

# THE HEPPLEMEYER PHENOMENON: SUBTLY DEMONSTRATING THE CO-OPTING OF SCIENCE INTO UNSCIENTIFIC CONTEXTS

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## ABSTRACT

In this article I propose that a short story, in this case Howard Fast's "*The Hoop*" (1975), can be used for educational purposes to demonstrate (in a quick and undivisive manner) how science can be co-opted into unscientific contexts. I also show how the story paves the way for brief explorations of three philosophical topic areas relevant in the context of science education, namely Horkheimer's (2004) operationalism and instrumentalism, Kuhn's (1977) take on theory choice, and Heidegger's (1977) technological Enframing. The foregrounding of a short story for the purpose of education within the sustainability sciences is offered as an interim step towards transgressive learning and disruptive capacity-building processes called for elsewhere.

**Keywords:** science education, literature in science education, short story, philosophy of science, transgressive learning

## INTRODUCTION AND BACKGROUND

In their 2015 article titled "Transformative, Transgressive Social Learning: Rethinking Higher Education Pedagogy in Times of Systemic Global Dysfunction", Lotz-Sisitka et al. call for a "break with maladaptive resilience of unsustainable systems" and a strengthening of "transgressive learning and disruptive capacity-building" (2015, 73). They make their call in the context of a society that knows much about various environmental issues it faces, but "lacks the capacity to respond to these challenges". The researchers identify "four streams of emerging transformative, transgressive learning research and praxis in the sustainability sciences that appear generative of a higher education pedagogy that appears more responsive to the key challenges of our time". Each stream is explored in the article in a manner suggesting that together they can "enable students and staff to deal with accelerating change, increasing complexity, contested knowledge claims and inevitable uncertainty".

While the Lotz-Sisitka et al. (2015) do make an excellent case for the need to transform sustainability science pedagogy, and while they provide overviews of four relevant and

promising approaches towards achieving their recommended outcome, I contend that it is unlikely that their suggestions will fit into the real working world of science education, the sustainability sciences, or of any scientific arena. The researchers themselves do foreshadow this theme, but do not foreground it, when they identify “mono-disciplinarity and mono-sectoral practice” as “the reality” (2015, 74) of the domain they wish to transform:

“[T]he reality is that mono-disciplinarity and mono-sectoral practice and governance activities remain dominant. In order to transform for the sustainability turn or transition, people everywhere will need to learn how to cross disciplinary boundaries, expand epistemological horizons, transgress stubborn research and education routines and hegemonic powers, and transcend monocultural practices in order to create new forms of human activity and new social systems that are more sustainable and socially just.”

This amounts to a statement of a problem, followed by another call for transformation, with a chicken-and-egg scenario becoming discernable: mono-disciplinarity arguably needs to be transformed in order for transformative praxes to transform mono-disciplinarity. Reframed, the problem can be stated as follows: dominant organisational structures are dominant in part because they are good at resisting transformation. I have written about this phenomenon elsewhere (Pittaway 2018; 2019), albeit with a focus on democratic capitalism, but the principle is applicable to varying degrees in any context where a structure or a system has become dominant.

Even simpler obstacles obscure the chances of Lotz-Sisitka et al.’s (2015) calls for transformation in sustainability science education (as well as in other scientific arenas) to be successful. Scientists, science researchers, and science educators tend to employ the conceptual frameworks and methodologies of positivism and often pragmatism. The very fact that these people work in the sciences suggests that they have not formally gravitated towards the kinds of critical, reflexive, and transformative pedagogies summarised by Lotz-Sisitka et al., who may be advocating for sprinting before walking when they identify paradigm-challenging praxes such as “[t]ransformative, transgressive learning processes influenced by critical phenomenology” (2015, 76).

I offer brief support in the second section of this article for the use of literary stories in science education as a step towards the outcomes aimed for by Lotz-Sisitka et al. (2015). In the third section of this article I summarise a prime example of a story that is short, effective at conveying pertinent themes, and contains content that is not likely to alienate or offend readers or audiences. In the fourth section I discuss how the story can be contextualised to have implications for science, leading to the fifth, sixth, and seventh sections, wherein I make links to three philosophical topic areas that may be of use to science educators who wish to enable

their students to think more laterally about science. This example of a lateral thought exercise may be useful for educators who work in the context of Higher Education in general, which may benefit from praxis involving simple starting points such as short stories that lay foundations on which to gradually explore challenging topics, theories, and paradigms. While the topics, theories, and paradigms that emerge from unpacking an appropriate short story may not in themselves be transformative for science education in particular or Higher Education in general, they may play small roles in the processes that give rise to new syntheses, which resonates to some extent with Lotz-Sisitka et al.'s (2015) calls for transformation, albeit in a more general manner (i.e., beyond the confines of the sustainability sciences). I conclude in the final section of the article.

## BRIEF SUPPORT FOR STORIES AND STORYTELLING

The pedagogical approach suggested here is to employ a short story for the purpose of foregrounding important themes such as the unforeseen and undesirable consequences that scientific endeavours may cause, and humankind's generally catastrophic impacts on nature. While this tactic may seem overly simple, three points can be raised to defend it, the first being a short point: well-chosen stories (such as the one to feature in this article) may convey messages without provoking in readers or audiences responses of outrage, attack, indignation, or offence, which have become extremely common in contemporary culture, responses which frequently result in the shut down of potential communication or discussion. Second, as Engel, Lucido, and Cook remind one (2018, 12):

“Storytelling has long been a way to capture the hearts and minds of children and adults alike. This method is also an incredibly effective tool to support learning. While English and the social sciences have long utilized storytelling as a tool for learning, the sciences have just begun to discover how successful storytelling can be for learning new concepts.”

The authors do highlight “storytelling” rather than “stories”, but their remarks are applicable to both. Their initial encouraging observation alludes to what may be a deeply entrenched human capacity for internalising the contents of stories, a capacity that may be easier to take advantage of than the potentially unfamiliar territory advocated by Lotz-Sisitka et al. The final remark of Engel et al.'s (2018) observations – that people in the sciences are just discovering the power of storytelling for learning concepts – may also strengthen the points I have already emphasised regarding barriers in science education: stories and storytelling are new additions to science pedagogies, and I repeat my contention that it is perhaps best to learn to walk (with the help of stories) before trying to sprint towards transformative pedagogies that may be perceived in the sciences as inappropriate or even radical.

Third, as Caminotti and Gray (2012, 432) point out in their research article on the effectiveness of storytelling for adult education,

“A fictitious book or novel can become an effective educational tool when it is applied to an appropriate subject matter and can assist a student’s learning process as well as provide a creative outlet for expression. A good novel is not just for English courses anymore, but can now be applied to a business, management, or even an accounting curriculum.”

My contention in this article resonates with the position espoused by Caminotti and Gray, and my focus adds science pedagogy in its broadest sense to the list of application areas offered by the researchers.

### **SUMMARY OF HOWARD FAST'S “*THE HOOP*”**

Howard Fast's “*The Hoop*” (1975) is a short story of approximately eleven pages. Its protagonist is a scientist named Julius Hepplemeyer. A recipient of two Nobel prizes, Dr Hepplemeyer is widely recognised as a genius comparable to Einstein. The omniscient narrator refers to the age being “the Hepplemeyer age” (1975, 186). “Hepplemeyer's Law of Return” had “opened new doors in physics”, with the “Hepplemeyer equations” reportedly only being understood by an estimated dozen people globally. He is liked by the public, partly due to idiosyncratic utterances such as “Wisdom obligates a man to perform foolishly”, “Education imposes a search for ignorance”, and “The solution always calls for the problem” (Fast 1975, 185). For the purposes of this article, the main events and details of the story are:

- Hepplemeyer translates “the mathematics” of his equations into a “hoop of shining aluminium” (Fast 1975, 186), with a circumference of 3.6 meters.
- The hoop is, “in effect”, a net in which “a tiny curl of the endless convolutions of space” might be caught (Fast 1975, 186). The narrator mentions that it was never Hepplemeyer's intention to “bend space”. Nevertheless, that is what the hoop does, although in effect its function is to make objects disappear.
- During the first demonstrations of the hoop, held on the university grounds where Hepplemeyer works, the doctor throws a pen into the hoop; the pen disappears.
- Despite Hepplemeyer's attempts to stop excited spectators, they throw a variety of objects into the hoop. The excitement ends after a student leaps into the hoop and disappears.
- Hepplemeyer has no idea of where the student went, or of where any of the objects thrown into the hoop went. They could be in another “part of space”, in a “different time

sequence”, in “Eternity”, or even in “Brooklyn” (Fast 1975, 190).

- The Mayor of New York City recruits the hoop for the purpose of dumping city rubbish into it.
- The hoop is celebrated locally, and envied from afar, for its perceived advantage it confers onto its users, i.e., instantly making the rubbish created by human beings vanish.
- After some time of garbage being delivered and dumped into the hoop, cracks appear in the asphalt of Wall Street. The cracks continue to grow, and the dumped garbage begins to seep out of them.
- The garbage quickly increases in flow and soon covers Wall Street “ten stories high” (Fast 1975, 196). At five o’clock that day the garbage begins to erupt as if it were being ejected by “a primal volcano”.
- For an hour, the garbage falls on lower Manhattan “as once the ashes had fallen on Pompeii”.

The bullet-point summary of the story does not convey the humourous tone created by Hepplemeyer’s comments, by the brief extracts of conversations with his wife and other characters respectively, or by the narrator’s commentary. The commentary often makes reference to features of a context that are those of extant society. The setting is specified: New York City and Columbia University. The scientific era is slightly post-Einstein. Various other references are made by the narrator, including: the New York Times weekly supplement, the author Isaac Asimov, the musician Bob Dylan, NASA, and numerous extant countries.

References are made to the large sums of money that leaders of various countries offer to Hepplemeyer in exchange for another hoop or the plans for it. To his wife’s displease, rather than accept any of the offers, Hepplemeyer states that he has “to think about it” (Fast 1975, 192). The two other occasions in the story, where Hepplemeyer comments on his thinking about something and his need to think about something, establish thinking as a notable theme in the story. The author uses this theme for the purpose of creating humour, for instance at the end of the story when Hepplemeyer says (in the penultimate line of the story) that he will “have to think about it” when asked by his wife if he will move the hoop as per request from the Mayor. The final line of the story is a statement by the wife: “‘I suppose you will,’ she said with resignation.” (Fast 1975, 196)

## **RELEVANCE OF THE SHORT STORY FOR THE SCIENCES**

Two areas of relevance will be discussed here. The first area pertains to the practicality of using the short story for pedagogical purposes. This is a simple descriptive process. The second area

of relevance is one in which interpretation will occur. While different people may interpret the story differently, this is not a methodological shortcoming, because what I wish to demonstrate is a process (relevant to both the sustainability sciences in particular and Higher Education in general) rather than an outcome, one applicable to different short stories or texts, which may include a variety of media types. The demonstration may be helpful for science educators and educators in general wishing to use other texts for purposes similar to those giving impetus to this article.

### **How using “The Hoop” overcomes some barriers to education in the sciences**

Considering that Lots-Sitsika et al. (2015) refer to mono-disciplinarity being dominant in various contexts, the use of a short story is tactically not too foreign for any one discipline because short stories are familiar literary formats to anyone with a rudimentary level of education. While the short story may not be familiar as part of a scientific methodology, it is not meant to be – rather, the short story can be used as a route via which reflection on scientific advancements can occur. If introduced as a step in the directions of trans-disciplinarity and cross-disciplinarity, and perhaps later in the directions of transformative and disruptive pedagogies, then scientists and researchers in scientific arenas may not feel that their positivistic or pragmatic methodologies are being sidelined for a different method that may carry with it a negative association to scientists.

The barrier of busy scientific research schedules or syllabuses that are heavily laden with technical scientific content is also overcome by using a short story. Consisting of only eleven pages, it could take as little as twenty minutes to read “*The Hoop*” (1975) if a person reads at roughly two minutes per page. A summary of the short story could also be read in a much shorter period of time, before stepping into an exploration of themes and potential philosophical links. Even if the latter steps do not ensue, the short story may have impacts on scientists and researchers who are exposed to it, effects that may not immediately be noticeable. Assuming that discussion of themes and links to philosophical ideas does occur, the steps in this direction would be facilitated by the content of a short story that contains no obviously divisive, offensive, or controversial triggers, as the summary of the short story has conveyed.

### **Some themes and issues raised in “The Hoop”**

One of the most important themes to arise in the short story is the co-opting of scientific knowledge, as well as the technological advancements made possible by science, into unscientific contexts, with unforeseen and disastrous consequences. This theme is foreshadowed moments after the hoop becomes operational, when an excited young student

“flung himself through the hoop” (Fast 1975, 188) and disappeared, with Hepplemeyer being unable to explain where the student went.

With Hepplemeyer being a stereotype of a scientific genius with his head in the clouds of mathematics and scientific laws, and with his knowledge having been applied to produce a device that can bend space, his inability to foresee the consequences of using the hoop puts applied science in a questionable light. When Hepplemeyer is pushed for an answer on the whereabouts of the missing student, the scientist adds some thought-provoking comments on the limits of scientific knowledge, knowledge that is applied to produce devices and machines that have completely transformed human life in a matter of a few centuries. “We build dynamos. Do we know how they work? We make electricity. Do we know what it is?” He is asked by the character he is addressing, “Do we?”, to which Hepplemeyer responds, “We do not” (Fast 1975, 189). The humility of the answer stands in strong contrast to the daring nature of the construction of a device that “bends space”, something that Hepplemeyer said early on in the story is only God’s domain: “Only God bends space” (Fast 1975, 185). Nevertheless, Hepplemeyer builds a device that bends space, thus raising the theme of the danger of scientists playing God.

The broader unscientific context of the story into which the hoop is co-opted is a socio-political, economic and ecological dispensation where human beings produce and discard massive amounts of garbage, activities that are part and parcel of a consumer capitalist economy that must grow or die (Kovel 2002). Without sufficient understanding of the consequences of throwing objects into it, the hoop’s widely perceived function is to make things disappear without a trace. This perceived function gets capitalised on by the Mayor of New York City for the purpose of dumping city garbage into the hoop. This perceived function of the hoop is celebrated and envied across the globe – that is, until disaster strikes. However, the perceived function is imposed onto the hoop by people who, with the exception of Hepplemeyer himself, did not wish to ask where the garbage was going or what the worst case scenario of their actions could be. This is arguably what people often do, i.e., act without thinking things through properly. Advances in science are not immune to such short-sightedness, with many historical examples being available to give credence to the theme – for example, the extant nuclear armament that was enabled by atomic physics. In this regard, the ecological crisis, caused in part by a human civilisation (Steffen et al. 2011) whose expansion has been powered by scientific advancements and applications, is of the utmost relevance. Hepplemeyer is brilliant enough to create equations and formulate physical principles to the point that his scientific work and creation enable the bending of space, but his ignorance of the broader contexts so far discussed is a weakness of his overall understanding of the world.

It is not Hepplemeyer's intention for the hoop to be used for the purpose of making "two million tons" (196) of garbage disappear. On close reading of the story, it is entirely unclear what his intentions are. On the first page of the story, the narrator states that it "was never Dr. Hepplemeyer's intention to bend space, and he pinned down the notion as presumptuous. "Only God bends space," he emphasized. "Man can merely watch, observe, seek – and sometimes find" (Fast 1975, 185). However, a page later, the narrator states that Hepplemeyer told his students he was "in effect building a net in which he would perhaps trap a tiny curl of the endless convolutions of space" (Fast 1975, 186). It is significant that Hepplemeyer's intentions for creating the hoop are somewhat unclear and even contradictory. A long-standing question in the philosophy of science is about whether science is an objective process. One of the most enduring ideas used to defend at least some aspects of science as being objective is the Cartesian notion that mathematics (upon which many scientific enterprises are based) is a fail-safe basis for knowledge: two and two will always equal four. Hepplemeyer is a mathematical mastermind, and prior to the creation of the hoop, his work is summarised as "the Hepplemeyer equations" and the "Law of Return" (186). Mathematics and laws are the foundations of Hepplemeyer's work, and for the typical scientist, this would justify describing what Hepplemeyer does as objective.

However, the mathematics that guarantees that two and two will always equal four is not confined to abstract theoretical realms – it typically becomes applied, and two extant objects are added to two more extant objects to arrive at a total of four extant objects. Similarly, Hepplemeyer applies his equations in an extant context. Whether one agrees that his mathematics and laws are objective, the move from the abstract realms of mathematics and laws to the realm of extant circumstances is unavoidable. The latter realm is understood by human beings through the lenses of language, culture, customs, values, and a variety of contextual factors – regardless of what the exact contextual factors are, many will always be present, and this is an incontestable aspect of the human condition.

The narrator states that Hepplemeyer "translated his mathematics into a hoop of shining aluminium" (Fast 1975, 186). The use of the word "translated" could not be more appropriate for the purpose of drawing attention to the shift from a potentially objective scientific realm of mathematics and laws to the extant contexts in which scientific advancements are co-opted. However, one can take a few steps backwards from the contexts already mentioned and instead focus on the choice made by Hepplemeyer himself to translate his mathematics and laws into the hoop. Despite Hepplemeyer's uncertainty that the hoop would be successful in bending space, he still went ahead and created a device that would perform a specific practical function. He conceptualised what he was creating as a device that might bend space, but his actions (as

commented on by the narrator) during the first demonstrations of the hoop perhaps speak far louder about the purpose of the hoop. After Hepplemeyer had thrown several items through the hoop, items that simply fell straight through it and onto the ground beneath, it became “evident to the onlookers that whatever was cast into the hoop was not intended to emerge from the other side” (Fast 1975, 188). Hepplemeyer may not employ this description of what the hoop is supposed to do; nevertheless, the onlookers are correct – the objects were meant to disappear.

Hepplemeyer’s decision to construct the hoop, a device that performs a practical function, may appear to unquestioning observers to be an expected step in what has historically become standard scientific practice. Information was made available through a tradition involving mathematics and scientific laws, which enabled the construction of a device that performs a task. It is at this point that any focus on the possible distinctions between objectivity and subjectivity in the sciences can be put aside, with focus instead being directed at the point where scientific knowledge becomes applied for an outcome. Hepplemeyer may be a stereotype of a scientist, unwavered by temptations of fame or fortune, but the broader context of instrumentalism and operationalism can be said to have had a formative impact on his thought and actions. It was not enough for Hepplemeyer to have mastered complicated mathematical equations – instead, he went much further and applied the science to create a device that performs a practical task.

The creation of a device that performs a task is a step that cannot be considered in isolation from what has so far been described as the broader unscientific contexts into which science is co-opted. Scientists are born into a dispensation enabled by pragmatism, instrumentalism and operationalism. This dispensation not only co-opts scientific knowledge, but it may be foundational to scientific endeavours in the first place – this theme will briefly be explained and commented on in the sections to follow. Science educators, as well as scientists and researchers working in the sciences, however, may not need to venture into the more philosophically oriented territory of the following three sections. Instead, they may opt to reflect on the work that scientists do by employing what I will here call the Hepplemeyer phenomenon and Hepplemeyer’s law of return.

The Hepplemeyer phenomenon entails the co-opting of science for unscientific purposes. At a push, it can include the question, at what point is science co-opted, i.e., at the point at which science is applied to create a device that performs a function, or before that point? Hepplemeyer’s law of return draws attention to the point that everything people do, scientists included, has consequences, but the law can be invoked to raise the issue of the unforeseen, undesirable, and even disastrous consequences that scientific work may bring about.

Two final general themes will briefly be highlighted to end this section. The first is the

theme of thinking about a problem, and the second is the theme of civilisation collapse. Hepplemeyer states repeatedly that he will have to think about a matter. It is possible to read into this characterisation of Hepplemeyer a shortcoming in this stereotypical demeanour of the scientist – deep thinking does not necessarily prevent disastrous events from occurring. This leads to the theme of civilisation collapse. Pompeii is an extremely well chosen symbol to employ in a short story that ends with a disastrous climax. The Vesuvius volcano eruption in 79 A.D. had catastrophic consequences, and it is possible that contemporary human civilisation, which is experiencing a mass extinction event (Steffen et al., 2011) alongside several interlinked crises of various types (ecological, socio-political, economic), is also headed towards increasingly troubled times. “*The Hoop*” (1975) can thus be read as commentary on a civilisation’s trajectory towards a possible collapse, commentary in which science and scientists may be inculcated as central participants.

## HORKHEIMER’S OPERATIONALISM AND INSTRUMENTALISM

“*The Hoop*” (1975) provides a serious warning to readers: advances in science can be co-opted into unscientific contexts, often with undesirable consequences. Within seconds of Hepplemeyer’s demonstration of the successful functionality of the hoop, a young student disappears into the device. This immediately sobers the crowd with the realisation that the operation performed by the hoop, which to the students is to make things disappear, can have an unforeseen and undesirable outcome, which foreshadows the climax of the story. Some elaboration on the terms operationalism and instrumentalism may provide insights on the co-opting of science for such unscientific purposes as the ones demonstrated in the story, and offer a glimpse of how some scientific ventures may be driven, in part, by motives that are not necessarily free from contextual factors.

In *The Eclipse of Reason* (Horkheimer 2004), originally published in 1947, Horkheimer makes an observation that is relevant not only for how the hoop ends up being operationalised, but also for the rational scientific process whereby the hoop was theorised and created. Note the style of expression in the following commentary – it may seem intimidating to some readers, who may perceive it as dense or lofty. Were, for example, philosophers of science to begin their reflexive contributions to a field of science (or science pedagogy) with such lofty language, they may run the risk of alienating the members of the scientific audience they address. By beginning one’s reflexive contribution to the realm of the sciences with an undivisive short story, one may first subtly raise specific themes and issues that can be used to ground the following important observation (Horkheimer 2004, 14–15):

“Having given up autonomy, reason has become an instrument. In the formalistic aspect of subjective reason, stressed by positivism, its unrelatedness to objective content is emphasised; in its instrumental aspect, stressed by pragmatism, its surrender to heteronomous contents is emphasised. Reason has become completely harnessed to the social process. Its operational value, its role in the domination of men and nature, has been made the sole criterion.”

Beginning at the end of the observation, attention may be given to the point, that operational value “has been made the sole criterion”. Operational value here is the value that an object or process is given for the practical and quantitative functions it serves. The context of the short story appears to be one in which operational value is the primary benchmark by which objects and processes are valued. After the hoop is put into operation for the purpose of making New York’s massive amounts of garbage disappear, Hepplemeyer is showered in awards from various organisations and countries (Fast 1975, 190):

“By a special act of Congress, the Congressional Medal of Ecology<sup>1</sup> was created; Hepplemeyer got it. He was made a Kentucky Colonel and an honorary citizen of Japan and Great Britain. [...] Honorary degrees came from sixteen universities, and the city of Chicago upped Japan’s offer to twelve million dollars for a single hoop.”

While it may not have been Hepplemeyer’s intention to be the recipient of the acclaim, his decision to translate his mathematics and laws into a device that performs an instrumental function, fits perfectly in light of Horkheimer’s points, “[r]eason has become completely harnessed to the social process” and “reason has become an instrument”. While it may be possible to put aside the question, at this level of analysis, of whether Hepplemeyer’s mathematics and physical laws are potential subjects in the debate about objectivity and subjectivity in the sciences, it is not possible to isolate the application of the science to create the hoop from the context of operationalism and instrumentalism highlighted by Horkheimer. It is almost as if Hepplemeyer has no say in the matter – he moves effortlessly and unquestioningly from the more abstract realms of mathematics and laws, to operationalising his knowledge. One could say that Hepplemeyer’s use of reason was eclipsed by the dominant context of instrumentalism in which he worked – this point should add insight on the title of Horkheimer’s text, *The Eclipse of Reason* – indeed, the direct translation of the German title of the book is *On the Critique of Instrumental Reason*.

Horkheimer’s point about reason’s “role in the domination of men and nature” could strike scientists as counter-intuitive. Reason, in its everyday sense, is generally regarded as something positive. However, the idea that reason could play a role in “the domination of” nature is well demonstrated in “*The Hoop*” (1975). While Hepplemeyer and the Mayor of New York both act in ways that first appear to be entirely reasonable, the climax of the story suggests that reason

can be put to use for purposes with disastrous consequences. In their *Dialectic of Enlightenment*, originally published in 1947, Horkheimer and Adorno invoke the theme of reason's more questionable character in the opening lines of the first chapter of the book (2002, 1):

“Enlightenment, understood in the widest sense as the advance of thought, has always aimed at liberating human beings from fear and installing them as masters. Yet the wholly enlightened earth is radiant with triumphant calamity.”

Horkheimer and Adorno's (2002) commentary can be accessed in support of the question of whether the undesirable climax of the story is simply an unforeseen outcome brought into being by only partially applying human reason properly, or if reason is itself partially characterised by inherent limitations or factors not generally acknowledged by human beings. Horkheimer certainly does acknowledge the more counter-intuitively limited and perhaps paradoxical character of reason (insofar as the application of reason can have disastrous consequences), and “*The Hoop*” (1975) succinctly illustrates events that can be discussed for the purpose of exploring this important issue.

## KUHN'S THEORY CHOICE

In a short essay with the title “Objectivity, value judgment, and theory choice”, originally published in 1977, Thomas Kuhn made an important contribution to the topic that has generally been described as theory choice in the sciences. Several key contributions have been made to the topic by, for example, Imre Lakatos (1978) and Paul Feyerabend (1975) respectively, but for the purposes of this article, only part of Kuhn's contribution will be incorporated very succinctly to shed light on aspects of the scientific enterprise as illustrated in “*The Hoop*” (1975).

In the 1977 essay, Kuhn provides five criteria that can be applied in the selection of one scientific theory over another, for example quantum mechanics over Newtonian physics. The five criteria are “accuracy, consistency, scope, simplicity, and fruitfulness” (1977, 322), and Kuhn refers to them as “shared or objective criteria”, though he states immediately after using the terms that later in his essay he will question their use. Of relevance here is Kuhn's observation that different people diverge considerably in their application of chosen criteria, and that with “respect to divergences of this sort, no set of choice criteria yet proposed is of any use” (1977, 324). Kuhn proceeds to provide examples of various factors that influence a scientist's choice of theory, and it is clear that historical context plays a major role (1977, 325):

“Other factors relevant to choice lie outside the sciences. Kepler's early election of Copernicanism

was due in part to his immersion in the Neoplatonic and Hermetic movements of his day; German Romanticism predisposed those it affected toward both recognition and acceptance of energy conservation; nineteenth-century British social thought had a similar influence on the availability and acceptability of Darwin's concept of the struggle for existence. [...] My point is, then, that every individual choice between competing theories depends on a mixture of objective and subjective factors, or of shared and individual criteria."

As already acknowledged, the topic of theory choice has a long history, and the glimpse here offered of Kuhn's contribution to the topic is indeed only a tiny glimpse. However, the glimpse does provide further support for the point, namely, that context matters immensely when it comes to the work that scientists do.

If it can be said of Kepler that his choice of Copernicanism was "due in part to his immersion in the Neoplatonic and Hermetic movements of his day", it can be said of any scientists that their theory choices are intertwined with various aspects of the historical contexts in which they work. The historical context in which Hepplemeyer developed his mathematical equations and formulated his own laws of physics is, as already discussed in an earlier section, a dispensation in which instrumentalism and operationalism are par for the course of the political economy in which Hepplemeyer thinks and works. This political economy hijacks the hoop after its creation by a stereotypically apolitical scientist with no interest in fame or fortune. However, the issue, focused on in an earlier section, of Hepplemeyer not necessarily intending to bend space, but in effect betraying such ambivalence and proceeding to create a device that makes objects disappear, suggests that contextual factors may impact the choices that scientists make in very subtle manners despite whatever can be said about their commitments to objectivity.

Kuhn's use of the phrase "shared criteria" rather than objective criteria is important because it allows him to engage in a conceptual exploration of how values and norms (1977, 330–331) influence the choices that scientists make when they theorise. While it is perhaps tempting to argue that the mathematics and laws that Hepplemeyer works with are objective, it is crucial to note here that the mathematics and laws he works with are chosen in an instrumental context where the ultimate tests for the accuracy and success of mathematics and laws are practical tests. In an advanced industrial society, it is arguably the case that the worth of a scientific endeavour is measured by the advantage the science confers to human beings in their quests to perform practical functions – sending a human being to the moon, breaking a previous high speed record, developing a vehicle that is not powered by fossil fuel, and so on. The issue is therefore not only that Hepplemeyer chose to create a device that performs a function; it is also that he chose to pursue mathematics and theorise laws that could be testable in conspicuously instrumental ways – in his case, via a device that, to him, bends space, while to

others it makes things disappear. A socio-political and economic dispensation in which operationalism and instrumentalism are dominant provides the context needed to explain, in part, the theory choices in question.

## HEIDEGGER'S TECHNOLOGICAL ENFRAMING

The final of the three more philosophically orientated arenas that will here be touched on in reflection on some of the events, themes and issues raised in “*The Hoop*” (1975) is Martin Heidegger’s technological Enframing. As is the case with Horkheimer’s articulation of some of his ideas about instrumentalism and operationalism, Heidegger’s manner of expression may intimidate some readers. However, the summary of the short story “*The Hoop*” (1975) provides a convenient backdrop for the purpose of assuring intimidated readers that they already have a literary framework to be able to comprehend the following comments from Heidegger (1977, 19–20):

“Enframing means the gathering together of that setting-upon which sets upon man, i.e., challenges him forth, to reveal the real, in the mode of ordering, as standing reserve. Enframing means that way of revealing which holds sway in the essence of modern technology and which is itself nothing technological.”

For the purposes of this article, what is meant by “the real” will be simplified to mean an essentially unknowable object or event that is made to fit a particular explanatory framework. While many objects or events may be given a name, and thus rendered familiar and ostensibly knowable – for example, the object that is the sun, or the event that is death – their essence remains unknowable. There is a certain philosophical humility that accompanies the knowledge of humanity’s inherently limited ability to know the real nature of many of the objects and events that some people may think are fully understood by experts working in the sciences (or in economics, or in politics, etc.). The events of “*The Hoop*” (1975) illustrate how an object, namely the hoop, that does something essentially beyond the limits of human understanding, i.e., bend space, can be co-opted for the purposes of reducing the object and the event into a framework for human understanding, an act that has disastrous consequences in the story.

The context of the short story has so far been described as one heavily influenced by operationalism, instrumentalism, and pragmatism, and this kind of context is largely compatible with Heidegger’s concept of technological Enframing. In this regard, Olivier (2008, 7) provides useful commentary on Heidegger’s concept of technological Enframing:

“[T]echnology, or rather, its ‘essence’ as ‘Enframing’, is a pervasive, inescapable ontological ‘framework’ which operates tacitly and implicitly as unquestioned assumption whenever questions are asked, or problems approached, concerning politics, society, economics, nature, and

just about anything which could possibly be a topic of conversation. No institution escapes being positioned in this framework of organisation and evaluation underpinning humanity's current manner of experiencing the real[.]”

It is important that Olivier refers to the framework as tacit and implied, functioning at the level of a network of hidden assumptions, rather than anything explicit or obvious. Hepplemeyer is characterised as a scientist with good intentions, and as a person not susceptible to the influence of fame or fortune – such influences are relatively easy to spot and avoid. However, the existence of a hidden network of assumptions that influence thought and action is much harder to detect. Hepplemeyer’s decision to create the hoop, and the Mayor’s co-opting of the hoop for the purpose of dumping city garbage into it, must be positioned against the backdrop of the implicit framework (hence the term Enframing) that certainly influences, and perhaps determines to a large extent, what people do with their knowledge.

Not only does an understanding of the technological Enframing provide insights on the question of why knowledge is put to use almost exclusively for pragmatic purposes, it also sheds light on the technologised contexts in which knowledge develops. Hepplemeyer, for example, does not work and think in a vacuum. Rather, his thought and his work are, in part, products of the socio-political and economic dispensation largely brought into being by the historically dominant applications of technology for anthropocentric purposes. With this in mind, consider more commentary from Olivier (2008, 7):

“What does Heidegger mean by saying the essence of technology is ‘Enframing’? For him, this manifests itself as a mode of being or ‘openess’ where everything is seen as being fit to be ‘ordered’ or ‘set upon’, or as something that presents itself as a ‘standing reserve’, according to which things and energy, including human beings, can be used or ‘stored’ as ‘resources’ for use[.]”

Accordingly, the development of technology can be viewed as a gradual creation of tools that structure the world in various ways, for example, by processing a “standing reserve” of natural materials into products and resources, by delineating what occupations are prioritised in the increasingly technological context, by dictating what employees must do, by enabling the accelerated expansion of the human species, etc. Nature and human beings alike are framed in instrumental and operational manners, and from what has briefly been seen in this section, one can add to the framing process a technological bias.

This technological bias adds important context to Hepplemeyer’s scientific work, his decision to create the hoop, and the Mayor’s co-opting of the hoop for the purpose of garbage disposal. With the story ending badly, heavily technologised contexts are put into the spotlight for their tendency to frame the work of scientists, and scientific work is itself inculcated in the processes by which heavily technologised contexts emerge. This is not to suggest that the

Enframing is limited to the scientific realm – all arenas of society are susceptible to aspects of the Enframing process. However, it is important that scientists do not think of themselves as being immune to such powerful forces, and “*The Hoop*” (1975) succinctly demonstrates this crucial point.

## CONCLUSION

Scientists and researchers working in the fields of the sciences may believe that the work they do occurs in a bubble of objectivity. Whether their belief is true, “*The Hoop*” (1975) offers a reminder that as soon as scientific knowledge becomes applied for pragmatic purposes, application occurs in a context where strong socio-political, economic, technological and other forces can be said to co-opt science for unscientific purposes. These purposes can generally be described as instances of operationalism, instrumentalism, and pragmatism, all of which can also be employed to describe the context that subtly influences, and even determines to a large extent, the choices that scientists make in the first place.

For anyone interested in transformative and disruptive pedagogies, this article may provide a useful glimpse of a stepping stone in the river of barriers that may need to be crossed in order for these kinds of pedagogies to eventually find a home in the sciences, and perhaps in other disciplines that constitute Higher Education. “*The Hoop*” (1975) quickly conveys an important point via a familiar literary medium in an amusing and undivisive manner while centring on a likeable, humble scientist with the best of intentions. It is even possible to extract from the short story two simple take-away ideas that will likely stick with many people who encounter them.

The first is Hepplemeyer’s law of return. The law is never explained in the story, but it is mentioned early on. It acts as a literary device in that it foreshadows the ending: the two million tons of garbage thrown into the hoop returns in a Vesuvius-like explosion that buries Wall Street (a symbol of human wealth, success, and achievement). The hoop is a device, the existence of which is made possible due to scientific work, and the law of return can be a reminder to scientists and non-scientists alike that what human beings do with their knowledge and their tools invariably has consequences – often undesirable consequences.

The consequences are often unforeseen in both scientific and unscientific contexts, which leads to the second and final take-away idea: the Hepplemeyer phenomenon. The Hepplemeyer phenomenon involves the co-opting of science into unscientific contexts, and it can be unpacked to explore all of the ideas addressed in this article.

In conclusion, the contention is here made that these two take-away ideas, due to their simplicity and their origins in a short and undivisive story, are likely to find homes in various disciplines that might otherwise be unreceptive to other seemingly radical transformative ideas.

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## NOTE

1. An additional literary device – namely, irony – is created by the issuing of an ecology medal for an achievement that turns out to have disastrous ecological consequences at the end of the story.

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