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How do museums and galleries help academics create societal impact? An analysis of the UK REF2021 Impact Case Studies

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ABSTRACT

Although the cultural and heritage roles of museums and art galleries are well recognised, they can also be vehicles to help scholars generate societal impact. This study systematically investigates this role for the first time, using evidence from UK Research Excellence Framework (REF) 2021 impact case studies (ICSs). We identified mentions of over 1,700 UK museums in 6,361 ICSs across all academic fields. While a third of ICSs in Main Panel D (mainly arts and humanities) mentioned at least one museum or art gallery, they were rarely mentioned in the other three panels (2.3% to 4.7%). The percentage was highest in the Art and Design (57%), Classics (56%), Archaeology (44%) and History (42%) Units of Assessment (UoAs). A content analysis of Art and Design case studies showed that collaborations or consultations with museums (25%), public engagement activities (23%), the display of cultural artefacts (18%) and preservation of cultural heritage (17%) were the main roles played by museums and art galleries. Evidence of societal impact in these cases came from testimonials (40%) and audience statistics or feedback (20%) in arts case studies. Overall, the study demonstrates the importance of museums and art galleries for helping many arts and humanities scholars to generate societal impacts.

Keywords: Museums; Galleries; Societal Impact; Research Excellence Framework; Impact Case Studies; REF 2021

1. Introduction

In the context of the UK's Research Excellence Framework (REF), generating and evidencing research impact beyond academia sits alongside research quality and the scholarly environment as a core dimension of academic research. An impact case study (ICS) within the REF framework is a narrative written by academics to provide detailed information and relevant evidence about "*an effect on, change or benefit to the economy, society, culture, public policy or services, health, the environment or quality of life, beyond academia*" (REF, 2021a). In REF2021, the impact component accounted for 25% of the overall assessment compared to 20% in REF2014, indicating its increased significance for assessing the wider benefits of research to society. In the upcoming REF2029, the impact component will be expanded to include "Engagement and Impact", maintaining its 25% weight of the overall assessment. To effectively demonstrate non-academic impact in the REF, UK academics are required to make evidenced claims about societal significance of the research such as impact on policy, law and services, health and wellbeing, commerce and the economy, environment, and creativity, and culture and society (REF, 2021b). Because of this, scholars must seek methods to generate impacts, whether in terms of societal health benefits, commercial innovations, or cultural contributions. For the last type, museums and art galleries are potentially useful, but it is not clear how useful they are.

Museums and art galleries may help scholars to generate "creativity, culture, and society" impacts, such as by consultancy, talks, artworks, and community events. Partnerships between academics and museums may also help with the preservation of cultural heritage or the co-production of new artefacts, as highlighted in the REF2021 Panel Criteria and Working Methods (REF, 2021b, p. 79). Moreover, art

scholars may have designs, artefacts, exhibitions, and digital or visual media as their primary scholarly outputs, which art galleries may display and bring to their existing audiences (Brook, 2018). Moreover, synergistic museum-university partnerships can include preservation or digitalisation of cultural heritage at museums or galleries (Galloway, 2011; Resta & Dicuonzo, 2024), facilitating academic research projects (Koebner et al., 2018; Hladik, 2023), curatorial relationships between museums and academia (Findlay, 2012; Wallace & Matthews, 2018), teaching and learning (Durksen et al., 2017; Palmer & Lindley, 2018), enhancing public understanding about research (Carney et al., 2009; Meyer, 2011), and other interdisciplinary collaborations between museums and academia (Costache & Kunny, 2018).

Despite the evident potential for museums and art galleries to help scholars generate impact from their work, and several case studies showing that it is possible, the extent to which this occurs in practice is unknown. The aim of this research is to fill this gap to help academics, policy makers, evaluators, and funders to identify when and how museums and art galleries can help scholars to generate societal or cultural impacts. Thus, this study analyses mentions of UK museums or art galleries in impact case studies (ICSs) submitted to the REF2021 across the four Main Panels and all 34 Units of Assessment (UoAs) to allow comparisons between fields as well as an estimate of overall prevalence. A content analysis was also conducted to analyse the types of impacts generated through UK museums and galleries and the evidence used to support impact claims.

2. Background

Most previous research investigating the impacts of REF case studies have used text mining or content analysis to assess aspects of claimed impacts or the evidence used to support impacts. Some other studies have used surveys or interviews to investigate the pathways through which researchers have claimed the impacts of their submitted case studies (e.g., Morgan Jones et al., 2017; Salinas, 2021; Watermeyer & Tomlinson, 2022) or the opinions of panelists or evaluators regarding the evaluation of societal impacts within the REF context (e.g., Samuel & Derrick, 2015; Watermeyer & Chubb, 2019).

2.1. Types of impact in REF impact case studies

Text mining techniques, topic modeling or searching selected terms have been widely used for analysing REF2014 and REF2021 ICSs to quantitatively assess the nature and extent of research impact across UK academia, typically finding field differences (e.g., Adams et al., 2015; Bonaccorsi et al., 2021; Chowdhury et al., 2016). A study conducted by King's College London and Digital Science (2015) analysed 6,679 REF2014 ICSs across all 36 REF2014 UoAs using text mining and topic modeling, and identified the nature, scale, and beneficiaries of impact based on 60 impact topics. The two largest topics identified through topic modeling were "Informing government policy" (n=1233, 20% of the case studies) and "Parliamentary scrutiny" (n=983, 17%). They identified 3,709 unique pathways to impact. Another investigation of all REF2014 ICSs classified impact types based on words in the "Summary of impact" and "Details of the impact" sections. Six classes of impact types were identified: Education (22.8%), Public engagement (17%), Environmental and Energy Solutions (17.6%), Enterprise (11.8%), Policy (17.1%) and Clinical (13.4%) (Terämä et al., 2016). Another analysis of all 6,652 REF2014 ICSs used text mining to identify and classify quantitative indicators of impact into seven broad classes (People, Economic, Reach, Significance, Prestige, Health, and Environment), finding that sentences matching the categories People (35%), Economy (30%) and Significance (11%) were the most prevalent (Parks et al., 2018). From a different perspective, the top three impact types mentioned in the ICSs were effectiveness improvement for users

(37%), experience improvement for users (20%), and efforts to translate research findings for users (15.5%) (Zheng et al., 2021).

A few other studies have also investigated impacts within one or a few UoAs (e.g., Koya & Chowdhury, 2020) or from a specific subject or region (e.g., Meagher & Martin, 2017; Midmore, 2017; Pollitt et al., 2023; Robbins al., 2017). For example, more than half (52%) of some management-related case studies claimed impacts on government policymaking (Morrow et al., 2017). In contrast, three quarters (75%) of public health case studies claimed influence on clinical guidelines and over half claimed changes in clinical policies (54%) and clinical or public health practices (52%) (Greenhalgh & Fahy, 2015; see also: Hanna et al., 2020; Rivera et al., 2019; Wilkinson, 2019). Very many different types and beneficiaries of impact have been found in the social sciences, varying between subjects (e.g., Bandola-Gill & Smith, 2022; Cain & Allan, 2017; Hughes et al., 2019; Laing et al., 2018; Smith & Stewart, 2017; Stewart & Sambrook, 2019). For example, a small-scale content analysis of two REF2014 ICSs from an anthropology department found diverse impacts (e.g., law, human rights, criminology, sociology, and psychology) by evidencing sources from UK, EU, or UN guidelines on human rights (Jarman & Bryan, 2015).

2.2. Museums and art galleries in REF impact case studies

Museums and art galleries maintain, curate and display artefacts for preservation and for the enrichment of the general public. These roles can be helped by academics and can help academics to reach a wide audience. The educational role of museums is also important, and this increases their reach (Earle, 2013).

Several previous REF2014 investigations have mentioned museums or art galleries. Brook (2018) analysed 63 selected REF2014 ICSs from three arts UoAs to identify the evidence types used. Over half (51%) mentioned exhibitions as a means of achieving impact. The most common type of impact evidence identified was the number of people attending (73%), followed by the number of events (52%), media coverage (52%), and benefits to artists, curators, and cultural institutions (51%). A content analysis of three REF2014 ICSs mentioning "museum" or "museums" within the Politics and International Studies UoA, found that only one evidenced an impact claim to support engagement between museums and politics. Mentions of the above terms were more common in Main Panel D (36%) than in Panels A, B, and C (2%, 4.7%, and 6.3%, respectively) (Hammond, 2018). However, the method used in the above study could miss many museums or galleries without the term "museum" in their names (e.g., Tate Modern, National Gallery, or National Portrait Gallery), which comprise around 36% of museums in the UK based on a list of museums from Arts Council England (see Methods).

Finally, a study of all 6,361 REF2021 ICSs used text mining, topic modeling and bibliometric analysis, investigating the nature and beneficiaries of research impact. The study identified 79 impact topics through natural language processing techniques. Two of the topics were “Museums and cultural heritage” and “Museums and curation”, covering 388 and 236 ICSs to these topics respectively (Stevenson et al., 2023). However, the study did not analyse the aspects of impacts attributed to the museums or galleries.

3. Research questions

The objective of this study is to analyse how UK museums and galleries help UK academics to generate societal research impacts through evidence in REF2021 ICSs. The research questions were designed to address the main objective of the study, which is to understand the ways in which museums and galleries contribute to societal research impacts in collaboration with UK academics. Collaboration with museums allows academics to engage with diverse fields such as art, history, science, and education, and

contributes to preservation and generating impactful outcomes. However, no comprehensive study has been done to approach this objective using both quantitative and qualitative methods.

The following questions drive this research.

1. How frequently are the names or URLs of the UK museums or galleries mentioned in the REF2021 impact case studies in all four Main Panels and all 34 Units of Assessment?
2. Which UK museums and art galleries are most frequently mentioned in impact case studies and does this differ between Main Panels?
3. Which types of impacts do UK museums and art galleries help to generate?
4. What type of evidence is used to support impact claims?

To answer RQ1 and RQ2, text mining was used to identify the percentage and frequency of museum mentions in the impact case studies. Since text mining may not fully capture the aspects of the impacts attributed to museums or galleries by UK researchers, content analysis was also used to answer RQ3 and RQ4. This approach helped us examine the societal impacts facilitated by museums and galleries, such as cultural preservation, public engagement, and policy influence, as well as the types of evidence used to support impact claims.

4. Methods

4.1. The REF2021 ICS and the UK Museum Datasets

The full text of 6,361 publicly available ICSs submitted to REF2021 was downloaded from https://results2021.ref.ac.uk/impact. We used REF impact case studies as the data source for analysis because they provide detailed narratives about a wide range of research impacts beyond academia (e.g., economic, social, cultural, public policy) and include sources to support impact claims in a structured format across 34 REF subjects. This makes REF impact case studies a suitable dataset for assessing the role of museums and galleries in generating societal impacts through academic collaborations, allowing for both text mining and content analysis.

A list of (fully and provisionally) accredited museums in the United Kingdom, Channel Islands, and the Isle of Man[1] from *Arts Council England* was used to identify mentions of UK museums and art galleries in the ICSs. This list includes the names of over 1,700 museums and art galleries in the UK, making it the most comprehensive and reliable source for UK museum and art gallery names. It includes buildings with museum-like elements, such as Brodsworth Hall stately home, but probably does not include many informal small private museums and galleries that may be primarily for entertainment, such as the Sherlock Holmes Museum and the (Dr) Who Shop Museum. The URLs of the accredited UK museums and galleries were also added to the associated names of museums or galleries to capture URL citations in the "Sources to corroborate the impact" section (see below).

4.2. Identification of Names or URL citations in Case Studies

Over 90% of the names from the Arts Council England list included specific museum-related terms (e.g., Museum, Gallery, Centre, Hall, Heritage, House, or Palace), generating high precision queries to identify relevant matches in case studies (case sensitive names), but a few museums with very common or short

[1] https://www.artscouncil.org.uk/sites/default/files/download-file/List_of_Accredited_Museums_in_UK_CI_IoM_090721.xlsx

names were removed (e.g., Springhill, Brantwood, and Charleston) because they could generate many false matches. Moreover, names without specific museum-related terms (about 170 names) were manually checked, and in some cases, they were modified. For example, "Thinktank" was changed to "Thinktank Birmingham Science", "Wireless in Wales" to "Wireless in Wales Museum", and "The New Room" to "John Wesley's New Room". After this, 1,732 UK museum and gallery names and associated URLs (out of 1,741 from Arts Council England) were used for the text mining.

Museum and gallery names and URLs were searched for in the "Details of the impact" and "Sources to corroborate the impact" sections of all ICSs (keyword searching has been previously used for different purposes: Jordan, 2020; Jordan & Carrigan, 2018). These two sections were used because they specifically include information about aspects of the research impact and sources to support impacts as defined in the context of REF2021 (REF, 2021a, p. 68). Some museum names from Arts Council England were cleaned or modified to maximize the number of valid matches. For instance, parenthetical descriptions, as in "Rye Castle Museum (East Street)", were removed. Moreover, for museums with "and" in their names, additional queries were used to retrieve museum mentions with "&" and vice versa. Different queries were employed for the Victoria & Albert Museum (see examples below) to enhance search performance, as multiple names are common, including "Victoria and Albert Museum" with 35 mentions, "V&A Museum" with 21, and "Victoria & Albert Museum" with 15.

URL citations provide an additional opportunity to identify impacts attributed to museums when exact museum names are not mentioned, or when capturing names alone might not be sufficient (see Kousha & Thelwall, 2021). For instance, "The National Museum Scotland" or "V&A" might be used instead of "National Museum of Scotland" or "Victoria and Albert Museum", respectively. Therefore, URL searches for "nms.ac.uk" or "vam.ac.uk" might find extra mentions, particularly when URLs are cited in the section "Sources to corroborate the impact". For URL citation searches in ICSs, the main addresses of museum websites were obtained by removing "http://", "https://", or "www." to conduct more comprehensive searches (e.g., "britishmuseum.org" or "nationalgallery.org.uk"). The queries used are illustrated below.

- Victoria & Albert Museum|Victoria and Albert Museum|V&A Museum|vam.ac.uk
- National Science & Media Museum|National Science and Media Museum|scienceandmediamuseum.org.uk
- Tate Modern|tate.org.uk
- National Gallery of Scotland|nationalgalleries.org

A program was written and added to the free *Webometric Analyst* software (accessible at https://github.com/MikeThelwall/Webometric_Analyst[2]) to automatically identify and extract names and URLs from all ICSs in either the "Details of the impact" or "Sources to corroborate the impact" sections. The program also extracts matching snippets from specified sections (e.g., "Founded upon collaboration with the British Museum"). For analysis the program also counted mentions of museum names or URLs once per ICS. For instance, the ICS "*Birth to three: transforming education and care for the youngest children*" had mentioned the Manchester Art Gallery name or URL (manchesterartgallery.org, in hyperlinked texts) in both "Details of the impact" and "Sources to corroborate the impact" but this was counted only once to avoid multiple counting. In the REF ICS output, URL citations to other sources were mentioned for hyperlinked texts, therefore we could also analyse URL citations to the museums even if

[2] See Tab-Sep menu and then option "Read file for queries in first column, count matches in second file [impact Case Studies]

the URLs were embedded in hyperlinked texts such as [https://www.vam.ac.uk/info/reports-strategic-plans-and-policies/] in the hyperlinked citation V&A annual reports.

4. Details of the impact

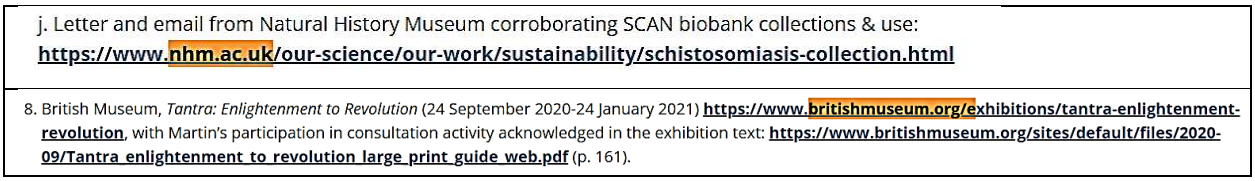
Changing curators' thinking about the role of galleries and museums in human cognition and shifting public perception of historical artefacts

In October 2016, the HDC team collaborated with National Museums Scotland (NMS) to create a day-long event at the National Museum of Scotland in Edinburgh, based on HDC project research [3.1 – 3.6]. Led by Anderson, Cairns, Sprevak and Wheeler, *Thinking with Things* welcomed over 100 people for lectures and discussions on humans' historical use of objects as mind tools to extend their cognitive abilities [5.1a]. The audience were for the most part members of the general public, with attendance skewed more towards a young adult demographic than is usual for the Museum [5.1a]. The lectures, along with seminars and blogs, available online on the History of Distributed Cognition website, have received 36,432 visitors by 31 December 2020 [5.1b].

Imperial War Museum

Stevenson served on the academic advisory committee for the Imperial War Museum's First World War galleries, which opened in July 2014. Costing GBP40 million, the galleries formed a centrepiece of the UK's centenary commemorations. Stevenson's appointment arose directly from his publications **[1] [3]** and he provided input across a number of areas of preparation, offering detailed comment on the design company's initial concept, on gallery layout (particularly on sequencing; i.e. the route intended to be taken by visitors), on content (of the different sections in the first part of the exhibition, on the outbreak of the war), and providing expert quality assurance for the entirety of the exhibits' accompanying text and captions. He coached museum staff on the war's outbreak, identified by market research as the topic on which visitors most desired information. Stevenson also contributed to the advisory committee's discussions about how to present more sensitive subjects to feature in the galleries, such as events in Ireland and Armenia.

Figure 1. Examples of mentions of museum names identified in the section "Details of the impact" of a REF2021 ICS.



j. Letter and email from Natural History Museum corroborating SCAN biobank collections & use: **https://www.nhm.ac.uk/our-science/our-work/sustainability/schistosomiasis-collection.html**

8. British Museum, *Tantra: Enlightenment to Revolution* (24 September 2020-24 January 2021) **https://www.britishmuseum.org/exhibitions/tantra-enlightenment-revolution**, with Martin's participation in consultation activity acknowledged in the exhibition text: **https://www.britishmuseum.org/sites/default/files/2020-09/Tantra_enlightenment_to_revolution_large_print_guide_web.pdf** (p. 161).

Figure 2. Examples of URL citations located in the section "Sources to corroborate the impact" of a REF2021 ICS.

4.3. Content Analysis of Museum and Art Gallery Mentions

Content analysis has been widely used to understand the complex societal impacts of research that require human judgment across various disciplines, such as education (Cain & Allan, 2017; Laing, Mazzoli, & Todd, 2018), public health (Greenhalgh & Fahy, 2015; Hanna et al., 2020), social sciences (Dunlop, 2018; Smith & Stewart, 2017), and business and management (Hughes, Webber, & O'Regan, 2019). In this study, content analysis was conducted to discover how UK museums were used to support impact claims and what types of sources were used to corroborate non-academic impacts, aspects that cannot be assessed through text mining. Content analysis also has the advantages of greater simplicity and face validity by completely bypassing issues like polysemy, synonymy, and grammatical patterns confused with topic patterns (e.g., Chen et al., 2023; Lee et al., 2010). This involved checking the names or URLs of UK museums from impact studies submitted to *the Art and Design: History, Practice and Theory* UoA. We selected this UoA because it had the highest number of museum and art gallery mentions per ICS. To develop a satisfactory classification scheme, two experienced coders (the second and third authors) discussed the coding of various impact types and evidence used to support impact claims. They did this by reading ICSs with museum or gallery mentions identified in Section 4.2. This process allowed the coders to discuss various examples and cases where museums were mentioned or cited to support impact claims by academics in the arts context and the second and third authors inductively built the classification scheme from these discussions.

To check the clarity of the classification scheme and the level of agreement between the two coders, they jointly classified 10% of the total sample, with the remaining sample being split evenly between them. Cohen's kappa agreement scores were calculated for each initial category. According to the guidelines of

Landis and Koch (1977), intercoder agreement rates for predefined impact contribution categories with sufficient data were mostly moderate (0.41–0.60), indicating an acceptable level of agreement between the two coders for analysing the museum mentions (Appendix A). However, in some initial categories such as "Economic Impact," "Cultural Tourism," or "Award-Winning Practices," few or no identified impact cases were identified in the jointly classified sample.

4.3.1. *Type of Impact Attributed to the Museum or Gallery*

This facet covers specific types of impacts involving UK museums or galleries and includes the six categories as described below. Because many cases studies claimed multiple impacts (e.g., Collaborations with museums, Preservation of cultural heritage or artefacts or community engagement). The six types of impact were identified through an initial analysis of impact case studies to capture the broad range of impacts. These categories were aggregated from more specific impact types. For example, the category "Public Engagement Impact or Activities" included various forms of public interactions such as workshops, lectures, and exhibitions. In some cases, impact case studies claimed more than one type of societal impact, such as policy making, educational contributions, and public engagement. To provide a more comprehensive view of the attributed impacts to museums, it was decided to categorise up to three impact types per case study. This approach is reasonable because it acknowledges the multifaceted nature of many impact case studies in arts, ensuring that significant societal impacts are not overlooked and a finer level of granularity in classification can be achieved.

The main challenge in developing the classification scheme was merging some initial impact type categories to increase consistency in the classification process. For example, the initial category "Collaborations and partnerships with art organisations or local councils" was merged with the "Collaborations and partnerships with museum or galleries or exhibitions" due to only three identified impact cases classified under the former category compared with 93 identified cases classified under the latter category. It was also decided to merge two initial categories "Reviewing/Evaluating Artefacts or Exhibitions" (6 cases) and "Award-Winning Practices" (4 cases) to form a new category, "Contribution to Exhibition Design, Assessment and Recognition", combining similar impact claims related to the development or assessment of the exhibition or collection in museums or galleries and acknowledgment of museum practices.

Preservation of Cultural Heritage or Artefacts: Impact narratives within this category provide evidence of how academics contributed to the preservation of cultural heritage or artefacts. Below are two examples of impact claims from REF2021 classified under this category.

> *Richardson's research resulted in Hampton Court Palace's adoption of **a new conservation method** to their treatment protocols. As a Conservator at Historic Royal Palaces (HRP), the charity that maintains the palace, explains: 'In previous phases of work there was a reluctance to use aqueous adhesives for fear of activating salt cycles or affecting the original technique in a way that would cause the painting to fail further. Aqueous adhesives would be preferable for this application as they are more re-treatable and have less of a potential to leave shiny residue on the surface'.*
>
> *As part of this stage of the exhibition, Coldwell arranged for the coat bought by Freud for his journey to London in 1938 to be x-rayed by the National Gallery to provide the **data for a life-size digital print, called Temporarily Accessioned-X-Ray**.*

Collaborations or Consultations with Museums/Galleries: Impact claims about collaborations or consultations between museums, galleries, or exhibitions and academics, who provide advisory services, serve on committees, or engage in consultation activities in various areas, such as collaborative research, collection management, and strategic planning.

> *Hunter's body of research has continued to develop the themes evident in his early work. For example, A Journey Home (2019),* ***a collaboration with Hastings Museum and Art Gallery****, Lucy Bell Gallery and Hastings taxi firm 247247, traces its research roots back to Living in Hell and Other Stories. Hunter photographed each taxi driver in their favourite location in the town. Their stories were recorded by Hanna Wiebe, a multimedia artist working with sound and photography;* ***these became part of the soundscape for the exhibition****. (A Journey Home, Hastings Museum and Art Gallery, 2019. 14,252 visitors. Funded by Arts Council England. 11 photographs inspired by paintings in the Hastings Museum and Art Gallery collection).*
>
> *In 2017* ***Peter was invited by Victoria & Albert Museum senior curator****, Ghislaine Wood (now Acting Director, Sainsbury Centre), and her American colleague Daniel Finamore (Peabody Essex Museum, Salem, MA) to* ***act as expert consultant on a major international touring exhibition****, Ocean Liners: Speed and Style. | In 2017 Peter was invited by Victoria & Albert Museum senior curator, Ghislaine Wood (now Acting Director, Sainsbury Centre), and her American colleague Daniel Finamore (Peabody Essex Museum, Salem, MA) to act as expert consultant on a major international touring exhibition, Ocean Liners: Speed and Style. | 16,500 copies of the catalogue were produced and the exhibition was seen by over 500,000 visitors in Salem, London and Dundee, generating substantial revenues for the 3 venues. For the V&A, this is a significant outcome.*

Public Engagement Impact or Activities: Impact claims about public engagement programs, events, or activities by museums, galleries, or exhibitions such as workshops, exhibitions, lectures, artist talks and other cultural involvement of the academics with diverse audiences mostly attracting visitors and artists to museums or exhibitions because of this kind of involvement.

> ***RI has engaged with diverse audiences delivering more than 60 events to 43,000 people and conducting workshops with over 1,000 participants****; the project team has worked with 65 internationally acclaimed artists (from the UK, Canada, USA, Ukraine, Israel, Spain and Belgium) and 70 community partners and local artists, including Reading Library, Reading Museum, Broad Street Mall, Greenham Common Tower, South Street, the Rising Sun Arts Centre and Jelly.*
>
> *Elements of the Ages of Wonder exhibition connected with the life drawing and printing live events toured Scotland to bring portions of t. Feedback from at least 3 of these venues, located in the towns of Ayr (on the south west coast of Scotland) and Linlithgow (in the south east),* ***indicates that these exhibitions received highly positive responses from visitors and brought in far higher than usual audience numbers to the venues****. The Art of Etching exhibition attracted 5,439 people (general public visitors) at the Maclaurin Art Gallery in Ayr.*

Contribution to Exhibition Design, Assessment or Recognition: Impact claims about the participation of academics in shaping, developing or assessing an exhibition or collection such as contributing their expertise and knowledge for exhibition layouts, acquisition, organization, or representation of artefacts or artworks within museum collections. It also includes award-winning practices for various aspects of designing, developing or assessing exhibitions or artefacts.

The grant allows Martin and the new Tibet Museum to establish an Archive of Tibetan Material Knowledge that brings Tibetan voices into the collection archives of the British Museum and the new Tibet Museum. Martin was part of an advisory panel for the British Museum's Tantra: Enlightenment to Revolution exhibition (24 September 2020 to 24 January 2021) [H]. ***The British Museum had no knowledge of the colonial histories of significant objects in the exhibition prior to Martin's involvement. She advised on provenance research methods for Tibetan collections that were incorporated into the exhibition.***

Painting the Modern Garden (Royal Academy London and Cleveland Museum, Ohio, 2015–2016 [3.4]), was a highly successful exhibition which attracted over half a million visitors, for which Willsdon was the only academic adviser, sought out for her specialism in art-garden relationships. ***Willsdon advised on the Impressionist and documentary exhibits, wrote key interpretation labels, and co-authored the exhibition catalogue, contributing also to the audio-guide, film, and lecture programme.***

Involvement in Museum/Gallery Learning Initiatives: Engagement of academics in educational activities conducted within museums, such as enhancing the learning experiences of participants, visitors or students.

For colleges as well as the IWM, there are benefits to bringing "students [who] had never been to the Imperial War Museum" through its doors *[S3: 1:41]. John Glancy of the IWM explained: "[MANW] launched at the Imperial War Museum in October 2018" and it helped "****my team's continuing work around exploring the causes, course, and consequences of conflict in innovative and engaging ways with learners****. This project, and projects like it … contribute to the team's way of working as museum professionals and educators" [S7].*

At ARTiculation events at Wolverhampton [Wolverhampton Art Gallery] and The Herbert Coventry, ***visiting students 'have been able to examine and discuss artworks in a more in-depth and thorough way' as a result of our collaboration*** *(S3, S7). 96.9% of visitors to MAP-inspired events who were surveyed state that are more likely to visit the galleries in future, and many asserted that they gained new appreciation of the contemporary relevance of the galleries' collections (S8). For example, audiences at BMT gained new knowledge about transnational art practice and disability in the arts, as they 'learnt about […] the development of art and artists in the past, and how and why some succeed' (S8). Visitors at Wolverhampton gained a new understanding of the impact of colonialism on art, that 'British imperialism was a major influence of trends in the art world' (S8).*

Display of Cultural Artefacts: The presentation, exhibiting or displaying of cultural heritage, artworks, or performances through public or special exhibitions in museums or galleries.

Another major exhibition, *"Gifts for the Gods: Animal Mummies Revealed", was initially held at Manchester Museum in 2015 and subsequently at the Kelvingrove Museum in Glasgow, the World Museum in Liverpool, and the Museum of Wigan Life. At least 300,000 individual visitors saw* ***the original and touring exhibition in person,*** *with over 165,000 people using Manchester's related social media resource. 3D printing proved successful in demonstrating to visitors the previously hidden artefacts inside the linen wrappings of the animal mummies.*

Fowle's insights into such dynamics have afforded exciting scholarly and curatorial potentials and new ways to engage the public. ***This was demonstrated by the two high-profile exhibitions*** *that she organized in her capacity as Senior Curator at the Scottish National Gallery, to which she is seconded.*

4.3.2. Evidence used to support impact claims

A classification scheme was developed for the types of "Sources to corroborate the impact" in REF2021 ICSs submitted to the Art and Design: History, Practice and Theory UoA. The purpose was to understand how researchers supported their impact claims. Because in many case studies more than one source was provided to corroborate impact claims (e.g., testimonials or audience statistics), up to two sources were classified.

Testimonials: This category includes evidence of impacts by citing testimonials or endorsements (e.g., letters, emails, interviews, transcripts) from museum directors, curators, staff, councils, or art centers. These testimonials are usually used to support the broader benefits of research on creativity, culture, and society. They demonstrate various impact claims in the context of museums or galleries, such as collaborations or consultations with museums, the preservation of cultural or historical heritage, collection development, exhibition design, and public engagement. Below are some examples identified under this category:

- *Testimonial letter from Joanna Norman, Director of V&A Research Institute, Victoria and Albert Museum, London.*
- *Testimonial email from Benioff Curator of Oceania, The British Museum; formerly Collections Manager for Ethnology, Bishop Museum, Honolulu, March 2020. [PDF], corroborating the impact on Pacific communities of kapa and tapa makers.*
- *Testimonials from gallery assistants and staff involved in caring for the painting machines.*

Audience statistics, feedback, or reports: Audience engagement statistics, audience feedback, and audience reports.

- *Statistics showing attendance at major art exhibitions, confirming Biennial attendance figure (accessed 2020, 22 Oct) https://www.artnews.com/art-news/news/exhibition-attendance-graphic-5471*
- *Visitor figures and catalogues sales information for* Rodin et la danse *exhibition.*
- *Visitor statistics and feedback from partner collections for exhibitions 'Maman', 'Reframing the Wild' and the Kotasz re\-hang \(2018\-2019*

News and media: Evidencing impacts through mainstream media reports.

- *BBC Springwatch broadcast 11 June 2018. [Video: Available on Request]*
- *The Guardian, 15 April 2014, 'The artist who brought her uncle back to life as a woman.'*
- *Local newspaper article 'New V&A Dundee exhibition explores factors in choosing a prosthetic hand', Evening Telegraph, 27 June 2019. https://www.eveningtelegraph.co.uk/fp/new-va-dundee-exhibition-explores-factors-in-choosing-a-prosthetic-hand*

Grey literature: Includes annual reports, institutional reports, and policy documents.

- *Report of the Trustees and the unaudited financial statements for the year ended 31 March 2019 for the Martin Parr Foundation*
- *V&A Annual Report 2018-9 [link]*
- *Freud's Coat, Arts Council England report, 20 April 2017. UAL on request.*

Social media and other web sites: Evidence obtained from web site engagement statistics.

- Feedback from 2018 pop-up museum at the Tate Modern https://vimeo.com/253141860 and PDF file
- 10.10.20 Big Draw Live 'Reportage Illustration' Instagram Live [780 views] for 'The Big Draw' [Instagram]
- My NatureWatch user forum pictures and feedback (PDF), https://mynaturewatch.net/ and https://twitter.com/search?q=%23mynaturewatch&src=typed_query

5. Results

5.1. Museum Mentions in Impact Case Studies

Figures 3 show the percentage and number of REF2021 ICSs with at least one mention of a UK museum name or URL in either the "Details of the impact" or "Sources to corroborate the impact" sections across the four Main Panels and 34 UoAs, respectively. The result indicates that there are significant differences between UoAs in the percentage of case studies that mention UK museums or galleries. In Main Panel D (Arts and Humanities), a third of ICSs (32.8%, or 502 out of 1,528) had at least one museum mention (names or URLs) while in Main Panels A, B, and C only 1.8% (25 out of 1,419), 4.6% (58 out of 1,268), and 4.7% (101 out of 2,146) of case studies had at least one museum mention, respectively.

The highest percentages of ICSs mentioning UK museums/galleries were in some but not all arts and humanities UoAs: Art and Design: History, Practice and Theory (57%), Classics (56%), Archaeology (44%), History (42%), English Language and Literature (31%), and Music, Drama, Dance, Performing Arts, Film and Screen Studies (25.5%). This list includes most arts and humanities disciplines, with two main exceptions: Theology and Religious Studies and Philosophy. These may be more book based and theoretical fields. Appendix B also presents the number of case studies with at least one mention of a UK museum name or URL in the four Main Panels and 34 UoAs.

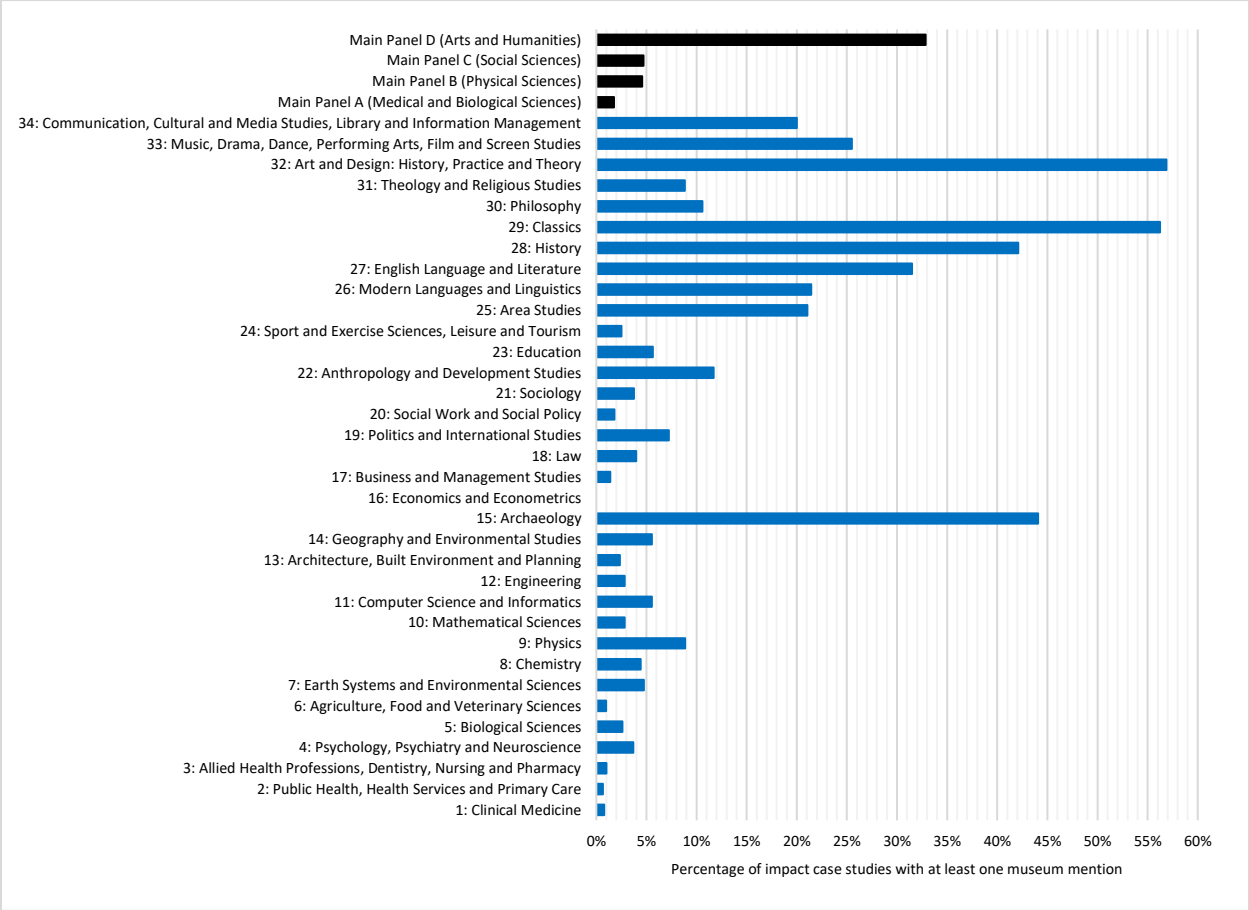


Figure 3. Percentage of REF2021 ICSs (total=6,361) with at least one mention of a UK museum name or URL in "Details of the impact" or "Sources to corroborate the impact" sections across the four Main Panels and 34 UoAs.

Figure 4 shows the percentage of all Museums, Galleries or Art Centres in the UK from the Arts Council England list (n=1,732) with at least one mention or citation in impact narratives across the four Main Panels and 34 UoAs. Most notably, in Main Panel D (Arts and Humanities) 16.4% (284) are mentioned and in History, Art and Design: History, Practice and Theory, and English Language and Literature UoAs, 6% of UK museums/galleries are mentioned. Thus, whilst most UK museums/galleries did not help UK academics achieve a substantial enough impact to merit a mention, a large number did.

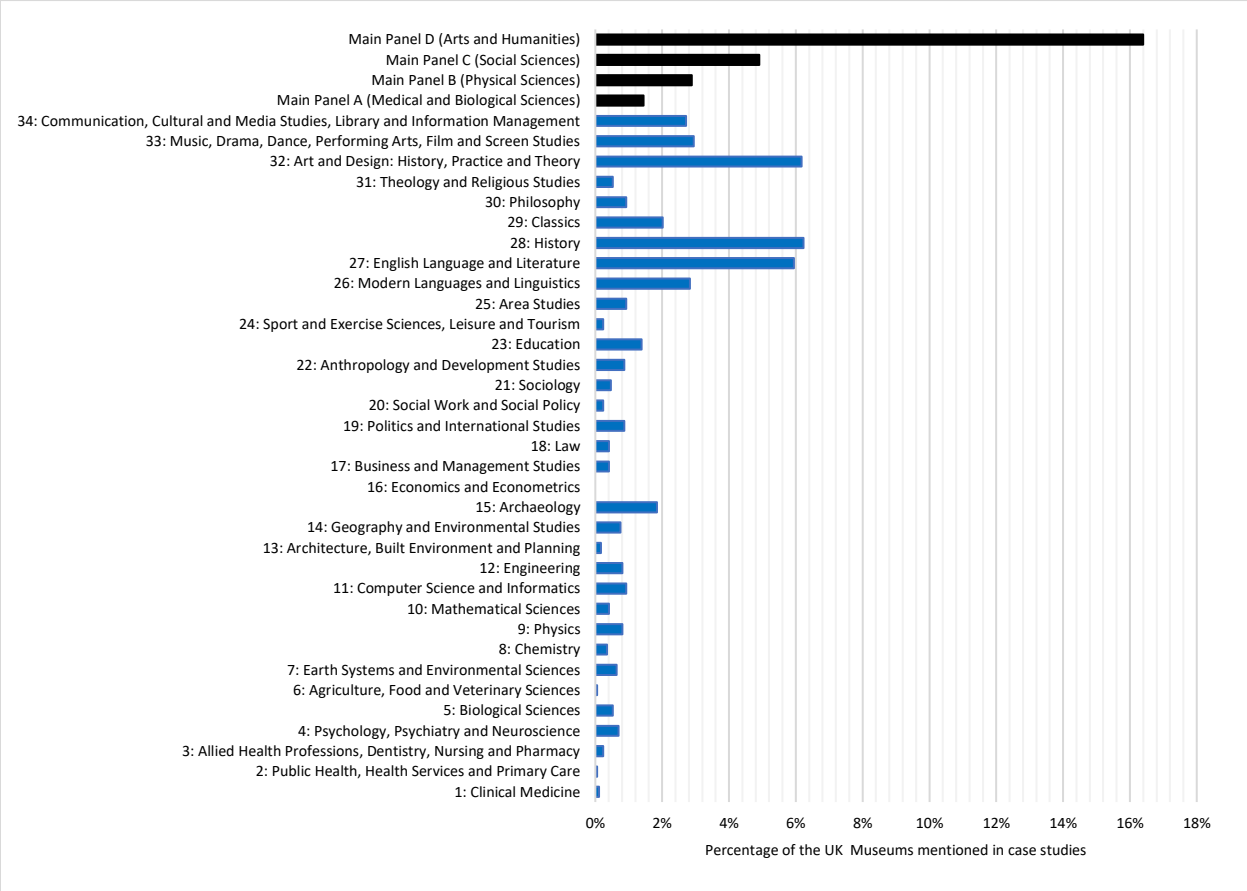


Figure 4. Percentage of all Museums in the UK from the Arts Council England list (n=1,732) with at least one mention or citation in the "Details of the impact" or "Sources to corroborate the impact" sections of REF2021 ICSs across the four Main Panels and 34 UoAs.

The top 5 UK museums or galleries mentioned in REF2021 ICSs are significantly different between the four Main Panels (Table 1), mainly due to expected subject-based associations. For example, in health and natural science subjects (Panels A and B), science-oriented museums like the *Science Museum* and the *Natural History Museum* are more frequently mentioned. However, in the social sciences and arts and humanities disciplines (Panels C and D) museums or galleries with historical or artistic collections such as *British Museum* and *Victoria & Albert Museum* were more important for researchers in the context of reflecting various non-academic impacts. A shared dataset provides information about the mentions of the UK museums or galleries in REF2021 ICSs across the four Main Panels (https://doi.org/10.6084/m9.figshare.25730088.v1).

Table 1. Mentions (%) of the 5 UK museums or galleries most mentioned or cited in "Details of the impact" or "Sources to corroborate the impact" sections of REF2021 ICSs in the four Main Panels.

Panel A (Total mentions: 33)		**Panel B (Total mentions: 90)**	
Natural History Museum	3 (7.3%)	Science Museum	15 (16.7%)
Wellcome Collection	3 (7.3%)	Natural History Museum	6 (6.7%)
Manchester Museum	2 (4.9%)	Science & Industry Museum	4 (4.4%)
British Museum	2 (4.9%)	Victoria & Albert Museum	4 (4.4%)
Science Museum	2 (4.9%)	Wellcome Collection	4 (4.4%)

Panel C (Total mentions: 166)		Panel D (Total mentions: 910)	
British Museum	15 (9%)	British Museum	54 (5.9%)
Victoria & Albert Museum	10 (6%)	National Gallery	45 (4.9%)
Museum of London	9 (5.4%)	Victoria & Albert Museum	34 (3.7%)
Science Museum	8 (4.8%)	Tate Modern	34 (3.7%)
Imperial War Museum	8 (4.8%)	Imperial War Museum	33 (3.6%)

In the UoAs within the arts and humanities (Panel D), the most commonly mentioned museums/galleries tend to be thematically relevant to the disciplines (Table 2). In History, the *Imperial War Museum* had most mentions in the cases studies (7.3%), likely due to its focus on military history. For example, the impact cases studies "Commemorating the First World War", "The Eighth in the East: The Military Heritage of East Anglia in the Second World War" or "Building Bridges, Deepening Understanding: The Community Impact of Belfast's First World War Military History" supported various impact claims by citing the Imperial War Museum. In Art and Design: History, Practice and Theory, the *National Gallery* had most mentions in the case studies (8.5%), perhaps as a prestigious art gallery with a high footfall and therefore the potential for wide public impact. In contrast, in the Music, Drama, Dance, Performing Arts, Film, and Screen Studies UoA, the Tate Modern was mentioned more, perhaps because it includes multimedia art, also encompassing some types of recorded performance. For instance, impact cases studies "Driving New Directions in Spatial Audio Art", or "Sound Diaries: Recording Everyday Life in Sound" backed their impact claims attributed to the Tate Modern in the context of audio performance and attracting visitors.

Table 2. Mentions (%) of the 5 UK museums or galleries most mentioned or cited in "Details of the impact" or "Sources to corroborate the impact" sections of REF2021 ICSs in the four arts and humanities UoAs with most museum mentions.

Art and Design: History, Practice and Theory		History	
National Gallery	22 (8.5%)	Imperial War Museum	14 (7.3%)
Tate Modern	17 (6.6%)	British Museum	12 (6.2%)
Victoria & Albert Museum	16 (6.2%)	Museum of London	8 (4.1%)
Design Museum	11 (4.3%)	National Gallery	7 (3.6%)
British Museum	10 (3.9%)	National Portrait Gallery	6 (3.1%)
English Language and Literature		**Music, Drama, Dance, Performing Arts, Film and Screen Studies**	
Science Museum	9 (5.7%)	Tate Modern	6 (7.8%)
British Museum	6 (3.8%)	National Gallery	4 (5.2%)
National Portrait Gallery	5 (3.2%)	Wellcome Collection	4 (5.2%)
Victoria & Albert Museum	5 (3.2%)	Victoria & Albert Museum	3 (3.9%)
National Gallery	5 (3.2%)	Imperial War Museum	3 (3.9%)

5.2. Content analysis of Museum Mentions in Impact Claims

Out of 149 ICSs in Art and Design: History, Practice and Theory with at least one mention of a museum name or URL (see Figure 4), 31 were unrelated to UK museums or galleries and were consequently excluded from the content analysis. For example, "National Gallery Washington" and "China Design Museum" were captured incorrectly instead of "National Gallery" and "Design Museum," both in London. Other examples included "Osborne House" within a book title, 'From Osborne House to Wheatfen Broad:

Memoirs of Phyllis Ellis (2011),' and "Royal Albert Memorial Museum" an author affiliation. As a result, 119 case studies with 198 mentions of UK museums or galleries within “Details of the impact” or “Sources to corroborate the impact” were selected for further content analysis. The shared dataset provides categorisation of the REF 2021 ICSs in Art and Design: History, Practice and Theory (https://doi.org/10.6084/m9.figshare.25730088.v1).

5.2.1. Type of identified impacts attributed to the UK museums

The content analysis of 119 ICSs within the Art and Design: History, Practice and Theory UoA identified up to three impact claims attributed to UK museums from 55% case studies (or 66 ICS). Overall, 368 different impact types were identified and classified into six categories. Collaborations or Consultations with Museums (25.3%) were the most common attributed impact types indicating researchers collaborating with museum curators for collection management, policy making and strategic planning. Public Engagement Impact or Activities (22.6%) were claimed showing how researchers engaged with the public through workshops, public lectures, or other events to attract divers audiences. About 18% of impact claims categorised as Display of Cultural Artefacts such as exhibitions showcasing historical artefacts uncovered during archaeological research or significant artworks related to cultural studies. Impact claims related to Preservation of Cultural Heritage or Artefacts (16.8%) mostly involved methods or techniques to preserve cultural heritage through research, such as the digitisation or the restoration of historical collections or manuscripts (Figure 5).

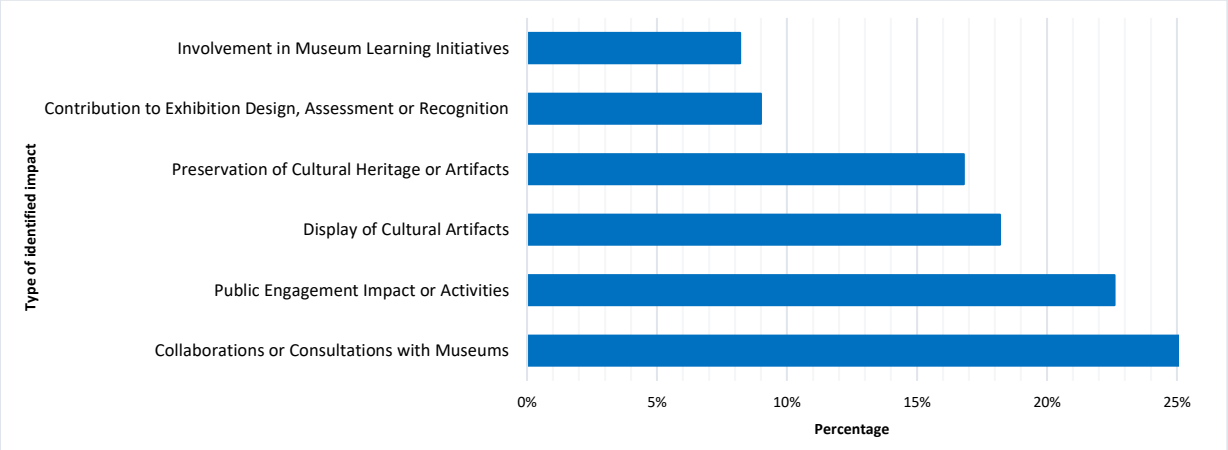


Figure 5: Percentage of identified impact types attributed to the UK museums or galleries from the REF2021 ICSs in the Art and Design: History, Practice and Theory UoA.

5.2.2. Evidence used to support impact claims

Testimonials (including letters, emails, or other informal correspondence) were the most prevalent impact evidence source (40%), followed by Audience Statistics, Feedback, or Reviews (20%). Websites and Social Media (14%), Grey Literature publications (15%), and News and Media (10%) sources were also used to corroborate impact claims (Figure 6). In contrast, 16% of impact claims attributed to the UK museums were not supported by any sources. Moreover, more than three- quarters (77%) of sources explicitly cited to support impact claims relevant to museums lacked external links (exceptions, e.g., “Tate Annual Report 2017/2018” or Wolverhampton Arts, “Phoebe Cummings: This Was Now”, [link]).

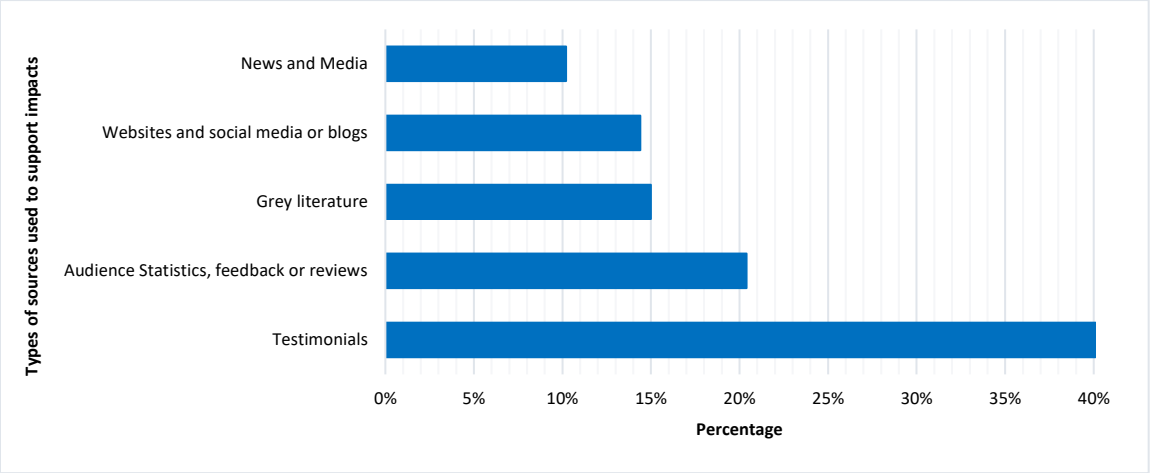


Figure 6: Percentage of evidence types supporting REF2021 impact claims in Art and Design: History, Practice and Theory UoA.

6. Discussion

6.1. Museum-university research collaboration within the REF

We conducted further analyses to assess whether academics and museum staff collaborated on research leading to impact. For this, we extracted all DOIs from the "Reference" sections of ICSs (Section 3) where academics cite underpinning research outputs (e.g., journal articles, conference papers, book chapters, monographs) from the Art and Design History Practice and Theory, and History UoAs. We searched for the extracted DOIs in Scopus and analysed author affiliations. Surprisingly, out of the 213 and 285 unique Scopus publications cited in the Reference section of the case studies, only 2 and 0 papers had co-authors from museums or galleries based on their Scopus author affiliations, respectively. This suggests that academics in arts and history mostly engage or collaborate with museum/gallery staff or experts primarily through non-research pathways (e.g., consultations, exhibitions, or public events) rather than through formal research collaborations. However, there might be disciplinary differences in research collaboration with museums. Further analysis showed that out of 109 cited Scopus publications in REF2021 ICSs in Archaeology UoA, 15% were co-authored between UK academics and museum staff. This suggest that in some fields museum or galleries may also be involved in research projects and joint publications.

During the REF2021 period 2014 to 2020, several prominent UK museums significantly contributed to co-authored Scopus publications, primarily with UK universities (Table 3). Notably, the Natural History Museum, London, has contributed over 4,800 publications, with approximately half co-authored with researchers from the Department of Life Sciences and a third from the Department of Earth Sciences, based on their author affiliations. The three Scopus subjects with the most research collaborations were Agricultural and Biological Sciences, Earth and Planetary Sciences and Environmental Science. However, our analysis suggested that despite the extensive collaboration between the Natural History Museum and the UK higher universities, about 1% of ICSs in related REF subject areas mentioned the Natural History Museum in their impact narratives In contrast, publications co-authored with the British Museum, particularly those published in archaeological-related journals, were cited in approximately 15% of case studies within the Archaeology UoA, indicating the impact of the British Museum on impact claims. This suggests potential disciplinary differences in the recognition of museum contributions to research impact within academia which needs further research.

Table 3. number of co-authored Scopus publications between the four UK museums and other universities or institutions (2014-2020).

Year	Natural History Museum, London[3]	British Museum	National Museum of Scotland	National Museum Wales
2020	757	52	43	43
2019	714	53	32	36
2018	673	48	40	47
2017	680	24	28	46
2016	667	45	40	42
2015	655	25	32	43
2014	660	38	24	31
Total	4806	285	239	288

6.2. Limitations

6.2.1. Museum names and representation

This study used the List of Accredited Museums from Arts Council England, which includes over 1,700 listed museums, galleries, exhibitions, and other art centers. While the text mining method aimed to capture mentions of UK museum names and URLs from ICSs based on the List of Accredited Museums from Arts Council England, there may be cases where certain museum names were not effectively identified or missed in the Arts Council England museum list. For instance, after data collection and analysis, it was found that "*Royal Museums Greenwich*" was absent from the original list used for text mining but was mentioned at least five times in the "Details of the Impact" section of ICSs. Another potential issue is variations in the use of museum names by researchers compared to the Arts Council list. For example, "*Amgueddfa Cymru*" was used to refer to the National Museum Cardiff in the list, with at least two mentions. There was also cases where researchers used short formats of some museums or galleries such as "Tate" for Tate Britain, Tate Liverpool, Tate St Ives, or Tate Modern, as well as “National Museum” refereeing to the National Museum of Scotland.

Finally, the study did not capture and analyse non-UK museums or galleries from other countries such as the Metropolitan Museum (USA), Louvre (France), and Rijksmuseum (Netherlands), which had 9, 5, and 4 mentions respectively in the "Details of the Impact" section of REF2021 ICSs. Therefore, the results presented here may underestimate the full extent of the role of museums, galleries, and exhibitions in the context of REF impact claims.

6.2.2. Content analysis

The classification scheme used for coding impact types and evidence sources relied on the interpretation of two experienced coders. While efforts were made to ensure consistency and reliability through cross-checking and calculating intercoder agreement rates, there may still be subjectivity in the categorisation process. Moreover, the study conducted content analysis on ICSs submitted to the Art and Design: History, Practice and Theory UoA, which may not fully represent museum-related impacts across all REF subjects and in particular Classics, History and Archaeology, which also had relatively high percentages of case studies with at least one mention of UK museum names or URLs.

[3] Scopus query used: AFFIL ("Natural History Museum" PRE/2 London) AND PUBYEAR > 2013 AND PUBYEAR < 2021

The content analysis showed that many impact claims could be categorised into more than one impact type due to their multifaceted nature. For example, collaborations and consultations with museums often lead to public engagement. Similarly, projects focused on preserving cultural heritage may also involve educational initiatives. This overlap suggests associations of different impact types and the complexity of societal impacts generated through museum-academic collaborations. Therefore, up to three impact types were recorded for each case study to ensure a comprehensive assessment of the diverse impact claims. However, this approach introduces subjectivity into the categorisation process, as the coders had to make judgments about which impact types were most relevant based on their perceptions.

Our study aligned with previous research (Brook, 2018) in identifying the importance of exhibitions and public audience events in generating research impacts in the arts. However, our study further categorised impact claims, including collaborations, preservation of cultural heritage, and learning initiatives within the museums. Our text mining methodology, which captured the names of over 1,700 UK museums, is more wide ranging and precise than previous studies that only located the term "museum" (Hammond, 2018) or used museum-related terms for topic modelling: “Museums and cultural heritage” and “Museums and curation” (Stevenson et al., 2023). This methodology not only captured various galleries and other art centres (e.g., Tate Modern and the National Gallery) but also included name variations and URL mentions in the impact case studies (e.g., Victoria & Albert Museum, Victoria and Albert Museum, V&A Museum, or vam.ac.uk) for a more comprehensive societal impact assessment. The method can potentially be applied to capture other names within impact narratives, such as international organisations (e.g., UN, UNESCO, FAO, WHO), government bodies (e.g., UK Parliament, NHS, Department for Education), or research organisations (e.g., Cancer Research UK or Alzheimer's Research UK).

7. Conclusions

In answer to the first research question, our analysis showed significant variation in the percentage of UK museums or galleries mentioned in REF impact case studies across the four Main Panels and 34 Units of Assessment. While a third of the impact case studies in Main Panel D (Arts and Humanities) included at least one mention of a UK museum or gallery, the percentage was much lower in other panels: 1.8% in Main Panel A, 4.6% in Main Panel B, and 4.7% in Main Panel C. Within the arts and humanities REF subjects, the most mentions were in Art and Design: History, Practice and Theory (57%), Classics (56%), and Archaeology (44%). This suggests the importance of recognising subjects with a high degree of impact on museums and galleries, particularly in the context of the REF. Hence, it is important to facilitate the ways researchers can collaborate with museums and galleries in these areas to benefit society through appropriate support and funding. This can potentially be achieved by implementing targeted policies, such as providing grants for collaborative projects and promoting networks between academics and museum professionals.

In answer to the second research question, the results showed significant differences in the UK museums mentioned between panels. In health and natural science subjects (Panels A and B), the Science Museum and Natural History Museum were the most frequently mentioned, whereas in the social sciences and arts and humanities (Panels C and D), the British Museum, National Gallery and Victoria & Albert Museum were more prominent. Within specific units of assessment, the National Gallery was frequently mentioned in Art and Design, the Imperial War Museum in History, and the Tate Modern in Music, Drama, Dance, Performing Arts, Film, and Screen Studies. This suggests that there are significant associations between the collections and activities of museums and galleries and specific academic subjects in generating

societal impacts. For example, in the history subject, collaborations with the Imperial War Museum and British Museum are particularly common, where historical collections and archival resources are important for research, education, and public engagement.

In answer to the third research question, the content analysis of impact case studies within the Art and Design: History, Practice and Theory UoA showed that collaborations or consultations with museums were the most common identified impacts, suggesting the significance of partnerships between museums and academia for conducting collaborative projects such as consultation, collaborative research, exhibition curation, and collection management. Public engagement impacts were also frequently claimed by researchers, indicating the importance of academics engaging with audiences within museums or galleries through activities such as workshops, exhibitions, and talks. This demonstrates the crucial role of museum-academic collaborations in generating societal impacts through diverse interactions.

In answer to the fourth research question, our analysis of the evidence used to support impact claims showed multiple citation practices. Testimonials such as letters, emails, or informal correspondence were the most common source of evidence provided to support impact claims (40%). Audience statistics, feedback, and reviews were also predominantly used as an audience engagement metric in supporting impact claims (20%). Because 16% of the impact claims lacked supporting sources and the majority of those that provided sources to corroborate impacts had no external links, it may be challenging for REF assessors to verify the validity of the claims. However, one reason could be that academics usually provide separate testimonial evidence to support impact claims when submitting ICSs to the REF rather than hyperlinking to testimonial evidence. These testimonials are often submitted in formal letters, statements, or emails from organisations detailing their engagement with the research or how they benefited from the research outcomes (Kemp, 2018).

Overall, this study demonstrated the significant role of museums and galleries in helping academics generate societal research impacts. The findings suggest the importance of promoting collaborations between academia and museums through appropriate policies and funding, especially in the arts and humanities fields, where academics may need to demonstrate the broader artistic or cultural benefits of their research activities in the context of the REF.

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Declarations

Competing interests: The first and fourth authors are members of the Distinguished Reviewers Board of Scientometrics.

Data Availability

The shared data provides categorisation of the REF2021 ICSs in Art and Design: History, Practice and Theory in terms of the types of impacts generated through UK museums and galleries and the evidence used to support impact claims. It also includes the mentions of the UK museums or galleries in REF2021 ICSs across the four Main Panels. The data is available via https://doi.org/10.6084/m9.figshare.25730088.v1.

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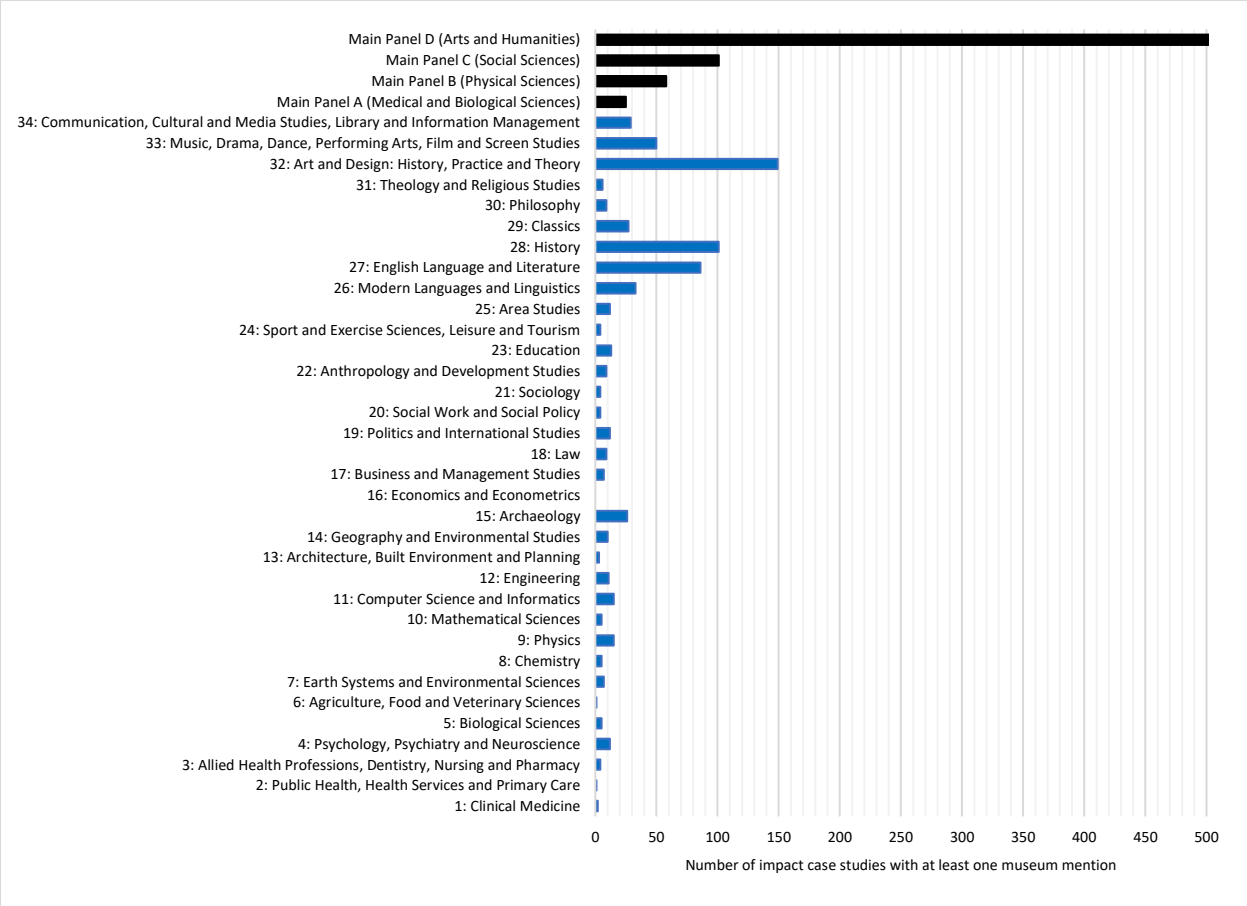
Appendix A. Cohen's kappa agreement statistics calculated for six content analysis categories.

	Categories for museum impacts	**Percentage agreement**	**Cohen's Kappa**	**Krippendorf's alpha**
1	Preservation of Cultural Heritage or Artifacts	78.3%	0.515	0.516
2	Collaborations or Consultations with Museums	78.3%	0.563	0.571
3	Public Engagement Impact and Activities	91.3%	0.617	0.625
4	Contribution to Exhibition Design and Curation	78.3%	0.587	0.595
5	Involvement in Museum Learning Initiatives	87%	0.511	0.505
6	Display of cultural artifacts or artworks or performance	82.6%	0.629	0.625

There are two scales of values commonly used for classifying agreement rates. Landis and Koch (1977) described 0–0.20 as slight agreement, 0.21–0.40 as fair agreement, 0.41–0.60 as moderate agreement, 0.61–0.80 as substantial agreement and 0.81+ as almost perfect agreement.



Appendix B. Number of REF2021 Impact Case Studies (total=6,361) with at least one mention of a UK museum/gallery name or URL in the “Details of the impact” or “Sources to corroborate the impact” sections in 34 UoAs.