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Title: A Brain worth Keeping? – Waste, Value and Time in contemporary brain banking

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Abstract:

If a temporal rather than spatial concept of waste is adopted, novel categories emerge which are useful for identifying and understanding logics of temporality at play in determining what is kept in contemporary brain banks, and reveal that brain banks are constituted by more than stored materials. First, I apply the categories analytically on a recent UK brain banking discussion among professionals. This analysis highlights the importance of data in brain banks, as well as the centrality of ideas about pasts and futures in the discussions. Secondly, I investigate the case of a seven decades old, Danish brain bank which had been reduced to its physically stored material for 24 years, before being reinstated in 2006. This case demonstrates the importance of material and conceptual infrastructures that co-constitute a collection, as they make up an experimental system that is crucial to maintaining the collection's continued relevance and usefulness as a scientific institution.

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1. Introduction

What makes a brain worth keeping in a collection? Are there limits as to how many brains we should keep – for how long? When is a brain no longer worth keeping? And why does it lose its value? Might it regain value, once lost, if kept long enough? Are we keeping it for the sake of the past or the future? What makes the collection itself valuable, and is it more than the sum of its collected parts? When is a collection useful, and when does it become obsolete?

The scope of this article is to demonstrate how a temporal concept of *waste* may be used analytically to better understand the temporalities at play in contemporary brain banking. By temporalities I mean the ways in which ideas about pasts and futures subtly structure practices and discourses, and how in turn collection practices inform the future as they (re)construct the past and present.

Recent decades has seen a rise in historical and social studies of the neurosciences (e.g. Rees, 2016; Lock, 2015; Rose & Abi-Rached, 2013; Martin, 2013; Stahnisch, 2014, 2003; Anderson, 2008; Borck, 2009, 2005; Dumit, 2004; Gere, 2004; Beaulieu, 2004, 2001). Most of these have, with good reason, focused on the cognitive neurosciences¹ and neuroimaging, which are and have been the most prominent kinds of neuro research since at least the 1990's. I enjoy and am inspired by these authors, but I will not make much use of their work in this article, as my focus is on a very different aspect of the neuro-complex, one that may be better understood through another research tradition. I do hope, however, that this article may also serve to highlight brain collection and the neurosciences affiliated with it as an understudied field both historically and in the social sciences.

I place this article within the academic study of collections, especially medical collections and museums. This field as well has been developed considerably in recent years by insightful scholars (Hallam, 2016; Knoeff & Zwijnenberg, 2015; Tybjerg, 2015, 2014; Strasser, 2012; Alberti, 2011, 2005; Kohler, 2007; Parry & Gere, 2006b, 2006a), all of which have inspired this article directly or indirectly. Even more

¹ Thanks to reviewer 2 for pointing this out

recently, a very convincing book has shown that archives and the practices surrounding them are central in many sciences across the disciplinary spectrum (Daston, 2017). The neurosciences are no exception.

The article proceeds in three steps. Section 2 introduces the theories that inform my understanding of *waste* and *collection*, which are the concepts that will structure the following analyses. It also presents briefly the materials I have chosen to study in sections 3 and 4 and argues for their usefulness in the scope of this article.

In section 3, the concepts are put to work in an analysis of concerns about *keeping* in a British brain banking context. The aim here is twofold: First, to demonstrate the applicability and usefulness of the concepts introduced in section 2, and second, to tease out some easily overlooked concepts of temporality and their importance in determining waste and value. This is done with a particular view to materials stored *in* brain collections.

Section 4 applies itself to a discussion of the brain collection *itself* as something more than the physically stored material. Specifically it points to the importance of infrastructures and experimental systems that also go into constituting a collection. While doing this, it continues the overall interest in the temporalities at play in brain banking, and in the ways in which *waste* is useful for understanding said temporalities.

2. Theories and case material

Brain banks, I will argue throughout this paper, are explicitly tied in with figurations of pasts and futures through these organising concepts: *waste* and *collection*. In this section I will introduce the key theories and concepts that I make use of in the subsequent case analyses. Section 2.1 introduces a temporal concept of *waste*, as opposed to a merely spatial one. Section 2.2 further explores this concept by defining three analytical types of waste. In section 2.3 present the theories that inform my understanding of *collections* and the collecting sciences, as well as the collectors themselves. Finally, in section 2.4 I argue for my choice of case material.

2.1 Waste as a temporal concept

In a definition that has become commonplace in studies of waste (see Viney, 2015; Thill, 2015; Kennedy, 2007; Waldby & Mitchell, 2006, pt. 2), Mary Douglas has claimed that dirt is “‘matter out of place’ and our attempts to be neat and clean do not relate so much to the things themselves but how we arrange, separate and order our psychophysical environments” (Viney, 2015, p. 1). As such, waste and practices of collecting (selecting what is kept and what is not) can be co-constitutive. Waste is that which is not worth keeping. William Viney complicates Douglas’ spatial understanding of waste and introduces temporality, arguing that “Waste is also (and in both senses of the phrase) matter out of time” (Viney, 2015, p. 2).

Viney argues that ‘waste’ as both verb and noun plays a key role in our temporal understanding of the world. He introduces two distinct temporal categories: *use-time*, the time of useful things:

The uses projected and achieved through [things] inform the limits of their time. In this way, use-time is explicitly future orientated, absorbed in the possibility that I might realize some latent or potential utility, but, in being so, [these things] become committed to a future in which a temporal limit remains an immanent part of their use. [...] Use-time is a time of wearing, emptying, digesting, breaking or exhausting – it is a somewhat entropic time, a time of diminishing potential, a time orientated to and by an end (Viney, 2015, pp. 7–9).

and *waste-time*, an “anachronistic tense, one that commingles pasts and presents and leaves things lingering, loitering and persisting above and beyond the time of its functionality” (Viney, 2015, p. 178). Our lives are fundamentally structured by narrative; an order which naturally assumes an end. However, when things end (when they are no longer a meaningful part of a narrative), they do not disappear, but rather *become* waste, which then has to be disposed of, removed. Waste, as Viney understands it, is “both a material continuity and a temporal discontinuity” (Viney, 2015, p. 29). Waste, then, is matter out of time before it is out of place. Stuff enters the ontological category of waste by being wasted: material and word are co-constitutive, but both depend on temporality.

2.2 Analytic categories of *waste*

In order to better make use of the category in my analyses, I will now divide it into more specific subcategories: *constitutive waste*, *virtual waste*, and *ontological waste*.

They are informed mainly by Catherine Waldby and Robert Mitchell's analyses of the meanings of waste in tissue economies (2006, pt. 2).

Constitutive waste is that kind of destruction which is productive – the kind of waste invoked in saying 'you can't make omelette without breaking eggs'. Waldby and Mitchell understand it as: "waste that is the precondition for producing "the new". [Waste that] is not in and of [itself] valuable but only manifest[s] *potential value*; [it is] waste, in other words, that promise[s] value." (2006, p. 109). The kind of value referred to here is called "biovalue", which "refers not to the stable and known properties of tissues but to the capacity of tissues to lead to new and unexpected forms of value." (2006, p. 108). In biovalue terms, objects are not valuable in and of themselves, but only as medium of monetary or epistemic value. Biovalue exists in many kinds of waste and non-waste material. The defining property of constitutive waste is that *potential* or *promise* which is invoked in favour of constructive destruction.

Virtual waste refers to some imagined loss, present or future. It is a concept picked up from a set of American congressional hearings addressing that innovation was presumably: "going to waste as a result of bureaucratic red tape and illogical government regulations" (Senator Birch Bayh, quoted from: Waldby & Mitchell, 2006, p. 102). This common trope in American ideology can as easily be applied to the value of tissues as to innovation. Virtual waste, it must be specified, "[cannot] be measured directly, of course, and so the specter of the future loss of inventions function[s] as a virtual image" (Waldby & Mitchell, 2006, p. 102).

If virtual and constitutive forms of waste regards the potential that certain objects may or may not hold, ontological waste is of another, perhaps more primary, kind. As we are dealing in this instance with human tissues, some of them may be inscribed with ontological meaning for a subject. This kind of meaning is not covered by the term 'biovalue', but is inherent in the objects themselves. Waldby and

Mitchell observe that “human tissues are more likely to be classified as waste as they lose ontological significance” (2006, p. 84). They are thinking here of such neutral kinds of tissue as hair or nail clippings, or stuff that is outright threatening to the subject’s stability, what has been termed ‘the abject’: faeces, puss, and cancerous cells. Such materials must be disposed of, lest the person itself wastes away. What Waldby and Mitchell seem less interested in (though not oblivious to), is the temporal changes objects may undergo *pace* Viney, and the possibility that ontologically significant tissues may *become* waste, given enough time: “waste is every object, plus time” (Thill, 2015, p. 8).

2.3 Collecting sciences: Finders and keepers

A collection, according to John Elsner and Roger Cardinal, “is the unique bastion against the deluge of time” (Elsner & Cardinal, 1994, p. 1). While this may be true of personal collections and some (older) museums, it certainly is not so for medico-scientific research collections; they seem rather to be vehicles for change. Recently, Bruno Strasser (2012) and Karin Tybjerg (2014, 2015), have argued for a revision of the standard narrative in the history of biology and medicine, respectively, in which experimentalism and the laboratory revolution has been considered the main causes behind scientific development since the late nineteenth century. Strasser and Tybjerg argue on the basis of different historical and contemporary cases that collections (be they natural history collections, medical museums, or modern biobanks) as well as their related “ways of knowing” (see Pickstone, 2000), collecting and comparing, have played much larger roles in the recent histories of these sciences than they are usually ascribed.

Robert Kohler (2007) has made a useful distinction between scientists that are “finders” and those that are “keepers”. Though Kohler equates all collecting scientists with keepers (Kohler, 2007, p. 432), I borrow his vocabulary to distinguish between two ideal types of brain collectors. Kohler’s distinction rests on the value of the collected objects: whether they have an “intrinsic value as objects”, or “they are simply unprocessed data, and in yielding up those data they are *used up*” (Kohler, 2007, p. 432. My cursive). Note that Kohler’s distinction fits naturally with Viney’s vocabulary of use and waste. *Finders*, in my analysis, will be those actors that see

primarily the use-time of an object, or for whom the most immediate form of waste is *constitutive waste* or, as Waldby and Mitchell defined it, destruction for the sake of (scientific) progress. For finders, collections that are not in use will most often constitute an unproductive kind of waste: waste of time, resources, and such like. *Keepers*, on the other hand, will be those actors that focus on the *virtual waste* (i.e. those insights that might be lost in the destruction of objects) or who consider collections part of a rich heritage, as necessary elements in an unfolding narrative, and oppose destruction of collected materials as a form of *ontological waste* to be avoided for its own sake.

If Kohler's vocabulary is useful in distinguishing different types of collectors, the conceptual work by Cathy Gere and Bronwyn Parry is helpful in parsing out different types of objects: "information-containing objects, resplendent in all their three-dimensional uniqueness, and information-bearing surfaces, transmissible in all their two-dimensional replicability" (Parry & Gere, 2006b, p. 47). The idea is that certain sciences gather knowledge by making objects readable, but what results from this making-legible is often the destruction of the original object, and with it all the other unrealised potential information it might still contain. This complicates the determination of value in objects, and raises the possibility that using an object *now* may hinder scientific insights *in the future*. Negotiating this chiasm between present and future, brain collectors and researchers have to make daily choices based on their view of the probable value of virtual and constitutive waste forms. Which brain best serves its purpose now, as constitutive of a new research object which may yield important insights; rather than in the future, preserved until neuroscientific research methods have made possible yet unimagined means of analysis? Connecting this pair of concepts with Kohler's, keepers will deem information-containing objects more valuable, whereas finders will try to produce as many information-bearing surfaces as possible. For more examples of the difficulties connected with preserving for the future and using for the present in scientific practice, see (Daston, 2017).

2.4 Choice of material

The material I have chosen in my case analyses (sections 3 and 4) reflects primarily the perspectives and concerns of the brain bankers themselves. Other scholars (Hoeyer,

2013, 2010; Svendsen & Koch, 2008; Eatough, Shaw, & Lees, 2012; Anderson, 2008; Waldby & Mitchell, 2006; Parry & Gere, 2006a) have given insightful attention to how human tissues are collected and traded through staggering networks, and have parsed out the multitude of interests in such affairs, be they concerns of governance, researchers, or next of kin; ethical, personal, practical, scientific, or political. They all, in some way or other, pay attention to the ways in which determining human body parts as *waste* play a significant role in facilitating these exchanges. The scope of this article is, as stated in the introduction, to investigate how a temporal concept of waste may be used to analyse the temporalities of brain collections; thus its focus is primarily on *kept* or *stored* material rather than on donations, exchanges, and fluctuations. Therefore, I have chosen two cases centred on those who store brains.

In section 3, I study a Wellcome Witness Seminar entitled “The development of brain banks in the UK c.1970-c.2010” (Overy & Tansey, 2015). The Wellcome Witness Seminars are described on their web-page as events where “significant figures in twentieth-century medicine are invited to discuss specific discoveries or events in recent medical history” (“Wellcome Witnesses Volumes | The History of Modern Biomedicine,” n.d.). The discussions are chaired by a “witness” and subsequently transcribed by historians who are present during but do not participate in the discussion. This format excludes many voices from the debates (e.g. patients’ interest groups, politicians, donors), but it does give participants a sense of belonging to a common community: in this case all invitees were either researchers or managers at UK based brain banks. This in turn gives room to these actors to delve into more esoteric concerns, and touch on themes and controversies that might not feature in public discussions involving outside perspectives. Because the participants all belong to the same group, they feel comfortable discussing ethically and politically difficult aspects of their practice, and are able to stay with specific and technical issues which would be swiftly dismissed in other settings. The material is also useful because it brings together actors from different collections and different areas of research in a single sitting, making it possible to identify shared concepts and assumptions across the field.

In section 4, I turn my attention to a single Danish brain bank and its daily manager. The studied material in this section is of a different kind, mainly because the collection in question is the subject of my active PhD-project. I have in that connection developed a relationship with personnel at the bank, especially its daily manager, Karl-Anton Dorph-Petersen MD, PhD. We have met frequently during the course of my PhD in the context of working together, for example by conducting a public symposium on the history and current status of the brain bank, and by co-writing a bibliography and meta-analysis of the bank's research output – work that is still in progress. His thoughts on managing a brain bank have naturally entered into our conversations on many occasions, and he has read and commented on earlier drafts of this article.. His observations and concerns are at the centre of section 4. Because of the frequency and nature of our meetings, the information gathered from him does not fit the pattern of a formal interview. Some of it is from conversation, some from email correspondence. Dorph-Petersen has reviewed and accepted the sections in which he is paraphrased or quoted. In addition to the insights gained from this contact, I draw in my own knowledge of the history of the collection, which spans seven decades, as well as some public debates surrounding it. Though such an approach presents only a view of a single brain bank, by coupling it with recent work on bio banking in general and with the concept of experimental systems, the particular concerns regarding this collection become indicative of some general characteristics of brain banking.

3. Valuable waste? – finding and keeping

In this section I will show how a temporal understanding waste, along with the ideal types of *finders* and *keepers* can usefully be applied to discussions about contemporary British brain banking. I show how the analytical categories highlight otherwise easily overlooked concepts of temporality. The aim is primarily to test the applicability of the conceptual tools, and to bring attention to the temporal logics that structure internal debates in the field of brain banking.

Though the discussions repeatedly return to issues of donation and exchange of material, I have focused my analysis in section 3.1 on those passages where

temporalities of *keeping* are central to the arguments in line with the overall scope of the paper with its focus on kept material. It turns out that disputes about what to keep revolve around the equally contentious definition of *value* in research material, which is the focus of section 3.2.

3.1 Wasting the future or keeping the past?

Quite early in the discussion, we see two of the brain bankers taking opposite positions with regard to the temporal criteria for accepting donations. Dr. Djordje Gveric, manager of the MS and Parkinson's Tissue Bank at Imperial College, worries that he and his team "have far too many brains for our own capacity" (Gveric in: Overy & Tansey, 2015, p. 41), and he wonders how appropriate it would be to turn away tissue donations based on their likely lack of usefulness. He mentions patients who have been registered as donors *initially* because their symptoms were relevant to research at the institution, but who "are *becoming* cases that are not really interesting to researchers" (Gveric in: Overy & Tansey, 2015, p. 42. My cursive)². Note that the use-time of diminishing potentiality is central to this argument.

This view, that brains should be turned away according to their loss of usefulness is opposed by Professor Margaret Esiri, an Emeritus neuropathologist at Oxford, who counters: "I think it can be difficult to predict what people are going to be interested in [... and] it's hard to predict exactly what could be valuable in the future" (Esiri in: Overy & Tansey, 2015, p. 43) She mentions her own research on Alzheimer's and multiple sclerosis in which she uses brain tissue that is usually 'low priority'. Esiri is a clear exponent for the 'keeper' approach. She pleads for maintaining collections of a wide variety of brain types, pathological and otherwise, in case they become 'valuable in the future' – it might be a waste to throw them away. Gveric, on the other hand, is clearly of the 'finder'-opinion that collected tissues should be used, and even notes the temporal limit of usefulness, as cases are 'becoming less interesting' as they age. They 'waste' whatever biovalue might have been present in the tissue at an earlier stage (this is of course a most happy form of waste, as it means

² The issue is specific to multiple sclerosis, in which the pathology is most easily observed in younger brains as the disease gradually 'destroys' its own lesions, leaving 'blanks' which tell very little of the aetiology or pathogenesis.

patients live much longer than expected). But at the same time he has ethical qualms over turning donors away:

Gveric: It's just about people who were registered at some point and who have lived happily for about 20 years, occasionally ask: 'I'm in my seventies now or eighties; am I really useful to you as a donor?'

Shaw³: And do you feel able to say 'no'?

Gveric: No, I don't feel able to say 'no'. You have to really judge the character over the phone and say: 'How do you feel about it?' and then it's a discussion. We have quite a few of these cases.

Shaw: We have enquiries in the same way but we are able to say 'no' in a nice way. It's explaining to people that actually it's not going to be valuable for research.

Gveric: It's more about the actual active approach, not just waiting for people to come into you, because we probably have more than 10,000 people on the donor scheme. Out of those 10,000 I'd say maybe 2,000 really shouldn't be on the donor scheme for all sorts of reasons.

Shaw: But you could, even at the time of death, say to the relatives, 'Actually...'

Gveric: It's very, very difficult. It's very difficult because then it's the lasting gift.

Shaw: I know, and you're disappointing them. Yes, I understand.

(Overy & Tansey, 2015, p. 43)

This opens up the issue of meaning for the donors' personal integrity. The last will of the deceased must of course be honoured, or it may be traumatic for their next of kin, even if this means 'wasting' resources on keeping material that is not useful for research. There is a double responsibility at work, and a double ontology in which 'waste' for Gveric cannot be considered 'waste' for donors and next of kin, and it would be disrespectful to even raise the issue after the time of death. Professor Seth Love, Director of the South West Dementia Brain Bank, Director of the UK Brain Banks Network and President of the British Neuropathological Society, seconds this stance, saying "if people have registered with brain banks and they've been on the donor register for several years it would be wrong not to accept their brains" (Love in: Overy & Tansey, 2015, p. 45).

³ Ms Karen Shaw is research/ brain donation nurse at the Queen Square Brain Bank for Neurological Disorders at UCL Institute of Neurology.

Professor Paul Francis, Director of Brains for Dementia Research and member of the MRC UK Brain Banks steering committee, operates by a different, perhaps more pragmatic, ethical codex:

It would be unethical for us to keep brains in our collection that are never going to be used [and the public needs to be made aware] that we will then dispose of the tissue if it is not being used or it's not being requested, I think that's something that we've got to move to: that we're not going to keep these collections forever; people understand that they will have – I don't want to use the phrase in the way that it's used in a supermarket – a shelf life; these brains will be in the bank for a certain amount of time and then they will be replaced by other brains. (Francis in: Overy & Tansey, 2015, pp. 44–45)

Again, as with Gveric, *time* is key in Francis' idea of wasting space and resources on what is to him essentially waste material. His is an understanding of waste as fundamentally temporal as Viney also suggested. Even though he denies the supermarket metaphor, it plays out not only in the limited shelf life of the brains, but also in the use of the word 'requested' – there is a supply-demand logic here, which plays badly with the 'keeper' frame of mind in which demand does not have primacy. Even though Francis and Esiri both agree that demands may change, they posit opposite solutions, supported by different temporal attitudes. Esiri is focused on storing material for the future as they may yet gain usefulness and thus still hold some potential, whereas for Francis unused materials are simply remnants of a past that has outlived itself, they have definitively lost their usefulness and entered waste-time.

Esiri is one of the only exponents for the 'keeper' approach of safeguarding objects for the future. It seems that many of the other discussants connect *usage* with *value*. Gveric states that the public will become more interested in brain banking if “there's something coming out of it, something valuable” (Gveric in: Overy & Tansey, 2015, p. 62); Love is calling for more interdisciplinary uses to “maximise the value of the tissue that we have” (Love in: Overy & Tansey, 2015, p. 64), and Professor David Mann, coordinator of the Manchester Alzheimer's Disease Research Centre, sums up the discussion nicely:

I thought it was really important to document that we're not just setting up a network that acquires, but we're also setting up a network which utilizes, so that the rate of utilization at least matches or

outweighs the rate of acquisition; that we're just not stamp collecting, because that's always the danger, isn't it – that you feel you're just collecting stamps at the end of the day? (Mann in: Overy & Tansey, 2015, p. 65)

This choice of metaphor is an interesting one, as the hope for stamp collections usually is that they rise in value the longer they are kept, though for Mann clearly value comes from usage. Let us try to unfold this recurring word 'value' which Waldby and Mitchell also identified as a key concept.

3.2 Biovalue in brain collections

Conceptions of biovalue centre on questions about who is producing the value, who is benefitting from it, who it is potentially denied to, what form it takes, what counts as valuable (and who has the right to define it as such). These topics are touched upon several times in the witness seminar. Take for example Professor Hugh Perry, Chair of the MRC Neuroscience and Mental Health Board, who says:

Every day all over the UK there are dozens of neurosurgical units *discarding* bits of human brain tissue. You were saying earlier, David [Mann], how your early studies had benefited from taking tiny samples of fresh human tissues with which you can do all sorts of things that you might not otherwise do. It has always puzzled me that there isn't a part of brain banking which involves the capture of small half-centimetre cubes of post-surgical tissue, which I would have thought *invaluable*. You could learn an enormous amount (Perry in: Overy & Tansey, 2015, p. 73. My cursive)

Being able to 'do all sorts of things' is always of interest to scientists, but the 'enormous amount' of knowledge that is going to waste is obviously imagined in this instance (that is not to say there is no wastage, but as with all virtual waste, it cannot be measured directly). What is deemed invaluable by Perry here is not so much the amount of tissue, though, as it is the *freshness* of it. This is discussed elsewhere in the seminar, by Esiri who complains that the 'death to post mortem' intervals are too long for brain removal:

So the value of the tissue is greatly reduced. I say greatly, there's still a lot you can do with it, but certainly it would be more valuable if we could bring those times down, and there seems to be no understanding of the importance of this. (Esiri in: Overy & Tansey, 2015, p. 50)

Note the key importance of time once again. There seems to be agreement about the cause of these prolonged intervals: bureaucracy (Overy & Tansey, 2015, pp. 50–55).

Mann notes that mortuary staff members, for example, “are quite happy to participate and reduce post mortem times, but they’re hide-bound by Trust bureaucracy” (Man in: Overy & Tansey, 2015, p. 50). Francis seconds, and adds that it is in everyone’s best interest to lower waiting times and raise the quality of the collected brains:

We can engage with GPs and persuade them that this is an important part of eventually helping patients – okay, it will be a generation further on – and the more we find out about research now, in the long term if we can improve and develop new treatments, it’s actually going to reduce the load. [...] The other people, and this is bureaucracy, are the R&D departments and the chief executives who control mortuaries. R&D departments in hospitals or Trusts gladly sign off projects, such as Brains for Dementia Research, and from the lack of communication with other people involved, mortuaries and chief executives, you’d think they weren’t on the same planet. (Francis in: Overy & Tansey, 2015, p. 54)

So as it was with American innovation, important and valuable information is literally wasting away, decaying, because of bureaucratic red tape holding up the smooth flow of tissue.⁴

As the discussion turns to another kind of regulation: intellectual property rights and the relationship with industry, Perry asks: “How do we feel that industry should use our brain banks? Djordje [Gveric], you’ve got an excess of brains; are industry clamouring to use your excess of brains?” (Perry in: Overy & Tansey, 2015, p. 75).⁵ It turns out that Gveric’s brains are much sought after, but not so easy to get to:

The issue is that there’s obviously a line referring to intellectual property in terms and conditions for every single tissue request, saying that they need to inform us of something that might be commercialized, something they might be making profit from, and so on. That’s the real problem: whether someone who is signing the contract in a pharmaceutical company will agree to it. There’s a lot of negotiation and renegotiation going on, obviously very complex if it starts involving the company, Imperial College lawyers, and charity lawyers as well. (Gveric in: Overy & Tansey, 2015, p. 75)

⁴ for a discussion of tissue regulations in the British context, see (Parry, 2005)

⁵ Note in this quote the very explicit ideas about excess, waste, and use

The real issue, though, turns out to be the question of ownership. This is much too big a question to explore here in its entirety⁶. Suffice it to say that donated tissue is placed into the custodianship of the collection in question, and that in principle human tissue cannot be owned (according to British law). This is a problem in for-profit industry, as it is hard to claim intellectual property in non-private materials:

Brayne⁷: The reason they want to own the tissue is that they will then be able to make profit on what they've discovered, is that right?

Jenkinson⁸: It's the specification [from industry] that they actually own the tissue that causes problems because it's a donation.

Brayne: [...] The problem is that the pharmaceutical approach doesn't fit that stewardship on behalf of humankind.

(Overy & Tansey, 2015, p. 77)

There is general agreement that research results should benefit all of humanity, and that this should be the first concern before profits. This rhymes well with something Kohler describes as typical of the 'keepers' of science: that they are more prone to consider their data communal and make it public. For 'finders' "raw data are regarded as private: because, I think, they are in principle unlimited" (Kohler, 2007, p. 449) in contrast to collections with their 'thing-y' materiality, "resplendent in all their three-dimensional uniqueness" (Parry & Gere, 2006b, p. 47).

Perry underscores that the main value of data is not financial but scientific, and that for science to progress, data must be shared and connected. This means both making it publicly accessible, 'legible' in Parry & Gere's terms, and upholding its material specificity, its connection to a particular collected brain:

I think it is a hugely important issue that the data that is collected from any type of analysis from a particular brain comes back to a database relating to that brain; this is the most useful way forward. [...] If all this information came back to a source we would have a richness that would be truly valuable (Perry in: Overy & Tansey, 2015, p. 80).

⁶ but do see (Parry & Gere, 2006a)

⁷ Professor Carol Brayne is professor of Public Health Medicine and Director of the Cambridge Institute of Public Health and the University of Cambridge.

⁸ Dr Joanna Jenkinson is part of the Medical Research Council where she manages the mental health and addiction portfolios.

This quote sums up the different perspectives on value nicely, arguing for a ‘keepers’ approach not only to objects, but also to the data of the finders, making a subtle synthesis between past insights and future ones, turning future knowledge into the facts of the past, which again become foundations of new theories. Data must be found, but not without keepers of both material objects and immaterial information about those objects. Only if kept is it truly valuable. Collections thus, are not only important as reservoirs of empirical material for researchers. They also serve the vital role of scientific archives that facilitate comparisons and meta-studies, guarantee verifiability, and preserve even seemingly irrelevant data in the hopes that it might be of use to future scientists.

4. Wasting the bank? – Problems of inheritance

In section 3, we saw understandings of temporality tied up with ideas about waste, utility and value. Of special concern was the longevity of research material (how long is its “shelf life”? will it become valuable in the future?), the death to post mortem interval and the freshness of tissue (how quickly can decay be stopped?), the ‘becoming-useless’ of cases as patients grow older, and therapeutic hopes for the future.

Most if not all of these concerns are about the tissues *in* the collection and, though temporal in nature, they are tied up in the *now* of acquisition and research. Further, as a necessary consequence of the Witness Seminar format, and because of the different professional affiliations of the discussants, the discussions were mostly concerned with brain banking in general, not with a particular bank or practice.

In this section I will present the case of a single Danish brain bank, which supplements the insights of section 3 in several ways. Studying a single bank makes us able to consider the collection *itself* as an object of interest, not just the tissues in it. This shifts our focus from the temporality of tissues to the timeframe of the bank itself, in this case spanning seven decades. It makes possible a closer look on the

importance of practice in brain banking, and highlights the intricate interplay between material and conceptual work.

First, in 4.1 I present briefly the facts of the case, both historical and contemporary. I also note a dichotomy between two perspectives, one concerned with the singularity of the collected brains, the other with the conglomerated entity of the collection as a whole. I then move on in section 4.2 to discuss a particular predicament of the collection's daily manager, who is having troubles with "inheriting" a collection which has been stripped of its surrounding infrastructures; a predicament which gives evidence to all that makes up a collection besides its materials. This discussion leads me to propose that we distinguish between the use-time of the materials in a tissue bank, and of the bank itself.

4.1 The bank at *Hjernepatologisk Institut*

The Danish bank was instituted in 1945 as a part of the Danish Institute of Brain Pathology (*Hjernepatologisk Institut*, henceforth HPI). It was actively collecting until 1982, when HPI was shut down. The bank collected brains from psychiatric patients dead in hospitals throughout the Danish state. The brains were collected without consent, as was standard practice at the time. The collection holds 9479 specimens.

In 2005 the bank was brought to new life with the proposition of several new research projects involving tissues from the collection. Between 1982 and 2005 the bank had been left without any maintenance or supervision, and was all but forgotten. The new research proposals, however, brought funding and personnel to the collection, and also sparked popular interest.

Especially the practice of collection without consent invited public debate.⁹ One woman, suspecting her deceased sister's brain to be part of the collection, commented: "it seems a tad grotesque that your "heirloom" may have been made into preservative without you knowing" (quote from Hansen, 2005a). Central in this quote is the strange choice of the word "heirloom [arvegods]". The word is

⁹ The ethical debate ran for many months in Danish media and culminated in a hearing in the Danish Ethical Council (Det Ethiske Råd, 2006). This debate is far too extensive for the scope of this article, but will be treated in a future publication.

indicative of the complex metonymical meanings which can be attributed to deceased bodily material (see Tarlow, 2016; and Lawrence, 1998 for two very different, though not opposing, treatments of the subject). It also signifies a focus on the singularity of collected materials, by underlining familial ties and personal narratives.

When this lay perspective is juxtaposed, as it was in the original interview, with that of Professor Raben Rosenberg MD, DMSc, the director of the collection, a dichotomy emerges between the singular object implied by the woman's using such signifiers as "sister", "mother", and "heirloom", and the more abstract conglomerated entity that is the entire collection, implied when Rosenberg refers only to "research material" in his answers, stressing the collection as the object of concern rather than the individual materials in it (Hansen, 2005a, 2005b).

Though not as singularly focused as the Danish woman, the British bankers in section 3 were predominantly concerned with the materials *in* their collections: the quality and characteristics of the material, the relationship to donors, &c. When the issue is collection practices, such concerns must enter into the discussions. The Danish bank, however, invites a different perspective because active collection ended in the 1980s. It can be viewed, in this regard, as a contained entity, stable in its entirety, in contrast to actively collecting banks, which are harder to conceptualise as *objects* because of their continued expansion and alteration.

4.2 Inheriting the bank without infrastructure

Following Rosenberg, we now shift our focus from the individual brain to the entirety of the collection. Strasser (2012) and Tybjerg (2015) have convincingly argued (as noted in section 2.3) that medicine relies as much on collections as it does on laboratories. Further, they both stress the longevity of collection practices in medical research. Strasser underlines, however, that historical similarity is not the same as continuity. Commenting on recent decades' increase in data-driven research, he calls modern databases *analogous* to earlier natural history collections, that is they share "common structure and function", but he is wary of calling them *homologous*, that is of a common descent (Strasser, 2012, pp. 336–337). Considering that modern databases began proliferating only from the 1980s, and that HPI was actively collecting from

1945-1982 this distinction between homology and analogy might hold an important lead.

When discussing an earlier draft of this article with Karl-Anton Dorph-Petersen, the daily manager of the HPI-collection, he mused on the fluidity of the *keeper/ finder* categories. He thought it funny that he had been ‘brought up a finder’, but had seen himself ‘become a keeper’. In other words, he was educated in a system that places great emphasis on experimental practice and on discovering new facts. He had then spent his formative years as a *finder* in an American brain bank, before coming to Risskov in 2006¹⁰ where the work with the HPI-collection required a shift in work ethics and practices, as he spent more and more time on management and maintenance of the collection. (Dorph-Petersen, personal communication 25 Nov 2016)

Continuing on this, he speculated that it is probably easier to start up a new brain bank than to inherit one.. Having done research in modern brain banks before, he was surprised by how much work would be required before even basic research could begin. There are several reasons for this, the main one being a lack of maintenance between 1982 and 2006. When Dorph-Petersen took over the collection, it was in a very sorry state, having been left to itself in remote basement rooms for 24 years. However, other factors also contribute to the difficulties with inheriting a collection.

Established in 1945 as a pathological collection dedicated to histological and gross-anatomical research, the collection in Risskov was in 2006 more akin to – even homologous with – 19th-century medical museums than to modern biobanks. The collection holds paraffin-encased samples, stained histological slices and formaldehyde fixated tissue. Its institutors saw themselves continuing the work of Cajal, Broca, Brodmann and their peers. In order to benefit modern research, this collection had to undergo some updates.

¹⁰ Though the research proposals are from 2005 as noted in 4.I, funding and research did not commence until 2006.

If collections are as much part of biomedical research as labs, it makes sense to think of them in the well-known terms of experimental systems, which Hans-Jörg Rheinberger has defined as “not simply experimental devices that generate answers; experimental systems are vehicles for materializing questions. They inextricably cogenerate the phenomena or material entities and the concepts they come to embody.” (Rheinberger, 1997, p. 28). By extension, experimental systems themselves are co-constituted with the epistemic things of the day. But epistemic things are famously unstable. They exist with the express purpose of giving way to facts. And once a fact is produced, what of the experimental system that corresponded with its epistemic thing?

Tobias Rees has recently shown the myriad kinds of painstaking work required in maintaining and developing an experimental system, and the fluctuations such systems see as, for example, post-doctoral researchers come and go, leaving unfinished research projects for the next in line (Rees, 2016). As an anthropologist in Alain Prochiantz’ lab, Rees followed and contributed to the lab’s scientific work on the ‘plastic brain’ for the duration of his fieldwork. He ends his book on a nostalgic note, realising that he has to “let go” of the plastic brain which is no longer an epistemic thing, but has become fact: “the plastic brain elaborated in Alain’s lab no longer has a center. It has become globally dispersed. The experimental system had itself become a black box, a building block of other experimental systems.” (Rees, 2016, p. 279n1).

What Dorph-Petersen effectively had to do in 2006, when he was appointed daily director of a brain collection which had stood unsupervised for 24 years, and which was epistemically geared towards decades old research questions, was pry open just such a black box. When Prochiantz’s experimental system ceased to generate questions, once its epistemic thing became fact, it had to be developed and reconstituted around new epistemic things and concepts, in order for new questions to materialise. This did not happen at HPI. Dorph-Petersen has since clarified his statement on inheriting a collection: to him, the difficulty results from a lack of infrastructure. When he began working with the Danish collection, there was no lab dedicated to it, no staff, and no logistics. In other words: no experimental system. The problem with this, in his words, is that “the organically symbiotic growth of the

collection and its infrastructure is lost when only the physical collection remains” (Dorph-Petersen, 2017)

Tybjerg (2015) has argued convincingly that the similarities between pathological collections and biobanks far outnumber the differences. According to her, the main difference “is one of methods – lab tests rather than vision, hearing and touch” (Tybjerg, 2015, p. 274). If we follow Rheinberger’s definition of the experimental system, then new methods also generate new epistemic things, and new concepts for these things. We might understand the “symbiosis” between collection and infrastructure as a metaphor for this relationship, in which case the problem of inheritance is, at least partly, that the inherited material does not fit the experimental system. The tissue in the bank is geared towards generating research questions of a different time.

Indeed, no small effort has been put into “updating” the data and metadata pertaining to the material: the case files of each brain have been combed through for outdated diagnoses, in which case a re-diagnosis has been attempted, estimating a suitable modern substitution based on noted symptoms, pathological examination, and other available data and tools. In other words, the concepts are actively changed in order to enrol the collection in a modern experimental system.

The epistemic things have undergone a similar refashioning, to better suit the framework of a modern biobank in which “diseases are now understood as vast causal webs with nodes both at the molecular scale of the body and in the environment from the womb onwards” (Tybjerg, 2015, p. 276). In addition to physically altering the objects in new ways (for example by utilising new histological stains not available to the original researchers at HPI), Dorph-Petersen’s research is making new epistemic things from the collection by novel methods, mainly by way of stereology, a mathematical field studying two-dimensional cross sections of three-dimensional bodies, thereby assessing structural information that would usually not be available to histological investigations of tissue slices.

Other research in the collection is concerned with epigenetic factors, expanding both the epistemic things (by, for example, including in their definition

environmental factors as Tybjerg noted), and the concepts explored as exemplified in the identification (and naming) of a “Danish Amyloid (ADan)” responsible for the development of a rare genetically inherited dementia (Vidal et al., 2000)¹¹.

All this work, which is both conceptual and material, is coupled with a time consuming expansion and restructuring of the collection’s infrastructure. What emerges is a new biobank, one which is homologous, in Strasser’s terms, with modern biomedical science but whose materials, the brains collected between 1945 and ’82, are not. They have been given a new use-time by becoming new objects both materially and conceptually.

The continuing co-development of research questions and practices keep biobanks from outliving themselves; keep them in use-time. Recall that use-time is not so much defined by the present as it is by the future. If experimental systems are “vehicles for materializing questions”, so are collections, and only so long as they generate new and intriguing possibilities for research do they have a future. We must not, however, be fooled and think of the collection only as the materials it holds. It was not because the specimens were old or decayed that HPI was shut down, but rather because the institute still belonged to a bygone research tradition homologous with the 19th century. Similarly, it was not new materials that allowed it to re-enter use-time, but novel methods, and visions of a new experimental system, generating new questions, new things, and new concepts.

Viney’s temporal vocabulary of waste makes a case for expanding how we think of the time of collections. Not defined by the longevity of the material within them but by their narratively and practically constructed potential for the future, the use-time of brain banks becomes more a question of the experimental systems, the infrastructures, the metadata, and the discourses pertaining to them, than a question of material integrity and subsistence.

¹¹ Though carried out before the reinstatement of the collection in 2006, this research used tissue (though not exclusively) from the collection. This first paper occasioned more research (Holton et al., 2002; Tomidokoro et al., 2005) leading up to the appointment of Dorph-Petersen, thereby perhaps playing a role in revitalising the collection. This hypothesis, however, needs more research before it can be established beyond doubt.

In section 3, we heard British brain bankers lament different types of waste in collection and research practices. A main issue was the material specificity of scientific data. Devoid of their material substrates, findings lose scientific validity, usefulness and value. In Dorph-Petersen's case, it was not the facts, but the material that had become stale. Going back to section 3.1 and the dispute between Esiri and Francis, we have in the HPI-bank a case where Esiri's future-oriented stance – that kept materials may always regain usefulness – is vindicated, but which also echoes parts of Francis' supermarket logic: if the material is not “requested” to be enrolled into dynamic experimental systems, it truly does become waste. When *merely* kept, without attending to the infrastructures (material as well as conceptual) which uphold an experimental system, collections simply waste away. These infrastructures include the archived data from previous studies in the collection, referred to in section 3.2, but they also include: curation, i.e. knowledge about precisely what objects are in the collection, their provenance and relevant background information, as well as making this knowledge accessible to relevant parties in a hassle-free way; continuously updating the curated knowledge of the collection to suit the current experimental system; refashioning the epistemic things in like manner, or at least facilitating their reconstruction by scientists.

5. Conclusion

If we understand waste as a temporal concept and distinguish between the use-time and waste-time of different objects, and if we further utilise this distinction analytically, concepts of past and future prove to be at the centre of some prominent discussions regarding brain banks. These discussions, whether ethical, scientific, or political; practical or theoretical, make the discussants return continually to their definitions and premonitions about time both past and future. More bluntly put *waste* is of key importance in structuring *keeping* strategies in brain banks and likely in other kinds of biobanks as well.

Through my analyses it has also become clear, and this is in accord with Tybjerg and Strasser, that brain collections, and indeed biobanks in general, are constituted by much more than the materials in them. In section 3, Professor Hugh

Perry concluded the Witness Seminar warning that what makes collections truly valuable is the data about the objects, and the *keeping* of data and objects in the same collections, knowing full well that the data would very soon become meaningless without the objects themselves. And in section 4, even more poignantly, it became clear from a case in which a collection had been reduced to its physical material, that a non-trivial infrastructure around the physical collection is necessary to maintain its usefulness. I equalled this infrastructure with the experimental systems that others have identified in laboratory sciences, and in the process showed how collection work requires not a small portion of manipulation and ‘tinkering’ in addition to collecting.

The identification of this crucial element in brain collections led me to strongly propose that the use-time of a collection and that of the materials in it must be considered distinctly. The latter is reliant mainly on storage technologies and the ability to prolong the longevity of the material, as well as on the specific characteristics of the individual objects: what may *this* brain tell us about *x*? The former is determined partly by the usefulness and availability of materials, but just as much, or more, by the conceptual and practical infrastructures that surround the materials, and crucially on the continued development of such infrastructures, a development that must be ‘organically symbiotic’ with the material and epistemic things that are kept.

The questions that opened this article, about which brains to keep and for what purpose, may help to establish practices based on a conscious attitude towards the present and the future. This attitude pertains to the foundational premises of a collection: Is the collection primarily oriented towards the future or the present? What kind of object is proper to this collection? Is the purpose of the collection primarily a specific branch of research, or is it more generally to provide materials to all kinds of basic research, and perhaps to explore novel the range and applicability of novel methods? Such premises, conscious or not, may be put into relief by identifying which kinds of waste time gives rise to the worst epistemic anxiety in collectors, curators, and researchers: Is it most fearful to destroy material now – constitutional waste – or is it worse to let it sit in the hopes of better tools for analysis in the future – virtual waste?

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