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How to Cite: Pedersen, Isabel, Tom Everrett, and Sharon Caldwell. 2020. "The Wearable Past: Integrating a Physical Museum Collection of Wearables into a Database of Born-Digital Artifacts." *Digital Studies/Le champ numérique* 10(1): 10, pp. 1–24. DOI: https://doi.org/10.16995/dscn.366

Published: 03 November 2020

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Digital Studies / Le champ numérique

Pedersen, Isabel, et al. 2020. "The Wearable Past: Integrating a Physical Museum Collection of Wearables into a Database of Born-Digital Artifacts." *Digital Studies/Le champ numérique* 10(1): 10, pp. 1–12. DOI: https://doi.org/10.16995/dscn.366

METHOD

The Wearable Past: Integrating a Physical Museum Collection of Wearables into a Database of Born-Digital Artifacts

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This paper describes the collaborative process involved in the novel creation of *The Wearable Past*: a collection of physical museum artifacts, presently on display at the Canada Science and Technology Museum in Ottawa, digitally re-presented in the context of the *Fabric of Digital Life* (or *Fabric*), a database of born-digital objects run by the Decimal Lab at Ontario Tech University. We discuss the multiple stages involved in integrating a physical exhibit of wearables within a database of born-digital artifacts. We argue that the inclusion of historic artifacts in Fabric effectively connects the past to the future, creating a dialogic relationship between digital artifacts rather than a hierarchical schema, facilitated by Fabric's metadata. Fabric provides a means to explore the cultural turn in wearable technology adoption, contextualized through a complex range of artifact representations. Following Bakhtin's notion of "dialogic interaction," we argue that the historic artifacts become dialogically entangled, and weave "in and out of complex interrelationships" (Bakhtin 1981, 276–277). We use Carole L. Palmer's thematic research collections framework to explain the overarching structure and intent for Fabric's born-digital collections. We then proceed to explain how *The Wearable Past* weaves historical cultural narratives from material artifacts into Fabric. We argue that they persist amid technologies that are proposed for future bodies to wear, reframing the conceptualization of wearables as lived phenomena. We draw on the work of several writers, including Lai Tze Fan (2018), Moynihan and Putra (2019), and Johanna Drucker (2009) to interpret *The Wearable Past*'s contribution to Fabric's content, metadata, and ontology.

Keywords: digital humanities; museum studies; history; archival studies; metadata; wearable computers

Cet article décrit le processus collaboratif qui a donné naissance à La technologie prêt-à-porter (*The Wearable Past*) : une collection d'artefacts physiques de musées, ce qui est actuellement présentée au Musée des sciences et de la technologie du Canada à Ottawa. Cela est représenté dans le contexte du Tissu de la vie numérique (*Fabric of Digital Life*; appelé *Fabric*), une base de données qui est gérée par La laboratoire décimale (*Decimal Lab*) à l'Institut universitaire de technologie de l'Ontario et qui se compose d'objets qui n'existent qu'au format numérique. Dans cet article, nous discutons des étapes multiples impliquées dans l'intégration d'une exposition physique de technologies portables dans le cadre d'une base de données d'artefacts n'existant qu'au format numérique. Nous avançons que l'inclusion d'artefacts historiques dans Fabric lie efficacement le passé à l'avenir, ce qui crée une relation dialogique entre des artefacts numériques, au lieu de créer un schéma hiérarchique, et ce que facilitent les métadonnées de Fabric. Fabric fournit un moyen d'explorer le tournant culturel qui est l'adoption de la technologie portable, contextualisé par une gamme complexe de représentations d'artefacts. Suivant la notion de Bakhtin d'« interaction dialogique », nous avançons que les artefacts historiques deviennent empêtrés de façon dialogique et s'imbriquent « les uns dans les autres dans des interrelations complexes » (Bakhtin 1981, 276–277). Nous nous servons du cadre de recherche de collections thématique de Carole L. Palmer afin d'expliquer la structure principale et l'intention concernant les collections d'objets n'existant qu'au format numérique de Fabric. Ensuite, nous présentons comment La technologie prêt-à-porter produit des narrations culturelles historiques à partir des artefacts matériels dans Fabric. Nous avançons que ces narrations persistent avec des technologies qui sont proposées pour le port de corps futurs, recadrant la conceptualisation des portables comme des phénomènes vécus. Nous nous appuyons sur les travaux de plusieurs auteurs, y compris Lai Tze Fan (2018), Moynihan et Putra (2019) et Johanna Drucker (2009), pour interpréter la contribution de La technologie prêt-à-porter au contenu, aux métadonnées et à l'ontologie de Fabric.

Mots-clés: humanités numériques; études muséales; histoire; sciences archivists; métadonnées; ordinateurs portables

Introduction

This paper describes the creation of *The Wearable Past* digital collection, the product of a two-year collaboration between researchers at Ontario Tech University and a curatorial team at the Canada Science and Technology Museum (CSTM). The result is a special collection of digitized artifacts from the museum, that are now integrated

with born-digital artifacts held in the larger Fabric of Digital Life (2020) (or Fabric) database (https://fabricofdigitallife.com) housed at Ontario Tech University (see **Figure 1**). Fabric uses a unique, humanities-based metadata scheme and archival practice to structure its open, web-based artifact repository that explores embodied computing (Pedersen and Iliadis 2020; Duin, Armfield, and Pedersen 2019; Pedersen, Everrett, and Caldwell 2019; Pedersen and Dupont 2017; Pedersen and Baarbé 2013). This paper highlights the complexities of the digitization process and expansion of the metadata ontology to accommodate the inclusion of historic material cultural artifacts, but it also describes the conceptual contribution *The Wearable Past* makes to the exploration of technology adoption and human adaptation to embodied technology as a phenomenon. For the sake of clarity, the word "wearable" describes a hardware technology, an object made by a human being, meant to be worn on an organic body. It includes both culturally-informed acts associated with wearing as well as practical, material constraints involved with adhering technology or material to a body. The Fabric database provides a means to explore the cultural turn in wearable technology adoption, contextualized through a complex range of artifact representations. Discussed later in this paper, the process involves both visual and textual interpretation. Fabric archivists predominantly collect video to archive, while curators at the Canada Science and Technology Museum are often

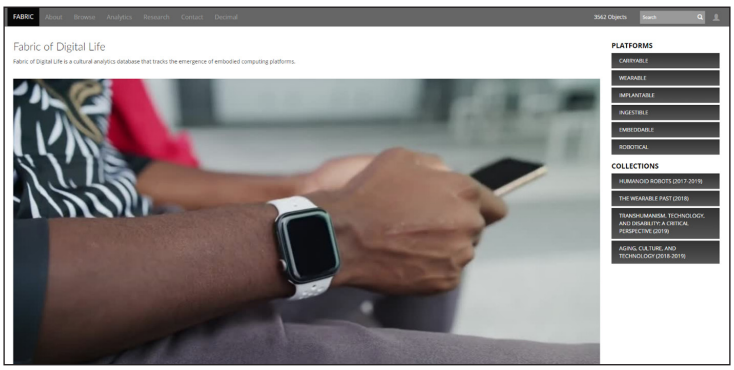

Figure 1: A screenshot of Fabric's frontpage showing one of its artifacts, an image of a person with a wearable smartwatch. The figure also displays the frontpage navigation buttons. (Fabric of Digital Life 2020) (photo permission granted by Isabel Pedersen).

concerned with the physical and multi-sensorial experience of museum exhibitions, oftentimes involving negotiation of its visitors' engagement with rich and complex visual exhibits. This paper contributes to archival studies a method to include and curate digitized historic artifacts amongst those that are born digital that effectively connects the past to the future, creating a dialogic relationship between digital artifacts rather than a hierarchical schema. It explains how Fabric's metadata facilitates narratives in a manner that enables the exploration of wearing technology as a lived phenomenon.

Since the post-Internet era, the Humanities has witnessed a growing chasm between the scholarly use of digitized historic material and that which is born digital. Susan Brown writes, "the humanities are being swiftly retooled by digital media and methods. More and more material from the past is being digitized, and the record of our current culture is increasingly 'born digital'" (2011, 03). Martin, Greenspan, and Quan-Haase write "The prolific use of digital information environments by humanities scholars has dramatically widened the divide between physical and digital documents" (2017). Their article discusses how "discovering texts serendipitously will be lost as humanities scholars turn increasingly to digital environments and search engines to seek information through direct queries" (Martin, Greenspan, and Quan-Haase, 2017). For this paper, one of the broader questions which we address through this curation project *is how does one integrate digitized historical artifacts with born-digital artifacts in a manner that neither isolates the two nor privileges one over the other?* Further*, can metadata design inspire interrelationships amongst artifacts from different times?* One project goal is to enable narratives of the past and future to speak to each other. Lai Tze Fan (2018) writes about the affordances and limitations of using a database to represent narrative and asks us to "think of extensive metadata itself as an accompanying narrative about a text and its contexts". Through the process of adapting the metadata structure to accommodate *The Wearable Past*, we sought to use metadata narratives to inform dialogic relationships for these historic artifacts amid born-digital representations of wearables. Fabric was designed during the "shift from textuality to visuality … to foster active engagement with new technologies rather than passive consumption of them" (Brown, 2011, p. 8) in archival practices. Much

has been written on digital tools that inform cultural discovery of visual content in digital archives or databases (Susan Brown, 2011; Lai Tze Fan 2018; Moynihan and Putra 2019). Moynihan and Putra (2019) describe "the very meanings that an archive enables [that] come into being through an entangled feedback-feedforward loop of influence—what N. Katherine Hayles has termed a 'technogenetic spiral' (Hayles 2012, 104)—wherein technologies and humans interact to shape what is sensible, knowable, and archivable in the first place". They call upon archives to "do more than simply enable the recording and creation of meaning" (Moynihan and Putra 2019). Likewise, Johanna Drucker (2009) writes that "speculative computing is grounded in a serious critique of the mechanistic, entity-driven approach to knowledge that is based on a distinction between subject and object. By contrast, speculative computing proposes a generative, not merely critical, attitude" (21).

We hope experiences with *The Wearable Past* evoke what philosopher Mikhail Bakhtin calls "dialogic interaction" (1981, 277) when defining the interplay of words and meanings. Bakhtin writes, "no living word relates to its object in a *singular* way … The word directed toward its object enters a dialogically agitated and tension-filled environment of alien words, value judgements and accents, weaves in and out of complex interrelationships, merges with some, recoils from others, intersects with yet a third group" (1981, 276). Bakhtin recognizes a decentralized, non-hierarchical, discursive relationship between signs and human interpretants. For *The Wearable Past* collection, one contribution proposed in this paper, is to foster dialogic experiences for visitors whereby artifacts are contextualized along with other past, present or future-proposed wearable technologies that may agitate value systems, provoke nostalgia, or simply inspire curiosity.

First, we discuss Fabric, its content structure involving born-digital artifacts and its metadata ontology. Second, we discuss the physical, site-specific *Wearable Tech* Exhibition at the Canada Science and Technology Museum and the decisions made for the creation of *The Wearable Past* digital collection. Third, we discuss curating, translating, digitizing, and archiving *The Wearable Past* digital collection. Fourth, we argue through several examples the manner through which artifacts become dialogically entangled. To make the argument, we show how historical

cultural narratives persist amid technologies that are proposed for future bodies to wear, in order to frame the conceptualization of wearables as *lived* phenomena. In this section, we explore how *The Wearable Past* informs other curated collections.

Fabric's content ontology

Fabric was established at Ontario Tech University in 2013. It falls under several theoretical domains due to its multidisciplinary contributions by researchers and its technological origins. Technologically, it is a *database* that provides researchers a means to *archive* representations to create a large repository of artifacts (See **Table 1**). It has developed and continues to evolve a customized data ontology

Table 1: A selection of metafield fields in Fabric (Fabric of Digital Life 2020).

Fabric Metadata		Results/Counts
Digital Artifacts		3813
Collections		43
Human-Computer Embodied Platforms (Content Themes)	Carryable	395
	Wearable	1946
	Ingestible	52
	Embeddable	177
	Implantable	378
	Robotical	390
	Other	475
Media Types	Video	2309
	Text	1416
	Graphical Image	44
	Audio	15
Media Subtypes	Journal articles	170
	Magazine articles	607
	Newspaper articles	243
	Film clips	324
	Television clips	104

(Contd.)

Fabric Metadata		Results/Counts
	Corporate videos	1226
	News broadcasts	179
	Web series	198
Keywords (approximations)	General	1800+
	Marketing	4900+
	Technology	3500+

based on the Dublin Core metadata scheme (Iliadis and Pedersen 2018). Fabric uses the CollectiveAccess open-source collections management and presentation software (https://collectiveaccess.org/). Used by many museums, arts academies, and universities, it provides a relational database that enables cataloging, searching, and browsing of web-based special collections. Fabric's archival practices are associated with digital humanities, rhetorical studies, and museum studies. Its mission is to provide a means to explore how humans are embodying and being embodied by emerging and future-proposed technology, through persuasive acts read through texts (Pedersen and DuPont 2017). However, it is also associated with digital humanities through the practice of including outside researchers, students, artists, curators, and museum professionals to create unique and evolving digital resources that put artifacts in dialogical relationships with other artifacts. With an international community, a range of contributor interfaces, and a suite of pedagogical tools geared to building digital literacy for this content, Fabric counters the notion that technological innovation and adoption are a purely corporate endeavour (See Fabric's *About*) (Duin and Pedersen 2020). It seeks to further develop its capacity to provide a means for cultural analytics. While it could never be considered a massive repository, some of its metadata categories provide keywords in the thousands to classify more than 3500 artifacts, including 2309 videos (See **Table 1**) (Fabric of Digital Life 2020). After seven years of growth, as well as the development of analytical resources such as a timeline interface and other visual tools, Fabric is beginning to enable the "uncovering" of "cultural patterns" that Lev Manovich (2017) describes as a marker of cultural analytics.

In terms of content, Fabric is not meant to be rigid, nor prescribed; it is meant to offer the means to explore phenomena. It includes tools to track the public emergence of embodied human-computer interaction platforms through modes of invention and in terms of human adaptation over time (Duin et al. 2018; Iliadis and Pedersen 2020; Pedersen and DuPont 2017). Specifically, it follows technologies that are designated according to body-centic platform categories: carryable, wearable, implantable, ingestible, embeddable, and robotical (see **Table 1**). Content also includes artifacts that represent technical ecosystems with other emergent technologies such as artificial intelligence, smart homes, social media, internet of things, biotechnology, and many others. Fabric allows visitors to explore emergence as both a technocultural and sociotechnical phenomenon amid the more common lenses, such as technical development or business and engineering reporting. At times, Fabric tells highly personal stories about why people make technology, adopt it, or even reject it. It allows for popular culture reactions to become enmeshed in the dialogue.

Originally, researchers at Ontario Tech University sought to create Fabric in order to critically engage digital culture with its orientation toward futurism. Corporate culture appeared to be celebrating bodily integration with technology. Inventors and companies were making bold, sometimes utopian speculations about the future in forms such as TED Talk videos that promoted positive transformations for machine-human mergers. TED stands for "Technology, Entertainment, Design" and its technoliberal themes and guest speakers coincided with the rise of wearable technologies that occurred after the year 2000. An exemplar is Google co-founder Sergey Brin's (2013) TED talk, "Why Google Glass?" In his justification for promoting the adoption of the device, Brin asks people to question mobile phone usage arguing that phones are isolating. He asks the audience to question "whether this is the ultimate future of how you want to connect to other people in your life, how you want to connect to information" (Brin 2013). With inflated rhetoric, the talk positioned Google Glass not only as a pre-release wearable product, but as an event that could change the future of social interaction. In 2013, Fabric was used to archive representations of Glass as a future-proposed technology; now researchers

can use Fabric to revisit Glass as a historic technocultural phenomenon amongst other artifacts. Following Joanna Drucker (2009), Fabric here performs a "generative" approach to exploring cultural artifacts, rather than casting a "merely critical, attitude" toward them (11).

Fabric also helps one reflect upon the grim, critical dystopian predictions made by science fiction authors, filmmakers, and journalists about our proposed lives. For example, the dystopian film *Minority Report* (2002) depicts wearables amid a future world that privileges technological determinism more than human rights. Fabric helps to reveal the extent to which the two are yoked. As Brian Greenspan (2016) puts it, "more than just a double-bind between transformative and skeptical thought, utopianism represents a mode of critical thinking that actively engages the 'dystopian figuration' of the dark side." Fabric's artifacts provide a means to think through and amongst these future propositions.

The name, *Fabric of Digital Life*, references a famous prediction made by Mark Weiser, Chief Scientist at Xerox PARC, "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it" (1991). Pedersen and DuPont (2017) further describe Weiser's influence on Fabric:

> As a slogan, the "*fabric of everyday life*" offers a way to reflect on Weiser's bold claim. Weiser's dream of technological disappearance is itself indebted to previous socio-technical scholars: he cites Martin Heidegger and Hans Georg Gadamer directly. However, the design of *Fabric* is also inspired by the writings of media, rhetoric, and communications scholars Marshall McLuhan, Jean Baudrillard, Walter Benjamin, and Kenneth Burke, which underpin our analysis of the telepathic sublime. The *Fabric* archive reflects the writings of these scholars to frame and contemplate how media shape attitudes, innovations, technologies, and culture.

Furthermore, over the years, designers considered John Unsworth's (2000) argument that a discoverable, annotated, and curated archive drawn from a selection

of representative artifacts might be the most appropriate way to address the phenomenon. Consideration was also given to Johanna Drucker's (2009) notion of metatext that enables analysis, search, selection, and display, which (alongside their metadata schemes) are capable of structuring and grouping elements (11). Drucker explains, "Metadata schemes must be read as models of knowledge, as discursive instruments that bring the object of their inquiry into being" (11). Fabric grows, expands, and morphs according to the rich collaborations it encounters. Analytical visualizations have been added to Fabric that offer a novel way to look at and discover relationships amongst the artifacts. Recently, Fabric has incorporated a graphical outline of a body and internal organs to let users navigate to relevant artifacts (e.g. clicking on the neck and filtering the HCI Platform to "wearable" leads to 95 artifacts involving that part of the body).

Right now, Fabric contains more than 3500 digital artifacts (see **Table 1**) (Fabric of Digital Life 2020). They include concept videos, film clips, academic research articles, documentaries, art pieces, video marketing materials, journalism, experimental media, fiction, and collected digital ephemera. As mentioned above, the majority of Fabric's metadata fields use Dublin Core standards, though some of the naming language has been adapted to capture the specific data and discourses that Fabric aims to track. For example, the element "Subject" has been split into three categories – "General Keywords", "Technology Keywords", and "Marketing Keywords" – in order to document technological invention and evolution, as well as the commercialization of these technologies through the creation of consumer products. In order to explore the ways in which the body is augmented and extended through the use of these technologies, some of Fabric's fields had to be customized, such as "HCI Platform", "Augments", and "Location on the Body". Additionally, the "Allusions and Responses" field creates both direct and indirect relationships between artifacts, helping to illustrate how inventions and ideas are informed by one another. The deliberate decision to not subscribe to a rigid controlled vocabulary not only allows the language that surrounds these technologies to continually grow and evolve, but it highlights the interpretive nature of archives themselves. Dialogical engagement allows space for this human interpretation without hiding behind

notions of neutrality. We acknowledge that after seven years of inviting archivists with varying levels of experience to contribute to Fabric, our assemblage of keywords is more extensive and expansive than consistent.

Fabric currently houses 43 collections, which feature interdisciplinary research from a growing community of scholars who are contributing curations (Fabric of Digital Life 2020). These collections visually display a selection of interconnected, digital multimedia artifacts that meet around a shared subject, like the *Transhumanism, Technology, and Disability: a Critical Perspective* and *Workplace Sociality and Wellbeing* collections, or a specific embodied technology, like the *Exoskeleton Project* and *What Language Sounds Like: Wearable Devices in Translation Communication* collections. Fabric's curated collections meet the criteria for Carole L. Palmer's (2004) "thematic research collections" framework. For Palmer, the basic elements are "digital" and "thematic", however, she further specifies "variable characteristics" which include the terms "coherent, heterogeneous, structured, and open-ended" (2004, p. 350) to define research collections. She describes the functional relevance of "coherence", as incorporating "all the materials included [that] assist in research and study on the theme. This coherence is generally anchored by a core set of primary sources" (321). In order to maintain coherence, Fabric's collections are framed by an abstract that includes a research question and commentary to explain the curation. Palmer goes on to mention that collections should also be "heterogeneous" and include "[a] mix of primary, secondary, and tertiary materials... which might include manuscripts, letters, critical essays, reviews, biographies, bibliographies, etc., but the materials also tend to be multimedia" (351). Fabric's curated collections usually include primary sources (e.g. concept videos of technology made by inventors) as well as secondary materials that further contextualize these primary sources with heterogeneous materials (e.g. a New York Times article about a new emergent technology; a film clip that depicts a fictional portrayal of a technology; a broadcast news clip about people wearing technology). Palmer (2004) writes about the term "open-ended":

> Collections of all kinds can be *open-ended*, in that they have the potential to grow and change depending on commitment of resources from collectors.

> Most thematic collections are not static. Scholars add to and improve the content, and work on any given collection could continue over generations. Moreover, individual items in a collection can also evolve because of the inherent flexibility (and vulnerability) of "born digital" and transcribed documents. (351)

Fabric collections vary in size and scope; while some, like *The Wearable Past*, are limited to a specific project and context, others continue to evolve over time as new technologies and discourses emerge and as archivists add new materials. For example, the *Humanoid Robots* collection has been growing since 2017 and now contains 249 artifacts.

The Wearable Past collection is novel to Fabric not only in its subject matter, but also in terms of its form. The process of adapting a physical exhibition to a digital, web-based environment complicated curatorial practices and outcomes.

Wearable Tech exhibition

Wearable Tech is a permanent exhibition at the Canada Science and Technology Museum curated by Tom Everrett, curator of communications. It opened in the fall of 2017 and features a diverse selection of body-worn artifacts drawn from Canada's national communications, transportation, natural resources, aviation, agriculture, and physical sciences collections. Artifacts include Google Glass (a well-publicized example of augmented reality eyewear, discussed earlier in this paper), Can-Dive Marine's Newtsuit (an early atmospheric diving suit), Nunavik Creations' Akulik Amauti (a modern take on a traditional Inuit parka for baby-wearing), and the National Research Council of Canada's Pigeon Telemetric System (an early successful attempt at real-time wireless biometric data gathering). Artifact displays are organized according to four general themes: workwear, communications, medical supports, and animal wearables.

The curatorial vision for the *Wearable Tech* exhibition was rooted in a desire to generate public interest in, and appreciation for, historically significant technologies that have been developed to augment, shape, or extract information from human and animal bodies. Each thematic section intentionally blurs the lines between

past and present, analogue and digital, 'high' and 'low' technology, so as to invite an engagement with the history of wearable technology that extends beyond the limited discursive field of consumer electronics. Indeed, many of the wearables featured in the exhibition are noteworthy for their ability to permit bodies to go places and do things they could not previously—all without any reliance on digital networks or smart computing infrastructures. By showcasing historic wristwatches next to smartwatches, spy cameras next to smartphones, an Inuit amauti next to a "Smart Parka," the exhibition encourages visitors to reconsider wearable technology as a much more diverse and multifaceted field of material and cultural practice. This shift in perspective in no way undermines the significance of the recent digital turn in wearable technology design but, rather, invites new and important connections between historic body-worn technologies and those of today.

Discussed below, *The Wearable Past* is not simply a digitized version of the museum's permanent *Wearable Tech* exhibition (See **Table 2**). As Berry (2011) explains, the mediation of objects by a digital platform requires first that those "object[s] be *translated* into the digital code that it [the platform] can understand" (1; emphasis added). This process of translation, taken here as a movement of historical

Table 2: Names, Dates, and Museum Artifact Numbers of Items in *The Wearable Past* (Fabric of Digital Life 2020).

Name of Artifact	Date	Museum Artifact Numbers
Akulik Amauti	2017	2017.0010
Animal Identification Microchip	c. 2016	2016.0164
Landmaster 5M45 Wristwatch	1994	1996.0215
Newtsuit Atmospheric Diving Suit Replica	1986	1986.0907
Fighter Pilot's Helmet	c. 1985	1995.1671
Pilot's Training Glasses	c. 1980	1996.0728
Polyethylene Corset	1967	2004.0099
Accutron Wristwatch	1965	2008.0107
Pigeon Telemetric System	1965–70	1985.0563
Biogalvanic Cardiac Pacemaker	1965–70	1985.0605

(Contd.)

Name of Artifact	Date	Museum Artifact Numbers
Ocular Prosthetic	1949	2001.0261
Micro 16 Camera	1946	1981.0934
Partial Dentures	1945–79	1982.0216
Modified Halter	1940	1988.0164
Pilot's Boot Liner	1939	2007.0014
Miller's Foot and Shin Guard	1939	2012.0040
Anti-Pix Chicken Glasses	1939	2016.0166
Welder's Safety Goggles	c. 1920	1992.1515
Beaver Fur Mitten	c. 1915	2004.0009
Concealed Vest Camera	1886	1981.1098

objects from a physical, site-specific exhibition into a digital environment, was such that it changed the entire curatorial project. The two exhibitions now stand alone as distinct curatorial works, despite sharing some of the same objects and interpretive frameworks in common.

The Wearable Past museum project tasks in the translation process

The Wearable Past involved several complex steps to manage the inclusion of material cultural artifacts in Fabric. The primary act of translation was the taking of digital photographs of the artifacts on exhibition, which would allow them to be uploaded into the database. This involved a tremendous amount of effort and specialized labour, since the team was not dealing with simple objects (if such a thing exists), but historically significant artifacts in an established national museum context. It was determined that while some artifacts could be reasonably well photographed in situ, others needed to be removed from their existing mounts and artifact displays. This required enlisting the help of specialized museum conservators to assess lighting and handling conditions; trained artifact handlers to open cases and physically remove artifacts; and a professional photographer to construct neutral backdrops, stage and light artifacts, as well as capture the digital images that were required for the project (see **Figure 2**). This translation effort demanded time, care, and significant

Figure 2: Photographer Pierre Martin photographing several artifacts for *The Wearable Past* at the Canada Science and Technology Museum.

investment on behalf of the museum and individual collaborators. The project also needed to be scheduled on a day when the museum was closed, to ensure minimal interruption to paying visitors, and required the wearing of personal protective equipment to mitigate risks posed by certain objects (such as the Pigeon Telemetric System, which contains high levels of arsenic and other hazardous chemicals).

While some artifacts could be photographed within and against the above constraints, others, however, were deemed off-limits. This is because the effort to remove these artifacts from their mounts and/or de-install glass casework (to reduce glare from overhead lighting, provide better angles for photographing, etc.) was considered too time-consuming, too disruptive to the existing exhibition, or too risky from an artifact safety perspective. These material challenges and restrictions imposed serious limitations on what was actually possible to achieve within the time and budgetary allotments of the digitization project. In the end, of the one hundred objects on display in CSTM's *Wearable Tech* exhibition, only about twenty-five were considered to be reasonable candidates for inclusion in *The Wearable Past* collection. The number was later reduced to twenty as described below (see **Table 2**).

This smaller pool of potential artifact candidates immediately influenced the curatorial process and eventual outcomes of the project. Once the smaller list of twenty-five objects was identified, it became clear that certain artifacts needed to be removed from consideration to restore equilibrium between different thematic

categories; so, too, did others which seemed to lose their heuristic impact when divorced from their original object pairings. All of this had an influence on the narrative and overall vision of *The Wearable Past* collection, which, in turn, necessitated further adjustments to the thematic organization of the collection, the conceptual framing of the accompanying text, and the compiling of the final artifact list. In the end, only twenty of the original hundred artifacts up for consideration were included in *The Wearable Past* collection (see **Figure 3**).

The Wearable Past's integration with other artifacts and curated collections

The Wearable Past was first inspired by the idea of bringing representations of historical objects into dialogical exchange, or conversation with the emergent technologies already featured throughout Fabric. *The Wearable Past* can be viewed as an autonomous collection or its artifacts can be viewed through metadata and/or other

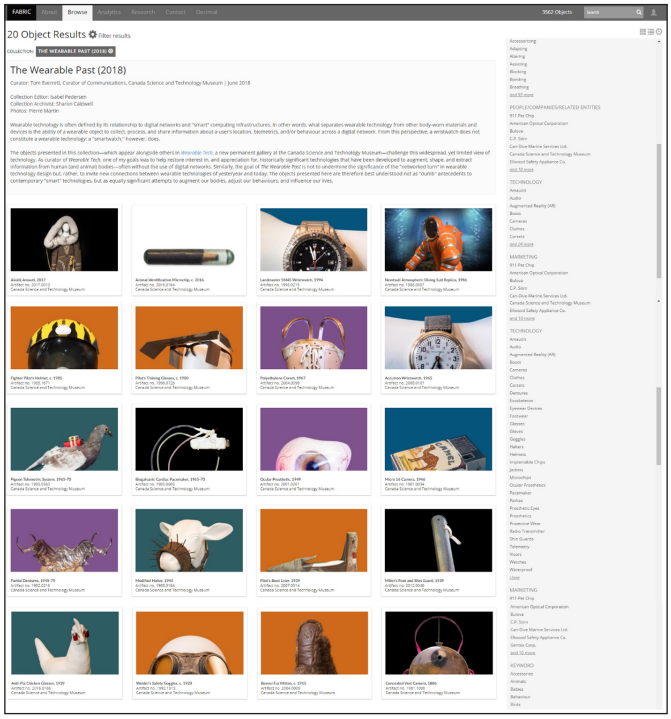

Figure 3: A screenshot of *The Wearable Past* collection of 20 artifacts in Fabric with much of the metadata in view (Fabric of Digital Life 2020). (photo permission granted by Ingenium – Canada's Museums of Science and Innovation).

collections. The hyperlinked, relational structure of Fabric's metadata facilitates rich, multilayered connections between digital artifacts. These modes of presentation—autonomous and interconnected—offer a powerful means of presenting and situating the historically-minded objects of *The Wearable Past* collection within the present- and future-focused collections already in Fabric (see **Table 3**). For example, exoskeletons (rigid, full bodysuits for performing difficult tasks) are a current wearable technology that have recently been made popular though both commercial inventions and fictional depictions. The technology keyword "exoskeleton" links the historic Newtsuit (c. 1986) with the other 156 multimedia representations of exoskeletons that Fabric has tracked so far, including film clips from *Iron Man* (2008*)* and *Elysium* (2013), corporate concept videos from Sarcos Robotics, and a research report about a futuristic "mind-controlled exoskeleton", which pairs an implantable brain-computer interface (BCI) with an exosuit.

Table 3: Selected Metadata from *The Wearable Past* Collection (Fabric of Digital Life 2020).

Metadata Field	Results
General Keywords	Accessories, Animals, Babies, Behaviour, Birds, Cardiac Rhythm, Cats, Cattle, Children, Communication, Culture, Design, Dogs, Experiments, Fashion, Health, Heat, History, Hospitals, Identification, Immersive, Indigenous, Industry, Inuit, Labour, Livestock, Medical, Military, Mobility, Mothers, Movement, Museum, Pets, Photography, Pilots, Polio, Protection, Research, Safety, Spy Operations, Surveillance, Temperature, War, Women, Work
Marketing Keywords	911 Pet Chip, American Optical Corporation, Bulova, C.P. Stirn, Can-Dive Marine, Services Ltd., Ellwood Safety Appliance Co., Gentex Corp., Holt, Renfrew & Co., Hugh Carson Ltd., L'Hôpital Sainte-Justine, Monoplex Eye Prosthetic, National Band & Tag Co., National Research Council of Canada (NRCC), Nunavik Creations, Saphira, Seiko Corp., Wm. R. Whittaker Ltd.
Technology Keywords	Amautiit, Audio, Augmented Reality (AR), Boots, Cameras, Clothes, Corsets, Dentures, Exoskeletons, Eyewear Devices, Footwear, Glasses, Gloves, Goggles, Halters, Helmets, Implantable Chips, Jackets, Microchips, Ocular Prosthetics, Pacemakers, Parkas, Prosthetic Eyes, Prosthetics, Protective Wear, Radio Transmitters, Shin Guards, Telemetry, Visors, Watches
Location on the Body	Arm, Back, Chest, Entire body, Eye, Feet, Hand, Head, Heart, Hip, Leg, Mouth, Neck, Shoulder, Spine Torso, Teeth, Wrist

Other Fabric collections now feature artifacts from *The Wearable Past*. The general keyword "surveillance" brings both the Concealed Vest Camera (c. 1886) and the Micro 16 Camera (c. 1946) into dialogue with artifacts in the *Surveillance Issues and Technologies* collection, including video clips from science fiction films and television shows like *Total Recall* (2012) and *Black Mirror* (2011–2019), news articles about filmmaker Rob Spence's *Eyeborg*, as well as more modern examples of wearable cameras used for life-logging, such as Google's Narrative Clip (2015). These new relationships add a valuable historical element to an ever-evolving narrative that examines social and ethical concerns like privacy and consent. By exploring all of the 240 artifacts tagged with the surveillance keyword, potential associations can also be made between the discrete nature of these spy cameras and more contemporary discussions around facial recognition glasses worn by police or the invisibility of data collection and control through the development of futuristic smart cities.

Much of Fabric's content explores altering, mixing, merging, or augmenting a person's reality with technology. Connections can be made between the Welder's Safety Goggles (c. 1920) (see **Figure 4**) and the augmented reality smart glasses of today. In the artifact description, Everrett notes, "augmented reality is often defined by the ability to change a viewer's perception of reality through the overlaying of

Figure 4: The Welder's Safety Goggles (c. 1920) (Fabric of Digital Life 2020) (photo permission granted by Ingenium – Canada's Museums of Science and Innovation).

digital information. Yet there are many cases where non-digital technologies have also been used to augment a viewer's perception of reality so as to adjust and/or limit exposure to elements of a 'live' event. These welder's safety goggles are an interesting case in point". The goggles were designed to filter out blue light through their amber-hue, thus protecting the eyes from bright flashes. They also helped increase visibility in low-light conditions. Right now, Fabric contains 535 artifacts tagged with the technology keyword "augmented reality (AR)" (Fabric of Digital Life 2020), as well as a curated collection titled *Human-centred Design for Augmented Reality (AR)*, which supports on-going collaborative research (Armfield, Duin, and Pedersen, 2019). The Welder's Safety Goggles (c. 1920) weave "in and out of complex interrelationships" (Bakhtin, 276) across artifacts and collections. For instance, it shares metadata with a news article about an AR oxygen mask artifact (a device named the Smoke Assured Vision Enhanced Display) designed for commercial airline pilots in 2018 (Fabric of Digital Life 2020). Both are tagged with the keywords "augmented reality (AR)", "protection", and "safety" and converge over the concept of work-based augmented reality and the prevention of physical harm. However, the AR oxygen mask is also discussed in the text as proposed for future military usage, which could inspire what Bakhtin calls a "dialogically agitated" relationship (1981, 276); a transformation occurs when one imagines war and combat in the mix alongside notions of care and safety. The narratives told through the metadata reflect both artifacts. As a concept, augmented reality takes on these sometimes-conflicting stories woven across the database.

Digitizing and translating from one medium to another never results in a simple copy of a text's meaning and function. Moynihan and Putra (2019) write:

> An act as seemingly simple as producing a digital facsimile of a text shifts and adds to the technical structures of that text, changing the media through which it can be read, the functions which it can perform, the networks in which it can participate, and introducing a point of contrast between the original medium and that of the remediated object which can reaffirm the mediating effects of both.

Remediating an artifact enables it to accrue different functions, participatory networks, and dialogical points of contact. *The Wearable Past* collection effectively broadens both time and notions of subjectivity, picking up themes that have been previously ignored by Fabric and current technocultural spheres in dialogical relationships. Many of the historical artifacts in the collection concentrate on care, carefulness, and human subjects who had been cared for by technologies crafted for that purpose. Fashioned to alter bodies, treat disease, or protect body parts that might be harmed by the elements, these objects signify not only novelty and craft, but also care in the making, e.g., The Pilot's Boot Liner (c. 1939) or Welder's Safety Goggles (c. 1920). The stress often falls on shape, contour, materials and human ingenuity.

Subtle reflections lie in some of the artifacts' descriptions, for instance, the Beaver Fur Mitten (c. 1915) is contextualized across time periods:

> There are a host of wearable technologies on the market today—think SharkSkin wetsuits and Cheetah running blades—that take inspiration from animal biology. Rather than constituting a radical break with the past, however, these developments are better understood as an extension of the longstanding practice of re-purposing animal body parts for their unique physical characteristics and/or material properties. These winter mittens, for example, are made primarily of beaver fur—a pelt long-known for its warm, insulating qualities and resistance to moisture. Hand-crafted over a hundred years ago, these mittens could withstand sub-zero temperatures and damp conditions as well as some of best synthetic gloves available today. (Fabric of Digital Life 2020)

By describing the Beaver Fur Mitten and other artifacts for their historical, material, or cultural influence on current technology, Everrett invites connections across different spheres in evocative ways that become further intermeshed through the metadata. Fabric currently holds 461 artifacts for the "hand" with 68 artifacts involving "gloves" which chronologically lead to the emergence of virtual reality gloves for creative escapism or even Imogen Heap's Mi.Mu gloves (c. 2014) for composing music (Fabric of Digital Life 2020). The identification of these historical

cultural artifacts broadens the category by providing an early anchor for hand-worn artifacts, allowing the past to speak to the future.

Conclusion

We have argued that the historic artifacts of *The Wearable Past* revitalize a repository of born-digital artifacts. We address how Fabric inspires interrelationships amongst artifacts from different time periods through metadata and collections imagined by other curators creating a rich and sometimes unexpected dialogue. Thus, we counter the inclination to create a hierarchy by neither privileging historical nor born-digital representations over the other. We discuss the physical tasks performed by members of The Canada Science and Technology Museum and the practical decisions made for the creation of *The Wearable Past* digital collection. Curating, translating, digitizing, and archiving *The Wearable Past* involved labour in addition to design and decision-making. We deliberately chose not to disassociate that labour from the conversation about the database, metadata, and the virtual connections that form across *Fabric*. *Fabric*'s goal is to enable visitors to linger over the dialogical entanglements of narratives that persist of past and future contexts made available based on the affordances of the database and its ontology. In future, Fabric curators will pursue further partnerships in order to continue to address the archiving of artifacts related to dynamically changing human practices. Wearing technology ought not to be viewed only as a post-Internet phenomenon. Through *The Wearable Past* collection, Fabric recoups a past that had been silenced.

Acknowledgements

This research was undertaken, in part, thanks to funding from the Canada Research Chairs program. We would like to thank the editorial team and also our reviewers for their thoughtful feedback.

Competing interests

The authors have no competing interests to declare.

Editorial contributions

Congress 2019 Editors: Barbara Bordalejo (University of Saskatchewan) and Luis Meneses (University of Victoria).

Section Editor: Nathir Haimun (University of Lethbridge Journal Incubator).

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How to cite this article: Pedersen, Isabel, Tom Everrett, and Sharon Caldwell. 2020. "The Wearable Past: Integrating a Physical Museum Collection of Wearables into a Database of Born-Digital Artifacts." *Digital Studies/Le champ numérique* 10(1): 10, pp. 1–12. DOI: https://doi.org/10.16995/dscn.366

Submitted: 30 November 2019 **Accepted:** 30 June 2020 **Published:** 03 November 2020

Digital Studies/Le champ numérique is a peer-reviewed open access journal published by Open Library of Humanities. OPEN ACCESS