The Spectacle of Data: A Century of Fairs, *Fiches*, and Fantasies

Shannon Mattern, forthcoming in *Theory, Culture and Society* (2019)
Images here: http://wordsinspace.net/shannon/presentations/small-moving-parts/

Abstract: Alongside the robots, rockets, kitchen appliances, and other technical wonders displayed at the great expositions and world's fairs of the late-nineteenth and early-twentieth centuries, visitors frequently found deceptively staid demonstrations of banal bureaucratic tools: cards, *fiches*, and files. Yet these technologies of information management were aestheticized and presented as integral to the generation and pursuit of the fairs' ambitious "world projects": global networks, universal intelligences, efficient cities, colonized galaxies. The small, moving parts of information functioned as critical tools for city- and world-building. In this article we begin with the 1964-65 World's Fair, where bits and fragments of information fueled space-age visions, then trace those mid-century imaginaries back to the 1939-40 World's Fair and a constellation of expos at the turn of the century, to see how the small, moving parts of information management "scale up" to generate grand fantasies, and, at the same time, how they serve to index their own particular political and cultural milieux.

The great expositions and world's fairs of the 19th and 20th centuries were known for celebrating new technological developments.[1] "[B]orn from a societal desire to showcase the wonders of science and technology," historian Lori C. Walters explains, the fairs were "a calling card to the future" (2014: 467). Perhaps not coincidentally, cards – *index* cards, along with *fiches*, files, and other technologies of data management – were also an integral part of the future-worlds on display in the exhibition halls. The world of files hardly seems germane to the avant-garde, one of the central concerns of this special issue of *Theory, Culture & Society* – yet the fairs made clear that information resources and information management systems were themselves designed, and were critical components of more obviously revolutionary design and practices and political movements. Those *fiches* were tools for envisioning new universal knowledge infrastructures, efficient cities, harmoniously networked worlds, and colonized galaxies; these small, moving parts of information "scaled up" into grand fantasies of future-worlds. They were among the "cultural technologies and technical projects" that made possible the panorama of *Weltprojekte*, world projects, that arose around 1900 (Krajewski, 2014). The "discovery of a new imaginative space" in the nineteenth century, Foucault writes, created the conditions for such fantasies; "the visionary experience" arose from documents and "the

black and white surface of printed signs" in the library, or, we might add, the filing cabinet (1977: 90).

Cards and bits became familiar attractions at expos throughout what we might call (adapting Eric Hobsbawm) "the long-20th century."[2] The concept of a "long" century represents a historical re-periodization acknowledging that much of what defines an age originates and culminates in events, and extends through long-term trends, that stretch beyond the arbitrary boundaries of a *fin de siècle*. This issue of *TCS* traces the cultural technologies and technical projects of the "long mid-century" both backwards and forwards in time; it inquires about mechanical, mediated, military, and aesthetic precursors and successors to "the centrality of technoculture," calculation, and control in the 1960s. In the present article, we begin with the networked global village and computer-engineered worlds of consumption and resource-extraction modeled in the 1964-65 World's Fair, then move backwards in time to identify the precursors (and their own antecedents) to the Fair's ambitious visions and small bits information. We trace those mid-century files and fantasies back to the scientifically managed World of Tomorrow at the 1939-40 World's Fair; then back further still to the index cards and internationalist aspirations on display at various world expos in the late nineteenth and early 20th centuries.[3]

These discrete fairs and expos also defy neat periodization; their individual histories are long, too. Particular actors reappear, and genealogies converge. And while, in each of these settings, the small, moving parts of information – sorted cards, organized files, processed data – are always present (and, indeed, cards have a history that spans far beyond even the long twentieth century), here those cards are transformed into spectacle and take on distinct roles as cultural technologies, indexing their own particular historical and cultural milieux.[4] We will examine how these techniques and

technologies of information-management have embodied different fantasies – different urban, global, and epistemological imaginaries and ideologies – as the cultural and political contexts surrounding them evolved. Then, in our concluding section, as we follow the "long mid-century" forward, we will see that cards and *fiches* have continued to serve as generative and aesthetic apparatae. Small bits and slips of information are still essential ingredients in our modeling of new worlds. In this age of data fetishization, when small bits are big business, it would behoove us to acknowledge that data, in both its digital and analog forms, has long been transformed into spectacle and packaged as a critical tool for cultural transformation.

1964: SPACE-AGE INTELLIGENCE

The 1964-65 World's Fair in New York revolved around a 140-foot-high stainless-steel globe. That globe was itself encircled by three metal rings representing the flock of satellites that began orbiting the earth a decade earlier. Gilmore Clarke's Unisphere embodied the mission of Robert Moses's fair: to bring the world together to celebrate "Man's Achievements on a Shrinking Globe in an Expanding Universe," and thereby promote "Peace Through Understanding." The 76-year-old Moses, New York's infamous master builder – the Baron von Haussmann of the 20th century – was winding down his career here; in order to become head of the Fair Corporation, he had to resign from his city appointments. Many of the fair's exhibits rivaled the scale, ambition and character (more authoritarian than avant-garde) of his half-century rein over countless massive public works. Rockets were everywhere on display, beckoning developers and settlers into new frontiers. General Electric's Progressland pavilion and the Hall of Science spectacularized the atomic future and predicted a coming age of electricity "too cheap to meter." Bell System chronicled the history of communications "From Drumbeat to Telstar," mapped the routes of undersea phone cables,

demonstrated "machines talking to machines," and presented its own touch-tone phones, Picturephone, and Vocoder as future forces in further shrinking the globe and uniting humanity.

Since the car-centric urban visions of their 1939-40 Futurama exhibit had become a reality, General Motors proposed new terrains for mega-scale engineering. In a fifteen-minute ride GM's visitors traveled to the surface of the moon, the Antarctic, the ocean floor, the jungle, the desert, and the city of the future to see "how improvements in current technology may clear the way for man to enter, exist within and develop lands which lie unused today" (quoted in Dickstein, 1989: 30). Just as Moses bent the city to his will and conquered urban communities resistant to development, GM's "machines of tomorrow" would subdue obstinate environments. Their jungle road-builder machine, for instance, would "bring a new way of life to an area that has long – and successfully – defied man's attempts to develop its natural resources and take advantage of its climate and fertile soil."

While images of fantastical technological, extraterrestrial futures were part of the Space Age zeitgeist, this was also an age of new, grassroots urban imaginaries. Moses met new rivals, including the indomitable Jane Jacobs and civil rights protesters, who challenged the lack of diversity and discriminatory hiring practices at the fair, as well as Moses's decades of discriminatory planning practices (see Reitano, 2006: 160-3; Samuel, 2007: 33-41). This new mid-60s utopia, Morris Dickstein explains, was "local and communitarian, suspicious of large-scale planning and regimentation, convinced that Small is Beautiful, and that the ethos of development was blind to fundamental human needs" (1989: 32). The coming age was one of participatory democracy and civil rights (the small, the personal as political), rather than the top-down master plan. Big plans would confront small, street-level interventions.

Paradoxically, it was Moses's fixation on the site's long-term master plan – the big vision – that led him to exercise a relatively light touch in overseeing the fair's architectural design. His primary interest in the fair, and in its predecessor on the same site in 1939-40, was as a pretext – in his terms, a "gadget" – for the permanent development of Flushing Meadows Park. The fair was a means to reclaim marsh and wasteland and build roads for a park that would be his great legacy. Moses's 1964 all-star design committee – consisting of Wallace K. Harrison, Gordon Bunshaft, Edward Durell Stone, Henry Dreyfuss, and Emil Praeger – proposed a single, donut-shaped building that would house all the fair's exhibits, but a frugal Moses insisted that they exploit the readymade 1939 site and push as many construction costs as possible onto individual exhibitors.[5] Moses rejected the proposal, the design team resigned, and in its place arose a new committee chaired by Major General Thomas F. Farrell. Despite Farrell's pedigree – he was former chairman of the New York City Housing Authority and deputy commander of the Manhattan Project – his inaptly-named Committee on Conformity oversaw the construction of a kitschy, non-conformist, "messy mélange of buildings" (Bletter, 1989: 107). The big, fantastic vision ultimately yielded small, idiosyncratic aesthetic enclaves.

Amongst that mélange was another spherical – or, rather, ovoid – structure that embodied another key transformative force of the age: the computer. The IBM Pavilion, designed by Eero Saarinen and completed upon his death by associates Kevin Roche and John Dinkeloo, was allegedly modeled after the "typeball," a small, moving part in the new IBM Selectric typewriter. A steel canopy at the pavilion's ground level featured puppets acting out computer logic, displays of computer circuits, and demonstrations of probability and language translation (small, accessible presentations of big, complex technical matters). Visitors perched themselves in the "People Wall" bleachers, which were then hoisted up into the oval for a 15-minute multimedia show designed by frequent IBM

collaborator Charles Eames. Using synchronized projectors, multiple screens, and a live host, the Information Machine presented a disorienting, kaleidoscopic mélange of scenarios: planning a dinner party and a football play, calculating a missile trajectory, designing a chemical compound. If IBM's "thinking machines" could orchestrate everything from household management to military operations, they would certainly prove useful in realizing the Fair's other grand fantasies, from rocketry to geo-engineering.

As these scenes played out across Eames's screens "in fragments and glimpses," Orit Halpern argues, visitors' eyes moved "rhizomatically, making unexpected and nonlinear connections" within the "perceptual field" before them (2014: 124, 215). "Eames did not expect everyone to see everything," Mina Hamilton proposed in a 1964 issue of *Industrial Design* magazine, concluding that the spectacle was "too fragmented to be entirely successful" (quoted in Harwood, 2011: 192). Yet architectural historian John Harwood argues that Eames deliberately aimed to promote productive confusion, to "shatter" perspective – perhaps to mirror the binary logic of the computer itself; the spectacle relied upon "breaking down the whole into innumerable bits" (2011: 193). Halpern proposes that Eames presented "information inundation" as a virtue, as a means of training visitors to discern pathways and patterns between fragments and glimpses – to find order (and beauty) amidst the small, moving perceptible units (28). Even the design of the pavilion itself – its labyrinthine stairs, its jumbled queues, its bleachers with no clear point of reference – staged similar moments of displacement and disorientation, yet they all ultimately revealed their logic. Bits and bodies passed through logic gates, and tangled circulation routes straightened into neat rows. The "apparent message," Rosemarie Bletter proposes, was that "apparent chaos can lead to order" (1989: 110).

Computational order was a prevailing aesthetic throughout the fair. Lists and printouts – tiny computational souvenirs – were popular. The National Cash Register pavilion featured displays on the state of paperwork and the historical trend toward miniaturization in record-keeping, as well as interactive kiosks where visitors could print recipes and generate lists of tourist attractions in particular cities and important events on particular dates. Punched cards, among those record-keeping artifacts on display at the NCA pavilion, were also integral to the operation of several fair attractions, including the sound-and-light show at the Fountain of the Planets. According to Lyon (1964), the fair depicted a world of gratuitous automation – "a world computerized to the teeth, a push-button world purveying instant fact and instant wisdom. It is a world proud of its systems of swift communication, sure of its lightning answers."[6]

The fair showcased computerized intelligence in many novel aesthetic and material forms: satellites and Picturephones, mainframes and multi-channel entertainments, rockets and Antarctic weather stations. Yet inside these fantastic, even sublime, machines, with their "instant wisdom" and "swift communication," were small, moving parts: keys and cards and fragments of intelligence. These components were not new: in fact, the manual and electro-mechanical techniques and technologies that *made possible* the digital Information Age celebrated in 1964 were among the key attractions at New York's other World's Fair, just 25 years earlier on the very same site, and by other expos in the preceding half-century.

1939: FILES AND SYSTEMATIC MANAGEMENT

At the 1939-40 World's Fair, exhibitions by RCA, Kodak, Westinghouse, and AT&T celebrated (and aestheticized) the communications devices and machines of information management that powered

The World of Tomorrow, a world that promised robots and nylon stockings, "picture radio" and speech synthesizers, Plexiglas and 3D film, fluorescent lights and fax machines.[7] The future was imagined to take place within a fantastical neo-Corbusian city: streamlined, rational, orderly, efficient. The World of Tomorrow, Leonard Wallock writes, "was the city's perfected dream of itself" (1988: 20). It manifested desires for "scientific rationality, technological progress, modernist aesthetics, industrial design,… consumer prosperity, and… corporate capitalism" in spatial form, via rational urban planning and progressive civil engineering, modernist architecture and sterilized suburbs (Bennett, 2010: 177-8). Just as important – though much less discussed – was the dream of efficient urban administration. Record-keeping and filing – the organization of small, moving pieces of information – were central to the World of Tomorrow and its urban imaginary, too.

A 1939 article in *The New York Times* describes an exhibit packed with typewriters, "elaborate computing machines and indexers, sorters and apparatus that seems (sic) almost capable of taking a national census at the push of a button" ("The Exhibits: An Amazing Array"). Exhibitors somehow even found means of dramatizing life insurance and credit analysis. And as the financially struggling Fair continued into its second year, under a new theme ("For Peace and Freedom") that acknowledged the war in Europe, the World Fair Corporation's ambitious office manager proposed an exhibit of her own. Katherine Brougher Gray aimed to display the efficiency of the Fair's administrative operations by pulling her Mail, Stenographic, Addressing and Duplicating Units out from behind the scenes and putting them on stage in a 1500-square-foot demo area. "My personal interest in pushing this plan," she wrote, "quite naturally arises out of the pride I feel in the efficiency of the Office Management Department here at the Fair" (Gray, 1940). She invited the participation of companies like IBM, Remington Rand, Addressograph-Multigraph, Ditto, Hammermill Paper, Strathmore Paper, and Eagle Pencil, and promised to "show [their] products in

actual use on current work in the hands of regular employees – to millions of people." These were the moving parts facilitating efficient administration of the World of Tomorrow.

In a "panorama" of their contributions to the "World of Business," Remington Rand's own exhibit featured four stages where actors would dramatize the use of various types of office equipment, while sound and lighting devices "heightened dramatic effects" ("Remington Rand, Incorporated," n.d.). Remington Rand's electric close shavers took center stage, but one full side of the exhibit was dedicated to the company's "business systems and equipment, including tabulating and accounting machines, adding machines, visible [card filing] and loose-leaf [filing] equipment, record protection equipment, portable and commercial typewriters and supplies" — along with a display of how its Dexigraph photographic technology could be used in the reproduction of business records (New York World's Fair Inc., 1939). Notably, the company was not located in the "Communications and Business" zone of the Fair, alongside peers like AT&T, Crosley Radio, RCA, Underwood typewriters, Universal Camera, and various publishers; but rather in the "Production and Distribution" zone, next to Westinghouse and its Elektro robot, and Electric Light and Power Companies. Tied to both communication and power companies, Remington Rand seemed to straddle two categories in the Fair's spatial taxonomy: it represented the electrification of – perhaps even the spectacularization of – the once painful banality of record-keeping. Rand's modest wares could collectively power fantasies of an efficient modern office, which could itself serve as control center to the efficient modern city.

Remington Rand rarely appears in our shorthand histories of computing, but since the early 19th century the company had played a central role manufacturing the mechanics of the Information Age (for a "longer," fuller history of the company, see Mattern, 2016). The three companies that

eventually merged in the mid-1920s to form Remington Rand – E. Remington and Sons, the Rand Ledger Company, and the Library Bureau – started off making rifles, typewriters, cash registers, ledger filing systems, filing cabinets, library equipment, and card catalogs: all machines for storing and moving small, moving parts, whether bullets or coins or files. By the 1930s, Rand, through various acquisitions, had expanded its portfolio to include office furnishings, adding and punched-card tabulating machines, and – incongruously – electric shavers. This was the Remington Rand that exhibited at the 1939 Fair – a company eager to distinguish itself from its rising rival, Thomas Watson's International Business Machines.

While IBM ultimately dominated in the world of bits, Remington Rand and its antecedent companies developed several breakthrough technologies in the realm of analog files. The Library Bureau's card catalog, originally developed for libraries, eventually proved its utility as an indexing system for *any* business or professional office, for any kind of record-keeping (see Flanzraich, 1993 and Krajewski, 2011). Compared with the bound ledger, previously the dominant means of record-keeping, the card catalog allowed for greater "ease and speed of reference," as well as simpler modification, expansion, and removal of records – in other words, easier management of those small, moveable parts – thus producing savings in "time, in labor, in space, and in clerical expense" (Library Bureau, 1909: 7). Moreover, it elevated office work to "scientific" analysis. The Bureau proudly declared in 1909 that its "greatest asset" was the adaptability of the card catalog to the "new Science of Business System" (5). Now a manager could easily compare sales data across categories, identifying weak goods or customers, weak salesmen or territories. The factory owner could track the efficiency of each machine, each operator, each process – each moving part – in the chain: "The reason for every fluctuation in cost and result is known. And these facts are collected, analyzed, compared, by fixed methods of almost automatic simplicity" (13-14). Real-time analysis enabled

prediction and preemption: "He can not only check bad conditions before they have done serious harm, but he can generally correct bad tendencies before they have developed" (15). The card index promised "working principles as positive and scientific as the science of war itself" (18). Again, small things generated big aspirations.

The Bureau was already advocating for "the principles of scientific management," two years before Frederick Winslow Taylor published his canonical text on the subject.[8] The company's martial metaphor proved prescient, too, as small cards – particularly punched cards – became an integral instrument in the early-20th-century's "mechanization of warfare" (Agar, 2003: 159). In World War I, the U.S. used punched cards to record soldiers' medical and casualty statistics, for example, and the War Industries Board used them to "control the production and distribution of virtually all goods and services" (Heide, 2009: 64). While the military-industrial complex propelled a dramatic increase in the use of card-based record-keeping systems, these small, moving parts were already in use well before the war. As business and bureaucracies grew in the late-19th century, various entities – corporations and cities, merchants and governments, dentists and teachers – came to embrace records-management as integral to their efficient and profitable operation, and they relied on an expanding industry to design, furnish, and manage their record-keeping systems (see Yates, 1991). After Herman Hollerith's punched card tabulating machines proved effective in calculating Baltimore's mortality statistics, the U.S. Census Bureau employed the machines in their 1890 census. Afterward, insurance companies, public utilities, railroads, international governments, and many New Deal agencies adopted the technology to calculate invoices, issue pay slips, and perform more complex data-processing tasks (see Adams, 1995; Agar, 2003: 147-54; Heide, 2009). Small tools of information management promised to fulfill bureaucratic fantasies for myriad big operations.

While its filing business flourished, Remington Rand returned in World War II to its firearm roots, manufacturing more small parts for the war: bomb fuses, the M1911 pistol, and the Norden bombsight. In 1951, after another acquisition, they delivered a larger-scale contraption – the first commercial computer system, the UNIVAC I – to the U.S. Census Bureau. The following year, Rand acquired Engineering Research Associates, pioneers in drum memory systems. The move into computing represented a logical next step — crossing over the analog-digital divide — for a company that had, since the 1880s, concerned itself with the efficient production, sorting, storage, and retrieval of data; with the management of information's small, moving parts.

When Remington Rand merged with the Sperry Corporation in 1955, it was on the cutting edge of computing, navigation, and automation. Sperry made marine navigation equipment and aircraft instruments, including autopilot. Yet even within the future-tech company of Sperry Rand there were still divisions dedicated to "physical data handling" – that is, files. The old guard hung on until 1978, when the company, which by then had lost considerable market share to IBM, finally sold off the Remington Rand divisions. In 1986, Sperry succumbed to a hostile takeover by the Burroughs Corporation (itself founded a century earlier as a manufacturer of mechanical adding machines), and elements from that merger exist today as Unisys, the global IT company. Remington Rand survives as Kardex Systems, a Swiss company specializing in automated storage and materials handling.

That original module, the card file, has grown so big as to encompass logistics writ large. As the 1939-40 and 1964-65 worlds fairs reminded their visitors, those small, moving parts of information technology ultimately made grand visions – the World of Tomorrow, and the grand engineering projects of the Unisphere and the space and computer ages – possible. Of course even these

promises echoed those from prior fairs, where analog information-management systems shaped similarly ambitious visions of social engineering.

1890s: CARDS AND UNIVERSALISM

Chicago's great Columbian Exhibition of 1893 brought another filing system to the world's attention. The Library Bureau, before it was folded into Remington Rand, had been commissioned in 1892 by one Dr. Nathaniel Rosenau, secretary of a charitable organization in Buffalo, NY, to create a special open "briefcase" allowing for the efficient storage of files on-edge. The contraption was then put on display at the fair, and the vertical (or suspension) filing cabinet – which revolutionized the way papers were shuffled in offices and archives across the world – was added to the Bureau's sales catalog (see Filing Primer, 1921: 3; Krajewski, 2011: 100-1; Yates, 1989: 56-63). Meanwhile, at a series of expositions in Europe, Paul Otlet and Henri La Fontaine, both Belgian peace advocates and lawyers and co-founders of the International Institute of Bibliography (IIB), introduced their own system of small, moving parts. Just as Melvil Dewey, founder of the Library Bureau, intended for his company's furnishings and equipment to reinforce adherence to their organizational systems, particularly the Dewey Decimal System, Otlet and Fontaine's filing system was much more than a bureaucratic mechanism: it was an intellectual and ideological one, too.

Otlet believe that all literature – all books, chapters, articles, lectures, and audiovisual media – could be "winnowed" into (1) facts, (2) interpretations of facts, (3) statistics, and (4) sources, thus revealing what unique contributions each resource made to the world of knowledge (Otlet, 1893: 16).

> The ideal…would be to strip each article or each chapter in a book of whatever is a matter of fine language or repetition or padding and to collect separately on cards whatever is new

> and adds to knowledge. These cards, minutely subdivided, each one annotated as to genus and species of the information they contain, because they are separate could then be accurately placed in a general alphabetical catalogue updated each day (Otlet, 1893: 17).

Otlet thought a medium's "fine language" and form were extraneous to its intellectual contribution; in fact, he regarded bibliographic form as primarily accidental: the book, he argued, is merely "a single continuous line which has initially been cut to the length of a page and then cut again to the size of a justified line" (Otlet, 1918: 149). "Documentalism," rather than bibliography, was based on the "monographic principle": "one work, one title; one title, one card," each "deal[ing] with a single intellectual element only" (Otlet, 1918: 149; 1920: 186).[9] Because the IIB's 12.5 x 7.5 cm cards (equivalent to the American three-by-five-inch card) – like Dewey's – constituted small, standardized, easily moved parts, they allowed for "manipulations of classification and continuous interfiling" (Otlet, 1893: 18). And to facilitate retrieval and interconnections, those millions of cards were housed in specially designed catalog furniture and filing cabinets; partitioned using specially designed, color-coded divisionary cards; and linked together into a Universal Bibliographic Repertory (and later a Universal Iconographic Repertory and Universal Repertory of Documentation) via the Universal Decimal Classification, a faceted (combinatory) system adapted from the Dewey Decimal System (Rayward, 1994: 242).

Belgium sat at the hub of much internationalist activity during the late 19th and early 20th centuries. International organizations arose with various aims: to promote free trade, to unite workers and women in the pursuit of universal rights, to champion world peace, even in some cases to reinforce nationalist interests by establishing particular countries – like Belgium – as brokers of that *pax orbis terrarum* (see Krajewski, 2014; Laqua, 2013; Ogilvie, 2012). Such ideals and aspirations preceded the First World War, but were reinvigorated after it. Otlet envisioned a *République Mondiale*, a Global

Republic, served by an international information service, one committed to capturing *all* the world's knowledge and promoting global exchange and understanding. He framed his vision in terms that would ideally resonate with the powerful individuals and organizations building and funding international ties. Just as Dewey's Library Bureau equated their operations with the "science" of business and the machines of war, Otlet validated his bibliographical practice through popular scientific language, via "tropes of facts, atomic elements, laws, and energy circulation"; European documentation, as he represented it, was an "information *science*" (Day, 2001: 17).

The Institute was a productive business, too. In a sketch from 1937, Otlet depicted a knowledge factory, the *Laboratorium Mundaneum*, where "mountains of documents" – books, journals, periodicals, correspondence, laws, patents, statistics – were mined and refined into the "purest matter useful for civilization." Those processed, winnowed resources – packaged on index cards – were then deposited into train cars representing the knowledge classes of the Universal Decimal Classification system, and sent off to be manufactured into new knowledge (see van den Heuvel, 2014: 132).

Starting in the late 19th century, many of the scientists, scholars, and entrepreneurs to whom Otlet appealed for support gathered regularly at professional conventions and trade meetings. The age of internationalism was an age of conventions, and the world's fairs and expositions were among the movement's grandest celebrations and instruments of propaganda. Otlet and La Fontaine, champions of such international exchanges (and conveners of many of them), regularly appeared – with or without their cards – everywhere from grand expositions and scientific conventions, to accountants' and administrators' meetings (see Laqua, 2013; Rayward, 1984; Wright, 2014). At the 1900 Universal Exposition in Paris, they displayed over two million cards from their Universal

Bibliographic Repertory, along with various bibliographic accessories and charts and graphs illustrating the Institute's purpose (Rayward, 1975: 77-8). The cards appeared again at the St. Louis Exposition of 1904 and at the following year's International Exposition in Liège.[10]

At the Universal Exposition of Brussels in 1910 Otlet and La Fontaine hosted the meeting of the World Congress of International Associations, whose members discussed the challenges of international collaboration and debated the standardization of weights, measures, and language. The expo also included an exhibit on the theme of internationalism, featuring parts of the IIB's collection. Some of those exhibits were then repurposed for Otlet's World Palace, or *Palais Mondial*, in Brussels, which displayed myriad instruments of knowledge: model airplanes, maps, diagrams, "projectors new and old, and gadgets drawn from all ages: microscopes, telescopes, navigation devices and printing tools" (Vossoughian, 2011: 97). The collection, which Otlet organized geographically and by research methodology, represented the small, moving parts of epistemological history – and implied that the cards of his Repository were the logical next step.[11] (At the 1937 World Congress of Universal Documentation in Paris Otlet and his co-presenters generated "grand, inspiring, impractical schemes" – fantasies – about a new "small" medium, microphotography, also on display at the concurrent International Exposition of Arts and Technology in Modern Life (Rayward, 1983: 267.))

Many of these global gatherings amounted to meetings about meetings, by associations of associations. At one such gathering – the 1923 meeting of the International Committee on Intellectual Co-operation in Paris – the Sub-Committee on Bibliography recommended a formal agreement between the new League of Nations and the IIB. Yet the committee at large took issue with the IIB's hubristically universal mission, its incomplete collections, and its "propensity to

overrate the value of index cards," leading it to "mistake the means for the end" (qtd in Rayward, 1975: 278). Undeterred, the very next year Otlet drafted plans for a global Mundaneum, a world city that would incorporate a library, a university, a World Museum, and an International Associations Building. This was to be a global hub – one designed by the architect Le Corbusier – for the organization, preservation, and exchange of all the world's knowledge.[12] All those small, moving parts scaled up to form the building blocks for a grand architectural vision – a city made to embody "the actual state of the world,…its mechanisms, complexity… the general problems that impose themselves upon the attention of a people and its citizens and its leaders" (Vossoughian, 2003: 85).

In its embodiment of pure ideology and its grand-engineered vision, the Mundaneum was not unlike the model cities of the world expos where Otlet began shopping his wares decades before, and where Melvil Dewey and Thomas Watson displayed theirs. All were imagined worlds built of cards and code. Of course the world into which Otlet sought to insert his repertoires and *Cité Mondiale* was quite different from the inter-war World of Tomorrow, which Remington-Rand promised to render measurable and predictable and efficiently manageable; and from 1964's competing global visions: a world of computer-engineered consumption and resource-extraction, and a networked Unispheric "global village."

Likewise, we might find a formal resonance among these various techniques and technologies, too. The Eames' "fragments and glimpses" – the whole of knowledge broken down into "innumerable bits" and presented in a multi-stream flow – were prefaced by Dewey's and Otlet's indices and repertoires. They are all composed of small, moving pieces of information; and those pieces all "scale up" to generate grand fantasies of universal epistemologies, networked libraries, streamlined cities, connected worlds. Yet they represent an array of aesthetics and politics, and contrary to

Otlet's conviction, information's aesthetics, its epistemological forms, are not extraneous to its meaning. The Eames's "fragments and glimpses," Halpern (2014) explains, arrived in a post-World War II period defined by the rise of mathematical communication sciences, cybernetic flows, and new management and scientific theories focused on process and pattern and complexity. Within such a context, those fragments and glimpses washed over viewers in a flood – an intentional inundation – as a means of training them to find order amidst the chaotic complexity. The Library Bureau's and Remington Rand's card indices and filing cabinets, however, emerged over half-a-century earlier, amidst the rise of systematic management. The companies' standardized components were meant to promote efficiency and interoperability and support "the new Science of Business System," with its data-driven, real-time analysis, prediction, and promise of pre-emptive management. The system's logistical efficiency – "as positive and scientific as the science of war itself" – presaged the mechanized administration of World War I. Meanwhile, Otlet's cards, inspired by Dewey's system, embodied a different sort of entrepreneurialism – one driven by an internationalist, even universal, mission, which was only strengthened by the war. Within the IIB, standardization and interoperability were ostensibly more about efficient and effective global intellectual exchange – about utopian visions of universal knowledge and world peace – than about managerial efficiency. As Cornelia Vismann has observed of files (which is also true of cards and *fiches*), they're "the mirror stage of any administration. Subsequently, they become the object of desire for a positivist historiography that uses files to deduce their administrative as well as their political background" (2008: 92).

Yet in all these exhibited cities-of-tomorrow and future worlds, information technology and records-management were central to the urban and global imaginaries and ideologies. Information resources constituted powerful tools for city- and world-building. These fairs' and visionary figures' fantasies –

big ideas borne of small components – represented *Weltprojekte* formed, in part, in that "imaginative space" of the card catalog, the filing cabinet, or the data processor.

POSTSCRIPT: MODELING NEW WORLDS OF BITS

Files, Visman reminds us, are not only read or referenced as "evidence" of something having happened, but they also function as objects that we think through – and even create with. Files and *fiches* do not just record; they generate. As we have seen, they have inspired myriad administrative, urban, global, and post-planetary fantasies from the age of internationalism through the space age. And since then, throughout the *long* twentieth century, they have continued to serve as generative "visioning," or what some speculative designers call "worlding," tools.

Otlet's cards certainly generated countless prescient fantasies. With a bit of a teleological twist, some scholars and critics have likened his Repertory to a relational database and his Universal Decimal Classification to a query language, and have added Otlet himself – alongside Great Men like Vannevar Bush and Tim Berners-Lee – to the Internet's family tree (see Pfanner, 2012; Wright, 2014). We could insert Remington, Rand, and Dewey into that genealogy, too, for all were concerned with the production, sorting, storage, retrieval, and *networking* of data. Books themselves were networked networks, according to Otlet: books "contain and constitute networks or webs ("*réseaux*"), both internally and externally in their relations with one another and to the world at large" (Day, 2001: 14). Otlet even envisioned, years before 1964, many of the technological wonders visitors saw at the fair in New York: he imagined "a system of networked computers," or "electric telescopes," "that would allow people to search through millions of interlinked documents, images, and audio and video files"; he "imagined that individuals would be able to upload files to central

servers and communicate via wireless networks"; he imagined participatory, multimedia exhibition displays and technologies for transmitting taste and smell (Wright, 2014: 8, 9, 190-4). He also conceived of a workstation that would integrate a radio, telephone, microfilm reader, television, record player, and a collection of personalized documents in myriad media formats; display the relationships between these various documents; and recognize human speech (235-8).[13] His Mondothèque was far more ambitious than Vannevar Bush's Memex or any of the rudimentary, list-generating kiosks found at the 1964 fair.

The card, we might say, was Otlet's muse. Over the decades, cards put to personal use have provided aesthetic and intellectual inspiration to myriad artists, writers, and designers. Jules Verne, Emily Dickinson, Walter Benjamin, Ludwig Wittgenstein, Claude Lévi-Strauss, Roland Barthes, Niklas Luhmann, Georges Perec, Raymond Carver, Stanley Brouwn, and Mark Lombardi all captured fragments of thought on cards or slips (see Hollier, 2005; Krapp, 2011: 1-26; Spieker, 2008; "Taking Note"). In his study of Roland Barthes' card files, Rowan Wilken argues that the cards served as much more than an *aide-memoire*; they were an "organizational device, a kind of 'creativity machine' that served a crucial function in the very construction of his written texts, and shaped his thinking on textuality and the role and operation of literary criticism"; in particular, Barthes' cards informed his theories on the "fragment" and fragmented writing (2011: 9).

Marshall McLuhan regarded cards as similarly generative. His *Distant Early Warning Cards*, created in 1969, referenced the real-life DEW Line, a band of 63 radar and communication stations that stretched across 3000 miles in arctic Canada, meant to provide early warnings of invasion during the Cold War (Belonax, 2013). McLuhan regarded artists as a human version of the DEW line – as early detectors of cultural shifts – and his cards were meant to promote such prescient perception.

McLuhan's cards preceded Brian Eno's and Peter Schmidt's well-known Oblique Strategies deck from 1975, which was likewise meant to promote creative, lateral thinking. As McLuhan was distributing his DEW cards, critic and curator Lucy Lippard deployed index cards as a curatorial and documentation tool: for her 1969 *557,087* exhibition in Seattle – which served as the foundation for her subsequent "Numbers Shows" – she invited 60 artists to submit event-score-style proposals on 4x6-inch index cards. Volunteers executed most of the works – either in the gallery or around the city – and all the proposals were gathered together, in their original index-card form, into an unbound, re-shuffle-able catalog (Foote, 2016; Graves, 2013; Lippard, 2009; Nelson, 2008).

Cards in punched form of course played a critical role in computing history, and even today web and software designers commonly use the "card-sorting" method to create or evaluate the information architecture of a website or program (Maxwell and Armen, 2013). Testers list various topics or functions on cards, then ask users to sort those topics into categories, which then inform an application's structure. Software designers use cards for conceptual and data modeling, and sometimes the index card even becomes a skeuomorphic module within the software, as was the case with Notecards, released by Xerox PARC in 1984, and Hypercard, released by Apple in 1987 – and as *is* the case with various contemporary note-taking and writing programs, like Evernote, WritersDuet, and Scrivener (see Agile, n.d.; CardStack, n.d.; Mattern, 2010; Tse, 2014; Williams, 2015).

Yet perhaps the most ubiquitous and persistent – "sticky," if you will – card-like module within the design world today is the Post-It, released by 3M in 1980. Post-Its are modular, movable, cheerfully colored. They are intuitive, low-risk, and liberatingly provisional. Their small size forces users to deconstruct big ideas into tiny parts. They foster collaboration by giving license to team members to

post even their smallest, most disposable ideas. And their tangibility fosters material connections between the people using them (see also Post-It; Lavenda, 2014). Design ethnographer Jamer Hunt (2010) notes that their low barrier to entry – a Post-It and a Sharpie are the new basic design tools – democratizes design and makes it accessible to "lowercase 'd' designers who are not necessarily skilled in drawing, rendering, or model-making." Post-Its have many of the material and operational virtues of Dewey's index and Otlet's Repertory (minus the comprehensive classification systems) – but their epistemology is much more local, crowd-sourced (amateur?), and provisional – and, I would add, perhaps wastefully disposable.

I have encountered many an "ideation" session in which the Post-It collage – itself a mini-World Expo of multi-colored adhesive wall art – seems to be the prime focus. A complex, polychromatic paper geometry creates the semblance of productive "design thinking"; it is an index of creative labor. As Design Thinking™ becomes the panacea for so many ailing or stagnant industries and government agencies, as "creativity becomes the lubricant of the innovation economy," what says "innovation" more clearly, Hunt asks, "than a crazy quilt of Post-Its?" All those small pieces add up to something fantastical. Could it be, as the International Committee on Intellectual Co-operation said of Otlet's International Institute of Bibliography, that the Post-It's proponents are also fetishizing their methods and instruments, reifying the process, mistaking the means for the end?

However gratuitous, methodolatrous, or wasteful this paper-intensive design practice might be, the Post-It map – even if it produces only an unmaterializable fantasy – serves as a topological model of the design *process*, of intellectual work, itself (see Mattern, 2013). Otlet, particularly in his exhibition collaborations with Otto Neurath and Patrick Geddes, celebrated the value of models as pedagogical devices, as means of making abstract, complex forces in the social world both material and

intelligible (Vossoughian, 2011). A model was also one of the chief exhibits at the 1964-65 World's Fair – and it remains today a key attraction at the Queens Museum. Moses commissioned Raymond Lester Associates, a model-making firm he had employed regularly in his urban planning practice, to create a 9,000-square-foot wood, plastic, and paper model of all 830,000 buildings in New York's five boroughs. The Panorama of the City of New York was intended to celebrate the city's 300th anniversary – but it also lionized Moses. He shaped many of the urban forms that were immortalized here in miniature; his urban fantasy became real. Lester & Associates consulted Sanborn fire insurance maps, aerial photographs, and a host of other city records – undoubtedly indexed in its libraries' and archives' card catalogs – in order to construct a model of striking scale and with remarkable accuracy (Queens Museum).

And Moses's model, like John Rand's and Melvil Dewey's and Paul Otlet's card indices, was meant to be modular and expandable. The model has undergone periodic updates. Amidst all the push-button gadgetry and spectacular automation of the 1964-5 fair, these paper buildings – illuminated with a dawn-to-dusk-to-night lighting cycle, animated with moving miniature airplanes, and indexed with colored lights on all municipal facilities – had widespread analog appeal. And today, as our urban imaginaries and epistemological visions are driven by sensors and data and a "Science of Business System" that bests Dewey's wildest dreams, visitors still flock to that paper and wood model, a fantastic index of not only the world they live in, but of the material and mechanical means – the small, moving parts – we devise to understand it.

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[1] Images illustrating the article, prepared for a January 2017 talk at the University of Amsterdam, are available on my website: http://www.wordsinspace.net/shannon/portfolio/small-moving-parts-2017/.

[2] Hobsbawn (1994) spoke of a "long nineteenth century" and a "short twentieth century," but I am arguing here for a different periodization.

[3] And while our excavation won't probe much deeper than the 1880s, we must acknowledge that our history is longer still; we find antecedents, for instance, in the early nineteenth century, which gave rise to many new machines – rifles, sewing machines, typewriters – with small, moving parts. Over the course of the century, then, small modifications in manufacturing and new machined parts allowed for these technologies' commercial production. One such "long" history is Berz's (1998) study of the German 08/15 machine gun, whose production – via a districted supply chain of atomized parts – gave rise to standardized manufacturing practices and prompted the establishment of the Deutsches Institut für Normung (DIN). Lisa Gitelman also examines how the increasing use of blank, printed forms and of machined tools in the late-nineteenth century "introduced or increased standardization" (2014: 38).

[4] Of course there's a much deeper history to this epistemological winnowing and atomization – to the desire to refashion the world's knowledge into small, moving parts, all easily manipulated and linked. Consider Konrad Gessner's 16th-century cut-and-paste note-taking technique; Placcius's stitched paper slips; John Wilkins's 17th-century combinatory classification system; Leibniz's *scrinium literatum*, a closet for organizing notes on little hooks; and Carl Linnaeus's botanical paper slips, which he shuffled in developing his taxonomic system. Consider, too, the index composed of standard-sized playing cards at the Parisian Academia des Sciences in the late 18th century; the hybrid handwritten-index-card-and-printed-paper-slip catalog William Croswell created for Harvard University in 1817; and the half-sheet card index Charles Coffin Jewett proposed at the 1853 worldwide convention of librarians (see Charmantier and Müller-Wille, 2014; Krajewski, 2011; Wright, 2014).

[5] Apple, who has famously consolidated many of our twenty-first-century technologies into a single, small device – the iPhone – has finally realized these mid-century designers' vision in their new, Norman Foster-designed donut-shaped headquarters in Cupertino, CA.

[6] For more on the aesthetics of computation at the fair, and particularly the role of IBM, see Barbrook, 2007: 14-69.

[7] Much of this section on Remington Rand and the 1939-40 World's Fair is adapted from Mattern, 2016.

[8] According to Yates (1989), "*systematic* management" was the informational counterpart to scientific management. Systematic management emphasized system and efficiency, and relied heavily on detailed record-keeping and "formal and systematic modes of communication," flowing "up, down, and across corporate hierarchies"; these systems, mandated by top management, served to "control and coordinate processes and individuals"; and "draw data and analyses up the hierarchy to serve as the basis for managerial control" (xv, 1, 2).

[9] See also the work of Wilhelm Ostwald, Karl Bührer, and the German collective, Die Brücke ("The Bridge"), which named Otlet its honorary president. Die Brücke, like the IIB, sought to connect formerly-isolated knowledge spaces and to normalize the means by which knowledge was created and shared among schools, universities, offices, labs, government agencies, and private citizens. Ostwald believed that the "organization of intellectual labor must begin with the purely mechanical ordering of written and printed documents," so Die Brücke proposed the World-Formats, including a standardized paper format, in order to both economize on the use of space and ensure that the material form of knowledge was universally transferrable, accessible, and storable (quoted in Vossoughian, 2014: 172; see also Krajewski, 2012, 2014). Ostwald, like Otlet, aimed to "split up scientific communications into very small component parts" (quoted in Hapke 1999: 143). The

group sought to standardize publication formats and their modes of distribution, and the furnishings and architectures used to house them. In many of their proposed designs, the standard index card serves as a spatial module that can be scaled up infinitely to generate architectural and perhaps even urban forms.

[10] The American Library Association also appeared at the 1904 St. Louis World's Fair. They created a small branch of the St. Louis Public Library, featuring Library Bureau furnishings and a card catalog supplied by the Library of Congress. The LOC also hosted an exhibition at the U.S. Government Building, where they displayed the evolution from handwritten to printed catalog cards (Eberhart 2016).

[11] See Vossoughian (2011) and Wright (2014) for fascinating discussions of Otlet's relationship with Otto Neurath and Patrick Geddes, both fellow pioneers in exhibition design, who carefully considered the epistemological and pedagogical significance of various forms of exhibition media and installation strategies.

[12] Otlet had earlier discussed similar plans for a World City with sculptor Hendrik Andersen (Wright, 2014: 124-174).

[13] Consider, too, Emmanuel Goldberg's Statistical Machine, a workstation that would use "search cards" to find and retrieve records storage on microfilm. When Vannevar Bush sought to patent his Memex, the Patent Office rejected his application, citing Goldberg's 1927 design (Wright 2011: 208-9).

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