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Collecting contemporary science, technology and medicine

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Abstract

Museums are often associated exclusively with bygones. This can be problematic, especially for those who manage science, technology and medicine (STM) collections. In seeking to correct this misconception with contemporary collecting, they also face other problems, especially in scale and complexity. While acknowledging such challenges, this opinion piece proposes *opportunities* afforded by the material culture of recent STM. Contemporary material can be used to tell stories as well as explain technicalities; it can connect with visitors using everyday objects and put 'difficult' material into context.

Against the backdrop of practice and publications from across the sector, we present examples from the redisplay at the National Museum of Scotland in 2016, and from our current collecting initiatives. We thereby bring our perspective on the current state-of-play in STM collecting to the attention of the wider museum sector, drawing scattered practices together and weaving in our own.

Keywords

Collecting; contemporary; science, technology and medicine; National Museums Scotland.

Introduction

'Something could be modern or it could be in a museum', the writer and collector Gertrude Stein is said to have observed, 'but it could not be both' (Altshuler 2005, 1). Museum professionals struggle with this misconception to this day, in both the arts and the sciences. We are perhaps guilty of perpetuating this myth: both generally as a sector, and specifically in National Museums Scotland's Science & Technology department, where the authors are based. In the relevant section of the volume published to mark the

sesquicentenary of our Chambers Street building, only one item is from the last decade (a 2012 Touch Bionics 'i-limb' prosthetic hand; see National Museums Scotland 2016). A 'top ten' scientific and technical items list selected for the press at the time featured nothing recent (Gibb 2016).

Here we challenge the perception of the museum as a repository of bygones (cf. Terway 2014). As contemporary art curator Howard Fox put it, the 'idealized version of museums tends to cast the museum as a reliquary, a mausoleum, a shrine to the past and the supremacy of material culture. Conceiving the museum on such a model serves to discount the actual involvement that a museum might claim with the culture of the present, or even of the future' (Fox 2005, 25). By way of balance, we explore the very practice that should keep a museum up-to-date: collecting the contemporary.

In this opinion piece we therefore reflect on recent experiences of science, technology and medicine (STM) acquisition processes at National Museums Scotland, set in the wider context of practice and publications. The latter have until recently been overly focussed on the *challenges* involved in contemporary collecting; so while we do survey these undeniable problems in opening our discussion, our aim is to join more recent work that considers the *opportunities* presented by the present. And given that this literature is often aimed at STM curators and other scholars rather than the broader museum community as a whole, we explore inter-disciplinary parallels.

'Contemporary' is by definition a changeable category, and one that is applied differentially across the sector, from 'since the Second World War', to a short, rolling window of up to five years (Rhys 2011; Rhys and Baveystock 2014). Here we present no hard-and-fast parameters, although we concentrate on this century. We do however encourage a focus on *use* rather than invention to keep collections relevant (Fischer and Lubar 2014); our material includes technologies that have come *into* use in the past decade and those that have come *out of* use in this time. And given the broad applicability of the term 'technology' – whether a narrow museum definition often centred on industrial collections to the

broader notion of *any tool* – neither do we attempt to define strictly our disciplinary limits. Our three case studies are mobile telephony; human and animal organs and their representations; and the material culture of the oil and gas industry. We selected them to allow discussion across collections classified as science, technology and medicine (STM), but the challenges and opportunities we discuss are shared by other parts of the heritage sector, as we will discuss in closing.

If our chronological and disciplinary parameters are elastic, our geographical scope is more specific: our attention is weighted towards Scotland. But even then, not exclusively so, reflecting the broad character of our institution. National Museums Scotland holds a multi-disciplinary collection of nature, design, history, archaeology and science across five sites in central Scotland: the National Museum of Flight in East Lothian, the National Museum of Rural Life near Glasgow, and in Edinburgh the National Museums Collections Centre, the National War Museum and the National Museum of Scotland. Capital development of the latter, our flagship museum, included a suite of new science and technology galleries that opened in July 2016; our selection of case studies stems from collecting to populate the new displays, but also includes the ongoing contemporary collecting we have undertaken since.

To interrogate how and why we collected these items, and contemporary STM more generally, we first provide some historical context for this kind of collecting, then outline selected present-day approaches in both policy and practice, and (in the following section) survey the challenges involved. We follow with three case studies, each set in their social and technical contexts. We finish with the opportunities this collecting afforded, and our thoughts on ways of collecting and engaging with new things. We hope to bring the current state-of-play in STM collecting to the attention of the wider museum sector, drawing scattered publications and practices together and weaving in our own. One important commonality is that narratives are paramount. Whether science or society, whether past or present, when we collect, we collect *stories*.

Contemporary collecting, then and now

Contemporary collecting is not new. ‘With its focus upon the delocalized “now,” the category of “contemporary collecting” is inherently ahistorical’, observes Robert Bud, ‘Yet the category itself can be analysed historically’ (Bud 2017, 50). The collections that seeded many current science and technology museums were established in the nineteenth century to showcase the latest in industrial arts. Our predecessor, the Industrial Museum of Scotland, was founded for this purpose: to collect the materials and processes of manufacture: that is, contemporary technologies and the tacit skills that went with them (Swinney 2013; Wilson 1860). It continued in this vein as the Edinburgh Museum of Science and Art, a branch of the same government Department of Science and Art that ran the South Kensington Museum (which gave rise there to the Victoria and Albert Museum and the Science Museum). These institutions acquired, modelled and displayed the latest technologies, for example by asking regional chambers of commerce for the latest goods (Archer 1861). Nearby, Glasgow Museums’ pedigree likewise includes the City Industrial Museum (now the Kelvingrove Museum), opened to showcase the city’s technical prowess.

These artefacts aged of course, and they were joined by already-historic material as the heritage function of science museums expanded. Nevertheless, curators continued to have an eye for the new over the twentieth century. Upon his appointment as Director of the Science Museum in London in 1960, David Follett worried, ‘our successors in twenty-five years’ time will applaud or condemn us in the light of history in what we now acquire to represent the contemporary picture’ (Boyle 2019). And the sector responded: even as scientific equipment became ever larger and opaque, museum stores expanded to allow museums to engage in ‘salvage’ or ‘rescue’ collecting (Butler 1992; Liffen 2010; Simpson 2017). This took place alongside a vogue for collecting and exhibiting popular culture towards the end of the century, including the influential ‘Samdok’ network in Sweden from 1977

(*samtidsdokumentation* – loosely, 'contemporary documentation'; see Axelsson 2014; Mattsson et al. 2007) and the hugely popular 'people's shows' in the UK (Pearce 2012; Rhys 2011). There followed an explosion of contemporary activity around the millennium. The Science Museum's collecting attention focussed on recent material in the closing years of the century (Bud 2017); and in the new Museum of Scotland (opened in 1998) contemporary technology included an Automated Teller Machine (ATM) designed in Dundee.

In this century, however, STM museums and science centres (especially) commonly deal with the contemporary via other media – programmes and digital content rather than material culture. In the Museum of Science, Boston, for example, the Gordon Current Science & Technology Center engages visitors largely with live feeds and talks rather than acquisitions. Examples of STM contemporary collecting practice that can be found in the twenty-first century include the Science Museum's 'Antenna' programme from 2000 (now 'Tomorrow's World'), for which the contemporary science team borrowed objects to represent current science and technology, only some of which were then acquired: industry lenders do not always want to become donors (Boyle 2016).

On a national level, the French network to safeguard contemporary scientific and technical heritage, *Le patrimoine scientifique et technique contemporain* (PATSTEC), is among the more active groups (Ballé et al. 2016), and the European Academic Heritage Network 'UNIVERSEUM' has a Recent Heritage of Science group which shares practice and publications relating to post-1945 material. The latter compiled selection criteria for recent material heritage – an avowedly practical 'roadmap' for which objects to keep and which to discard (Wittje 2014; Hagmann 2016). This drew on sector approaches to significance assessments that have been developing in recent decades (for example, *Reviewing Significance* 2.0; Reid 2012) and, while acknowledging the 'delocalization of research', focussed on what to select from existing university holdings and what was important to each institution as a teaching and research

entity. Curators in Copenhagen, meanwhile, have reflected thoughtfully on *very* recent and future biomedical artefacts and encouraged us to reconsider what we think of as a museum artefact (Söderqvist et al. 2009).

These activities do not take place in a modern scientific vacuum, but rather are embedded within other collecting categories and periods. They are reflected in (and ostensibly guided by) collecting policies and more recently collection development strategies. Leaving aside for the moment the impact of these documents on curators' day-to-day practice, the extent to which they explicitly address recent material varies across institutions. In our own institution, one of the seven strategic priorities for collecting across the collections is to 'increase our contemporary collecting'; and we explicitly focus on twenty-first century material in our physical science, biomedicine and communications collection areas (National Museums Scotland 2017). Among the Science Museum Group's dozens of 'key collecting areas' for 2016–21, for example, are 'recent research in astronomy and physics', an emphasis within aerospace collecting on the 'novel materials, techniques and systems informing the futures of flight and space travel' and contemporary artefacts associated with rail travel (Science Museum Group 2016; Boyle 2016). Best practice there and elsewhere involves collection reviews to understand the strengths of existing holdings that can then be built upon (Reid 2012).

An added complexity of recent material is that by their nature, strategies tend to be in place for a period like five years – by which time, the present has of course passed (Sichau 2010). In any case, whether inhibited or enabled by institutional policy, contemporary collecting like other forms of acquisition tends to depend on the impetus of a particular project, especially if extra resources are involved, and of course on opportunities.

Challenges

At worst, however, collecting is un-strategic, passive, or does not happen at all (Szczepanski 2017). There is a sense in which this is entirely understandable: STM curators have been eloquent in detailing how difficult contemporary collecting is. Here we review this lively literature, gathering the arguments into six categories, and we weave in our own experiences in these areas. None of these challenges is exclusive to STM collections, but this combination is particular.

1. Quantity and size

Like other curating areas there is a profusion of material from which to select. While we would argue this presents an opportunity for the STM curator, there is no doubt that the volume of material culture generated by mass-production makes it difficult to select (Macdonald and Morgan forthcoming). There is not only an abundance of things available already, but also of new technologies arriving rapidly on the market (de Chadarevian 2013; Hagmann 2016).

Perhaps more characteristic of STM objects is the range in their size. We tackle the brute materiality of heavy industry below; we could equally have addressed the challenges of rail and maritime transport; aerospace; or Big Science. The table-top apparatus and pocket sundials in historic collections may be expensive, but at least they are portable; particle accelerators may not be. The famous Laser Interferometer Gravitational-Wave Observatory (LIGO), on which the observations awarded the 2017 Nobel Prize in Physics were carried out, has two sites with 'arms' that are four kilometres long. (We will return below to how parts of a larger whole can be collected.)

The colossal is not the only problematic scale: massive apparatus is often required to detect the very, very small. For the past decade, nanotechnology has required careful thought. Take for example graphene, an allotrope of carbon identified in Manchester in 2004; storing and displaying a substance that can be mere atoms thick is not easy, but the Museum of Science and Industry in Manchester

tackled it in *Wonder Materials*, 2016–17, where they displayed the sticky tape dispenser used to pick up this invisible substance (Baines 2016). Objects that museums have traditionally collected (astrolabes, microscopes) have immediate 'presence effects' – what one might term a *material charisma*. Contemporary collecting, by contrast, includes those that do not: 'the molecular revolution in medicine looms small in museums' (Söderqvist and Bencard 2008, 164).

2. Materiality and immateriality

Graphene exemplifies not only the challenge of scale but also the problems of new materials. There is no way of knowing how a material that has only existed for ten years will behave in twenty years' time. New hazards will require a reassessment of our risk topography both in store and on display. 'The wonder-materials of today', a group of curators worried recently, 'may be the danger-materials of the future' (Robertson et al. 2017, 9; see also Pantalony 2015).

Beyond the risks of the material are the challenges of the immaterial (Blyth 2015). Many of the phenomena scientists and doctors examine are intangible; so too are many of the technologies of everyday life. Like other kinds of collections, STM museums are fully engaged with digital developments in cataloguing and engagement. But they are also among the select group it behoves to *collect* the digital realm; a broad effort that involves design, technology and multi-disciplinary museums collecting digital processes and products in similar ways. Institutions such as the Smithsonian's Cooper-Hewitt National Design Museum and the Victoria and Albert Museum collect digital art and apps, for example. As we will discuss below, a digital device is mute when not functioning, but storing and maintaining the software combines the problematic of other working technologies (risk to the artefact *versus* undeniable experience enhancement) combined with the difficulties of future-proofing formats. The Science Museum Group and the Smithsonian are collecting born-digital, but many institutions are in a state of paralysis when faced with risks such as digital deterioration ('bit rot'). As collaborative efforts such as

those of the Digital Preservation Coalition make headway (Corrado and Sandy 2017), museum professionals can learn lessons from their library and archives colleagues in this respect (Lowood 2017).

3. Complexity and mundanity

Even those objects that do have three dimensions are not always legible. The hardware that reads the software is seldom visually engaging – a great many technical devices have the 'black box' problem – their internal workings are utterly opaque. (Often of course they are actually green, grey or beige – Pantalony 2009; Pantalony 2015; Sumner 2016.) This can be both literal and figurative. Compare for example the Harwell Dekatron computer from 1951 at the National Museum of Computing (Bletchley, UK) and a twenty-first century hard drive. The latter may have several billion times the processing power of the former, but not an ounce of its visual appeal. The complex workings of STM require considerable skills and time to render engaging.

STM can be not only unintelligibly alien but also unappealingly familiar. Although they are associated with innovation, science and technology are manifested in our lives as mundane. Research is often undertaken with off-the-shelf instrumentation, and in common with (other) social history collecting, everyday technology is important to collect but can be mass-produced and dangerously uninspiring (Fischer and Lubar 2014; Hagmann 2016; Pearce 2012). We will discuss below the way we selected from the 6.8 billion mobile devices phones in use today; suffice to note here that the fate of mundane things on their way into collections is revealing of the values afforded them. As context for a telephony acquisition we collected a sign made by 'Telephone Ladies' in rural Bangladesh to advertise access to the village mobile phone in the years around 2000, a micro finance Village Phone initiative by Grameen Telecom (National Museums Scotland accession number T.2015.4.8). When this artefact arrived at the museum, the parcel company, considering the item mundane and valuing it accordingly, had adhered sticking tape directly to its painted surface: traces remain to this day. The sign was subject to a

pronounced shift in value upon arrival in the museum – from everyday parcel content to accessioned artefact.

4. Here and there

The geographical source of the Telephone Ladies' sign illustrates the fourth feature of contemporary collecting we wish to highlight: the international character of STM. Like many heritage organisations we have an ostensible remit – albeit inclusively 'To Bring Scotland to the World and the World to Scotland' – that means we seek material where possible with Scottish connections. The sciences, however, are increasingly delocalized and collaborative (Hagmann 2016; Krige and Barth 2006); the LIGO experiment, for example, involved over 1,000 researchers from around the world (Abbott et al. 2016). Museums struggle to identify pertinent collecting opportunities from such mobile, international enterprises (Hagmann 2016); but it encourages us, if encouragement were needed, to connect our geographic areas to broader developments.

5. Rights (and wrongs)

Such shifting, multi-partner enterprises generate unprecedented complexities around intellectual property, ethics and other legal elements. Some tangles arise because research groups and funders have dissolved or merged; at other times it is challenging, ironically, to identify the legal owner of redundant equipment. All museums face a changing legislative landscape and some have been unfortunate enough to feel the sting of litigious corporations, especially around image rights (Graham et al. 2013). For STM, intellectual property lies at the very heart of what we seek to collect, especially around innovation. To begin with, a massive proportion of research and development is in any case secret (Galison 2004), and therefore (for now anyway) uncollectable. Companies and individuals may be reluctant to release patent-pending or other prototypes for fear of industrial espionage. One workaround for us was to

collect an empty pacemaker (T.2015.96), so that we could show the object without the donor risking revealing its sensitive innards.

The reason the company was keen to give us even the pacemaker shell points to one of the ethical elements of collecting such material. They were understandably keen to promote their products for commercial purposes; we were keen to evidence technological development. We are not the only museum to have experienced a robust exchange with a (different) industrial partner about the way their product was interpreted in our displays. The broader debate around the ethics of museum and gallery sponsorship rumbles on (Mahony 2017; Proteau 2018).

6. Finished and unfinished

The particular sensitivity around intellectual property is a symptom of the unfinished nature of contemporary STM. Whereas we collect material relating to the history of STM with the (supposed) benefit of hindsight, as we discuss below in the case of the kidney, contemporary research is *in process* – and can therefore be messy. As we learn from David Chittenden (of the Science Museum of Minnesota, who has done a lot of work in this area), 'Most science museums and centers are focusing their programmatic efforts on introducing and engaging their audiences in science exhibits focusing on well-established science phenomena and principles and not on the emerging edges of science or its associated societal and ethical implications' (Chittenden 2011, 1550). Rather than collecting science as an established series of discoveries, current research involves attention to process rather than product, and an openness about technical dead-ends and conflicting theories (Arnold and Söderqvist 2011; Hine and Medvecky 2015). It does make understanding significance especially complex, however, when the consequences and impact of a medical technology (for example) are as yet unmeasurable.

Furthermore, the pace of STM research and development does not necessarily match that of heritage organisations (Yaneva et al. 2009). The dynamism of science makes future-proofing museum products

tough; curators at the Science Museum in London are presently wrestling with this as they collect for the medical history galleries that they intend to last for 25 years (Hurley 2017). But contemporary *collecting*, while related, is distinct from contemporary *interpretation*; continuing the former can help render the latter adaptable.

IPhones

One artefact that immediately draws attention to profusion and mundanity in contemporary technology is that ubiquitous device, the iPhone. First released in 2007 by Apple Inc., the iPhone was not in itself especially innovative, but rather brought together existing techniques into a well-designed and well-marketed package – essentially a hand-held computer (Lyytinen 2017). A mere 18 variations have been released in its first decade, but over 2.2 million apps are available. At National Museums Scotland we have not yet tried to capture this proliferation of software, but in a modest way to collect some of the hardware.

We have been collecting portable telephony since the 1990s, part of the broader collections relating to telephony, radio transmission and before that telegraphy; a collection built to show the development of telecommunications technology. The mobile phones are also part of the wider collection in a multi-disciplinary museum, where objects are especially open to multiple interpretations. Science & Technology department have taken the lead in this inter-disciplinary collecting – for example a device used to by health workers during the 2015 Ebola outbreak. Mobiles are of course also relevant to the Museum's departments of Scottish History and Archaeology (in relation to use by refugees on journeys to reach Scotland, for example); Art & Design (with reference to iconic designs of some mobile products); World Cultures (collecting evidence of global impact of mobile technologies, from examples of phones made and sold to a specific African market to fabric patterns based on mobile and IT designs); and even Natural Sciences (in relation to rare earths usage). The devices themselves remain in the care

of the department of Science & Technology but a crucial element in their cataloguing is their context of use as well as design and manufacture which makes them available for interpretation across all Museum departments.

We collect mobile telephones not only because they are significant in terms of hand-held technology and design but also because they have stories – a context of use, intended to illustrate the social, economic as well as technological impact. How, then, to understand their function, to present their human element, while maintaining the integrity of the devices? Of the Museum's current collection of sixty mobile devices, around a quarter have a documented history of use. The iPhones are among them. In October 2017 we were offered a first-generation iPhone from 2007 (T.2017.22.1-2). It was acquired by the donor as a prize in an online competition, and shipped to Scotland from the US, arriving just before the first iPhone was launched on the European market, which must make it a contender to be one of the earliest examples in the country. That it was acquired online seems fitting for a device heralded by Apple as a 'breakthrough Internet communications device' (Apple, Inc. 2007). It was an attractive acquisition for the Museum as the donor still had its original packaging though the device itself had clearly been used.

We already had by this time two examples in the collection. The first, a 3G model from 2008 was offered by Mike Dailly of YoYo Games in 2013 in his capacity as a videogame designer, as part of our initiative to represent Scotland's – and specifically Dundee's – leading role in the development of gaming. He had not considered it as a piece of historical interest, in comparison to the older equipment he was offering – which highlights not only the museum-bygone association but also that even users and designers consider potentially collectable material mundane. But what interested us was how he had used it: to write gaming programs for a Scottish-based company, including Apple's number one free title of 2011, *Simply Solitaire*. The donor has a long involvement in some of the key titles to emerge from the Dundee

gaming industry, providing an opening into an appealing and perhaps unexpected Scottish story, rooted in Scotland's 'Silicon Glen' microchip and computer manufacture of the late twentieth century, through a device very familiar to many. (However, the difficulties we alluded to above loom large: we collected neither the code nor the software for *Simply Solitaire*.)

We did deploy strategy as well as relying on serendipity in collecting iPhones. In 2015, while planning our new Science & Technology galleries in the National Museum of Scotland, we approached the photojournalist David Guttenfelder to help us populate a section of the history of telecommunications display on the growing trend in social media communication using images. This was to bring up-to-date a gallery strand on the history of sending images 'down the wire', with specific reference to news gathering. Guttenfelder is a professional photographer, a regular contributor to *National Geographic*; which nicely connected him to our existing holdings relating to Alexander Graham Bell, second president of the National Geographic Society.

Guttenfelder is best-known for his commissioned work in conflict zones, for which he uses professional camera equipment; but he was also an early adopter and keen advocate of the online photo-sharing platform Instagram, using only mobile phone shots, and he now has over a million followers (Guttenfelder 2017). He agreed to donate the iPhone 3GS, a device released by Apple in 2009, that he had used for this purpose until in 2012. Guttenfelder sees Instagram as a new visual language, one that democratises the production and consumption of photography. Acquiring this mobile enabled us to feature a shift in social media to communicating using images rather than words, through the work of an established photojournalist.

This case then illustrates the advantage of a contemporary acquisition – we simply asked a living user, who generously donated the device, and provided context of use by email and online material. But it also illustrates some difficulties. The immediate and most time-consuming issue was first of all

identifying someone we could approach to donate, a search which took over a year and the serendipity of a chance mention of the quest at a conference where a delegate made the introduction. But another challenge soon followed. Displaying the phone without his images would not distinguish this phone from many others. However, to meet copyright requirements meant seeking permission to reproduce one of his Instagram posts for which the fee was sizeable (if not insurmountable) – a useful reminder that collecting donated artefacts does not make them cost-free, particularly in relation to interpretation. That these images, in their millions, are freely viewable, does not make them freely useable for these purposes.

Collecting contemporary mobile telephony, then, illustrates not only the mundane but also IPR and immateriality. Acquiring the 3GS prompted us to consider the durability of platforms and the way we represent social media in our collections; in this case, for the time being, via a simple combination of hardware and image – which we keep in digital form and display on a screen in the new *Communicate* gallery in the National Museum of Scotland in 2016. In collaboration with a donor we were able to collect a simple (mostly) device with accompanying media to connect it to the experience of our current audiences, and record a particular media moment for future users. We will watch carefully as Apple begin to move away from iPhones towards augmented reality devices. But this begs the question: how many iPhones do we need in our collection?

Organs

Too often museum scholarship and practice relating to physical sciences and technology is undertaken separately from that relating to biomedicine; and yet these areas have much in common, and often sit side by side in collections (for a conceptual approach combining 'ways of knowing' across STM, see Pickstone 2000). In the development of the new galleries, with the support of the Wellcome Trust, we set out to weave biomedicine through the galleries, not only Science & Technology but also Art & Design

(in the latter with limited success – see Alberti et al. 2017). Next to *Communicate,* the *Technology by Design* gallery, for example, displays bicycles with wheelchairs and prosthetics.

But our focus now will be on the gallery above, *Enquire*, in which are juxtaposed historical and contemporary artefacts from a range of physical and medical sciences. We move now from technology to anatomy, and reflect on our experiences of collecting the material culture of recent biomedicine. Here we encountered the challenges of size, immateriality, inscrutability, and 'unfinishedness'; but we took advantage of the opportunity to work directly with users and practitioners, to develop rounded narratives, and to collect representations – that is, models and images of phenomena that are difficult to collect.

Although collecting and exhibiting in medicine began rather later than technology for the national museum, in the new galleries we wanted to capture Scotland's biomedical heritage, considered to be especially rich. We included pharmaceutical material; an updatable case dedicated in the first instance on opening in 2016 to issues of current importance displaying Ebola related material; and content related to genetics (which connected with our most famous artefact, the taxidermied remains of Dolly the Sheep). We focussed where we could on patient experience and patient stories. One example of mundane collecting was the inhaler spacer we acquired while working with people who live with asthma to collect their stories and to understand the material culture that is important to them.

Another story we wanted to tell was of the Lothian Birth Cohort (Deary et al. 2007), the world's longest running study of cognition and aging, drawing on intelligence tests which were given to all 11-year olds in Scotland in 1932 and 1947. The study revisits some of the same participants to compare their scores and abilities in childhood and later life. Our question was how to represent this enterprise in the gallery; and we also wanted objects to display which would illustrate the current state of medical imaging. This has been an area of rapid development over the last 45 years, with a significant impact on people's lives.

However, the artefacts most closely associated with contemporary progress in this field tend to be large scanners, intangible programming or digital images. We searched for tangible artefacts which could visually contribute to this story.

Our answer involved the brain scans undertaken recently on a selection of the participants: one, John Scott, was willing to let us use the resulting data. We had been inspired by the 3D printed model of the white matter of a brain, 75 cm across and printed in eight pieces, commissioned and exhibited at the *Your Brain* exhibition from 2014 in the Franklin Institute in Philadelphia (Das 2014). The 'Brain Work' project by the artist Katherine Dowson, formerly on display at Wellcome Collection (2012) and Science Gallery Dublin (2015–16), and Angela Palmer's *Brain of the Artist* displayed at the Scottish National Portrait Gallery in 2014 were also pertinent (Dublin Science Gallery 2016). More recent comparators are the 3D scans displayed as part of the Oxford University Museum of Natural History's *Brain Diaries* exhibition (2017–18).

We too set about rendering John's brain in three dimensions. The external physical form of his brain was reproduced in standard 3D printing (T.2016.1), but the white matter image, acquired using diffusion tensor Magnetic Resonance Imaging, proved more challenging (Alexander et al. 2007). This medical imaging technique detects the motion of water molecules as they diffuse, and uses this to map the neural structure and connections in the brain. However, 3D printers are unable to cope with the fine detail needed at life size, and neither we, nor the researchers, wanted to reduce the data to a cruder generic outline because of technical limitations. For us the solution was to approach Laser Crystal Inc., a company which carries out custom laser etching into glass blocks. Because of limitations on the size of block they could etch into we divided the brain into two halves and had it reproduced at 85% life size. Seeing these etched models gave Scott new insight into the research he had participated in, and the researchers saw their data afresh, realising for the first time that Scott's brain stem was off centre – a

harmless asymmetry (University of Edinburgh 2016). The research group were inspired to commission their own pair of these etchings to use in outreach – evidence of unusual genuine knowledge *transfer* between museums and researchers.

Our display is thereby intended to tell a double story: as well as portraying the technical capabilities of brain imaging, it shows a particular research project which uses this imaging. And as well as being an accurate representation of the capabilities of this imaging, the glass blocks are beautiful objects. In this instance there was little interplay between science and art curators, but in principle this is the kind of collecting activity that has strong art and science parallels and lends itself well to inter-disciplinary collaboration. It was an especially important consideration to have aesthetically pleasing objects within what can be perceived as a difficult subject – medical science – as a way of drawing in some resistant portions of our audience. Furthermore, the acquisition process was unusual for us, because we actively participated in their inception and design, rather than collecting from existing material or simply commissioning a maker. We hope that they will retain their interest as well as the historic medical models in our collection have. Glass is a material with excellent long-term preservation prospects, whereas the plastic 3D printed model of the physical shape of the brain is at more risk of degradation.

Neither our collections nor biotechnical research in Scotland is limited to humans. One of the smallest and perhaps least assuming acquisitions we made for the new galleries was the product of laboratory work intended to benefit humans, but which is itself of animal origins. T.2015.135 is a microscope slide including a mounted mouse kidney. Grown from stem cells from a mouse embryo, it is only 3 mm across. It was made by experimental anatomist Jamie A. Davies and renal biochemist Melanie Lawrence at the University of Edinburgh Integrative Physiology Laboratory in 2015 (Davies et al. 2014), with the potential to support pharmacological research. The investigators – to whom we were introduced by 3D

printing researchers –grew this kidney specifically for the Museum, and altered their usual techniques by using silver stain on it, which has better longer-term survival prospects.

This kidney was collected for immediate display in *Explore*, part of the story of drug invention and testing. Our aspiration was to show current research, which may have major consequences for future health care and fit in with a wider story about the science behind pharmaceuticals. Much development work is needed before such kidneys might revolutionise organ transplants, but lab-grown kidneys have strong potential to be used in mass testing potential drug candidates to see if they cause kidney damage. This would reduce the animal testing needed, and give results relevant to human physiology. If the aspirations for this technology are fulfilled, the significance of this small acquisition will be greatly enhanced. Given its size, physicality and ephemerality, it would probably not have been possible to have acquired it retrospectively if hindsight confirmed its importance.

The kidney could be supplemented by later developments if the technology proves successful; in which case T.2015.135 may become a treasure of the collections. Alternatively, it may represent a technological dead-end. (Arguably, this could be said of Dolly the Sheep – adult cell cloning has not developed in the way many anticipated it would in 1996.) Like gallerists judging the significance of contemporary artwork, with this and other acquisitions from unfinished STM research we collect in hope as well as to engage audiences today. In any case, this unprepossessing bio-artefact allows us to tell the story of big pharma on a small scale. We were able to capture some human elements of the story, too, for example about the 'Pretty in Pink' nail varnish used to frame the slide. 'When one day we ran out of the proper stuff and needed something in a hurry,' Jamie Davies explained via email to our colleague Sophie Goggins on November 12, 2015, 'someone suggested nail varnish, so we dashed out to South Bridge and bought the cheapest we could find. It worked so well we have been using it ever

since.' This colour has now become the standard colour for subsequent versions to maintain material consistency.

Oil platform

Our final example takes us from the minute to the colossal, and represents the end of a technical endeavour rather than the beginning; or so it may seem. The discovery of oil and gas under the North Sea proved to be of great significance to subsequent British history, and to the culture of Scotland in particular (Shepherd 2015). More than 40 billion barrels of oil equivalent (oil and natural gas) have been extracted since the first licenses were granted in 1964. Despite continuing expansion of the demand for oil-derived products, North Sea sources are declining as the remaining reserves become harder to reach. The infrastructure on most existing fields – some 500 installations – is now being decommissioned: a process that will take at least 25 years and cost over £40 billion.

The off-shore hydrocarbon industry has been the subject of heritage attention for some time, especially in Norway (Sandberg and Gjerde 2017); it has also been a source of sponsorship, problematically (Mahony 2017). As a historical and technical phenomenon, offshore oil and gas production from the late 1960s are already represented in the National Museums Scotland technology collection: drill and platform models, for example, as well as samples of North Sea oil. Decommissioning is now a distinct phase in the industry and its material culture; and we are seeking to be pro-active and to take advantage of the profusion of material. The remote and hostile environment of use and the scale of the artefacts are problematic; contrasting with the pocket-sided material culture discussed so far, sources from welcoming domestic and laboratory settings. Even if we do not go to these sites, there are other hazards in the materials, not least the crude oil itself.

Nevertheless, we set about developing the collection on three levels: the decline of the industry; the engineering involved in removing these mega-structures from the North Sea; and – perhaps most importantly – the people who work in these alien environments (Cox 2016). For the 2016 gallery *Energise* the items we therefore acquired for display include the original driller's console from the Murchison oil platform from its operating body Canadian Natural Resources International (UK) Limited (one corporate manifestation of the internationalism of STM). The Murchison field, discovered in 1975, and extracted since 1980, is in the Northern North Sea in the East Shetland Basin in the UK Continental Shelf. The Murchison platform ceased operation in 2014 and was removed in 2017. Since operations ceased we acquired a number of other items: among them – after rigorous risk assessments – was a sample of the last crude to come off Murchison.

The crude sample was displayed in a temporary exhibition in the National Museum of Scotland, *Age of Oil* (Cox and Taubman 2017) which included a selection of artefacts relating to decommissioning supporting the artwork of Sue Jane Taylor. Taylor has been depicting the oil and gas industry for decades, including the memorial in Aberdeen to those killed on the Piper Alpha platform disaster. She spends time offshore, including on the Murchison platform as it ceased to operate. Taylor was able to help us access material from an industry sensitive to reputational risk, as well as sourcing oral and video supporting information.

Taylor was also instrumental in securing for us one of our largest acquisitions in recent years. Given that collecting an entire 'rig' would have been difficult, we intended as part of *Age of Oil* to display the flare tip from the Murchison platform. When crude oil is extracted raw natural gas is also brought to the surface at the same time. This is often burnt off as unusable or waste gas. A gas flare is used to burn off flammable gas to reduce the danger of over-pressuring equipment. This flare tip was installed in 1982, replacing the original tip which had deteriorated swiftly given the initial intensity of the flare. The flare

tip is emblematic of oil rigs, but usually viewed as a tiny protuberance on the iconic photograph of a platform. Originally mounted on a 90-metre diagonal scaffold, this tip is a 3.5 m, 800 kg section and proved too large for *Age of Oil*. Unable to acquire the whole platform, we secured this synecdoche, a part to represent the whole. (Similar efforts are underway at the time of writing in astrophysics collections to represent the massive LIGO instruments with segments such as beam splitters.)

Taylor helped us to arrange for the crucial transfer of associated video, oral history, images and logbook entries recording the operation of the flare, as well as footage of the highly symbolic act of its final ignition. The flare tip, meanwhile, travelled with other elements that had been removed to a scrapyard in north east Scotland, where National Museums Scotland staff inspected it (one likened the site to an oil-rig graveyard). They were helped of Roy Aspden, Canadian Natural's Decommissioning Projects Manager, whose support was crucial, given the realisable value of this nickel-chromium based superalloy; most of the platform was scrapped in Norway, so special effort had to be made by Canadian Natural's to repatriate the flare tip to Scotland, at some cost. This illustrates the importance of both good relationships with companies and often an influential individual within a corporation who sees the value in preserving material and can make that happen. Aspden had been inspired to support the heritage retention of elements of the industry after a visit to Stavanger in Norway, where oil decommissioned platform remnants are embedded in the city's physical infrastructure.

In November 2017, the flare tip arrived by flatbed truck at our National Museums Collection Centre (Robertson 2017). It may have been a gift, but there are resource implications in moving such massive artefacts around; and in preparing it for potential display. While we will ensure no hazards are present, it will otherwise retain the scars of decades of flaring – its own patina of use – and we have commissioned a stand so that it can be exhibited. We are alert to any opportunities for display, but in the meantime the flare tip and its accompanying media form an important research resource (in

principle) and a feature of tours of the facility (in practice). In either space it is intended to provide a powerful experience of the scale of the industry and continues our collecting practice for macro-industrial technology of securing the interface between human and industry (compare for example power plant control consoles). And we continue to collect in the broad area of energy; not only hydrocarbons but also renewables.

Opportunities

We have presented these examples not so much to illustrate the challenges of contemporary STM collecting but rather to highlight the opportunities these practices and products afford. There will always be a mix of strategy and serendipity, we have shown; but to an extent we can engineer our own luck. By way of concluding this piece we present our thoughts on the ways we collect, engage, and tell stories.

Ways of collecting

We should acknowledge at this stage that the majority of acquisitions are responsive (Kavanagh 2014; Szczepanski 2017). But for those museums with the luxury of time and other resource it pays to be pro-active when thinking about contemporary material. Museums can build sustainable relationships with STM practitioner groups, just as they do with source communities in other areas. At National Museums Scotland our investment in relationship management with the Integrative Physiology group and with Canadian Natural paid dividends. We were alert to their expectations and drivers as far as possible – ensuring that interpretation was balanced, editorial freedom was maintained, and there was no unrealistic expectation regarding guaranteed display.

For the university sector, in the UK at least, the imperative to evidence impact for the Research Excellence Framework should make the prospect of working with museums attractive to STM researchers. Both private and public sectors are motivated by science engagement, and museums'

capacity to reach a range of audiences including young people makes collaboration appealing. We should note, however, that this is more difficult if we cannot guarantee that something will be on display. In any case, beyond these historically contingent factors, we know that scientists, like other donors, will continue to have a variety of motivations.

Sustained programmes of such 'co-collecting' are evident in social history and ethnographic contexts with a range of communities (Meijer-van Mensch and Tietmeyer 2013; Rhys 2011; Terway 2014). Other STM collections have also worked in this way, as the Science Museum did with astronomers for the International Year of Astronomy in 2009, and with Cameroonian phone salespeople for *Information Age* (Blyth 2015; Boyle 2016; Bunning et al. 2015; Science Museum Group 2017) – an approach we echoed on a different scale in our work with Bangladeshi Telephone Ladies. The contemporary context allows us to make selections in collaboration. Instead of the museum professional visiting a site and making the selection, as one might at an auction, we can work with STM practitioners and users to collect at the intersection of what they and we consider important and feasible.

And if said items are still in use, we sustain the practice of 'Post-it note' collecting; identifying equipment still in use with a request to alert us when it is replaced or obsolete (Pantalony 2015). This is already an established practice in science collections: for example, apparatus in National Museums Scotland bears a plaque from the Photogrammetric Society identifying the instrument as of historical interest, with a request to contact the Society before sale or relocation (Burnside 1993). When collecting from an individual, meanwhile, we have explored the option of buying a replacement for the object donated.

A living contemporary community allows us to collaborate long-term, and – crucially – to *listen*. The same is true of users as it is of makers. Carefully managed, there are opportunities to work with museum audiences, on-site and online, to collect technologies with particular meanings, and enrich our

understanding of them once in the collection – via tagging collection databases, or crowdsourcing information (Rounce 2014). As part of their *Memories are Made in the Kitchen* initiative, for example, the Canada Science and Technology Museums Corporation (now Ingenium) asked their visitors to select domestic technologies that were important to them to collect for 'future research' (although this was not without its challenges, see Adamek 2017). Our colleagues at Ingenium plan further inventive contemporary collecting.

Relationships with communities and the STM sectors also enables rich supporting contextual material to be collected, such as the videos that accompany the flare tip. With living donors and users, documents and testimony can in principle be generated, from software to kitchen gadgets (Boyle and Hagmann 2017; Terway 2014). And as the brain scan materialization showed, working with contemporary practitioners and users/patients provides the opportunity to fashion bespoke artefacts or models thereof – commissioning is not the exclusive preserve of the art gallery.

The brain is one example from a range of *representations* of contemporary STM as opposed to the objects themselves (real brains are famously difficult to preserve and display). Models, images, films and scans of artefacts that are too large, dangerous, or otherwise unfeasible to collect, can be collected by proxy. Representations like the brain scans can be generated to order; or, like the flare tip, a slice or part of the whole can be collected. Like many of these ways of collecting, these practices are not particular to STM nor are they new (see for example Brenna et al. 2018) – but we mention these contemporary recording and commissioning because they are ways of overcoming the challenges we began this article by outlining.

Ways of engaging

When deploying these and more object-based modes of collecting, we are always mindful of the potential use of contemporary STM, whether for events, display or research; but in the examples

presented here, the acquisition or engagement pathway was refreshingly direct. We have argued here that interpreting the contemporary is enriched by collecting the contemporary. Our evaluation of activities leading up to and based on the new galleries at the National Museum of Scotland showed that family audiences for example enjoyed seeing recent material on display, especially when presented as part of the development of a technology over time (Robertson et al. 2017).

Part of this appeal is the relevance of the new acquisitions to users (Simon 2016). At the Science History Institute, for example, in the exhibition *Second Skin: The Science of Stretch* the technicalities of material science were rendered engaging using everyday items such as a newly-acquired 'Jogbra' (Science History Institute 2016). An iPhone may be mundane, but it is recognizable – even surprising to be in a museum (Alberti 2017) – and can act as an access point to the more obscure artefacts around it.

For those institutions that are cracking the nut of digital collecting, software in general and videogames in particular attract audiences that might not otherwise engage with STM museums. One established instance is the Smithsonian's Cooper-Hewitt, National Design Museum, which collected an iPad music app and source code in 2013. An active app, it is kept updated by its online users, thereby blurring the distinction between the importance of preservation and significance of use (Shelly 2013).

The potential relevance of STM extends beyond familiarity to provocation and controversy (Cameron and Kelly 2010; Kavanagh 2014; Yaneva et al. 2009). Contemporary artefacts such as those detailed here can materialize current debates around animal testing and fossil fuels, for example. Even while looking for a trusted, authoritative voice, we know museum visitors are stimulated by debate (Mazda 2004). In principle this has the capacity to enhance science literacy and even decision-making (Hine and Medvecky 2015); certainly contemporary artefacts can stimulate dialogue around social, political, environmental aspects of STM.

Contemporary acquisitions can demystify as well as provoke. Juxtaposing the familiar with the obscure is a tried and tested technique; at the National Museum of Scotland next to Dolly the Sheep we display an Affymetrix GeneChip Hybridisation Oven 640 to introduce the Human Genome Project. Our intention with this, as with the mouse kidney, is to render concrete and immediate those concepts and enterprises that may otherwise have been obscure and remote.

Ways of telling stories

'The curator of contemporary technology,' argue Suzanne Fischer and Steven Lubar, 'has to choose carefully, document wisely, and collect contextually' (Fischer and Lubar 2014, 377). What these ways of collecting and engaging reveal is not the particularity of STM, however, but rather how much these collections have in common with other museums. STM merges and blends and overlaps with ethnographic, social history, artistic and other forms of collecting. A focus on collecting STM in museums rather than STM museums collecting draws our attention to practices at the Victoria and Albert Museum, for example, whether 'Rapid Response Collecting' or displaying the remains of the ritually destroyed laptop used by whistle-blower Edward Snowden (Higgitt 2015). In all cases *we collect to tell stories* (Lubar 2017; Macdonald and Morgan forthcoming; O'Neill 2007) – it just so happens that these stories are about a group of activities that have particular status in contemporary society.

And as John Durant (2017) reminds us, the stories we can tell about science and society will be poorer without objects. With physical black boxes we can unpack the figurative back box of STM. We can provide process narratives as well as accounts of STM products, telling the stories of science-in-the-making with contemporary things. Science is messy, contingent, human and *social*. Its tools and artefacts bring concealed and social processes into view, the accompanying testimony and context reveal the humanity behind research and development – the nail varnish on the mouse kidney slide we

mentioned above; the Human Genome Project researchers naming their sequencing decks – now in the MIT Museum collection – after subway stops (Durant 2017).

Crucially, these stories need not be limited to great discoveries – nor to innovation at all. Contemporary material can be used to develop narratives of experience, of impact, of maintenance, and of use in different and deeper ways than older collections. We can access the operational lives of instruments and other machines, for example; or patient stories of medical technology. By collecting contemporary STM, then, the mundane and general can be rendered interesting and particular; the incomprehensible can be rendered comprehensible; and the universal rendered specific and human.

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