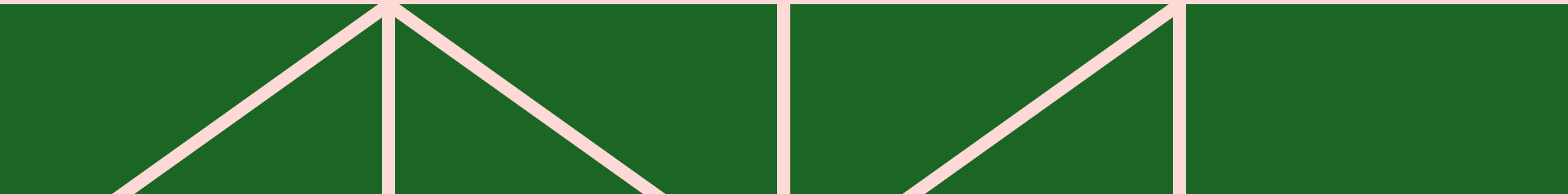
Preserving and sharing born-digital and hybrid objects from and across the National Collection

Project Report: January 2022



Preserving and sharing born-digital and hybrid objects from and across the National Collection

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Acknowledgements

We are grateful to all interviewees and workshop participants for their substantial contribution to the research. We also recognise the critical and sustained feedback from our colleague Corinna Gardner, and the contribution to developing the case studies from Will Massa and Henrik Mauler. This research has been possible thanks to the AHRC grant AH/T01122X/1.

We would like to thank Kaja Marczewska, Claudia Heidebluth and Joanna Norman from V&A Research for their support on the project.

Thanks to Pita Arreola and Katherine Mitchell for proofreading the text.

Publication design by *Supanaught*.

Lead research organistion

V&A

In partnership with

Birkbeck University of London

BFI

Funded by

Towards a National Collection

UKRI Arts and Humanities Research Council

Contents

1. Executive summary

This report is one of a set of outputs from the Arts and Humanities Research Council funded project '*Preserving and sharing born-digital and hybrid objects from and across the National Collection*'. It has been designed to provide an extensive account of the project research activities and findings, to be useful to museum, heritage, and preservation professionals, as well as to scholars interested in born-digital materials.

The aims of the project were to instigate a conversation and build confidence across the museum sector to support the collecting of born-digital objects, and to lay the foundations for future research in the field. The research gathers the expertise of professionals from different backgrounds, and has an international ambition; however, institutions addressing this type of collections tend to be concentrated in a few countries across Europe, Australia and North America.

The research's methodology includes: desk-based research, the focused investigation of four case studies, interviews and workshops. The analysis of the data collected has supported the articulation of a set of themes and key ideas that provide the grounding for the expression of policy, research and practice-related recommendations.

The report understands the challenges of collecting born-digital objects as going beyond the mere technical realm of obsolescence and broken dependencies, to address issues of legality, visibility and accountability. It discusses the multi-layered and complex authorship of many born-digital objects associated with communities or corporate ownership, and expands on the potential of collaborative approaches to collection stewardship.

Born-digital artifacts frequently elude the objecthood typical of museum collections. In fact, they are embedded in multiple infrastructures (such as the Internet), they rely on networks and external resources (such as data, servers and hardware); they are often acquired as ecosystems of components and documentation (including contextual elements and process materials) and challenge the traditional separation between main and auxiliary objects. For instance, the documentation of the creative process and testimonies of user-experience acquire increasing importance as part of preservation and access strategies. This complexity poses difficult questions of value to curators and conservators. The principles expressed in collection policies, the reasons for collecting and the perspective of the curator all contribute to the decision-making process in establishing preservation approaches and in negotiating priorities across the different elements, versions and manifestations of an object.

Born-digital objects are sometimes community-generated or defined in their meanings by user-groups, often beyond the original intentions of their creators. Their authorship might be difficult to track down, such as for open-source or orphan works, and can be described as collective, fragmented across multiple teams or corporate actors. To address the heritage of contemporary digital culture, museums recognise the need to liaise with new interlocutors in the technology and the creative industries, and to address barriers to collecting associated with privacy issues, intellectual property rights as well as the inaccessibility and invisibility of cloud-based services. In negotiating with corporate donors, curators' autonomy can be at risk. However, the curatorial intention and vision becomes crucial when the authorship is distributed or hard to reach, such as in the case of industry, corporate and community-generated objects.

Flappy Bird, Dong Nguyen, 2013. CD.27-2014. ©Victoria & Albert Museum.

While there is developed infrastructure for digital records, and simple objects such as digital images and videos, museums are at an early stage in developing the capacity to care for complex born-digital collections. **As the tech industry becomes the gatekeeper of part of our cultural heritage, new questions arise around the intersections between media and cultural policy. The report signals a number of gaps in current policy and the need to develop more experimental and small-scale pilot initiatives to help understand needs and requirements.**

The recommendations proposed at the end of the report articulate directions for a research agenda that should address:

- The multi-part nature of born-digital objects and their reliance on external infrastructures, thus requiring new forms of curatorial intervention and decision making mechanisms.
- Collaborative and open approaches to collection stewardship involving actors beyond the institution.
- A stronger relationship between media and cultural policy to better support the safeguarding of emergent heritage objects associated with cloud and platform-based services.

The recommendations also encourage policy change to:

- Enable more flexibility and experimentation around born-digital collections, leading to better understandings of resources and needs.
- Identify collection responsibilities across the sector.
- Guarantee that born-digital collections are sustained by a robust infrastructure.

The research findings suggest that caring for the born-digital is pushing museums to redefine understandings of the acquired object and of what collecting might entail.

2. Introduction

Research context

Contemporary collecting is a growing practice in many institutions of memory but the scholarship exploring the role of digital culture within the heritage of the present is a rather emergent field. The field of digital art preservation has generated a set of theoretical advancements and established practices to support the development of museum collections. However, digital culture has produced types of objects that constitute an increasingly significant portion of our cultural, intellectual and scientific history which present characteristics and challenges that are not accommodated by digital art collecting practices. These object types are of interest to museums dedicated to art, design, social memory and technological development. At great risk of disappearing quickly as a consequence of rapid innovation, obsolescence and lack of dedicated institutional support, complex born-digital objects demand a timely intervention from collecting institutions. If not collected when they are still in use, contemporary digital media and devices might become inaccessible, leaving significant gaps in our records, a prospect that has been called a 'digital dark age' (*Kuny 1998*).

The AHRC funded project '*Preserving and sharing born-digital and hybrid objects from and across the National Collection*' was part of the *Towards a National Collection* scheme and ran from February 2020 to March 2022 [1]. It is led by the V&A in partnership with Birkbeck University and the British Film Institute. The research leverages the expertise of museum professionals to address the challenges of collecting objects representing contemporary digital culture. This is an area of research that has received little attention from the heritage and museum studies communities, where the investigation of digitised collections has been so far prioritised (*Keene 2012, Terras 2015*). By contrast, the project looks at a broad range of born-digital and hybrid (combining physical and digital elements) objects from websites to mobile apps, from data visualisations to digital film, videogames, digital product design, AI services, social media and immersive media. These objects are often based on networked and proprietary systems, relying on changing libraries and databases, and featuring user-generated content.

This report is conceived as the core element of a set of resources for the museum sector which include also four case studies, a toolkit and a model to support decision-making before and during the acquisition of complex born-digital objects.

The research has looked at collection and preservation practices taking place internationally across multiple institutions and aimed at benefitting the museum sector broadly. However, it was embedded within a museum of art and design, the V&A, and specifically within a department dedicated to design, architecture and digital, whose 'collections encompass industrial, product, furniture and digital design, architecture and urbanism' (*V&A Collection Development Policy 2019 p.9*, prior to the department's restructure in 2021). The department has an emphasis on contemporary collecting and focuses on industrial and product design, including mass-produced objects and objects that 'aid navigating daily life' (*ibid 2019 p.11*), but also more unique pieces of art and design. Digital design, in particular, is defined in the Collection Development Policy as consisting 'of but not limited to: product design, software and physical computing;

[1] Due to disruptions associated with the Covid-19 pandemic, the work covered by the report was concentrated in the period from January 2021.

systems and industrial design; web design and social media; interaction, interface and information design; videogames and communications design; new media and computer programming' (*ibid 2019 p.12*). The research process was informed by such context and was sensitive to the differences between contemporary, every-day, mass-manufacture and single-authored objects. However, it recognises that born-digital objects share some of the challenges of collecting analogue contemporary objects. Further, it was conscious of the public-facing, display-oriented mission of museums, which differentiate them from other institutions of memory, such as archives and libraries which are more oriented to scholarly and specialised userships.

State of the art

To date, relevant research has concentrated on the preservation of born-digital art, in particular time-based media, net-art and interactive art, with influential projects such as the Variable Media Initiative (from 1999 at the Guggenheim Museum) and the *Matters in Media Art* (launched in 2005 and involving Tate, MOMA and SFMOMA), to name just two. With obsolescence and loss of authenticity frequently identified among the main risk factors, these projects explored several approaches to preservation such as storage, migration, emulation, and reinterpretation. The field of videogame heritage has also produced a rich body of literature, which evidences the role of amateur communities in caring for and preserving games (*Newman and Simons 2018*). The debate has addressed the role of play in display, legal and privacy issues and the challenge of disappearing literacies (*McDonough P. et al. 2010, Guins 2014*). Whilst an excessive focus on preserving the end product has been the object of criticism (*Winget and Murray 2008*), the literature on videogames shows the complexity of born-digital objects, as they come with many dependencies and associated elements including hardware, peripherals, marketing materials, packaging, different versions and so forth.

The Cooper Hewitt Smithsonian Museum of Design has been at the forefront of investigating the preservation needs for digital product design with the Digital Collections Management Project, which identified risk factors (including technological obsolescence, loss of relationship across key dependencies, and loss of specialist knowledge) and preservation strategies (*Fino-Radin 2019*). The findings emphasise the need for constant monitoring and frequent updates, and conceptualise the preservation of the born-digital in terms of riskscape to emphasise the interdependent complexities forming an ecosystem of risk factors and decision-making (*Barack et al. 2021*). MoMA and SFMOMA are additional examples of institutions collecting born-digital design, featuring objects such as the iPhone, emojis, and videogames. Nevertheless, the field of digital art and design preservation leave substantial gaps and unanswered questions. For instance, the role of documentation, as a preservation strategy and a source of authenticity, and the reproducible and variable nature of the artwork (*Graham 2014*, *Falcão, and Ensom 2019, Dekker 2018*) are still widely debated. Additionally, the role of communities and user-generated content, and the networked and live dimension of many digital products need further investigation. On this topic, Himmelsbach understands the networkedness of digital artworks to the concept of performance (2019); on a more practical perspective, media conservator Claudia Roeck centres the preservation of internet-based works on the reduction of server maintenance and of external dependencies (*Roeck et al 2019*). More recently, Tate's AHRC funded Software-based Art Preservation project (2017 – present) has sought to address the challenges and the longevity of software-based artworks in their art collections, through the definition of standardised workflows and processes for the preservation of collections objects, and through the systematic application of these standardized approaches to their existing collection, while identifying work at risk, howeverto date this research does not address the networked, and focuses on authored artworks, with specific artist intention and documentation.

Digital platforms, such as social media, streaming and e-commerce services, tend to be associated with web-archiving efforts and the gathering of user-generated content (*Costa et al 2017*; also see for

instance the *UK Web Archive project*), whilst their value as design objects is yet to be appraised within collecting institutions. Distributed ownership, intricate layers of intellectual property rights and proprietary regimes are being recognised as a challenge to preserving and enabling access to born-digital objects (*Lee 2018*, *Fisher 2020*, *Rees 2021*), but these issues are not adequately examined in the literature, and we lack case studies to inform legislative and policy change. Finally, whilst the field of collecting digital art relies heavily on the artist's intention for the significance on the work, with the acquisition questionnaire now a standard practice in most museums, other types of digital object present less defined forms of authorship and use, raising the question of what factors should guide the decision-making process around acquisition and preservation priorities.

iPhone 6, Apple, 2014. CD.2-2015. ©Victoria & Albert Museum.

3. Research aims and questions

The aims of the project were to identify gaps and areas for further investigation within the scholarship and professional practice associated with collecting the born-digital. Adopting a broad scope in terms of object types, types of institution and collecting issues, the research team aspired to lay the foundations for future research, build capacity across the heritage sector and promote debate and knowledge exchange to capitalise on expertise currently distilled within institutions internationally. Uncovering these emerging avenues of research is key to develop leadership, create the premises for sector-wide agreements and standards required to care for the born-digital.

The research focused on three areas of collecting and articulated specific questions for each of these areas.

A. **Collection Management**. This strand addressed the adequacy of the museum information and rights management systems to account for complex digital objects; ways of negotiating different sources of knowledge and authenticity; documentation modalities and aims; the adequacy of current policies and systems of governance. It asked questions associated with the inclusion of communities of user's knowledge within museum's data management systems; and with the ethical and legal implications of managing objects with multiple and corporate authorship.

B. **Preservation**. This strand focused on the risk factors and requirements to preserve access to digital, networked, database-oriented and hybrid objects. It questioned the relationships between management, preservation and access and asked questions on the skills and infrastructures needed to care for born-digital objects and their significance and values.

C. **Access**. This strand investigated how to enable access to fully functioning, interactive digital objects going beyond approaches limited to displaying the hardware alone; it questioned the potential to show born-digital objects online, in relation to IPR, accessibility and design barriers; and it explored the reception of contemporary collections across time, comparing current and future audiences. Further, it posed questions around narratives, biases and ways of contextualising the object.

4. Structure of the report

This report presents the outcomes of the research and condenses the findings of a broad scoping initiative into a set of key themes. It is structured around the following sections:

I. an account of the methodology;

II. the discussion of findings elaborated from the desk based and fieldwork research;

III. the discussion of findings grounded in the case studies and the workshops;

IV. the articulation of key recommendations.

These are grouped around three categories: objects, stakeholders and policies; and target policy-makers, the research community and museum professionals.

Y-Stop SEACRH Card, Release & StopWatch. © Victoria & Albert Museum.

5. Methodology

The findings presented in this report result from the analysis of a qualitative dataset based on interviews and workshops with stakeholders, and on the development of four case studies.

Literature review

A preliminary phase of desk-based research led to identification of existing gaps, open questions and relevant themes to inform the subsequent stages of the project. This produced a literature review structured around object types as well as overarching topics such as the role of documentation and the definition of digital objects. The research team reviewed the literature on collecting born-digital art, videogames, social media, consumer electronics, smartphone-based applications, immersive and imaging technologies (Virtual Reality, Augmented Reality, Computer Graphics, and Visual Effects) architecture, 3D data (such as 3D models, animations and virtual environment). The review comprised academic publications, blog posts, policies and strategies.

Interviews

A set of qualitative, semi-structured interviews extrapolated concerns and perspectives from ten professionals, including: five museum practitioners (one media conservator, a curator, one collection specialist, a digital archivist and a chief experience officer), an Intellectual Property Law expert, a scholar versed in technological cultures in design and architecture, an expert in open technologies and maker cultures, a scholar and practitioner with expertise in digital creativity and the commercial sector, and an expert in imaging technologies (see *Appendices*). Questions were

customised to the role and expertise of the interviewee, but with an overall focus on: the process of institutional adaptation to collecting born-digital objects; key preservation challenges and opportunities; approaches to online and offline access; ethical issues; the sustainability of collecting the born-digital and the value of collaborative approaches to stewardship; cultures of preservation within specific industry sectors; the role of amateur communities; the assessment of authenticity and integrity of the object; skills and infrastructures required for caring for the born-digital; notions of authorship and ownership.

The interviews aimed at shedding light on the significant gaps and assessing maturity and confidence across the sector. They were not intended to offer an exhaustive survey but to provide nuanced and rich perspectives from a range of roles and institutions.

Workshops

The project included three online workshops dedicated respectively to Collection Management, Preservation and Access. Leading professionals (see *Appendices*) with relevant expertise for each of these three key areas of collecting were selected as participants. They come from institutions including the British Library, The Digital Preservation Coalition, the Science Museum and the Cooper Hewitt Smithsonian Design Museum.

The Collection Management workshop took place on the 8th of June 2021 with 13 participants, including four members of the research team. The other participants came from museums, libraries, archives and research institutions, where they hold leading roles in collection management or collection services. The workshop featured an activity aimed at discussing collection policies and policy innovation; an activity focused on case studies, especially in reference to the introduction of collaborative forms of stewardship and of open, less museum-centric forms of knowledge; and an open discussion on issues of documentation, information systems and institutional readiness to collect the born-digital.

The Preservation workshop took place on the 18th of June 2021 with 12 participants, including three members of the research team. The other participants were media conservators, curators and researchers in the field of digital media preservation. They were invited to investigate the decision-making process to collect and preserve complex digital objects and to evaluate the preservation risks associated with the proposed case studies. The workshop concluded with an open discussion which touched on the topics of sustainability and curatorial decision-making.

The Access workshop took place on the 22nd of June 2021 with 13 participants, including three members of the research team, curators, designers, educators and an IPR expert. They engaged in activities speculating on the experience and literacy of the audience across different timescale and on actions to be taken to ensure the long-term access and contextualisation of three born-digital objects. The rest of the workshop was devoted to an open conversation addressing the challenges for museums willing to collaborate with big tech industry.

Case Studies

An essential component of the research was the development of four case studies, focused on different types of born-digital objects. The case studies allowed the team to observe and analyse challenges in depth, complementing the interviews with more focused data. The case studies were also key elements during the workshops, catalysing the participants' investigation and prompting debate on a range of real-life problems.

The first case study is *geist.xyz*, a procedurally generated film by design studio ZEITGUISED, using computer generated imagery, whose acquisition is accompanied by a set of materials illustrating the creative process behind the piece. This work has been acquired by the V&A with support from the Art Fund.

The second case study is *In the Eyes of the Animal*, a Virtual Reality experience by collective Marshmallow Laser Feast, in the process of being acquired in an experimental initiative by the British Film Institute. At the moment of writing the acquisition is still in progress.

The third case study is another ongoing acquisition at the V&A: *Y-Stop* is a piece of information design including an app and printed materials, devised to inform people on how to handle the interaction with police officers during a stop-and-search in the UK.

The fourth case study is *Instagram*, the image-based social media platform owned by Meta, which is used mostly through a mobile application. This is a speculative study, as it is not being acquired by any institution. It was selected to enable the team to address an extreme example that pushes the boundaries of what can be collected; and to bring the attention to complex forms of ownership and intricate questions of value, legality and privacy.

Research limitations

By capturing in progress (or entirely speculative) acquisitions, the case studies concentrate more on problematising concerns and practices, than in providing an account of successful solutions. The broad scope of the research was calibrated to gain a comprehensive view of the status of born-digital collecting. As a consequence, a more fine-tuned, targeted investigation of specific issues was beyond the scope of this foundational project. We acknowledge that members of the research team also acted as research informants and workshop participants in their capacity as professionals employed by the V&A (Natalie Kane) and BFI (Stephen McConnachie), hence equipped with specific expertise on their institutions as well as the case studies.

ZEITGUISED. geistxyz. 07.

In the Eyes of the Animal, installation view, courtesy of Marshmallow Laser Feast.

6. Literature review and interviews: summary of findings

In this section, we combine the findings emerged from the literature review and the interviews, which provided a framework to the subsequent research activities. Born-digital objects go on a spectrum from very simple and self-contained such as linear audiovisual content or image files, to more complex, networked, hybrid, mutable and interactive. This research has focused primarily on the latter, which are collected in a number of museums around the world, especially dedicated to digital art (ZKM, Netherlands Media Art Institute, Tate Modern), the moving image (ACMI), videogames (The National Videogame Museum, The Finnish Museum of Games), contemporary design (MoMA, Victoria and Albert Museum, Cooper Hewitt Smithsonian Design Museum), museums of science and technology (Science Museums Group, Powerhouse Museum, National Museums Scotland), and social history museums (London Transport Museum).

The literature review identified a range of preservation risk factors and strategies shared across different object types, with the field of digital art pioneering solutions - migration, emulation, reinterpretation and documentation - that can be potentially or partially suitable for digital product design, immersive technologies, videogames, web services. Re-interpretative approaches to preservation (*Depocas et al 2003*, *Rinehart and Ippolito 2014*, *Himmelsbach 2019*, *Finn 2021*), based on the reinvention or reinterpretation of the work to replace the elements which have become obsolete, catalyse a significant portion of the debate. These transformations can be more or less irreversible and radical, and even established strategies such as emulation involve some alteration to the original work. The scholarship is divided between rigorous positions embracing historical accuracy (such as those advanced by the Digital Art Conservation Research Project led by ZKM, see *Serexhe 2013*) and others valuing the idea of living objects, constantly being re-developed and continuing their existence under different forms (*Van de Vall 2015*, *Mansoux et al 2020*). For instance, Pip Laurenson grounds the conservation of time-based media in the identification of significant properties that should be maintained to preserve the artwork's identity, as opposed to maintaining its physical integrity in a fixed status (2006). Nevertheless, the concept of significant properties is further problematised in association with complex, networked digital objects such as social media platforms, which materialise through performances unique to every user at each access (*Espenschied and Rechert 2018*). In general, authenticity, authorship and ownership are frequently debated points.

Expanded authorship and the role of relevant communities

Understandings and regimes of authorship differentiate digital art and design from consumer electronics and mass-produced, mass-distributed digital objects (apps, web services and so forth). In the first case the artistic intention, captured in acquisition questionnaires (*Paul 2009*, *Paul 2019*), remains the primary point of reference to guide decision-making and establish priorities in terms of preservation and display, so that the integrity and authenticity of the object is maintained. Nevertheless, we note that the field of digital art has developed an awareness that preservation should focus on the object as much as on the experiences, interactions and behaviors it brings about (*Lurk et al 2012*), and has interrogated the importance of documenting user experience, especially in relation to interactivity (*Muller 2016*, *Giannachi 2019*). For mass-produced, consumer products or community-generated designs, authorship tend to be complex and multi-layered. It responds to different IPR regulations and is difficult

to trace back to a clear, individual source of authenticity. Further, for this kind of objects, users are an important agent in shaping the meanings and significance of the object but there are currently limited ways to include their perspective within the institutional knowledge systems used in the museum.

The inclusion of multiple voices to challenge existing biases in museum management has been highlighted for some time (*Srinivasan et al 2009*). The embeddedness of born-digital objects into current socio-technical practices is reinvigorating this debate as scholars and practitioners bring attention to the role of amateur and user communities in preserving and documenting expressions of past and present digital culture. From the efforts of retrogamers in maintaining rich accounts of videogames (*Newman 2013*, *Stuckey et al 2015*), which comprise self-documentation of play, personal memories as well as the development of emulators, to the concept of 'networks of care' (*Dekker 2020*), the role of piracy in media preservation (*De Kosnik 2020*), and the potential of blockchain technologies to support novel forms of ownership and shared guardianship (*Liddell 2021*), there is a growing awareness that museums should look towards non-professional and non-institutional practice to sustainably maintain born-digital heritage. Responses from the interviews are aligned to these debates and testify to the importance of collecting user experience, the role of relevant communities as advisors on specific acquisitions in the area of open technologies, and the agency of different actors including corporate and collective owners or creators.

"As important to me as the object, is the experiences of those people who used the object, and the views of those people who used the object. And in a way that's (possibly) more important. So, archiving those experiences and exploring curatorially those experiences is interesting and useful." (Grierson interview)

"When we acquired Arduino and some of those other works, there was a staff member here who was very involved with a group in New York called NYC Resistor, which is a very DIY kind of collective of people that are hackers and love taking things apart and making new kind of robotics and things like that. So they were, in many cases, included on our conversations when we were investigating these fields. Sadly, we didn't document that as well as we should have." (Galloway interview)

"[Architectural firms] consolidate authorship in a figure or a small set of figures that concentrate the authorship. And here's what I think the interesting question is, if a museum wants to take a more progressive approach to thinking about authorship in architecture, perhaps this shouldn't be exclusively approaching architectural firms, and they should be asking questions about what the architectural object is. [...] The different kinds of accounts of that object that exists based on the different disciplinary groups that engage with them from clients to contractors, to builders, to all sorts of things. I think that this opens up a more difficult question, right? But I think it's a question that deserves attention because architecture is more complex than what happens in an architectural office. And architects are the first people to know this because, their work, to a large extent, is about interfacing." (Cardoso Llach interview)

The idea of engaging with users, and to value their cultural knowledge and subjective accounts is considered an effective alternative to unsustainable and problematic approaches to preservation (*Nylund 2021*), emphasising the nature of digital artifacts as socio-technical assemblages. This is an area that, beyond the

field of videogame heritage, deserves further investigation and lacks guidance and best practices concerned with negotiating with, crediting and shaping narratives in concert with relevant communities. Despite a range of experiments on folksonomies and participatory tagging (*Trant 2009*) which have involved museum collections over the past decades, museums are yet to develop sustained approaches to gathering community knowledge associated with collected objects, especially if not confined to temporary initiatives. Whilst there is potential in using existing platforms for collaborative knowledge (see the quote below), as well as in developing new ones, we still need better understandings on the barriers to collaborative stewardship and collaborative collecting and on approaches to moderating and facilitating the inclusion of multiple sources within the museum information infrastructure. Above all, the potential is to identify through collaborative models and community engagement, new synergies across conservatorship and knowledge development.

"So, we have had several WikiProjects for Wikipedia, where we are actually producing knowledge based on our collections. And that's been hugely successful, I would say. Because just giving that focus for a project like this, to focus on Finnish Games, has made it possible to produce a lot more knowledge. Here, we'd had several Wikidata projects with the same Wikipedia activists, and I see that as a kind of collection management and outreach, but also pedagogical work in a way."
(Nylund interview)

Skills and infrastructure

Museums have adapted gradually to collecting born-digital art through 'subunit proliferation and adjustments to established practices and procedures' (*Van Saaze et al 2018*). Over the last twenty years, media conservators have slowly been added to the team in some of the leading museums engaging with the born-digital, such as MoMA, ACMI and Tate; collection management systems, storage systems and repositories have been expanded, modified or reconceived to accommodate digital objects. Some collections have made strategic efforts to address resourcing gaps; between April and August 2019, Science Museum Group worked with digital preservation consultants Charles Beagrie Ltd. at a point where auditing and assessing SMG's digital assets had become 'business critical'. Charles Beagrie Ltd helped SMG produce a digital preservation gap analysis across SMG 'to highlight key risks, opportunities, and priorities for the organization [in order to] to develop its digital preservation strategy and the business case for resourcing it.' This ultimately led to the group joining the Digital Preservation Coalition and advertising and subsequently recruiting a Digital Preservation Manager.

Some interviewees see their institutions as being at the early stages of building capacity towards collecting the born-digital, in the process of identifying preservation priorities, developing pilot projects and new policies. At ACMI (Melbourne), this process is made visible within the museum space and offers an opportunity to attract attention and catalyse the support of potential partners and stakeholders to digital preservation. In fact, the creation of the ACMI Media Preservation Lab as a publicly accessible space represented the convergence of engagement, strategic and research aims:

"It was really about bringing the collection out of the basement and out of storage, particularly because our collection is so much like discs and reels and boxes, that until it is on a screen it doesn't really have an exciting form. So, part of this was also about seizing the opportunity of bringing media preservation and that sense of the physicality of the collection into public view, but also into view of our key stakeholders as well. So, it was both a public engagement piece, but also a strategic piece about showing that a museum of media does have a

Blackmagic Design Media Preservation Lab at ACMI, Melbourne. Photograph by Shannon McGrath, courtesy of ACMI.

collection, and that collection is fragile... And digitization and preservation are physical processes." (Chan interview)

The skills needed to preserve born-digital objects are heterogeneous. In-house expertise, where present, tend to include digital archiving, cultural material, software and time-based media preservation skills. As revealed by several interviewees (Chan, Galloway, Gialanella), it is not uncommon that conservators with more traditional backgrounds are upskilled to also care for digital objects. Because of the diversity of technologies, programming languages and media at stake, museums are recognising the need to outsource specialised expertise, especially through universities or other organisations, on a case-by-case basis, even when dedicated staff is available in-house.

"The primary weakness with any kind of complicated work is that no one person can be an expert in every kind of manifestation that a digital work can make. [...] So, we've very quickly identified some of these problems, and have at times tried collaborating with outside researchers. We took one piece, an interactive software artwork, and we had the programming source code, the commented source code for this work, and we actually collaborated with New York University's computer science department to go through line by line of the code and see the commented code, and we sat down with the artist and went through his code. It was a really revealing experience, because the artist had done the piece 10 years before, and had already forgotten everything he'd done, so it was almost new for him as well." (Galloway interview)

"We work with a lot of the local universities. The Grimwade Centre for Materials Conservation is at the University of Melbourne, and we also work with RMIT, who has a very large games and design specialization, and also Swinburne University's Centre for Transformative Media Technologies, that has specialization in digital cultural heritage. So, we try to work with the universities to bring in specific skills. [...] One of the interesting challenges for us is balancing the technical skill sets around very particular things, so digitizing celluloid, versus working with magnetic media, versus working with software. The very specialized technical skills... So, what things do permanent staff need, and what sort of literacies do those permanent staff need? Which I think increasingly is some literacy, some software literacy, because everything that we now acquire, commission and collect pretty much is software-based in some way." (Chan interview)

Access, living heritage and explorations of value

Recent work in heritage studies conceptualises heritage objects as fluid and transient processes, akin to natural phenomena and subject to mutable arrangements and temporalities (*Harrison 2015*). Even before their musealisation, born-digital objects are not 'static objects that can be 'stabilized" in the classical sense' but are comparable 'to performance because new conditions can arise in each process' (*Himmelsbach 2019 p. 234*). Technological and cultural obsolescence, their dependency on constantly updated databases, libraries, live feeds, user-generated content, live interaction, and the fact itself that they are often collected while still in use, suggest the idea that born-digital objects should be addressed as living heritage, to be seen 'in terms of persistence and change, persevering in a process of continuous growth and creative transformation over time' (*Holtorf 2018 p.3*).

UNESCO's definition of intangible cultural heritage also puts an emphasis on 'living expressions'. However, such definition does not explicitly include references to digital culture and its interactive, networked nature. In fact, UNESCO's vision for digital heritage tends to remain limited to self-contained digital artifacts and resources (described like expressions of human knowledge, texts, databases, moving image, software and web pages) (*UNESCO 2003*) rather than engaging with lively representations of our digital lives. This approach then, has its own implications on the way conservation and preservation are conceived.

Museums are still coming to terms with the evolving and networked dimension of the born-digital: in many cases, collecting consumer electronics has meant preserving access to the hardware only (see for instance the case of the iPhone at SFMOMA illustrated by *Martina Haidvogl 2016*). In a recent article accounting for a research project at the Cooper Hewitt Smithsonian Design Museum, Barak et al. point out that:

> *'Full functionality is not always a critical factor in acquiring an object, particularly if maintaining it exceeds the museum's preservation capabilities and if that aspect can be effectively communicated through video documentation or other mean.' (2021)*

A similar position is expressed by MOMA's Collection Specialist Paul Galloway:

> **"We understand our role as not being an archive for these things. We're not the place that's going to necessarily keep all of those objects operational. We are instead about demonstrating their use. And because, before the COVID pandemic, MoMA got around three million visitors a year, it's not feasible for us to have, say, Makey Makey or Colour Chaser actually working, because we can't let people play with them. They'd be broken in five minutes by our visitors. So instead, the kind of approach we've been taking when we exhibit them is to show them as a static object with a video that explains their use, right? [...] That is one I personally really struggle with, because looking at an IBM laptop from 1991 with the screen off renders it just into a sculpture for me, and it is meant as an object that is interacted with. So, we are constantly running up against what the limits of what you can do in an art museum are. It's not possible for us to have that laptop turned on and let people play with it, because it's the only one and it would be broken in five minutes if somebody were to play with it. I think what we've arrived at is an understanding that there's a real limit to what we can accomplish with helping the public understand these things. Often, the best we can do is show it as a sculpture object and then show a video of it being used."**
> **(Galloway 2021)**

Displaying functional digital objects, in fact, clashes with traditional display approaches in museums. Further, this approach is often dismissed because of the perceived banality of old and recent technologies to contemporary audiences (*Cormier 2017*, *Alberti et al 2018*). Maintaining of full functionality can also appear paradoxical, as collected objects get separated from their original context and inevitably lose their original agency and materiality (*Zuanni 2021*). In sum, the sector currently lacks criteria and models to support complex decision-making and respond to questions such as: which components of an object are the most significant? When should networkedness and interactivity be prioritised? How can museums use and display multiple versions, core and collateral materials?

> **"If you want to make an exhibit where you're showing people the actual device and they're able to touch it...that's quite unusual. It's not often that you get to do that with historical objects in a museum, right?"**
> **(Grierson interview)**

"Some of the challenges are actually deciding what to collect. [...] So perhaps we might collect one version or one to three versions as opposed to the five versions, and set in in a period of time so we collect this 2020 version as opposed to the three more that you might develop. And then we might have this sort of ongoing conversation about, "Well, maybe the creator now considers that is superseded, and it's time to collect this new version. Or actually, maybe we just stop here and we collect this version as an example, or exemplar of that at the time when it was quite significant."
(Cranmer interview)

"I think the first step for us will be to analyse those collections and determine: do we actually want that software or was the material collected for its format? Because it's very much a mix here, we do have a computer history collection so there's a lot of material that came in strictly for the carrier. I think we need to sort that out first, and then we can decide from there. We're going to want to develop some kind of value model, get a sense of what are the highest priority materials that we must preserve, that we must keep as interactive and functional as we can, and try to focus on those."
(Gialanella interview)

The need to develop models for decision-making is dictated by the sheer variety and richness of elements or parts that could be acquired for every object (from peripherals, to dedicated hardware, from different versions to source code and so forth), and by the uncertainty around the object's legacy, its trajectory of success and decay and consequent access opportunities. The question of sustainability surfaces frequently in this context, as museums' limited financial, staffing and infrastructural resources impose critical choices, including privileging documentation over maintaining fully functional multipart acquisitions. For instance, the acquisition of Chinese social media WeChat at the V&A has been complemented by an edited video of a screen capture of the app, featuring the motions of a typical user chatting with friends, ordering food and transferring money (*Cormier 2017*).

"A lot of the work at the moment is about getting the best possible documentation in as many sorts of vectors as we can, so we're not putting all our eggs in the, "We need to collect the headset as well, or the computer as well, or image the drive as well, or collect the source code as well." Yes, we're doing some of that but we're not collecting everything for everything. Because it's probably not necessary, but we're more documenting the performance of it. I think that's been an interesting shift, but I don't think there's a correct way. I mean, we know there isn't a correct way of doing it. Otherwise, we wouldn't be having this call. There isn't a standard way."
(Chan interview)

Building mock-up, fake version of fragile technological devices is also indicated as a potential solution to enable audiences a real interaction:

"I know that it seems weird to have a display case of circuit boards, but I think that having the objects themselves would be the right thing to do because the circuit boards would become themselves cult objects. And then I would probably do a software version of what it meant to plug something in. So instead of doing an Arduino where you had to fidget the cable in, it's tiny, you can't have a million people working on it, they break after four people use them. But what you could

do is build a fake one that worked the same way and use patch cables from a synthesizer system because patch cables are designed to be ripped in and out of things all day long and they can be replaced really easily, or you could use gigantic alligator clips."
(Leitch interview)

These testimonies partially explain the slow progress in addressing the networked dimension of born-digital objects. However, the question cannot be dismissed so quickly, as functionality and interactivity are fundamental to enable effective, meaningful and long-term, public understanding. Future-proofing a born-digital acquisition involves the consideration of a range of factors, such as the collection of associated objects, legal agreements, and potentially useful items (from the source code to specific peripherals and consumables) that will enable the display of the object in the future. The combination of the decontextualising effect of collecting, and the multiplicity of items, documentary materials and possible arrangements associated with the object, demands for an expansion of the curatorial role, called to reframe and recontextualise born-digital objects as well as developing display solution able to making such reframing visible to the public.

An important and unresolved question in the context of contemporary collecting concerns ways of anticipating and developing the value of objects acquired in the present. How can museums predict what might be of interest in 50 years? To what extent should museums over-collect to in order not to miss something of future value? How does an institution work towards increasing the value of born-digital objects, especially considering the typical trajectory of technological devices, as illustrated by ACMI's Seb Chan:

"Things have a high value when they're new, and then for about the next 50 years they have no value at all, and then 50 years later they have higher value again. So, can you wait 50 years while it's sort of like, "Oh, this piece of ephemera from whenever"? If we think about the virtual reality works that we commissioned even as recently as two years ago, I don't think they're very interesting. They were interesting for that moment. They won't be interesting again until we can do a survey show of virtual reality from the 1960s to 2060, 100 years of virtual reality. That's when it's interesting."
(Chan interview)

Intellectual Property Rights, Privacy and proprietary systems

From an IPR point of view, digital artworks tend to present relatively straightforward copyright regimes, even though some of them involve the use of proprietary content. Mass-produced digital product design objects like software, physical computing, consumer electronics, by contrast, are hindered by a set of legal challenges limiting preservation and accessibility. For instance, part of the useful documentation that curators would like to collect alongside an object, might never became available as manufacturers try to protect their interests:

'We're never going to get the hardware schematics and source code for Google Glass–it's a trade secret. Things like that in the architecture and design collection are also software-based works, but because of their nature, we can't treat them the same way as we treat the media artworks, where we can get the source code and have access to the artists and their engineers.' (Hellar 2013)

The field of videogame heritage, rooted in piracy and semi-legal practices (such as the extraction of ripped game code for execution

on emulators), has engaged in a longstanding battle to support legislative change that could enable preservation, access and playability. The limitations in terms of legal deposit and the limited scope for institutions of memory to operate only within the exceptions to the rights of reproduction and communication of copyrighted content have been highlighted by early research initiatives such as the KEEP Project (*Anderson 2014*). Whilst libraries, archives and museums are currently allowed to make preservation copies of born-digital objects and showing them on the institution's premises (UK Copyright, Designs and Patents Act, section 40B), when it comes to show digital content online legal barriers are solidly in place. According to IPR scholar Paula Westenberger, this constitutes a conflict between fundamental human rights: the right to intellectual property (and to profit from it) and the right to participating in cultural life:

> *'It can be argued that this limitation to copyright should not be restricted to the communication and making available of works within the facilities of cultural institutions; it should also allow, in specific circumstances, the making available on online platforms managed by the cultural institution. Since not everyone is able to personally visit cultural institutions, narrowing down the access in this manner would be a 'retrograde step in an era of digital culture' and not consistent with the human right of participating in cultural life.' (Westenberger 2017 p.304)*

However, international law only allows for limited exceptions to copyright, that have to comply with the so called '3 steps test': exceptions have to be conceived (i) in certain special cases, (ii) that do not conflict with a normal exploitation of the work and (iii) do not unreasonably prejudice the legitimate interests of the copyright owner. More research is needed to craft and test specific solutions and their viability:

> **"I had looked at possible solutions like, for example, having an exception that would be tailor-made to certain kinds of uses and have some kind of safeguards, as well, to the rights holders, maybe some technical constraints on the files themselves to avoid that people download ... It's hard to think in abstract. I think it's so important that this is based on empirical research to see what are the issues, what are the current practices, and then what are the possible solutions? [...] There could be solutions with the collective management organisation, those organisations that represent rights holders. Instead of asking a license to the government, maybe there could be solutions involving asking licenses to these societies that represent rights holders." (Westenberger interview)**

The interviewees reported not only legal challenges in providing access to the public, but also those associated with the complexity of negotiating and clearing rights with commercial or corporate donors, and the intricated nature of IPR for many born-digital objects.

> **"We have institutionally been quite limited in the thinking around that [open access], simply because 99.9% of the collection has complicated rights not only around the work, but also potentially around the soundtrack of the work, and other performer rights and other things. [...] So, we have quite a conservative approach because of the relationships that we need to maintain with studios, film studios, and rights' holders. Either way, there's just no middle ground. [...] We are involved in that work, and there are changes coming to the Australian Copyright Act, or proposed exemptions for museums and libraries and archives, which would be much more flexible. One of the other challenges obviously with a moving image collection is that it's not just about the law. It's about the relationships that need to be maintained." (Chan interview)**

> **"It's just that in this case it would be more difficult to get an agreement with the right source. Sometimes the right source**

is difficult to identify in this case, or not interested in the museum collecting the artefact, and so on."
(Grierson interview)

"That's why these acquisitions take so long, because we have to negotiate these very complex legal ownership agreements."
(Galloway interview)

When born-digital objects involve user-generated content, the legal framework is complicated by privacy issues, including the need to comply with the General Data Protection Regulation (GDPR) and the intricate regimes of ownership of content across owners of the platforms or services (such as social media or videogames) and users. For instance, established institutional procedures such as the Deed of Gift are conceived on the expectations to deal with only one signatory, and are not suited to objects with distributed or collective authorship. Permissions to preserve and display user-generated content can be especially difficult to obtain (see for instance *McDonough et al 2011* on preserving Second Life). In this case, legal barriers are intertwined with ethical issues, as users' identity, privacy and authorship are at stake. Further, the increasing popularity of server-based games, where players create avatars and assets, as well as the practice of modding (*Unger 2012*) and hacking games, generate new questions of preservation and abandonment:

"And when this service closed, players don't have access anymore to what they created. So, I'd say this is problematic and it's going to be much more problematic in the future, because most or many games nowadays work according to this logic. So, everything is server-based. The company owns the whole IP and players are creating stuff here. And sort of looking at it from the player side, I don't really feel the rights of the players are protected enough in these cases."
(Nylund interview)

New stakeholders: collecting with industry, commercial and corporate donors

The development of born-digital collections is embedded in a range of preservation cultures and archival practices within diverse creators such as architectural firms and commercial studios. These practices have a significant impact on the future preservation interventions and on the longevity of an object. For instance, complex objects such as architectural, CGI and VR works, are the result of layered and intricate making processes, involving different software, dependencies, sources, versions and patches. The long-term preservation of these objects also depends on museums' capacity to negotiate with new stakeholders and to become interpreter of their archival practices:

"Different architectural firms engage very differently with the digital artifacts they produce. They subdivide the work differently. They have different kinds of expertise. They may subcontract some elements that all firms consider to be key to their proposition. I think, there's a lot of interpretive work on the side of the archivist or the collector to make sense of those idiosyncrasies. My sense is, there has to be a very interpretive stage where the specificity of the firms is approached."
(Cardoso Llach interview)

VFX content and production materials produced by commercial studios is at high risk of disappearance. This is partially because it falls outside the remit of most collecting institutions, as those devoted to the moving image tend to prioritise the final output over elements from the making process. Further, VFX records are

Primitives (2017) Production Documentation. Courtesy of Alan Warburton.

Primitives (2017) Production Documentation.
Courtesy of Alan Warburton.

especially prone to obsolescence, are diverse in sizes and formats, and are often produced by multiple creators, including 'work for hire' who do not own the rights to the assets they produce (*Samaras 2018*). This complicates the issues of provenance should an object be proposed for a museum collection, whereby ownership must be established in order for due diligence to be undertaken to satisfaction.

Archiving the creative process is interpreted by the industry more as a utilitarian form of back-up (*ibid 2018*) than as related to cultural legacy and preservation. However, the archival practice of commercial studios differs significantly from that of VFX and CGI practitioners working independently, more exposed to obsolescence and risk of loss because lacking the resources for storing and caring effectively for their creations:

"These are large multinational, visual effects studios that employ thousands of people. These kinds of practices are very industrialised and they have standardized procedures and they have almost unlimited capacity to archive projects because they can afford storage. And they also have people working for them that can code, custom proprietary code that will join systems together. So, they have an ability to customize the software so that they can create a very stable ecosystem. […] So that's on one end of the spectrum. You have this industrialized practice that has a high level of control over their archiving procedures and over their proprietary code and over many things. On the other end of the spectrum, you'll have someone like me or an independent game studio or a graphic design practice or a solo illustrator, anyone who is maybe self-employed, precarious, it's those kinds of more independent practices." (Warburton interview)

The born-digital is disrupting museums' 'traditional idea of exclusive ownership over a tangible original' (*Besser 2019*), paving the way to new forms of ownership and custodianship but also adding complexities to collection management. The multiple, layered and unclear authorship of assets and products poses important questions of attribution and authorship.

"We'd get into intellectual property and ownership and provenance, assigning labor, figuring out who you can talk to about these things. It's the same with any complex code-based project, isn't it? If you look at bias in software, for example, it's very hard to

pin down who is responsible for that bias. And so, any problematic aspects of a digital artifact are very hard to trace back to the source, because that information just isn't necessarily preserved."
(Warburton 2021)

The heritage of our digital culture is also produced by less commercially driven enterprises, such as the maker and hacker communities. These communities' interest in preserving their creations is limited, as principles of innovation and acceptance of the ephemeral dominate their philosophy. However, some very representative objects of maker culture have been acquired by major institutions such as MoMA and the Chicago Art Institute (Arduino, Makey Makey and Ototo).

"Most makers haven't been all that worried about preserving these things. The way that we end up preserving them is that we buy 20 items and then they sit in our basements for an indefinite period of time and then a better one comes out and we buy 20 of that one and it sits in our basements for an indefinite period of time. [...] That's why you are having trouble finding preservation culture because it was the opposite of preservation culture.

[...] [There is a] fundamental conflict there between systems of value where tech values youth and new things and new ideas and being able to burn people out quite young but not on prestige, and museums are specialists in scarcity and prestige systems."
(Leitch interview)

Because of the way projects can be appropriated, modified and customised by different creators, open technologies present unique challenges of attribution. The following quote refers to the example of the open-source microcontroller Arduino (currently in the collections of MoMA and the V&A), and associated with a controversial history as there are claims that it was developed from a student (Hernando Barragán)'s masters thesis project by supervisor Massimo Banzi and his team.

"The issue that I've noticed is the hottest button is accreditation because it is so much about originality and I can see that being the biggest difficulty in these collections. If the V&A credited only Massimo Banzi for Arduino, that would be publicly embarrassing because that work was appropriated from a graduate student and a different community and he did great with it and he didn't do anything

Arduin Uno, Arduino, 2005. CD46:1-2016. © Victoria & Albert Museum.

legally wrong because it was licensed as open."
(artist interview)

Software companies, big tech corporations, social media, and creative studios are becoming new potential stakeholders and partners for museums, who needs to take into account the impact of their policies and priorities. Among other challenges, museums face important ethical questions as negotiating acquisition agreements might endanger curatorial autonomy. For instance, large media companies are protective of their brand and reputation, and might want to maintain a great deal of control on the way their artifacts are displayed and represented not only in the present but in the longer-term future too. Developing nuanced and critical narratives around this particular strand of contemporary heritage work will be crucial for museums to maintain their civic, social and educational mission.

"Businesses have got enough money to promote their own ideas through their own channels. I'm not sure there's a societal or a cultural benefit to allowing them to promote their ideas through public institutions."
(Grierson interview)

"That's part of the reason why when we negotiate these agreements, we're very careful that we're not going to be turned into a marketing arm or Sony or Nintendo or something. That's part of the reason why we don't have Nintendo games, because Nintendo was very interested in turning us into a showroom and having very specific ways their works were shown, and we just couldn't agree to that. That's why there's never been an Apple exhibition at MoMA, because they want to turn us into the Apple Store, and that's not what we're interested in doing."
(Galloway interview)

The themes articulated in this part of the report constituted the basis for the development of the workshops, where some of the issues discussed above were refocused in relation to the four case studies. These are discussed in the next section.

7. Case studies and workshops findings

The workshops were complementary to the development of the four case studies, which were used to provide concrete prompts for debate to the participants. The findings for this second stage of the research are organised around the three areas of Collection Management, Preservation and Access. These findings extend and corroborate the points emerged from the literature review and the interviews, but they also introduce new themes and questions.

The report incorporates insights from the four case studies, however, an extensive analysis of the same is presented separately (see *Case Studies*). Below is a short summary of the findings.

The multipart acquisition of *geist.xyz* features a set of files documenting the creative process, presenting specific preservation challenges associated with the proprietary nature of the software used by the creators, and with the interrelationship and hierarchies across its items.

In the Eyes of the Animal presents challenges associated with its hybrid nature and with the complexity of its making process. The acquisition constitutes an experiment aimed at understanding requirements and needs for this type of object, unprecedented for the institution. In fact, challenges are identified within the BFI National Archive's collection policy, skillsets and infrastructure, including barriers to acquire relevant hardware.

The case of *Y-Stop* situates the preservation of a mobile app, an especially difficult type of object because of its networked dependencies, within the process of acquiring community-generated materials. It suggests that museums should continue to explore approaches to include and document the multiple perspectives of the making process and user experience, and emphasises the importance of managing expectations and commitments from the early stages of the collaborative process of acquisition.

Instagram poses to a potential collecting institutions challenges associated with its lack of boundaries and heterogeneity, the role of user-generated content, issues of privacy, IPR, opacity and ephemerality of its cloud-based system.

Collection Management

One of the goals of the project was to understand the adequacy of current policies and forms of governance present in museums, and to identify areas for policy change. Invited to pinpoint areas of current policies limiting the collection of born-digital objects, the participants to the Collection Management workshop mentioned a disparate range of issues, from a primary focus on physical objects and on complete works (leaving behind component parts and process) to a lack of clarity around what can and cannot be acquired; requirements concerning possessive forms of ownership (so that the title is transferred to the museum) do not fit with many digital objects which frequently elude traditional, traceable and univocal forms of ownership; other gaps concern guidance on online display, job descriptions and storage facilities.

The literature review and the interviews have emphasised the potential of collaborative collecting to address born-digital objects that might present characteristics and elements only partially fitting with a single institution. A few museums such as ACMI and the Smithsonian Institution have started exploring forms of

cross-institutional stewardship. Nevertheless, these initiatives are still at an early stage and yet to be distilled into best practices and guidance to address the many questions of governance, division of responsibilities and crediting that would benefit the sector more broadly. Above, we have pointed at the importance of interdisciplinary expertise and the role of amateur communities or communities of concerns in maintaining digital heritage alive across time. Annet Dekker for instance proposes the concept of 'networks of care' in relation to preserving net-art, involving collaborative professional and amateur practices prioritising the social reproduction of the living memory of a work, over its static conservation (Dekker 2020). Bringing this proposal forward and extending it to other object types raises important questions. What would the role of museums be? Would it involve coordinating, maintaining, motivating relevant communities? How does reliance on informal 'carers' change the expectations, principles and values of the institution? Can an institution accept to leave crucial decisions and stewardship out of its hands?

The participants identified a number of challenges associated with ways of engaging partner organisations and communities. One of these refers to ensuring that the organisations' senior management support the collaboration as much as staff directly involved in the acquisition. Further, participants mentioned the need to determine whether the same object components could sit in multiple digital repositories and the broader question of understanding born-digital objects as ecosystem. A clear distinction between core and auxiliary objects, in fact, is perceived as increasingly problematic for complex objects, especially within the framework of collaborative stewardships where different organisations focus on different elements depending on their collection remits and priorities.

This discussion also delved into unclear collection responsibilities and the lack of institutions devoted to emergent types of born-digital objects, falling outside the realms of art, design, moving image or social history. For instance, in the UK no institution focuses on collecting immersive technologies, whilst the above-mentioned lack of policy coverage for non-final products generates further risk of loss. The risk of maintaining a very partial record of the present was signaled during the debate, alongside ethical implications of orchestrating collaborative forms of collecting:

"There is a risk around inclusion in collaborating only with institutions or creators which are prepared to this approach: we work with the people who have the closest access to us. We need to also engage voices less close to us. And communicating the risks back and the needs of flexibility for institutions to work towards presenting and preserving what is being created through these multinational platforms. Because the platforms themselves are not that worried about the long-term preservation and there is risk of loss." (Cooke workshop intervention)

The ITEOTA example catalysed the participants' reflections on the theme of institutional readiness. The necessity to develop a pilot acquisition at the BFI National Archive is negotiated within the gap 'between ambition and resources', with the VR object presenting novel preservation and storage needs that the institution is currently unable to meet. This case study highlights the importance of experimental and research-led collecting practice to understand requirements, build capacity and redefine expectations for both institutions and creators. Documenting loss is proposed during the session as a minimum but important step towards collecting difficult objects that challenge the institutional readiness to effectively care for the born-digital.

"These are new and emerging objects, we cannot say that we understand fully

what a digital object is, rather we need to constantly negotiate our understanding of digital objects. Digital objects 5 years ago were a completely different thing. So, there is a constant need for experimenting or remixing to understand how this type of object might fit in the framework of the museum. Institutional readiness means to accept that experimentation is now a core part of collecting."
(Rees workshop intervention)

Preservation

The Preservation Workshop gave special attention to very complex, distributed and platform-like objects, in order to test the limits of institutional collecting and to address, at least speculatively, some of the biggest challenges faced by museums. Discussing complex objects such as online, multiplayer videogames, social media platforms, proprietary software, AI technologies and apps, participants listed a range of features that make them difficult objects to collect: their networked, multi-user, distributed nature; the importance of preserving user experience and social history materials alongside the main object; the fact that these objects are hard to explain and experience in a comprehensive way and the multiplicity of their performances and manifestations.

Participants also pointed out that, differently from art and design objects that are acquired by negotiating directly with the artist(s)/creators(s), these objects present more elusive forms of authorship. Complex web-services and platforms cannot be understood in univocal way, and demand a rethinking of collecting criteria and processes. Better described as ecosystems than self-contained objects, they present ramifications of ownership and management that, according to the participants, challenge linear models of decision-making during the acquisition process. Invited to develop a flowchart to visualise the different possibilities in acquiring Instagram, participants resolved that a linear approach to decision-making was not appropriate for this type of object. Instead, they suggested thinking about clusters of problems or rhizomatic patterns of perspective-finding. Besides speculating on a set of items that could be acquired, participants discussed these in relation to different ways to present Instagram to the public, showing the centrality of envisioning access opportunities at the acquisition stage. The variety of access solutions conceived for the platform include the play-back of real interactions, the recreation of novel interactions, the capturing of snapshots from a specific curated point of view. The articulation of hierarchies across the elements of each acquisition, distinguishing between core and auxiliary or collateral objects, was also considered key in guiding preservation decisions. Whereas an ecosystem or infrastructural approach would recognise the interdependencies across the various parts of an acquisition, a more common strategy would be to prioritise the preservation of the core object over the auxiliary ones, whilst recognising their potential usefulness for preservation purposes.

Reiterating the need for experimental and pilot initiatives, participants concluded that museum policies should make room for more flexibility around the preservation of born-digital objects. This involves recognising that long-term preservation might not always be guaranteed, but salvaging or storing part of the object is nevertheless a valuable intervention, given the fragility and high rate of loss surrounding digital culture.

The collection policy is recognised as a key factor in supporting preservation-related decision-making, as different museums will have different reasons for collecting an object, and different priorities. For instance, the V&A would collect Instagram as an object of interaction design, but also as a social object, representing the role of design in society. In this case, the graphic interface, the interactions, the users' testimonies and interventions might be equally important. Therefore, the idea of a curatorially-driven approach to conservation was seen by participants as the most viable proposal for determining parameters, meanings and values. This would not only fill the gap left by a single and univocal authorship, but also respond to preservation strategies that involve

re-creating and re-contextualising the object, hence requiring a great deal of confidence in undertaking interventions that move away from its original fixed status.

"The role of the curator is becoming more and more important in this context, in relation to conservation. Curatorial decision-making will be determinant in preservation. Curators are becoming the source of authority to establish what of the object needs preserving, especially when the artist or author is not on board."
(McConnachie workshop intervention)

Engaged in a focused analysis on the four case studies, the participants identified a set of preservation risk factors that go beyond the realm of technical obsolescence. For instance, compliance with privacy requirements such as the GDPR, were prominent in the discussion, as well as issues associated with the proprietary and private nature of software and networks. In this context, participants advocated for policy change across the areas of digital cultural heritage and media policy, to induce owners of web platforms and services to cooperate with institutions of memory for depositing and salvaging their materials. One of the main findings of this strand of research, in fact, concerned the relevance of media policy and internet governance to cultural policy (*Burri 2016*).

Access

The emergent literature on preserving the born-digital makes frequent reference to the responses that today's digital product design will generate in future audiences, as opposed to contemporary ones, because of their different familiarity and literacy (*Marchese 2011 p.302*, *Cormier 2017*, *Fino-Radin 2019*). Whilst an iPhone can appear 'uninspiring' (*Alberti et al 2018*) to contemporary audiences, future ones will need context and renditions of the interaction with the device to gain a meaningful understanding. This issue reaches beyond the 'digitality' of the object, and is associated with the practice of collecting the present, capturing objects which are still in use and whose narratives and trajectories of use and success are still evolving. Invited to consider different temporalities in relation to providing public access to the case studies, workshop participants addressed the task in terms of futureproofing, focusing on what to acquire or safeguard to guarantee different future possibilities for display and contextualisation. For instance, they mentioned the importance to capture the socio-historical context of the object, such as local council data on stop-and-searches in the case of Y-Stop. They advocated a maximal approach to including a variety of items in the acquisition: documentation of prototypes and the design methodology, elements of the making process, documentation of audience reception across time; users' interactions and user generated content.

The example of Instagram had catalysed significant part of the discussion as participants recognised the closed, inaccessible nature of social media platforms, which would prevent museums to acquire essential content without the cooperation of the corporate owners. The ethical questions surfaced within the interviews (see *section 5*), were reproposed during the Access Workshop where attention was given to questions of brand-protectionism, the conditions that technology corporations would pose to support the acquisition, and on the costs (financial as much as in terms of autonomy) of the negotiating process.

"What do you trade-off for fidelity and the ability to access? You trade off in curatorial autonomy sometimes and I think it is a really interesting thing to bring up here. In order to get access to Instagram you need to play at Instagram's rules a little bit."
(Kane workshop intervention)

The cloud-based nature of contemporary digital platforms and services was raised as a further challenge to museums:

"The idea of things sitting on a server: back when software was something that you could buy in a box, it's the same thing about the hardware design: [one could say] 'OK the company doesn't want to play, then I'll go buy the product'. But right now, the product does not live in a CD-ROM, it is in a cloud, the cloud lives in multiple places and to be able to capture that creates an extra layer of complexity."
(Foti workshop intervention)

"With the cloud, if we don't find an alternative, everything is going to be lost. While a lot of this technology might be reverse-engineered and 'modded' by the community in the future, because there is access to the code, even indirectly, on the cloud this is gone. You are allowed anything except video-recordings of the graphic user interface."
(Dimita workshop intervention)

The discussion further signaled that there are significant uncertainties and grey areas, among professionals, in relation to IPR, permissions, privacy and licences associated with born-digital objects. Questions concerned the need to ask permission to users and visitors to document their experience, but also the possible 'expiry' time for the commercial value of the source code for commercial web services. The idea of instituting a formal legal deposit for media and digital services, advanced during the preservation workshop, was reformulated in this context as a way to enable museums to collect objects that currently fall beyond any official and public form of preservation and archiving.

The multiplicity of legal and technical barriers to collecting surfaced during the workshop reflects the layered and composite nature of many complex digital objects. A contextual approach to collecting, going beyond the self-contained object and gathering a variety of items and representations, have the potential to guarantee not only more accurate and flexible preservation strategies but also resources for developing balanced narratives and innovative access opportunities. The sense that legal and media policy reform could mitigate the risk of loss was shared across the group of participants, and accompanied by the recognition that the quick pace of innovation makes such intervention especially urgent:

"With the digital, because it evolves so quickly, just in the space of a human life, or even just a year, if we wait, the whole thing will disappear completely and we will never get out of the system those files. Or what we will have access to isn't actually the platform or the app or the website."
(Foti workshop intervention)

Installation view of the exhibition "Applied Design", March 1, 2013 – January 20, 2014. Photograph by Thomas Griesel, courtesy The Museum of Modern Art, New York.

8. Discussion and recommendations

Collection policies and practices to safeguard and transmit our born-digital heritage to future generations are at an early stage of development globally, with a few institutions paving the way with adjusting policies, investigating resources and infrastructural needs and developing pilot initiatives. Current knowledge is patchy, especially for some types of born-digital objects, such as digital product design, digital platforms and complex digital creative work made with proprietary software and 3D technologies. The awareness that safeguarding the born-digital before it is too late is an urgent matter is shared across the sector, and it demands incremental changes at the level of professional practice and policy. The report aims to contribute to this process by proposing a research agenda to address immediate gaps identified through the research, by advancing a set of recommendations for key actors in the sector, and by publishing a tentative decision-tree-based data model for practitioners undertaking collecting of born-digital and hybrid objects in the sector.

That decision-tree model attempts to codify the major areas of consideration when assessing an acquisition, using the case studies and the workshop discussions as starting points. It offers a set of traversable models - one for each major area identified - leading the user through a series of questions, offering documentation and other guidance, as well as flags for those factors where risks are most difficult to mitigate fully. It is hoped that this model can be used by the sector as a means of continuing the discussions started in the workshops, and to collectively develop a structured approach to the complexities of this collecting activity.

The recommendations are structured around three key areas concerning respectively objects, stakeholders and policies.

The objects and its surroundings

Talking about born-digital 'objects' is useful to circumscribe what is being collected. However, some objects could be better understood as assemblages (*Zuanni 2021*) or ecosystems, due to their mutable and composite nature. We discussed through this report how born-digital acquisitions frequently comprise a variety of items, increasingly challenging the traditional separation between main and auxiliary objects. The role of users in redefining the object, and the fact that much of digital culture is about social objects, are not unrelated to this expansion. Similarly, the importance of documentation, which addresses the making process, the public reception and interaction with the object, public display occurrences and preservation interventions, contributes to problematise the boundaries of the collected object. Collecting the contemporary offers unprecedented opportunities to gather ephemeral materials as well as user testimonies when they are easily available. Such availability is unique to contemporary collecting, but for the born-digital, the window of availability might be both especially short and highly distributed. The increase in digital storage capacity is also responsible for a stronger interest in maintaining materials pertinent to the making process and the socio-historical contextualisation of the object.

Hence, it can be useful to emphasise the reliance of born-digital objects on multiple infrastructures (such as the Internet, servers, datacentres) and the fact that they manifest themselves as distributed and networked ecosystems incorporating core-items, processes and contexts. When objects such as Instagram or the Y-Stop app are acquired, it is unclear in which ways they get decoupled from their digital infrastructure: is this replaced by the archival infrastructure of the museum, or is this simply superimposed to the original one? Further, to collect these objects then, museums need to engage in the task of documenting and safeguarding an ecology of heterogeneous elements. Further, the relationship across core and auxiliary items might change across time. In fact, due to the uncertain preservability of many born-digital objects, auxiliary and documentation materials might become the only way to access and understand them. Collecting a broad set of materials then is a way to futureproofing the acquisition, as curators maintain different possibilities open to reconstruct or reinterpret the object. This might involve acquiring the source code, different file formats for the same product, as well as different kinds of hardware. However, acquiring too much can also become unsustainable: finding the right balance between futureproofing and effective use of resources might become of the most challenging tasks for the curator.

At the extreme of the spectrum for complex objects we find platforms and cloud-based services which are particularly difficult to downsize to a manageable acquisition. They have been described as boundless, manifested through performances and decoupled from any self-contained carrier. They might live on multiple servers, evolve across time, and extend to scales that strongly challenge standard museum collecting practices. Museums are therefore faced by multiple dilemmas, especially as the boundless nature of these objects is accompanied by hard to reach, corporate forms of ownership and authorship. In the absence of the artist intention as a source of authenticity, curatorial decision-making is increasingly decisive.

Recommendation 1:

Develop research into theoretical and practical understandings of the way born-digital objects rely on multi-part systems, networks and infrastructures, and the implications for documentation, information management and sustainability.

Recommendation 2:

Develop research to gain better understandings of the expanded role of curators in the context of preserving born-digital objects, and their relationship with conservators and stakeholders/ donors/communities.

Recommendation 3:

Develop value models for understanding the reasons for collecting and the significant manifestations of an object, to support difficult decision-making processes.

New stakeholders: users, communities and authenticity

Born-digital objects lead museums to engage with a range of stakeholders beyond the institution, including expert conservators, communities and corporate partners, in conjunction with a stable in-house team.

Collecting the born-digital pushes the institution to outsource skills and resources as well as to seek new collaborative models of caring for the collection. For instance, the variety of technologies, programming languages, software, together with the rapid pace of innovation and unique, non-standardised ways in which technologies are used in contemporary art and design, generate the need to regularly complement in-house expertise with specialised external knowledge on a case-by-case basis. Museums might seek the support of universities, other institutions of memory, organisations or independent practitioners.

The meanings and value of products of everyday use, from smart phones to social media platforms, are shaped not only by their creators but also by communities of users. In some cases, these communities have specific stakes in the coming to life of a product, such as in the case of Y-Stop, but even when they are only involved with the finished object, their experience, memories and narratives are an important part of the knowledge associated with the object. Liaising with relevant communities, understanding how to engage, credit and reward them, is becoming a significant task for curators during the acquisition process, but the potential to involve them in caring for the collection needs further empirical exploration. The same can be said for approaches to collaborative stewardship involving two or more institutions.

Furthermore, many born-digital objects are associated with complex and multi-layered forms of authorship, including collaborations, industrial and corporate productions, ambiguous attributions (such as in some cases of open-source works) or orphans works. Big tech corporations, in particular, constitute a difficult potential partner for museums. The idea of framing their platforms and services as heritage is surfacing through the sector (*Thompson and Kilbride 2015*, *Werf and Werf 2020*) but the research has shown that the related preservation challenges are substantial, and include their cloud-based dimension as well as the industry's business models. Further, the typical archival and disposal practices in the industry are not standardised and do not recognise the potential long-term preservation of the digital products. This lack of commitment has significant impact on the ability of museums to ingest and care for digital design records.

Recommendation 4:

Develop and support research into models of collaborative stewardship involving museums, organisations or communities.

Recommendation 5:

Develop and support research into the meanings, values, and approaches to collect what we tentatively define as ‘big tech heritage’.

Recommendation 6:

Develop and support opportunities for collaboration across museums and the media and creative industry to generate shared and deeper understandings of the respective approaches to archiving born-digital objects.

Flexible policies: redefining expectations and supporting piloting and collaboration

Some museums are redefining collection policies to better care for born-digital objects, but policy change is needed also beyond the institutional level. Legal barriers associated with IPR and personal data protection are recognised as significantly impacting collection practice. Investigating examples, feasibility and strategies to balance conflicting interests could support advocacy and legislative change in this area. In particular, the relevance of products from the tech and digital creative industries to museum collections and the current barriers to collect them raise new questions of media policy and their intersections (or the lack thereof) with cultural policy.

The case studies demonstrated the importance of taking flexible stances towards preservation and access, and the value of experimenting, piloting and collecting whilst negotiating traditional expectations and policies. They also highlighted how unfinished items, materials related to the making process, and specific types of technologies and creative work are not always covered by existing policies and institutional frameworks, often preventing the effective preservation of complex, hybrid objects. It is also worth noting that the global dimension of digital culture leaves further gaps within the national scope of many cultural and collection development policies.

Finally, the research highlighted that many institutions not only lack adequate infrastructure, storage facilities and expertise, but also that there is uncertainty on the resources and infrastructural needs to care for and provide access to heterogenous, complex, hybrid objects. Research aimed at understanding these needs will contribute to shape substantial policy work in this area.

Recommendation 7:

Policy must now help institutions of memory in safeguarding expressions of digital and media culture and incentivise the tech and digital industry to cooperate to this end.

Recommendation 8:

Cultural policy must develop guidance to identify collection responsibilities across the sector, considering objects which might fall beyond traditional categories and national or regional remits of many collecting institutions.

Recommendation 9:

Museum policy should incorporate flexibility and scope for uncertainty and experimental collecting.

Recommendation 10:

As museums continue experimenting with collecting born-digital objects, they need to develop resourcing models focused on specific types of object, and consider factoring adequate financial, staffing and infrastructural resources.

9. Conclusion

The heritage of the present is in significant part digital. Digital technologies impact creative production, social and cultural life, innovation and communication. These expressions of human cultural and creative life are at risk of disappearing quickly but the research dismantles the belief that their fragility is only a technical problem. In fact, it brings to the fore challenges such as the lack of standardised archival cultures and policies encouraging the producers of digital products to maintain better records; the profusion of digital objects and their complexity, making traditional approaches to preservation unsustainable. Risk factors are contingent to the context of acquisition as much as inherent to the object. Specific types of objects have so far received less institutional and scholarly attention and it is there that more effort should be concentrated in the near future. These include digital product design, smart and networked digital appliances, proprietary and closed systems and platforms.

Investigating the born-digital is instigating a rethinking of what collecting means. For instance, the traditional system of single authority and ownership is broken down, as well as established conceptualisations of the collected objects, now prone to be understood as a mutable socio-technical system.

The purpose of the report is to articulate and share a set of themes that permeated through the research activities and sustain a broader response from the sector. Building on the research findings, it aims at encouraging a set of changes in policy and professional practice, alongside an emerging research agenda encapsulated by the recommendations in *section 8*. The recommendations are starting points for different actors across and beyond the sector to work towards ensuring that more of the contemporary can be safeguarded. The project took an explorative stance and privileged an institutional perspective, looking at how museums could adapt to care for born-digital objects. The recommendations, stemming directly from the research findings, reflect this context. In concluding the report, we want to remind the reader of other unexplored areas that would complement this study, including the perspective of creators/makers/designers, practitioners, amateurs and organisations involved in less formal preservation activities, as well as that of museum audiences.

“Digital technologies impact creative production, social and cultural life, innovation and communication. These expressions of human cultural and creative life are at risk of disappearing quickly but the research dismantles the belief that their fragility is only a technical problem.”

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Case study: geist.xyz

Process and proprietary systems: probing institutional collecting practices with the acquisition of a procedurally generated film

Gabi Arrigoni, Natalie Kane

Contents

1. Introduction

Procedural and algorithmic art and design entail the execution of instructions and are based on the development of systems which generate potentially countless media objects, sustaining a collaborative dynamic between human and machine. Whilst procedural aesthetics are strongly associated with change and variability, the final output of this kind of creative practice can be as definitive and self-contained as traditional film. This case study discusses the acquisition of a digital design film, 'geist.xyz' (2016), encapsulating the pioneering use of procedurally generated and rendering technologies by the collective ZEITGUISED. Besides the film itself, the acquisition package for the Victoria and Albert Museum comprises a set of elements selected to document the making process of the work.

The growing scholarship on time-based media conservation (*Laurenson 2016*, *Kramer et al 2021*) and software-based art conservation (*Laurenson 2013, Falcão 2019*) offer a set of useful insights to deal with complex objects coming with multiple dependencies and with specific exhibition requirements. However, 'geist.xyz' also presents unique challenges that bring the attention beyond issues of technological obsolescence, to look more closely at the intimate relationship between production and presentation technologies.

This study contextualises the acquisition within the institutional infrastructure of the V&A. It is based on the analysis of the acquired materials; interviews with the curator responsible for the acquisition, Natalie Kane, interviews with ZEITGUISED founder Henrik Mauler; and three workshops with museum professionals where 'geist.xyz' was explored respectively under a collection management, preservation and access perspective.

In this study we discuss factors pertaining to this acquisition which are in some way novel for the V&A, and attempt to identify a set of preservation risks and explore the fluid relationship between the documentation of the making process of the piece and the main part of the acquisition, i.e. the film. The analysis of a multipart, entirely digital acquisition, that present multiple preservation challenges, highlights how the use of proprietary and rapidly evolving software generates significant barriers to the long-term accessibility of the object.

ZEITGUISED, geistxyz, 07.

2. A bundle acquisition

'geist.xyz' is an experimental film created using computer generated imaging techniques, most often seen in videogames, to manifest '*0% organic*' textiles and textures moving across a gravity defying virtual environment. ZEITGUISED is active in the field of digital art as well as being a commercial design studio, '*and often create experiments such as geist.xyz to demonstrate their creative expertise, which is typical of contemporary digital design practice, in which experiments go to promote and draw in client work as well and show their particular aesthetic as studio*' (*Kane 2021*). The film is however also considered as an autonomous artwork by the studio, inherently valuable beyond its role as a design experiment. The shapes and textures inhabiting the film are constituted by parametric animated patterns, which are based on rules which inform the relationship between the elements and their behaviour.

The acquisition consists of a film, presentation materials such as the dedicated website and the soundtrack, and a set of process-related materials including animated .gifs and 3D objects. These elements represent snapshots of the work-in-progress, and were selected by the curator in dialogue with the creators in order to account as accurately as possible for the making process. More specifically, the acquisition includes the following:

- A special edition of the film alongside one of the five editions that have been produced (4K UHD -25fps plus a show version in 1080p in h265 and 264 format with AAC sound). A master has been provided, with back up versions in lower formats also provided.
- A complete .WARC archived file of the Microsite created for the project, featuring a 'poem' written by the designers which explains the algorithmic nature of the design process, and showcases a curated selection of .gifs which highlights some of the isolated elements of the film as snapshots.
- 255 Pattern Designs (in .jpg format).
- A set of the Parametric Animated patterns pre-render, in .mov and .gif form.
- A set of Research and Development clips and stills in .mov, .gif and .png formats from the studio archive that clearly depict the process through which procedural animation is made.
- Work in progress 3D data, which includes a series of alembics and .obj files of the moving and static virtual textiles. These were generated working within the 3D software suite Cinema 4D and Houdini.
- A soundtrack by Ugly Stupid Honest (Chris Hoffman, formerly of ZEITGUISED) which itself was algorithmically generated in line with the visual project, and the physical EP that was produced alongside (in vinyl and in .mp3 format).

The growing possibilities in terms of digital storage space, the limited time in which materials move from being available to disappearing, and

the complex nature of born-digital objects concur in making multi-part acquisitions common in born-digital collecting practice. In fact, for a born-digital work, museums might acquire software, hardware, source code, databases, different versions, promotional material, peripherals, packaging and so forth (see for instance *Smith 2020*). Such multiplicity poses a range of questions to collection management, as it becomes necessary to track and identify auxiliary objects alongside the main item(s), label and categorise the different components and gain a solid understanding of their interrelationship.

Process-related materials are typically present in archival collections and kept primarily for research and pedagogical purposes. Born-digital records of the making process, for instance, have been discussed in the fields of architectural practice (*Cardoso Llach 2019*) and videogame production (*Kaltman 2020*). This scholarship investigates techniques to uncover and bring back to life aspects of the making process associated with the use of software tools for Computer Aided Design. This hints to the unique bond between born-digital records and their production tools, as the possibility to retrieve access to past records depends on one's capacity to run or emulate compatible software. Design production records then differ substantially from other kinds of collateral items that might be acquired, such as contextual socio-historical and marketing materials, because of their uncertain accessibility. The case of 'geist.xyz' however takes into account the aesthetic orientation of the design collective towards experimentation, and their focus on process and transformation as an inherent part of their narrative. This is focused on exploring 'how to design fabrics that could be real or could become real' (*Mauler 2021*) but also address the realm of speculation and fantasy, effectively using digital technology to push the boundaries of the real.

As illustrative of the making process, the 'collateral' items acquired for 'geist.xyz' are independent from each other and the film can

ZEITGUISED, geistxyz, pattern design (95).

be preserved and accessed independently from the process-related materials. The V&A has an established practice of incorporating the materials illustrating the process into a distinct collection as 'designs', which gathers preparatory materials, studies and traces of the making process. This acquisition, however, breaks with this approach to separating main and auxiliary items, and adopts instead a holistic approach where the film and process materials are kept together within the Department Collection system. This decision is motivated by the way the object is understood by both the designers and the curator, as a multipart object that constitutes the project, and by the reasons for collecting. The film in fact is not so much collected because of its inherent aesthetic qualities, but as an expression of this design practice. Alongside those objects selected for acquisition into the Art, Architecture, Photography and Design (AAPD)'s collection from this bundle of material, any parts not selected (for example, not all of the material is understood to be integral to the project) will become part of an archive of 'Associated Materials', brought in as an archival museum procedure in 2017 which includes 'Design drawings and other design process material which would not be suitable for acquisition by the Designs collection' which holds material to the same status as museum objects which has been given by the donor or vendor.

During the workshops the distinction between core and auxiliary objects was discussed in relation to sustainability and preservation choices. In this context, participants clearly supported the need to prioritise the film, but advocated for the potential role of the auxiliary, process-related materials as instrumental to its preservation. In fact, the preservation uncertainty that characterises born-digital collections (see *section 4* for this particular case), leads to a question regarding the relationship between the main object and the process materials. Should the first become inaccessible, can the process materials provide not only sufficient knowledge on the piece, but also sufficient content to understand and enjoy the original experience, for future audiences? Should museum curators and conservators introduce a greater fluidity and flexibility in the way they establish a hierarchy across the various acquisition elements? What kind of display approach can provide visibility to born-digital process materials, making them relevant beyond research purposes only? Effectively, the designer-creators expressed a different view on the process-materials, which they consider as finished works in themselves. Because ZEITGUISED's practice is especially focused on experimentation and exploring the boundaries of the technological tools at their disposal, the research and development (R&D) clips acquire their own value as integral parts of a complex and composite piece of work:

> ***'So, all the bloopers or the outtakes or the experiments and R&D side steps, we treat them like finished work, or like smaller fragments of finished work. […] And this shapes the work as well so that the scope of the work becomes smaller in a way, or more fragmented. So larger bodies of work or a larger piece is then made of fragments, so to say.' (Mauler 2021)***

Therefore, a distinctive feature of this acquisition is the open relationship across its main and auxiliary parts, which signals the importance of preserving the process not just as instrumental to future research but also as valued autonomously as an inherent part of a composite object.

3. Institutional fit: between tradition and innovation

Foti (2018) argues that when collecting computational technologies, museums tend to simultaneously follow their own principles and traditions, and 'establishing new precedents for the museum's future endeavours in collecting digitally-based objects' (*ibid p.92*), deploying a curatorial expertise that she defines as adaptive. This refers to curators' capacity to flexibly invent new approaches building on top of traditional work processes (*ibid. p.51*). This case study shows a similar balance between a reliance on established procedures and strategies in place at the V&A, and a push to innovate to effectively care for an object which presents new requirements to the institution. The museum has a small number of comparable objects in its collection, as well as adequate storage and cataloguing systems in place. The gathering of essential curatorial and preservation knowledge from the creators through the use of acquisition questionnaires is already common practice in different museum departments. The museum also holds some specialised technical expertise within the IT, conservation and collections management department, although it is described by the curator as 'distributed' and not incorporated within a central or specialised conservation unit. For example, digital objects are currently stored on a digital asset management system (DAMS) in which digitised images of objects, digital collections objects and other digital media exist and are cared for simultaneously by collections management. This section will focus on elements of continuity with regard to existing collection practices at the V&A, exploring the presence of processual elements and the links to comparable objects in the collection.

Process

Digital design practice is underpinned by tentative processes of trial and error and plural directions of development, and it operates across complex systems and tools. This makes documenting its process especially compelling in view of supporting both future research and further creative work. The acquisition of 'geist.xyz' responds to the V&A's Design, Architecture and Digital Department (now restructured into the Art, Architecture, Photography and Design Department) mandate to document '*the practices and process of design*' (*Collection Development Policy p.8*) and to collect Digital Design '*as process, interface and object*' (*ibid*). Further, it acknowledges that the Digital Design strand of the Collection aims to prioritise '*examples of the work of innovators and change-makers*' (*ibid. p.13*). ZEITGUISED, in fact, '*established a practice that is pioneering in their use of emerging and new digital design technologies, and have led a new wave of designers experimenting with rendering technologies*' (*Kane 2021*). 'geist.xyz' is emblematic of the studio's early uptake of this emerging aesthetic. Furthermore, one of the six strategic objectives included in the V&A's mission is to '*focus and deepen the relevance of our collections to the UK creative and knowledge economy*' (V&A website). Documenting and making accessible the design process supports this objective, inspiring the work of practitioners across the creative industries.

From an institutional perspective, collecting the process provides a scholarly resource to future researchers and practitioners willing to study the evolution of digital design practices and technologies, as the rapid transformations in the field as well as the challenges of archiving complex and storage-demanding materials outside of an institution mean that a lot of process is constantly being lost. Documentation of process can also be

central to public engagement and the public understanding of design, and support preservation strategies as a source of authenticity and guidance, revealing the creator's perspective (*Fauconnier and Frommé 2004*, *Dekker et al 2017*).

Collection kinship

'geist.xyz' is the initial step, for the V&A, towards the acquisition of a larger body of works made by artists engaging with software and especially procedural and rendering technologies, demonstrating their impact on computational design (*Kane 2021*). Furthermore, the museum has a tradition of collecting computer-generated artworks, initiated in the late 60s and progressed with the acquisition of the Patric Prince Collection and the archives of the Computer Arts Society (*Dodds 2019*). Most of these early works were computationally generated but effectively acquired as prints on paper, hence not presenting any of the challenges of digital preservation. More recently, the Digital Art collection has grown with a number of born-digital acquisitions by artists such as Aaron Koblin, Casey Reas and Andy Lomas. As V&A Senior Curator Douglas Dodds testifies in a recent book chapter, digital artifacts were not easily ingested within the museum collection:

> ***'For many years, the Museum has also commissioned temporary exhibitions and displays of digital art and design–in the garden, throughout the buildings, or online. In many cases, the artworks selected could not be added to the permanent collection, principally because of the range of complex issues that they might manifest. Indeed, some of the Museum's most successful born-digital exhibitions have been ephemeral, with video or other documentation as the principal legacy.' (Dodds 2019 p.227)***

None of the objects already in this collection effectively compare to 'geist.xyz' in terms of complexity and preservation needs. Casey Reas's 'Process 18' (*Accession number E.297:1-2011*), a generative software artwork, is also a bundle acquisition including 9 items: 2 CDs, a documentation print, 5 digital prints, and a presentation box. Furthermore, there are precedents of collecting the packaging alongside the product, such as in the case of the Microsoft Adaptive Controller (*Accession number CD.39-2018*), which testifies of the museum's interest in composite and multipart acquisitions. However, 'geist.xyz' presents a diverse set of challenges associated with the acquisition of 3D data and the microsite which are unique to this case. These are investigated in the next section.

ZEITGUISED, geistxyz, pattern design (114).

4. Preservation: stability vs uncertainty

Each item in the bundle acquisition has specific preservation needs and risk factors. Differently from many complex digital objects where a key task for conservators exists in maintaining a functional link across different parts of an object, in this case each item is independent from the others. This is because of the nature of the work-in-progress material as illustrative and exemplary of the process, rather than being necessary to play the film. The film itself is acquired in .mp4 and like other video formats, it is relatively stable and low risk. Something similar can be said of the soundtrack, the animation files (.gifs), the R&D clips and stills, and the parametric animated patterns. This section is therefore going to concentrate on the most problematic objects from a preservation perspective: the microsite and the 3D data files.

The acquisition of the website includes a set of animated .gifs, a text file, and two .png files capturing screenshots of the site. Despite these elements reproducing a complete account of the website, albeit as a set of separate parts, ZEITGUISED also offered the museum a bespoke permission to download the website as a .WARC archive, to effectively safeguard it in a more cohesive way. To do so, the curator has used Conifer, a web-archiving service developed by Rhizome as an evolution of Webrecorder (*Rhizome 2020*) to archive and then play-back the website. .WARC files, the format in which the site will be archived, is suitable to be played into an emulator, hence guaranteeing relatively stable access for at least the near future. However, further investigation is needed to explore Conifer's emulation capacities and public access opportunities. Much has been written on emulation (*Van der Hoeven et al 2007*, *Guttenbrunner et al 2008*, *Lurk et al 2012*), and on issues of accuracy and fidelity in rendering the original experience. Using emulation as a tool for access presents several technical challenges that can be daunting for museums and cultural institutions.

However, the recent development of 'emulation-as-a-service' (*Liebetraut et al 2014*), which does not require complex set-up but is proposed as a web-service, offers the potential to become a commonplace tool in institutions holding born-digital collections. What this case study is bringing into light is how emulation can be at the centre of an entanglement across technologies of creation, preservation and access.

ZEITGUISED, geistxyz, pattern design (103).

5. Preservation: proprietary constraints

The defining feature of digital objects is that they need to be played or run through a device to be accessed. The example of 'geist.xyz' illustrates how the survival of the technologies of making have a significant impact on the possibilities of survival for the digital object. In fact, the challenges associated with preserving 3D data are strongly intertwined with the proprietary nature of the software used for creating them, so that process elements become inaccessible outside of the proprietary system of creation:

> *'The idiosyncratic creation of preservation practices has the potential to compound the technological barriers of sharing proprietary 3D data, so that one cannot find nor interface with other 3D datasets, hampering (or making impossible) new discoveries and 3D research.' (Moore and Kettler 2018 p.9)*

Whilst proprietary systems create exclusion, works which are created in formats which can be played back or rendered using third party tools can count on a longer lifespan. As a consequence, open-source software has been proposed as having a potentially fundamental role in the context of software-based art conservation:

> *'If a software product is discontinued or a company disappears completely, aging software tools can become impossible to run as the technologies surrounding them move forward. Proprietary (or closed source) software is in conflict with conservation – it's a black box that cannot be opened. With*

proprietary software, the artist and the collector have no agency in decisions about the conservation of an artwork. Open-source software projects are also abandoned, but the open-source community is more robust and flexible than failed or discontinued proprietary software.' (Reas 2020).

To be visualised properly, the 3D objects accompanying the 'geist.xyz' acquisition require expensive closed source software (in this case Cinema4D) which the V&A currently does not have and lacks the capacity to purchase. ZEITGUISED's Mauler explains how the Alembic files are especially problematic because of their dependency not just on the specific software used to create them but also on the particular hardware and software set-up (for example specific packages and plug-ins) and version of the software at the time of creation:

'If you want to recreate the scenes [in the Alembics files] with the textures, movement, lighting, all that, that is really, really difficult. That is so difficult that I had to, in order to give you those Alembics, I had to go back to an old version of Cinema4D, download an old plugin that we used to import those movements, and also render in an old renderer.' (2021)

The constraints deriving from the use of proprietary software then are exacerbated by a business model oriented towards rapid innovation and constant updates that even further restrict the conditions of accessibility:

'Cinema 4D, the program, is changing so much that they can't even make their own files backwards compatible, and then to ask software developers, third party developers to make their old plugins.' (ibid 2021)

In order to enable public access, and to maintain the integrity of the material, the museum will need to investigate the availability of equivalent open-source software. However, reproducing 3D data with software different from the one used for producing it can be problematic in terms of fidelity. Moore and Kettler remind us that when 3D data needs:

'To be reproduced or migrated for preservation purposes, there is no way to evaluate whether the reproduction is faithful or the migration successful without a clear understanding of how the data were created in the first place. Since much of today's 3D data streams from scanners is entirely proprietary, the likelihood of successful reproducibility of 3D scanning data is low to non-existent.' (2018 p.3)

Where free software is not available, an alternative measure to counteract these barriers is identified in creating back-up video documentation of the 3D content, when running on suitable software (for instance, run by the design studio). '*But the screen-capture would not be the object, it would be documentation*', clarifies the curator in an interview with the author (2021), suggesting how specific boundaries across the multiple parts of the acquisition are maintained also in relation to a preservation perspective. Considering the tension between fidelity and stability of the object, Kane's response epitomises the inevitability of compromising, adopting a 'do what you can' approach. According to this perspective, safeguarding at least part of the object, maintaining it as accessible for a decade, and collecting good documentation is preferable than altogether renouncing its collection because the museum is unable to guarantee a longer-term preservation. Therefore, one of the benefits of this multipart acquisition is to support the potential for multiple access solutions.

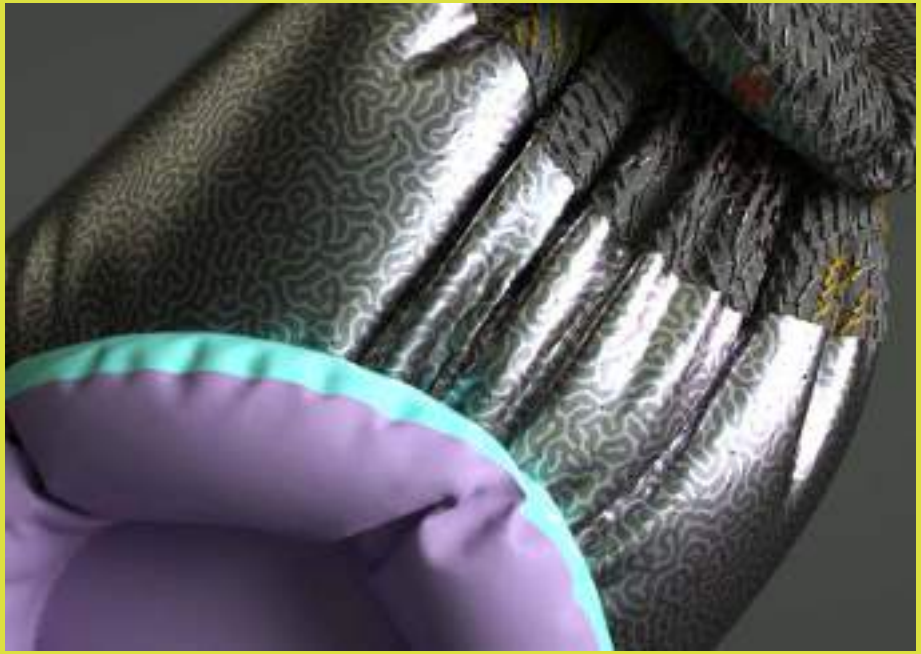
6. Conclusion

Falcão argues that 'when preserving software-based artworks we have two main objectives, preserving the experience of an artwork and at the same time its technical history' (2019 p.278). The technical history of the object has value in its own right but it can also become instrumental to preservation interventions and to provide access, making the procedural nature of the work more evident and comprehensible. In the case of 'geist.xyz', the autonomous value given to the process materials by both creators and curator instigates a change of practice within the institution, so that film and design records are held together in the same collection with no explicit hierarchy separating the various items between each other.

Collecting the born-digital brings about the question of 'what is the object' and this particular case study indicates that the answer is not obvious. Procedural media are based on 'processes or effective procedures, descriptions of tasks that are to be executed by a human, a mechanical system, or a computer' (*Carvalhais and Cardoso 2017 p.18*). Even if there is a final output, such as a film, the performative, changing nature of procedural art remains relevant throughout its life cycles, getting in the way of a stable and definitive identification of 'the work'. Discussing the conservation of his own work, also based on process and instructions, Casey Reas captures the fluidity behind any preservation strategy:

'In digging deeper into the nature of the Work, it appears to be software, or maybe the source code for the software, but it's not. The Work is more fundamental — it's a set of instructions that defines a System. These instructions exist only to realize visual or audiovisual information, but from the point of view of creating the Work and of conservation, the most important aspect of the Work is the information encoded in the instructions.' (2016)

The relationship between main and collateral objects, or records, is only part of the openness that characterises this acquisition. The case of 'geist.xyz' shows something which many time-based media conservators have already experienced in their practice: at the time of the acquisition a well-articulated preservation plan is absent, and the object is acquired in the knowledge that it may or may not be preserved for the long-term, and in the knowledge that the moment when it will stop functioning is unpredictable. On the one hand, this acquisition is inserted in a tradition present within the institution, and fits with existing policies and practices, as well as forthcoming plans. On the other hand, many questions of the future preservation and accessibility of the piece remain unanswered at the moment of the acquisition. This suggests that the only way forward that will make sure this kind of object is cared for is to collect it nonetheless, and accept that preservation strategies will be developed experimentally, in due time, and that those strategies might fail. A significant dimension of this experimentality is based on contemplating different ways to support the public understanding of an object, and on the potential to rely on a variety of materials and resources, which might or might not become part of the access and preservation strategies. 'geist.xyz' is just an example of the need for born-digital collections to maintain an openness to multiple kinds of lives and afterlives for their objects.



ZEITGUISED, geistxyz, stitch4d10 (005 close).

ZEITGUISED, geistxyz, russenschick in beige.

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Case study: In the Eyes of the Animal

Experimental collecting: safeguarding virtual reality at the British Film Institute

Gabi Arrigoni, Stephen McConnachie

Contents

1. Introduction

Virtual Reality (VR) works usually consist of systems of interlinked components, often underlined by proprietary software, supported by a fast-moving industry. VR has received the attention of conservators as a tool to preserve the experience of cultural heritage (*Selmanović et al. 2020*; *Gaitatzes et al. 2001*), such as in the case of the Mogao Grottoes, a UNESCO Heritage site virtually accessible through the Pure Land UNWIRED prototype (*Greuter et al 2018*). However, it has only recently been considered as an object of preservation in its own right. Talking about preserving VR means addressing a variety of technologies (such as 360 video, native and web real time 3D), viewing modalities (including head-mounted display or Cave Automatic Virtual Environment system), and contexts of use (from digital art to videogames, from entertainment to the moving image). Furthermore, VR objects often display uncertain boundaries: collecting these works might involve considering the acquisition of different versions, dedicated hardware, processual elements, marketing materials and ephemera, in addition to the 'main' object, the video file. The rift between hardware and software, and the difficulties in keeping the relationship between them intact has been highlighted in the few existing pieces of research on the topic. As noted by Campbell (2017), VR artefacts tend to be displayed 'as inert artifacts, rather than interactive experiences' (p. 50), 'divorced from both their content and their intended use' (p.51).

The process of acquiring *In the Eyes of the Animal* (ITEOTA), undertaken by the BFI National Archive, reflects these concerns. The case study highlights how the hybrid nature of this work clashes with the policies and standardised procedures in place in an institution typically devoted to collect more traditional films and videos. The difficulties in maintaining the link between digital content and its physical components are well evidenced in the first section of this study, which addresses the barriers to acquiring the carefully crafted and media specific hardware together with the digital files. The following sections discuss preservation issues as well as the fit of the work within the existing collections management system at the BFI National Archive. The case study concludes by offering a few discussion points on the challenges posed by hybridity: the fit and frictions with the institution's policies and infrastructure; the value of experimentation in collecting practice and the way it can lead to renegotiating expectations and priorities in relation to preservation and access.

The case study is based on interviews with former Curator of Contemporary Fiction at BFI National Archive, Will Massa (WM henceforth) and BFI Head of Data and Digital Preservation, Stephen McConnachie (SMC henceforth); a set of three workshops with museum professionals where ITEOTA was discussed from a collection management and preservation perspective; and the analysis of documentation such as the BFI Collection Policy, and notes from the curatorial team and members of the artist collective who authored the work, Marshmallow Laser Feast (MLF henceforth).

2. The object

ITEOTA (http://intheeyesoftheanimal.com 2015), by the UK-based art and design studio Marshmallow Laser Feast, is a Virtual Reality project, offering users the sensory exploration of a forest from the perspective of three different animals: dragonfly, frog and owl. The experience is rendered by computer generated graphics built in the live programming environment vvvv, with footage captured with laser (Lidar) scans, 360-degree drone cameras, computerized tomography and photogrammetry. Binaural audio uses sound captured in Grizedale Forest (England), where the work was also first presented to the public as part of the media art event AND Festival (2015). On this occasion, users wore bespoke 'mossy' headsets and vibrating backpacks which were synchronized with the sound design. Both the visual and audio content were processed in real-time generating a unique and responsive experience different for each user. Since its 2015 launch, ITEOTA has toured internationally and it has been presented in different contexts, including large scale installations and projects in indoor venues as well as online to users experiencing it via YouTube through Google Cardboard. In each iteration, the version of the work is adapted for each installation.

In the Eyes of the Animal, installation view, courtesy of Marshmallow Laser Feast.

3. Experimental collecting: assessing the institutional unreadiness

ITEOTA is being collected as part of an experimental acquisition pilot project at the BFI at the BFI aimed at identifying the specific needs and requirements of unusual (for the institution) objects. This experimental framework is important as it allows the curatorial team to explore the requirements and unsolved problems of collecting an object that challenges established practices and expectations. It is important to note that this acquisition is not being undertaken with the same expectations of robust preservation that must normally accompany an acquisition – in this case, it must be seen as an experiment not a formal accession to the national collection.

Whilst recognising the importance of the haptic peripherals and bespoke hardware, and their value not just as a delivery mechanism but as an integral part of the work, the curatorial team was not able to include them in the acquisition. Policy constraints, lack of resources and procedures in place combined to create a barrier to the acquisition of the hardware that SMC considered impossible - and undesirable – to attempt to overcome within this experimental acquisition. In fact, the BFI National Archive Collection Policy (2011, currently under review) does not formally address the acquisition of physical objects associated with moving image artefacts. The Policy's only explicit reference to this topic states that '*We do not generally collect objects relating to production and viewing technologies such as cameras, projectors or editing equipment except where essential for conservation and access*'. Further, the institution lacks dedicated staff (such as a specialised conservator), expertise and suitable storage space to care for physical objects of this type (though the Special Collections of the Archive care for many types of objects such as photographs, designs and documents). As an archive of the moving image, the BFI National Archive collects analogue objects and digital files and applies a general standard procedure to many different materials that fit within that standard. Caring for complex born-digital objects, by contrast, requires ad-hoc solutions, from specific workflows and monitoring systems to customized preservation strategies. Collecting such objects would demand a significant effort and adjustments to the institutional infrastructure as well as recruitment of experts with the required specialist skillsets. According to SMC, such adjustments and investments are being considered among the other commitments in the Archive's collections development planning.

Whilst fitting within the policy remit of collecting the 'art, history and impact' of the moving image, ITEOTA is the first interactive work experimentally collected by the BFI and pushes at the boundaries of its collection policy. The question posed by SMC during one of the research activities: 'Is interactivity core to our remit, or the passive consumption of moving image?', is ultimately a question of malleability which concerns the collected object as much as the institution.

ITEOTA was selected for the pilot scheme especially because of the multiple challenges it poses for the institution. The research team, in conjunction with BFI staff and workshop participants, discussed the role played by experimental projects and pilot initiatives in overcoming institutional barriers to collecting challenging objects. In these contexts, it was agreed that the acquisition of difficult objects could productively disrupt established practices and beliefs and encourage institutions to provide resources and develop a more adequate infrastructure to care for such

objects. However, the process of organizational and policy change is often long, discontinuous and more adaptive than disruptive (see for instance *Van Saaze et al. 2018*). The ambition for this pilot acquisition was to identify specific infrastructural, skills and financial needs as a first step towards assessing the future feasibility of documenting and care for complex digital objects.

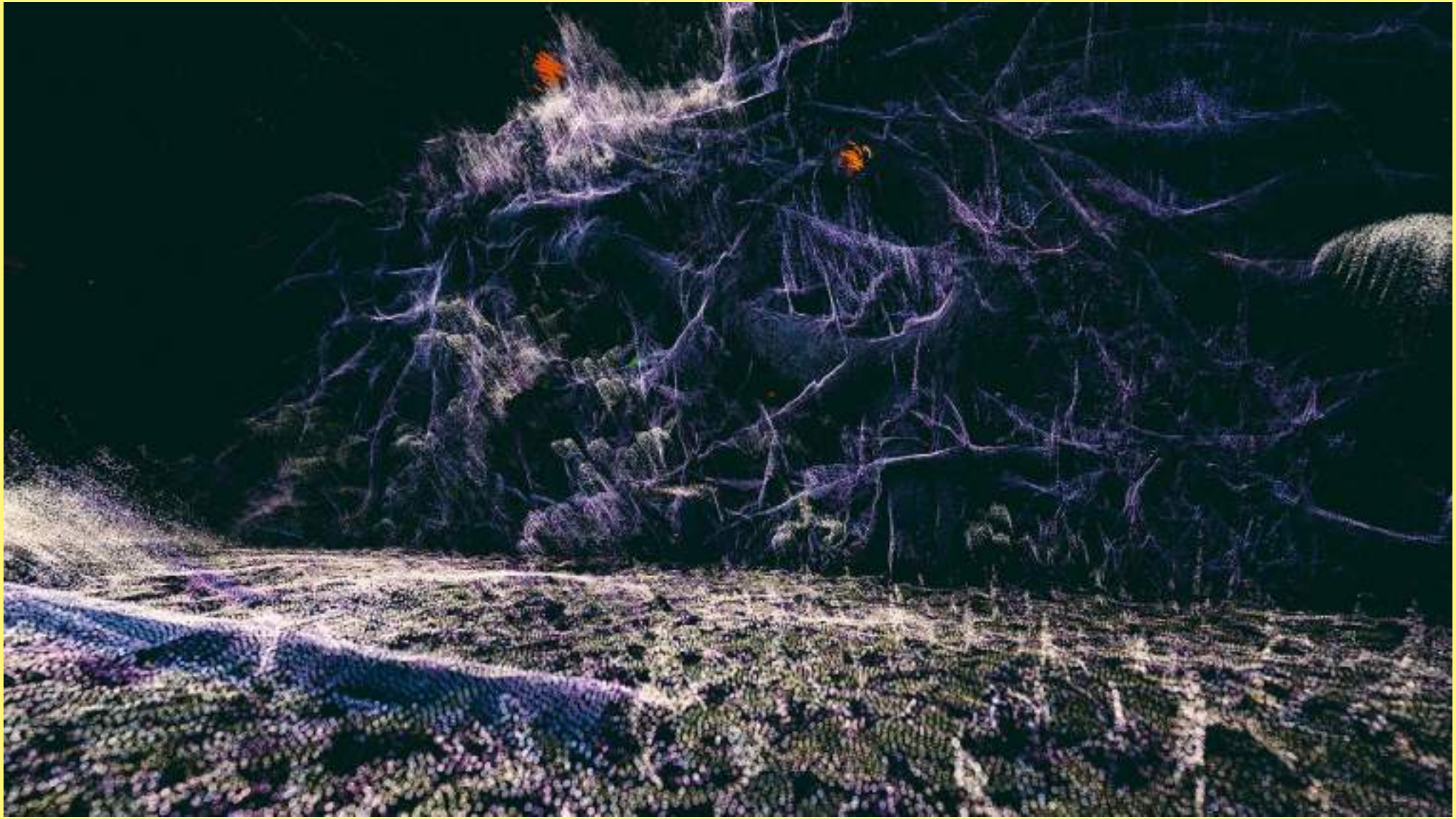
In the Eyes of the Animal, installation view, courtesy of Marshmallow Laser Feast.

4. De-prioritising access?

At the time of the acquisition, BFI does not hold any playback equipment to screen the work for internal purposes, nor to enable audiences or researchers to view it. Further, there is no plan or model to support access to ITEOTA in the future, the work presenting requirements significantly different from the rest of the moving image objects held in the BFI National Archive.

The impossibility to guarantee full access constitutes another point of misalignment between this experimental acquisition and BFI's Collection Policy. There is in fact an established institutional rhetoric of due diligence that intends to assure donors and creators that their works will be preserved for the long-term and that there are effective plans in place about providing public access to the work. In the first place, this demands for careful negotiations between the curator and the creators of the collected object, to make sure expectations are clear. Moreover, the absence of a preservation and access plan suggests a new balance between the need to experiment with the acquisition of complex objects, and the limitations of resources, staff, expertise and facilities to properly care for these objects. Safeguarding, or securely storing a core part of the object, such as the 360 video files, becomes more appropriate goals in this case:

'It should not be described as a preservation initiative. It is only bit-perfect storage. It can also be seen as an offer to the immersive and interactive media community for storage. This is different from what BFI does usually, when it preserves films on behalf of the nation. In the case of ITEOTA the access question is so precarious that everything has to stay in the realm of the experimental. But at least it offers a safe harbor for very vulnerable works.' (SMC 2021).



In the Eyes of the Animal, courtesy of Marshmallow Laser Feast.

5. Collection Management: a manageable task

A record of ITEOTA is under development within BFI's Collection Management System, which uses the European standard EN15907 for description of moving image works. This data model will provide the standard to document the work, but the team aims to modify the terminology and other system-controlled functions to describe the VR work more accurately. Because the number of VR works expected in the collection for the near future is very small, such modifications will be minimal and concentrated on developing a data-structure suitable for multiple versions of an object.

The files comprising the acquired object will be absorbed into standard digital preservation fixity confirmation and monitoring workflows. Until then, they will be stored in a resilient RAID NAS server within a digital preservation network in the BFI National Archive Conservation Centre. Ultimately the VR files will be ingested to BFI's digital preservation repository, with data stored on three instances of data tape (two online in libraries in the BFI National Archive Conservation Centre, and one offline in a remote collections storage site, for disaster recovery). Overall, the fit of ITEOTA's digital files within the current collection management architecture and workflow is not particularly problematic.

6. Collecting without preserving

Preserving ITEOTA involves more than the preservation of the VR video content, and the existence of multiple versions of the work, poses the question of which one(s) should be prioritised or considered more suitable for preservation. The impossibility of collecting the hardware constitutes a risk factor in relation to the loss of this specific user experience and version. However, it also enables the institution to address ITEOTA as a digital-only object, rather than a hybrid one.

The acquired items are intended to address multiple versions of the work and to take the shape of file packages whose specific elements are still undecided at the time of writing. The scant literature on preserving VR identifies two major risk factors in the lack of standardization (*Cranmer 2019*) and the mapping of 3D objects (*McConchie and Ensom 2019*). Digital conservation experts consulted within the research workshops argued that 360 videos make collecting without the hardware less problematic than other formats, because especially it is portable between different players or hardware. Nevertheless, the risks associated with obsolescence and lack of suitable players and decoders are still to be taken into account. Further, 360 videos requirements for preservation are similar to those needed for linear videos (*McConchie and Ensom 2019*).

In 2006, the Joint Information System Committee defined digital preservation as 'the series of actions and interventions required to ensure continued and reliable access to authentic digital objects for as long as they are deemed to be of value' (*JISC 2006*). This definition resonates with the more recent one by the Digital Preservation Coalition, that describes digital preservation as enduring continued access to digital materials for as long as necessary (*DPC 2015*). As mentioned above, the current approach to caring for ITEOTA cannot guarantee full preservation according to the above definitions. Rather, it is based on the safe and long-term storage of the files. However, the outcome of the workshop we conducted on the topic of preservation indicated that documentation, emulation and constant incremental updates could be considered as part of the preservation strategy. All of them are resource intensive and 'risk the loss of important characteristics of the original version' (*McConchie and Ensom 2019*).

The workshop discussion conducted on ITEOTA pointed to the importance of documenting user experience, especially in relation to the difficulties in acquiring the dedicated hardware. Workshop participants highlighted an ambiguity regarding whether 360 video capture of VR works are positioned as the collection object itself or as documentation of the object. Such blurring of boundaries does not merely present a theoretical problem but has very practical consequences in relation to the way these materials are stored, managed and cared for.

As an experiment, ITEOTA is acquired by an institution unprepared to commit to its digital preservation in the fullest sense. The mere conservation of the files is usually considered to be a risky and partial approach within the digital preservation community (*Fino-Radin 2019*), as regular monitoring and frequent refreshing are considered essential to the longer-term maintenance of a functioning digital object. Safeguarding the data, however, is considered by the BFI team involved in the initiative as a useful step towards preservation, as it might still enable future access opportunities and the regeneration of the piece. This is especially important also given the absence of institutions explicitly dedicated to immersive media in the UK, which carries the question of determining institutional responsibilities in the contest of rapid technological innovation. Ultimately, the pilot serves as a useful worked example to understand the gaps between current digital preservation capabilities and policies, and the capabilities that would be required to commit to formal collecting of such complex objects.

In the Eyes of the Animal, courtesy of Marshmallow Laser Feast.

7. Discussion

Museums are adopting a variety of approaches to collecting the born-digital: from concentrating on the preservation of hardware (see for instance the early acquisitions of digital design at MOMA and SFMOMA, such as the iPhone (*Haidvogl 2016*)), to engaging in research alongside the collection process (ACMI, Cooper Hewitt Smithsonian Design Museum) (*see Fino-Radin 2019*), to supporting preservation of and access to the functioning objects (at Tate with time-based media and at the V&A with digital design) (*Laurenson 2016*). As an emerging area of contemporary collecting, born digital objects cannot be smoothly ingested by institutions without a process of adapting existing infrastructures. These efforts often require compromising, as solutions, templates, procedures and workflows are, in the best-case scenarios, developed on the go. The case of ITEOTA reflects some of the ideas emerging from the scholarship on preserving digital art and time-based media, such as the importance of maintaining a dialogue with the creators and the role of documentation (see for instance *Dekker et al 2017*; *Graham 2014 Chapter 1*). The latter has been discussed within the research team both as a resource to enhance the public understanding of the object and as a preservation strategy in its own right. Nevertheless, the case offers a few emergent points which call for further investigation and concern the challenges of managing complex hybrid objects and the need for collecting institutions to introduce more flexible and negotiable approaches to preservation and access, to support experimentation.

Complexity and hybridity

Many born-digital objects are hybrid, featuring both digital and physical components. Further, they might comprise a variable number of elements that can be considered as core or collateral to the object itself depending on subjective curatorial choices as well as on the mission and identity of the institution. The acquisition of ITEOTA presents a wide range of possibilities as the work involves different versions, hardware, marketing materials, process files etc. The decision-making process in this case was necessarily and consciously constrained and directed by existing barriers and priorities set within the institutional framework of the BFI as the UK's national archive for the moving image.

The case study demonstrates also that the hybridity of born-digital objects needs to be considered carefully at policy level. Whereas institutions of memory are prepared to care for discrete objects with predictable characteristics, the hybridity of born-digital objects translates into competing or at least very different needs, as a holistic approach would involve storage, management systems, and preservation strategies for both the physical and digital elements. Emerging technologies are offering new languages and creative opportunities to artists and designers, leading to the existence of new types of objects that, because of their newness, are not accounted for in policy documents. A further challenge is associated with the stress of collection policies on complete works (such as in the case of BFI), while born-digital objects offer a wealth of materials to preserve and document the making process, which are also paramount for preservation purposes, and which risk being lost as a direct consequence of this gap in the policy.

A small number of institutions have started exploring the idea of collaborative stewardship and joint acquisitions (*Chan 2021*, *Gialanella 2021*), as a response to the hybridity and complexity of digital objects. Different parts of an object might fit better within different museums or organisations, depending on their specific missions. For instance, the research team has been discussing the possibility of a collaborative collecting initiative where ITEOTA's physical parts would be collected by another institution equipped with storage facilities and expertise to care for the hardware. However, a set of important questions emerged from the proposal: how to identify a suitable partner institution? How to ensure the willingness to collaboratively collect at all levels of the original institution, including senior management? How to manage artists' or creators' expectations around the integrity of the acquisition?

Managing expectations and embracing uncertainty

With the pilot acquisition, ITEOTA is situated in a 'gap between ambitions and resources' (SMC), at a moment when BFI is cautiously moving towards collecting more complex moving image works. The initiative, which at the time of writing is ongoing, is generating new knowledge as well as new questions. It forces the institution to withhold from some of its most established priorities, including those of providing access and preservation for all the objects in the Archive. The success of the experiment further depends on the willingness of the artists-creators of the object to also accept that there is no guarantee for access and preservation. In this particular instance, MLF's collaborative approach and their understanding of the preservation challenges was crucial for the success of the pilot.

The main take-away from the study concerns the importance of embracing uncertainty as a driver of organizational change, allowing for temporary disruptions and for the small-scale bracketing of institutional imperatives. However, as acknowledged by SMC:

> ***'For collecting institutions, it is uncomfortable to stay in that probing stage, as they are used to having policy, solutions and budgets, but maybe we just need to accept that for born-digital objects these things are not in place'.***

The experimental framework of the acquisition allows for the institution to assess its preparedness for the ingestion of born-digital complex objects, contributing to analyse preservation needs, identify roles and responsibilities, and determine required actions such as the introduction of new standards and policies. The case study however demonstrates in the first place the need to disrupt the institutional reliance on standardised procedures, suggesting instead that flexibility and exceptions to the general approach are strongly needed whilst navigating a potentially long phase of adaptation. One of the most prominent points of disruption relates to the framing of preservation and access as uncertain and unconfirmed. In parallel, expectation setting with creators and donors needs to be managed and reframed around more open-ended standards. Engaging creators in the process and collaboratively generating understandings around minimum preservation levels that the institution can achieve are important, iterative steps to ensure a successful acquisition.

8. Conclusion

The case of ITEOTA is unique but not isolated in the museum sector, as institutions with disparate missions and remits are coming to terms with the new needs of a variety of digital objects. Significantly, it highlights a gap in resources (infrastructure, expertise, capacity) and a lack of procedures to manage complexity which is emblematic of the sector. It also suggests the possibility to investigate post-preservation approaches to collecting. This potentially emergent paradigm, however, comes with two important features. First of all, expectation setting becomes a crucial curatorial practice mediating between institutions and donors or creators. Further, documentation is foregrounded as a counterpoint to preservation strategies. The discussion developed during the workshops highlighted the idea of documenting loss, for instance in relation to the missing hardware. This is an area in need of further exploration, even at the level of documentation methodologies. Indeed, the future life of ITEOTA within the BFI National Archive is rife with uncertainties: will it be possible to reproduce the haptic, embodied experience offered by the original backpack and headset? Will the stored files offer enough material to bring the piece back to life once current playback equipment, libraries and software packages will have become obsolete and unable to relate to each other? What uses of ITEOTA will be possible over the years? Will documentation be enough to maintain and communicate the integrity of the piece? Collecting the born-digital becomes understood as a boundary-pushing endeavor renegotiating the meanings and the aims of collecting, which museums should consider as an unprecedented opportunity for change and renewal.

“Will the stored files offer enough material to bring the piece back to life once current playback equipment, libraries and software packages will have become obsolete and unable to relate to each other?”

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Case study: Y-Stop

Acquiring, gently: bringing contemporary testimony to the acquisition of a community-generated app

Gabi Arrigoni, Natalie Kane, Joel McKim

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1. Introduction

Digital design products are socio-technical assemblages. The literature addressing their place in museum collections is in its infancy, but the importance of contextualising these objects in relation to their users is surfacing as one of the leading questions of collection and preservation. Materials pertinent to the object's context of use are valued as a museum asset to illustrate the social impact of products such as the smartphone (Alberti et al 2018). This contextual material testifies to personalised and participatory forms of usership that contribute to defining the object's meaning:

> ***'The design is there to be customised and personalised–whether this takes the form of bejewelling the tangible handset with a luxury cover or simply entering in your friend's phone number.' (Park and Samms, 2019)***

The field of videogame preservation is paradigmatic in demonstrating the role of communities in selecting, preserving and developing heritage narratives around past and present games (*Winget 2011, Newman and Simons 2018*). The stories, walk-throughs, diaries, and ephemera generated by users, fans and players are valuable resources for developing polyvocal approaches to documentation, but museums are facing many open questions around ways of crediting, benefitting and interacting with relevant communities of users and makers as part of the collecting process. The case study investigates how the acquisition of an object of information design, such as a mobile app, is embedded in a process of careful and sensitive negotiation with a community-based organisation.

The Y-Stop app was created to help individuals navigate the interaction with police officers during a stop and search encounter. At the moment of writing, the design object is in the process of being acquired by the Victoria and Albert Museum and the study captures a particular moment in time where many acquisition issues are still unresolved. Consequently, this discussion offers a glimpse into a number of collection concerns and priorities, rather than providing a definitive a set of solutions. The case study draws on qualitative data gathered through interviews with the acquisition curator, Corinna Gardner, and through a set of three workshops in which Y-Stop was discussed by museum professionals, digital conservators, curators and designers under the perspectives of collection management, preservation and public access. The research methodology is influenced by the challenges inherent to the ongoing acquisition, and the sensitive mediation process with the community behind the creation of the object. For this reason, this case study document is oriented around the institutional point of view and addresses the community as a key subject of curatorial concern.

The case study interrogates the fit of the object within the museum institution and explores the concerns arising from working in partnership with a community of creators and users, as well as discussing preservation risks and tentative approaches to access. It concludes by recognising the need to work in close collaboration with the community of creators and users, and to accompany the uncertainty about the future preservation of the app with careful consideration of the expectations, time and resource commitment demanded of both community and institution.

2. The object: capturing the impact of a community-led project

Y-Stop (https://y-stop.org) is '*a collaboration between charities, lawyers, young people, youth workers, community, and media organisations*' (*Release 2020*), run by London-based charity Release in partnership with the policy-oriented coalition StopWatch. The project is based on a participatory approach and is the result of a 12-month consultation period involving a number of youth groups. This led to the development of a website, a mobile app and a set of print and digital informative materials to guide people (especially young men from minority backgrounds) in managing a stop and search interaction and in potentially seeking legal support. The project utilizes graphic and digital design to make an intervention in the social and power relationships inherent within urban space. It seeks to provide sustainable alternatives to existing patterns of conflict and prejudice involved in stop and search procedures. The app (available for iOS and Android devices), launched in 2015, enables users to video-record the interaction with police and share it with expert lawyers in order to receive advice.

The V&A has acquired the wallet card summarising the key principles emerging from the project, and is working towards the more complex acquisition of the mobile app. The uncertain fate of the app acquisition is tied to the way preservation challenges are enmeshed in collaborative practice. Time, effort and resources are required from Release (especially the developer who commissioned the app) in order for the app to be acquired in a format suitable to guarantee long-term access. Additionally, one of the V&A curator's priorities is for the acquisition process to reflect the community-led dimension of Y-Stop by collaboratively coming to an understanding of which project elements are most representative and impactful:

> *'Choosing the wallet card was a pragmatic decision. I see the wallet card as the beginning of a closer engagement. If we do come to acquire the app, great, if we don't, I still have an interest in some of the other materials [...] I have been trying to come closer to what Release themselves see as the most effective part of this deck of cards: is it the app, is it the wallet card, is it the online information, is it their outreach work, what is it that they feel the most impactful?' (Gardner 2021)*

Furthermore, Y-Stop is an active and evolving project. Since its launch, issues of social and racial justice have become more prominent in the UK (and globally) and Release is in the process of updating its materials, incorporating new principles and guidance directed also towards those witnessing a stop and search. The curator intends to take stock of this fluidity and bring the new materials into the collection. Mutability is a feature of the digital and the contemporary. Responding to living objects, which are still in use and part of an ongoing creative process, is one of the crucial responsibilities of curators interested in born-digital collection and preservation. The case of Y-Stop however presents an additional layer of complexity by placing an emphasis on the dialogic and participatory approach necessary to adequately collect and care for community-led design.

3. The institutional context: continuing to learn

Y-Stop is being acquired by the V&A as part of an effort to document how information design can impact urban life and to expand and diversify the range of voices representing design and architecture within the museum.

> ***'We want to tell a story about infrastructure, wayfinding, and the lived experience of the city; and the sense that the design of places and spaces is from those who authored them but also those who use them.' (Gardner 2021)***

Inclusivity is one of the priorities expressed in the V&A Collection Development Policy for the area of design, architecture and digital. The policy commits to:

> ***'Consider design within the context of society, to document important global shifts in the practices and processes of design and show connections between the designed world and current socio-political concerns.' (V&A 2019)***

Y-Stop links to two bodies of work featured in the collection. Since 2014, the V&A has acquired a small number of mobile apps which already posed questions of contextualisation, documentation and long-term preservation (*Volsing 2014*, *Cormier 2018*). The collection approach adopted for the Chinese social media app WeChat, in particular, is based on collaborating with the creators to secure a version of the app freed from all networked dependencies (essentially a demo version) and to populate it with fabricated content, exemplifying the activities of a typical user, in order to avoid using real content subject to privacy and legal barriers. Y-Stop, however, presents different challenges to the institution and requires an adjustment to the WeChat model in order to support the acquisition of an object whose users cannot and should not be reduced to typical profiles which are potentially insensitive and against the acquisition's aims, which is '*about enfranchising voices and making sure more people are heard*' (*Gardner 2021*).

Further, the museum has acquired several objects addressing urban tensions and social dissent such as the design identity of Extinction Rebellion and the umbrella from the Hong Kong Umbrella Movement protests. These objects contribute to shaping the museum's community ethos and to developing collaborative acquisition practices that are respectful towards and concerned with the plurality of creators and users associated with the object. With its focus on social history (despite the V&A not being a social history museum) and giving space to the user's perspective, the acquisition of Y-Stop disrupts the museum's traditional prioritisation of the designer's perspective and the documentation of the design process. The acquisition therefore builds on existing curatorial developments and confirms the need for the institution to understand how to work with communities, consolidating emergent approaches to collaboration that are conscious of potentially different priorities and informative around benefits and institutional management and administrative concepts.

4. Community focus: a gentle acquisition

As a community-generated project led by a charity working collaboratively, Y-Stop is a compelling example of distributed authorship, and the institution aims to reflect this orientation in the acquisition process as well as in the addition of the object to the collection management system. Because Y-Stop's significance lies with the role of the community in shaping, supporting and using it, documenting the perspective of multiple actors becomes a fundamental part of the acquisition process.

The object is representative of a broad tendency in digital culture to blend the roles of makers and users (*Bruns 2008*, *Jenkins and Ito 2015*). Museums are responding to this tendency by exploring more expansive approaches to documentation, incorporating oral histories, memorabilia, snapshots of user experience and interviews. At the V&A, the concept of *contemporary testimony* is gaining currency to describe the polyvocality that the museum aims at incorporating in the acquisition. The idea of testimony is associated with the transmission of first-hand experience and memories making a transition from individual to shared versions of history (Givoni 2016). Combining an appreciation of the design process and a growing adoption of social history approaches, the museum's approach demonstrates an awareness of the many voices that could comprise an exhaustive documentation of Y-Stop. However, the curatorial role also involves establishing a balance between inclusivity and sustainability, openness and meaningful narratives:

> ***'The person who talked about it, the developer who was commissioned to make it, the person who workshopped it, the person who finalised the user experience, the people who play-tested it or tested it in the field, the person who downloaded it, the person to whom it has been useful and the person to whom it has been unhelpful: to what degree do you capture those voices? As a curator you need to be able to decide which voice is decisive to define the object.' (Gardner 2021)***

The impact of the community-led dimension of Y-Stop extends beyond the question of documentation. As museums diversify the provenance of their collections, they engage in conversation with donors and creators who are unaccustomed to the conventions of the acquisition process. In these cases, the conversation between the curator and the organisation also involves communicating the administrative and conceptual steps of acquiring an object:

> ***'This is a type of acquisition where we need to sit with them, and sit with them gently, to work with them to bring the object into the collection. The idea of an acquisition is something entirely foreign: bringing a piece of print paper that they otherwise just give out into the collection, having to sign a deed of gift is already an unusual occurrence, and then to think about what that might mean in the sphere of the digital is an even greater task of explanation, communication and nurture.' (ibid)***

The uncertainties around the preservation of the app (discussed in more detail in <u>*section 5*</u>) increase the need to carefully understand the time and resources demanded of both the charity and the institution. On the one hand, the museum is responsible to properly care for its collections and the relationship with the charity and its community intersects this sense of responsibility. At the time of writing, the V&A was undergoing a restructuring, therefore there is currently little clarity around priorities and allocation of resources:

'If we were to acquire this app, would we be able to commit a certain amount of time and energy to make sure that we act responsibly in collaboration with Y-Stop?' (ibid)

On the other hand, there is a need to also determine what is demanded of the charity to make sure the object is collected and preserved in a way that respects what the institution and the community 'collectively understand as a fair representation of the object in the collection' (ibid.). Ensuring that there is mutual understanding around the preservation challenges and requirements is an essential step in the process, as is the identification of benefits and ways of crediting the organisation. The curator understands the benefit for the community in relation to the way entering the collection enables the social issues embodied in the object to access a different arena:

'The benefit is that that lived experience becomes part of the narrative, part of the history of design, in the here and now. But to what degree is it reasonable to demand the time of an organisation like Y-Stop? I need to work through that community benefit. It still feels abstract to me.' (ibid)

In the case of Y-Stop then the challenges of the digital are not only a matter of preservation tools, but they are also associated with cultures of participation and with the presence of multiple authors and stakeholders. Whilst acquiring the wallet card will not require any further work from the Release or the community, the app necessitates a process of careful negotiation with the creators, as the museum struggles to establish needs, strategies and expectations before effectively finalising the acquisition.

5. Preservation and access

The Digital Preservation Coalition considers mobile apps as critically endangered and describes the fast pace of upgrades and disposal as one of the main risk factors for mobile apps (2021). Because of their reliance on servers, licenses and frequently content hosted externally to the app, they are likely to lose their integrity over a short period of time. The V&A is at an early stage in the development of an adequate infrastructure to care for born-digital objects, and the museum is considering how to collect objects strongly dependent on digital networks and communities of users. A review of the few museums around the world currently holding mobile apps in their collections (including the Cooper-Hewitt Smithsonian Design Museum, Powerhouse Museum and MoMA) reveals that acquisitions tend to happen in partnership with the creators and that they usually comprise the app file (.APK or .IPA), the source code, documentation of the design and of the user experience and dedicated hardware. With its attention to the participatory dimension of the design, the V&A's approach might align with this tendency, but, at the time of writing, it is too early to advance more than a tentative prediction on which components of the app will be acquired to preserve its long-term access.

To avoid the app becoming inaccessible due to no longer being supported by servers and licenses, keeping the dedicated hardware offline will be an essential step towards extending its life. Further, acquiring the executable .APK or .IPA file from the app store is likely to be insufficient to enable conservators to reconstruct an outdated app: the acquisition package will have to include metadata on the required operating system and hardware and software libraries (*van der Knijff 2021*). This information will enable future conservators to explore the possibility of using emulators to extend the life of the app beyond the survival of the original handset and to reconstruct the link across key dependencies. The fact that Y-Stop is an object in use and subject to change poses questions which are not uncommon in the field of collecting the born-digital: if an updated version of the app will be released, should the museum collect and document both versions? Discussing the acquisition of the Planetary app by the Cooper Hewitt Museum Seb Chan argues that software should not be:

> ***'Sealed in carbonite like Han Solo. Instead their acquisition simply transfers them to a new home environment where they can be cared for out of the wild, and where their continued genetic preservation requires an active breeding program and community engagement and interest.' (2013)***

The Cooper Hewitt Museum sought to support the preservation of Planetary by enhancing its capacity to evolve and be cared for by a community of passionate fans. The release of the source code with an open license was hoped to catalyse the community's effort to resuscitate the app once it stopped working. This effectively happened in 2020 when an iOS developer recreated the software, a substantially new object, but one able to reproduce the original behaviour of the app (*Chan 2020*). The Cooper Hewitt approach was centred on the idea that the source code was the core of the acquisition and capitalised on the broad popularity of the app. Y-Stop is being used by a narrower user base, and it is a hybrid, multipart, participatory initiative, holding a strong relationship with its community of user-creators. In this case, open-sourcing the code might not be a fruitful solution, but more research is needed to explore different community-based approaches to preservation.

Y-Stop has a limited number of dependencies specific to its defining features, as it links to the phone's camera and geolocation service and to the Release's repository where the recordings of the stop & searches are received. Which of these dependencies will be necessary to maintain meaningful access to the app in the future? How important will it be, for future audience, that the app could maintain its full functionality, including the capacity to connect to the charity (which might no longer exist)? What is the best approach to documenting the way the app is being used, and how much documentation will be representative of the diversity of users?

During the preservation workshop, expert digital conservators identified additional questions for consideration, addressing the data associated with the app, privacy issues related to users' personal information, and hardware dependencies. Further, workshop participants corroborated the curatorial vision of balancing a design focus with historical and social justice perspectives. The technical preservation of the app was discussed as complementary to the documentation of the socio-cultural context and of the design methodology, gathering interviews with the app's creators, wireframes and prototypes. The preservation of the Y-Stop app is inscribed within a dialogic process that takes into account its collaborative authorship and the responsibilities and concerns of the stakeholders involved. Preserving the app, in this case, means preserving its multivocality. The lack of a solid infrastructure to preserve born-digital objects within the institution and the uncertainty around preservation strategies are increasingly pushing curators to develop experimental initiatives in collecting and to accept that they might not be able to offer the same guarantees of long-term preservation and access that museums offer for traditional objects. Bracketing born-digital acquisitions as temporary and tentative however presents significant risks, not only in association with the delicate relationship with donors, but also because of the dangers of assigning digital objects a different status within the museum collection:

Y-Stop SEACRH Card, Release & StopWatch. © Victoria & Albert Museum.

'We are capturing the era now, it's a big world but it is the job of the contemporary curator to make those decisions and we need to have confidence that these objects are literate enough to have the potential to stand the test of time. One concern is that the contemporary or the recent never gets the attention it requires and by the time it's historic we cannot capture it any longer.' (Gardner 2021)

6. Conclusion

The case study shows how the challenges of collecting born-digital objects are not necessarily only associated with keeping technological dependencies alive and counteracting obsolescence. Rather, they are embedded in the participatory dimension of digital culture and design methodologies. The study has analysed concerns around accounting for multiple authorship and for objects conceived as platforms of change. In acquiring Y-Stop, the question of the digital adds a further layer of complexity to the institutional exercise of due diligence and accountability towards the museum's immediate stakeholders. This entails negotiating expectations for the museum life of the object as well as the nature and entity of the active involvement of the organisation.

Future research is needed to develop new approaches to incorporating multivocality within the collection practice: which models from design and social history can be drawn upon to craft effective models of preservation and documentation? How can communities be credited and rewarded when participating in the collection and care of complex digital objects?

The example of Y-Stop is a provocation for understanding issues of institutional readiness and the need for institutions to attempt collecting experiments in order to develop knowledge and best practices in the emerging field of born-digital collections. When communities are involved, priorities are renegotiated. In fact, the need for experimentation and for working outside established frameworks should be balanced by a clear and shared understanding of requirements and expectations. Redefining uncertainty and setting up the boundaries of experimentation is a way to both include multiple voices and establish the value of born-digital objects alongside the rest of the collection.

"How can communities be credited and rewarded when participating in the collection and care of complex digital objects?"

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Case study: Instagram

Collecting the untraceable, encapsulating the unlimited: Instagram in the zoo

Gabi Arrigoni, Joel McKim, Natalie Kane

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1. Introduction

Some of the most pervasive artifacts of the digital age are distributed, embedded in scaled-up infrastructures, experienced by individuals from unique and mutable points of access. Social media services, media sharing services, blockchain technology or the Internet itself (*Lagendijk et al 2019*) are typical examples. These artifacts are increasingly frequently as platforms (*Bogost and Monfort 2009*, *Gillespie 2010*, *Langlois and Elmer 2013*), a concept that characterise widely shared and programmable systems and services embedded into underling supporting structures. This latter feature, in particular, has recently nurtured the idea that 'platform-based services acquire characteristics of infrastructure, while both new and existing infrastructures are built or reorganized on the logic of platforms' (*Plantin et al 2016*).

This case study focuses on Instagram to understand the implications of collecting platform-like objects, from the perspective of a museum of art and design. It explores how the boundless nature of highly complex digital objects pushes the institution to elaborate novel approaches to collecting, preserving and providing access. In fact, the example of Instagram shows how museum professionals are able to conceive practical solutions in order to domesticate unmanageable objects. However, the study exposes the invisible and inaccessible dimensions of digital platforms, highlighting the policy and legal vacuum that currently hinders the mission of institutions of memory.

The scholarship on web archiving is substantial (*Gomes et al 2011*, *Costa et al 2017*), with the acquisition of Twitter by the Library of Congress being one of the most emblematic examples. The acquisition demonstrates the challenges associated with scale, privacy and socio-cultural issues faced by a major institution, working in close collaboration with Twitter (*Fondren and McCune 2018*). Many institutions of memory have undertaken collecting initiatives which use social media to preserve memories from relevant communities and user-generated content. This case study, by contrast, looks at Instagram not as a container of content or tool for collecting, but as an object of interaction design, valued for its socio-cultural, aesthetic, and historical significance.

The study takes a speculative stance and imagines the processes, challenges and concerns a museum of art and design would need to confront in order to move forward with such an acquisition. The methodology is based on the following steps: i) a literature review addressing social media, platform studies and the preservation of complex networked objects; ii) a reflective process conducted by the research team speculating on how to collect Instagram; iii) a set of interviews and three workshops involving museum professionals and experts in Intellectual Property Rights, creative computing and the tech industry. The interviews focused on general issues of collecting born-digital objects, while the workshops involved a more focused investigation of Instagram under the perspectives of collection management, preservation and access.

The case study unfolds by determining the desirable, the impossible and the possible in selecting, acquiring and preserving the image-based social media platform. It addresses the decision-making and boundary-making processes that could be applied to identify what to collect to maintain a comprehensive and accessible representation of Instagram. It also identifies preservation risks and interrogates the challenges associated with Instagram's intricate proprietary ecosystem, concluding that only a collaboration with the Instagram design and legal teams will enable a museum to effectively achieve a meaningful acquisition.

Speculatively collecting Instagram elicits questions relevant to the broader field of digital product design, such as: how to preserve a networked experience and an experience which is different to every user? Whose point of view should be prioritised in documenting such a multilayered object? How do you collect an item that is in a process of perpetual change? How can museum's balance a socio-cultural perspective with a design focus?

The case study reveals the fragility of digital culture at risk of remaining un-preserved not just because of technical challenges and technological obsolescence, but also because of the legal and privacy issues produced by the private nature of both the networks and the user-generated content constituting the platform. These challenges can only be dealt with by negotiating with the owner/creators (currently Meta), which brings about new questions for museums, having to learn to collaborate with the tech industry and shape independent and critical narratives of the digital now.

2. An elusive object

Instagram is a photo and video sharing social media platform released in 2010 as an iOS app only, with an Android and a desktop version released in 2012, when the service was acquired by Facebook Inc (now Meta). A search on Google Scholar for the term Instagram generates over 1700 results, as the platform has been both a subject and a tool for researchers from such fields as the social sciences, interaction design and computer science. Its significance has been associated with the rise of ubiquitous mobile photography, popularising specific aesthetics (especially associated with the use of filters) and photographic styles, contributing to new business models and socio-cultural phenomena, such as the culture of influencers.

Instagram has undergone a number of changes since its initial release, a significant one being the easing of restrictions that allowed only square pictures, and a general redesign of the interface in 2015. Messaging features, the removal of the like counter, the introduction of IGTV, Stories, Reels and a retailer function are also fairly recent additions to the original version. Considering this evolution is important as it brings the question of which moments in the Instagram history are worth capturing. Uses and styles of visual communication have also evolved from the initial tendency of uploading photos on the go, to increasingly curated sharing practices.

The research team considered that meaningfully collecting Instagram would require the acquisition and preservation of items capable of explaining the way in which the platform influenced participation, sociality, creative and identitarian expression. Van Dijck argues that

Image credit: Tom Schofield.

platforms can be analysed by looking at technologies, users, content, governance, ownership and business models (2013). Can museums adopt such a comprehensive approach to collecting? What can effectively be collected to address these perspectives? Platforms:

> ***'Have precise (and shifting) technical affordances that constrain and guide practice–both in their own design and in their fit with a myriad of infrastructures, including their back-end data systems, the protocols of the Web, and the dictates of mobile providers. They have rules and norms that bless some practices and are used to restrict others.' (Clark et al. 2014)***

Just like the grey fuzziness of software (*Fuller and Goffey p.11 2012*), invisibility comes to the fore as a defining feature of platforms: the invisibility of the back-end decisions unknowable to users, back-end data systems and interactions are paradigmatic of the inaccessible nature of objects that, resisting comprehension, also resist traditional forms of collecting.

Born-digital objects resulting from variable orchestrations of networked processes, performing interactions with remote servers or responding to specific contexts of execution and users have been described within the digital preservation literature as 'boundless' or 'apparently infinite' (*Espenschied and Rechert 2018*). Social media platforms come to life through performances unique to each user (*ibid*). For this reason, they have been declared impossible to collect:

> ***'If an object is in its entirety located remotely, exposing an unknown range of possible performances, it must be considered boundless. A typical example might be any social media platform like Twitter, which provides many modes of access to items with complex relationships inside the platform and further remote sources, but offers no way to inspect the defining processes or even creating an index of provided items from an outside perspective. […] there is no way to preserve them while ensuring the continuous availability of all provided interfaces and potential.' (ibid p.1)***

The cloud-based nature of these services adds further barriers to the collecting institution:

> ***'These often lack any easily separable form, may not have distinct versions, can be enormous and spread over discs or tapes in many locations, and often exist in very limited numbers of copies. Once these sites or services have been turned off, it can be extraordinarily difficult even for experts to reassemble all the needed components.' (Weber 2016)***

The study challenges this sense of impossibility and identifies tentative steps towards preserving meaningful access to Instagram and similar boundless objects. This effort is motivated by the urgency of salvaging key representations of our digital culture at high risk of loss due to rapid technological change and the lack of corporate strategies for long-term archiving.

3. ‘It’s not an object!’: acquisition dilemmas and non-linear decision-making

Instagram is distributed across time and space; non-local but only experienced by individuals through localised manifestations; and its effects are manifested through interactions. When a particular user and context are identified, Instagram appears like a more manageable object, suitable to be captured and collected. Otherwise, its scale makes it difficult to identify clear boundaries and defining its constitutive parts. Overall, the case study shows that digital platforms do not fit institutional understandings of ‘objecthood’, demanding instead new forms of conceptualization conscious of their infrastructural (*Plantin et al 2016*), tentacular and penetrative dimension.

In fact, circumscribing a set of suitable items to acquire as part of our speculative exercise proved arduous to the research team, whose initial steps where to determine a set of options, whilst lacking a firm criterion to select the desirable ones.

When we posed a similar task to workshop participants, the list of possible items for acquisition included:

- the mobile app with its operating system and underlying database;
- the desktop application;
- dedicated hardware;
- interface design;
- source code;
- a range of contextual objects including interviews with users and designers, documentation of user experience (through video-capturing interactions and walkthroughs), social history content, and examples of user profiles.

Participants agreed that users are an essential part of Instagram and that, absent of user content, the app would not communicate enough about its meanings. Consequently, a clear distinction between core and contextual objects proved problematic, as participants challenged the characterisation of Instagram as an object (with comments such as ‘it is not an object’, ‘there is no uber-Instagram’), in favor of interpretations of the social media as an infrastructure or ecology. They also advocated for non-linear approaches to determining how to go about the acquisition, proposing that the decision-making process should be based on clusters or thematic groups of possibilities. Moreover, participants felt that, when facing a corporate, distributed and hard to reach form of ‘authorship’, the institution’s collection policy and the curatorial perspective were the most compelling starting points to go about selecting options and bounding Instagram into a manageable acquisition.

Modes of representation and capture constitute a further layer of complexity: participants considered different approaches from playbacks of user interactions, live interactions with a networked platform with no pregiven content, to a series of snapshots bringing together both interface and content at a small scale. The idea of recreating a functioning Instagram

at scale was rejected, in line with literature that recognises the unsustainability of this approach (see *Webster* cited in *Foti 2018 p.37*, and *Espechiend and Rechert 2018 p.2*, coming to similar conclusions respectively on collecting Facebook and YouTube). Rather, workshop participants used the metaphor of the zoo to suggest collecting and presenting an encapsulated version of the social media platform, taken out of the wild: a scaled down demo version featuring made-up personal data or approved personal data. The participants also felt that only the Instagram design team would have the expertise to create a suitable demo. Hence, the collaboration with the donors was positioned at the onset of the decision-making process, determining all subsequent steps.

Image credit: Tom Schofield.

4. Preserving closed systems

Our survey of born-digital collections demonstrates that there are currently no precedents for collecting social media platforms as design objects in their own right. Most explorations of preserving social media have focused on user-generated content only, neglecting the infrastructural and design dimensions of the objects (see for instance *Donahue et al 2012*). The closest precedent is the V&A acquisition of China's largest social network WeChat. This case was especially fortunate as the curators Corinna Gardner and Brendan Cormier were able to collaborate with the WeChat design team at Tencent, which provided an offline demo version of the app to circumvent issues of technological obsolescence and networked dependencies. Further, the design team helped in addressing the legal and privacy barriers to collect users' content to populate the app. The solution consisted in creating a simulated user profile, with fake contacts, chats and photos, and to document user interaction through a video showing typical activities such as chatting and ordering food through the app (*Cormier 2017*).

The suggestions made by workshop participants when asked to speculate on the Instagram acquisition reflect the WeChat model in at least three ways: i) the involvement of the corporate owners; ii) the choice of crafting fabricated content; iii) the choice of scaling down an object with uncertain boundaries by crafting a non-networked, decontextualized version illustrating one instance of the platform. These solutions are not unproblematic. For instance, one could argue for lack of authenticity in reference to presenting fake, 'typical' user profiles; or could point at the limits of a demo version, preventing liveness and real interactions. Finally, collaborating with industry partners brings about important ethical questions of curatorial autonomy (see *section 5*). However, they offer a grounded and viable approach to transmit to future generations some understanding of a significant piece of contemporary culture that otherwise risks disappearing.

Privacy issues, restrictions on uses of personal data, database rights and Instagram's Terms of Use were indicated by several participants as major obstacles ('*Maybe the risks of breaching data protection make Instagram uncollectable?*') [1], corroborating the proposition that a curated simulation with sample data would be easier, not just from a technical but also from a legal perspective, than capturing a real Instagram dataset.

Corporate collaboration was considered crucial also in reference to acquiring and preserving the app itself or sample interactions. This is especially true because of the private nature of the data and the services provided by Instagram. In fact, Instagram is based on a cloud application architecture hosted by the Facebook datacenter (previously by the Amazon Virtual Private Cloud) (*Sverdlik 2014*). As users only experience the most superficial effects of the black-boxed infrastructure, private clouds are entirely inaccessible to third parties, and position cloud-hosted 'objects' at a particularly high risk of loss. As explained by creative computing expert Mick Grierson during an interview with the author:

> ***'Reconstructing internet protocol requests, internet protocol activity, or reconstructing experiences from internet protocol activity is not that challenging, because servers have logs. Capturing the network aspects of something which happens on a private***

[1] Comment by Stephen McConnachie, Head of Data at the British Film Institute, during one of the workshops.

network, like for example a gaming network, or an app network, or iCloud, that's just not possible. Because there are no public records, there will never be any public records. […] And you're also talking about, for example, if you wanted to capture the network impact, and network effects on Facebook, there's no way in hell they're ever going to let you do that. Because that's their primary business. Managing and massaging the network effects on the internet, that's what they do, that's their business. And they can't give that away.' (2021)

Museums are not new to dealing with commercial partners. However, characteristics of the tech industry increase the sense of inaccessibility: '*the distributed nature of big tech companies, their large facelessness, their attitude in protecting their brand makes it feel different from dealing with an individual donor*' [2]. The study revealed that tech corporations are perceived as difficult partners for museums and that the sector is rife with stories of failed acquisitions and difficult and long negotiations with lawyers (*Arrigoni et al. 2021 section 6*). Negotiating legal agreements with corporate donors can have high transaction costs as museums want to make sure to gain enough flexibility to present the object in a variety of ways and contexts in the future. The obvious risk is '*to be turned into a marketing arm of Sony or Nintendo. [..] That's why there's never been an Apple exhibition at MoMA, because they want to turn us into the Apple Store, and that's not what we're interested in doing*' (*Galloway 2021*). Trading curatorial autonomy and criticality for the fidelity and completeness of the acquisition is viewed by participants as an unacceptable compromise.

[2] Comment by Natalie Kane, curator of Digital Design (Victoria and Albert Museum), during one of the workshops.

5. Access strategies and big tech narratives

If we approach Instagram as both a design and social object, any exhibition strategy will be based on bringing together the technology, the interactions and the community involved. As a living and still evolving object, Instagram's legacy is still uncertain, and its narratives are in formation. Web history pioneer Marc Weber points to the impact that the difficult preservation of complex online systems has on ways of displaying them:

> *'One of the biggest obstacles to direct re-creations of online systems is social interaction [...] For highly social online systems like virtual worlds, some researchers have essentially had to give up on trying to meaningfully preserve the system itself. For them, video has become a standard way to capture the look and feel of the online experience not just for exhibits, but for preservation purposes. As the Web returns to the more social models and user-generated content that marked many early systems, the preservation of ordinary Web sites may face similar issues.' (Weber 2015 p.12)*

Existing models for displaying 'online worlds', including now historicised examples of the web, feature a mix of strategies from exhibiting screenshots, video-documentation, to devising interactives and simulating the experience of defunct web applications (*ibid*, *Blyth 2016*, *Foti 2018*). In speculating about Instagram's displays for present and future audiences, workshop participants focused primarily on the elements to acquire in order to craft meaningful forms of access. Besides display modes, an important challenge concerns the critical contextualisation of social media platforms. Over the last twenty years, a small number of platforms, intended as multifunctional comprehensive online services, have risen to global prominence, setting a paradigm for social media and attracting hundreds of millions of users. Museums interested in capturing the significant actors of contemporary digital culture face the task of illustrating the impact and the dramatic expansion of the dominant platforms '*through the way they produce convergences among personal communication, creative content and mainstream media consumption*' (*Burgess and Banks 2014 p.286*). Nevertheless, communicating to the public the apparently hegemonic role of Instagram risks to reinforce biases and dominant narratives of successful innovation if not problematised and counteracted through careful and critical curatorial work. For instance, the creative work of artists critically engaging with Instagram could create a productive complement to the encapsulated Instagram in a display.

The uncertain path towards acquiring Instagram in cooperation with its corporate ownership and the experimental, unprecedented nature of our speculative exercise leave many questions unanswered: how to contextualise digital platforms in critical ways, shaping polyvocal narratives and introducing stories that account for both success and failures, benefits and controversies? How to narrate the way Instagram has transformed the web from a social, infrastructural and cultural perspective? Which contextual objects to collect to support audiences in developing autonomous and balanced understandings?

6. Conclusion

Instagram has been addressed by workshop participants as: difficult to explain and difficult to preserve because of its networked, multi-user, and distributed status. Any attempt to collect such an elusive object will have to deal with inaccessible digital and corporate processes. Major barriers to its acquisition reside in intellectual property and commercial interests. Indeed, the case study raises questions regarding how museums might need to change their relationship with donors and creators to negotiate the legal and technical terms of the collaboration. In addition, access strategies are intimately related to acquisition and preservation barriers and opportunities. Lacking objecthood and being manifested through multiple performances, platforms like Instagram elicit further questions concerning narratives and modes of display. Accounting for Instagram's platform-sociality and platform-design can be a daunting task, as it requires acquiring and identifying approaches for a heterogenous set of components and performances of the object.

Instagram's distributed, non-localisable and mutable nature produce scalar dilemmas to the collecting institution, hindering the decision-making process and suggesting the impossibility and unsustainability of collecting the platform. The study indicates that collecting Instagram as a whole, at scale and with its interactive and live dimension, is considered impossible or unsustainable by practitioners. However, the research moves forward beyond the position of recognizing social media platforms as being unmanageable acquisitions, to problematising the necessary but delicate relationship between museums and the tech industry. Careful processes of de-contextualisation and re-contextualisation, approaches to bounding the boundless through curated snapshots capturing diverse perspectives of use, and an attitude for capitalising on the variety of items and records that can be acquired, should all be part of the emergent curatorial toolkit to care for the fragile, precarious but pervasive nature of platforms.

"Lacking objecthood and being manifested through multiple performances, platforms like Instagram elicit further questions concerning narratives and modes of display."

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12. Appendices

List of Interviewees

Daniel Cardoso Llach (Carnegie Mellon University)
Seb Chan (ACMI)
Candice Cranmer (ACMI)
Paul Galloway (MOMA)
Leigh Gialanella (Smithsonian Museum of American History)
Mick Grierson (University of the Arts London)
Alex Leitch (University of Maryland)
Niklas Nylund (Finnish Museum of Videogames)
Alan Warburton (artist and researcher)
Paula Westenberger (Brunel University)
Anonymous artist

List of Workshop Participants

Collection Management Workshop
Ian Cooke (British Library)
Marion Crick (independent consultant, former Victoria and Albert Museum)
Zoë Hollingworth (Victoria and Albert Museum)
Natalie Kane (Victoria and Albert Museum)
Jack Kirby (Science Museum)
Jenny Mitcham (Digital Preservation Coalition)
Stephen McConnachie (British Film Institute)
Joel McKim (Birkbeck University)
Richard Palmer (Victoria and Albert Museum)
Arran Rees (Loughborough University)
Caylin Smith (Cambridge University Library)
Elizabeth Thurlow (University of the Arts London)
Sophie Walker (British Film Institute)

Preservation Workshop
Michael Day (British Library)
Tom Ensom (Tate)
Patricia Falcão (Tate)
Corinna Gardner (Victoria and Albert Museum)
Martina Haidvogl (Bern University)
Natalie Kane (Victoria and Albert Museum)
Stephen McConnachie (British Film Institute)
Joel McKim (Birkbeck University)
Lozana Rossenova (designer and researcher)
Bhavesh Shah (Victoria and Albert Museum)
Jon Uriarte (The Photographers' Gallery)
Gaby Wijers (LIMA)

Access Workshop
Marc Barto (Victoria and Albert Museum)
Gaetano Dimita (Queen Mary University)
Petrina Foti (Loughborough University)
Corinna Gardner (Victoria and Albert Museum)
Gabriella Giannachi (Exeter University)
Andrea Lipps (Cooper Hewitt Smithsonian Design Museum)
Natalie Kane (Victoria and Albert Museum)
Stephen McConnachie (British Film Institute)
Callum McKean (British Library)
Joel McKim (Birkbeck University)
Florence Okoye (designer)
Kati Price (Victoria and Albert Museum)
Giulia Carla Rossi (British Library)

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