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Reputations are crucially important to scientists, so it is valuable to examine processes by which reputations come under attack. One potent method is a degradation ritual, an event or process that stigmatises the target and often results in feelings of shame and humiliation. Anthropologists and other scholars from a range of disciplines have examined degradation rituals and ceremonies, but their use in science has received little attention, perhaps because of the focus on the rational features of the issues involved. Degradation rituals can be described in terms of various features, including degrading agents, contexts, means and severity. Attacks on scientists in a variety of fields can be usefully interpreted through the lens of degradation rituals.

Introduction

On 25 March 1981, Melvin Reuber – a leading researcher on pesticides and cancer who worked at the Fredrick Cancer Research Center in Maryland – unexpectedly received a severe reprimand from his boss, Michael G. Hanna, Jr. Until then, Hanna had given Reuber glowing reports on his work. A few weeks later, most of Hanna's reprimand letter was published in the trade journal *Pesticide and Toxic Chemical News*. Reuber was so distressed by these events that he resigned (Schneider, 1982).

Like Reuber, most scientists place a very high value on their reputations. In the course of their careers, reputations are the basis for obtaining jobs, grants and awards. Independently of material and symbolic advantages, scientists value the respect and admiration of peers. Reputation is the currency of the operation of science: it is the basis of trust on which science is built (Shapin, 1995). If a scientist's good reputation is a valuable asset, then it is to be expected that reputations can be targets for attack, for a variety of reasons: undermining the reputation of other scientists can be a means of discrediting their work or getting ahead of them in competition for jobs and awards.

When a scientist does something wrong – for example, scientific fraud – and deserves to be exposed and reprimanded, then a formal procedure for dealing with the infraction may operate as a degradation ceremony. But even in these cases, there are different ways of proceeding, only some of which involve shaming as a central element. It is these cases that we examine using the concept of degradation rituals. A critical aspect of the enormous power of degradation rituals, involving feelings of shame and humiliation, lies in tapping emotions. Emotions are important in the operation of science, but have not been studied nearly so much as cognitive aspects of the enterprise (Mitroff, 1974; Mahoney, 1976, 1979).

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In the next section, we explain our approach to ritual as a particular kind of human activity and provide an overview of degradation rituals as studied in various fields. We then introduce several classifications of features pertaining to degradation rituals. In the following section, we provide several cases of degradation rituals in science, assessing them in terms of our classifications. In the conclusion, we sum up the importance of this concept. Degradation rituals serve to control people's behaviour. As such, they can play a role in restricting incentives for innovation, for example, by humiliating those who challenge established ways of doing things. More generally, degradation rituals, by inducing shame, discourage the sort of free and open discussion and inquiry in which innovation thrives.

Degradation rituals

Formal and informal rituals that humiliate or shame a person, degrade their status or expel them from group membership appear to be universal features of societies, whether subsistence-based or industrial. Informal social rituals of degradation may involve shunning, ignoring or excluding individuals from participation in everyday social interaction, or berating subordinates about their performance. As more formal and stylised events, they can appear as ceremonies where the ritual subject is literally and symbolically expelled from the social group in front of a representative audience (Carey, 1998).

In tribal contexts, degradation ceremonies, such as rituals of punishment, have been particularly studied by anthropologists (Gould, 1969; Bilmes and Howard, 1980; McDonald *et al.*, 2007, p. 883). In contrast to rites of passage (van Gennep, 1960) that, say, transform a boy into a man, two individuals into a married couple or an outsider into a member of a secret society, a degradation ritual aims not to incorporate the individual into an esteemed social category, but either to lower that person's categorical status or to exclude or expel him or her from the group entirely. There may be different types of degradation rituals depending on the outcome they are geared to achieve.

In sociology, Garfinkel (1956) defined a degradation ceremony as any communicative work that lowers a person's status within a group context. Successful degradation ceremonies, as outlined by Garfinkel, include a *denouncing agent*, usually an institutionally sanctioned or authoritative figure; a *denounced agent*, the person targeted for punishment, demotion or excommunication; and an *assembled audience*. In this view, degradation ceremonies are rituals with clear beginning and end points, undertaken by individuals recognised as authoritative who devalue the status of the target into a stranger or outsider to the group, in front of an audience representative of the social group in question. The presence of an audience for the degradation ceremony is seen as critical by Garfinkel to ensure witnesses and to invoke shame, humiliation and passive acceptance in the ritual subject.

The degradation ceremony can be seen as a particular kind of institutionalised discipline and punishment that Michel Foucault (1977) would distinguish from premodern forms of discipline and punishment involving extreme physical consequences, such as public displays of torture or execution. As examples, we can contrast the degradation ceremony suffered by the key figure in the Dreyfus Affair – a traditional army degradation where epaulettes are ripped off uniforms and swords are broken in front of other officers – versus the dire consequences of rituals where individuals are executed by the state (Smith, 1996; Beschle, 2000). However, we will argue that degradation rituals need not always take the form of explicitly formalised and highly

ceremonial events which occur, in the first instance, in front of audiences, nor do they always succeed in achieving a clear cut degradation of the target or repudiation by others who may come to know about the degradation at a later time.

The traditional anthropological approach to ritual is that it ensures social integration, namely, builds cohesion within a group. This approach, called functionalist, was originally advanced by Emile Durkheim (1995/1914) and developed by many others, such as Bronislaw Malinowski and A.R. Radcliffe-Brown (Alexander, 1997, p. 146). Although we agree that rituals express (Geertz, 1973) or are performances of (Turner, 1974, 1982) core values of the social systems in which they occur, we are particularly concerned with the notion of ritual as social action as well as the political dimensions of ritual practices, whether they result in cultures being maintained (called 'cultural reproduction') or transformed.

Our preferred approach to ritual focuses on the political or power effects of what has been called 'ritualisation': strategic and distinctive human activities or practices geared to produce particular social effects (Lukes, 1975; Bloch, 1989; Bourdieu, 1991; Bell, 1992, 1997; Rappaport, 1999; Couldry, 2003). Building on the work of Max Gluckman (1962, 1965), the notion of ritualisation has been advanced especially by Catherine Bell (1992, 1997):

> [R]itualization is a way of acting that is designed and orchestrated to distinguish and privilege what is being done in comparison to other, usually more quotidian, activities. As such, ritualization is a matter of various culturally specific strategies for setting some activities off from others, for creating and privileging a qualitative distinction between the 'sacred' and the 'profane', and for ascribing such distinctions to realities thought to transcend the powers of human actors. (Bell, 1992, p. 74)

As Bell notes, ritualisation as a strategy of power is effective in certain contexts, places and times, but may prove useless or counterproductive in others, a perspective that proves particularly fruitful to the analysis of degradation rituals and their intended versus actual effects. Therefore, it is critical to analyse the power relationships constructed through ritualisation as well as the contexts in which ritualised action occurs to discern how effective or fruitless such forms of social action are (Bell, 1992, p. 206). Attacks occasionally lead to enhanced support for targets and the undermining of attackers themselves (Martin, 2007).

The concepts of degradation ritual and ceremony have been employed to analyse social situations and settings across diverse fields of scholarship, including: the treatment of inmates as they enter 'total institutions' such as prisons, psychiatric wards or army camps (Goffman, 1961); legal and courtroom proceedings (Antonio, 1972); punitive management practices and organisational rites (Moch and Huff, 1983; Trice and Beyer, 1984); corporate crime and punishment (Levi, 2002); educational contexts (Hull, 1976; Westhues, 2004, pp. 199–203, 259); politics and administration (Bennett, 1981; Herd *et al.*, 2005; Roth, 2005); and media practices (Carey, 1998; Yadgar, 2003). The concept of degradation rituals in scientific contexts and domains, however, remains largely unexplored in any explicit sense.

It could be argued that the notion of degradation rituals has been implied in studies of scientific boundary work (Gieryn, 1983, 1995, 1999) that analyse social practices delineating what is science from what is not, as well as practices making value distinctions within science (Swedlow, 2007). Explicit analysis of demarcation battles in science as degradation rituals, however, including their various features, participants and intended versus actual effects, appears not to have been pursued. Applying the

concept of degradation rituals to the analysis of suppression in science (and beyond) allows for judicious use of anthropological insights regarding the range of cultural responses to persons or practices perceived as dangerous, anomalous or polluting within particular cultural contexts (Douglas, 1966).

Analytically, discerning features of degradation rituals allows insights into how social agents, by intention or default, protect existing practices, power arrangements and categories of thought by marking off certain things, activities or people as polluted, polluting and, therefore, dangerous to core cultural values and practices. Thus, analysis of degradation rituals in any context should pay close attention to how they attempt to mark targets and/or their behaviour either as deserving punishment, or demotion, or the more serious ritual of expulsion.

We use the term 'degradation ritual' to refer to particular practices – forms of ritualisation – that work to transform the status and identity of the ritual target into a devalued category within a group or to expel the target from the group entirely. We follow Goffman (1963) in making a distinction between 'social status', which includes formal and structural attributes, such as a person's occupation, and 'social identity' which includes personal attributes, such as (perceived) moral character, abilities or reputation. As discussed below, degradation rituals may be overtly conscious strategies or relatively unconscious, habitual strategies which attempt to undermine individuals or their work, but they do not necessarily succeed. Some rituals may be less ceremonial, formal, patterned and public than others, as we discuss in more detail below.[1]

There has been little in the way of systematic categorisation of types of degradation rituals by considering various features of these social practices. Although the concept of degradation ceremonies or rituals is used in quite a number of disciplines and scholarly areas of research, we could locate no *schema* of their various features and effects, whether in the context of science or other institutional domains – so we developed our own set of categories. The *schema* we present here is illustrative rather than exhaustive.

We delineate features of degradation practices in terms of *degrading agents* who enact them, such as those with formal authority over the target or those who are potential equals; *contexts* in which they occur, specifically public or private and formal or informal; the *means* by which ritualised degradation is enacted (for instance, through symbolic representations such as texts and images or embodied acts); and the *severity* of a degradation ritual, including effects on the formal status, identity, emotions and behaviour of the target, as well as effects on other audiences who may witness the event or come to know about it.

Degrading agents

The person or group that administers a degradation ritual can be an immediate superior (e.g. boss, head of school), a person with collective authority in the wider group (e.g. dean, vice-chancellor), co-workers (with roughly equal status), competitors within a field, or detractors from beyond one's immediate professional or group context. The implications of degradation rituals, such as their emotional or behavioural impacts, can vary with the nature of the degrading agent. Rituals enacted by those in a position of structural power over the subject are likely to be more serious in their effects than those enacted by co-workers.

Degradation rituals can occur by intent but also by default, as when the putative degrading agent does not intend to degrade.[2] The critical issue is their effects on the targets and on audiences that may witness or learn about the degradation.[3] The notion

of ritualisation as strategic practice allows for behaviour that is strategic by default: individuals play the authoritative role they believe is expected of them. It is usually easier to find data on the emotional, behavioural and social effects of degradation rituals than to establish the original intent of the perpetrator.

Public or private

The usual idea of degradation rituals is that they are necessarily public: an audience apart from the target should be involved. We build upon Garfinkel's definition of a degradation ceremony by suggesting that a degradation ritual is any communicative work that attempts to lower a person's status and/or identity within the context of a particular group. For social effects of degradation to occur, the three distinct types of parties to degradation rituals (degrader, target and other audiences) do not all have to be present at the same time and in the same space. We therefore introduce the idea of private degradation rituals, namely those without an audience apart from the target, as when a superior, in the confines of an office, admonishes, demotes or fires an individual or severely criticises their work. Between the two poles of public and private are semi-public degradation rituals, for example, verbal abuse or other degrading speech acts in front of a small number of work colleagues.

Even without an audience, the effects of degradation rituals on targets may involve a perception of oneself as diminished within the group context in addition to other negative emotional and behavioural impacts. As pointed out by Goffman in his study of stigma, people degraded in private are faced with the task of information management to prevent knowledge of their stigma leaking out and their subsequent transformation into publicly discredited individuals (Goffman, 1963, p. 4).

A variety of communicative means can be used for degradation, such as defamatory or insulting texts, pictorial representations, gestures or the refusal to acknowledge someone's presence or respond to verbal or written communication. Hence, an assembled audience may not be necessary to achieve degradation. Indeed, even the target of the degradation need not be physically present. Defamatory texts or images or other representations of degradation may be circulated through diverse media and to a range of audiences. Whether the ritualised degradation is successful greatly depends upon the interpretation and subsequent emotional and behavioural responses of the target and any audiences.

Formal or informal

Acts of degradation can range from sporadic and spontaneous social practices (including ostracism, verbal abuse, abusive gesturing and gossip) to more formal, stylised, rehearsed and pre-planned institutional ceremonies at special places and times. While formalisation is a highly common feature of ritualisation which aims to differentiate the specialness of ritualised behaviours from everyday, quotidian acts, Bell suggests that formality is not required for something to be a ritual. She notes, for example, that some ritualised acts set themselves off as special precisely through their self-conscious informality 'usually in contrast to a known tradition or style of ritualization'. Thus, Bell (1992, p. 220) argues, ritual practices need to be analysed within a specific 'semantic framework whereby the significance of an action is dependent upon its place and relationship within a context of all other ways of acting: what it echoes, what it inverts, what it alludes to, what it denies'.[4]

While ostracism or abuse may appear spontaneous, unlike the traditional view of ritual as highly standardised and ceremonial, we argue that the significance of these actions as ritualised practices is found in their echoing of more formalised degradation ceremonies, in their allusion to the stigmatised nature of the target and the core values that the target is deemed to have breached, and in their making clear to the target and any audience present that the target is being denied acceptable social status within the group.[5]

Textual or embodied

Textual acts of degradation are ritualised through the creation and circulation of texts or signs – for example, dismissal notices, demeaning pictorial representations or television programmes – that denounce or degrade the ritual target. Embodied degradation acts may involve group members (usually but not always in positions of authority) being physically present and either speaking or making facial or bodily gestures geared to stigmatise, downgrade or expel the targeted person, who may or may not be present. Some embodied performances involve an audience at the site of degradation or connected to events through live or delayed distribution, including print, broadcast transmission or conversation (gossip) (Cox, 1970). Some embodied degradation rituals are carried out in stylised media settings such as morality attacks on talk shows (Shattuc, 1997) where the target is not necessarily aware he or she is about to be degraded.

Severity

The severity of any individual case of ritualised degradation can range from mild to extreme and can be usefully viewed as an emergent property of the complex combination of features of the case. We distinguish three facets here (although more are possible): change in formal status, change in reputation and emotional impacts on targets.

Change in formal status may include demotion, removal of previous responsibilities, assigning trivial or stultifying duties, transfer to a less desirable location, loss of workspace and resources, and salary reductions. An extreme type of formal status degradation is dismissal, a clear form of expulsion from a person's previous role and institutional or group membership. Change in formal status is usually enacted by a degrading agent who has sanctioned structural power over the target within that group context. Change in reputation or social identity – as distinct from formal status – can occur through circulation of demeaning and derogatory gossip, texts or other representations of degradation. It may be reflected in shunning or exclusion from everyday social communication, or by a more critical or sceptical attitude towards comments and performance.

Emotional and behavioural impacts on a target can range from extreme humiliation – sometimes leading to suicide – to enhanced commitment and resistance. Some targets seemingly accept a degraded status, taking on the shame that degradation rituals are geared to produce and exhibiting docile behaviour. Others actively resist taking on shame and persist in prior behaviours. Witnessing a degradation ritual or coming to know about it has emotional and behavioural impacts on the audiences involved, although we do not explore this important topic in detail here. Witnessing others being degraded or finding out about degradation may work to encourage (apparent) compliance and docility to avoid becoming a target oneself.

Case studies

We briefly describe several examples of degradation rituals in science, including events that might or might not be classified as ceremonies, depending on definition. We comment on how each case fits in with the classifications presented in the previous section. Our aim is to probe into a common occurrence in science, but one whose power and emotional dynamics are seldom recognised fully. We select examples without prejudging whether the process of degradation was right or wrong. In much analysis of science, the focus of attention is on scientific correctness; our focus is on rituals and their consequences for the ritual subjects.

First, consider a common experience of many scholars: receiving hostile referees' reports accompanied by a harsh covering letter from the editor. Some referees' comments are dismissive or abusive, for example, calling a submission 'wacky' or 'academic AIDS' (Dear, 2001). Can the routine experience of receiving referees' reports be a degradation ritual? It can certainly be psychologically damaging for authors. Some have or develop thick skins and simply carry on, sending the paper to another journal. Others, though, especially junior scientists, are more seriously affected. We know informally of researchers who have given up on research projects because of hostile responses.

Submitting a paper to a journal and receiving responses from referees and editors is certainly a ritual, one of the most common in science. It has the potential to humiliate the author, but the ritual is mostly in private, between the editor and author, especially when double blind reviewing is used. Furthermore, the impact is usually mild and without lasting effects on the scientist's career. So, this ritual can usually be classified as private, formal, textual and low in severity, at least compared with the examples given later. Many authors accept referees' comments but some vehemently resist, sometimes contesting an editor's judgement: the emotional effect of this ritual varies from case to case.

This paper opened with the story of Melvin Reuber. He was attacked in two forums: in a meeting with his boss (private, formal, embodied) and through publication of his boss's negative evaluation in a trade magazine (public, formal, textual). Reuber's work on pesticides and cancer was becoming useful to critics of pesticides; it may be presumed that pesticide interests were behind the attacks. Reuber was so rattled that he resigned, a sure sign of the potency of the attacks. Only later did Reuber attempt to fight back, and then he was in a weak position, namely unemployed and without the status of his former position. Reuber suffered what might be called a double-barrelled degradation ritual – private and public – of a high severity. His career never recovered.

Dhiraj K. Pradhan was a highly productive computer engineer, a tenured professor at the University of Massachusetts. He was lured to Texas A&M University in 1992 by a huge salary and opportunities for building a research team, but as soon as he arrived in Texas, Pradhan encountered racism. When he resisted, he was attacked. While he was away, his computer and some of his documents were confiscated, but he was not told what was happening; his graduate students were instructed not to talk with him. The story is long and complicated, but eventually Pradhan was charged with criminal offences, though documents were later released showing he was guiltless. The ultimate humiliation was spending a month in prison for unauthorised use of the telephone and photocopier. He has since become a full professor at Bristol University (Pradhan, 2004). Pradhan's case can be classified as a combination of public and

private rituals, formal and informal, textual and embodied. Pradhan's degradation was severe: both his career and reputation in Texas were destroyed. Pradhan was a scientist, but his dramatic humiliation had nothing to do with the quality of his science: the attack came via alleged misuses of monies. This case illustrates a variety of degradation rituals, but its features are not specific to science.

George Waldbott was a physician and medical researcher. From the mid-1950s until his death in 1982, he was the leading US scientist opposed to fluoridation: some of his research was on the adverse health effects of fluoride and he was a prominent figure in support of local anti-fluoridation campaigns. The US dental establishment heavily supported fluoridation; there have been many instances in which dentists, doctors and other opponents of fluoridation came under attack by professional bodies (Martin, 1991, pp. 68–114). However, it was not so easy to threaten Waldbott's livelihood because he was in private practice.

The American Dental Association's Bureau of Public Information produced a dossier on opponents of fluoridation, including Waldbott. The dossier, composed largely of quotes from newspaper stories and statements by individuals, was initially circulated as a brochure and later published in the *Journal of the American Dental Association* (Bureau of Public Information, 1962, 1965). Most of those listed in the dossier had little scientific credibility, for example, the right-wing John Birch Society and purveyors of miracle cures, but a few reputable scientists were listed – including Waldbott. By being grouped with political extremists and fringe practitioners, Waldbott's own reputation was blighted, an indirect form of ritualised degradation that stigmatises by association.[6] Degradation by association may occur in the absence of direct attacks on the work or person themselves or, as in Waldbott's case, in addition to direct personal attacks. Waldbott (1965, p. 66) said that whenever he opposed fluoridation, 'this dossier always showed up like a steady companion … handed to newspaper editors, physicians, dentists, medical editors, officials of medical societies, key lay persons, leaders of clubs and organizations, wherever and whenever there was need for countering my data'. This was an example of a severe public degradation, beginning with the publication of the dossier (public, formal, textual) and continuing with each distribution of Waldbott's entry, for example when he appeared to give a talk (public, semi-formal, both textual and embodied). Pro-fluoridationists who distributed Waldbott's dossier entry obviously believed it was a powerful tool against Waldbott. However, the dossier had no effect on Waldbott's formal status as a doctor and researcher.

Being accused and found guilty of scientific fraud constitutes one of the most powerful degradation processes in science. It could be argued that falsifying or manufacturing data is such a serious violation of proper scientific behaviour that serious humiliation is quite appropriate as a penalty. Against this is the argument that fraud is more common than ordinarily recognised and that some prominent scientists, such as Isaac Newton and Gregor Mendel, fiddled their data (Broad and Wade, 1982; Kohn, 1986). The implication is that high-profile degradation rituals against a few violators serve as moral lessons for the wider community, signalling that science has been cleansed of dereliction while allowing a host of dubious practices to continue without comment (Martin, 1992).

An example of a ritual humiliation of an erring scientist is the treatment of William McBride, a doctor who won accolades for reporting the harm caused to babies by the drug thalidomide but who was later found guilty of fraud in a study of the drug Bendectin. McBride's research career was halted by the fraud claims. However, there was an extra ceremony of degradation, seemingly unnecessary: his licence to practise

medicine was revoked. McBride's degradation was public, formal, both textual and embodied, and severe: asked what effect the experience had on him, McBride said, 'It has nearly killed me' (Daniel, 1998, p. 157).

On the other hand, some of those who try to expose scientific fraud are themselves adversely affected. Scientists Philip Vardy and Jill French, who spoke out about McBride's fraud, lost their jobs; their reputations were later restored, but their careers were damaged beyond repair. Robert L. Sprague, who researched the effects of psychotropic medicines on the behaviour of people with intellectual disabilities, reported fraud by a collaborator, Stephen Breuning. Although Sprague was more senior and meticulously documented the shortcomings of Breuning's research – and Breuning himself admitted problems – the National Institute of Mental Health (NIMH) delayed investigating and then, when it finally began, started by investigating Sprague's own laboratory, supposedly because he had made the accusation. Being the target of an investigation can be considered a degradation ritual: semi-public, formal, embodied. The emotional effect was significant: Sprague (1993, p. 116) reports that he became very angry when the investigators came to his lab. The effect on Sprague's reputation and career was also significant: a recipient of NIMH grants continuously for 14 years, after he blew the whistle on Breuning he was unsuccessful for the first time, forcing him to close his lab.

Bruce W. Hollis, another scientist who reported scientific fraud, was condemned in an investigating committee report along with other scientists, even though Hollis was not given an opportunity to defend his work. After the report was leaked to the media, Hollis and the other scientists were 'crucified in the Cleveland media. The university acted to protect itself, but not us. The public humiliation was the worst experience of my life' (Hollis, 1987, p. 12). The degradation ceremony was public, formal, textual and emotionally severe.

These are just a few instances of degradation rituals in science; there are far too many potential examples to attempt a comprehensive assessment of their scale, distribution or multifaceted effects. We have chosen older cases with ample documentation for which the long-run consequences are clearer. Our aim here has been to illustrate how rituals can be classified in terms of degrading agents, context, means and severity.

Conclusion

Degradation rituals occur in all sorts of occupations and activities. Because there is no standard way of analysing these rituals, we have proposed several categories for classifying them: degrading agents, which can be authority figures, equals or competitors; means of degradation, which can be public or private, formal or informal, textual or embodied; and severity of impact. Using a set of case studies, we come to a series of conclusions concerning their role in science.

First, degradation rituals can vary enormously in scale. Most attention is on prominent public ceremonies, such as denunciation of a scientist for fraud. These cases are easiest to recognise and analyse – as we have done in the previous section – but their visibility may distract attention from other rituals which may be smaller scale, private and routine (e.g. receiving abusive referee reports or being reprimanded by a supervisor) or spontaneous, semi-public and seemingly benign (e.g. being heavily questioned in a seminar). The low-end degradation rituals form a continuum with the pervasive role of shame in organisations (Wyatt and Hare, 1997): even without a formal

ceremony, organisation members can feel ashamed because they do not measure up to expectations. Studying high-profile degradation ceremonies can be a way of probing into processes that are usually subtle and sometimes unrecognised.

Second, most attention – including in this article – is given to public shaming rituals, but private events can be potent as well. Being told by your supervisor that your performance is inadequate and that you may not obtain tenure can be deeply humiliating. Many subject to such treatment may decide to accept rather than contest the adverse judgement and to leave quietly rather than risk a more public humiliation. Private rituals can be low or high severity. High-severity private rituals are under-studied because so many of the targets keep the story to themselves or tell only a few friends.

Third, a degradation ritual in science may involve either discrediting a scientist's work or skill (e.g. accusations of being a careless experimentalist or adopting a deficient research protocol), or questioning the scientist's moral qualities (e.g. accusations of falsifying credentials or misappropriating corporate resources). It may prove useful to see whether these strategies lead to the same sorts of outcomes in terms of humiliation and marginalisation. The case of Pradhan can be seen as an example of the latter tactic; despite the horrendous treatment he experienced at Texas A&M University, he was able to continue a productive academic career elsewhere. In contrast, Reuber and Waldbott experienced rituals that directly tarnished their reputations as scientists, but here too the ritual effects differed: Waldbott retained his formal status as a doctor and researcher whereas Reuber lost his position and his career.

Either type of attack can discredit a person, but the targeting of scientific reputation is especially important in struggles between advocates of rival scientific theories. When scientific orthodoxy is backed by powerful groups such as governments, corporations or professions – for example in debates over fluoridation, pesticides, nuclear power and genetic engineering – then attacks on dissident scientists can be expected (Martin, 1999; Delborne, 2008), with degradation rituals as one tool available to orthodoxy.

Fourth, the impact of degradation rituals has seldom been analysed and factored into accounts of the dynamics of science. For the target, the emotional impact can be overwhelming, as suggested by several of the cases described here. The impact is especially potent on unsuspecting targets, without experience in the cut-and-thrust of struggles within science. Whistleblowers who suffer major reprisals may be seriously affected (Alford, 2001); degradation rituals and ceremonies often play a major role in their experiences. However, perhaps the more significant impact of public degradation ceremonies is on scientific audiences. When peers witness the humiliation of a colleague, most of them take away the message that they should do whatever is required to avoid such a fate themselves, which usually means being more cautious, although a few may be outraged and become more active.

Our examination points to several areas for further investigation. One is whether degradation rituals in science have any special features compared with those in other fields. We suggest that attacking a scientist's reputation is a key factor, but reputation is important in many fields, such as law, politics and even selling used cars. Science may be different only in that scientific knowledge is widely seen as a special form of truth – despite the analyses of sociologists of scientific knowledge (Barnes, 1974; Mulkay, 1979) – so that imputations of being careless or deceptive about scientific truth are especially damaging.

Another area for further investigation is lower-profile degradation rituals. Most analyses of degradation focus on prominent events: they are easier to recognise and

study. We have taken a wider perspective on ritualised degradation to include smaller and more frequent events, such as hostile comments in a seminar or a referee's report. These meld into what some observers believe is the pervasive role of shame at work. The processes involved in the shame dynamic in the everyday life of scientists remain to be studied. Degradation rituals are worth studying because of their impacts, which include personal damage to targets and apprehension among audiences that can potentially hinder discovery, innovation and progressive cultural change. When degradation rituals operate to stifle free and open debate, they are contrary to the ethos of the scientific enterprise.

Acknowledgements

Notes

1. Degradation rituals can be seen as one of many types of suppression. Suppression can be seen as encompassing a range of techniques by which individuals or groups may be silenced or marginalised, for example, censoring papers or blocking appointments or promotions. We see degradation rituals as involving a particularly tangible form of suppression because of the elements involving attempted pollution of person and reputation, such that audiences would be persuaded to see a person as explicitly stigmatised, e.g. dangerous or incompetent or fraudulent, and either as lower in a group hierarchy or as expelled from the group.
2. Following Pierre Bourdieu, Bell (1992, pp. 79, 81) suggests ritualisation can be seen in terms of *habitus* which is the collection of routine or regular dispositions which people use to 'shape and form social conventions'. Bell makes clear that ritualisation shares four key features of human practice in that it is situational, strategic, embedded in a misrecognition of what it is doing, and able to reproduce or transform the social world.
3. There is another possibility: an agent may behave in a way that has the capacity to degrade, but the target and immediate audiences do not see it as doing this. Consider a manager who admonishes a subordinate for poor performance in front of others in an office. The target and the bystanders might interpret the admonishment as reflecting the poor management skills of the perpetrator rather than any shortcoming of the target. The perpetrator, however, may mention the alleged poor performance and admonishment of the target to managers in other departments, thereby damaging the subordinate's standing within the organisation irrespective of the target's or initial audience's interpretation.
4. This nuanced approach to ritual supports our inclusion of shunning, gossip or other derogatory treatment such as abusive language or gesturing as (relatively) informal degradation rituals. While less formalised than a traditional degradation ceremony, practices such as verbal abuse or even shunning are clearly understandable and readily interpretable by any who enact or experience them.
5. Indeed, we would argue that it is critical to analyse informal ritualised degradation because it is one of the few forms of degradation where the denouncer does not need to be a superior within the group. A highly significant and powerful form of behaviour is suggested when a degradation ritual is enacted against a subject by someone who could be seen as a status equal, thereby bringing the devaluation of the target into sharp relief. Certainly, it may be crucial to the severity of the ritual whether the agents of degradation are in a position of authority to the ritual target, but the social and psychological effects of purported equals degrading targets should not be overlooked.
6. While degradation rituals often involve devaluation through direct attacks on the person or their work, indirect ritualised degradation, involving the claimed association of the ritual target with groups, beliefs or practices seen as stigmatised and anathema to the specific institutional context, should not be overlooked. Although only Waldbott's case, out of

those mentioned in this paper, brings this distinction to light, the categories of direct and indirect degradation could be usefully added to the *schema* presented here. Indirect degradation can be seen as particularly potent or polluting when targeted scientists are claimed to be associated with pseudo-scientific or anti-scientific groups, claims and activities.

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