Monstrous regiment versus Monsters Inc.: competing imaginaries of science and social order in responsible (research and) innovation

Stevienna de Saille, Paul Martin

All monsters are undead. Maybe they keep coming back because they still have something to say or show us about our world and ourselves. Maybe that is the scariest part. (Beal, 2014: 10)

As new technological domains emerge, so too do promises and warnings about the future they will bring. However, as technology has grown ever more complex, predicting either benefits or risks has become increasingly difficult, particularly where a high level of control over natural processes is concerned. This can lead to uneasiness on the part of both the public and policymakers that scientific information alone cannot counter (Douglas, 2015). Moreover, in a time of rapidly increasing political and economic uncertainty, the difficulty of separating science from politics, and business interests from both, only exacerbates the public's concern that necessary precautions may be discarded in the rush to open up new markets and find new sources of economic growth.

Powerful corporations do indeed succeed in shaping regulations to their needs, at times with great cost to public health or the environment. But potentially useful technologies can also be blocked by a public that does not trust those who create and regulate technology to hear its concerns. For some technologies these tensions have resulted in an intractable, decades-long debate in which each side imagines the other as monstrous and rampaging out of control. In this chapter we want to open up these ideas, to examine how the concept of 'monsters' functions in entrenched controversy, and ask whether this

can be addressed through evolving frameworks for responsible (research and) innovation (RI).¹

Since the 1980s it has been suggested that greater understanding of science (and, later, greater engagement with science) would help provide the context necessary for the public to feel confident of the benefits of a new technology, as well as mitigating fear of its risks. Historically, however, these imperatives to engage the public as a means of gaining legitimacy for new technological fields have been accompanied by a growing fear of those who wish to engage with science on their own terms (Hess, 2014; Marris, 2014; Welsh and Wynne, 2013), in particular through direct protest. While considering RI as a more responsible way of 'embedding' innovation in society (von Schomberg, 2014: 39), it is therefore also necessary to consider the ways in which it represents a socio-technical imaginary in which progress is achieved through enlightened governance of the entire research and innovation system, in order to keep under control both potential technological monsters and a potentially unruly public response.

According to anthropologist Martijntje Smits (2006), monsters embody inseparable but directly opposing characteristics that make them both horrifying and fascinating at the same time. Because the simultaneous fear and attraction they evoke can never be reconciled, monsters are more than mere creatures of the imagination; they are deeply rooted in the binaries of modernism – body versus mind, nature versus technology, superstition versus science. When we speak of monsters in the socio-technical imaginary in this sense, we are referring not to the 'imaginary' as non-existent, but to a concrete, collectively embraced, politically actionable future in which technology is expected to bring about certain positive, culturally intelligible improvements to the human condition (Jasanoff, 2015; Jasanoff and Kim, 2009). These are generally (although not only) framed as large-scale scientific projects that embody national economic aspirations – for example, building a civil nuclear industry or setting out a strategy for world leadership in a new scientific field. As socio-technical imaginaries are also rooted in the modernist project of social progress

1 We use RI here to refer generically to discussions around responsible innovation, and RRI to refer specifically to its recent formulation by the European Commission as part of Horizon 2020, its funding programme for research and innovation.

through science, arguments for and against these projects also tend to be framed through binary opposition, so that science, rationality and control wind up juxtaposed against culture, emotion and messy nature. Monsters, therefore, can be thought of as signifiers of disorientation in imaginaries of progress, markers for that which cannot easily be assigned to one side of the binary or the other, perhaps cannot even be properly categorised at all because they too are unknown, like the warnings placed over the uncharted portion of an incomplete map. To illustrate these points more clearly in the discussion that follows, we will draw upon both the Frankenstein story, as one of the original monsters in the socio-technical imaginary of progress through science, and more recent metaphors from popular culture, to discuss genetically modified organisms (GMOs), one of the most intractable technological controversies of our time.

While those involved in creating GMOs, particularly multinational corporations such as Monsanto, have been characterised as a kind of ‘Monsters Inc.’, likewise the biotechnology sector has sometimes appeared to view the public as a kind of monstrous regiment, an army of dissent intent on thwarting the aspirations of a field that seeks only to improve upon nature to feed the world (Riley-Smith, 2014). We draw the metaphor from the highly successful animated Pixar film *Monsters, Inc.*, released by Disney in 2001 (Docter et al., 2001). The film turns on the idea that the monsters hiding in our childhood closets have a reason for terrifying us every night: power for their city, Monstropolis, is derived from human children’s screams. Unfortunately, modern children are not as fearful as they once were, and a scream shortage is now threatening the economic security of Monsters Inc., the factory which produces the ‘clean energy’ that powers the city. The conceit of the story is that the monsters are really just like us – worried about jobs, family and social status – and it is human children who are monstrous, radioactively toxic creatures who must be contained behind their closet doors lest they contaminate the normal world. When a human child (Boo) sneaks into the factory on the back of her ‘scarer’ (Sulley), her discovery throws the whole city into a panic. In solving the problem of getting Boo safely back to her world, Sulley has to reconcile his fear of human children with the realisation that, as a top scarer, he is the monster in Boo’s eyes. This

reconciliation ultimately leads the monsters to discover that children's laughter is a more powerful energy source than screams.

Ultimately, as a children's film, *Monsters, Inc.*, validates cooperation and understanding as leading to better ways of producing what is necessary for society to prosper. However, as Tranter and Sharpe (2008: 305) point out, it is also a parable about fear, both of running out of the energy upon which society depends, and – in the character of the CEO Waternoose, who is plotting to kidnap human children and torture them to produce more efficient screams – of how far some corporations may go to secure a profit. The film's references to clean energy and a running joke about the vicious scrubbing to which human-contaminated monsters are subjected draw heavily on cultural knowledge about the civil nuclear industry, where clean energy cannot be separated from the deadly toxicity of the materials used and the waste produced, even were accidents never to occur. Boo, therefore, functions as both a caution against excessive fear (she is not actually toxic), but also as a reminder that technology can have undesirable social costs.

Unlike *Monsters Inc.*, the term 'monstrous regiment' is several centuries old. It originates with a sixteenth-century Protestant reformer who coined the phrase to argue against the passage of the Scottish Crown to a woman, the Catholic Mary Queen of Scots (Knox, 2011 [1558]). 'Regiment' in this time meant rule, not army. The monstrosity in this case was allowing a woman to assume a role that God had reserved for men. Terry Pratchett (2003) later used the term more literally in a satiric novel about a Balkans-like country engaged in an endless war no-one seemed to understand, fought by an army of women secretly disguised as men (the actual men having all been captured or run away). We use the term both to characterise the illusion of an army which does not actually exist and, 'monstrous regiment' being inherently a gendered term, the practice of ascribing stereotypically 'feminine' negative traits – such as being irrational, emotional and illogical – to those who attempt to oppose regimes of power such as science, technology, politics and the market, which are still very much the province of the male.

Beginning with an exploration of metaphors as carriers of meaning, we will then use the metaphors of *Monsters Inc.* and the monstrous

regiment to consider how certain actors and technologies become constructed as monstrous, and how this contributes to the continued intractability of some technological debates. We end by asking what ‘monster theory’ (Smits, 2006) can offer towards a better understanding of competing social imaginaries in RI.

Monsters in the imaginary (rather than imaginary monsters)

Metaphors function as condensed, culturally intelligible stories, or ‘scripts’ (Shank, 1990, quoted in Turney, 2000: 6) that guide meaning making towards a prespecified conclusion. Perhaps their most visible use in controversy is through symbolic action by social movements, in order to illustrate an issue that has been left unspoken (Melucci, 1985). For example, anti-genetic modification (anti-GM) protesters often wear hazmat suits to illustrate the toxicity of pesticides used with GM crops. In particular, metaphors are able to carry meaning from one context to another (Hellsten, 2006), transferring or extending the original script to make a clear statement about how to read something new.

Inasmuch as monsters can be defined as an irreconcilable hybrid of two opposing cultural categories simultaneously eliciting both fear and wonder (Smits, 2006), they do not spring purely from wild imagination. Rather, as Smits argues, monsters require grounding in a culturally specific context to give them concrete existence. The script for *Frankenstein* is generally interpreted as a reflection of the uneasiness with which Mary Shelley and her circle of friends viewed the pace of change from agrarian society to industrial modernity, and it is still considered a cautionary tale about the capacity of technology to do ill as well as good (Botting, 2003; Latour, 2012; Turney, 2000). As Turney explains:

It is frightening because it depicts a human enterprise which is out of control, and which turns on its creator ... [but] the myth is never a straightforward anti-science story ... the *Frankenstein* script, in its most salient forms, incorporates an ambivalence about science, method and motive, which is never resolved. (Turney, 2000: 5)

This ambivalence is also apparent in the public’s tendency to amalgamate the scientist, Victor Frankenstein, with the flat-headed monster of

Hollywood films. As Smits (2006) argues, the creature's monstrosity is not merely the result of being a crime against nature, as other commentators suggest, but rather the internal chaos caused by the contradictions of being simultaneously alive and dead, benign and lethal, natural and technological. The maker of the creature is equally reviled and persecuted as a man seeking the power of granting life, which is supposed to belong only to God, but whose horrified abandonment of his creation sets a series of violent events in motion. In other words, both the creature and the scientist embody key binaries of modern progress which can never be reconciled by calling upon either values or science (Smits, 2006: 499). For Shelley, the context was the development of electricity and the industrial revolution. Cultural theorists have similarly argued that the surge in the prevalence of monstrous characters and topics in popular media post-9/11 signifies that the monster figure may have now 'transcended its status as metaphor' to become 'a necessary condition of our existence in the 21st century' as both technology and social relations become ever more complex (Levina and Bui, 2013). Zombies, for example, which were once slow undead shufflers, are now victims of a virus capable of super-fast motion and driven by super-rage,² perhaps reflecting a shift in the locus of public fear from the supernatural to the technological, and from mindless violence to directed fury. As in Shelley's work, therefore, monsters continue to reflect unease not only with technology per se but with the increasing pace and direction of change. Similarly, historical uprisings against the introduction of new technologies, in particular the Luddites smashing the first mechanised looms as a threat to their jobs and way of life as traditional weavers, are still featured in the techno-scientific imaginaries of modernity as ignorant, superstitious mobs standing in the way of inevitable progress (see, for example, Wood, 1999). They are the pitchfork-wielding villagers of the Hollywood version of the Frankenstein story, whose rejection sets the creature on its rampage, so that the cultural resonance of the monstrous regiment is always anti-progress and anti-science.

These two inherently irreconcilable scripts, that of technology as simultaneously the saviour of humanity and a kind of monster factory,

2 As depicted in a new generation of films such as *28 Days Later* (20th Century Fox, 2002) and *World War Z* (Paramount Pictures, 2013).

and the public as simultaneously the eager beneficiary and the irrational (yet organised) saboteur of technological progress (Marris, 2014; Nowotny, 2014; Welsh and Wynne, 2013) are extremely powerful in the debates on GMOs. But is it possible to use the values that RI supposedly embodies to directly grapple with – rather than seek to bury – the contradictions that are inherent in GM itself?

Monsters and the imaginary of RI

The socio-technical imaginary of RI – in which research and innovation, guided by the continual involvement of a technologically literate public, result in goods and services that answer society's needs – has been the most recent attempt to answer unease about the risk and pace of change. While there is no agreed definition of RI, in general it is understood as a means of involving the public in an iterative and mutually reflexive process of shaping innovation, from upstream research, all the way downstream to its eventual introduction to the market and beyond (Owen et al., 2013; von Schomberg, 2013). However, it is also in the interests of multinational corporations and growth-eager governments to shape public engagement in ways that tend to dismiss, defuse and disinvite engagement from the dissenting public (de Saille, 2015) before opposition can grow strong enough to interfere with the commercialisation process; in effect producing a good public for the product rather than a product for the public good (Thorpe and Gregory, 2010). This has also been an irreconcilable contradiction in the development of RI.

Lurking deep within the imaginary of RI is the monster of recombinant DNA (rDNA), born in the early 1970s to both fanfare and fear, not least amongst the scientists, who were worried that public reaction to it might curtail their research. If, in this story, rDNA was an infant monster, the lullaby that sang it to sleep was the 1975 Asilomar Conference on Recombinant DNA, at which genetic scientists, accompanied by lawyers, journalists and government officials, agreed on a set of restrictions within which they could continue their work (Berg, 2008). Acknowledging that there was particular concern about rDNA's potential siblings – viral cloning and bacterial pathogens – scientists set about reassuring the public that the process of recombining DNA to create organisms not found in nature would only ever be

used for good, not harm, and that these could be contained within the lab until mature enough to be safely released.

By the early 1980s the field of agricultural GM was slowly being made 'business-friendly' through deregulation (Stavrianakis, 2012: 159), and in 1994, with the introduction of the Flavr Savr tomato to the US market, rDNA's children finally began to leave the lab and seek their fortune in the world. The Flavr Savr was engineered by Calgene to turn off the genes responsible for softening. Ordinary tomatoes must be picked and shipped while they are hard and still green, and are then chemically ripened with ethylene gas, but these could remain firm while they matured on the vine. This improved flavour so much that despite being almost twice the price of ordinary tomatoes they met with good public demand.³ Ultimately though, Calgene was staffed by scientists, not farmers, who did not know how to get the tomatoes from the fields to the market in numbers large enough to make the business profitable.⁴ In 1997 the company and its patents were acquired by Monsanto, which promptly discontinued production of the Flavr Savr, as it had its own tomato under development. A paste made from GM tomatoes was launched on the UK market in 1996 but withdrawn in 1998 when sales fell sharply after a media broadcast claimed that while the modified gene itself was not a risk, adverse health effects could still ensue from the GM process (Bruening and Lyons, 2000).

According to most of the tellers of this tale, this is when the European public, having until then been largely content with Asilomar's assurance that science could be trusted to raise the monster with care, suddenly panicked and grabbed their torches and pitchforks with the intention of driving GMOs from their shores. Organic farmers' associations, in particular, were increasingly concerned about pollen contamination from adjacent GM fields, as this could cause them to lose their certification and thus their entire business. In 1998 a leading organic farmer in the UK sued for a judicial review of the legality of a maize test site adjacent to his own organic maize. He eventually won the case on

3 One Calgene scientist interviewed twenty years later remembers they were so popular in her hometown of Davis, California, that greengrocers had to ration them (for a video report, see Winerip, 2013).

4 Again, for a video report see Winerip (2013).

appeal, but when the GM crop was not ordered to be removed, his supporters invaded the field and destroyed the plants before their pollen could be released (Reed, 2002). In 2000 a trial jury accepted that the destruction was done ‘in order to prevent greater harm’, setting a precedent which has meant that for most similar instances since then, crop destruction has gone unpunished (Tait, 2009). Activists have subsequently destroyed more than eighty fields and test sites in Europe alone (Kuntz, 2012), have staged numerous protests across the world, and have made both carefully documented and wildly inaccurate claims about health and environmental risks, soil depletion, threats to bee and butterfly populations, predatory corporate practices, and social upheaval caused by adoption of GMOs.

The monstrous regiment, therefore, has certainly engaged in behaviour that is reminiscent of pitchforks and torches. In a more recent example, Ecover, a company known for its natural products, unexpectedly ran into strong resistance when it announced that for reasons of sustainability it planned to replace the palm oil in its laundry detergent with an oil derived from genetically modified algae (Strom, 2014). Although initially stating that the company that supplied the algal oil was using synthetic biology to produce it, when protest ensued, some representatives subsequently tried to argue that synthetic biology meant creating a new organism from scratch, whereas they were only harnessing the algae’s ‘natural’ fermentation process (Domen and Develter, 2014). Ecover, in fact, had been using enzymes created from GM bacteria for some time (see Asveld and Stermerding, 2016, for a full account), but it is possible that consumers were not aware of this before. Neither argument was likely to defuse resistance to the product among Ecover’s deep green customers, who could not reconcile the idea of scientifically altering an organism to produce something it did not normally produce with the term ‘natural’ (Thomas, 2014). A boycott was called, after which Ecover withdrew the product and announced a period of public consultation. As of the end of 2016, any further plans to use algal oil appear to have been shelved.

In terms of the socio-technical imaginary of public engagement in innovation through RI, it could be said that this is how RI could and should function, in that the incident created an open public debate and the company responded to concern about a pathway of innovation and changed its trajectory accordingly. However, few on either side

would claim to be satisfied with the outcome, particularly as the laudably responsible goal of replacing palm oil with a more sustainable alternative remains unrealised. Ecover's experience suggests that the difficulties of innovating responsibly are far more complex than simply 'engaging' the public, and that even a company with an ethical reputation could suddenly find itself seen as Monsters Inc. if it tried to smooth away the irreconcilable tensions between the natural and the technical that are inherent in genetic engineering.

However, focusing on the irreconcilable tensions of the technology itself should not obscure acknowledgement of fear and fascination also arising from the context within which a new technology will be received. Monsanto, for example, has been extremely successful at commercialising GM crops as the solution to feeding a growing world population. But it has also been called 'Monster Monsanto' because of its historic production of Agent Orange, a defoliant used to destroy North Vietnamese agriculture during the Vietnam War, which has had long-term health effects on both US soldiers (and their descendants) and the Vietnamese population (see, for example, Ragonesi, 2004). Although Monsanto stopped producing Agent Orange for the military in 1969, its website states that it is still 'responsible' for the compound (Monsanto, 2017), whose broad herbicidal function is similar to its signature product, Roundup, which kills all plants except the seeds engineered to withstand it. Roundup's active ingredient, glyphosate, has been the subject of intense scientific debate about long-term toxicity,⁵ while Monsanto was also a major producer of polychlorinated biphenyls (PCBs) and dioxin, and has been sued repeatedly (and occasionally even successfully⁶) for contamination of dozens of sites in the USA alone. Therefore, beyond the ethical questions which have often surrounded Monsanto's particular model of generating profit

5 The World Health Organization's International Agency for Research on Cancer (IARC) has issued a report reclassifying glyphosate as 'probably' carcinogenic (IARC, 2016), causing some member states to refuse to renew its licence for sale in the European Union. The European Food Standards Agency (EFSA) subsequently issued its own report finding it not carcinogenic if used as recommended (EFSA, 2015). As of this writing, the licence has been temporarily renewed while a third agency reports (European Commission, 2016).

6 As one high-profile example, a long-standing lawsuit over clean-up in Anniston, Alabama, was finally settled for \$700 million (Associated Press, 2003).

through the stringent enforcement of patents (Barlett and Steele, 2008) or by successfully lobbying the US Congress for laws that protect it from being sued in the public interest (Godoy, 2013), the company's reputation as a food producer continues to be inseparable from its historic reputation and present market leadership as a producer of poison. Moreover, from the point of view of the public, the way in which Monsanto has pursued the commercialisation of GM can make all industrial actors in the field look like *Monsters Inc.*, as well as making any application of GM, however useful, seem monstrous – as with the term *Frankenstein*, the creator has been conflated with its creation over time.

At the same time, the failure to commercialise Golden Rice, which has been hailed as a 'humanitarian' GM crop aimed at delivering vitamin A to areas which are traditionally malnourished, has been blamed on the 'wicked' monstrous regiment of anti-GMO activists destroying test fields (Riley-Smith, 2014), with some GM proponents even circulating images of starving children, captioned 'Thank you, Greenpeace, for saving us from Golden Rice' (Everding, 2016). Embarking on a campaign of public 'education' about GM in the 1980s, the chairman of Monsanto similarly said that:

the only thing that will stand in the way of our achieving the full potential of our next golden era is that we will be thwarted by a public that doesn't understand science or technology and that doesn't trust us to use science wisely and with appropriate regard for the concerns of the public we serve. (Richardson, 1985, quoted in Kleinman and Kloppenburg, 1991)

The above statement resonates with the argument, common in the 1980s and 1990s, that the public was resistant to new technology because there was a 'deficit' of scientific understanding. Trust in the company and understanding of the science are conflated, so that better science communication is assumed to produce trust in the company's agenda, and when this does not happen, it is the public's ignorance that continues to be blamed. Yet some scientists working on the rice have insisted that the problems are scientific, not political, and in the meantime the Philippines has reduced vitamin A deficiency by methods which do not include GMOs (Everding, 2016).

These examples suggest competing imaginaries of social order, one in which progress through technology is inevitable and desirable, no

matter the cost, and the other in which technology is not always benign, nor even always necessary for social progress. As technology becomes ever more complex, finding means through which we might be able to explore both the fascination and the fear becomes ever more crucial, not least to the imaginary of RI.

Monster theory, or bringing the monsters into the open

To return to our metaphors, from the point of view of Monsters Inc., the human world (the public) is both potentially toxic and necessary to produce the energy (of market acceptance) upon which successful innovation depends. In this imaginary the public does not understand either science or the importance of Monsters Inc. as a driver of the economy, and so is standing in the way of progress and growth. This imaginary, however, can also perceive 'the public' as more singular and unified than it actually is. In the case of rDNA's great-grandchild, synthetic biology, Marris (2014) suggests there is now a kind of synbiophobia-phobia, in which an exaggerated fear of a potential public backlash informs the drive towards RI. Marris argues that the continued assumption that resistance is a product of ignorance has meant that, in fact, the 'inclusive engagement' elements of RI have remained mired in precisely the kind of top-down 'we talk, you listen' form of scientific communication that RI was meant to overcome. Science-studies scholars have long criticised such endeavours, suggesting instead that the public is not a single entity, but is made up of many publics with many different sets of values that come into play. These publics need to have opportunities for meaningful engagement with scientific topics, which includes the right to introduce questions about the social impact of technological change, rather than simply being furnished with more scientific information.

In *Options for Strengthening Responsible Research and Innovation*, the European Commission (2013: 14) agrees that the €300 million spent on safety research has not been adequate to resolve society's concerns, and laments the lack of a European market for GMOs. In this and other key policy documents, RRI is constructed as a way to resolve these concerns at an early stage, so as to accelerate the pace of innovation without incurring the kind of intractable distrust and resistance which has been the case with GMOs. However, key

assumptions linking innovation to growth, and both to social progress, remain unquestioned, as does the linkage between upstream information and downstream trust. As a tool for shaping avenues to facilitate meaningful engagement, it is possible that RI's drive towards openness is more likely to produce an artificial closure at the earliest stages of the development process, thus re-entrenching old positions, rather than ameliorating them, as it is how technology acts in the world – what Frankenstein's creature does after exiting the lab, more than the fact of his existence – that matters most in terms of generating trust.

Braidotti (1996: 135) suggests that 'to signify potentially contradictory meanings is precisely what the monster is supposed to do.' In other words, it is perhaps not the intractability of polarised positions that is the problem, but the reluctance to honestly acknowledge that the contradictions cannot be prised apart. Scarers on the factory floor do not see themselves as monsters, but rather as the responsible producers of a necessary commodity. Likewise, human children are still needed for the energy they provide, but this can be produced in a better way once it becomes apparent that they are not as monstrous as the residents of Monstropolis fear.

In an earlier definition of the term, Law (1991) even goes so far as to suggest that 'socio-technical' is a monster in and of itself, as the social and the technical are generally seen as occupying mutually exclusive disciplinary realms. This suggests that 'society' exists in permanent opposition to science, and indeed much of the polarisation in the GM debate is due to a framing that relegates social and ethical concerns to the irrational, set in opposition to rational concerns that are usually framed as economic.⁷ In this way, by not continuing to acknowledge both the fear and the fascination as legitimate responses, corporations engaged in biotechnology are perceived as untrustworthy and not interested in what the consumer might really want to purchase (such as better-tasting tomatoes), but rather only in advancing the interests of industrial agriculture and their own profits (Holland, 2016).

Latour (2012) argues that the dominion and mastery that signify progress do not bring freedom from nature, but rather an ever-deepening attachment to that which is being dominated and mastered.

⁷ See, for example, arguments that the 'green blob' of environmentalists are acting against national economic interests (Riley-Smith, 2014).

He argues that 'we use the monster as an all-purpose modifier to denote technological crimes against nature' because, like Victor Frankenstein, we are unable to either love our technological creations or accept that it is our own actions that turn good creations bad. Plastics, for example, were initially hailed as a wonder (Smits, 2006). They became monstrous only when it became apparent that they continued to retain their cultural shaping (such as bags and bottles) after they became waste, causing great damage out of context by, for example, clogging up waterways and strangling birds. In other words, RI suggests that we must not, like Victor Frankenstein, run away from the technological monsters we have created; we must love and socialise and remain always responsible to our monsters so we may live with them in peace. But loving and taming our monsters may first require that we are able to acknowledge that 'monsters' is exactly what they are.

Conclusions

RI claims that greater public involvement at the research stage will shape innovation towards social benefit, but it has less capacity to control what happens when the monsters leave the lab and begin to interact with the world. As we cannot separate trust in science from trust in the adequate regulation of its marketable technologies, attempts to provide more scientific information about monsters which have not yet left the lab often produces no difference in acceptability and may, in fact, provoke more distrust as the inbuilt tensions between claimed social benefit and real-world actions, and between corporate risk management and corporate profit, become clear.

For Smits (2006), taming the monster – what she calls the cultural domestication of a new technology – is a process of mutual shaping, so that the technology opens a new space in the existing social order even as the social order tames the technology to fit it. Indeed, not all monsters are necessarily the stuff of nightmares – mermaids and satyrs, for example, while embodying contradictions, are not nearly as unsettling as Frankenstein's creature or the fast zombie. Considering controversial technologies through Smits's monster theory may reveal some of the simultaneous contradictions inherent not only in the innovation itself, but in the entire shaping of the innovation system towards the production of economic growth even at great social cost.

Whether the monster enables desirable or undesirable outcomes – whether it becomes Sully or Waternoose – will require something more than controlled forms of public engagement to provide a context in which it can be adequately socialised. RI should not be aimed at resolving differences, but rather seeking new forms of openness that can accept contradictions and explore the social and the technical as intertwined. Instead of leading to intractable polarisation, bringing the monsters out of the shadows through RI may help point to more useful ways of dealing directly with their potential to turn on their creators, thus attempting to productively address larger concerns about the overall pace and trajectory of technological change. We have suggested that the socio-technical imaginary of RI still contains a fear of both Monsters Inc. and the pitchfork-wielding monstrous regiment, the truth and exaggeration of which must be brought into the open, as part of the landscape in which innovation occurs. Taming, rather than hiding, the monster could be key to realising RI's goal of creating a new socio-technical imaginary of governance which enables truly socially beneficial research and innovation to emerge.

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