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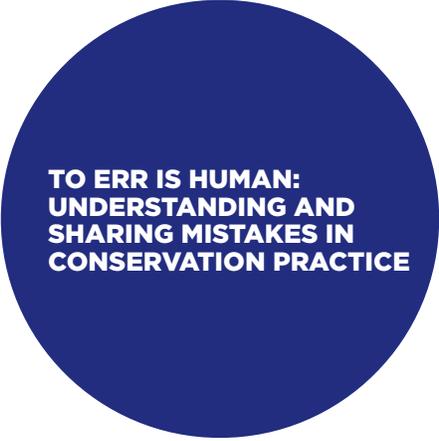
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**TO ERR IS HUMAN:
UNDERSTANDING AND
SHARING MISTAKES IN
CONSERVATION PRACTICE**

Keywords: human error, mistakes, heuristics, bias, risk, reporting, education, ethics

ABSTRACT

Successful practice in many professions, including conservation, benefits greatly from the lessons learned through the attempted – and failed – approaches in the past. Yet mistakes by conservators are widely regarded as unacceptable, particularly if they result in damage to an object. This belief hampers our collective acknowledgement and sharing of mistakes. Drawing examples from different fields of conservation, the paper discusses the types, causes and effects of human error. The experiences of other fields, especially healthcare and aviation, highlight the value for practitioners of understanding the principles of human error from a cognitive perspective, and of raising collective awareness through the sharing of mistakes. Using these models, the paper concludes with several concrete proposals for how errors can be more effectively understood and shared by conservators to reduce the risks of their occurrence.

RÉSUMÉ

Les bonnes pratiques, dans bien des professions, y compris la conservation-restauration, résultent largement des leçons tirées des essais – parfois infructueux – du passé. Pourtant, les erreurs des restaurateurs sont très largement considérées comme inacceptables, en particulier si elles entraînent des dommages à un objet. Cette croyance nous empêche collectivement de reconnaître et de partager les erreurs. À partir d'exemples issus des différents domaines de la conservation-restauration, cet article discute des types, des causes et des conséquences de l'erreur humaine. Les expériences des autres domaines, notamment la santé et l'aviation, soulignent l'importance pour les praticiens d'une bonne compréhension des principes

INTRODUCTION

Mistakes are a given in science, because it evolves through trial and error: by the production of new hypotheses that derogate preceding ones, by proving the mistakes of other scientists. However, they are hardly tolerable in conservation, especially if they happen to have short-term, perceivable consequences (Muños-Viñas 2005, 124).

Mistakes and errors, whilst unfortunate, are almost universally recognised to be invaluable tools for learning and development. Indeed, successful practice in many professions, including conservation, benefits greatly from the lessons learned through the attempted – and failed – approaches in the past. In recent decades, conservation has achieved a far greater degree of specialisation and recognition than ever before. Paradoxically, the culture of infallibility and risk aversion that has developed out of this directly hampers our collective acknowledgement and sharing of mistakes. Evidence of this can be found in the dearth of literature and discussion that address the unsuccessful outcomes of treatments and interventions.

This dilemma is not specific to the conservation profession. Other fields, from healthcare and aviation to the financial industries, have had to address the same issues. Their experience highlights the value for practitioners of understanding the principles of human error from a cognitive perspective. Furthermore, they have demonstrated that the collective sharing of errors and mistakes, if carried out through means which are professionally unthreatening, can raise collective awareness of specific, error-prone activities and reduce the likelihood of mistakes occurring in the future.

By contrast, whilst the conservation profession has typically focussed on object study and treatment, it has paid little attention to the cognitive patterns and limitations of the conservators themselves. Drawing examples from different fields of conservation, this paper will look at the types, causes and effects of human error. It will then go on to examine, both on an individual and collective level, how mistakes can be more effectively understood and shared by practitioners to reduce the risks of their occurrence.

TYPES OF ERROR

The term “error” has been applied by cognitive psychologists to intentional actions that either did not go as planned, or failed to achieve their desired

de l'erreur humaine du point de vue cognitif, et d'une sensibilisation collective à travers le partage des erreurs. À partir de ces modèles, cet article débouche sur plusieurs propositions concrètes destinées à favoriser une meilleure compréhension des erreurs et leur partage par les restaurateurs, afin de réduire les risques qu'elles ne se produisent.

RESUMEN

La práctica exitosa en muchas profesiones, incluyendo la conservación, se beneficia en gran medida de lecciones aprendidas a partir de acercamientos probados – y que han fallado – en el pasado. A pesar de ello, los errores de los conservadores en la mayoría de los casos se consideran como inaceptables, especialmente si un objeto resulta dañado. Esta percepción frena nuestro reconocimiento colectivo y limita la difusión de errores. A partir de ejemplos de diferentes áreas de conservación, el artículo analiza los tipos, causas y efectos de los errores humanos. Las experiencias en otras profesiones, concretamente en salud y en aviación, ponen de manifiesto el valor de que los profesionales comprendan los principios del error humano desde una perspectiva cognitiva, y de la sensibilización colectiva como consecuencia de que los errores se compartan. Usando estos modelos, el artículo concluye con varias propuestas concretas sobre cómo comprender los errores de una manera más efectiva, y cómo compartirlos entre los conservadores para reducir el riesgo de que se vuelvan a cometer.

end (Reason 1990, 5–10). The kinds of errors people make are relatively few (given the possibilities), and may be grouped into a handful of broad categories. Although in common speech we use “mistake” and “error” interchangeably, they hold different meanings for psychologists; mistakes are defined as a subset of human error, in which the intended action was not the appropriate one to make. Failures of execution, in which the action that occurred is not the one intended, are termed slips or lapses (Norman 1981). In an influential essay, the philosophers Gorovitz and MacIntyre further divide error types between those made from ineptitude, which we might better term a failure in planning, performance or execution, and those made from ignorance or lack of knowledge (Gorovitz and MacIntyre 1976). It is this classification that will be applied to human failure in conservation.¹

Errors of planning, performance, or execution

These errors typically take the form of slips and lapses, in which either the action that took place was not the one intended (such as a slip of the tongue or tool), or involved a failure of memory (a lapse) (Reason 1990, 9). Humans have evolved an astonishing ability to model the perceived world and store that information in a retrievable fashion. We have developed levels of automaticity for tasks that are well practiced and familiar, leaving mental workspace available for tackling more complex problems. One cost of this highly ordered cognitive ability is a propensity to absent-mindedness. We become easily distracted, or overwhelmed by information, or overconfident, and slip up despite our training and skill. How common such errors are to the field of conservation is impossible to say, because we do not keep records of them. However, as is known from some better-studied professions, errors of planning and performance are not made significantly less common by increasing expertise or skill level. At least half of the 150,000 deaths per year following surgery in the United States are due to mistakes made despite extensive training and specialization of staff (Gawande 2009, 31).

The wall painting conservator Isabelle Brajer has published an instructive example of a lapse in conservation that involved mounting a detached fresco to a rigid support for re-installation in its church. Brajer completed this step in her studio, and brought the mounted fresco to the church. There, she was shocked to discover that it did not fit through the opening; she had forgotten to measure the door (Brajer 2009). Brajer had the knowledge and ability to plan and execute such a project successfully, but through an oversight failed to complete a small and critical part of the procedure. Multi-step processes provide more opportunity for errors of execution, likely due to the automatic nature of some of the work. Although published examples are scarce, most conservators have heard of, or experienced, an error of performance. Examples known to the authors include the collapse of a sculpture base likely due to under-engineering; a frame destroyed when its original hanging wire, reused, broke after re-installation; and the application of a solvent instead of a cleaning agent to a painting, an action that resulted in the removal of original material.

The last example demonstrates the need to look at what are called ‘latent errors’, which are conditions that exist in the system and create potential for error (Reason 1990, 173). In this case, the bottles were indistinctly labeled and the conservator was distracted by the telephone shortly beforehand. In addition, psychological and organizational considerations such as stress, fatigue and poor communication can also serve as powerful latent factors. In most cases the latent conditions under which the error occurred constitute the comparable factor, making the study and awareness of such errors especially useful for their prevention.

Knowledge- and rule-based errors

Knowledge-based errors occur when a person lacks the knowledge or skill to solve a problem or complete a task. Rule-based errors, by contrast, are mistakes made when a person has the requisite knowledge but applies the wrong ‘rule’ to a problem or task. Both types of error are often made by people in the learning stages of their careers. Similarly, they occur in professions with an expanding knowledge base, where trial and error forms a necessary part of the working method. These types of error are therefore common to conservation, a relatively young discipline where practitioners are frequently presented with novel and highly complex challenges. In the 1990s, one of the authors published the results of a technical examination of a figure of a *Standing Bishop* attributed to the workshop of Tilman Riemenschneider, today in the collection of The Cloisters. The detection of barium sulfate in the azurite blue paint layers led her to conclude that the polychromy on the sculpture was 19th century in date (Marincola, Soutanian and Newman 1997). Sometime later, she learned from a colleague at the National Gallery, London that small amounts of barium sulfate – in about the same percentage as what is found on The Cloisters’ *Bishop* – are sometimes seen mixed in with azurite in German 15th-century paint layers, and are considered a contaminant from the local mineral source for the blue pigment. Similar examples of actions undertaken from a lack of information come easily to mind, such as the early 20th-century varnishing of Impressionist paintings. Knowledge- and rule-based errors are widely held to be crucial to the development of knowledge in a field; we tend not to have a strong judgmental reaction to them, and consider them “forgivable”. Such errors can pass unnoticed for a long period of time (Woods 1984), and begin as actions made in the absence of other, or better, options. It is important to keep in mind that many treatments we consider problematic today may not have been entirely ineffective in the period in which they were carried out; in fact, the continued survival of the objects may be due to these very “mistaken” methods. The consolidation of polychrome sculpture by hot wax immersion, which resulted in darkening of the paint and the unintentional loss of original (previously unrecognized) wax brocade decorations, also secured polychromy that would otherwise have been lost due to climate fluctuations.²

Conservators may be particularly prone to rule-based mistakes because our knowledge base is still developing. A 13th-century Norwegian polychrome

wood *Crucifix* was damaged during overpaint removal in 1930, thanks to unquestioned reliance on old sources. It was widely believed at the time that Vasari's theory of the invention of oil painting was correct, and that this medium was first used by the van Eycks. It was assumed, therefore, that the original paint on the sculpture, well preserved beneath layers of later oil paint, was egg tempera. A chemist analyzed the proposed cleaning material, a commercial paint stripper, and found it harmless to tempera. The paint stripper was applied, and indeed attacked the overpaints, but also the original oil-based polychromy (Kollandsrud 1997). The wrong rule (this paint stripper is harmless to tempera) was used to solve the problem.

Prevention

Knowledge- and rule-based errors arise from the adaptive mental processes that humans use to cope with levels of uncertainty. These can generate bias as people fall back onto thought patterns and solutions that have worked for them in the past, and rely on heuristics (shortcuts in thinking) for problem solving (Groopman 2007, 35–36; 290–291). We are also affected by the limits of the human brain and information overload of the conscious workspace (Reason 1990, 33–48). Practicing metacognition – thinking about how we think – offers promise for reducing error in medicine (Graber 2003) and can be extended to conservation. We can step back and view our thinking process rationally from a distance, not linked to our feelings about a project or object. Considering alternatives is key, as is making time for “pause points”, especially effective in teamwork, which leaves time for review during the active phase of a project. It has been shown that simple errors of execution can be prevented by examining and adjusting the context in which familiar tasks are carried out to reduce latent factors, as well as by the use of memory aids, such as checklists (Gawande 2009).

PROFESSION-WIDE CHANGES

Whilst error awareness can be practiced by the individual, the real benefits will come when conservators are able to share errors with the profession as a whole. This is primarily a cultural challenge, since altering entrenched attitudes regarding professional infallibility, individual blame and error denial takes time (Reason 2000). It is therefore instructive to examine professions that have dealt with the same issues and taboos.

It was the highest-risk industries that were the first to tackle human error in a non-punitive way. The aviation industry, in particular, has long represented the benchmark for an open, blame-free reporting culture. In such professional environments errors are considered the norm, not the exception, and learning from them is integral to improvement (Hudson 2003). In more recent years, the medical profession has made significant attempts to emulate the culture and measures put in place by aviation (Helmreich 2000). Consequently, the healthcare professions are currently attempting change and could, in turn,

provide an important model for conservation. Of course medical parallels have, in the past, been problematic for conservators. Comparing ‘objects’ to ‘patients’ is distorting and largely irrelevant to our practice (Ashley-Smith 1999, 10). This does not, however, preclude essential similarities between ‘doctors’ and ‘conservators’ in terms of the interventive nature of our work and our universal proclivity for error. It is important to recognise that there is no single way of initiating cultural change within a profession that will lead to the immediate, widespread and honest sharing of mistakes. Nevertheless, as with medicine, the combination of measures outlined below could, over time, take us far in the right direction.

Reporting systems

The development of reporting systems that are effective and professionally safe for people to use are essential if mistakes are to be shared. One proven way of doing this is to create anonymous online incident reporting systems, run by independent national or international institutions. The U.S. Patient Safety Reporting System (PSRS) run by NASA, provides one such example. Describing itself fundamentally as ‘voluntary’, ‘confidential’ and ‘non-punitive’, the PSRS allows private or federal medical practitioners anywhere in America to quickly and simply report any form of adverse event including medical errors (Patient Safety Reporting System website 2010). Such systems also allow for the reporting of ‘close calls’ or ‘near misses’, that is, events or errors that could have led to an accident had the circumstances been slightly different. This significantly increases the quantity of useful information that can be obtained and presents fewer barriers to data collection (Barach and Small 2000). Once the information from such systems is received, it is analysed, collated and then disseminated to the profession as a whole.

Professional conservation bodies such as ICOM-CC, the IIC and the AIC might well be in a good position to implement comparable systems. Whether work is carried out on site in a large multi-disciplinary team, or within a small studio, the wealth of information that could be obtained from such reports has the potential to dramatically improve our awareness of specific and repeatable errors, and lead to future prevention.

Education

Relatively minor adjustments could be made in training courses to enhance error awareness among our students. Currently, conservation education tends to support the notion of unerring professional perfection as an attainable goal. Students are not, on the whole, made aware of undesirable treatment outcomes unless they relate to the less developed, ‘shoddy’ practices of our predecessors. Until recently, the situation was similar for medical students. For some years, error awareness has been on the curriculum for post graduate physicians. In 2005, The U.K.’s National Patient Safety Agency (NPSA) released a publication aimed at educating junior doctors about medical error (NPSA, 2005). In addition to including

practical information on how to identify, handle and report medical errors, the publication sought to instigate cultural change. It therefore included actual detailed accounts by highly regarded physicians of their own serious errors. Such examples serve as a powerful educational tool, ensuring that the younger generation of professionals is aware of and open to the possibility of mistakes.

More recently, the PRSA piloted its first undergraduate module aimed at students on the issue. The aim was to develop not only knowledge of human error, but also the skills to recognise, cope with, and report it, and the ability to learn from mistakes (Patey 2007). It seems likely that an equivalent would benefit conservation students alongside a more ongoing acknowledgement in everyday teaching of the risks posed by potential mistakes.

Ethical standards

According to two codes of ethics within our profession, conservators have a professional responsibility to "... contribute to the development of the profession by sharing experience and information" (ECCO Professional Guidelines 2002) and to "contribute to the evolution and growth of the profession... [by the] sharing of information and experience with colleagues, adding to the profession's written body of knowledge" (AIC Code of Ethics). Neither is specific as to the nature of such 'information' and 'experience', nor mentions the sharing of adverse outcomes and mistakes as even desirable, let alone required.

By contrast, the medical profession has, in recent years, gone much further, so as to make this form of sharing an ethical obligation. For example, the American Medical Association states that physicians "... should play a central role in identifying, reducing, and preventing health care errors... and... participate in the development of reporting mechanisms that emphasize education and systems change" (AMA Code of Medical Ethics 2010). Whilst there can be no guarantee that conservators would, in practice, universally adhere to such recommendations, their presence within the ethical guidelines would go a long way towards promoting the acceptance of error within the field.

CONCLUSION

Human errors and mistakes are an inevitable part of any profession, and conservation is no exception. The precise extent of the problem is hard to quantify due to the absence of a reporting culture at present. However, the experience of other, better studied professions indicates that far from being manifestations of incompetence, errors and mistakes arise out of the very mental processes that allow us to function effectively. Becoming aware of our very human limitations in this respect can inform the way we individually approach problems and manage risk. Collectively learning from mistakes in the wider professional context is more challenging due to the risk of professional embarrassment. However, as other industries

have already demonstrated, the provision of confidential reporting systems, alongside small alterations to our codes of ethics and training programs, will set us on the road to a much more fruitful learning culture.

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NOTES

- ¹ For other classification systems for error, see Reason (1990, 10–13; 17–18).
- ² This has been observed by one of the authors at the Walters Art Gallery in Baltimore, where wax-immersed sculptures retain their polychromy and remain stable in the variable gallery conditions.

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