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REMAKING COLLECTIONS

Mining the Material Archive: Balancing Sensate Experience and Sense-Making in Digitized Print Collections

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Large-scale digitization appears to put literary collections at one's fingertips, but, as some critics warn, the books themselves are increasingly out of reach as university libraries continue to shift from being 'physical repositories' to becoming 'access portals' to digitized materials (Stauffer, 2012). People who are drawn to print books often find that digital surrogates 'lack feeling' (Piper, 2012). Digitized texts preserve linguistic content of print works but not their many meaningful physical features that fundamentally shape interpretation (McGann, 1991) and contain valuable historical traces of print technologies, markets, and readerly interactions (Stauffer, 2012). Changing how we physically interact with texts also changes how we sense and make sense of them. How can we harness the potential of digital media to better represent and analyze print collections? How can we accentuate their unique historic, aesthetic, and material qualities while also allowing rich linking supported by computer-assisted content analyses? How can design critically engage with the sensory differences between reading print materials and on-screen reading in order to promote different modes of meaningful textual engagement? Addressing these questions, we introduce synesthetic visualization as a speculative approach to creating digital on-screen and tangible representations of print collections that translate — not replicate — sensory experiences of interacting with print collections by coupling visual representations with cues for other sensory modalities (e.g, sonic, tactile) that are routinely engaged by print texts. Drawing insights from aesthetic theory, book history, reception studies, literary studies, information visualization, human computer interaction (HCI), and digital arts, we propose possible ways to experiment with digital on-screen and tangible representations of print collections that explicitly aim to translate — not replicate — sensory and sense-making experiences inherent in interacting with print collections. We illustrate this through our own ongoing work with the Bob Gibson Anthologies of Speculative Fiction, unique hand-crafted booklets composed of science-fictional items culled from popular periodicals published between 1844 and 1992.

Introduction

Large-scale digitization appears to put literary collections at one's fingertips, but, as some critics warn, the books themselves are increasingly out of reach as university libraries continue to shift from being 'physical repositories' to becoming 'access portals' to digitized materials (Stauffer, 2012: 336). People who are drawn to print books often find that digital surrogates 'lack feeling' (Piper, 2012: 15), and scholars of book and media history help us recognize how digitization imperils the historical information embedded in, and readerly experiences elicited by, the materiality of print artifacts (e.g. Brake, Littau). This is due in large part to the necessary shift in materiality from print to digital media and the limitations imposed by common modes of digital display. And yet, as many critics acknowledge, 'digitization takes place in an economy of loss *and* gain' (Mussell, 2016: 25, original italics), and part of the promise of the digital humanities is that 'digital media can be used fruitfully to redirect and reinvigorate humanistic inquiry' (Hayles, 2012: 18) and our engagement with literary collections. In sum, while we may lose access to meaningful physical features (size, weight, paper texture, bindings, etc.) that contain valuable historical traces of print technologies, markets, and readerly interactions (Stauffer, 2012), we gain opportunities for large-scale analyses of corpora and for alternative modes of display and interactive play.

This paper is based on the premise that changing how we physically interact with texts also changes how we *sense* and *make sense* of them. Our considerations are based on our own attempts to digitally represent a print-based science fiction collection in ways that engage meaningfully with its unique aesthetic and material artifacts. We start by describing this collection's unique artifacts, our representation approaches, and the inherent challenges we encountered. We then outline theoretical grounds to promote more responsible remediation of print materials that remains sensitive to both the specificity of print artifacts as historical witnesses and the transformative potential of digital media to help us engage with historical materials in new ways. Drawing insights from aesthetic theory, book history, reception studies, literary studies, information visualization, human computer interaction (HCI), and

digital arts, we propose possible ways to experiment with digital on-screen and tangible representations of print collections that explicitly aim to translate — not replicate — sensory and sense-making experiences inherent in interacting with print collections. We hope that these considerations will fuel new, provocative modes of digitally displaying and analyzing print collections and archives in all their material, historical, and semantic complexity.

The Stuff of Science Fiction

The Gibson Anthologies of Speculative Fiction are exceptional in many ways and as such function as a particularly interesting test case for thinking about the complexity of print artifacts. Arguably, the more unusual the print object, the more its 'total form' (McKenzie, 2002: 307), including binding, page size, texture, and weight, *matters*, and therefore the more is potentially lost when it is digitized. Part of the University of Calgary's Special Collections, these 888 booklets were hand-crafted by Canadian collector, science fiction (SF) fan and artist, Bob Gibson (1908–2001). Gibson harvested more than 13,000 little-known specimens of speculative writing and illustration from 570 different popular magazines published between 1844 and 1992. He then bound these materials himself into unique booklets of different sizes and colors, using paper scraps and other household materials for the covers and bindings (see **Figure 1**). He provided a title for each of these anthologies (based on their source magazine), illustrated many of their covers, and provided a table of contents, handwritten with bibliographic details for each item. The table of contents also includes symbols through which Gibson rated the 'SF content' of the items he collected. We have identified approximately 78 symbols, however Gibson left no key to their exact meaning, even if he did sprinkle his anthologies with marginalia that provide some clues about his approach to classification.

To help us make sense of this unusual collection and its vast potential, we began by combining archival and exploratory visualization methods in an intertwined way (Forlini *et al.*, 2016; Hinrichs *et al.*, 2016; Hinrichs *et al.*, 2018). Working with a subset of 50 digitized anthologies, we produced detailed metadata (including titles, date and place of publication, author name and gender, keywords, and abstracts) from reading

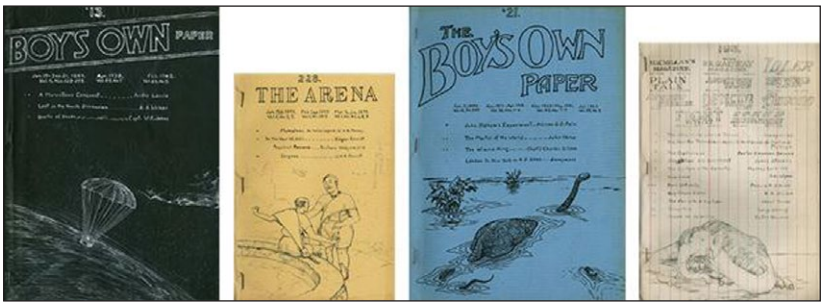

Figure 1: Four Gibson Anthologies of Speculative Fiction.

more than 1,500 individual items in Special Collections. In parallel, we developed the Speculative W@nderverse which provides different perspectives on the Gibson anthologies and this underlying metadata through an interlinked visualization (see **Figure 2**). The W@nderverse visualization consists of four interactive and interlinked visual views that showcase the topics present in the SF items through keyword motifs and also in relation to the Gibson symbols, the temporal distribution of SF items, and the large variety of titles and authors included in the anthologies (for more details about the visualization see Hinrichs *et al.*, 2016). The W@nderverse thus offers multiple points of entry into the Gibson Anthologies. People may scroll through story titles and access abstracts, or they may select SF items based on a particular range of years by manipulating the timeline. Alternatively, people may browse the keywords through the tag cloud and/or the radial tree diagram, which offers greater insight into the granularity of our extensive keyword system, or they may focus on Gibson's symbols (at the center of the radial tree diagram) whose meaning is (even to us) largely unknown. Additional filters at the top of the visualization help balance exploratory with more targeted content searches.

This interactive visualization was produced through an iterative design process informed by our archival work and feedback from different audiences (general public readers and SF fans as well as humanities and visualization scholars), and it allowed us to interrogate a subset of the Gibson Anthologies in an exploratory fashion and to identify large-scale patterns that were difficult or impossible to see without computational assistance. This intertwined process of visualizing the Gibson anthologies as a collection combined with archival work enabled us to: 1) decipher

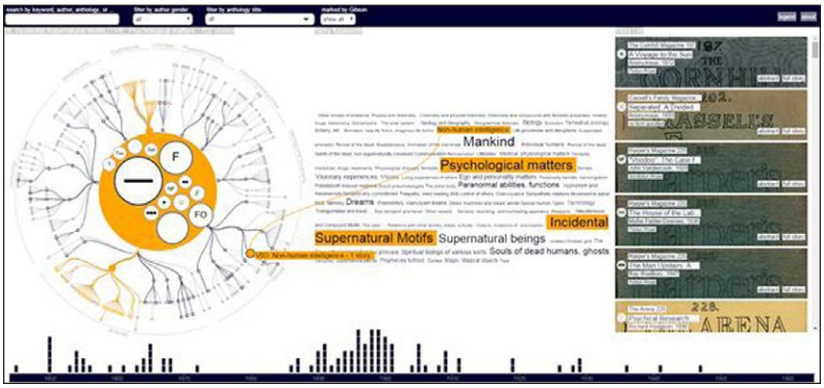

Figure 2: The Speculative W@nderverse visualization with its four interlinked views.

several of Gibson's SF content symbols providing insight into his own categorization of SF works; 2) identify numerous writers not included in authoritative bibliographies of the genre; and 3) learn of a range of Victorian periodicals not previously suspected of contributing to the development of SF (see Forlini *et al.*, 2016; Hinrichs *et al.*, 2016).

The Speculative W@nderverse can be considered a milestone in our process, but we do not think of it as a final result, in part because we approach visualization as a speculative and critical intellectual process. We have referred to this process as 'building visualization sandcastles' (Hinrichs *et al.*, 2018), a method of research thinking through visualization and a variation of 'thinking-through-practice' (Burdick *et al.* 2012: 13). We consider the W@nderverse a product of our early explorations of the Gibson anthologies. It is a visualization sandcastle that has, through its very limitations, motivated our theoretical explorations of ways to embrace the unique aesthetic and material characteristics of print collections while translating them into digital form. The W@nderverse emphasizes the content-related metadata of the Gibson anthologies, but it only hints at the qualities of this collection of unique print artifacts. While the item list (see **Figure 2**, on the right of the interface) provides a glimpse of the anthology covers, this does not effectively convey what the Gibson anthologies may look and feel like (e.g., their size, weight, and paper material) neither does it allow the navigation of the collection based on aesthetic or material features.

This neglect did not remain unnoticed. The academic scholars, general interest readers, and SF fans to whom we presented the Speculative W@nderverse at

different events were fascinated by the visualization and the unique collection it represents, and visibly engaged in the exploration of anthologies and SF items. However, they frequently commented on the striking visual and material aesthetics of the anthologies ('*My favourite part is the cover snippets—they are beautiful & have character*'), all the while pointing out the lack of presence of these very characteristics in the W@nderverse. For example, one participant suggested the need to present '*some alternate representation of the anthologies as artifacts. I think it is important that this is still visualized, as Gibson created these [the anthology covers] as a way to understand the content*'. These critical discussions of the W@nderverse with different potential audiences motivated us to consider how best to translate print collections into digital media in ways that are not only driven by their content but also their aesthetic and material characteristics. We realized that the process of remediating cultural artifacts into digital environments must be informed by research (and researchers) from a wide variety of fields, including humanities-based areas (e.g., book history, literary studies, and critical theory), library and information sciences, and the cognitive and design-oriented sciences (e.g., psychology and human computer interaction and visualization). The goal is to translate (critically and creatively) embodied experiences with physical print objects into digital environments, recognizing the strengths and limitations of each medium, their associated perceptual habits, and their entanglement in larger media ecosystems (Piper, 2012; Hayles, 2012). In the following we present these considerations that are the result of our review of a broad spectrum of perspectives from the humanities, the sciences, and design. We introduce these considerations as a theoretical foundation to drive design innovation, but also to provide a critical perspective on current approaches to digitization and the design of interfaces for cultural collections.

Remaking Collections: Transforming Print Artifacts Into Digital Space

#1 The Matter of Content || The Content of Matter

> '*To hear books speak, you have to interview them in their original habitat.*'—
> Anthony Grafton

Mass-digitization of print collections promises to preserve and promote widespread access to our most precious cultural resources, but there are a number of often uninterrogated, problematic assumptions involved in digitization as it is currently practiced. One of the most pernicious of these inherent in current digitization practices is the idea that what matters most about a print artifact is its written content, and that this content functions independently of its underlying material instantiation. This assumption is apparent in the 'more product, less process' approach (Greene and Meissner, 2005) which drives digitization practices whether conducted by Google Books or research libraries. Such a process typically treats every print artifact in largely the same way, and the resulting digital archive, as Andrew Piper notes, 'flattens everything into identical objects' (Piper, 2012: 78–79).

However, scholars of book history and of what Jerome McGann has called the 'textual condition' have long argued that 'the text's language *and* the book's physical properties are *both* involved in constructing meaning' (Levy and Mole, 2014: *x*, our italics). Andrew Stauffer (a nineteenth-century scholar) reminds us that print books are not just passive conduits of semantic meaning, but 'scenes of evidence', containing valuable physical historical traces of, for example, print technologies, markets, and readerly interactions (Stauffer, 2012: 340). When print artifacts are digitized they are in effect 'stripped [...] of the rich evidence that their original form could provide' (Grafton, 2009: 311). According to Anthony Grafton, original documents 'tell us things no image can'. For example, he recounts the story of a historian who systematically sniffed '250-year-old-letters in an archive' and by detecting the smell of vinegar 'which had been sprinkled on letters from towns struck by cholera in the eighteenth century, in the hope of disinfecting them' was, thus, able to 'trace the history of disease outbreaks' (2009: 311). All this is not simply to say that there is no substitute for the material archive (there isn't). The point, rather, is to recognize the complexity of the material archive and to consider the potential of digitization and digital displays to open up new ways of analyzing and understanding it and new ways that engage with — rather than ignore — its rich complexity.

Moreover, even if we forget for a moment the rich evidence embedded in the very 'stuff' of print artifacts, the pervasive privileging of content (narrowly defined as

semantic content) forecloses the kinds of non-interpretive uses of books by different people. It turns out that books and other print artifacts matter to us in many ways, and not only (for some, not even primarily) because of their content. Numerous studies show that semantic interpretation is only one way that people interact with print books (e.g., Silverman, 2016; Price, 2012; Litau, 2006; Cormack & Mazzio, 2005; Jackson, 2001; Bogdan *et al.*, 2000; Cressy, 1986; Davis, 1983). As Gillian Silverman has recently summarized, 'reading is but one approach to the book, an object that might also serve as a totem, a gift, a decoration, a shield against unwanted intrusions, or a form of cultural capital' (2016: 308). If, as she suggests, we allow for a consideration of neurodiverse readers and 'a range of textual approaches that at times privilege sensate experiences over sense-making' such as those employed by autists and bibliophiles alike, we could 'help revise traditional notions of reading and print culture' (Silverman, 2016: 309).

In effect, then, digitization is often preserving only part of the cultural significance of print materials, and digital archives are promoting only a small fraction of the many ways in which we might interact with and experience cultural collections. The pervasive privileging of content (narrowly defined) might help explain why, for example, many readers find that digitized texts 'lack feeling' (Piper, 2012: 15), and it helps explain the often uninspired reading interfaces for digitized print collections (and for many e-readers for that matter). It seems that the privileging of semantic content above all is accompanied by a kind of forgetting of both books' physicality and our own bodies, which places us in the peculiar position of having to intervene in order to 'remember' both (Hayles, 1999: 20). These theoretical groundings as well as our own experiences with enabling the digital exploration of the Gibson anthologies highlight the importance of promoting intertwined perspectives on the collection that embrace both semantic content and materiality when designing digital interfaces for cultural collections. If we recognize the importance of an artifact's materiality, then this design process must be considered a transformation, not a replication.

#2 Transformation Not Replication

'*As it is new material facets that give digital resources their analytical power, the goal of digitization is modification, not simulation.*'—James Mussell

A lot of approaches to interfaces to digital (library) collections have embraced the assumption that digitization produces a copy or digital surrogate of a print artifact, resulting in re-renderings of bookshelves with books that can be skimmed page-by-page on-screen, as we are used to from their physical counterparts (see, e.g., Kleiner *et al.*, 2013). However, as many digital humanists readily recognize, framing the relation between a print artifact and a digitized artifact as one between original and copy is ill-conceived. Doing so necessarily relegates the digitized artifact to the status of a derivative, inferior copy that will always fall short of the 'original', and as such fails to recognize the process of digitization as the creation, remediation, modification, or translation of artifacts that then become part of a complex media ecology and artifactual history. Digitization is not some external process that is applied to print artifacts without fundamentally affecting them; whether we recognize it or not, digitization intervenes in the life of that artifact, becomes part of and alters the history of its dissemination, transmission, study, and preservation. Moreover, seeing the print artifact as the 'original' also 'misinterprets the relation of printed material to the past' (Mussell, 2016: 27). Following the lead of textual scholars, 'archival objects are better considered […] "witnesses", documenting the processes that produced them, the society in which they circulated, and the archival practices that kept them safe' (Mussell, 2016: 27). If we consider a particular book, it does not make sense to think of it as a unique original, since it has always been multiple, and the wide diversity of its material existence (in different editions, for example) everywhere complicates the idea of an original. In the case of literary texts, the common practice of digitizing only one edition of a book, for example, has the effect of obscuring the complex history of a text as well as the evidence provided by readerly marginalia that may be scattered in different copies and not always present in the version digitized.

As mass-digitization efforts continue apace, and major policy makers continue to push the use of 'digital surrogates' and to advocate for permanently eliminating public domain print books from research libraries once they have been digitized (Stauffer, 2012: 338), it is increasingly urgent that we recognize that such initiatives (driven primarily by narrowly pragmatic and short-sighted economic concerns) will fundamentally affect how different audiences engage with historical cultural materials. For example, as Stauffer points out the proposed shift to 'digital surrogates' would have profound impacts on students' training in certain fields of humanistic study for which idealized digital surrogates alone just will not do. But it is not only students and scholars who will necessarily be affected. The great democratization of access to cultural materials and knowledge that is promised by the digital age (and its mass-digitization efforts) means that the ways in which these materials are digitized and, subsequently, presented will necessarily impact legions of what Marin Dacos has called 'unexpected readers' that we will have to learn to address and to welcome (Dacos, 2017). We therefore urgently need to reconsider the dominant approach to digitization not only for the sake of researchers, teachers, and students (who depend on these materials), but also for the unexpected readers who might be drawn to engage electronically with some of our most precious cultural collections.

In such a context, it is important to think about the types of data we would like to collect, translate, and make visible digitally. We also need to think about ways that draw from the analog yet embrace the digital medium and the possibilities it offers, and about data that might be missing from current large-scale digitization approaches led by big contributors such as Europeana and Google. The costs of digitization will make it unlikely that print collections which have already been digitized will be revisited for additional metadata production any time soon. Priorities will be on new artifacts. Stauffer predicts that 'in a decade or two it will all be over, as the wide-scale reliance on digitized surrogates pushes the public domain physical collections to the margins or out of the libraries completely' (2012: 341). In addition to intervening in decisions about what material collections will remain physically accessible as Stauffer argues, scholars must also help address the limitations of current digitization and

digital display practices to make sure that they better attend to the complexity and richness of the irreplaceable material record.

What we propose here then is to embrace digital media as an opportunity to transform critically and creatively, rather than replicate, print collections in ways that remediate both their content and physical presence. We seek to promote new interactions with and interpretations of cultural collections, weaving together sense-making of content with sensate experiences informed by —not copying — embodied interactions with print artifacts. We might begin by reconsidering ways of understanding the necessarily embodied modes of reading both print and digital texts and the materiality of books and bodies.

#3 Embracing Embodied Experiences

> '*[R]eading is always a practice embodied in acts, spaces, and habits.*'
> —Roger Chartier

Reading (whether print books or screens) is a fundamentally embodied experience. As Piper puts it, reading does not just happen in our brains but 'spans several domains of sensory and physical experience' (Piper, 2012: 154). When we change how we physically interact with books, we change how we both sense and make sense of them.

In fact, as N. Katherine Hayles has pointed out, 'early reports suggest that we do not read screens in the same way we read [paper or print] pages, and that there are different cognitive outcomes of reading within different environments' (2012: xviii). Hayles notes that there is a marked difference in modes of attention from 'the deep attention characteristic of humanistic inquiry [and "close reading" of print books] to the hyper attention characteristic of someone scanning [hyperreading] webpages' (2012: 69). Ongoing mass digitization of print materials has also permitted more and more kinds of what Franco Moretti calls 'distant reading' — that is, the computer-assisted quantitative analyses of large corpora (Moretti, 2005).

Part of the work of remaking digitized print collections must thus include more robust investigations of embodied reading practices, but also the imagining of new possibilities enabled by aesthetically provocative representations of digitized

materials. In his reflections on 'reading in electronic times' (as his recent book is subtitled), Piper calls attention to the need to understand better both the differences between reading print and digital media and to identify what matters most to us as we imagine how things might be:

> Only when we understand the differences between books and screens at these most elementary of levels—at the level of the person, habit, and gesture—can we make informed choices about the values associated with the kind of reading we care about and the technological (and pedagogical) infrastructures that should support such values. Technologies don't just happen. At least not yet. We are still agents in this story, and we have some choices to make (2012: xiii).

The choices we have to make must be informed, critical choices, not dictated by default practices. This involves both a more robust engagement with materiality of books and bodies and an interrogation of who is making these choices and for whom.

#4 Performative Materiality

> '*Consider things, and you will have humans. Consider humans, and you are by that very act interested in things. Bring your attention to bear on hard things, and see them become gentle, soft or human. Turn your attention to humans, and see them become electric circuits, automatic gears or softwares.*'—Bruno Latour

Approaches to understanding and translating the materiality of print artifacts (in both their material and digital forms) must be capacious enough to support different understandings of materiality grounded in vastly different disciplines; in particular humanities-based disciplines, which are best equipped to untangle the complex meanings of print and digital artifacts, and research disciplines based in computer-science (especially interaction design, HCI, and visualization), which are best equipped to theorize and innovate new modes of meaningfully translating print artifacts into digital environments based on concerns identified by humanistic inquiries.

Johanna Drucker, perhaps the staunchest proponent of humanistic interface design, makes a strong case for the need to attend to humanistic understandings of materiality in the development of graphical interfaces. Specifically, she cautions against a literal approach to materiality, which she identifies as a 'naïve if well-intentioned focus on the properties of entities', and she distinguishes this literal materiality from both forensic (which 'refers to evidence') and formal materiality (which 'refers to the codes and structures of human expression') as identified by Matthew Kirschenbaum (Drucker, 2013: np). While both forensic and formal materiality are useful in understanding the properties of things, Drucker seeks to extend these considerations to include an understanding of performative materiality — the understanding that part of what something *is* has to do with what it *does*. Drucker here draws on a rich humanistic tradition of thought (especially by feminist and queer theorists) to challenge ontologically based understandings of materiality. Although primarily focused on encouraging the development of visual interfaces better suited to 'the situated, partial, and constitutive character of knowledge production' in the humanities (Drucker, 2011: np), Drucker is also encouraging digital humanists to 're-engage' with 'the mainstream principles of critical theory on which a model of performative materiality is based' (2013: np).

In parallel to these arguments, researchers in HCI have started to engage in theoretical and practical discussions of the complexity of materiality, including its performative dimensions. Recently, Elisa Giaccardi and Elvin Karana have proposed a framework of what they call 'materials experience', which provides ways of articulating how the experience of different (digital) materials call forth different ways of doing and modes of practice. Although the vocabulary they develop primarily brings together interaction design communities and 'emerging practice-oriented agendas in HCI', they also draw from humanistic theories, including Merleau-Ponty's *Phenomenology of Perception* and John Dewey's *Art as Experience*, as they similarly call for a 'broader understanding of materiality' (Giaccardi *et al.*, 2015: 2448) that takes into account the complex interactions between people, materials,

and practices. Their framework delineates four experiential levels (sensory, interpretive, affective, performative) to help us understand how these relationships exist and change in time. Although Giaccardi and Karana's work does not focus on visual interfaces, their insights into the importance of materiality draw attention to 'the link between the aesthetics of a design and the performances that are carried out *with* and *through* its materiality' (2454, original italics). In focusing on the situated experiences of different materials (through which we can move beyond the distinction between the physical and the digital), their work can help us explore the possibilities of letting materials '"lead the way" in the potential unfolding of social and cultural practices' (2454) that we might want to facilitate and promote around cultural collections.

These understandings of materiality in its broader sense (beyond characterizations of properties), coming from largely different disciplines and working toward different aims, can nonetheless be brought together synergistically to help us make the performative, experiential materialities of both print and digital artifacts a central theoretical and practical endeavor. They can help us to imagine the kinds of situated, embodied experiences we hope to foster in digital environments based on the recognition of what we value in print artifacts and the opportunities their digitization hold. The aim is not simply to replicate experiences with print, but rather to transform habits and gestures of reading/engagement with print and digital media.

#5 Embracing the Superfluous: Rethinking Aesthetics

'*I am one of those to whom superfluity is a necessity.*'—Théophile Gautier

Based on the above considerations, we propose that the business of migrating our cultural heritage into digital environments is fundamentally an aesthetic one and should be approached as such. In practice, aesthetic concerns are typically relegated to secondary importance in the process of creating digital representations — that is, when they are not dismissed altogether as superfluous window-dressing. However, if we remember that aesthetic experience is central to meaning-making — and thus the way we represent collections influences the types of questions that get asked — it becomes necessary to give more concerted attention to the importance of aesthetic

engagement in the representation of digitized print collections. By emphasizing aesthetics, we mean to invoke some of the meaning of the Greek term from which it originates — *aesthesis*: 'the faculty of sense, the capacity to both perceive a given and make sense of it' (Rancière, 2009: 1). We seek to draw a closer connection between that which is given to the senses and the modes through which we can make sense of these givens. In the case of digitized collections, this involves reexamining the 'original' print artifacts for the ways in which they elicit sensate experiences and sense-making, and paying attention to how the digitization of these physical artifacts fundamentally alters both how we *sense* and *make sense* of them. Designing new modes of preserving and interacting with digitized print collections must be more clearly informed by the differences and continuities between print and digital media, particularly at the level of sensory and sense-making experiences.

The work involved in 'remaking' digitized print collections is at once critical, theoretical, creative, and technical. In particular the fields of visualization and human computer interaction have started to explore approaches that transform print-based collections into a digital environment while reflecting on content and visual and physical features in combination (both from the perspective of object properties and interactive performance). Most digital interfaces to cultural collections provide thumbnail images of the cultural artifact in question to enable a glimpse of the visual and physical manifestation of the corresponding real-world object itself (e.g., manuscripts, paintings, or sculptures). Some interfaces are almost solely driven by thumbnail images. For example, the interface of Google's Cultural Institute[1] predominantly consist of thumbnail images to preview items of particular collections. While this provides a striking overview of the diverse characteristics of these collections in high resolution and showcases artifacts' real-world appearance, thumbnail images alone do not allow for 'generous' approaches (Whitelaw, 2015: np) to, or 'rich prospect browsing' (Ruecker *et. al.*, 2011: 3) of, digitized cultural collections that leverage the meaning of aesthetics in the wider sense. To take advantage of one

[1] https://artsandculture.google.com/.

of the main benefits of remediating collections into digital realms, we should allow making sense of collections from multiple perspectives and at a large scale.

Another common approach is linked visualizations that provide abstract views summarizing a collection's abstract metadata in combination with side-by-side or integrated thumbnail views that provide information about individual items. We follow this approach in the Speculative W@nderverse (see **Figure 2**), and many other examples exist (c.f., Hinton, 2010; Whitelaw, 2015). Other approaches use the thumbnail image as a transitory surrogate that allows the pivoting between individual artifacts of a collection to birds-eye perspectives that provide a high-level overview of collections based on abstract metadata. This form of '*Media*' or '*direct*' visualization — (terms coined by Lev Manovich to describe visual representations where 'data is reorganized into a new visual representation that preserves its original form' (2010: 14) — places thumbnail images within more abstract visualizations. With the image histogram, slice histogram, and the entourage plot, for example, Crockett discusses a number of ways to directly integrate thumbnails as glyphs into charts and cluster visualizations (Crockett, 2016). Similarly, Glinka et al. skillfully integrate thumbnails of historic sketches into an interactive timeline and enable their detailed visual exploration through fluid zooming. Here the unique visual aesthetics of a cultural collection are intertwined with content-driven metadata.

Only few approaches exist that integrate metadata driven by aesthetics and materiality of cultural items into abstract visualizations. One exception to this is the Bohemian Bookshelf by Alice Thudt et al. which features the 'book pile' and the 'cover colour circle' as visual overviews where books can be explored and filtered based on their page length (commenting on size and weight) and cover color alongside more content-related metadata such as author, publication year, or keywords (Thudt *et al.*, 2012; see **Figure 3**). In contrast to this more literal engagement with visual and physical properties of cultural collections, EMDialog by Hinrichs et al. engages more explicitly with transforming, rather than replicating, the aesthetics of a cultural collection into digital space. EMDialog presents paintings and diary entries by expressionist artist Emily Carr in the form of interactive abstract visualizations that are based on the visual metaphor of trees and the woods as a direct commentary

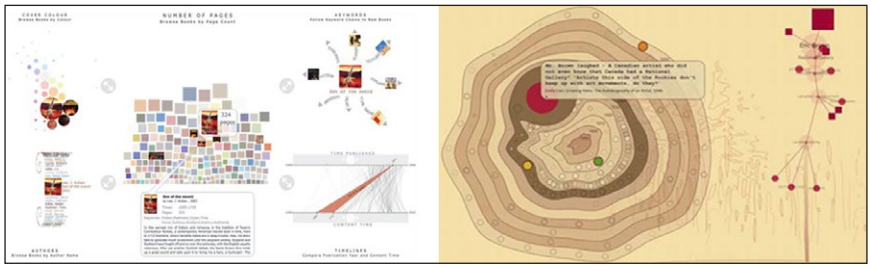

Figure 3: The Bohemian Bookshelf (left) juxtaposes content-related aspects with visual and material qualities of the underlying books (Thudt *et al.*, 2012). EMDialog (right) uses the metaphor of a tree to visually reflect on a collection of paintings and literature by expressionist artist Emily Carr (Hinrichs *et al.*, 2008).

on the motifs shown in the Carr's paintings (Hinrichs *et al.*, 2008; see **Figure 3**, right). The visualizations are presented on a tilted direct-touch tabletop display resembling a drafting table which is surrounded by ambient sounds of the woods (water rushing, birds twittering, and wind combing through high trees) to comment on the production process of the artist who created most of her sketches out in the woods. The aesthetics inherent in the visualization are not just to evoke curiosity and to promote interaction among visitors, but they fundamentally contribute to making sense of Carr's work as a whole, considering the topics addressed (content), as well as material qualities inherent in the production process of art.

All of these examples represent powerful ways of navigating cultural collections in digital space. However, approaches to transforming print collections into digital media that comment on the extended materiality of the collection's individual items, including their texture, smell, the process of making them, or performative aspects of the component materials (e.g., use context or promoted reading experience) are still rare, partly because of the lack of corresponding metadata.[2] The importance of

[2] Some notable precedents include, for example, projects that specifically focus on readerly annotations of specific print artifacts such as Andrew Stauffer's Book Traces project https://www.booktraces.org/ and Lindsey Eckert and Julia Grandison's The Almanac Archive https://www.digitalhumanities.org/dhq/vol/10/1/000240/000240.html. In the case of periodicals, Andrew King's Nineteenth-Century Business, Labour, Temperance, & Trade Periodicals (or BLT19) site is particularly notable; it includes Ann M. Hale's discussion of the differences between physical and digital periodicals and images that attempt to show the actual size of Victorian periodicals, see 'Physical vs. Digital Periodicals' https://www.blt19.co.uk/secondary-materials/topics/physical-vs-digital-periodicals/. Such examples show an attentiveness to unique materiality of specific print artifacts and the challenges and opportunities of translating them in a digital environment.

collecting data about the visual and physical material qualities of cultural collections is highlighted by data models as, for example, introduced by the Europeana, which considers descriptive categories for material qualities of cultural artifacts (e.g., the medium — 'the material or physical carrier of the resource', Meghini, 2016: 55). We need to further expand such approaches to address material aspects of print collections not only from the perspective of property descriptions but also social, situated, and performative aspects of materiality.

A turn toward alternative modes of data representations, including auditory data displays (c.f., Pauletto & Hunt, 2009), tangible interfaces (c.f., Marquardt *et al.*, 2009), data physicalizations (Jansen, 2015), as well as recent trends in shape changing interfaces (c.f., Rasmussen *et al.*, 2012) and augmented reality (c.f., Bach *et al.*, 2017) may provide inspiration to transfer particular embodied experiences with print-based collections into digital environments. Similarly, inspiration from nature or from observations of people interacting with print artifacts in physical environments can spur digital interfaces that promote engagement with digitized print-based collections on sensorial, interpretative, affective, and performative levels (Giaccardi & Karana, 2015). At the same time, we may draw inspiration from more theoretical methods and insights grounded in humanities research, known for, among other things, its incisive analyses of modes of representation, to imagine new ways of remaking print collections that consider not only content but also the physical, sensate, social, and performative experiences they provoke.

#6 Synesthesia

'*And the hyacinth purple, and white, and blue,*
Which flung from its bells a sweet peal anew
Of music so delicate, soft, and intense,
It was felt like an odor within the sense.'—Percy Bysshe Shelley

Opening up our repertoire of possibilities, we might draw inspiration from long-known representational techniques, such as we propose here in the example of synesthesia: a mode of literary description that suggests (more or less explicitly) a sense analogy

or transference between senses, describing one mode of sensory experience in terms of another. In the above lines from Shelley, the synesthetic connections are multiple as a scent is represented as a sound that affects the ears as if it was a scent. Literary synesthesia is often employed to capture and describe situations or experiences in vivid and relatable ways for more immersive, captivating reading experiences. Synesthesia as an aesthetic technique cultivates such connections between different senses on purpose, in contrast to the related phenomenon of psychological synesthesia, which refers to a typically involuntary 'condition in which stimulation in one sensory modality also gives rise to an experience in a different modality' (Sagiv, 2005: 3), as in, for example, seeing colors in response to letters, numbers, or even a day of the week. Although initially 'considered to be an "abnormal" manifestation of perception', more recent research suggests that psychological synesthesia might be rather 'an intensification of an otherwise "normal" perceptive processing' (Gsöllpointner, 2016: 12), and, thus, might offer unique insights into how we process multiple sensory stimuli simultaneously. Whitelaw provides a detailed overview of synesthesia in terms of neuro-and perceptual science and audiovisual art and argues for a model of 'cross-modal binding' as preferable for understanding audiovisual art in particular (Whitelaw, 2008).

Our concern in this paper is with synesthesia as an evocative aesthetic technique, but it is worth noting that, although patently distinct, both literary and psychological synesthesia suggest ways in which our experience of the world is mediated, amplified, and enriched by complex relationships between the senses. Literary uses of synesthetic imagery can be traced back to ancient Greek poets, but the technique becomes especially prominent in writers and artists from the nineteenth-century (especially Romantic, Symbolist, and Aesthetic poets) and is revived, more recently, by contemporary digital artists (see, for example, Gsöllpointner, 2016). We are particularly drawn to instances in which poets and digital artists alike turn to synesthesia because it allows them to experiment with crossing sensory modalities for different aesthetic ends, often to defamiliarize or heighten the representation of sensory and affective experiences.

Along these lines, we suggest applying the idea of synesthesia to visualizing digitized print collections as a way to defamiliarize our relation to print and digital artifacts. As a provocative analogy, synesthetic visualization has the potential to re-orient discussions of how we routinely engage with printed artifacts in physical environments, in order to inspire new ways of how we might want to navigate, read, and experience print collections by coupling and crossing visual representations with cues for other sensory modalities (e.g., sonic, tactile) in digital environments. Just like trends in biohacking seek to augment the human body to experience digital information, we argue for 'hacking' digital environments, and visualization and visual interfaces in particular, in order to facilitate the experience of print collections as triggered by their unique materialities. Synesthetic visualization can take many different forms, and this chapter does not provide prescriptive models, but rather the theoretical grounding for more aesthetic approaches to digitized print collections that we hope might serve as a call to the community to boldly engage in creative experimentation when remaking collections. In the next section, we offer speculative possibilities for centering aesthetic experience as a way of engaging with print and digital artifacts.

Paper Traces in Digital Environments

Unusual collections such as the Gibson anthologies and other 'mixed material items … pose special cataloguing, access and interpretive challenges for archivists and researchers alike' (Zboray & Zboray, 2009: 101), but they also offer unique opportunities for pushing the boundaries of digitization and digital display precisely because they do not easily fit pre-existing categories. These are what Walter Benjamin referred to as 'booklike creations from fringe areas' (1970: 66), and more recently, what Zboray and Zborary call 'whatchamacallits' (2009: 101). While we do not believe in a one-size-fits-all approach, we do believe that thinking through challenging test cases, such as the Gibson Anthologies (hand-crafted, fanzine-like, scrapbook-like folk art booklets), can inform the digital representation of other print artifacts. Here, we briefly present some of our own speculations based on our work with the Gibson Anthologies.

We begin with a consideration of what becomes possible when we integrate representations of paper texture in digital displays of digitized print collections. As mentioned above, Gibson's hand-crafted booklets are made up of speculative fiction stories and illustrations harvested from a wide-range of periodicals originally published between 1844 and 1992. Because Gibson harvested these items directly from periodicals before reassembling and rebinding them into handmade booklets, the anthologies not only contain thousands of little-known works of SF, they also contain physical traces of the history of periodical publishing and the involvement of 'pulps' (cheap pulp paper magazines) and 'slicks' (more expensive glossy magazines) in shaping the evolution of SF. In particular, the earliest works (1844–1930) offer unprecedented insight into the literary and publishing experiments that first helped establish the SF genre and paved the way for the emergence of specialized SF pulp magazines in the 1930s.

Notably, the earliest periodicals harvested by Gibson are increasingly available only in digital forms that do not preserve information about paper type and size and are viewable primarily through interfaces that promote indiscriminate mining of verbal content. Integrating the representation of paper types into digital displays has the potential to accentuate the significance of the anthologies beyond their literary content, highlighting also the history embedded in the very stuff of their pages. Standard digitization does not preserve this information, but this does not mean that digitization cannot help accentuate it.

Bibliographers have long employed raking light as a way of examining and distinguishing paper types (Gaskell, 1972: 227) and the same method has been employed to accentuate surface texture of paintings and other kinds of artifacts, including, for example, photographic paper (see Johnson *et al.*, 2014). Close-up raking light imaging has the added benefit of not requiring any other additional equipment than is routinely employed in digitization. Another approach to be considered would be employing microscopic imaging in raking light (such as was used, for example, in a study of 'foxing' or the 'small, roundish spot stains of reddish or yellowish brown colour' in eighteenth-and nineteenth-century drawings (Manso

et al., 2009: 2029)) to accentuate texture even further, though this does involve more specialized equipment. Using close-up raking light imaging we have started to explore how to showcase visually the tactile differences between paper types (see **Figure 4** for examples).

These extreme close-ups of paper material under raking light accentuate texture, and although they showcase detail not immediately apparent to the unassisted eye, they evoke a synesthetic sense of the relative 'feel' of papers in the collection. The images themselves can augment qualitative and quantitative metadata about paper types. In the absence of sufficiently granular standardized vocabulary for nineteenth-century machine-made papers (Elmore, 2016), this type of imagery could facilitate a tailored qualitative classification of paper material which, in turn, could be supplemented with quantitative methods to computationally distinguish between

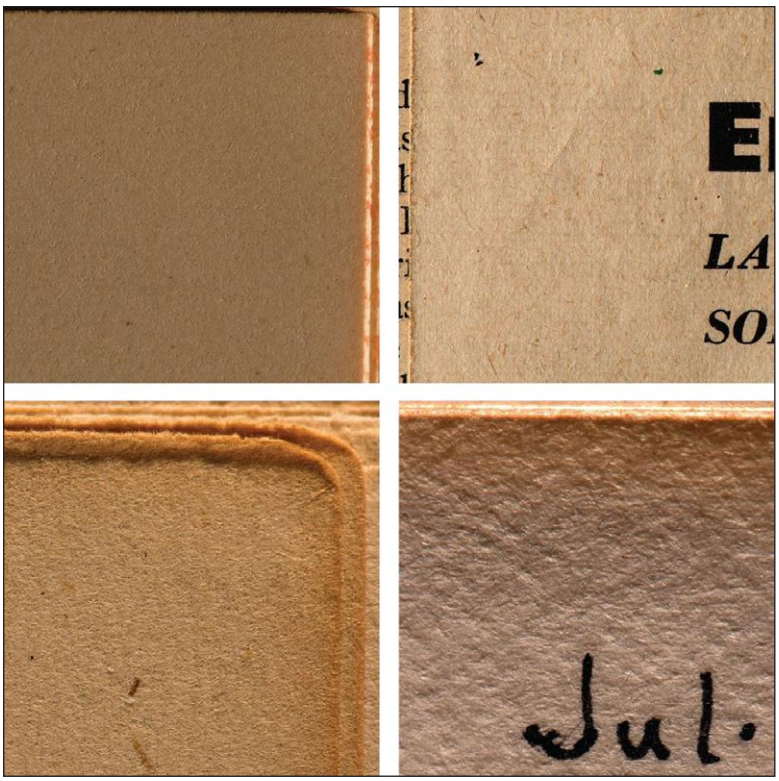

Figure 4: Examples of the different paper materials of source periodicals of the Gibson Anthologies using raking light imaging.

the relative graininess of paper samples at a large scale (as, for example, through wavelet-based multi-resolution analyses for texture discrimination (Laine and Fan, 1993)).

Such seemingly innocuous details as paper texture constitute physical evidence of evolving paper-making and publishing practices that necessarily impacted the development of the SF genre. While some will find information about paper interesting in its own right, it also implies different kinds of content, contributing authors, and audiences. A visualization that clusters stories according to paper types provides information about the context in which these stories were published, with grainier paper more often associated with cheaper weekly periodicals aimed at broader audiences and finer paper more often associated with more expensive monthly periodicals usually aimed at a supposedly more discerning readership. The distinction may also suggest what kind of authors might be writing for each type of paper, and may even provide insight into whether upper and lower market publications showed any preference for (or bias against) publishing men or women writers.

However, the display of raw paper material would also indicate that there is no simple and easy division to be made solely based on paper type, since Victorian periodicals were often published in a variety of forms at a variety of price points aimed at different audiences (including bound book-like in semi-annual or annual compilations printed on better paper and intended as more permanent parts of a personal library for those who could afford them). This range of paper types (and their associated price points) is also significant as it highlights the diversity of forms of Victorian periodicals — a diversity that is erased in current digital displays of periodicals (Mussell, 2016). Making visible raw paper material may also help alert readers to the fact that the appearance of paper will also bear the marks of environmental exposure and age (through things like 'foxing' for example).

Once combined with representations of literary content (from metadata manually derived through archival and curatorial work, or computationally derived through text analysis), these visual representations of paper 'feel' can invite readers to explore the broader significance of the Gibson anthologies. By analyzing the content of these

early SF stories by paper type, we can begin to tell a more 'textured' history of how literary innovation was tied to changes in paper-making and periodical publishing. Such a combined analysis of paper type and content on a large scale offers a new approach to large-scale literary history (something we could not feasibly do with print artifacts alone).

Although focused on synesthetic connections between visual and tactile cues, we could imagine involving alternate sensory modalities. For example, we could sonify paper types ('pulps' and 'slicks') or augment their texture to be explored using haptic interfaces (for example, as demonstrated in the haptic puck introduced by Marquardt *et al.*, 2009, a haptic device to make visual features in digital images presented on large horizontal displays tactile and, hence, more palpable).

Similar imaging of the Gibson covers could help give a 'feel' of the diversity of paper that makes up individual anthology covers and that simultaneously suggest the crafted, homemade nature of the Gibson archive. Gibson was not a collector of expensive first editions; his anthologies gather ephemera largely neglected in histories of the genre. His homemade archive is appropriately made of household papers, signaling his work as that of a bricoleur (tinkerer or crafty handyman) who makes do with the materials at hand, including old wrapping paper, paper bags, used envelopes (still bearing traces of an address or stamp), waybills, and repurposed covers of old IBM manuals or even accounting papers (see **Figure 5** for examples). The Gibson anthologies thus showcase what he has done not only with the materials he harvested from periodicals but also materials sometimes sourced and repurposed from other kinds of print artifacts. This is one of the many ways we do things with print artifacts other than (or in addition to) reading them as suggested earlier.

To highlight the crafted nature of the anthologies is to attempt to use the digital medium against the grain, so to speak. The anthologies are the work of one's hands, and as Piper notes 'there is a profound sense of person that comes through the work of one's hands that cannot be fully replicated digitally' (2012: 81). However, if we move away from attempting to 'replicate' digitally, we could better imagine ways to evoke or elicit different but nonetheless meaningful related experiences.

Figure 5: Examples of Gibson Anthology covers highlighting the differently sourced paper materials used in Gibson's manual crafting process.

For example, in the case of the hand-crafted Gibson anthologies, we could invite readers to engage in the kind of performative archiving that Gibson practiced through the work of his hands, and we could do this both on screen and through data physicalization. Tapping into the malleability and versatility of the digital medium we could invite readers to engage with the crafted nature of the anthologies by permitting the disassembling and reassembling of collected pages according to

different variables (dates of publication, authors, literary or formal features, etc.). This would accentuate the scrapbook-like nature of the anthologies and the practice of scrapbooking itself as a form of meaning-making through print artifacts that has migrated into the digital realm through 'the "cut and paste" terminology used by computer programs and applications' (Grubar Garvey, 2012: 21). At the same time, such digital remaking of the anthologies offers what the print anthologies enclosed in Special Collections do not — an opportunity to take these compilations apart and reassemble them in new ways to test out different ways of making sense of what they are and what they contain. Here we could tap into the fact that what the Gibson anthologies are has a lot to do with what they do. They were for Gibson a means of preserving and organizing the detritus of print culture (the many forgotten works that nonetheless fundamentally helped shape the emergence of SF). Allowing others to remake Gibson's anthologies, we can explore what readers and researchers can do with them. We can certainly learn about Gibson's own handiwork and from his categorizations, but in addition to this, we could also emphasize the role of new readers in making and remaking histories of a living genre.

Moving beyond on-screen representations, we could explore *digitally-enhanced data physicalization* as a means to translate information one gets from handling the anthologies and noting their scrapbook-like nature. This means understanding the ways Gibson himself implicitly re-thought the structure of the book and the page as he deconstructed existing periodicals and, by cutting, pasting, and binding, reconstructed from their individual pages anthologies of his own making. As others have also suggested, we believe that translating print into a digital environment should involve a rethinking of the formal structure of the page and the physical structure of the codex book to take advantage of the fluidity and malleability of the digital medium (Piper, 2012). We could enable the compilation of Gibson items into new reader-driven anthologies represented by digitally enhanced physical tokens that could visually and/or physically reflect on their source anthologies and, when placed on a display, allow reading of the items. One could even explore different fabrication methods that would take the Gibson anthologies' material aspects and/or

readerly habits and practices as input. This latter reader-driven example involves understanding both print and digital objects as fundamentally social, and the act of embodied reading as a generative act. Gibson's reading (with scissors and glue), much like ours (with different digital tools such as visualization, raked light imaging, and text analysis), is also a form of making and sharing reading materials and experiences.

Offering multiple possible views, sensory experiences and analogies, and modes of interactions becomes a way of accentuating the richness of the material print collection, and, at the same time, of inviting numerous kinds of readers with different interests and inclinations to engage with it.

New Directions in Digital Representations of Print-Based Collections

> '*The technique of art is to make objects "unfamiliar", to make forms difficult, to increase the difficulty and length of perception.*'—Viktor Shklovsky

With the passing of the age of print, we have become increasingly aware of 'the assumptions, presuppositions, and practices associated with it' (Hayles, 2012: 2), and, by contrast, we glimpse the apparent devaluation of materiality that appears to haunt digital culture (Hayles, 1999). It has become a critical commonplace that print and digital media are being defamiliarized for us by their very co-existence in seeming transition. Ongoing mass-digitization efforts underline the multivalent value of print artifacts and the need for traditional collections of print artifacts that can 'tell us things no image can' (Grafton, 2009: 311). However, these same digitization efforts also continue to hold the seductive promises of democratizing access to cultural heritage and of the 'wonders' that might be revealed by opening up large corpora to computationally assisted large-scale analyses (Stauffer, 2012: 341). Taking on the challenge of remaking collections means taking on a simultaneously technological and aesthetic challenge with profound social, scholarly, and cultural implications. The speculative possibilities we present through the example of the Gibson Anthologies are not meant to be prescriptive but rather suggestive of alternative approaches to this challenge. If, as some theorists suggest, aesthetic experiences are those which arrest our attention, interrupt perceptual automatisms, and provoke us to feel

and think differently and often more critically, then aesthetic considerations offer particularly fruitful opportunities for reinvigorating our engagements with digitized print collections. Based on our own evolving cross-disciplinary speculative practices, we outline in conclusion a set of more generalizable practical possibilities:

Data Misgivings: Data (etymologically speaking) means that which is 'given', but data is not without its misgivings. It is also necessarily about the givens we choose to attend to, how we choose to attend to and measure them, and how we endeavor to make them perceptible and understandable to others. All of these critical steps involve various kinds of decisions and interpretations that should remain open to critical deliberation and debate. When it comes to digitized print collections, metadata collection must be informed by the specific historical and cultural context of the collection and with uniquely tailored interface design/visualization in mind. We should explore ways of moving beyond the descriptive and start to develop standard alongside free-form vocabularies that can be more specific to unique artifacts and their visual, material, and performative aspects.

Opening Editions: As part of the efforts toward open access to cultural materials and knowledge, we might also consider opening editions of works to ongoing curation. The mutability and accessibility of digital media is here brought to transform the notion of the scholarly edition of any one work or set of works. Researchers, students, citizen scholars, and unexpected readers can contribute new metadata, in a layered, filterable, and transparent way to promote participation in cultural heritage and the rich resonances it offers for different audiences. Of course, such participatory digital editions already exist to some extent. However, the opening editions we envision would make the traces of participation directly visible and customizable in the resulting digital (or physical) interfaces, and would be informed by studies of readerly and interactive experiences with both print collections and their digital representations. To do this, we must engage different audiences (scholars, general-interest readers, amateur experts, fans) in discussions of how best to transform print collections into digital media. In-depth (comparative) studies that investigate readerly experiences with interfaces to cultural collections

are still rare. However, such studies would not only provide empirical evidence into experiments in remaking collections, but also inform and inspire novel design explorations.

Tailored Interfaces and Aesthetic Provocations: In parallel to developing general one-size-fits-all 'tools', we should continue exploring unique interfaces that speak to the specific character of print-based collections. The graphical interface is here understood as a dialogue with and interpretation of the collection, visible and/or tangible in visual and haptic aesthetics that might incorporate physical aspects of the print-based artifact directly or metaphorically. Interpretative reflection on the collection might also manifest itself in interaction design and performative aspects considering how readerly 'performance' will evolve with the collection as transformed into digital space. Drawing and extrapolating from sensate and sense-making experiences inherent in print media, we can harness the potential of new media rather than trying to replicate (usually rather poorly) print media in a digital environment. Synesthesia's crossing sensory modalities offers interesting opportunities for defamiliarizing habits and gestures of reading/engaging with print and digital media. We believe that this could be important in getting people to think more critically about their experiences of different media through suggestive bridges between physical and seemingly weightless digital worlds.

Representational Palimpsest: Transforming a print collection into digital form — be it through a visualization or an interface of a different kind — is not a straightforward process, and different approaches and solutions are not only plausible, but desirable, especially if we think of digital interfaces to cultural collections as *critical engagements* or *dialogues* from multiple situated perspectives. For any given print collection, we should therefore aim not for one single best solution but multiple digital manifestations that each reflect on different critical and designerly interpretations of the same metadata. Digital representations within such a palimpsest could be discernable individually or in concert; they could be rough static sketches, or high-fidelity interactive marvels. What is crucial is that we experiment critically, creatively, and variously.

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The authors have no competing interests to declare.

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