benefit of consolidating socio-political institutions, so Marcuse argues, that individuals are put into a situation in which they “experience death not only as the biological limit of organic life, as the scientific-technical limit of knowledge, but also as a metaphysical limit. [Because] to struggle, to protest against the metaphysical limit of human existence is not only foolish, it is essentially impossible” (ibid., 129). Resistance against technoscientific knowledge remains a possibility because it is through the advance of the technoscientific quest for the determination of death that the contingency of the limits set on life becomes visible. This is why politics complements death determination with an ideology that should be accepted as a necessary, metaphysical limit that evades every potential form of resistance.

Therefore, according to Marcuse, the metaphysical limit of death on human existence is not an absolute given; here the ideology of death becomes manifest. The metaphysical limit set on human existence by death falsely appears as a condition *sine qua non* for human existence, while it is in fact an *ideological* limit that is contingent on particular processes of decision-making and is better understood as an exercise of political power: “Compliance with death is compliance with the master over death: the polis, the state, nature, or the god. Not the individual, but a higher power is the judge; the power over death is also the power of life” (ibid. 130). Accordingly, death and the limits it sets on human existence is presented as a metaphysical inevitability in order to eliminate the possibility of conceiving of death—and therefore of political and legal institutions—as something that can be challenged.

And yet, according to Marcuse this not the whole story. Compliance with the limits set on life through the politics of death is not simply a matter of obeying political rules, but also contains an element of the willingness of self-betrayal: “But [political compliance] is only half the story. The other is the willingness, the wish to quit a life of untruth—a life which betrays not only the dreams of childhood but also the mature hopes and promises of man” (ibid. 130). By accepting that death determination is a problem of the state (i.e., an ideology), individuals fail to come to terms with death existentially as they refrain from taking responsibility for their own fate. Accordingly, the ideology of death ultimately creates a situation in which an existential relation with death is no longer possible; life and death are then problems of the state, not of the individual.

4. Death as a Choice

Different from the (bio-)political interpretations of Agamben and Marcuse, Don Ihde addresses death determination on an individual, existential level, by describing a choice he had to make on behalf of his mother. Also Ihde calls for deeper existential involvement with the boundaries between death and life. Don Ihde's perspective is of interest here because it assumes a particular anthropology that puts human's engagement with technology at center stage, and explicitly asks how our understanding of death co-evolves with technological developments. What it is to encounter death in our technological times is an issue Ihde speaks about in his *Technology and the Lifeworld* (1990) when describing the passing away of his mother. After a necessary, invasive surgery had taken place, his mother's health had started to decline rapidly. The various prospects of further treatment did not look promising, still a choice had to be made:

I thus 'chose' an alternative that had not been mentioned by the surgeon although it had been discussed with the family physician: proper pain-relieving medication but no further surgical procedures. This was clearly 'deciding a death.' It occurred two days later. (Ihde 1990, 181)

Putting the "choice" he had to make in scare quotes, Ihde identifies this difficult situation as a Sartrean predicament created by our technological civilization:

What has changed in this technological context? Biologically, death remains inevitable. There remains a border, against which death occurs. But in approaching that border, technological civilization created what I shall call a 'Sartrean' situation in which I increasingly must 'decide my own death.' That is the burden to be placed upon conscious decision. (Ibid., 181)¹⁴

In order to explain the change brought about by technology, Ihde discerns in this passage between the actual "occurrence of death," and the inevitable "border" against which it occurs. That border is for him the biological inevitability of death. Approaching this inevitable limit of life, so Ihde's reasoning goes, technology increasingly places upon us the burden to decide *when*, *where*, and *how* death actually will occur; a type of conscious decision bringing about a Sartrean existential situation in which "to refuse to decide is also a decision" (ibid., 182).

It is important to add here that Ihde is generally quite wary of making the distinction between the "natural" (or: the biological) and "artificial" circumstances too strongly. In various publications, he argues that our scientific conception of na-

ture has always been established through technological means.¹⁵ This, accordingly, means that also death's inevitability—as a biological fact that is—is not available to us straightforwardly. We can clarify Ihde's philosophical perspective by referring to our discussion of brain death. Brain death's irreversibility is a fact acquired and established through technological means. Above, we have showed how it can even be described as an artifact itself, inasmuch as its existence is conditioned by life-supporting technologies. Putting Ihde's point differently, therefore, the very discrepancy between “the biological” and its “artificial” circumstances is itself an artifice, it constitutes a “widening range of life-supporting boundary situations medical technology has created” (ibid. 182). The biological irreversibility of brain death is revealed therefore only in our artificial articulation and embrace thereof, which involves also a *choice* for the inevitable:

This feature of the technological age is felt, it lies underneath the rising debates about euthanasia, meaningful suicide, and, at the other end of the spectrum, the alternative means of birth control and abortion. In each of these instances, the very power of decision is felt and seen in its “Sartrean” inevitability. (Ibid., 182)

Ascertaining the biological inevitability of death represents for Ihde an existential boundary situation of choice which he calls here “Sartrean.” As such, he describes death in technological times as something *inevitably volitional* since not making a decision is also a decision; not deciding “how to die” turns out to be another “way to die.” What can be called properly Sartrean about this situation is that by “not choosing” we will have covertly chosen something else inasmuch as we cannot outrun the consciousness of our responsibility catching up with us. Similarly, so Ihde argues, today, we cannot externalize our decision regarding death when technologies give us the choice between alternative endings. In the end, therefore, “not God, not Nature, [but we] will have to decide” (ibid., 182).

However, at this point we must remark that it is quite strange to say one truly chooses death. For although it might be inevitable for me to choose something in a particular situation, it seems I cannot properly “choose” something that is itself inevitable, like death supposedly is.

Addressing this puzzle, it is useful to contrast Ihde's explorations here briefly with the more classically attuned phenomenologist Sartre, whom he refers to in this context. For Sartre, some things are not a matter of choice: such as my freedom itself (which is precisely the reason why I cannot properly not-choose), my birth (which I did not consent to) and—crucially—my death. My death, according

to Sartre, is “no longer a part of my possibilities” (Sartre 1956, 537). Death is not some ‘thing’ we choose, but is the absurd limit of life “freedom never encounters” (ibid., 547). “Death is a pure fact as is birth; it comes to us from outside and it transforms us into the outside” (ibid., 545). Death is no matter of decision, but instead a *limit* which is “interiorized only as unrealizable” (ibid., 531). According to Sartre, death is not (only) an object in the natural world, but also a non-object indicating the limit of my world.

Different from Sartre, Ihde would argue that technologies condition our freedom in a material, and historically contingent way—instead of the other way around.¹⁶ Ihde philosophizes thereby not about, but *from* technologies, which is why he terms himself a *post*-phenomenologist, and why both the biological inevitability of death as well as the inevitability of our choices appear for him as a consequence of our technologies evolving.¹⁷ However, like Sartre, Ihde also refers to death’s biological inevitability lying at the very extremity or *limit* of our technological freedom. To refer again to the example: the determination of brain death is reckoned as an end station—as a biological fact that is—only because we understand it is *technologically* irreversible. Ihde would therefore agree with Sartre that death can be “interiorized only as unrealizable,” but he crucially adds to this that we are forced today to recognize this fact technologically. The inevitability of death is so contingently established that we accept it through our tinkering at the margins of life. Or, as Ihde phrases it with implicit reference to Heidegger: “[o]ur being-towards-death takes its vector within the new form of heightened [technological] contingency” (Ihde 1990, 182). This connects to John P. Lizza’s recent suggestion that existentialist approaches show us that “just as there are new ways in which we can live [with medical technologies], there may be new ways in which we can die [with them]” (2006, 49).

In the previous section, we showed how Agamben and Marcuse argued that ambiguities surrounding death can easily turn into an ideology that presumes a metaphysical necessity as ultimate means of the justification of political power. In quite a similar way, also the biological inevitability of death could be instated as a metaphysical truth, as one that is evinced by science as necessary. The strength of Ihde’s analysis lies precisely in pointing out that such metaphysical ideas (no matter whether they make an appeal to the “justness” or “naturalness” of death’s inevitability) are today conditioned technologically, and thereby always instantiate also a moment of existential choice for the inevitable. Whether this makes us fully responsible for our death is questionable though, since we do not actually choose the inevitable itself, but rather accept the inevitableness of death through technol-

ogy. This brings us to the final perspective we want to present here, namely that of Derrida in his *Gift of Death*.

5. Death as a Mystery

Agamben, Marcuse, as well as Ihde show how our relation with death necessarily involves a measure of political or existential choice. However, since they argue that this choice cannot be grounded in metaphysical or natural categories, are we ever truly able to take responsibility for death? A comprehensive response to this question can be found in the difference that Jacques Derrida explicates between the notions of *secrecy* and *mystery* in his essay *The Gift of Death*.¹⁸ According to Derrida, the relation towards death by the modern subject is one in which the *mystery* of death (i.e., the fundamental incomprehensible nature of death) is incorporated within a logic in which death is understood in terms of a *secret*. As a secret, our relation towards death “points towards a separation and more generally towards the objective representation that the conscious subject keeps within itself: what it knows, what it knows how to represent, even though it cannot or will not declare or avow that representation” (Derrida 1995, 20). As a secret, death appears as something that can in principle be represented when its secrecy is unraveled. Only the fact that we have *thus far* not unraveled the secret of death prevents us from coming to an objective representation of death. However, according to Derrida, this logic of secrecy remains to contain a more original—or *demonic*—mystery.¹⁹ As a mystery, death is originally constitutive of the subject, and in such a way that it cannot principally be responded to, nor known, and does not allow for any representation. Because death strictly speaking is not something that *is*; it is the gift towards which the subject is incapable of responding, and evades every logic of unraveling.

According to Derrida, European civilization tends to forget that the understanding of death as a secret remains to contain the original mystery of death as something to which we cannot respond. This constitutes a situation in which the technoscientific quest for a definition of death as objectified is equated with the quest for coming to an understanding of what death is. Following this line of reasoning, Derrida would agree that technology has growingly enabled us to envision our death as some kind of secret that needs unraveling.

However, Derrida’s assessment is more complex as he believes that “contrary to what is normally thought, technological modernity doesn’t neutralize anything; it causes a certain form of the demonic to re-emerge” (ibid., 35). In this citation, “demonic” refers to the original mystery that is concealed in the logic of secrecy

in which it is incorporated. This suggests that the technoscientific objectification of death also remains connected with the original mystery of death and will inevitably appear when death is investigated by scientific means. We suggest here that our reading of brain death and persistent vegetative state as “tragic artifacts” is indicative of this demonic mystery. For though we feel the obligation to employ technologies, trying to save lives and unravel the secret of death, this likewise brings about new tragedies that nobody can take ultimate responsibility for.

When this is forgotten, so Derrida holds (i.e., when death is only approached as a secret, without acknowledging it as a mystery), we “would transform the gift [of death] into an economy of sacrifice” (ibid., 31). Agamben feared this was happening in the case of brain death, and this is what Marcuse more generally described as an ideology of death. In these perspectives, death appears as an ideological secret that is need of unraveling. However, when following the logic of Derrida, this problematically situates death within an economy of sacrifice, which in turn will make us forget that death is not only something that forces us to define it and unravel its secrets, but simultaneously is “what gives me my singularity, . . . is what makes me unequal to the infinite goodness of the gift that is also the first appeal to responsibility” (ibid., 51). It might be that Ihde’s perspective on technology can be a response to this appeal. The technological choice for death he describes is a choice inasmuch as we scientifically unravel the inevitable as a secrecy, whereas accepting it as an inevitable mystery, both death itself and the choices faced in the light of it appear also as a *gift* that cannot be evaded.

6. Conclusion

In this paper, we have explored how technoscientific and medical involvements shape our understanding of death. We have shown how the technological mediation of death can be described in terms of technoscience (2), and explained as political ideology (3), as existential responsibility (4), and as a mystery (5). An overarching perspective on the problematics discussed can be found in the famous myth of Prometheus, as it intrinsically connects human’s technicity with death.

According to Greek legend, it was Prometheus the giant who oriented humankind towards the future by entrusting us with the power of fire. In philosophy of technology, great significance is attributed to the myth of Prometheus and its allegorical meaning: when Prometheus stole the fire from the gods, he compensated for a fundamental human lack, thereby making technicity fundamental for the human condition (cf. Böhme 2012; Gehlen 1940; Scharff and Dusek 2013; Stiegler 1998). We became the animals that were always-striving, turning the

world into a better, more comfortable place with technological means. However, Prometheus's gift came under certain conditions—according to the poet Aeschylus at least. Our technological productivity was given only after Prometheus first took another thing away from humans: the knowledge of their death.²⁰ The relevant passage (PB 248–256) of *Prometheus Bound* reads as follows (Aeschylus 2012, 14):

- Prometheus: I stopped mortals from envisioning their death.
Chorus Leader: What cure did you discover for that sickness?
Prometheus: I brought blind hopes to settle in their hearts.
Chorus Leader: That gift to mortals did them a great service.
Prometheus: And it was I who gave them fire as well.
Chorus Leader: So creatures of a day have blazing fire?
Prometheus: Yes, and from fire they'll find out many arts.

Hans Georg Gadamer understands the moral of this story as follows: as soon as we really understand that we are going to die, building a future seems to lose its point somehow. By receiving the gift of technology, we therefore had to forfeit our knowledge of death and be endowed with *blind hope* in order that technology (and thereby the humans) might thrive (cf. Gadamer 1993, 88). Technology, with which we build our future, so the implication is, only functions if we remain ignorant of our death.

In this paper, we have showed that by turning technology in the direction of death, the Promethean myth is turned into a genuine puzzle. For if, according to myth, ignorance of death builds the condition for our positive relation to the technological future, technology can consequently never fully take this ignorance away.

This Promethean puzzle is reflected in death determination. It can be identified as the tragic moment in the technoscientific objectification of death. The increasingly fine-grained distinctions between different types of death simultaneously and their technological conditions confront us with situations in which the distinction between life and death is not self-evident. We discussed how Agamben and Marcuse argued that settling this ambiguity is not a technoscientific, but ultimately a political affair: the societal acceptance *that* death sets a limit on life coincides with the acceptance of a political system deciding when the time of death has come. We showed—as a critical response to the analyses of Agamben and Marcuse—how according to Ihde the intricate relation between death and technology might turn death into a matter of existential responsibility that is increasingly constituted as a choice. Using Derrida's difference between secret and mystery

as a heuristic, we argued that technological death determination, even though it seems to turn death into a secret, also envelopes it in new mysteries.

Returning now to the Promethean myth: does technology thereby allow us to either “envision our death,” or does it rather “instill blind hope”? If Gadamer’s reading of Aeschylus is sensible, then both must be the case: technology makes our death both more, and less visible. This paradoxical relation between technology and death is quite significant, so we suggest. Remaining ignorant of our final fate—not only as a secret, but also as a mystery—is here a constitutive lack. This defines the human quest for technological mastery as an *ongoing* pursuit, albeit a tragic one. Without ignorance of death, we would lose motivation, become acquiescent, and be left without genuine drive. Or worse yet: a false presumption of knowledge about death (be it either in terms of medical science, political justice, or existential self-righteousness) makes one complacent. What we have shown, therefore, is how these counterpoints to philosophical reflection are in fact continuously challenged by technologies.

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Notes

1. The authors are listed in alphabetical order and have contributed equally to this paper.
2. The coroner of the case reportedly stated that “he thought the patient was alive when the kidney was removed, although there was no hope for him.” A physician stated that the man was already “virtually dead,” though turned “legally dead” only after artificial respiration was stopped and the heart stopped beating. A neurologist considered the man dead already before kidney removal, since “[t]he brain damage was such that life was impossible, and the man was kept going by the machine” (Halley and Harvey 1968, 423).
3. Some attention has been paid to the status of brain death in the context of organ donation (cf. Hacking 2007; Rosenfeld 2015). These authors explicitly address

the relation between death determination and organ donation, and what conception of the human body is thereby presupposed. Thereby, these analyses focus on the human *body*, rather than on how technoscientific developments shape our understanding of death *sec*. It is the latter issue that we pursue here. Another author that has dealt with this subject more extensively from an (bio-)ethical perspective is Peter Singer in his *Rethinking Life and Death: The Collapse of our Traditional Ethics*. (1996).

4. This term, “tragic artifact,” we adopt from Steven Laureys’s article on brain death and persistent vegetative state (2005). This tragedy pertains to what John P. Lizza has called a “biological artifact”: “a living being that has human characteristics but falls short of being human, a form of life created by medical technology” (Lizza 2006, 15).

5. See, for instance, Maimonides, *M. Mishneh Torah*, Hilchot Tumat Met 1:15.

6. This is claimed for the *adult* brain, more specifically.

7. A second death certificate of Jahi McMath was issued in June 2018, listing liver failure amongst other things as a (second) cause of death.

8. The diagnostic value of such ancillary or confirmatory tests provided by brain scanning technologies are contested (Wijdicks 2010). Brain death determination relies mostly on clinical bedside diagnostics of the mentioned brain death criteria.

9. An important distinction is made in the literature between “persistent,” and “permanent” vegetative state. Recently, a group of experts argued that naming this condition “vegetative” is misleading and needlessly pejorative. Alternatively, they propose to call it *unresponsive wakefulness syndrome* instead (Laureys et. al. 2010). We have opted here for the general description “vegetative state” as it is most familiar and still commonly used.

10. The somewhat commercializing title of the latter, more recent study, “Do medical students have the knowledge needed to maximize organ donation rates?” indicates, so we fear, a lack of appreciation for the historically uneasy alliance between brain death determination and organ donation medicine narrated above (Bardell, Hunter, Kent, and Jain 2003).

11. We can in the context of this paper not further elaborate on the influential concept of biopolitics as developed in twentieth-century critical humanities. The way this notion is employed is often traced back to Michel Foucault. In a recent introduction to biopolitics, Lemke (2011) states that Foucault’s notion of biopolitics can be defined as “the entry of phenomena peculiar to the life of the human species into the order of knowledge and power, into the sphere of political techniques” (Foucault 1980, 141–42).

12. Agamben gives a slightly misinformed representation of how brain death is discussed in medical circles. However, because he explicitly mentions (Agamben 1998, 162) that he does not aim to connect to medical discussions on brain death, we

surpass this issue, and use Agamben to highlight the political dimensions involved in the determination of death.

13. This essay was first published in a collection that inaugurated the field of thanatology (cf. Feifel 1959).

14. An interesting distinction to make here, is that between my own death and the death of someone else. Ihde does not explicitly differentiate the two here. We will pass over the issue here as well.

15. By making this claim, a rather broad notion of technology is put into play, ranging from simple documentation of repeated observations to complex means of interpretation such as microscopes hooked up to computer software (cf. Ihde 1991, 1998).

16. For a more elaborate consideration of this notion of technologically mediated freedom and the non-modern subjectivity it entails, see: Verbeek (2011).

17. By contrast, Sartre takes freedom as the ontological condition structuring my world, preceding all engagement with the technological features of reality. One could compare, if but structurally, here the Sartrean concept of freedom (or also: “nothing”) with the role Ihde appoints to technologies. Both condition the relationality of the human being (to both world and the self) as a not-coinciding, as a distancing, as taking up a perspective, and hence as free and responsible beings that have to choose. Sartre gives primacy to this “nothing” of freedom, as for him technologies appear only as conditioned by it: “We are no longer dealing with those relations of instrumentality by which, according to Heidegger, objects in the world disclose themselves to “human reality.” Every *négalité* appears rather as one of the essential conditions of this relation of instrumentality” (Sartre 1956, 24).

18. In the present text, we use this difference observed by Derrida as a heuristic and do not explicitly connect it to the role it plays in Derrida’s analysis of the history of responsibility, religion, and the sacred—although connections between the present analysis and Derrida’s project can be made. For a discussion of the use of the terms “secret” and “mystery” in Derrida’s specific project, see Gasché (2007).

19. Of course, in a strict sense this original mystery cannot be described. Within the work of Derrida it functions as a moment in which the subject appears not yet as responsible, because it still “belongs to a space in which there has not yet resounded the injunction to *respond*; a space in which one does not yet hear the call to explain oneself” (Derrida 1995, 3).

20. Bernard Stiegler does pay attention to the relation between technology and death, and argues that technicity is constitutive of human temporality (1998, 197–203). However, he does not explicitly thematize how we should understand that technicity can also be put to use to come to technoscientific definitions of death as we do in this paper. An in-depth discussion of the differences between our view and Stiegler’s is beyond the scope of this paper.

References

- Aeschylus. 2012. *Prometheus Bound*, trans. Deborah Roberts. Indianapolis: Hackett Publishing Co.
- Agamben, Giorgio. 1998. *Homo Sacer: Sovereign Power and Bare Life*, trans. Daniel Heller-Roazen. Stanford, CA: Stanford University Press.
- Akselrod, Hana, Mark W. Kroll, and Michael V. Orlov. 2009. "History of Defibrillation." In *Cardiac Bioelectric Therapy*, ed. Igor R. Efimov, Mark W. Kroll, and Patrick Tchou, 15–40. Boston: Springer.
https://doi.org/10.1007/978-0-387-79403-7_2
- Bardell, Trevor, Duncan J. W. Hunter, William D. T. Kent, and Minto K. Jain. 2003. "Do Medical Students Have the Knowledge Needed to Maximize Organ Donation Rates?" *Canadian Journal of Surgery* 46(6): 453.
- Böhme, Gernot. 2012. *Invasive Technification: Critical Essays in the Philosophy of Technology*, trans. Cameron Shingleton. London: Bloomsbury.
- Burkle, Christopher M., Richard R. Sharp, and Eelco F. Wijdicks. 2014. "Why Brain Death Is Considered Death and Why There Should Be No Confusion." *Neurology* 83(16): 1464–69. <https://doi.org/10.1212/WNL.0000000000000883>
- Caplan, Arthur, and David Magnus. "Brain Death Really Is Death." *Time*, January 3, 2014, <https://time.com/194/brain-death-really-is-death/>. Accessed August 26, 2019.
- Chamayou, Grégoire. 2008. "The Debate over Severed Heads: Doctors, the Guillotine and the Anatomy of Consciousness in the Wake of the Terror." *Revue d'histoire des sciences* 61(2): 333–65. <https://doi.org/10.3917/rhs.612.0333>
- DeGrazia, David. 2016. "The Definition of Death." In *The Stanford Encyclopedia of Philosophy* (Spring 2017 Edition), ed. Edward N. Zalta, <https://plato.stanford.edu/archives/spr2017/entries/death-definition/>. Accessed August 26, 2019.
- Demertzi, A., D. Ledoux, M.A. Bruno, A. Vanhaudenhuyse, O. Gosseries, A. Soddu, C. Schnakers, G. Moonen, and S. Laureys. 2011. "Attitudes Towards End-of-Life Issues in Disorders of Consciousness: A European Survey." *Journal of Neurology* 258(6): 1058–65. <https://doi.org/10.1007/s00415-010-5882-z>
- Derrida, Jacques. 1995. *The Gift of Death*, trans. David Willis. Chicago: The University of Chicago Press.
- Douglass, G. E., and M. Daly. 1995. "Donor Families' Experience of Organ Donation." *Anaesthesia and Intensive Care* 23(1): 96–98.
<https://doi.org/10.1177/0310057X9502300126>
- Feifel, Herman, ed. 1959. *The Meaning of Death*. New York: McGraw-Hill.
- Foucault, Michel. 1980. *The History of Sexuality, Vol. 1: An Introduction*, trans. Robert Hurley. New York: Vintage Books.

- Freeman, E. A. 1992. "The Persistent Vegetative State: A 'Fate Worse than Death.'" *Clinical Rehabilitation* 6(2): 159–65. <https://doi.org/10.1177/026921559200600211>
- Gadamer, Hans-Georg. 1993. *Über die Verborgenheit der Gesundheit: Aufsätze und Vorträge*. Berlin: Suhrkamp.
- Gasché, Rodolphe. 2007. "European Memories: Jan Patočka and Jacques Derrida on Responsibility." *Critical Inquiry* 33(2): 291–311. <https://doi.org/10.1086/511505>
- Gehlen, Arnold. 1940. *Der Mensch. Seine Natur und Stellung in der Welt*. Berlin: Junker und Dünhaupt.
- Hacking, Ian. 2007. "Our Neo-Cartesian Bodies in Parts." *Critical Inquiry* 34(1): 78–105. <https://doi.org/10.1086/526088>
- Halley, Martin M. and William F. Harvey. 1968. "Medical vs. Legal Definitions of Death." *JAMA* 205(6): 423–25. <https://doi.org/10.1001/jama.1968.03140190005002>
- Harvard Ad Hoc Committee. 1968. "A Definition of Irreversible Coma: Report of the Ad Hoc Committee of the Harvard Medical School to Examine the Definition of Brain Death." *JAMA* 205(6): 337–40. <https://doi.org/10.1001/jama.1968.03140320031009>
- Hsu, Christine. "Danish Teen Wakes from the 'Dead'; Just as Doctors Prepare to Harvest her Organs." *Medical Daily*, October 18, 2012. <https://www.medicaldaily.com/danish-teen-wakes-dead-just-doctors-prepare-harvest-her-organs-243163>. Accessed August 26, 2019.
- Ihde, Don. 1990. *Technology and the Lifeworld: From Garden to Earth*. Indianapolis: Indiana University Press.
- Ihde, Don. 1991. *Instrumental Realism: The Interface between Philosophy of Science and Philosophy of Technology*. Indianapolis: Indiana University Press.
- Ihde, Don. 1998. *Expanding Hermeneutics: Visualism in Science*. Evanston, IL: Northwestern University Press.
- Journal of the American Medical Association*. 1968. "What and When Is Death?" *JAMA* 204(6): 539–40. <https://doi.org/10.1001/jama.1968.03140190121012>
- Kompanje, Erwin J.O., Yorick J. de Groot, Jan Bakker, and Jan N.M. IJzermans. 2012. "A National Multicenter Trial on Family Presence During Brain Death Determination: The FABRA Study." *Neurocritical Care* 17(2): 301–08. <https://doi.org/10.1007/s12028-011-9636-2>
- Laureys, Steven. 2005. "Science and Society: Death, Unconsciousness and the Brain." *Nature Reviews Neuroscience* 6(11): 899–909. <https://doi.org/10.1038/nrn1789>
- Laureys, Steven, Gastone G. Celesia, Francois Cohadon, Jan Lavrijsen, José León-Carrión, Walter G. Sannita, Leon Szabon, Erich Schmutzard, Klaus R. von Wild, Adam Zeman, Giuliano Dolce, and the European Task Force on Disorders of Consciousness. 2010. "Unresponsive Wakefulness Syndrome: A New Name for the Vegetative State or Apallic Syndrome." *BMC Medicine* 8. <https://doi.org/10.1186/1741-7015-8-68>

- Lavrijsen, J. C. M., J. S. G. Van den Bosch, R. C. T. M. Koopmans, and C. Van Weel. 2005. "Prevalence and Characteristics of Patients in a Vegetative State in Dutch Nursing Homes." *Journal of Neurology, Neurosurgery & Psychiatry* 76(10): 1420–24. <https://doi.org/10.1136/jnnp.2004.058198>
- Lemke, Thomas. 2011. *Biopolitics: An Advanced Introduction*, trans. Eric Frederick Trump New York: New York University Press.
- Lewis, Ariane. 2018. "Reconciling the Case of Jahi McMath." *Neurocritical Care* 29(1): 20–22. <https://doi.org/10.1007/s12028-018-0561-5>
- Lewis, Ariane, James L. Bernat, Sandralee Blosser, Richard J. Bonnie, Leon G. Epstein, John Hutchins, Matthew P. Kirschen, Michael Rubin, James A. Russell, Justin A. Sattin, Eelco F. M. Wijdicks, and David M. Greer 2018. "An Interdisciplinary Response to Contemporary Concerns about Brain Death Determination." *Neurology* 90(9): 423–26. <https://doi.org/10.1212/WNL.0000000000005033>
- Lizza, John P. 2006. *Persons, Humanity, and the Definition of Death*. Baltimore: Johns Hopkins University Press.
- Lock, Margaret M. 2002. *Twice Dead: Organ Transplants and the Reinvention of Death*. Oakland: University of California Press.
- Lynn, Joanne, and Robert Cranford. 1999. "The Persisting Perplexities in the Determination of Death." In *The Definition of Death: Contemporary Controversies*, ed. Stuart J. Younger, Robert M. Arnold, and Renie Schapiro, 101–14. Baltimore: Johns Hopkins University Press.
- Magnus, David C., Benjamin S. Wilfond, and Arthur L. Caplan. 2015. "Accepting Brain Death." In *Replacement Parts: The Ethics of Procuring and Replacing Organs in Humans*, ed., Arthur L. Caplan, James J. McCartney, and Daniel P. Reid, 49–52. Washington, DC: Georgetown University Press.
- Marcuse, Herbert. 2011. "The Ideology of Death." In *Philosophy, Psychoanalysis, and Emancipation: Collected Papers of Herbert Marcuse Volume Five*, ed. Douglas Kellner and Clayton Peirce, 122–31. London: Routledge. <https://doi.org/10.4324/9780203838709>
- Maruya, Jun, Keichi Nishimaki, Ji-ichi Nakahata, Hiroko Suzuki, Yasuo Fujita, Yasuo, and Takashi Minakawa. 2008. "Prolonged Somatic Survival of Clinically Brain-Dead Adult Patients." *Neurologia Medico-Chirurgica* 48(3): 114–17. <https://doi.org/10.2176/nmc.48.114>
- Mohandas, A., and Shelley N. Chou. 1971. "Brain Death: A Clinical and Pathological Study." *Journal of Neurosurgery* 35(2): 211–18. <https://doi.org/10.3171/jns.1971.35.2.0211>
- Owen, Adrian M., Martin R. Coleman, Melanie Boly, Matthew H. Davis, Steven Laureys, and John D. Pickard. 2006. "Detecting Awareness in the Vegetative State." *Science* 313(5792): 1402. <https://doi.org/10.1126/science.1130197>

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- Pallis, Christopher. 1982. "ABC of Brain Stem Death: From Brain Death to Brain Stem Death." *British Medical Journal* 285: 1487–90. <https://doi.org/10.1136/bmj.285.6353.1487>
- Pernick, Martin S. 1988. "Back from the Grave: Recurring Controversies over Defining and Diagnosing Death in History." In *Death: Beyond Whole-Brain Criteria*, ed. Robert M. Zaner, 17–74. Dordrecht: Kluwer.
- Pernick, Martin S. 1999. "Brain Death in a Cultural Context: The Reconstruction of Death, 1967–1981." In *The Definition of Death: Contemporary Controversies*, ed. Stuart J. Younger, Robert M. Arnold, and Renie Schapiro, 3–33. Baltimore: Johns Hopkins University Press. https://doi.org/10.1007/978-94-009-2707-0_2
- President's Commission for the Study of Ethical Problems in Medicine, Biomedical, & Behavioral Research. 1981. *Defining Death: A Report on the Medical, Legal and Ethical Issues in the Determination of Death*. Washington, DC: U.S. Government Printing Office.
- President's Council on Bioethics. 2008. *Controversies in the Determination of Death: A White Paper of the President's Council on Bioethics*. <https://bioethicsarchive.georgetown.edu/pcbe/reports/death/>, accessed 08-01-2019.
- Rosenberg, Roger N. 2009. "Consciousness, Coma, and Brain Death—2009." *JAMA* 301(11): 1172–74. <https://doi.org/10.1001/jama.2009.224>
- Rosenfeld, Adam. 2015. "Mediating Multiplicity: Brain-dead Bodies and Organ Transplant Protocols." In *Postphenomenological Investigations: Essays on Human-Technology Relations*, ed. Robert Rosenberger and Peter-Paul Verbeek, 203–14. London: Lexington Books.
- Sartre, Jean-Paul. 1956. *Being and Nothingness*, trans. Hazel E. Barnes. New York: Philosophical Library.
- Scharff, Robert C., and Val Dusek, eds. 2013. *Philosophy of Technology: The Technological Condition: An Anthology*. Oxford: Wiley-Blackwell.
- Schindler Schiavo v. Schiavo. 2005. Supreme Court of the United States. 24 March 2005. Case No.: 04A-825. Respondent Michael Schiavo's Opposition to Application for Injunction. <https://euthanasia.procon.org/sourcefiles/Michael-SchiavoOpposition.pdf>, accessed January 12, 2019.
- Shewmon, Alan D. 2011. "Controversies Surrounding Brain Death." In *The Ethics of Organ Transplantation*, ed. Steven J. Jensen, 21–42. Washington, DC: The Catholic University of America Press. <https://doi.org/10.2307/j.ctt3fgpsr.6>
- Shewmon, Alan D. 2018. "Truly Reconciling the Case of Jahi McMath." *Neurocritical Care* 29(2): 165–70. <https://doi.org/10.1007/s12028-018-0593-x>
- Singer, Peter. 1996. *Rethinking Life and Death: The Collapse of Our Traditional Ethics*. Oxford: Oxford University Press.
- Stiegler, Bernard. 1998. *Technics and Time, 1: The Fault of Epimetheus*, trans. George Collins and Richard Beardsworth. Stanford, CA: Stanford University Press.

- Truog, Robert D., Thaddeus M. Pope, and David S. Jones. 2018. "The 50-year Legacy of the Harvard Report on Brain Death." *JAMA* 320(4): 335–36. <https://doi.org/10.1001/jama.2018.6990>
- Veatch, Robert M. 1975. "The Whole-Brain-Oriented Concept of Death: An Outmoded Philosophical Formulation." *Journal of Thanatology* 3: 13–30.
- Verbeek, Peter-Paul. 2011. *Moralizing Technology: Understanding and Designing the Morality of Things*. Chicago: University of Chicago Press. <https://doi.org/10.7208/chicago/9780226852904.001.0001>
- Wijdicks, Eelco. F. 2001. "The Diagnosis of Brain Death." *New England Journal of Medicine* 344(16): 1215–21. <https://doi.org/10.1056/NEJM200104193441606>
- Wijdicks, Eelco F. 2010. "The Case Against Confirmatory Tests for Determining Brain Death in Adults." *Neurology* 75(1): 77–83. <https://doi.org/10.1212/WNL.0b013e3181e62194>
- Wijdicks, Eelco. F., Panayiotis Varelas, Gary S. Gronseth, and David M. Greer. 2010. "Evidence-Based Guideline Update: Determining Brain Death in Adults: Report of the Quality Standards Subcommittee of the American Academy of Neurology." *Neurology* 74(23): 1911–18. <https://doi.org/10.1212/WNL.0b013e3181e242a8>
- Youngner, Stuart J., Seth C. Landefeld, Claudia J. Coulton, Barbara W. Juknialis, and Mark Leary. 1989. "Brain Death and Organ Retrieval: A Cross-Sectional Survey of Knowledge and Concepts Among Health Professionals." *JAMA* 261(15): 2205–10. <https://doi.org/10.1001/jama.1989.03420150055037>