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Playing at the Page: Designing to Support Creative Readership Practices

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ABSTRACT

In this paper we look at examples of creative, emergent and performative practices in readership. Starting with the history of the book, and including a discussion of a range of reader practices we make connections with our own creative practice as designers of interactive mixed reality movable books today. A theoretical frame for characterizing the reader today as postdigital is presented to push back against commonly held beliefs about the act of reading as passive or somehow less creative or enacted compared with digital technologies. Finally, our own interactive movable book project Simmer is discussed as a means to bridge historical methods and materials with the digital, and a set of design strategies are provided in support of postdigital readership.

KEYWORDS
Reader, Postdigital, Mixed Reality, Affect, Movable Book, Book History

CITATION

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1.   The Postdigital Reader

In this paper we examine theorizations of readership practices to develop our concept of the *postdigital reader*, as a way of informing our own interdisciplinary art practice in designing mixed reality movable books. While we reflect on historical understandings of the reader based on text-only conceptions of the codex, which we might call immovable books, our focus is understanding the reader of *movable* books. Just as the computer has been described as a *gesamtkunst* medium, able to synthesize and remediate many older forms of expression, so too can the movable book provide a wide range of expressive capability, including in combination with the computational medium. This type of multi-modal expression has appealed to humans throughout time, and continues today. The form of the movable book is not new, and dates back centuries.[1] Movable books are useful for our discussion, as they are a broader characterization than the pop-up. Pop-up books focus on three dimensional forms, often leveraging the potential energy of the central fold of the codex spine to activate these forms in motion. While movable books may include three dimensional pop-ups, they can also include any number of other interactive paper forms including flaps, enclosures, volvelles, peep structures, and transformation views. Enclosures can allow for a broad range of interactive paper forms to be incorporated such as flip books, tunnel books, thaumatropes, paper toys, and more. The multi-dimensional nature of movable books means these volumes can include both the tight interrelation of word and image found in traditional picture books, along with an eclectic range of interactive structures that today even bridge the computational, incorporating digital sensors, companion systems, and remediations in a variety of ways.

While our discussion focuses on understanding the postdigital reader, we seek to keep in view the entangled, relational nature of all components in the book-ish ecosystem, which today of course includes digital technologies as well. Acknowledging the entangled relations of book, author, reader, fellow readers, information, text and paratexts, publisher, producer, and material (including the computational) is necessary, as each of these components have agential capabilities within this web. Unfortunately this relational web is often referred to by only one of its components. This tendency toward synecdoche has led many theorists toward the siren songs of either suppression or liberation regarding the analogue book and digital counterparts, claiming, as astutely critiqued by Paul Dugid: "[...] a technological Prospero seems at last to be at hand to free the informational Ariel from the cleft pine (or wood products) in which he has been trapped" (Dugid 2006, 499). Indeed, we foreground Dugid's corrective that "Books produce and are reciprocally produced by the system as a whole" (Ibid., 501) and in our analysis of the postdigital reader of movable books include both material and authorial relations, while noting the opportunities for future research into other relations, such as the social, political, and economic aspects of the book system.

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[1] Examples of early books with movable structures include Matthew Paris' *Itinerary Maps from London to Palestine* manuscript from c. 1250, which includes flaps, and Peter Apianus' printed book *Cosmographicus Liber* from 1533, with complex rotating volvelles.

Building on prior research creating a typology of movable book forms and their relevance to digital design grounded in a media archaeological approach (Rouse & Holloway-Attaway 2020; see **Fig. 1**) we further extend this typology by providing an exploration of correlated reader types, interaction patterns, and associated design strategies. While our previous work looked back to examples of movable books to construct a genealogy of the interactive prehistory of electronic text, this companion paper examines a genealogy of readers who throughout history have interacted with the codex in "other" ways. This genealogy of interactive readership is both utilized in support of design but can also serve to trouble the dominant conception of reading as a passive activity, as has been discussed by many historians and theorists, elaborated below in Section 2. Our focus on the movable book is somewhat unique in terms of research into readership practices, as some have critiqued movable books as non-literary, spectacle, or even gimmicky commercial elements of popular culture that are somehow anti-literacy or not conducive to readership at all (Opie & Opie 1975; Maynard 1986). But given the range of theoretical work that does complicate all types of reading practices as more than cognitive interpretation of linguistic signs, such as discussed by Benjamin (2008), Reid-Walsh (2018), Field (2019), Johnson (1993), and Emerson (2014) which we examine below, we also take note of the movable book's proximity to the toy. Given this relationship of the movable book and the toy, we turn our attention to associated genealogies such as the history of how people have interacted with pre-cinematic image technologies and the role of tactile, embodied interaction in the movable book and related forms, to more broadly understand the postdigital reader.

In our usage of the term *postdigital*, we do not mean to indicate we are past or done with the digital, but rather call out the redundancy of the term as the computational medium becomes ever-more deeply integrated not only through literal incorporation (your refrigerator likely has a computer) but also through the adoption of computational media interaction conventions, strategies, and techniques into other media, thus reifying the computational throughout contemporary culture, including in analogue forms. We also use the concept of the postdigital to allow for an examination of the ahistorical usage of digitality, as a concept commonly deployed to distinguish contemporary interactors as ever-new and markedly different from those who interacted with apparatuses and environments prior to the computer age. The digital, however, can also refer to the fingers (digits) of the hand. In this sense, we have always been digital. Similar to Jenny Sundén's concept of the transdigital (outlined in Section 3.1), we identify the historically disruptive, transgressive, and transformative capabilities of the postdigital reader who is not isolated in either analogue or digital domains and who is resistant to simple or passive conceptions, definitions or tools (Sundén 2018). Indeed, we consider how some much older apparatuses may provide more engaging digital interfaces - for example, the piano.[2] As mixed reality designers today, working across the material and the digital, we still have much to learn from older digital interfaces such as the piano, and the movable book.

MOVABLE BOOK TYPE
Book as Instrument
Book as Intimate Object
Book as Secret Keeper/Giver
Book as Substrate for Accretion of Objects
Book as Illusion of Motion
Book as Game or Puzzle
Book as Performative Space or Stage

Fig. 1 Typology of movable books as presented in Rouse, R., Holloway-Attaway, L. (2020) "A Prehistory of the Interactive Reader and Design Principles for Storytelling in Postdigtial Culture." Book 2.0 Journal (10) 1, pp. 7-42.

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[2] The piano could be understood as a black-boxed machine operated by digits that provides instant response, similar in some ways to the cell phone touch screen. And yet, when one plays the piano, one can fill a house with music, and contribute creative expression when practiced enough to do so. No matter how much we practice contemporary digital interfaces such as Twitter, it will never fill a house with music. We will never master it as a creative medium, and it will never respond to us as a creative partner or at least, not yet.

Fortunately, these pre-computational examples of digital interactivity are prolific, even though they may seem at first to be eclipsed by discussions of passive codex readership and passive cinematic viewership in dominant cultural discourse and some scholarship on media. Instead, it may be the case that these passive media ecologies are the exception, and not the other way around, given the extensive and rich history of hands-on interaction. As Wanda Strauven states in her media archaeology research on tactile interaction in pre-cinematic technologies such as zoetropes and thaumatropes, "the eye is depending on the hand [...] the key element of the human body is the hand, that congenital prosthesis distinguishing men from animals. Thanks to his skillful hands, man is a technical animal" (Strauven 2011, 154). We might take this one step further to claim humans as *digital* animals, thanks to the hand. Strauven goes even further to connect the hand to language as follows: "[...] thanks to man's vertical walking, the hand is linked to the face, that is, to the talking instance: gesture and word are fundamentally intertwined" (Ibid., 154). Interestingly, Strauven identifies the cinematic screen (as opposed to the touch screen) as what we might interpret as anti-hand, or anti-digital, describing the cinematic screen as: "More rigorously than its predecessors, the film screen is a screen that protects the apparatus from the touching hand [...]" (Ibid., 138).

Given the legacy traced by Strauven through 19th century philosophical or optical toys, and the long history of movable books discussed in our prior research (Rouse & Holloway-Attaway 2020), one begins to wonder if the conceptions of the 'purely' visual, passive codex and cinema are part of a narrow imaginary more specific to a particular time period during the 20th century, and less of a dominant norm in wider history. Interestingly, it may have been in part the dominance of these passive forms as a broadly accepted cultural imaginary of what it means to interact with media that provided the necessary friction for the early 20th century avant-garde to gain traction with its wide range of creative practices focused on inviting (or even fetishizing) active participation, which had broad impacts throughout 20th century on conceptions of the reader.

2. 20th Century Conceptions of the Reader

Here we briefly revisit historical understandings of 20th century readers. During this time period, many theorists of culture, media, and literature developed conceptions of the reader with a focus on readers of traditional codex forms or immovable books as opposed to movable books. More recently, theorists have developed understandings of readers of 'other' twentieth century texts, such as early hypertexts and their relation to experimental literary forms. In addition, contemporary scholars have looked back to examine readers of both picture books and movable books, albeit with a focus on child readers. We discuss this range of conceptions of readers to draw inspiration for our own typology, as well as note the ways in which our typology differs, given our focus on movable books and adult readers.

2.1. Readers of Immovable Books

Theorist Michel de Certeau discusses the text as a liminal space, with the reader as a traveler, but not a settler, who may take from and refashion the text as she traverses the codex: "The reader produces gardens that miniaturize and collate a world [....] He deterritorialized himself, oscillating in a nowhere between what he invents and what changes him. Sometimes, in fact, like a hunter in the forest, he spots the written quarry, follows a trail, laughs, plays tricks, or else like a gambler, lets himself be taken in by it" (De Certeau 1984, 173). For De Certeau, the reader playfully takes on many roles in moving through the author's text;

a gardener, a traveler, a hunter or poacher, a trickster, a gambler. The act of taking on these roles transforms the text, through reader performativity, into something produced in collaboration between author, material, and reader.

In the digital media context, we may be more familiar with theorist Henry Jenkins' invocation of the figure of De Certeau's poacher as a creative reader, in Jenkins' discussion of fan fiction, remix, and other digital culture reading/writing practices that further make visible the performativity of the reader and the text as liminal space for readers to transform into writers (Jenkins 2012). Jenkins' focus on popular culture also connects with conceptions of the reader through the lens of contemporary 'genre' fiction. These are readers who self-identify with a particular popular fiction genre (i.e, mystery, science fiction), and engage with multiple transmedia consumption practices (film adaptations, video games, collector cards, etc.) centered around this consumer identity, but may also become writers themselves within these communities' many platforms for participatory practice. Roland Barthes, similarly, also developed a dichotomy of readership that included the possibility for the reader to transform into a writer, categorizing texts as "readerly" or "writerly." The writerly text invites the reader into a kind of interactivity enabled by literary structures that require intellectual engagement that rises to the level of an invitation to write (Barthes 1974). Barthes further discusses reader types as erotic, blissful, hunters, desirous, dreaming, and more, and describes writing as a process of pleasurable disfigurement of the body of the text, which we might interpret as a sadistic reader type (Ibid., 37).

Michel Foucault provides a conception of the reader as visionary, imbued with these powers by experimental literary structures in his discussion of Gustav Flaubert's *The Temptation of Saint Anthony*. Flaubert's novel is notable for its highly intertextual literary forms and performative use of dramatic structures. Foucault describes this intertextuality of the book as "[...] extending the space that existing books can occupy. It recovers other books, it hides and displays them and, in a single movement, it causes them to glitter and disappear. [...] The library is on fire" (Foucault 1977, 91-92). In addition to this fiery intertextuality, the novel is also analyzed for its performative use of dramatic structure as transforming the reader into a spectator, and causing "[...] the book [to] disappear in the theatricality it creates" (Ibid., 93). Through the uses of intertextuality, invocation of dramatic structure, and the novel's many shifts through time and perspective, the reader becomes a "visionary" who: "[...] attracted by the sights placed before him, rushes into this simultaneously empty and overpopulated space, identifies himself with this figure of shadow and light, and begins to see, in turn, with unearthly eyes" (Ibid., 98-99). While Foucault's conception of the reader as visionary thus emphasizes the visuality of the book, he does also draw attention to the materiality of the book's substrate as an elemental quality that enables the proto-hypertextual intertextuality he describes, stating that the book's "powers stem from its singular existence--from the unlimited proliferation of printed paper" (Ibid., 106). It is in the proliferation of multiple copies of books that Foucault identifies a pre-computational literary flow state, claiming the book as "infinitely extended" by the copy, and "prolonged without end, without illusion, without greed, without sin, without desire" (Ibid., 109).

This brief revisiting of 20th century theorizations of the reader show that even with a focus on immovable books, the reader is understood as highly dynamic, having been described above as: traveler, gardener, hunter, poacher, trickster, gambler, erotic, blissful, desirous, dreaming, sadistic, and visionary. It is clear that even within the seemingly homogenous form of the printed text, the reader can take on many attributes and inhabit a wide variety of roles, even within the interaction with a single text.

2.2. Readers and the Avant-Garde

The legacy of 20ᵗʰ Century avant-garde engagements with text both within and beyond the codex form is examined by Scott Rettberg in his book, *Electronic Literature* (2018). In the opening pages, Rettberg begins a kind of thought experiment with the words: "Imagine a book" (1). He then continues to create a fantasy of readership practices based on engagement with the codex versus digital forms. He compares the traditional book, which he clearly identifies as a codex form, to the varied kinds of electronic literature at the core of his study of computational forms and genres, including hypertext and interactive fiction, combinatory poetics, and network writing (Ibid., 1). Rettberg's initial presentation of the historical codex / electronic form duality enacts a binary distinction often repeated by those who want to compare *early* to *later* 'book' forms, grounded in a model of complexity defined by the digital, thus ascribing comparative passivity to readers of traditional (codex) books. The codex is described as distinct from electronic works based on properties like its "fixed" nature, always available on the bookshelf, and its functional "permanence," even after its possible "decay" (Ibid., 1). It is a verifiable model for cognitive understanding by readers who can re-check it often and expect it to stay the same. Rettberg tells us the codex book is an historical document that freezes history: "One of its main functionalities is to get thoughts down in print and carry them through time" (Ibid., 1).

Looking more carefully at Rettberg's model of the codex, we can also understand that his definition of the form itself is deeply connected to the book's assumed readability, usability and knowability. The ease with which one accesses information, transports it, and communes with others based on a shared understanding of its contents is based in part on its tactile and material form:

Imagine a book. That should be easy enough, you're holding one now. The book is a traditional reading technology, and it's a good one. It took a long time to develop. The codex book is portable and can be lugged from place to place. It is addressable. It has page numbers so I can easily communicate with you exactly where any piece of information is within its volume: we can get on the same page and read the same words. (Ibid., 1)

The codex is a form we can literally touch with our hands and that property affixes it in place and space. Electronic texts, by contrast, are far more complex in this scenario. They are distributed and mutable networks for engagement, places where friends can leave comments for each other, change and alter authorial meanings, move and shift language and content, and even create three-dimensional spaces: "Imagine the book as a networked computer," Rettberg concludes, meaning not the codex but electronic texts (Ibid., 2). But of course this kind of speculative fantasy only works if we imagine the book as a limited, homogenous form, ignoring a whole host of books, book-like forms, and literary material engaged by readers who do *more* with the works they confront, like readers of moveable books, for example. Rettberg goes on to complicate his initial binary scenario and to illustrate how electronic forms are not truly anomalies that have emerged only in the computer age. Through an exploration of varied pre-computational genres, Rettberg demonstrates that each is in fact connected to 20ᵗʰ century avant-garde, Modernist, and Postmodernist practices that deconstruct texts and readers.[3] Connecting to 20th century Modernism and avant-garde movements, he illustrates how electronic literature is contemporary, but also historically retrospective, always moving in a transhistorical networked path that is decisively non-linear. And yet, he begins with that familiar trope of the book as codex, as *anti-network*.

However, this pervasive binary myth is only sustainable if we think of the book as a fixed object, a thing

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[3] Rettberg here refers to movements such as Dadaism and Surrealism, and forms like concrete and visual poetry, for example.

that can always be touched, and held by all, one easily carried from place to place, that may even be shared after its death or decay. This is not a book that may be more fragile, delicate and/or exclusive, one possibly inaccessible for the masses, such as a 15th Century astronomical volvelle or, as with Matthew Paris' *Chronica Majora*, a documentary text shared with monks and scholars. This binary model also excludes other highly accessible and interactive books, such as commercially produced movable books with pulling strings and fold out tabs, that are meant for mass consumption, even for young readers, but that are not totally sustainable over time, either in form or canonical memory.[4] Books like these, with their pop-up letters and pictures are highly touchable, functioning precisely because readers engage them through material digital (finger) affordances, interactively shaping and sharing participants in the unveiling of a story—much like a hypertext fiction operates, coming together through a procession of links and fragments. In spite of this resonance with electronic forms, movable books are often left out of origin stories of the book, especially in digital histories which remain fixated on earlier 20th century origins and do not look toward a wider history. The 20th century histories and theories shared here reveal the book as always-already multiple, networked, active and inviting, and readership practices as often eclectic, engaged, active, and designerly.

2.3. Child Readers and 'Other' Books

Shifting our focus to conceptions of readers of other types of books beyond the printed text, we find scholarship has focused on child readers.[5] We first look to Walter Benjamin who stands apart from the theorists discussed above due to his inclusion of children's picture books in his examinations of readership. In Benjamin's discussion, the combination of color, image, and text functions together to not only invite the child to enter into the book as a performative space in which "[...] the child stands in the center of a masquerade" but also encourages the child to "join in" (Benjamin 2008, 226). In doing so, the child reader becomes both a literal writer (as in, adding annotations to the page) but also writes *herself* into the book: "So the child composes into the picture [...] the child marks out a little place for himself" (Ibid., 227).

More recent picture book scholarship from Paula Eubanks characterizes the picture book medium as time-based and interactive, citing the "pace at which the artist guides the turning of pages" (Eubanks 1999, 39), just as scholar David Lewis describes the interactive nature of picture book reading in terms similar to those used by interaction designers when describing user trajectories through an experience, noting the "reader-responder must find routes through the text that connect words and images" (Lewis 2001, 32). This discussion of the more literally active child reader of the picture book by Benjamin, Eubanks, and Lewis connects well with more recent scholarship on the active child reader of movable books from both Jacqueline Reid-Walsh (2018) and Hannah Field (2019).

Reid-Walsh's research provides a nuanced understanding of the complexity of the movable book form, which she conceptualizes as a "hybrid object (part book, part picture, part game or toy) [...] like digi-

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[4] Such as the Bookano book series for children of the 1930's and 40's which have become rare books now, for collectors only.

[5] The focus in scholarship on child readers of movable books (as opposed to adults) may be due in part to the proliferation of more affordable printed books during the 1700s and 1800s, along with new conceptions of childhood which resulted in a burgeoning market for children's literature. This growth in children's book publication, and in particular, the production of movable books and related paper toys for children, is interrelated with the growing industrialization of the book and paper industries. However, then as now, moveable book production included significant labor by hand, and in that time period it was often the case that child labor was used to produce the lavishly colored and constructed books that would be consumed by wealthier children.

tal apps transformed into paper but retaining their mobility [...] interactive, narrative media on paper supports" (Reid-Walsh 2018, 11). Drawing connections between paper and the computational medium, Reid-Walsh references Janet Murray's theorization of the user as interactor or dancer, and the author as choreographer (Murray 2017). In terms of understanding the reader of movable books, Reid-Walsh notes their interactive, "uncommon formats" are made apparent by the "reader-viewer-player" engaging with the artifact (Reid-Walsh 2018, 125). This hyphenated conceptualization of the reader emphasizes the complex multiplicity of the movable book form, and refuses to flatten the reader into a single mode of engagement, just as movable books continually invite dynamic shifts from the reader.

Field's research on Victorian-era child readers of novelty books provides insight into the ways these readers were framed by novelty book publishers and authors at the time: "as travelers, builders, cooks, or magicians" (Field 2019, 44). Field points out that the interactions offered to child readers by novelty books generated "patterns of usage that are different from those seen with other kinds of books--notably, patterns that indicate an adjustment of the very idea of what reading is" (Ibid., 9) and that "Novelty books provide the child with a rich sensorium as enmeshed with touch as with sight: they make the production of visual illusions a function of the child's body [and] contribute to the increasing sense in book history and criticism that reading might encompass physical activities and motions as well as intellectual processes" (Ibid., 193).

Research by book artist and educator Paul Johnson is also helpful for understanding the continued impact movable books provide the child reader, who can also engage the movable book form as an author or designer. Johnson describes the interdisciplinary power of movable books as follows: "Coexisting words and images--the interdependency of the two great communication systems of literacy and visual communication--is the most powerful force of intellectual and emotional development we have. And the book form is the most potent way of housing that force" (Johnson 1993, 1). To this fusion of the textual and the visual as described by Johnson we add the interactive, pointing out that the movable book form is at core an interactive narrative structure. Writing from the educational perspective, Johnson also draws attention to the importance of the paper medium: "There is so much that needs to be experienced about the spirit of paper [...] once you see the book as sculpture or mini-architecture, it can do things for you that you would not think possible. [....] I could explore not only two symbolic systems simultaneously but also the surface that gave those systems life" (Ibid., 2). These systems are indeed brought to life, quite literally, through reader interaction. In keeping with this broader conception the reader discussed by Benjamin, Reid-Walsh, Field, and Johnson, our postdigital reader typology presents not metaphorical but literal roles for the reader. Whereas De Certeau's poacher is not literally killing and stealing animals from the forest of the text, in our case, the actions denoted by the roles in our reader typology are literal, and not metaphorical (see **Fig. 2**). While some of the earlier 20th century reader typologies discussed above conceptualize readers in a range of active, imaginative and generative ways, they focus on a reading/writing duality that is grounded in an understanding of the book as neutral container for text, or even erase the book as it is presented as synonymous with text itself. Our typology, on the other hand, is grounded in the structural elements and functions of movable books, meaning our typology is more elemental, since it is not grounded in the "content" of text. Reading is a performative act of material engagement with the elemental structures of the worlds in which they build and build upon. Although, certainly, meaning making is facilitated by the nature of the book structures, the types of roles they invite the reader to enact, and the resulting interaction patterns afforded by the relations between form, content, and reader are considerably more-than textual.

The postdigital reader has always been digital, and has always been engaged in meaning making that synthesizes literacy (the decoding of linguistic signs), the visual, and hands-on interaction facilitated by digits (fingers). Of course, these reader types are not rigidly defined or confining for the postdigital reader,

who has freedom to move between roles but also work within or push against roles in a range of ways.[6] Our study of readership then includes, but also significantly pre-dates the 20th century with its Modernist cultural imaginary and Ezra Pound's call to "Make it new" (Pound, 1934). Our concept of the postdigital reader complicates the idea of the easy separation of book material, form, and content, its attendant readership practices, and also complicates book form relationships to genre and to genre expectation, and to simple classification. The presumed passivity of the reader, controlled to a degree by the affordances of the book and its content, is connected to hierarchical notions of authorship and control that seek to simplify definitions of what a book and its readership *is* by nature. By presuming the reader is a recipient of knowledge only, and not a maker or shaper of its form, we miss opportunities to understand how transhistorical intra-actions among books in all their complexity and readers have been and are often inherently part of their creative design.

MOVABLE BOOK TYPE	READER TYPE	EXAMPLE
Book as Instrument	Reader as Scientist	*Cosmographicus Liber* from 1533 by Peter Apianus. The book is used as an instrument to facilitate a range of astronomical calculations. To achieve this, the reader must carefully manipulate the complex volvelles embedded in the book. Volvelles are rotating paper disc structures that may also include strings used to position and manipulate the discs into position, reflecting for example, the current arrangement of bodies in a night sky, to aid in calendar calculations.
Book as Intimate Object	Reader as Companion	At miniaturized scale the book comes into an intimate, personal relation with the reader, rendering this reader as *Companion* to the book. Miniature books such as medieval book of hours with girdle bindings, for example, were attached and worn on the body, for easy access in daily devotional practice, with book and reader acting as companions in ritual.
Book as Secret Keeper/ Giver	Reader as Confidant / Confessor	Using flap structures, transparency overlays, or leveraging the dual opaque and translucent nature of paper, these books invite the reader into the role of confidant or confessor, giving or receiving secret information. For example, in Roald Dahl's *The Magic Finger* (1966), the reader can hold the page up to the light to both witness and help enact the magical transformation of the teacher into a cat, both partaking in the secret and contributing to it as well.
Book as Substrate for Accretion of Objects	Reader as Archaeologist	These books present a collection of fragments the reader is invited to uncover, sort through, and arrange into meaningful order or construction. Examples include Dutch trompe l'oeil manuscripts from the late 1700's and contemporary works like the Ahlbergs' 1990s *Jolly Postman* series or Steer's *Dragonology* book (2003).
Book as Illusion of Motion	Reader as Digital Eye	In this case, the reader's fingers (digits) facilitate the illusion of motion for the reader's eye to observe. Examples include flip books and contemporary commercial pop-ups, which utilize the fold of the codex spine to develop 3D paper forms via the movement of turning the page.
Book as Game or Puzzle	Reader as Player	The reader is positioned as a player in works such as Ron Van Der Meer's *The World's First Ever Pop-Up Games Book (*1982) and Janet and Allen Ahlberg's *The Jolly Christmas Postman* (1991). In both cases each book contains board games presented either as pop-ups or enclosures.
Book as Performative Space or Stage	Reader as Performer	In these examples the reader performs along a spectrum from the minimalist (such as peeping through a tunnel book) to more active forms of performance, such as rearranging doll figures, manipulating objects in toy theatres, or even building backdrops and set pieces as in Denchfield and Vining's *Alice Pop-Up Theatre Book* (2002).

Fig. 2 Figure 2: Typology of Postdigital Readers of Movable Books.

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[6] Here we can refer to Stuart Hall's research on Encoding/Decoding (1973) to help understand readers as interacting in canonical, emergent, and resistant modes. Reid-Walsh (2018), Field (2018), Crain (2013) and others provide examples of agential reader practices that range from the canonical (evidence of pull tabs being used) to the emergent (ie., using a book dust jacket to house homemade paper dolls), to resistant (ripping, tearing, or other reader interactions that border on the destructive, such as grangerization or extra-illustration).

Further we can see readership as part of a dynamically changing social sphere that allows and disallows different kinds of discursive interactions representative of much more than the pervasive image of co-dex books lined neatly on a bookshelf. Our typology of postdigital readers therefore also complicates the concept of genre, which places readers into specific roles as recipients or consumers of texts, even if resisting their institutional assignments as discussed by Derrida (1980) and Todorov (1976). Reading in our model is a mutually cooperative and constructive social process, and we offer this porous and playful typology of readership that entangles and overlaps boundaries and disciplines, while still foregrounding the postdigital reader as designer-in-action, in concert with the form. Unlike the many other contemporary definitions of genre, the reader types we examine are not naturally built into the text through a desire for authorial control; these readers' roles do not pre-date the interactor who fits into the definitive role prescribed by the book's creator. Similar to Carolyn R. Miller's foundational work on genre theory (1984) we find genre to be "an intersubjective phenomenon, a social occurrence" (156) that emerges in play, and we seek to find its interactive possibilities in our own designs.

3. Design Strategies for the Postdigital Reader

3.1 Mixing Realities and Affective Design

How might we use design practice to further our understanding of reading as a sensory, material, and affective set of embodied relations beyond the semiotic? If we consider more specifically the materiality of reading as *doing*, as a pleasurable act intimately tied to how our bodies break apart and then interface with distributed acts of reading, like Barthes' *pleasurable disfigurement* (Barthes 1974, 73), we might also align ourselves with the *designerly* (not only the readerly or writerly) significance of postdigital reading interactors and interactions. In this act of deconstructing the reader/text/material/form/history/culture system, we can understand that reading is always an act of multiplicity, not simplicity, and is not dictated by the so-called limited affordances of a codex book vs. a more complex digital or other material form, like the moveable book. Designerly practices are bound to material-making and extend the intellectual capacity of interaction to physical doing, creating and activating the embodied and physical affordances of coming into alliance with the book and its content. It is this entanglement of embodied interaction with the complex book system we seek to activate in our own mixed reality design art practice, discussed below. Bringing readers into contact with the materials they engage is more than a body-to-body connection, and it may be exemplified by studies of affect and its entangled relation to material and non-cognitive processes engaged in acts of knowing the world, such as in reading. In "Affect Theory in Reading Research: Imagining the Radical Difference" (2020), Boldt and Leander draw on Deleuze and Guattari's theories (1987) to illustrate how reading is not (and never has been) only an internalized, abstract, cognitive process. Rather, reading is a set of affective embodied relations that construct/deconstruct experiences in layered interactions in and out of the body and mind. For them, reading is a " 'material doing' and it is taken up by bodies, materials, spaces, histories, feelings, and ideas" (Boldt & Leander 2020, 1). Reading books, for Boldt and Leander, even traditional codex books, is never hierarchical and ordered or based on one's binary constructions of knowing vs. not knowing or on encounters with stable representational semiotic systems based on cultural norms. They open their essay with a scene of two young children reading a picture book together, and using that as a framing reference, they break down the scenario into its complex performative, material multi-dimensions and extrapolate from it general reading practices.

They detail the complexity of interactions with books as readers confront literacy levels and draw on human and interpersonal social relations, personal and social histories, and other ideological cultural contexts that frame their active and tactile relationships to reading. If, like Boldt and Leander, we can see all reading and reading practices within Deleuze and Guatarri's context of organic rhizomatic relations (1987), that is, reading as entangled in a multiplicitous and ceaseless *mass of roots,* where thoughts, representations and interpretations come into play, forming and un-forming themselves into nodes of understanding, and then veering off like shoots on a vine into other directions, we might further understand how to maximize these disorderly affects in our designerly practice.

This sort of processual, material dynamic of making and unmaking the interface, both by designers and by users, and the enabling of affective rhizomatic passageways across bodies (human and nonhuman, text and reader) is the focus of the edited volume *Networked Affect* (Hillis, Paassonen and Petit 2015). Although the works in the volume are focused to a degree on exploring affect in online communities and Internet communication and in related networked and media technologies, the primary aim is to illustrate how digital domains can never be truly virtual because of their embodied nature. In this way, they allow for the analog, not only the digital, to be deeply networked in its layered and non-linear hyper-relations across bodies and worlds. The volume offers further support for thinking about the postdigital reader and designerly practice that engages both technical and analog relationships as co-constitutive, performative and materially complex. It does not assume matters like books ever fall into the binary relationship that Rettberg proposes in his initial conception of codex vs. digital forms, which only truly arrive in the 20th century (Rettberg 2018). Collectively the authors in the volume demonstrate how encounters with technical information reach across computational boundaries into the material life experiences of users, exposing the affective relations that are connected and distributed though *acts* of communication. Here, one encounters digital content and as anti-intellectual, in the body. Users are afforded "near-constant prosthetic connections to information, communication, and media technologies" (Hills, Paassonen & Petit 2015, 1). The networked bodies they describe reveal the "the affective underpinnings of human-machine relations and the complex forms of agency that arise from these" (Ibid, 1).

Lori Emerson's scholarship also resonantes with our transhistorical multi-modal approach to mixed reality book design, one offering a mixed material model for reading. In *Reading Writing Interfaces,* Emerson uses a media archeological method to establish a back-and-forth and historically disruptive, non-linear relationship between old and new media forms (Emerson 2014). Without supporting a teleological progress story where forms of writing and reading become more complex and progressive based on their digital, technical sophistication, Emerson disavows the idea that *success* is achieved through the design of contemporary easy-to-use (digital) interfaces that disappear. In fact, she illustrates how the concept of the user-friendly interface—such as we might connect to the traditional concept of the familiar codex form, but also to iPads, touch screen devices, and other (seemingly) natural and organic interfaces (NUIs or OUIs)—is really only a way to hide the complexities of such interfaces and limit the understanding of the role of the reader/user.[7] This is a rhetorical falsehood that perpetuates a myth that some kinds of reading/using are simple, natural and even *magical*. For Emerson, the consequences of such erasure and operative oversimplification when interface workings are hidden behind rhetorics of simplicity or ease of use is about enforcing control. Passive consumers are never producers and do not intervene in the process of mutual development, deciding for example which technologies are necessary, helpful, or cost-effective. In short, readers/users lose power. In technical contexts,

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[7] We might connect this idea of digital blackboxing as strategy to constrain interactor agency to highly complex commercial popup books sold today, which provide the reader no view into the mechanism of their paper engineering structures, and limit reader interaction to the careful opening and closing of the page/spine to activate the three dimensional forms.

for Emerson, this means users might allow developers to mold them unchecked into being passive recipients/consumers of their capitalist wares, tricked by how natural and seamless they appear, without considering how they manipulate, financially, but also politically. Consequently users lose focus on how reading and writing via all interfaces is mutually constructive and materially complex.

 However, reading/writing for complexity, not simplicity, means one can connect to powerful *designerly* strategies by discovering and foregrounding the interface properties in paper and digital forms. Emerson documents, for example, how 19th century American poet Emily Dickinson utilizes complex paper design and writing techniques to express her resistant and revolutionary poetry and to foreground the materiality of her writing practice. Although Dicikinson's actual readership may have been very small, as she was primarily published, posthumously, Dickinson wrote with the understanding her work was meant to be read, and its formal properties were essential to composition. Emerson illustrates how Dickinson creates complex pre-digital interfaces with her experimental poetry by foregrounding the many modes afforded and exploited by (*simple*) pencil and paper technologies. Dickinson's 40 fascicles (the multiply folded booklets, pierced and bound with string that held her poems), but also her *pinned poems* within them, exemplify her understanding of reading and writing as deeply dynamic and intra-active. Dickenson's pinned poems extended the formal and material properties of her handwritten poetry, bound in the more (codex) book-like fascicles, and they were created by her literally pinning additional scraps and bits of paper to the larger sheets in the fascicle. The fragments allowed her to to add, annotate, or even contradict previous content. This method created layered word collages that could also be temporary, as the pinned paper fragments could be moved from place to place un-fixed to a single location, leaving only the holes to mark what once might have been. For Emerson, Dickinson's playful methods were a deliberate way to show the dynamic complexity of both reading and writing—to make manifest in the interface design how such intra-action, inherent to creative expression, is always both "process and product" (Emerson 2014, 68).

Another contemporary theorist whose work resonates with our cross-analogue and digital design practice is Jenny Sundén. Sundén's work on 21st century Steampunk cultures, "Technologies of Feelings: Affect Between the Analog and the Digital" (2015) provides a useful model for considering postdigital readership as we describe it in our work with moveable books and contemporary digital technologies. Sundén offers a model for mutual consideration of technical making (analog and digital) that is co-constructed by utilizing tactile and affective communication pathways between material and virtual elements of interaction. Sundén frames her discussion around the retro-futurism style and design of online/offline Steampunk cultures, inspired by 19th Century 'Victorian' steam-driven technologies, fashions and cultures (clunky brass gears, exposed clockwork parts, cogwheels, soft leather crinolines, giant monocles, and face goggles, reminiscent of contemporary VR technologies, minus the sleek design). This is a fantasy technical past that never truly existed, but is obsessed with imagining technology as palpable, heavy, material, offering a counterpart to the invisible slickness of contemporary digital devices, like iPads, smartphones, and wearable devices. Instead, Sundén illustrates a mode of design construction underlying the creative and expressive culture of Steampunk that is both transhistorical and transmediated in its remixing and punk-ifiying of history, 'technical' materials, and to past/present/future cultural expression as well as to sophisticated digital media design.

Similar to our discussion of the more-than codex moveable book, Steampunk is "technology turned inside out in an endless exposure of cogs, cogwheels, springs, and screws, bringing together visual beauty with a noticeable tactile dimension and an invitation of sorts to take part in the making of technology" (Sundén 2015, 137). But this technical making is grounded in an ease of movement between analog and digital expression, and particularly in the refusal to make technology disappear. The *punk* aim is to make technology as blatantly and manifestly material as possible, and then to share and exhibit it in online com-

munities (in an immersive virtual world like *Second Life*, for example) meant to showcase and celebrate it, in all its gear-y, clunky glory, and particularly in its touchability, its affordances for the digits of the hands that create/engage it: "Within steampunk communities, technologies are something to touch and be touched by, distinctive technologies of feeling that attempt to restore or recreate a sense of technological uniqueness and magic supposedly lost in the streamlining and uniformity of contemporary digital technologies" (Ibid, 138).

This touchability, this tactile desire to make manifest the creative property of the technologies and interfaces that comprise it, is further explored by Sundén when she considers the connection between Steampunk making, literary expression, book production, and reading practices. Using as an example "Trilby's Mill," a virtual location in *Second Life* created by a real life book artist who goes by the name of Trilby Minotaur, Sundén specifically connects Steampunk aesthetics to analog/digital transhistorical bookmaking and to user engagement identifying it as particularly performative and creative. The "Mill," which is a highly popular site for visitors, is a virtual place for papermaking, letterpress, and bookbinding activities for all who travel there, but also a place to celebrate material making processes. Included in the space is a steam-powered printing press and a place where visitors may sit and sew books together, reveling in the fantasy of crafting book-technologies that, although digital (by virtue of their existence in *Second Life*), are also raw, old-school tech, and homemade. The physical, paper properties of these books are brought to the forefront through digital simulation, and these books, like moveable books, easily transform into other objects, into dresses for example, that incorporate book leaves in their patterns and designs. So, although "Trilby's Mill" is a digital space in an immersive virtual world, it is also a highly tactile and material environment that brings bodies of all kinds into relation, reminding one clearly of their analog components but with no allegiance to either. They are of both worlds and histories and there is "an affective switching, or turn-taking, between analog and digital forms of embodiment" (Ibid, 145).

MOVABLE BOOK TYPE	READER TYPE	INTERACTION PATTERN	DESIGN STRATEGY
Book as Instrument	Reader as Investigator/Scientist	Construction, measurement, bridging the book and the physical world	Instructional, cut-and-fold forms
Book as Intimate Object	Reader as Companion	Continual use, close proximity	Durability, size
Book as Secret Keeper/Giver	Reader as Confidant/Confessor	Searching, revealing, connecting	Hiding information for reader discovery
Book as Substrate for Accretion of Objects	Reader as Archaeologist	Digging, arranging, collecting, navigating	Mapping multiple potential trajectories
Book as Illusion of Motion	Reader as Digital Eye	Flipping, spinning, folding	Animation structures
Book as Game or Puzzle	Reader as Player	Playing, solving	Game design
Book as Performative Space or Stage	Reader as Performer	Enacting, directing	Stage design, casting, playwrighting

Fig. 3 Extending our understanding of movable book and postdigital reader relationships by identifying interaction patterns and accompanying design strategies for each type.

For Sundén, Steampunk cultures are representative of the many ways we can consider what it means to be postdigital, particularly when we do not see the *post* as only coming *after* the analog. Related to our conception of the postdigital, Sundén proposes the concept of the *transdigital* to highlight and enable the rebellious, transgressive properties of analog/digital co-relationships. Transdigital media support disruptive metamorphosis at personal and cultural levels, challenging social norms of many kinds. The transdigital, in Sundén's model, also draws on work from transgender and queer studies to suggest a kind of radical, norm-breaking creative expression and process where "intra-relationship between many identities, subjects, bodies and politics that resist clear boundaries and cross-over, cut across ideological distinctions (Ibid, 147). For Sundén, *trans*-conceptual modes (which include transhistorical and temporal time frames) are deeply culturally transgressive in their re-shaping of concepts of binary analog and digital culture and instead revealing the materiality of both. They create "attention to the specificity of digital materiality and processing, and at the same time underscore the digital as something highly porous and interconnected" (Ibid, 147). In this way of mixing, we also find inspiration for our moveable book designs that cross time-periods, forms and traditional binaries that restrict the codex forms and its readership to passive roles.

We next turn to examine each book-and-reader relationship to draw out the particular interaction patterns present in each relationship. From there, we reflect on the larger design strategy used to produce these relationships (see **Fig. 3**).

3.2. Codex Materialism(s) & The Role of Computational Media

The core interactivity of movable books is facilitated by the *paper* medium - a material that is distinct in its flexibility, ubiquity, and durability. While many digital technologies today are characterized as "responsive" meaning they provide computationally generated responses to human user input, paper is "responsive" in a more immediate fashion. Johnson notes: "The pen or pencil symbolizes through direct line work on paper. There is no system to be processed--as in computer technology--before ideas can be expressed; the computer's own language has to be understood for it to be of any use" (Johnson 1993, 9-10). How can the movable book be further expanded to incorporate digital technologies, without losing the direct responsiveness of the paper medium?

In *Simmer* (2019), a handmade AR (Augmented Reality) artist book, we experimented with the development of a physical movable book designed with digital media. Our handmade artist book was designed with accompanying audio delivered via handheld AR from a smartphone. This hybrid digital and physical design approach was motivated by our understanding of the entangled material histories of codex structures and contemporary digital media. The physical book itself is multiform and structured as both a linear codex book with a fold-out panorama on one side, and then when refolded, reveals a dollhouse/carousel structure on the other. In its physical form the book creates tensions between linear/nonlinear narrative spaces and patriarchal/domestic space in the form of the dollhouse, relevant to the themes of our story as described below. The use of AR audio creates a further layering of multiple realities and connections with virtual media for readers. Our art and design methods, combined with critical transhistorical research in digital technologies, offer a practical and theoretical critique of the binary divisions between analog/digital and passive/active associations with readers. While not all of the interactions and design strategies we identify (see **Fig. 4**) can be found within elements of *Simmer,* we do make use of four of the post digital reader configurations in the work. These include:

- **Reader as Confidant / Confessor** (The reader is privy to secrets characters have kept from each other in the context of the story, revealed through hidden structures like thermochromic paint, flaps, and enclosures)
- **Reader as Archaeologist** (The reader collects and assembles a wide range of story fragments to develop their own understanding of the narrative/s)
- **Reader as Digital Eye** (The reader sets the entire book in motion to transform it from a linear accordion fold structure to a three-dimensional dollhouse, and also manipulates a miniature flipbook hidden within the house)
- **Reader as Performer** (The reader enacts performative peeping through a small tunnel book hidden underneath the bed in the dollhouse side of the book, and more explicitly acts as a performer manipulating the paper dolls representing the daughters in the story)
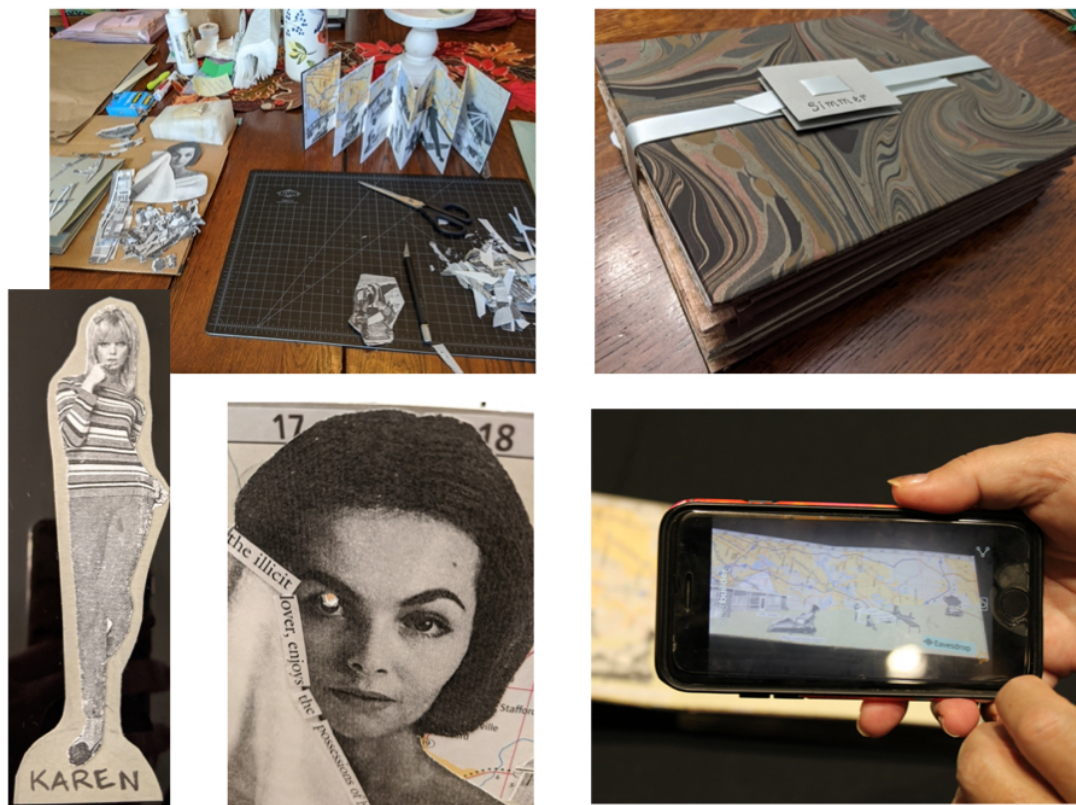

Fig. 4 Images of the Simmer design process (top left), the book in codex form (top right), and other elements (bottom row) that trigger AR audio from the companion smartphone.

By emphasizing these postdigital reader roles and associated interaction patterns as the basis for design strategies, the overall construction of *Simmer* allowed us to explore the material entanglements of making/thinking processes and the close connections and affective affiliations between paper and digital expressions. In fact, *Simmer* was originally created for the International Conference on Interactive Digital Storytelling Art Exhibition (ICIDS 2019)[8] which was based on the theme "The Expressions of Emotions in Humans and Technology." At its core we saw our making of *Simmer* as an opportunity to consider the material relationship between bodies of all kinds (books, human, historical, literary, social, technical)

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[8] *Simmer* won the ICIDS 2019 *Excellence in Innovation Award*, a juried prize based on the best use of design and technology and was recognized for its mixed material form.

and to explore their interrelatedness for expressive storytelling and reading practices. We have outlined the content and design of *Simmer* in detail in our essay "Augmenting Affect: Interaction, Materiality and Mimetic Communication in Augmented Reality Movable Books" (Holloway-Attaway & Rouse, 2020), that was included in the book about the exhibition. While the discussion of all design strategies leveraged in *Simmer* is beyond the scope of this paper, here we examine one of the primary roles inhabited by the reader and accompanying design strategies: the "Reader as Confidant/Confessor." This conception of the reader is entangled within the thematic, material, and AR audio compositions that are fundamental to our overall design strategy, and as such it intersects and connects these three threads in a variety of ways that bring readers into proximity with the affective narrative confessional content, making them a confidant and a bearer of secrets.

At its most fundamental, the thematic work in *Simmer* is an expansion of the John Cheever short story "The Swimmer" (1964) and the film of the same name (1968), and it is intended to bring forward the story of the women in the text who are overwritten in these original, inspirational works. Cheever's text and later film focus on the narcissistic male protagonist, Ned Merrill, filtering the world he tells through his own subjective and biased perspective. His wife Lucinda never enters the original text in her own voice, and the four unnamed daughters, who (must) populate his 1960s suburban dwelling and lifestyle with a strong female presence, are also never represented in any meaningful way.

Fig. 5 Details of interactions with both sides of Simmer. Turning pages in the codex (left); listening to AR Audio (insert, left); and folding out the dollhouse (right).

Ned is the dominant character in his life story, and the women are hidden, their secret perspectives remaining untold. For us this meant they were *simmering* beneath the surface of the text, and we wanted to afford them a more embodied, manifest presence. By expanding the original narratives, and creating a book that reveals them anew, we offer ways to showcase the women's voices in the manifold materials of our moveable book, particularly in the domestic dollhouse spaces, but also via the expressions of the emptiness of their unknown lives, even when spoken through the very personal audio soundtrack and narration we created.

Fig. 6 The paper dolls that represent Ned and Lucinda's four daughters

By listening, for example, to Lucinda's first-person stories via her AR audio monologues, readers are intimately connected to the illicit parts of her life that nobody has heard before: her affair with a teenage boy who becomes her secret lover, her mother's derision for Ned, her poetry written in the manner of Emily Dickinson and collected on scraps of paper in a small poetry book hidden in her writing desk that interactors may discover by 'searching' the house for narrative clues. The daughters have stories to tell as well, but like their lives, we discover, they are empty and devoid of joy, human connection, and animation. They are represented by classic paper doll figures (See **Fig. 6**) that users can stand up and place in the house, following a set of instructions on folder paper found in the dollhouse. The four daughters are voiced in our AR audio using recordings of Thomas Edison's failed me-

chanical doll commercial venture.[9] Eerily reciting recordings of late 19th century children's nursery rhymes when accessed via AR, the dolls reflect a mysterious childhood and adolescence that others may get close to understanding, but never really know through the oblique forms (material and virtual) in which they are shared. Other musical themes composed by our collaborator Brendan Padgett for some of the other female characters (Lucinda's mother and Ned's mistress) create other registers for discovery, for getting to know the lives of the women. The music is an affective expression, a non-representational way to understand their composition, multilayered and deconstructed. The form of the book, moving from codex to dollhouse, offers a complex way of knowing a story through material manipulation (the digits of the fingers), but it also contains multiple modes and nodes of expression through the surprises and secrets it reveals, through the interactors' tactile engagement with all the other objects one discovers in the book further distributing its material affordances. Hidden in its folds, rooms, histories, and places, but also through the AR audio which pops-up and appears on the phone, activated by trigger images, the interactor is drawn closer into a personal encounter with previously silenced stories. Objects like tunnel books, flip books, and a map of the neighborhood painted over with thermochromic paint invite the interactor into close alliance with the texts. They peep through the tunnel book to search for clues about Ned and Lucinda's relationship, they flip and animate a miniature booklet with their hands, to reveal a cocktail glass filling and refilling, a pre-digital way to bring objects to life (See **Fig. 7**).

Fig. 7 Images of the tunnel book, LP albums and miniature poetry book, and cocktail glass flip book elements from Simmer.
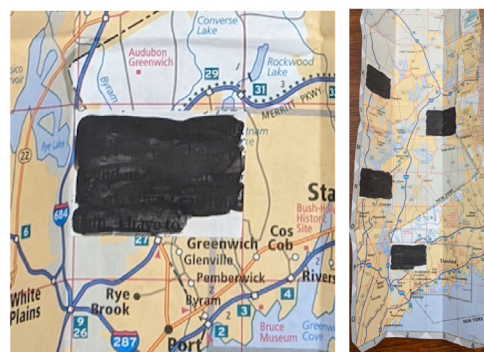

Fig. 8 Map with thermochromic paint swatches covering text fragments which can be revealed through the application of heat in Simmer.

The cocktail glass itself is representative of the drunkenness and alcoholic excess that is aligned with both Ned and Lucinda and their circle of pool-hopping cocktail party friends, a hint of the unspoken debauchery. The neighborhood map with its blackened squares from the thermochromic paint responds to human *heat,* and so it can be touched, or even breathed on, to reveal barely legible elements of other confessional stories (See **Fig. 8**). This is another way to reveal clues of what simmers beneath an otherwise simple, recognizable world. The AR audio, working in concert with the objects one discovers tracks off their visual elements (book or album covers, figures on the map, or panorama images), and it is meant to be spoken directly into the ears of the user. As such the audio is another up close and personal way to receive the private and confidential secrets of lives unknown.

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[9] The fascinating history of Edison's ill-conceived commercial venture into talking dolls is researched by Gaby Wood (2003).

3.3 Future Research

We identify the audio components of *Simmer* as fruitful for us to expand on in future research, to examine the role of audio technologies in connection with the codex across a range of time periods and forms, and develop a more nuanced understanding of audio, affect, augmented reality and the postdigital reading experience. Beginning with the advent of technologies of recorded sound, a genealogy of intermedial storytelling with sound could be traced, with examples including mechanical sound synchronization in early cinema, Edison's wax cylinder doll toy, children's books accompanied by LPs and later cassettes, and embedded digital sound chips in contemporary books.

This historical research could help to further contextualize *Simmer's* combination of traditional pop-up and moveable elements with its mobile AR soundtrack and help illuminate the ways in which audio moves among different semiotic registers and sites for engagement for readers, who must parse the dispersed aural information that slowly unfolds, like the book. Readers discover the story in non-linear pieces both through the paper objects and structures discussed above, but also through the audio, which situates the reader in different states of proximity to access the story. Sometimes narrative voices, confessional and diary-like, invite the reader to come close. Other times, voices place the reader outside the story, as an eavesdropper. Padgett's musical scores, constructed and deconstructed as themes for primary characters, are composed according to their physical placement within the book – on linear accordion folds, or in non-linear dollhouse space, allowing the material setting and structure to contextualize the sound. Future research could help to contribute to both understandings of the entangled history of audio and books, as well as examine these affective relationships between audio, image, text, and interactivity to provide a deep understanding of the role and potentials of audio and augmented reality in conjunction with unique codex constructions possible in movable books today.

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