THE COMPUTERIZATION OF MATERIAL CULTURE CATALOGUES: Objects and Infrastructure in the Smithsonian Institution's Department of Anthropology

Hannah Turner

UNIVERSITY OF TORONTO

ABSTRACT

The history of museum collections is also a history of the management of information about these collections. Today, increased access to large amounts of robust collections data requires that information be curated so that is useful for communities and individuals who wish to access it. This has caused scholars and communities to question the modes of ordering that do not necessarily map onto their own local and personal understandings of the world. In light of the major pragmatic and intellectual affordances stimulated by information technologies, the inner workings of these systems are often made invisible and act as infrastructures rather than singular or simple tools. By providing a historical account of how information about anthropological museum collections was computerized in the 1970s at the Smithsonian Institution's National Museum of Natural History (NMNH), I consider the museum catalogue as a socio-technical information infrastructure. From that perspective, I argue that the knowledge produced by modes of inscription such as catalogues is generated by relationships of individuals and technologies. A detailed and critical history of catalogues must take into account these historical socio-technical infrastructures. [catalogues, information, computerization, knowledge organization]

It has been proposed that the recent “ontological turn” in anthropology and material culture studies is indeed a return to an interest in studying difference as such, a concept that has been a feature of anthropological discourse for some time. This idea that there are not only cultural but ontological differences among peoples, cultures, and groups has also been critiqued. It has been argued that theorizing different ontologies is in fact an evasion of the age-old “culture question” across social sciences and humanities disciplines (Carrithers et al. 2010; Salmond 2012). Despite these critiques, information technologies around the world have brought scholars and communities into an engagement with modes of ordering that do not necessarily map onto their own local or cultural understandings of the world (Geismar and Mohns 2011; Srinivasan et. al. 2010). In light of the major pragmatic and intellectual affordances stimulated by information technologies such as the Internet, algorithmic searches, and databases, for example, the inner workings of these systems are often made invisible, and thus they act as distributed networks rather than as singular or simple tools (Kirschenbaum 2008).

As primarily archival institutions museums are dedicated to the long-term preservation of material culture. Increasingly this has meant long-term preservation of the information or the “data” of material culture as well (Parezo et al. 2003). Original packing slips, field journals, digital images, conservation reports, exhibition histories, donor information, loan histories, and other metadata fields about objects all need to be preserved through data migration. That is, these records are translated into new technical mediums. For example, catalogue records that appear in earlier database programs are often migrated into newer systems, which is an expensive process that requires specialized knowledge. Museum records are also increasingly seen as sites where knowledge is produced, not just recorded (Beltrame and Jungen 2013; Boast 2011; Glass 2015;

Krmpotich and Peers 2013; Srinivasan et al. 2010). Now that museum catalogue records are often available online, they are seen as the first point of encounter between objects and the larger community or specific publics. Mapping the origins and histories of these “databanks” is necessary to determine if there are any operating logics or media affordances that confine, constrict, or construct museum knowledge.¹

As Geoffrey Bowker and Susan Leigh Star (1999, 5) have argued, there is a kind of “casual magic” ascribed to these kinds of mechanisms when a procedure becomes so normalized that it goes unnoticed. Catalogues, like other forms of documentation, have become what have been called “black-boxed” objects. That is, they can only be described by their outputs as their inner workings have become occluded by various levels of abstraction or by processes of forgetting (Cantwell-Smith 1996; Lave and Wenger 1991; Star 1992). As has been addressed by Greene (this issue), and as I argue, many of these “levels of abstraction” or “affordances” are in fact physical and intellectual limitations or constraints imposed upon record-keeping technologies. Part of “opening up” museum practice requires a re-engagement with past forms of documentation. Therefore, in order to situate present record-keeping systems, most often content management platforms and databases, we must turn to understanding the construction of these systems as well. As Elizabeth Povinelli (2011) has argued, archiving is always and ever a political act, and it behooves us to call into question whether or not postcolonial archives could ever be compatible with archives that amassed, sorted, and described objects under colonial rule or for the purpose of imperialistic empire-building. The need to open or confront these archives and rework ontologies that are located in historical epistemologies has been identified as a recent conceptual move within museums and described as a necessary step for successfully engaging with, and perhaps decolonizing, practice (Waterton 2010).

This article offers a specific and particular contribution to this larger goal by examining museum catalogues and the knowledge structures that form them as “information infrastructures.” It takes the history of the computerized anthropological object catalogue at the National Museum of Natural History (NMNH) in Washington, D.C., as its primary example in order to address how catalogues operate as intellectual and material infrastructures. By using the notion of infrastructure as developed in recent scholarship (Baker and Millerand 2007; Bowker et al. 2010; Cordella 2010; Edwards 2003; Edwards et al. 2013), it seeks to understand the performative and heterogeneous ways that information actually becomes “embedded” or “durable” through time and within the museum catalogue. By using specific examples in the Smithsonian Institution’s history, such as the transition from paper-based records to automated computer indexes and the emergence of legacy data, I suggest something that many cataloguers and museum professionals may already experience: that routine cataloging is an intellectual practice and that managing the data held within computer databases is a complex negotiation among technology, history, and epistemology. As I have recently suggested elsewhere (Turner 2015a), in opening up this history it may become possible to “decolonize” anthropological and museum catalogues as sites of iterative development and uncover how their status as authoritative knowledge documents is maintained. In our aim to understand latent meaning imbued in the documentation of ethnographic material culture, conceptualizing catalogues as information infrastructures thus deserves elaboration.

Studying the Information Infrastructure of Anthropological Catalogues

To understand the history of the computerization of the anthropology catalogue at the NMNH, it is first necessary to speak to current work in information studies that analyzes information

systems as social and technical infrastructures. The critical concept of information infrastructure predominately originates from the work of social studies of science and information studies. It is often used to address the large-scale yet often-invisible material networks that structure our world such as roads and Internet cables. In a broad sense infrastructure has been described as a concept that

evokes vast sets of collective equipment necessary to human activities, such as buildings, roads, bridges, rail tracks, channels, ports and communications networks. Beyond bricks, mortar, pipes or wires, infrastructure also encompasses more abstract entities, such as protocols (human and computer), standards, and memory. (Bowker et al. 2010, 97)

In this way, as Larkin (2013, 329) has recently observed, infrastructures include “matter that enable the movement of other matter” at whatever the scale. Information infrastructures are also specific kinds of infrastructures. Bowker et al. (2010) also revealed how information infrastructures silently but fundamentally structure our lives and thus can be considered ubiquitous forms or networks. Instead of roads and buildings, they are the computational services and data repositories associated with digital technologies (Bowker et al. 2010, 98). Infrastructures are thus a relational concept that “emerges from people in practice, connected to activities and structures” (Bowker et al. 2010, 99).

Infrastructure is also a way of theorizing the knowledge work that becomes deeply rooted in practice. Categorizations and classifications are often used in the standards that form the structure of information systems. As Susan Star (1992; 1999; 2002) has expanded upon in her work, infrastructures are “boring things” (2002, 379) that can be defined by how they are

embedded into a system; by their temporal and historical reach or scope; by the way that they are embodied in standards; and how it is that they become visible upon breakdown or when “inverted.” In her study of a community of biologists, Star observed that the situation becomes more complex when studying those who are not served by a particular infrastructure. Put simply: “One person’s infrastructure is another’s topic, or difficulty” (Star 1999, 380). The more naturalized an infrastructure is the less obvious it becomes for those who work within it. Normative infrastructures are always political.

A pertinent example of a kind of information infrastructure is the classificatory tables and schemes that order much information. Through a re-invigoration of Foucault’s (1970) concept of order and archaeology, Bowker and Star (1999) addressed the politics of these large-scale classificatory schemes. They argued that these are descriptive devices that ultimately structure our world (Bowker and Star 1999, 5). For Bowker and Star (2000), classification is a “spatiotemporal” segmentation of the world. A classification system is a set of “boxes” and robust hierarchies of categories of description into which things can conceptually be “put.” These systems achieve a kind of work that produces knowledge. Classification and categorization schemes can be formal or informal and ad hoc. Largely classificatory schemes are never “innocent” and are constantly shifting (Mai 2004). They are often seen as normalized or ordinary as well. It is this normalization that Bowker and Star (2000, 152) have urged scholars to question. To do this they have argued that an “infrastructural inversion” must occur. Infrastructural inversion is necessary to reveal the “behind-the-scenes, boring background process to [see] the real work of politics and knowledge production” (Bowker and Star 2000, 156). This is important because once an infrastructural system is in place the politics of past

decisions are forgotten or built into recording mechanisms or software (Bowker and Star 2000, 161).

In the case of the Smithsonian's anthropology records, the normative naming strategies and methods of digitization can be "inverted" by conducting a full history of these systems. In doing so, we can come to understand the mundane and routine ways through which information is transferred and mediated in the medium upon which it is held. In the next section, I unpack a small portion of this history and explain how paper-based documentation systems were automated into the newly developed Smithsonian Institution computerized system in the late 1960s. How information was transferred to the digital system elucidates a practice that was based in a specific epistemological moment regarding what ethnographic collections should be and how they should "correctly" be recorded so as to be useful for ethnographic research.

Anthropology and the Object Catalogue at the National Museum of Natural History

Much early museum cataloguing in North America focused on developing classificatory schemes of material culture collections (as noted in, Greene, this volume). As David Jenkins (1994) has argued, the making of American anthropology has been caught up in a scientific classification that ultimately ordered object collections in museums. He outlined how ethnographic museums began to arrange their representations and displays, along with the natural sciences, according to Darwinian principles of evolution. When recorded in paper-based ledgers, catalogues, and object drawings, museum objects moved from being three-dimensional artifacts to inscriptions on paper. These inscriptions served as the full documentary records of objects. Although the process varied among institutions, generally each new development in technology required the transfer of

information from paper-based records in ledger books to the new medium, as identified by Greene (this volume).

The history of anthropological collecting and cataloguing in the Smithsonian's Department of Anthropology has been primarily defined by a strategic method of collecting North American Indigenous material culture (Hinsley 1981; Nichols 2014; Parezo 1987; Walsh 2002). Since the 1850s, objects collected for the museum by field operatives and aspiring "ethnologists" were documented in field notebooks and large, bound ledger volumes in the museum. This practice was not uncommon for many natural history museums at the time, in particular in Europe (Marsh this volume; Thomas 2012). As explored by Greene (this volume) and Nichols (this volume), the anthropological catalogue at the NMNH has taken its form in a variety of material technologies—from paper ledgers and card catalogues to a contemporary digital database. Throughout each transition, the different material affordances of each documentation technology were imprinted and stabilized in practice. The antecedent to modern database systems of cataloguing can thus be found in the "paper work" of historical documentation technologies like the ledger and the card catalogues.

As others have noted Greene this volume, the card catalogue at the NMNH (then the United States National Museum) was likely first adopted by Otis Mason (then curator of ethnology) near the turn of the twentieth century. As was common across other institutions, this card catalogue organized the collection by accession and therefore by collector. Unlike a book, the museum object had no written content, and unlike librarian's catalogues, upon which the card catalogues in museums were likely based (Urban 2014), museum objects required different kinds of information in order to be "useful" for scientific ethnological research at the time (Turner 2015a). The work of cataloguing museum collections was not just an effort to index the object

but also to record all of the contextual information about it. Put differently, the card catalogue was not only a finding index but a curated container of valuable information. Different organizational schemes were needed to glean new information about objects either by accession or by (what would later be known as) tribal affiliation.

In the late 1960s and early 1970s, museums across North America began to think seriously about increasing access to their collections not just for the public but also for their staff. It was becoming increasingly difficult to know what still existed in the museum's collections as sorting through millions of objects by hand in dusty attics took an enormous amount of time and resources. At this time, the Smithsonian's anthropology collection was stored in areas that were difficult to access within the existing Natural History building on the National Mall. The administration at the institution understood that the computerization of collections' documentation would allow for greater access and ease of use of the information in the object records. At the time this was seen as a first step in conducting new research on collections (Turner 2015a). The computerization of the catalogue in the Department of Anthropology was thus a significant shift in the museum's approach to information and collections management. With proper data entry, computerization was seen as a way to "solve" the problem of the card catalogue index and make all object information easily retrievable. Yet, the transition from card catalogues to the first computerized catalogue was not simple. When the museum's first computerized information organization system was constructed, new records were manually created from scratch and the information on each catalogue card was entered into the system, one catalogue card at a time. With each data migration new capabilities and restrictions allowed for different modes of recording. The age of the mechanical and invisible hand behind ethnographic cataloguing had begun.

Automating the Catalogue

There were many influences and changes that occurred during the time of intensive computerization at the Smithsonian, more broadly, and in the Department of Anthropology, specifically (Parry 2007). Work roles had shifted and an epistemological understanding of collections and collections management as a pragmatic tool for the care of collections inflected all aspects of this work (Turner 2015b). After 160 years of ledger books, card catalogues, and translations between documentation types, much information had either been lost or was unverified and impossible to reconcile with newer attitudes toward this information. Several professional networks and research groups were established in the late 1960s, in part due to the massive move to computing across all disciplines. Their task was to deal with the complex issues that arose due to computerization—namely the creation of terminological standards and new information practices and work roles that would be required of museums more broadly. Notably, the Museum Computer Network (MCN) was established in Washington, D.C., in 1967, and the Information Retrieval Group of Museums Association (IRGMA) was established in the United Kingdom. Their goals were to create information structures that could be interoperable among museums and that could accommodate the range of data that was required of cultural heritage institutions (Parry 2007, 19). Many of these endeavors focused on data standardization, classification, and the development of terminologies that would work as descriptors for museum collections of all types. If anything else, the advent of computerization in museums, as Parry (2007) rightly argues, brought an increased awareness of the organization of information and its importance in facilitating research and providing access to collections. A first step in the data standardization of the computer age was to input the paper-based records and revisit out-of-date

or missing information in the card catalogue. Computerization was seen to be a legitimate way to solve this issue.

In 1969 a formalized data standard and method of data entry was envisioned at the Smithsonian. As a first iteration, information was entered into the system using paper tape punches. These were electric typewriters with paper tape attachments. Paper tape punches were also used to create the labels that were attached to the objects themselves (Chenhall 1975, 87). Staff at the Smithsonian also experimented with using early optical character readers. In 1970, the NMNH established the “Automatic Data Processing Unit,” or the ADP. The goal was to develop and coordinate a data-processing unit that would be a permanent part of the museum. Through this project, the computer system SELGEM was developed in-house at the Smithsonian.² SELGEM was the first instantiation of a computerized system at the Smithsonian and was envisioned, as Parry has noted, as “a general purpose program developed for information management” (2007, 16). SELGEM held the information from the card catalogues and other related data from the entire institution. It functioned by having users create queries on punch worksheets or punched paper, inputting these into the system, and then retrieving the information through pages and pages of lists of objects that appropriately fit the specifications in the query (Parry 2007, 16). SELGEM consisted of 25 basic programs (Chenhall 1975, 93–94) that included input and editing programs as well as queries, retrievals, and indexing programs (1975, 94). It was not only a collections documentation software set but it was used across the museum to hold many different kinds of information—from maintaining specimen slides to political slogans, mottos, and banners (1975, 95). The “computerization” of the card catalogue in the Department of Anthropology at the NMNH was achieved in 1977 (Turner 2015b). Using

SELGEM also meant manually entering all of the information from the card catalogues from nearly one hundred years prior.

From Paper Index to Computerized Catalogue

The transfer of “paper” documentation from the ledgers and the card catalogue is good evidence of how some descriptions become more durable once made “material.” As the catalogue cards were copied into SEGLEM, this part of computerization was seen as “frustrating” and “time-consuming” (Elder 1978, 2). During this process, staff members were requested to physically mark what parts of the descriptive information from the cards were to be entered into the system. The cards were marked using a red pen to denote important information like the localities and object names. These marks delineated which particular parts of the older card catalogue would be input into the new system. Figure 1 shows the traces of this practice as the catalogue cards were physically modified to represent a newer “computer logic.”

What to mark on the cards was not always an easy or logical conclusion, as one museum staff member noted in a record documenting the procedures for inventories during this time. Robert Elder, then collections manager, expressed his frustrations: “As a general rule the entries faithfully reproduce the items underlined on the cards, but again I am at a loss to explain why certain items were underlined in the first place” (1978, 3). The information on catalogue cards was manually entered in the system as individual records and frequently pieces of information from the catalogue cards were mistakenly omitted (Elder 1978, 3). If information was entered incorrectly, the computer file became almost completely useless. A lack of standard terms for describing objects provided increasing confusion. In a search-and-find inventory system such as

SELGEM, if one did not already know the terms to look for then the object could never be found—effecting a kind of infrastructural amnesia.

The catalogue cards were sent to a data entry firm to be transferred to the computerized system and the red marks under each of the categorical headings were taken “as is” (Greene, pers. comm., 2014). If mistakes were made in the underlining of the original catalogue card data, it affected how later curators and collections managers could find and interact with the data. Curators and collections managers were thus frustrated with the amount and quality of information that existed in the records copied from the card catalogue records. The computerization of these cards also had a significant effect on the development of standardized terminologies for the department. Without some standardization of terms, the computerized system would not be able to recognize misspellings or the alternative object names that many of the collections records contained.

In addition, there were general principles established for the rules of data entry when the data from the card catalogues was entered into the new system. No changes were to be made on the catalogue cards and only the information that was on the catalogue cards was to be entered into the computer without any revision. In fact it was suggested that “spellings of names of objects, cultures, and places will be exactly as shown on the catalog [*sic*] cards” (Gibson 1977). If there were two or more object names on the card, the names were all to be entered into the computer and the “common English name” was selected as the “principle” name (Gibson 1977). Locality information was to be entered “up to three levels of specificity” (Gibson 1977), with a primarily North American focus (country, state, town). This resulted in inevitable spelling variations and mistakes that caused enumerable issues when working with SELGEM. For

example, object names often caused the most confusion as the “materials” fields was to be left out of the object’s name and the formal and functional aspects of the object were emphasized.

Information work at the Smithsonian was soon seen as an intellectual practice that required great care and in many cases significant expertise. Curators worried about the accuracy of the institution’s records and noted several issues involved with designating tribal affiliation. In a memorandum from William Fitzhugh to John Ewers (both curators at the institution), Fitzhugh noted how past problems in inconsistent record keeping affected the then current records in the context of provenience:

To be most useful our records should reveal degrees of certainty of the tribal identification of the objects. It would be creating future problems if inexperienced persons were to try to judge of the completeness and accuracy of our catalog [*sic*] record.³

The gross inconsistencies found in each catalogue card clearly made computerization difficult. Through each data migration, each object record had become removed from the object itself. Due to the issues and the cost of repairing the computerized catalogue records, it was suggested by the administration that the department engage in proceeding more slowly when recording information. It was even desired that instead of recording the text on the catalogue cards, cataloguers should return to the collections themselves and mark each catalogue card as each individual specimen was considered—a formidable task.⁴

Although computing made it possible to search large amounts of data, it also required a reduction in the kinds of information that could be represented. The earlier object names could

not actually be recorded in the computerized database exactly as they had been written, and the use of alternative names for objects also increased confusion. Consequently, the use of object names as search tools became completely ineffective due to the way that collections information was digitized (Elder 1978, 2). The marks on the catalogue cards are traces of a routine yet complex practice that sought to efficiently and pragmatically input old “paper” information into a new automated system. Notations that denote the specific fields of data were entered in the new computerized system inconsistently. This involved decisions around what information and terms to use and what to exclude. This example also shows the significant agency that the material technologies had themselves. The card catalogues had specific information and space limitations for describing objects, and the early computerized system required the standardization of at least some terms. The information crafted out of these cards in the computer system presented a genuine problem for collections managers and researchers who wanted to access collections at this time.

The routine and habitual reproduction of catalogue card data as translated into a digital system meant that much of the information “stuck” to the record, preserving (for better or worse) the legacies of earlier epistemological attempts to document and understand cultural heritage (Nichols, this volume). At each step, the staff encountered the infrastructure of the catalogue—the combined force of past practices and technological affordance. The impact of these material technologies on knowledge practices is particularly important when considering the effects these practices have on marginalized knowledge systems, such as Indigenous knowledges. The infrastructure of collections documentation is made up of the continually practiced or performed nature of routine work and bureaucratic regulation as well as the technologies themselves. This

manifests as what museum workers refer to as “legacy data”—that is, the unanticipated remnants of material culture information that “linger” in the contemporary catalogues.

The Legacy of Data

As has been noted here and in the preceding article Greene, (this volume), the transfer and computerization of catalogue cards in the Department of Anthropology presented enumerable challenges for collections management. Throughout the late 1970s and 1980s, terminologies, dictionaries, and naming conventions were all reconfigured with increased care. The majority of the work in collections management in the mid-1980s was thus dedicated to remedying earlier cataloguing errors and evaluating the state and variety of object names that existed in the catalogue data. However, the vast amount of data collected during a large inventory of the collection data did not map neatly onto the older card catalogue fields. Curators and collections were tasked to find what and where these errors were.

Computerization made it possible to store and retrieve data in a fundamentally different way from the previous typewritten records. It also raised two significant challenges for the institution: the standardization of terminologies and object names and the encounter of historical data that had been migrated from earlier paper records. For example, standardizing the names of objects as “index terms” was required because after nearly 160 years of inconsistent naming strategies composed on paper-based recording systems (the ledgers and the catalogue cards), the abundance of distinct names for similar objects was seen confusing and unmanageable. Staff members thus created a variety of lists, authority files, and naming conventions that functioned as ad hoc nomenclatures. Data present from earlier typed records and handwritten sources,

accurate or not, were directly migrated into the computerized systems, and this became known as “legacy data.”

The department was keenly aware of “legacy data” in records that had been held over from information collected and recorded in the nineteenth and early twentieth centuries, especially in the context of epistemological shifts in anthropological practice during the mid- to late twentieth century. Primarily, Indigenous communities began to request the return of their objects from museums and gained access to their collections, which had been displaced for centuries. In 1989 and 1990, respectively, the National Museum of the American Indian Act (NMAIA) and the Native American Graves Protection and Repatriation Act (NAGPRA) were passed as law requiring federally funded institutions to have a full listing of their ethnographic objects that may have come from North American Indigenous communities. To clarify, in order to comply with the NMAIA legislation, the Smithsonian and all federally funded institutions were required to produce a list of all of the Native American objects in their collection. The creation of these lists was a feat, and throughout this process staff occasionally encountered information that was inaccurate and incomplete: legacies of older methods of data transfer.

As the political landscape changed and as respect for Indigenous peoples’ rights grew, information attributed to objects in earlier moments was sometimes only out of date but—at worst—it was racist and harmful. This legacy data is a kind of unclean ghost of a colonial past. Encountering these offensive terminologies in contemporary museum work can be read as a re-performance of the colonial encounter. Legacy data is a residual outcome of the fact that the Smithsonian is an old institution, but it is also an effect of an increasingly pervasive and invisible information infrastructure. The data of cultural heritage amassed in the twentieth century thus

outlives either exhibitions or displays and continues to have an effect on the interpretation of cultural heritage.

Lasting Effects: Durability and Collections Data

If you get tired or confused, stop and rest; when mistakes are made, it may take another hundred years to find and correct them.⁵

Legacy data made manifest through computerization and data migration is perhaps best understood through the concept of material durability. Durability typically connotes objects that have material force, things that can be touched and pushed back upon. Relations, as John Law has claimed, can also be made “durable” when they become embedded in “inanimate materials” like buildings or texts (1992, 6).⁶ Material durability thus denotes the ways that certain things, relations, or actors last longer than others. Put another way, social arrangements last longer when they are made outside of the relation itself in physical existence (Law 2008, 148). In this context, the social relations of earlier object epistemologies are made durable through their consistent description, emulation, and migration in recording technologies. Yet there is a complication to this reading of durable information infrastructures. As Law metaphorically notes, the walls of a prison are only as durable as the guards who watch them. Indeed the relations between durable materials change depending on their location within a network or adoption into a new one (Law 1992, 6). As certain terms remain durable, individuals also *perform* the relations as each adoption or migration to a new technological medium is required.

If relations become “durable” in material objects or technologies, then these undoubtedly become hidden and naturalized through work practice. For example, studies of the sciences have

argued that there are multiple lived realities in which many different actors, networks, and communities participate. These realities are all practiced and performed in different ways. As Annemarie Mol (2002) has examined, multiple realities are not conceptual but are practiced or “done.” That is, they are situated not only in the realm of philosophy but in everyday, routinized work. These performances become naturalized and the distinctions, politics, and genders enacted in performances often hide the political nature of their actions (Haraway 1994). As Waterton furthers in her recent discussion of digital archival practice, performance is something “done,” whereby “objects and categories are only really present in ‘the doing of them,’ they have to be continually performed to exist at all” (2010, 650). This is bolstered by other theories of performativity that place the existence of objects and categories in their continued construction—their “doing” (Szymanski and Whalen 2011). In order for things to become materially durable, they must also be continually performed.

Material durability is therefore a feature of the information infrastructure of the anthropology catalogue at the NMNH. It denotes how practices of object-naming and classification seem to “stick” to the current object records despite decades of postcolonial research and revision. Despite the fact that many of these systems were often envisioned to have a practical value for the institution, many other communities find that they do not apply to their material culture and ways of knowing. Even museum workers themselves find many of these kinds of categorizations in the catalogue unworkable and historically outdated (Turner 2015b). As has been suggested, epistemologies are also made manifest in systems of organization (Marsh, this volume). To say that these are material durable means that there are physical and technological devices that capture, constrain, or afford not just levels of description but entire modes of organization and relational patterns. Information storage devices, such as hard drives,

and software, such as databases, have distinct affordances that “contribute to their implementation and reception” (Kirschenbaum 2008, 4). The longevity of these legacy terms is thus afforded by the material technologies and the acts imposed upon them by human agents (Nardi 2015, 19). The terms, chosen in specific epistemological moments, are inscribed and re-inscribed upon new sets of technologies through time—from the ledgers to the catalogue cards to the computerized database. The fact that legacy data is continually inscribed in collections records is thus a contemporary ethical issue (Opp 2008; Phillips 2011). As an information infrastructure, the catalogue is durable and performative—both descriptive and generative (Waterton 2010).

Fields of description are maintained through continued action or performance and because of the affordances of the technologies of description. As Greene (this volume) notes, individual object cards and other informational card catalogues had only so much space in which to write descriptions; they allowed only for the use of efficient, singular terms, and they were also designed with specific technologies in mind—in many cases the typewriter (see Figures 2 and 3). Yet there were also the physical margins of these cards that could be reworked and manipulated at the hand of the cataloguer (see Figure 4). The early database was a more strict interpretation of the information, and much of the data on the card catalogues was lost in the transition. The red marks thus delineate that which could be input into the SELGEM system based on its “informational” and computational requirements. Images of the card catalogue records were taken as a cheap solution to access the information on the cards, but they had the effect of preserving this information “as is” without it being mediated by a digitized medium. SELGEM allowed researchers to count and quantify the collections, but the cards (and before

them, the ledgers books) maintained a level of proximity to the early interpretations of material culture that are still upheld today as authoritative.

Conclusion

This brief history of computerization at the Smithsonian Institution's Department of Anthropology proposes a key argument concerning information infrastructures. Collections documentation during the mid-1960s and into the 1970s had stabilized the earlier object descriptions and naming conventions through translation and mediation into new "digital" technologies. In this example, modes of description were assumed to be constrained or afforded by the space itself or the field descriptions available on the catalogue cards as paper sources of information. Through each migration of data, the newer technologies "inherited" the constraints of the past, and this led to much missing information. At the NMNH, these descriptions were inscribed in the computerized system as a way to preserve the information about objects in the collection. Institutional work practice and the categorical difference of the new computerized system from the early paper system resulted in misread transcriptions and, ultimately, in the preservation of terms and ideologies about cultural heritage that were rooted in older ways of knowing the "specimens."

A deeper investigation into the relationship between the structures of knowledge systems such as large classification schemes allows a glimpse into the kinds of ordering logics that guide experiences with the catalogue and thus with the knowledge produced through its use. The construction of museum knowledge can be considered to be part collaboration with communities, curators, and those who document the collection, and part engagement with the materials or the affordances of the technology itself. Because systems of classification necessarily organize data

in order to make it retrievable and useful as information, they enable the discovery and re-discovery of objects in museums that aid in providing accounts of the past. However, they are also powerful ordering mechanisms that structure what is known and what can be known about objects. They are systems of organization, material documents, and sets of relationships that create complex narratives of history and memory (Beltrame 2012; Bowker 2005; Brown and Davis-Brown 1998; Glass 2015; Manovich 2007). When dealing with knowledges that have been previously silenced, in particular Indigenous knowledges, we must consider how the museum catalogue might inhibit alternative ways of knowing and how the colonial history of the museum is made visible (or invisible) by the way objects are described, coded, and constructed.

Notably, mistakes that were made when the catalogue cards were transcribed into SELGEM were rarely fixed, and eventually it was decided that the catalogue cards were to be digitized and attached to the records in order to preserve the information upon them. Although this practice of data migration was considered pure routine work—a kind of daily performance—it also draws attention to the complex nature of information infrastructures. It highlights the local and material practices that exist in these spaces. Following Bowker and Star (2000), daily practice is a kind of invisible work perpetuated by reiteration and reinscription that only becomes visible when it breaks down. During this moment, normalized categories and “ways of doing” become inescapable. As I have suggested, museum records are often viewed as files that possess an “as is” authority and are made durable by their reinscription in the computing software. The information infrastructure thus becomes invisible in daily work. It is pulled into view when things fail to work or when, for example, staff members or communities encounter the legacy data in the catalogue. This also highlights the key point about information infrastructures: that they are durable because of their continued performance.

When we speak of the legacies of colonialism in museums, we are often critiquing the collection of great amounts of cultural heritage, the development of exhibitions and displays of this heritage, and the scholarly work produced. Less often do we critique the normative and pervasive ways that objects are described and thus constructed as evidence in scientific research. The transition from paper catalogue cards to the computerized system at the Smithsonian thus demonstrates that cataloguing practice is not a simple copy-and-paste methodology but that it is intellectual work to modify the records and the names that would then be normalized in the computer system. This manifests as “legacy data” that persists through time and is made visible in unexpected ways in the current database. These issues, although mundane and often minute, raise complex ethical issues about the suitability of historical terms for contemporary museological work. Once embedded into the information infrastructure, the daily, routine work practice becomes invisible. The contemporary database imbued with these historical legacies is a performance of earlier colonial-era collecting and is a process rather than a stable documentary form. This is not to say that these terms or data should be deleted and altogether erased, as many institutions opt to retain the historical legacies of their data. As the NMNH’s online collections database notes: “The data represent a work in progress” (Smithsonian Institution, 2015). Yet, this analysis calls into question our daily work in museums and draws attention to the complex infrastructure that composes what we today consider to be ethnographic object data. It hopefully calls other institutions to question the historical narrative of computerization as an embodied socio-technical practice. It is also a call to question a fundamental issue with all ethnographic record-keeping institutions: What is an authoritative document? How does information become, for lack of a better word, true? And how does documentation as a practice come to create and

define what counts as ethnographic knowledge? Lastly, how does this affect the communities who seek the return of their cultural heritage? This article has laid some groundwork, but further research is still needed—particularly when work conducted in many ethnographic museums is mediated by the digital and historical infrastructures of ethnographic documentation.

NOTES

1. The term affordance has been used widely across the social sciences, design theory, and information studies to denote the way that material technologies or documentation technologies give or yield modes of inscription. Gibson (1979) declared that this is a relationship between both the designed system and the user, or actor. For Gibson, different environmental objects have different affordances for manipulation by the user. In the context of media studies, it is also understood that mediums have affordances. For example, different writing forms (blank ledgers, fill-out “boxes” in software programmes) have physical limitations and presuppose a way of using them (Gitelman 2014). The blank ledger is only so long—allowing for only a few words or sentences. Similarly, blank forms in software programs or online allow certain character limits, thus “affording” similar word length constraints. Thus, the material technologies afford a kind of description that is different than, say, long-form descriptive work.

2. An acronym for the Self-Generating Master program (Parry 2007).

3. Fitzhugh, William to John Ewers, n.d. *Re: Computerizing the Ethnological Collections*. Department of Anthropology, Admin Records 1972–94, Ethnology Catalog Computerization, of. NAA: Suitland, Maryland.

4. Ibid, n.d.

5. Wilcox, Vince to All Staff. April 21, 1980. *General Inventory Procedures*. Elder Inventory Completion Memo, Robert Elder Files, Unpublished Internal Smithsonian Staff Documents. Department of Anthropology, NMNH. MSC: Maryland.
6. As well as Bruno Latour (1987) and Marilyn Strathern (2004).

REFERENCES CITED

- Baker, Karen S., and Florence Millerand. 2007. "Scientific Infrastructure Design: Information Environments and Knowledge Provinces." *Proceedings of the American Society for Information Science and Technology* 44 (1): 1–9.
- Beltrame, Tiziana Nicoletta. 2012. "Le corps numérique des données: Le transfert des fiches documentaires des objets du musée de l'Homme au musée du quai Branly" [The body of the digital data: The transfer of fact sheets of objects from the Museum of Man to the Quai Branly Museum). Edited by Christine Jungen and Candice Raymond. *Ateliers d'anthropologie*. *Revue éditée par le Laboratoire d'ethnologie et de sociologie comparative* [Anthropology Workshop. Review edited by the Laboratory of Ethnology and Comparative Sociology] [Online] 36 (May). DOI: 10.4000/ateliers.9081, accessed March 7, 2016. [please insert the English translation for the journal title too] [Sorry - hope that is correct!]
- Beltrame, Tiziana Nicoletta, and Christine Jungen. 2013. "Cataloguing, Indexing and Encoding." *Revue D'anthropologie Des Connaissances* [Review of the Anthropology of Knowledge] 7 (4): 747–59.
- Boast, Robin. 2011. "Neocolonial Collaboration: Museum as Contact Zone Revisited." *Museum Anthropology* 34 (1): 56–70.

- Bowker, Geoffrey. 2005. *Memory Practices in the Sciences*. Cambridge, MA: MIT Press.
- Bowker, Geoffrey, and Susan Leigh Star. 1999. *Sorting Things Out: Classification and Its Consequences*. Cambridge, MA: MIT Press.
- Bowker, Geoffrey C., Karen Baker, Florence Millerand, and David Ribes. 2010. "Toward Information Infrastructure Studies: Ways of Knowing in a Networked Environment." In *International Handbook of Internet Research*, edited by Jeremy Hunsinger, Lisbeth Klastrup, and Matthew Allen. [97-119] London: Springer.
- Brown, Richard Harvey, and Beth Davis-Brown. 1998. "The Making of Memory: The Politics of Archives, Libraries and Museums in the Construction of National Consciousness." *History of the Human Sciences* 11 (4): 17–32.
- . 2000. "Invisible Mediators of Action: Classification and the Ubiquity of Standards." *Mind, Culture, and Activity* 7 (1–2): 147–63.
- Cantwell-Smith, Brian. 1996. *On the Origin of Objects*. Cambridge, MA: MIT Press.
- Carrithers, Michael, Matea Candea, Karen Sykes, and Martin Holbraad. 2010. "Ontology Is Just Another Word for Culture: Motion Tabled at the 2008 Meeting of the Group for Debates in Anthropological Theory, University of Manchester." Edited by Soumhya Venkatesan. *Critique of Anthropology* 30 (2): 152–200.
- Chenhall, Robert G. 1975. *Museum Cataloging in the Computer Age*. Nashville: American Association for State and Local History.
- Cordella, Antonio. 2010. "Information Infrastructure: An Actor-Network Perspective." *International Journal of Actor-Network Theory and Technological Innovation (IJANTTI)* 2 (1): 27–53.

- Edwards, Paul N. 2003. "Infrastructure and Modernity: Force, Time, and Social Organization in the History of Sociotechnical Systems." In *Modernity and Technology*, edited by Thomas J. Misa, Philip Brey, and Andrew Feenberg, 185–225. Cambridge, MA: MIT Press.
- Edwards, Paul N., Steven J. Jackson, Melissa K. Chalmers, Geoffrey C. Bowker, Christine L. Borgman, David Ribes, Matt Burton, and Scout Calvert. 2013. "Knowledge Infrastructures: Intellectual Frameworks and Research Challenges," Report of the workshop at the University of Michigan School of Information, Ann Arbor, May 25–28, 2012.
- Elder, Charles. 1978. *Report on the Cheyenne-Arapaho Inventory Project February 1 April 28*. Elder Cheyenne-Arapaho Inventory File. Smithsonian Staff Documents, Department of Anthropology, NMNH.
- Foucault, Michel. 1970. *The Order of Things: An Archaeology of the Human Sciences*. New York: Vintage.
- Geismar, Haidy, and William Mohns. 2011. "Social Relationships and Digital Relationships: Rethinking the Database at the Vanuatu Cultural Centre." *Journal of the Royal Anthropological Institute* 17:S133–55.
- Gibson, George. 1977. *Computerization of the Ethnology Catalog: Understandings Reached in Conference, 8 March 1977*. NAA, Department of Anthropology Record group, Box 87, Admin Records 1972 – 94.
- Gibson, James J. 1979. *The Ecological Approach to Visual Perception*. Boston: Houghton Mifflin.
- Gitelman, Lisa. 2014. *Paper Knowledge: Toward a Media History of Documents*. Durham: Duke University Press.

- Glass, Aaron. 2015. "Indigenous Ontologies, Digital Technologies: Plural Provenances and the Kwakwaka'wakw Collection in Berlin and Beyond." In *Museums as Process: Translating Local and Global Knowledges*, edited by Raymond Silverman, 19–44. London: Routledge.
- Haraway, Donna. 1994. "A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s." In *The Postmodern Turn: New Perspectives on Social Theory*, edited by Steven Seidman, 82–115. Cambridge: Cambridge University Press.
- Hinsley, Curtis M. 1981. *Savages and Scientists: The Smithsonian Institution and the Development of American Anthropology, 1846–1910*. Washington, DC: Smithsonian Institution Press.
- Jenkins, David. 1994. "Object Lessons and Ethnographic Displays: Museum Exhibitions and the Making of American Anthropology." *Comparative Studies in Society and History* 36 (2): 242–70.
- Kirschenbaum, Matthew. 2008. *Mechanisms: New Media and the Forensic Imagination*. Cambridge, MA: MIT Press.
- Krmpotich, Cara, and Laura Peers. 2013. *This Is Our Life: Haida Material Heritage and Changing Museum Practice*. Vancouver: UBC Press.
- Larkin, Brian. 2013. "The Politics and Poetics of Infrastructure." *Annual Review of Anthropology* 42 (1): 327–43.
- Latour, Bruno. 1987. *Science in Action: How to Follow Scientists and Engineers through Society*. Cambridge, MA: Harvard University Press.
- Lave, Jean, and Etienne Wenger. 1991. *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.

- Law, John. 1992. "Notes on the Theory of the Actor-Network: Ordering, Strategy, and Heterogeneity." *Systemic Practice and Action Research* 5 (4): 379–93.
- . 2008. "Actor Network Theory and Material Semiotics." In *The New Blackwell Companion to Social Theory*, edited by Bryan S. Turner, 141–58. Oxford: Blackwell.
- Mai, Jens-Erik. 2004. "Classification in Context: Relativity, Reality, and Representation." *Knowledge Organization* 31 (1): 39–48.
- Manovich, Lev. 2007. *The Language of New Media*. Cambridge, MA: MIT Press.
- Mol, Annemarie. 2002. *The Body Multiple: Ontology in Medical Practice*. Durham: Duke University Press.
- Nardi, Bonnie. 2015. "Virtuality." *Annual Review of Anthropology* 44 (1): 15–31.
- Nichols, Catherine. 2014. "Lost in Museums: The Ethical Dimensions of Historical Practices of Anthropological Specimen Exchange." *Curator: The Museum Journal* 57 (2): 225–36.
- Opp, James. 2008. "The Colonial Legacies of the Digital Archive: The Arnold Lupson Photographic Collection." *Archivaria* 65 (Spring): 3–19.
- Parezo, Nancy J. 1987. "The Formation of Ethnographic Collections: The Smithsonian Institution in the American Southwest." *Advances in Archaeological Method and Theory* 10:1–47.
- Parezo, Nancy J., Don D. Fowler, and Sydel Silverman. 2003. "Preserving the Anthropological Record: A Decade of CoPAR Initiatives." *Current Anthropology* 44 (1): 111–16.
- Parry, Ross. 2007. *Recoding the Museum*. New York: Routledge.
- Phillips, Ruth. B. 2011. *Museum Pieces: Toward the Indigenization of Canadian Museums*. Vol. 6. Montreal: McGill Queens University Press.

- Povinelli, Elizabeth. A. 2011. "The Woman on the Other Side of the Wall: Archiving the Otherwise in Postcolonial Digital Archives." *Differences* 22 (1): 146–71.
- Salmond, Amiria. 2012. "Digital Subjects, Cultural Objects: Special Issue Introduction." *Journal of Material Culture* 17 (3): 211–28.
- Smithsonian Institution. 2015. "Terms and Conditions for Use of Online Collections Databases." http://www.mnh.si.edu/rc/db/2data_access_policy.html, accessed July 15, 2015
- Srinivasan, Ramesh, Katherine M. Becvar, Robin Boast, and Jim Enote. 2010. "Diverse Knowledges and Contact Zones within the Digital Museum." *Science, Technology & Human Values* 35 (5): 735–68.
- Star, Susan Leigh. 1992. "The Trojan Door: Organizations, Work, and the 'Open Black Box.'" *Systemic Practice and Action Research* 5 (4): 395–410.
- . 1999. "The Ethnography of Infrastructure." *American Behavioral Scientist* 43 (3): 377.
- . 2002. "Infrastructure and Ethnographic Practice: Working on the Fringes." *Scandinavian Journal of Information Systems* 14 (2): 6.
- Strathern, Marilyn. 2004. *Partial Connections*. Vol. 3. Walnut Creek, CA: AltaMira Press.
- Szymanski, Margaret H., and Jack Whalen. 2011. *Making Work Visible: Ethnographically Grounded Case Studies of Work Practice*. Cambridge: Cambridge University Press.
- Thomas, Jennifer. 2012. "The Documentation of the British Museum's Natural History Collections, 1760–1836." *Archives of Natural History* 39 (1): 111–25.
- Turner, Hannah. 2015a. "Decolonizing Ethnographic Documentation: A Critical History of the Early Museum Catalogs at the Smithsonian's National Museum of Natural History." Special Issue: Indigenous Approaches to Cataloging, *Cataloging & Classification Quarterly* (CCQ), 53 (5/6): 658–76.

———. 2015b. “Information Infrastructures in the Museum: Documenting, Digitizing and Practising Ethnographic Objects in the Smithsonian’s Department of Anthropology.” PhD thesis, University of Toronto.

Urban, Richard J. 2014. “Library Influence on Museum Information Work.” *Library Trends* 62 (3): 596–612.

Vance, David 1975. "Museum Computer Network: Progress Report." *The Museologist*, 135:3–

10. [not cited in text. Delete?] [Oh yes please!]

Walsh, Jane MacLaren. 2002. “Collections as Currency.” In *Anthropology, History and American Indians: Essays in Honor of William Curtis Sturtevant*, edited by William L. Merrill and Ives Goddards, 201–209. Smithsonian Contributions to Anthropology No. 44. Washington, DC: Smithsonian Institution Press.

Waterton, Claire. 2010. “Experimenting with the Archive: STS-Ers As Analysts and Co-Constructors of Databases and Other Archival Forms.” *Science, Technology & Human Values* 35 (5): 645–76.

FIGURE CAPTIONS

Figure 1. Example of red underlined words on a catalogue card, Department of Anthropology Card Catalogue, NMNH Museum Support Centre, Suitland, Maryland. (Photo by Hannah Turner.)

Figure 2. Draft, History of Collection Card. National Anthropological Archives, Series 2, Alpha subject 1828–1963, Box A, Folder “Accession Routine.” (Photo courtesy of the National Anthropological Archives.)

Figure 3. Draft, Object Catalogue Card. National Anthropological Archives, Series 2, Alpha subject 1828–1963, Box A, Folder “Accession Routine.” (Photo courtesy of the National Anthropological Archives.)

Figure 4. Object Catalogue Card, “Model of Kyak,” with added notes, Department of Anthropology Card Catalogue, NMNH Museum Support Centre, Suitland, Maryland. (Photo by Hannah Turner.)