A Free-form Medium for Curating the Digital

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Abstract We present a free-form medium of curation for digital arts catalogues, which connects an infinite zoomable canvas, sketching, and spatial arrangement of rich catalogue elements. We draw on an architectural theory that integrally joins the properties of building materials, construction techniques, and sites to develop a tectonic theory of media of digital curation The theory addresses media of curation on two levels: the materials of *elements* that can be collected and the medium of assemblage, which prescribes how those elements can be joined together in a spatial matrix. The elements of prior digital arts catalogues are joined together in linear lists or grids. These assemblages do not scale well, making them agonizing to wade through when collections are large. Assemblage in our new, free-form medium supports curating across multiple scales, easing demands on visual attention, while opening conceptual horizons. We created an artifact, *The Digital Curated*, as an example of a digital arts catalogue represented in our new medium.

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1 Introduction

A mission of digital arts is to challenge and transform people's senses of technology's potential, addressing what is possible, what is in/appropriate, what is intimate, and what is scary. Yet, while boundaries have been blurred and hybrids assembled, the form of the arts catalogue has hardly advanced. We develop a tectonic theory of curation, rooted in materials and how they can be joined to create a meaningful sense of place. We use the tectonic theory as the basis for a new medium of curation that applies digital arts and sciences methodologies to the form of the arts catalogue. The medium embodies *free-form thinking*, which involves improvisation, divergence, and emergent associations [19]. The free-form medium is referential, visual and semantic, scalable and expressive. Contextual semantics, textual exegesis, rich imagery, video, and sketching are integrated in a holistic medium for authoring and exhibiting free-form curations.

We present *The Digital Curated* [29], a digital arts catalogue exemplar of our free-form medium of curation (see Figure 1). *The Digital Curated* joins clippings of artworks with curatorial writings and sketches in a free-form assemblage designed to attract engagement and provoke divergent interpretations. Multiple scales of detail develop narrative across levels of a holistic spatial ensemble as the user zooms in and out. Text and sketching articulate themes. In contrast with prior digital arts catalogues (e.g., see Figure 2), the new medium takes advantage of the capabilities of digital computing, interaction, and display to bind heterogeneous visual and semantic elements into a meaningful and poetic whole.

2 Media of Digital Curation: A Tectonic Theory

> The tectonic potential of the whole would seem to derive from the eurythmy of its parts and the articulation of its joints. . . The word for space ... means a place cleared or freed for settlement and lodging. . .
>
> – Kenneth Frampton, *Studies in Tectonic Culture*

Tectonics, as an architectural theory, integrally addresses the properties of building materials and sites. According to Frampton, *tectonics*, the art of joining, is derived from *tekton*, signifying carpenter or builder [7]. He says that in Sappho, the tekton assumes the role of the poet. A tectonic system binds all parts of a building into a single whole. The parts are assembled to encompass a spatial matrix.

In formulating a tectonic theory of media of digital curation, we thus consider the 'material' [21] elements that a curator gathers, and the means through which through which a platform enables the whole of a curation to be assembled. On the web, the medium of the individual material *element*s of a curation varies, based on the situated context of the platform of a hosting website. The user experience is realized both through the the material of these elements, and through how the platform enables them to be joined together.

Fig. 1 Static rendering of the overview of an inherently dynamic medium. This work, entitled *The Digital Curated* [29], presents a digital arts catalogue. The assemblage expresses the curator's ideas about the relationships among elements and a synthesis of the whole collection.

We draw from Giaccardi and Karana's materials experience framework for HCI [8]. The framework suggests that materials are experienced through sensory, interpretive, affective and performative aspects. In forming a tectonic theory of media of digital curation, the *sensory* involves the representation of elements of curation—with text, metadata, graphics, and multimedia—and the modalities they can be interacted with—such as mouse, keyboard, touch, pen, tangible, and full body. The manner of interaction, such as point and click or gesture, is also sensory. The *interpretive* involves how people understand curations—based on representation, interaction, and content—and our processes of ascribing meaning. The *affective* involves human emotional response—from art museum collections to cats [19] to
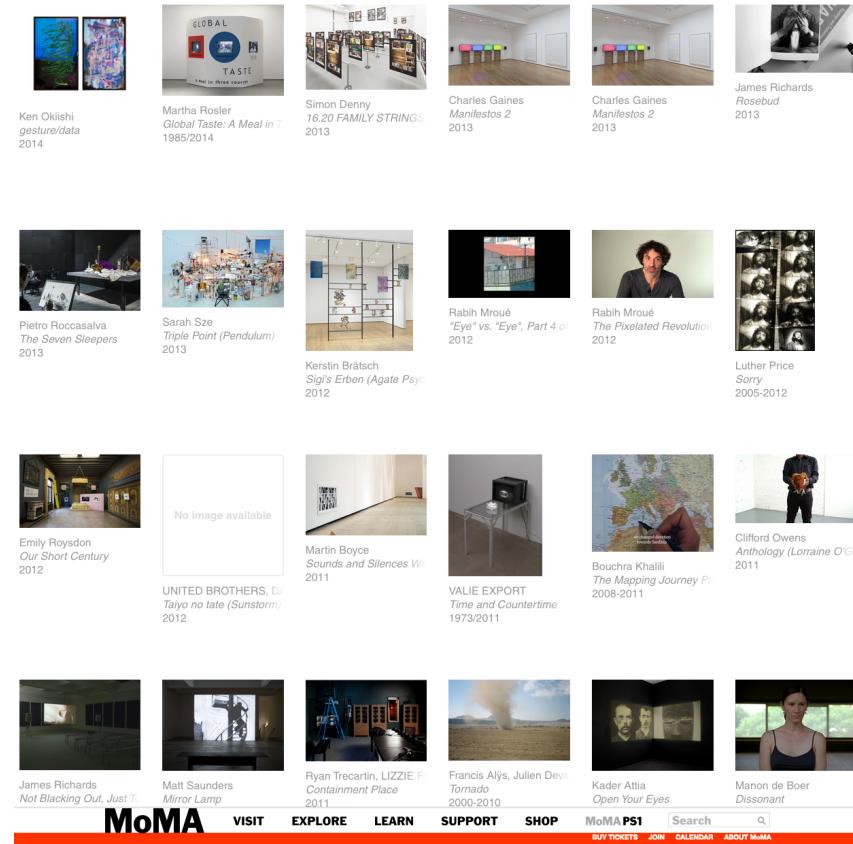
Fig. 2 The Museum of Modern Art has one of the better digital catalogues. Yet, clicking on the Medium:Installation link from an artwork by Bill Viola brings us here, to 48 of 319 results [22]. It looks pretty, but form is trumping function. We can see neither the scope of the collection, nor its associationality. Further, the page lacks a label for Installation. As a result, the user could forget what this collection represents, as I myself did, while preparing the present research.

#blacklivesmatter social media[17]—through situated interpretation of the sensory. The *performative* involves the activities people engage in with elements and assemblages of curation, which in turn are affected by sensory, interpretive, and affective aspects of their materiality and tectonics.

The tectonics of elements of web curation differ in personal and institutional curation contexts. In personal digital curation, the *material of elements*, depending on the platform, potentially encompasses images, bookmarks, videos, clippings, and other web content formats. On Pinterest, these material parts are manifested as pins, on Facebook, they become posts, and on Twitter, tweets. The material of the pin, for example, is always an image, chosen from a web page by the user, with underlying text, which by default is the title of the web page, and which the user may modify. A

tweet, on the other hand, is text first, which may be augmented with an image, video, or link. In the digital arts catalogues of museums, such as MoMA or the Tate, the material of elements is a templated web page, which typically incorporates images and descriptive semantics.

Like the material of elements, the *media of assemblage*—how content elements are arranged and exhibited as a whole—vary in the ways that affordances of web platforms enable arrangement and organization of elements. Meaningful and connected user experiences result when the eurythmy of how elements can be joined together enables constructing what Harrison and Dourish call *places*, which frame interactive behavior [9]. Media of assemblage for popular web curation platforms, such as a Pinterest board or a Facebook feed, constitute *places* that have been designed to provide for settlement and lodging through meaningful and social experiences of exhibits. On Pinterest, as users curates pins, the medium of assemblage that they flow into is the board. The board is a two dimensional representation of the first in first out feeds in which Facebook posts and Twitter tweets likewise flow. These mechanisms are effective for showing people the latest content. However, they provide limited support for making deeper associations.

In prior digital arts catalogues, works for a particular artist or genre are similarly assembled in a list or grid (see example, Figure 2). Facets, such as medium and genre, may be specified. As collections grow large, the user is left to fend with a seemingly interminable sequence of items, across linked web pages. These are agonizing to wade through and hardly usable. The grids of thumbnails barely ameliorates the problem. The grid doesn't scale very far, particularly since unless semantic information for each entry is simultaneously displayed, the presentation, while perhaps pretty, is rendered uninformative.

In short, instead of taking advantage of digital media's potential for joining graphic and interactive techniques to bind parts into a new form of whole, major museums presently represent themselves on the web in a manner resembling disadvantaged print art catalogues. The material of elements is similar to what you see in print, but with lower resolution. The medium of assemblage is even worse. Catalogues as print books afford thumbing through. Thumbing through a printed catalog typically constitutes a rich, high fidelity, sensory experience because the elements are nicely printed photographs, and the grain of the paper is tactile. In contrast, digital lists and grids can be experienced as long and arbitrary edifices, in which order, selection, and presentation read as machinic. New media of curation have the potential to make digital arts catalogue experiences better resemble the curation spaces of physical museums.

3 Information Composition

We consider precursors to the present free-form medium of curation. In spatial hypertext, elements were flexibly organized by users in 2D space, using features such

as size and weight [20, 23]. The elements were typically plain text scraps, which don't support re-finding or visceral engagement.

Information composition is a joining medium, which extended spatial hypertext by emphasizing the visual [14]. Composition is an artistic method. Composition means to assemble elements to form a coherent whole. Information composition added emphasis on images, overlap, and translucence to spatial hypertext's flexible 2D medium of assemblage. From the start, information composition constituted a medium of curation, in that elements typically included source URLs and so afforded re-finding. The medium of information composition was found to improve navigation while browsing a collection of web pages, as compared to linear text [15]. Composition was subsequently found to improve creativity during open-ended tasks through a field study of students [14] and a laboratory study [16], and to contribute to phenomena of situated creative learning and distributed creative cognition [13].

4 Multi-Scale Information Composition of Rich Clippings

The present research extends prior work on information composition through the incorporation of sketching and a zoomable interface to create the new curation medium of mutli-scale information composition. By mutli-scale, we mean spatially organizing elements across a range of sizes, in order to improve the readability of large datasets. The result is reminiscent of Powers of Ten [6] and Google Maps, but here the space and data create an information geography corresponding to an abstract, rather than physical space. The zoomable user interface literally adds dimension to the sensory aspect of the medium of assemblage.

We illustrate principles of multi-scale information composition as a new, freeform medium [11] for art curation through an example, *The Digital Curated* [29] (see Figure 1). In this exemplar, we curate media from museums, exhibitions, and scholarly literature, joining concepts, forms, and content that underlife this chapter, itself, to form an integrated whole. We use our tectonic theory of curation to examine the medium of multi-scale information composition on two levels, the material of elements and the medium of assemblage.

4.1 Material of Elements of Curation: Rich Clippings

The materials of the composition's elements of curation include rich clippings, writings, and sketches. A *rich clipping* is web content (image, text, or video), which a user chooses, clipped from a web page. The clipping automatically becomes enriched with the joining of contextual semantics, including the URL and title of the source document. Rich clippings may contain additional web semantics, such as a paper's journal title, authors, references, and citations. Composition of rich clip-
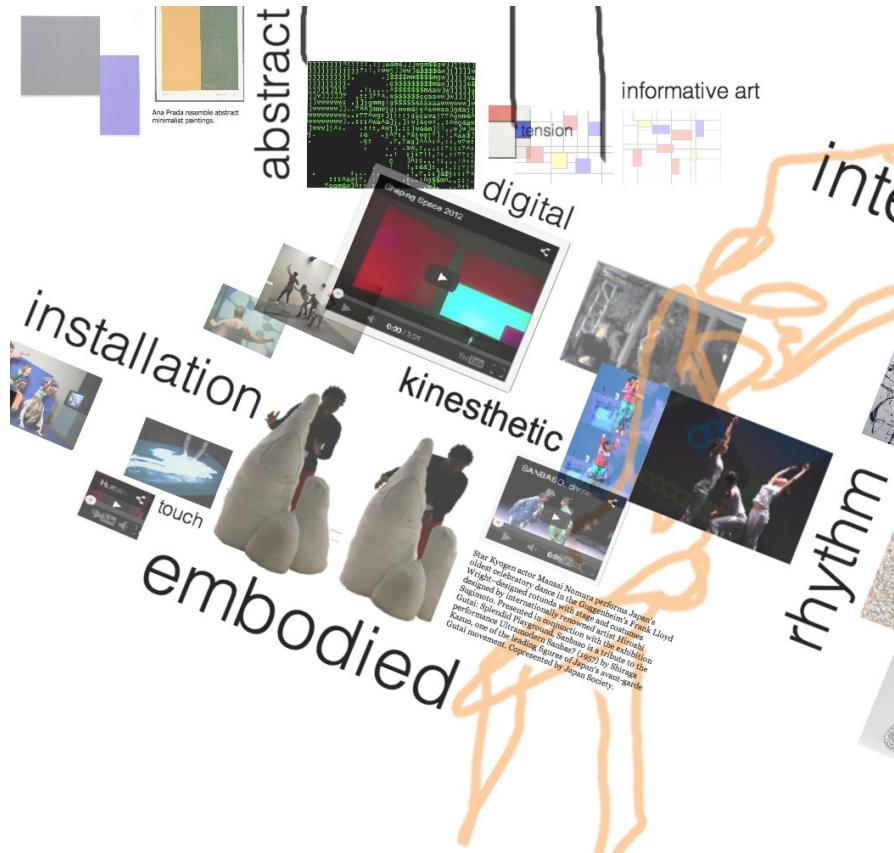
Fig. 3 Annotations label themes in the Digital Curated, such as 'embodied', 'kinesthetic', 'abstract', and 'rhythm'.

pings was found to support reflection and interpretation during open-ended ideation tasks [30]. Writings are used as expository labels and annotations in *The Digital Curated* to call out themes, such as 'aesthetics', 'abstract', 'kinesthetic', 'embodied', 'digital', 'analog', 'rhythm', 'found object', and 'assemblage' (see Figure 3). For example, in the area delimited by the labels 'embodied', 'kinesthetic', and 'touch', we encounter a spatial matrix of rich clippings representing works by Schiphorst [27], Rokeby [12], and Candy and Edmunds [3]. The assemblage of clippings joins gestures, everyday users, dancers, sculptures, wearables, and projections. Embedded YouTube video can be played, paused, and scrubbed directly from within the curation.

Activating a rich clipping presents its semantics in an exploratory browsing interface [26] (see Figure 4). For an ACM article, e.g., soft(n) [27], we explore the reference list, and in turn, discover an article on second and third wave HCI method-

ology [1]. Through the semantic browsing interface we read the article's abstract, again without leaving the context of the curation. We read that this work involves topics of multiplicity, context, boundaries, experience and participation, particularly as they arise as technology spreads throughout everyday cultural contexts. Thus, through the experience of this curation as a place of lodging, we discover an interesting conceptual juxtaposition between nested, discoverable semantics, and themes articulated by the visual and conceptual assemblage of the exhibit's whole.

4.2 Medium of Assemblage: Multi-Scale Information Composition

Cultural theorists, Deleuze and Guattari, describe the assemblage of cultures and societies as a *rhizome*, a meshwork of interconnected heterogeneous elements without a clear beginning or end [5]. The relationships among elements are as important as the elements themselves. A rhizome is a map conveying relationships rather than a tracing, which accurately reproduces elements at the expense of the whole. We argue that our free-form medium of digital arts catalogue constitutes a map, not a tracing, and so functions rhizomatically. With an infinite and zoomable canvas, curators can continually evolve digital arts catalogues in this new medium. Curators express relationships between artworks by joining them together through use of scale, spatial juxtaposition of elements, and sketching. The eurythmy of the catalogue's parts, constructed as a multi-scale information composition of rich clippings, affords interpretation and provides space. Thus, multi-scale information composition, as a medium of assemblage, with sensory, interruptive, and affective aspects, has the potential to transform the digital arts catalogue into a functioning virtual exhibition.
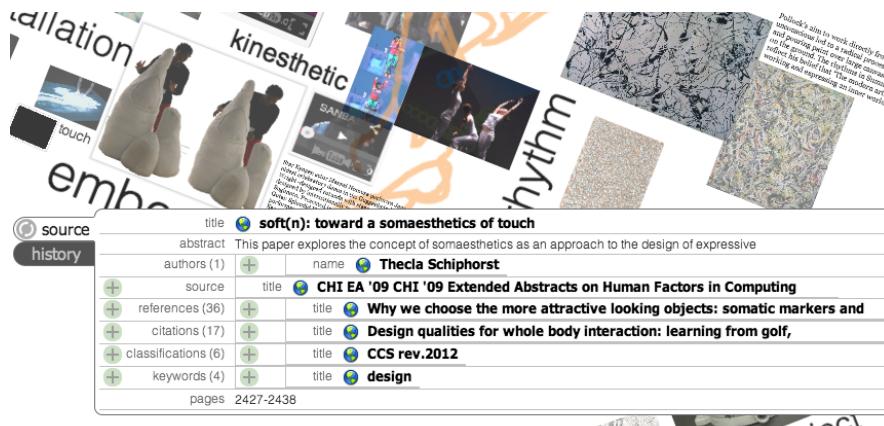
Fig. 4 Semantics for soft(n) [27] rich clipping are displayed in-context. Nested fields such as references and citations, which incorporate semantics for other scholarly articles, can be expanded, iteratively, to discover connected works. Clicking the title for these related articles enables the user to browse the actual articles, in a new browser tab.

Further research can also enable visitors to annotate these free-form assemblages for themselves, engage socially in their midst, and thus create a sense of place in the digital arts catalogue / exhibition.

5 IdeaMâché

The medium of multi-scale information composition is currently supported through the web application, IdeaMâché [free to use at http://ideamache.ecologylab.net]. IdeaMâché is a web application that supports free-form curation on an infinite and zoomable exhibition space with design capabilities for writing, sketching, and graphical transformation. Sketching adds free-form lines to the composition of image and text rich clippings. It can be thought of as a graphical form of annotation. Zoomable user interface techniques enable assembling information on and across levels. This, in turn, enables conceptually and cognitively scaling the assemblage of a curation. Incorporating curation tools into the cloud makes data available anywhere, freeing the user from working on particular computers. Through IdeaMâché's web browser extension, which processes drag and drop events, all of the content a user browses directly affords incorporation into the curation environment, which also resides in the browser. Contextual semantics are automatically extracted from source web pages [26]. We examine three specific aspects of free-form curation, multi-scale, juxaposition and arrangement, and sketching.

5.1 Multi-Scale

In *The Digital Curated*, we see that over 50 elements have been joined together. In a linear or grid representation, this collection would overwhelm cognition, and so be rendered almost meaningless. In the information composition, we see the clippings are organized into a tectonic system of four or five clusters; the sizes and positions of elements cluster are arranged in accord with associated labels. Thus, the curation as composition is articulated at multiple scales, incorporating techniques originated by Perlin and Fox [25].

At the initial, top level scale, we encounter a gestalt reading of the whole, but can see little detail in individual rich clippings. To focus, we use pinch or mouse scroll wheel to zoom in and examine a subset of the composition, the 'analog-installation-kinesthetic-digital' region. The focus of the zoom action is easy to control, because it is centered around the point of interaction. Constituent elements get bigger. With semantic information from Foundation Langlois, a series of rich clippings representing works by Paul Sermon, Steina and Woody Vasulka, and Bill Viola, lead to a transition, through the 'analog' label across to 'digital' installations with David Rokeby's Very Nervous System [12] (see Figure 5) and then to the 'kinesthetic-embodied' cluster, described above. The transition through history that this repre-
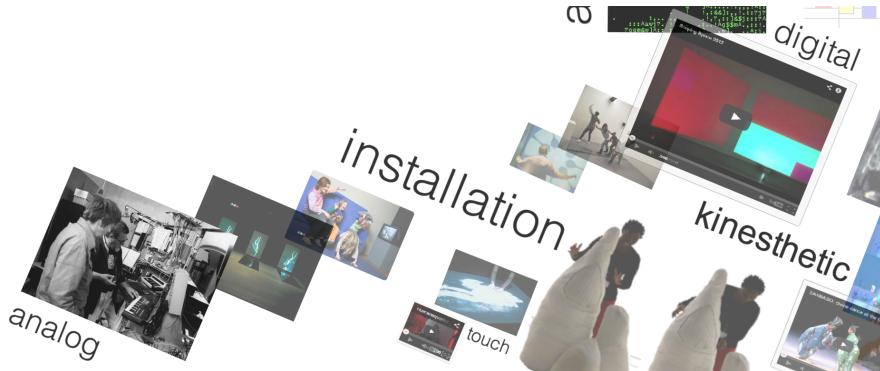
Fig. 5 Zoomed in view of the 'installation' theme. Use of scale creates a visual transition between themes of 'analog' and 'digital'.

sents is expressed spatially not just by position, but further, by a rotation of near 30 degrees. This juxtaposes the two clusters in orientation, while connecting them in space.

5.2 Juxtaposition and Arrangement

Through spatial areas and rotation, elements of curation are joined together to articulate themes. Annotations are joined through spatial proximity and rotation consistent with related rich clippings. For example, 'rhythm' is positioned closely between a clipping from an article by Latulipe et al. [18] and one of a painting by Jackson Pollock (see Figure 6). This presentation strategy constitutes a tectonic system of curatorial association. On a more macro level, we can trace from 'embodied' to 'kinesthetic' to 'rhythm', then, through a forking path [2], to 'interaction' in one direction, and 'found object' and 'assemblage' in another. 'Kinesthetic', 'embodied', and 'touch' are rotated similarly, promoting readings in which they bind together.

5.3 Sketching

Sketching is a means for visual annotation. Glyphs can be sketched to bind elements, promoting synthesis and emergence. In a playful pastiche style, a figure recalling the Matisse dancers has been sketched through the 'embodied-kinesthetic-rhythm' region. Again, its rotation aligns with associated annotations and rich clippings, promoting integral readings. To organize the elements of curation in the area labeled 'aesthetics-abstract-minimalist-informative art', a grid has been sketched, employing a style recalling Mondrian. This echoes a rich clippings from an article on in-

Fig. 6 The theme of 'rhythm' juxtaposes work by Latulipe et al. [18] with that of Jackson Pollack. A connection is formed from 'rhythm' to Marcel Duchamp's Fountain through arrangement of elements with 19th century guitars from the Met.

formative art, which also looks Mondrian-esque. From a clipping of Duchamp's *Fountain*, we see wavy sketched lines that suggest water splashing back, up and out of the readymade urinal, toward 'rhythm' and 'interaction', into clippings of a guitar and harpo-lyre from the Metropolitan Museum of Art, and a Pollock at the Guggenheim. How rude!

6 Discussion

Curation is a structure-generating process that takes a heterogeneous collection of artworks and yields, as De Landa would describe, a joining of specific hierarchies and meshworks [4].

Hierarchies homogenize subsets of the heterogeneous collection into groups of similar importance and relation, providing a top-down, linearized representation. Hierarchies are formed through sedimentary processes, in which similar elements are sorted and grouped together over time, forming layers of detail. The medium of multi-scale information composition supports hierarchies, enabling curators to sort and assemble artworks into meaningful groups through both spatial proximity and scale. From a holistic view, the most general level of detail is shown, but through zooming in, more specific levels of details become revealed.

Meshworks are non-linear, rhizomatic structures, in which elements become bound through strong mutual interactions [4]. Emergent properties, not present in any single element, arise through the meshing of heterogeneous elements. The free-form medium of multi-scale information composition is a meshwork, supporting the emergence of new ideas. Through overlap and juxtaposition, curators are able to mix and connect artworks in imaginative ways, exploring and discovering new understandings, interpretations, and approaches for exhibiting artworks. The sensory form of rich clippings, as material, with visual representation of artworks and details-on-demand, supports tectonic free-form assemblage into interconnected hierarchical and meshwork structures.

Information composition, as medium for authoring and exhibiting conjoint meshworks and hierarchies, becomes a convivial tool [10], supporting free-form thinking for curator and audience. The curator can explore a space of possibilities, break away from common structures, and represent new experiences with art. Audiences form their own interpretations. Stimulated by the curator's composition, but not forced into a specific path, audience members become able to move freely, not only up and down hierarchical structures, but across and between, through meshwork connections.

The *Art of Assemblage* was the title of an exhibition at The Museum of Modern Art, in New York, in 1961, featuring works e.g. by Apolinaire, Gide, Picasso, Schwitters, Ernst, and, the originator of readymade, Marcel Duchamp [28]. Assemblage is a form for joining meshworks and hierarchies in innovative combinations. *The Digital Curated* develops a new tectonic exhibition catalogue medium, connecting form and content. Assemblage is invoked on the material not of chair caning and painting, using paste, but of clippings and contextual semantics, using position, scale, rotation and sketching.

Through the composition of rich clippings, the assemblage of this free-form medium of curation is rhizomatic. The multi-scale representation enables elements to be reproduced accurately, with great detail, enabling micro conceptual and visual assemblage, and yet combined pointillistically, at macro scales.

MoMA curator, William Seitz, wrote of assemblage as involving ordinary objects, placement, juxtaposition in, "... not only a technical procedure, ... but also a

complex of attitudes and ideas" [28]. He associates with assemblage, harmony of contrary and similar elements, explanation in Gestalt psychology, an abstract aesthetic of multiple confrontation, and the syntax for a sharp break with previous modes of aesthetic coherence. Assemblage becomes an abstract method for binding elements in rhizomatic tectonics of curation.

7 Conclusion

Multi-scale information composition is a free-form medium for curation, which provides a tectonic representational strategy for digital arts catalogues. Eurythmic joining of elements to form a connected whole becomes a means of binding diverse artistic forms and creating new ones. The assemblage of art works, as material, to form a whole in the virtual space of the digital catalogue corresponds to how contemporary curators such as Harald Szeemann, working in physical space, become artists, using works by other artists as material, in exhibitions such as Documenta [24]. Multi-scale information composition enables the curator to function as tekton, in the role of poet, supporting the continuing evolution of the curator as artist.

Free-form curation is a tectonic method for the flexible joining of elements in hierarchies and meshworks. Compared to lists and grids, multi-scale information composition better conveys conceptual and sensory aspects of curated elements as material. Composition better captures the ineffable interplay between elements of an exhibition. Its rhizomatic form supports interpretation. We constructed *The Digital Curated* as an exemplar, to demonstrate how multi-scale information composition can function as a tectonic medium for the digital arts catalogue. We look forward to the potential of multi-scale information composition as a medium that engages people in new digital arts exhibition experiences.

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