Mind the Gap: Embodied Cognition, Curiosity, and Recent Designs for Academic Libraries

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Abstract: This paper examines recent library designs in terms of the perspectives offered by the psychology of curiosity, embodied cognition, and social infrastructure. Several buildings are selected as examples, with some emphasis on Snøhetta's recently completed Charles Library at Temple University.

What type of building has been more challenged than the library? Many people are confused by new, or recently remodeled academic libraries. Some ask "Where are the books?" Others wonder why we are still building libraries if all of us have one in our pocket. But what went into our pockets was the library building of the 1960s – a hyper-rational machine for the retrieval of information, proud of its rectilinear clarity and predictable floor plans. I am an architecture librarian who once enjoyed working in an International Style box with identical floors and a vertical core, because it was a fine scaffold for the orderly sequencing of books and the straightforward wayfinding required for their retrieval. But as systematic access moved from floors and shelves to web pages and interfaces, the building's other, overshadowed social functions have been revealed and are demanding the attention of designers. When considered from the point of view of research on embodied cognition and psychology, as well as the academic library's contributions to social infrastructure, some recent designs by Snøhetta may be seen as effectively arousing curiosity in a building's visitors, sometimes consciously and sometimes unconsciously, and thereby promoting the library's goal of engaging students in discovery and self-improvement. The arguments presented here are largely based upon other academic writings, but construct a fresh perspective by combining three previously unrelated bodies of literature: those on the library as social infrastructure, on embodied cognition in architecture, and on the psychology of curiosity. Inherent to embodiment, each of the buildings discussed was visited. Two audiences are intended: librarians who may not have considered the potential impact of design, and designers who may find interest in the current state of this building type or in curiosity as a consideration in the experience of a building. Since I am most interested in academic libraries, some focus on Snøhetta has been useful because that global firm has designed many of the largest examples during the last decade, and Snøhetta's designers show some interest in curiosity and embodiment. The goal is not to introduce new ideas, but to look at some well-known aspects of architecture in a different way[1].

SOCIAL INFRASTRUCTURE

Librarians writing about trends in library spaces – reductions of open stack collections and increases in spaces for people and technology – usually concentrate on interiors, furnishings, and the introduction of new uses and services, sometimes pairing these to new pedagogical efforts. They don't often cite social explanations, with the exception of urban sociologist Ray Oldenburg's 1989 introduction of the term "third place" – the space beyond home and the workplace where much time is spent and important socialization occurs.[2] This concept has been helpful but awkwardly broad (Oldenburg describes various third places, but does not include libraries), is difficult to apply to students (which is their workplace?), and has arguably been challenged by today's spaces where entertainment and work are less segregated – a Google office being one example.[3] Now Eric Klinenberg and cultural critic Shannon Mattern assert that today's libraries provide "social infrastructure" (i.e. the "facilities and conditions that allow connection between people.")[4] Klinenberg names other spaces contributing to social infrastructure: public facilities (schools, playgrounds, parks, athletic facilities, sidewalks, courtyards, and community gardens), community organizations (churches, clubs, etc.), and even some commercial establishments (if they function as third spaces) but dedicates most of his study to libraries, because they are uniquely suited to an atmosphere of self-improvement and openness to alternatives. He goes so far to suggest that, in today's polarized, "bowling alone" society, libraries stand out as the clearest example of hope for broad societal improvements.[5] While Klinenberg may overstate the potential of libraries, his is probably the most detailed explanation of how they contribute to social infrastructure. Mattern's more measured assessment discusses a set of infrastructures that define libraries (social, architectural, technological, epistemological and ethical).[6] Regarding ethics, both writers applaud the library's non-capitalist agenda of sharing – an exemption confirming the democratic value that the world functions better when information and ideas are available to all – and recognize the increasing marginalization of this agenda by the rise of an information economy.[7] Both Mattern and Klinenberg focus on public libraries, but see parallels to academic communities, where interdisciplinarity, informal learning, collaboration, diversity, and student engagement have all become high priorities and where the campus library is one of a small number of facilities clearly intended for all.[8]

The design of the 2004 Seattle Central Library by OMA seemingly foreshadowed the rise of the term "social infrastructure" with its "urban living room" panorama of group
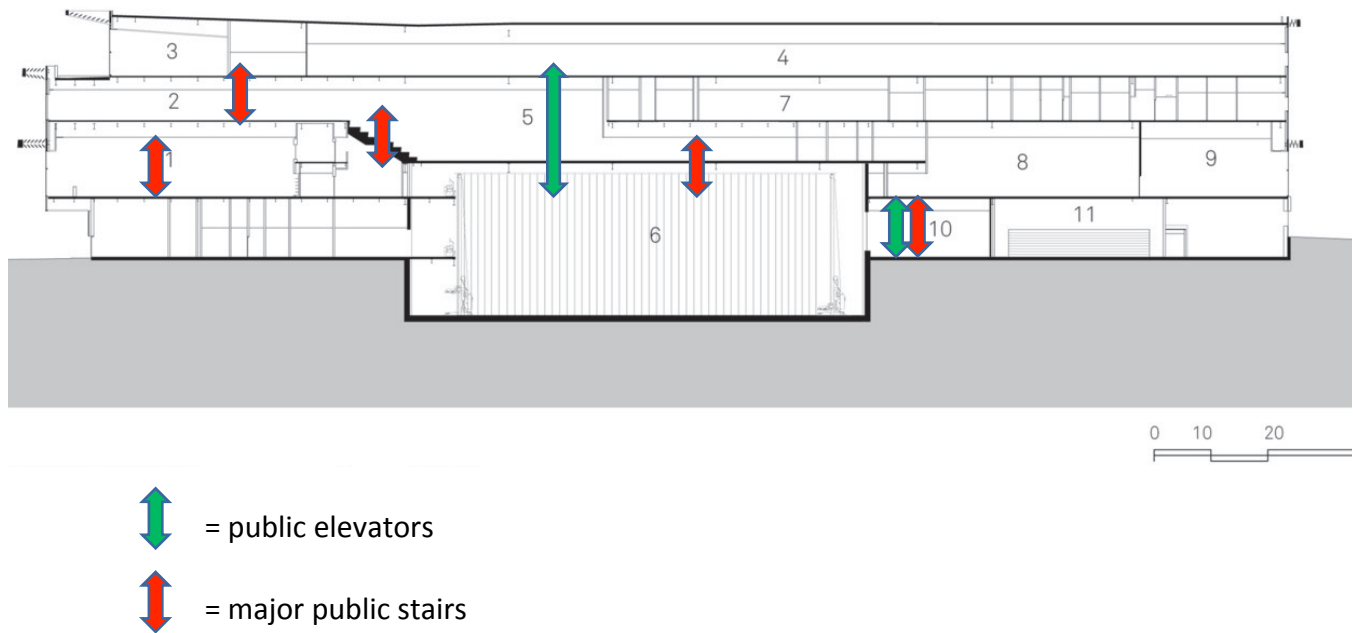
Figure 1. Hunt Library, North Carolina State University, Snøhetta, 2012. https://www.archdaily.com/354701/hunt-library-snohetta and author..

and individual functions.[9] Among those noting the variety of social interactions it facilitates, Kim Dovey adapts spatial syntax analysis to show how its vistas and circulation patterns offer visitors choices, freedoms, and chance encounters. Rather than restrictive linear routes or centrally controlled fan-shaped paths, one ambles through rhizomatic networks that present multiple choices. Dovey notes that these nets are characteristic of department stores, shopping malls, or public squares.[10] Regarding circulation, Snøhetta principal Kjetil Thorsen cautions "Accessibility is a precondition, but openness and transparency are also important for a sense of freedom. The space mustn't be obtrusive by prescribing what you should do."[11] For this sense of freedom, awareness that does not require commitment seems optimal. But how many options can anyone handle? This question might be answered by guiding the flaneur's stroll through a carefully contrived *promenade architecturale*.[12] Dovey and others discuss the vertical routes that are divided into segments and scattered around the Seattle library, routing people past several of a floor's features simply to go up or down.[13] A similar tactic in Snøhetta's Hunt Library, completed in 2012 at North Carolina State University, helps introduce new visitors to the library's many service areas and grant the building's regular occupants social opportunities beyond the silence of the elevator. (See Figure 1.) Perhaps one condition that fosters social infrastructure is a somewhat paradoxical need to offer both simultaneity and sequence.

EMBODIED COGNITION

The response to Seattle's library has been ample, even including a collection of essays on the building comparing many of the critical approaches and research methods employed in the study of design.[14] But the current discourse on embodied cognition offers a lens that has not been directed at library spaces. Building on both phenomenological theories and environmental psychology, writers such as architectural critic Sarah Goldhagen or philosopher Mark Johnson leverage breakthroughs in neuroscience to demonstrate the subliminal powers of designed space. Most relevant here are the basic principles that our exploration of spaces may be pre-conscious, imagined, or vicarious – what Johnson calls "non-conscious simulations." Neurologists posit mirror neuron systems to explain why, when we see someone performing an action, the neural clusters activated are the ones we would use to perform that activity. Moreover, these empathetic responses may occur even when we only imagine an action and this mirroring may take place at either a conscious or preconscious level.[15] Johnson and Goldhagen identify these imagined bodily actions as one element in the complex of interactions between the body/mind and the designed space around it. "Book Mountain," the small public library designed by MVRDV outside Rotterdam, (see Figure 2) confronts the visitor with a pyramid of book-filled shelves so dramatically that, even if anyone can resist scaling

Figure 2. De Boekenberg [Book Mountain], Spijkenisse, MVRDV, 2012. http://www.mvrdv.nl/media/uploads/Boekenberg_DariaScagliola_007.jpg

the ziggurat, the trek has been imagined, perhaps before the form was fully perceived. The body has reacted. The building has invited exploration.
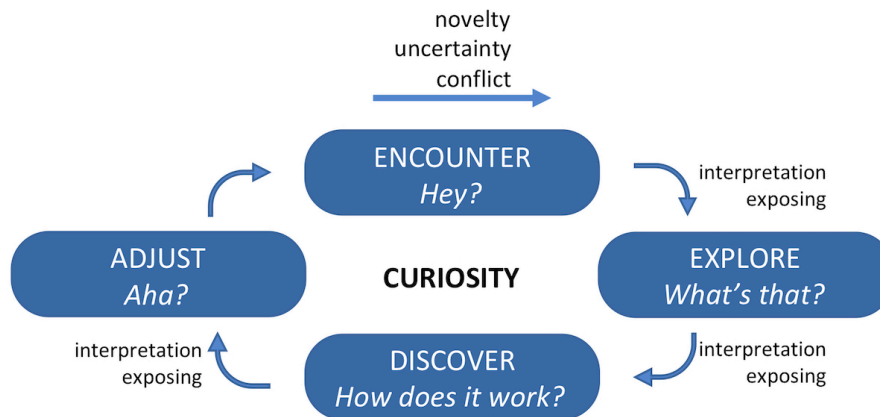
CURIOSITY

The psychological literature on curiosity also seems relevant to library design. Since curiosity is an important characteristic of academic success, researchers such as Sophie von Stumm conclude "educational settings should fully exploit their plentiful opportunities to induce and inspire curiosity."[16] If any campus building can, by its design, foster inquisitiveness, it might best be a library – if only because of the broad scope of its offerings (be they disciplinary collections, services, or social encounters.) Research into the psychology of curiosity is varied and unsettled, but a widely-respected theory, first stated by George Loewenstein, describes an information gap. Curiosity is largely a matter of encountering this gap – a "sweet spot" between clarity and chaos that ignites the desire for more information.[17] Interest among designers in this research seems rare but a Dutch team investigating game design dares to assemble a practical summary. They detail the information gap theory with five main principles for evoking curiosity: conflict, novelty,

partial exposure, uncertainty, and complexity.[18] They diagram key processes of curiosity as a cycle of encounter, exploration, and discovery that repeatedly ends in the adjustment of expectations. (See Figure 3.) The Dutch designers had trouble initiating curiosity. They published their guesses about what percentage of students might be engaged by each of their test installations and were usually wrong. But their experiments introduce the unlimited variables at play, both on the part of the perceiver and what is perceived. Perhaps the best any designer can hope for is to be effective with a quantity of people that swells the middle of a bell curve.[19] A clear example of success in stimulating curiosity in Hunt Library is a large, and technically unnecessary, window with a public view of the robotic book retrieval system. It pulls a large portion of visitors into the cycle of "Hey?," "What's that?," "How does it work?," and perhaps finally an "Aha!" adjustment of expectations about what a library is.[20]

CHARLES LIBRARY

Snøhetta's design for Charles Library at Temple University conveniently exemplifies the three topics introduced above: social infrastructure, embodied cognition, and curiosity. Social

novelty
uncertainty
conflict

ENCOUNTER
Hey?

interpretation
exposing

ADJUST
Aha?

CURIOSITY

EXPLORE
What's that?

interpretation
exposing

DISCOVER
How does it work?

interpretation
exposing

Figure 3: *the curiosity process – encountering, exploring, discovering and adjusting. Initiated by novelty, uncertainty and conflict. Driven by interpretation and exposing.*

(from Tieben, *et al.*)

Figure 3 Diagram. From Tieben, Bekker, & Schouten, "Curiosity and Interaction"

infrastructure has been a critical mission for the building since its inception. Temple's President Richard Englert believes "this uniquely inspirational environment is defining what scholarship in the digital age looks like."[21] The term "stoa" has appeared in the press indicating the desire for a structure that is both workspace and public square. Its central, high-traffic location near a free-standing bell tower and two precious green spaces, attracts the varied uses of a welcoming building in a dense urban campus.[22] It contains ample collaborative spaces, including forty group study rooms, training rooms, an event space, the requisite coffee shop, and numerous other amenities. Like other new or refurbished academic libraries, students pack the seating most afternoons.[23] If Dovey were to analyze its circulation, as he did with the Seattle Central Library, he might find that fewer routes are available for walking in this smaller building, but that visual connections between spaces are plentiful.

Although the Dutch game designers, Rob Tieben and colleagues, only meant them as loosely-conceived, and overlapping categories, I want to use their five principles for evoking curiosity to consider the possible embodied and other psychological impacts of specific traits of Charles Library. By doing so, I do not mean to suggest that feature X has impact Y, merely that these affordances avail themselves and may be impactful for some portion of the building's users, consciously or pre-consciously. Affordances are not things, they are the potential of things resulting from their encounter by a human or other animal.[24] Considering design elements in this way also

helps relate the research on curiosity to that on embodiment, and may be consistent with the intentions of many designers. Snøhetta's Kjetil Thorsten and Craig Dykers might speak for other architects when they warn, "We do not…see ourselves as creators of architectural symbols, but rather as suppliers of possible associations….This also expands the performative aspects of a building by allowing the user to define their own experience."[25]

Tieben's category of "Conflict" includes violated expectations and conflicting experiences. Like droves of public buildings in recent decades, the new library introduces forms that are unfamiliar (see Figures 4 and 5), especially when compared to the domestic spaces that influence most people's preconceptions of buildings as cubic volumes pierced by rectangular doors and windows – notions that neurologists call "schemas."[26] The mix of angular and curvilinear geometries in Charles Library challenges these schemas. Formally, it does not resemble most Temple University buildings. Its coarse gray granite cladding bears some similarity to the neo-gothic buildings nearby, but is installed in floating vertical strips uncharacteristic of masonry – violating the brick-and-mortar mental model held by many and undercutting its contextual gesture. The huge atrium is laden with the traditional grandeur of domes in the great libraries of the past, but distorts that convention toward the limits of recognition.[27] Like other contemporary designs, the building evokes a tone of inventiveness, one aspect of which may be seen as setting the stage for the "Hey?" encounter that can get the curiosity cycle moving.

Figure 4. Charles Library, Temple University, Snøhetta, 2019 (detail of rendering). https://snohetta.com/projects/460-charles-library-at-temple-university

For "Novelty" the game designers combine both attention-getting and sensorial experiences. Most of the features already described may attract attention. But sensory appeal is also an important link between embodied impressions and the heightened awareness accompanying curiosity. The interior color palette is muted and neutral: gray terrazzo, dark grey metal, off whites, and brushed aluminum. Wood warms things selectively. In this setting, the occupants become the source of color and this directs our attention to the social. Displays of books also inject color and attract the eye. Goldhagen reminds us that some visuals may become haptic:

> Haptic impressions are visual stimuli that provoke us to mentally simulate tactile sensations: … the mere sight of them cues our imagined sensorimotor engagement with them. That's why cushioned chairs … elicit feelings of relaxation and warmth even if students never sit in them.[28]

She argues that textures such as rough masonry may transmit negative associations for some people "because they non-consciously imagine that brushing up against it might hurt."[29] The granite on the exterior of Charles Library is contrasted to western red cedar cladding underneath the huge sheltering canopies. Warmed by uplights, this appealing material continues in the atrium and is reprised on the fourth floor – usually gently curved and in several places touchable.[30] The

fourth floor must be some urban academic's idea of heaven. About 200,000 books, selected for their popularity or brows-ability, occupy the center of the floor crowned by a ceiling of those inviting wood slats. This glass-clad floor boasts 360 degrees of penthouse views of the campus, ringed by roof garden plantings. The space between the envelope and the books holds an array of seating areas and study rooms, both large and small. Every move through the fourth floor combines the sensations of people, furniture, books, plants, and distant views. Cleverly chosen throughout the building, colors and materials remix on the fourth floor in a sensory cocktail.

In their category "Partial Information," Tieben's crew isolates the impact of knowledge that is incomplete. At the main entrance to Charles Library, an enormous amount of information about the building presents itself. Before entering the building, three stories are revealed through the glass under the canopy and even the wood ceilings of the all-glass fourth floor may be glimpsed above the canopy.   Stepping inside, one is greeted by sightlines to every floor and most major services – sightlines dramatically framed by the irregular dome whose undulating forms are activated by slats of wood that evoke images of waves more than floorboards. Directly above, where one might expect a dome to culminate in an oculus, cupola, or lantern, are two unusual forms. One is a large, curved, rectangular window with rounded corners at the level of the third floor. Since it has some resemblance to the televisions of yore, let's

Figure 5 Charles Library, Temple University, Snøhetta, 2019. Author.

call it "the screen." The other, an oval opening at the top, is indeed an oculus, but instead of opening to the sky or skylights, this apotheosis only reveals a portion of white ceiling on the fourth floor. To the right of the entrance, services are displayed on three floors and a wide staircase summons. But this ocular information is partial. The main service desk for the building sits underneath the grand staircase, peeking out from either side of it. The dark gray railings for the stairs and balconies are opaque and above waist height, limiting our vision of the upper floors to their varied ceiling treatments and the bobbing heads and shoulders of people in transit.[31] The screen, which is a floor-to-ceiling window, also reveals people. From the entrance, the presence of someone in the screen, real or imagined, empathically suggests the dramatic view from this vantage point. The mysteries of the screen may be as physically compelling as the urge to climb Book Mountain. Anyone taking the challenge would be rewarded by discovering the third-floor Scholar's Studio, with its makerspaces, tech tools, and good views. The memory of the glass penthouse, glimpsed from the exterior, or of the blank ceiling above the oculus, may draw the curious to the fourth floor and its rewarding mix of atmospheres. The

oculus punctures this floor plate in an open oval surrounded by a shoulder-high wooden wall. One does not need to wait long near this odd form to find someone standing on tiptoes to look down to the main entrance of the building. Traffic beckons traffic. The sightlines that pull people through this library by revealing and obscuring, are not without precedent. The strategy has some similarities to the 2012 University of Helsinki's Central Campus Library, designed by Anttinen Oiva Architects. Both designs employ atria and other creative openings to reveal and conceal.

The curiosity-evoking principal of "Uncertainty" integrates surprise and doubt and relates to the formation of predictions. Perhaps considering the dispersal of books in a library has become one of these areas of uncertainty. In some new libraries, all books are hidden and in others, such as Book Mountain or MVRDV's more extreme Tianjin Binhai Library (2019), they are front-and-center, some say to the level of fetish.[32] In Snøhetta's earlier Hunt Library, which serves a North Carolina State University satellite campus focused on technology programs, browsable books are only found in a small display of leisure titles

in the largest reading room. The high-density vault holds all other books. But Temple's library users include book-bound disciplines in the arts and humanities. While a robotic book vault was also required in this tight Philadelphia campus, a new visitor might have difficulty predicting Temple's approach to books. The first two floors resemble the Hunt arrangement of leisure books and windows for watching the bookbot's movements. But with effort, another approach to books is discovered on the fourth floor.

Under "Complexity" the Dutch gamers discuss difficulty and ambiguity. Examples might be the use of curves and the qualities of glass. Understanding the geometry of the building's ubiquitous multi-radius curves requires a computer. They approach the somehow-sensible randomness of animal or plant anatomy. The curved slats of cedar are compelling not only because of their design but also as craft in execution. Of course glass is used to reveal lots of those ocular freedoms that coax someone through the building, but glass also reflects and sometimes distorts. A pedestrian on Thirteenth Street may be intrigued by the window that reveals the Special Collections reading room but this view comes with reflections of the campus, which our selective perception normally ignores. We look right through them, but they contain latent complexity. In that curved screen on the third floor refractions become poetic and vary by time of day and other lighting conditions. The previous four principles for evoking curiosity are most readily understood as initial experiences, but complexity has greater potential to engage curiosity through repeated visits to a building. This resembles what Kjetil Thorsen discusses as "emotion":

> This individual perception and state of emotion is singular by definition and unveils the unknown. Under certain conditions you might even find that this effects your capacity to surprise yourself by finding something you did not think yourself capable of discovering. Once experienced, this sensation is addictive."[33]

CONCLUDING DISTRACTIONS

In the 1940s Jean Piaget theorized that the practical purpose of curiosity and play is to construct knowledge through interactions with the world, a theory that has been "well attested in recent developmental psychology studies."[34] But in academia, is curiosity also a distraction? Perhaps Mattern touches upon this question:

> Libraries are not, or at least should not be, engines of productivity. If anything, they should slow people down and seduce them with the unexpected, the irrelevant, the odd and the unexplainable. Productivity is a destructive way to justify the individual's value in a system that is naturally communal, not an individualistic or entrepreneurial zero-sum game to be won by the most industrious. .... I'd venture that there is room for entrepreneurial learning in the library, but there also has to be room for that alternate reality where knowledge needn't have monetary value, where learning isn't driven by a profit motive. We can

accommodate both spaces for entrepreneurship and spaces of exception, provided the institution has a strong epistemic framing that encompasses both.[35]

Curiosity then might be an important link in the library's dual mission of offering both requirements and distractions. Of course, the book stacks of the 1960s library sometimes fed curiosity, but in our current information-saturated world, that function has become less about efficient provision of the required and more about marketing options. To be sure, the visual display of goods and services in these new libraries sometimes recalls the cruder experience of some department store atriums or shopping mall promenades. And embodied perceptions share some characteristics of subliminal advertising. Enticement, even though put to a higher purpose and handled with considerable charm in the examples considered here, is recognizable as a symptom of the blend of educational and commercial interests that comprises today's university, with a coffee shop in every building and a plaque on every bench.[36] But true to the values of a library, what is being marketed are shared resources, learning opportunities, other people, and glimpses of one's potential place in the community.

ENDNOTES

1. I am grateful to helpful discussions of this topic with colleagues Ute Poerschke, Laia Celma, Joseph Julian, Donald Kunze, Jr., and Tara Murray, but publicly absolve them of any responsibility for the faulty aspects of my work. The same goes for the ACSA reviewers who commented on drafts. Thanks also to Patrick Deaton, Josh Boyer, Karen DeWitt, Sonny K. Banerjee, Joe Lucia, and other librarians who have helped with my visits to their new facilities. Penn State's support of this research is also appreciated.

2. Ray Oldenburg, *The Great Good Place: Cafes, Coffee Shops, Community Centers, Beauty Parlors, General Stores, Bars, Hangouts, and How They Get You Through the Day* (New York: Paragon House, 1989).

3. A literature review and critique of the third place approach is: Mark N. Wexler and Judy Oberlander, "The Shifting Discourse on Third Places: Ideological Implications," *Journal of Ideology* 38, no. 2 (June 2017): 1–34. A descriptive list of specific social behaviors being accommodated in recent library designs is provided by: Sam Demas, "From the Ashes of Alexandria: What's Happening in the College Library?" in *Council on Library and Information Resources. Library as Place: Rethinking Roles, Rethinking Space*, Washington DC: CLIR, 2005, 25-40.

4. Eric Klinenberg, *Palaces for the People: How Social Infrastructure Can Help Fight Inequality, Polarization, and the Decline of Civic Life*. (New York: Crown, 2018), 5.

5. Klinenberg, *Palaces*, 31-3. A clear sign that Kleinenberg's ideas are becoming part of the the discourse on library architecture was his appearance as a keynote speaker at the 2019 "Designing Libraries VIII" conference (https://designinglibraries8.library.gatech.edu).

6. Shannon Mattern, "Library as Infrastructure," *Places Journal*, (June 9, 2014), https://doi.org/10.22269/140609.

7. And both would agree that "while social infrastructure alone isn't sufficient to unite polarized societies, protect vulnerable communities, or connect alienated individuals, we can't address these challenges without it" Klinenberg, *Palaces*, 15.

8. Klinenberg, *Palaces*, 83-116, discusses schools and colleges and drew parallels to academic libraries in his keynote to the Designing Libraries VIII conference, October 7, 2019, Atlanta, Georgia. Mattern chooses examples from both public and academic libraries.

9. The official attribution of the building was to the Office of Metropolitan Architecture (OMA) with the Seattle firm LMN. Rem Koolhas is often credited with this and other OMA projects. After Joshua Prince-Ramus left OMA, he was interviewed as the lead designer for Seattle Central Library in the documentary television series: Dan Frank and Stephen Chung, "Libraries" episode of *Cool Spaces* (San Francisco: Public Broadcasting Service, 2014). Without using the term "infrastructure," Mattern discussed the social functions of libraries earlier in: Shannon Mattern, *The New Downtown Library: Designing with Communities* (Minneapolis: University of Minnesota Press, 2009).

10. "The network syntax is defined by a ringy spatial structure and a choice of pathways; it is common in places designed to maximize exchange such as markets and department stores." Kim Dovey, "One-way Street," in *Take One Building: Interdisciplinary Research Perspectives of the Seattle Central Library*, eds. Ruth Conway Dalton and Christoph Hölscher (London: Routledge, 2017) Chap. 4. Kindle ed. loc. no. 1497-781; and his discussion of shopping malls in Kim Dovey, *Framing Places: Mediating Power in Built Form*, 2nd ed. (London: Routledge, 2008), 123-38. Dovey's "One-way Street" article is an updated abridgement of his 'Urbanizing Architecture', in Dovey, *Framing Places,* 103–23.

11. Kjetil Traedal Thorsen and Sabine Drey, "Landschaft, Freiheit Und Sozialer Raum : Kjetil Thorsen Über Die Philosophie von Snøhetta = Landscape, Latitude and Social Space : Kjetil Thorsen Talks about Snøhetta's Philosophy [Interview]," *Detail* 57, no. 12 (December 1, 2017): 23.

12. On Le Corbusier's approach to guiding someone through a building see for example: Flora Samuel, *Le Corbusier and the Architectural Promenade* (Basel: Birkhäuser, 2010).

13. Dovey, "One-Way," loc. no. 1529 & 1667; and Ruth Conroy Dalton, "OMA's Conception of the Users of Seattle Central Library," in *Take One Building*, Chap. 3, loc no. 1425-529; and Amy Shelton, Steven Marchette, Christoph Hölscher, Ben Nelligan, Thomas Shipley, and Laura Carlson, "Why People Get Lost in the Seattle Central Library," *Take One Building*, Chap. 9, loc. no. 3970-4187.

14. Ruth Conway Dalton and Christoph Hölscher (eds.) *Take One Building: Interdisciplinary Research Perspectives of the Seattle Central Library*, eds. (London: Routledge, 2017). This collection of essays intended to "illustrate a range of different methods available to researchers of the built environment through their application to the same building."

15. Sarah Williams Goldhagen, *Welcome to Your World: How the Built Environment Shapes Our Lives*, (New York: HarperCollins, 2017); Mark L. Johnson, "Body, Mind and Imagination", in Sarah Robinson and Juhani Pallasmaa, (eds.) *Mind in Architecture: Neuroscience, Embodiment, and the Future of Design* (Cambridge: MIT Press, 2015), 33–50. These are chosen as representative of a rapidly growing body of literature. While embodied cognition offers valuable new insights, its debts to phenomenological theories and several decades of research in environmental psychology are too often unstated.

16. Sophie von Stumm, Benedikt Hell, and Tomas Chamorro-Premuzic, "The Hungry Mind: Intellectual Curiosity Is the Third Pillar of Academic Performance," *Perspectives on Psychological Science* 6, no. 6 (2011): 582.

17. George Loewenstein, G. (1994). "The Psychology of Curiosity: a Review and Reinterpretation," *Psychological Bulletin* 116 (1994): 75–98. A useful literature review that places Loewenstein's approach in the context of more recent research is: Celeste Kidd and Benjamin Y. Hayden, "The Psychology and Neuroscience of Curiosity," *Neuron* 88, no. 3 (November 4, 2015): 449–60, https://doi.org/10.1016/j.neuron.2015.09.010

18. Rob Tieben, Tilde Bekker, and Ben Schouten, "Curiosity and Interaction: Making People Curious Through Interactive Systems," in *Proceedings of the 25th BCS Conference on Human-Computer Interaction, BCS-HCI '11* (Swinton, UK: British Computer Society, 2011), 361–70.

19. Although Goldhagen, *Welcome*, provides a useful and thought-provoking overview of the relationship between embodied cognition and buildings, she fails to acknowledge the importance of the individual person as a variable rather than a constant. This omission might lead some of her readers to the conclusion that the conditions she describes are universals rather than potentials.

20. I am grateful to Josh Boyer, North Carolina State University Libraries, for his observations about public responses to the bookbot window.

21. Quoted in a pamphlet distributed at the building's opening ceremony: *Shaping the Future Here and Beyond* (Philadelphia: Temple University, 2019).

22. A forthcoming collection of essays focuses on the building: Kate Wingert-Playdon, ed., *Library as Stoa: Public Space and Academic Mission in Snøhetta's Charles Library* (Novato, California: ORO Editions, 2019).

23. Harold Shill and Shawn Tonner, "Does the Building Still Matter? Usage Patterns in New, Expanded, and Renovated Libraries, 1995–2002," *College and Research Libraries* 65, no. 2 (2004): 123–151, is an important study of increases in library use resulting from new facilities and a similar update would be useful.

24. I paraphrase the classic definition from: James J. Gibson, *An Ecological Approach to Visual Perception*, rev. ed., (Boston : Houghton Mifflin, 1979), 119-35; alternative definitions are discussed in: Anthony Chemero, "An Outline of a Theory of Affordances," *Ecological Psychology* 15 no. 2 (April, 2003): 181-95.

25. *Conditions: Snøhetta: Architecture, Interior, Landscape* (Baden: Lars Müller Publishers, 2007), 69.

26. An introduction to schemas and their role is provided by Goldhagen, *Welcome*, 50, and 72-9.

27. A psychologically-oriented discussion of the history of domes is: Harry Francis Mallgrave, *The Architect's Brain : Neuroscience, Creativity, and Architecture*, (Chichester, U.K.: Wiley-Blackwell, 2010), 91-7. The Charles Library dome may present other perceptual puzzles. How, for example, does the structure of the main atrium work? Are we looking at structural pendentives or are the giant akimbo columns holding things up?

28. Goldhagen, *Welcome*, 55-6.

29. Goldhagen, *Welcome*, 58, bases her observation on: Joshua M. Ackerman, Christopher C. Nocera, and John A. Bargh, "Incidental Haptic Sensations Influence Social Judgments and Decisions," *Science*, New Series, 328, no. 5986 (2010): 1712-15.

30. "People respond to curving surfaces with 'approach' behavior and in general tend to prefer them." Goldhagen, *Welcome*, 46; Oshin Vartanian et al., "Impact of Contour on Aesthetic Judgments and Approach-Avoidance Decisions in Architecture," *Proceedings of the National Academy of Sciences of the United States of America* 110, Suppl 2 (June 18, 2013), 10446–53, https://doi.org/10.1073/pnas.1301227110; and Ori Amir, Irving Biederman, and Kenneth J. Hayworth, "The Neural Basis for Shape Preferences," *Vision Research* 51, no. 20 (October 15, 2011): 2198–206, https://doi.org/10.1016/j.visres.2011.08.015.

31. The second floor contains just-out-of-sight classrooms, so groups of heads moving along those visible paths when classes change will probably aid wayfinding more effectively than signs. The importance of seeing other people in a space, for orientation and general understanding of a space is discussed in: Jan Gehl, *Cities for People*, (Washington, DC: Island Press, 2010)

32. Mattern, "Library as Infrastructure."

33. *Conditions*, 97.

34. Kidd, "The Psychology and Neuroscience of Curiosity": 455-6

35. Mattern, "Library as Infrastructure."; In a similar vein, Klinenberg notes that efficiency can be at odds with social infrastructure: Klinenberg, *Palaces*, 85.

36. A history of American higher education's struggle to find its way in the marketplace is: David F. Labaree, *A Perfect Mess: The Unlikely Ascendancy of American Higher Education* (Chicago: University of Chicago Press, 2017).