Library Plus
Towards the Self-Curation of Healthcare

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners.

I understand that my thesis may be made electronically available to the public.

ABSTRACT

Our heavily populated world is facing exponentially increasing healthcare demands that challenge existing healthcare infrastructure. Struggling to respond to the rapidly changing spatial needs of healthcare, the architecture of healthcare facilities undergo frequent cycles of building renovation, reconfiguration and expansion. The relevant financial stress and resource expenditure has impelled both publicly and privately funded healthcare institutions to seek the most effective and cost effective ways to deliver quality healthcare results. However, these current resolutions, such as facility focus on outpatient services and decentralization of clinical functions, imply a certain shortsighted view that architecture's only role in healthcare is the facilitation of medical procedures.

Whether on the individual or collective level, healthcare is a continuous and comprehensive event that extends far beyond medical procedures that are predominantly reactive in nature. Such is architecture that is capable of contributing to successful healthcare results, by providing a variety of other spatial functions and conditions. With the noticeably growing value of preventative healthcare and interest in the self-curation of healthcare, this thesis intends to redefine the traditional role of architecture in healthcare, by exploring the possibility that healthcare and the public libraries can be effectively integrated through architecture. By spatially conditioning the combined access and experience of diagnosis, consultation, awareness education and anticipatory data collection, architecture can become the means to maximize the potential of preventative healthcare, and proactively improve the overall health of a population.

Using Brooklyn Public Libraries' Pacific Branch as an opportunity of investigation, this thesis first examines the needs and trends of both healthcare and the public libraries, to align their mutual interests as institutions and as building types. An unconventional program and a list of qualitative criteria are then created as the basis of a design proposal, which attempts to resolve these two apparently incompatible functions. Finally, a theoretical analysis of the proposed library renovation with added healthcare components suggests this hybrid architecture as an appropriate strategy to begin resolving current and future healthcare challenges.

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Introduction

Sustaining health is a basic concern for every individual, upon which depends all of life's greatest enjoyments, accomplishments and aspirations. The possibility and freedom to realize one's potential always begins with a state of wellbeing capable of carrying out one's pursuits. It has thus always been our individual and collective endeavor to maintain optimal health. As the World Health Organization (WHO) Constitution defined, the highest attainable standard of health is a fundamental right of every human being[1]. This "right to health" obliges the government to provide to people adequate and best available health and social measures, including dissemination of medical and psychological knowledge that are essential to the fullest attainment of health.

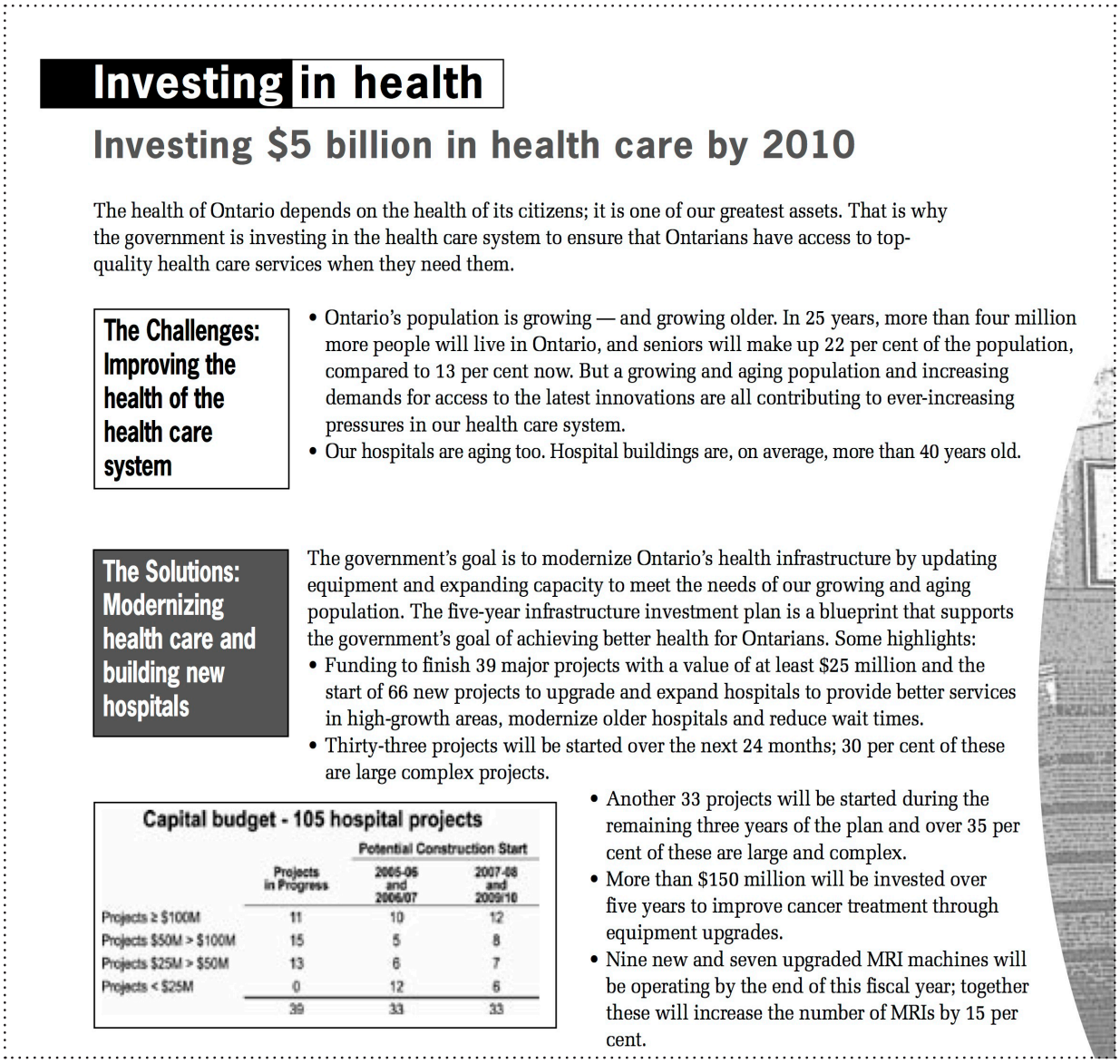
The inclusion of healthcare knowledge as part of the right to health is a clear indication of its importance to the wellbeing of people. In a world running on a knowledge economy, not only does healthcare knowledge drive medical decisions, healthcare goals and lifestyle choices at various scales, it essentially constitutes people's understanding and definition of health and healthcare. No longer plainly distinguishable by either the presence or the absence of illness, the very concept of health is manifested through a comparative scale that has virtually no upper or lower limit. For the individual, it is only by being sufficiently informed that he can more accurately identify his current health status before taking appropriate actions for improvement. Likewise for a population, it is only by increasing the overall level of health literacy that healthcare system can most effectively implement services for the maximum benefit of its people. Access to information therefore becomes recognizably integral to the eventual health outcomes, in perfecting healthcare practices, in transforming healthcare architecture and most importantly, in empowering

individual healthcare recipients.

However, healthcare literacy is thus far only beginning to produce positive outcomes on a large scale. Our general understanding of health as shaped by the conditions of our surrounding, focuses on the built environment in which we live our daily life and in which we receive healthcare. As a society we invest considerably in establishing a system that delivers healthcare services, and in constructing the physical infrastructure that facilitate these services, trusting that they will fulfill all of our healthcare needs (Figure 1). This made healthcare facilities and their architecture, the methodology through which standards of healthcare can be and should be implemented. Echoing this circumstance, the General Comment by UN Committee on Economic, Social and Cultural Rights has defined four basic elements for the Right to Health - availability, accessibility, acceptability and quality, all of which identify healthcare facilities as a primary focus. Therefore compared to healthcare architecture that is often central to the discussion of health and healthcare, an individual's healthcare literacy is a lesser concern[2].

Regardless of their current prominence to the subject of healthcare, both healthcare architecture and healthcare literacy are mutually beneficial agencies that contribute to health outcomes. When acting separately however, either one quickly reaches a certain limit in meeting healthcare demands. For healthcare literacy, as much as it encourages healthy behaviors and lifestyle, and assists in making informed medical decisions, it can never ultimately guarantee health. In the event of inevitable illness, people will always be physically reliant on medical procedures and the architecture of their facility. For healthcare architecture, as much as it provides necessary and ideal clinical space, its capacity do to so is often and largely challenged by the rapidly changing healthcare demands[3]. Whenever demands change, architecture must quickly adapt lest it becomes inadequate.

It is therefore apparent that these two contributors of health should be closely integrated for greater positive impact – a hybrid architecture that engages healthcare literacy and



Investing in health

Investing $5 billion in health care by 2010

The health of Ontario depends on the health of its citizens; it is one of our greatest assets. That is why the government is investing in the health care system to ensure that Ontarians have access to top-quality health care services when they need them.

The Challenges: Improving the health of the health care system

- Ontario's population is growing — and growing older. In 25 years, more than four million more people will live in Ontario, and seniors will make up 22 per cent of the population, compared to 13 per cent now. But a growing and aging population and increasing demands for access to the latest innovations are all contributing to ever-increasing pressures in our health care system.
- Our hospitals are aging too. Hospital buildings are, on average, more than 40 years old.

The Solutions: Modernizing health care and building new hospitals

The government's goal is to modernize Ontario's health infrastructure by updating equipment and expanding capacity to meet the needs of our growing and aging population. The five-year infrastructure investment plan is a blueprint that supports the government's goal of achieving better health for Ontarians. Some highlights:

- Funding to finish 39 major projects with a value of at least $25 million and the start of 66 new projects to upgrade and expand hospitals to provide better services in high-growth areas, modernize older hospitals and reduce wait times.
- Thirty-three projects will be started over the next 24 months; 30 per cent of these are large complex projects.

Capital budget - 105 hospital projects

	Projects in Progress	Potential Construction Start 2005-06 and 2006/07	2007-08 and 2009/10
Projects ≥ $100M	11	10	12
Projects $50M > $100M	15	5	8
Projects $25M > $50M	13	6	7
Projects < $25M	0	12	6
	39	33	33

- Another 33 projects will be started during the remaining three years of the plan and over 35 per cent of these are large and complex.
- More than $150 million will be invested over five years to improve cancer treatment through equipment upgrades.
- Nine new and seven upgraded MRI machines will be operating by the end of this fiscal year; together these will increase the number of MRIs by 15 per cent.

Figure 1: Page 7 of ReNew Ontario 2005-2010 Strategic Highlights, showing a typical political "solution" to improve health and healthcare. *Source*: Government of Ontario

practice with respect to one another. For healthcare literacy, this hybridization would provide a valuable source of medical information acquired through practice, and would more effectively disseminate such information in practical application. Consequently for healthcare architecture, a heightened health literacy level would lead to more moderate and predictable volume of demand, and more efficient medical procedure with active patient involvement[4], both of which could greatly reduce current and future spatial burden on healthcare architecture.

As suggested by the concurrence of healthcare's spatial challenge and its need to accommodate the added function of healthcare literacy, the opportunity for the proposed hybridization should be sought outside existing healthcare facilities. Based on the intended accessibility and scope of influence, one architectural type emerged as suitable candidate – the public library. Already a social institution responsible for the deposit, maintenance and dissemination of a society's shared general knowledge, public libraries possess not only the informatics resources to support healthcare literacy, but also the operational structure and readily available, networked building facilities to universally deliver healthcare and its literacy services[5].

With the ultimate goal of improving health for a population, this thesis in three chapters will propose and evaluate the architectural integration of healthcare services and the public libraries as an intervention to some of today's healthcare challenges. Starting from the perspective of healthcare, Chapter one will declare the basic motives of such integration and its pragmatic necessity and benefits to both healthcare providers and individual care recipients. Chapter two will identify the public libraries as the ideal opportunity of integration, and analyze the libraries' reciprocal incentives. Chapter three will specify the functional requirements and architectural features of the integration. The conclusion will summarize the design proposal and hypothesize its short-term and long-term impact.

Endnotes

1. Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946; signed on 22 July 1946 by the representatives of 61 States (Official Records of the World Health Organization, no. 2, p. 100) and entered into force on 7 April 1948.

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Chapter 1
Motive: Self-curated Preventative Care

1.1 Healthcare Architecture

Architecture by nature bears the responsibility to spatially provide for the purpose of its audience. Its form and function that effectively address its purpose, is what constitute its architectural characters and value. For healthcare facilities whose principle purpose is to accommodate healthcare activities, its architectural value is recognized through the successful facilitation of those activities in achieving quantifiable and qualitatively evident health outcomes. It is exactly this utilitarian trait that set healthcare architecture as one of the most essential types of our built environment, worthy of continuous investment, research and innovation.

As the world is more than ever populated with people of intensified healthcare needs, the increased volume of demand greatly burdens healthcare infrastructure, causing existing facilities to become inadequate to spatially support the activities of their patrons[1]. Compared to other building types, even healthcare buildings that are designed with adaptability to future changes undergo frequent renovations and expansions due to functional needs[2]. For architecture that should be well built to serve future decades, many healthcare buildings often seem a few steps behind, thus criticized for compromising the quality of service and impairing healthcare results.

Without doubting the professional competence of architects, the challenges of current healthcare and its architecture are perhaps attributable to the conservative view that the sole role of architecture to healthcare is its spatial facilitation of medical procedures[3]. This view not only impairs architecture's potential to contribute to healthy outcomes by alternative design interventions, it also implies a narrow-minded

assumption that medical procedures equal healthcare. Affected by this view, the natural course of action responding to the increasing and changing healthcare demands becomes the continuous renewal of existing healthcare facilities[4], accompanied by short service life period of each renewal[5]. (Figure 2-3)

Whether in publicly or privately funded systems, the investment on building facilities and associated operational cost has always constituted a critical portion of healthcare expenditure. Frequent facility renewal that is universally exhaustive of resources motivates stakeholder institutions to employ more effective methods in delivering sufficient healthcare. Indicated by the growing emphasis on outpatient services, outsourcing and decentralizing clinical functions, the currently favored approaches seem to focus exclusively on the cost-effectiveness of healthcare's clinical operation, rather than on the effective achievement of healthy results per se. As such, healthcare architecture is bound to an incomplete scope that is preoccupied with medical procedures and remedies. When these fundamentally reactive healthcare practices[6] become inadequate to meet changing demands, the architecture of healthcare becomes involuntarily incapacitated.

With rapid advancement in medical sciences that constantly redefine health and healthcare, current practices often become inadequate. From overcrowded emergency rooms and hospital corridors to lengthy wait times at physician's office, we preoccupy ourselves with resolving these existing issues of healthcare delivery, assuming that by improving the process of treatment, a higher level of health can be obtained[7]. This remedial mentality towards healthcare is perhaps grounded in Western medicine that conventionally regards health as the absence of disease. Although this belief has expanded since the 1940's, when WHO defined health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity", it is still the underlying principle of many healthcare systems worldwide that operate based on a "medical model". Within this model, healthcare practices endeavor to identify and cure determinants of sickness, thus placing heavy demand on the process of cure

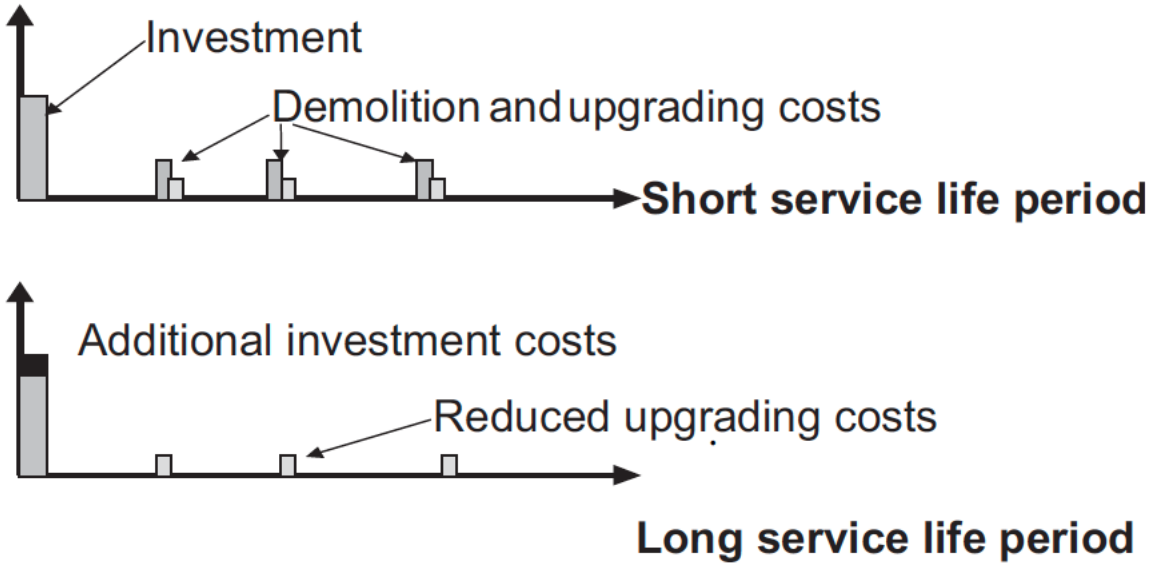


Figure 2: Short and long service life period. *Source: Bjørberg S., Multiconsult, personal communication, 2007.* Note: Service life period is the period of time with no change/refurbishment in the building.

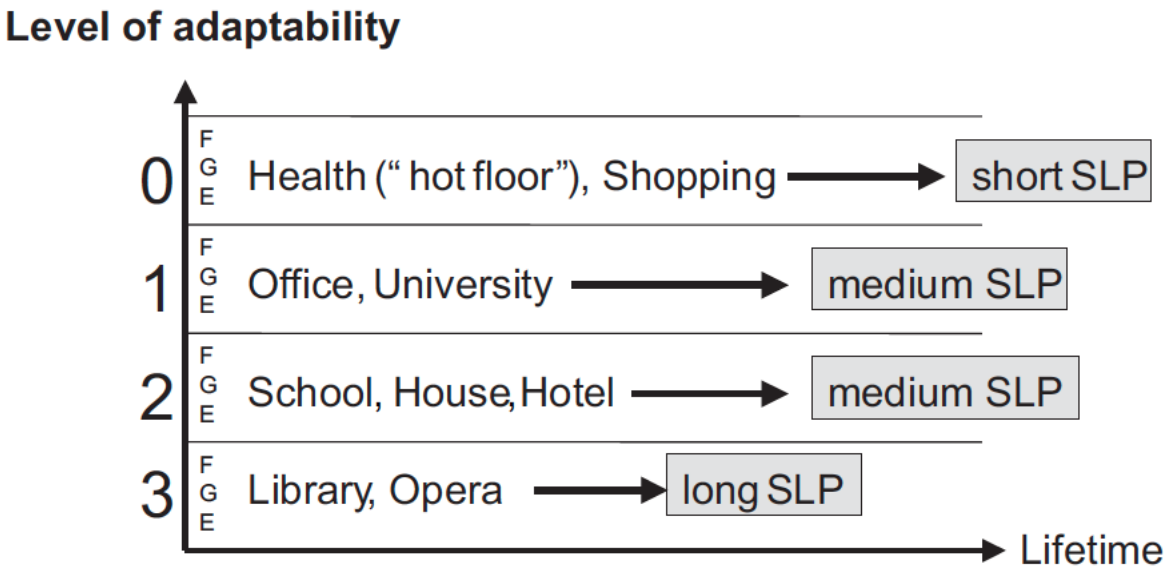


Figure 3: Examples of adaptability requirements between building types. *Source: Bjørberg S., Multiconsult, personal communication, 2007.* Note: F: flexibility; G: generality; E: elasticity; SLP: service life period.

and the architecture of its facility. Hence we build more and better facilities, and continuously update them to be sufficient for the process of cure.

However, frequent facility renewal that is typical of healthcare type buildings is hardly a sustainable way to meet healthcare demands for the following reasons. First of all, decision makers of health sector are often faced with a high level of uncertainty regarding capital investment. There is little evidence that can inform them on the best way to configure hospital services or change the way hospitals operate[8]. Secondly, the lengthy cycle of design and construction (of healthcare facilities) is often overtaken by the rapid cycle of innovation in medicine and technology[9]. In the publication *Designing Hospitals of the Future,* architect Richard Sprow has described some generally expected frequency of a hospitals facility renewal: inpatient additions at 10 years apart, ambulatory care additions at an increased rate of 5 years apart, diagnostic functions at a even faster incremental change rate to match the rate of new and improved technology[10]. As Julie Sless, Vice president of Herman Miller Canada said while referring to the six-years-long development of Bluewater Health in Sarnia Ontario, "It's virtually impossible for a design that is one snapshot in time to support an ever-changing environment like healthcare"[11].

With such design obsolescence, in many cases of healthcare construction projects large or small, in North America or Europe, renovations could begin almost as soon as the facility is built, simply due to the changed demand during the time of planning and construction[12]. Whatever made this unsustainable building renewal an acceptable solution in practice, it has certainly overlooked architecture's potential to more actively alleviate the burden on healthcare. Rather than passively reacting to intensified spatial demands for medical procedures, architecture can work more directly to reduce healthcare demands.

Healthcare architecture deserves to realign its functional purpose towards achieving healthy outcomes, instead of merely complying with one specific healthcare approach. The way to do so begins with spatially supporting preventative

healthcare and self-curated healthcare, both of which encourage proactive wellbeing rather than retroactive recovery. With these alternative healthcare approaches that are gaining increasing prominence among general care recipients, healthcare architecture may finally begin to reestablish itself from buildings that institutionalize medical processes, to ideal environments that generate, facilitate and maintain health.

1.2 Preventive Healthcare

Preventative healthcare has steadily gained attention as a practice that is inherently oriented towards the future. That is, to obviate potential problems and risks in advance. After all, no one prefers the experience of recovering from illness if illness can be reasonably avoided in the first place. Often from the economic point of view of those responsible for medical expenses[13], or from one's natural instinct to sustain wellbeing, preventative approaches to healthcare appear as a compelling alternative to conventional medicine. For the same reason that individuals and families promote personal health through prevention, health professionals and government do so for communities and population at large, confirming the pertinence of preventative healthcare to public health. According to Winslow's definition in 1920, public health is "the science and art of preventing disease, prolonging life and promoting health through organized efforts and informed choices of society, organizations, public and private, communities and individuals."

Regardless of a healthcare system being owned and operated by private or public sector, or even both, it is always the social and political responsibility of a government to implement the best attainable public health measures in the interest of its people. Facing economic constraints and scarcity of other resources such as facility space and medical professionals in ideally accessible locations, the government needs to sufficiently increase the effectiveness of its policies and measures in order to reduce expense. Private healthcare corporations, incentivized by maximum profit at minimum cost, also hold the same cost-saving interest. Although health

economists and researchers such as Louise B. Russell and Joshua T. Cohen have long disputed the general economy of preventative care, all seem to agree that certain preventative means can cause higher overall spending while others are proven to be cost-effective[14]. The difference in cost-benefit ratio between means that save more versus ones that cost more is often a result of their effective application to certain types and sizes of population. For example, screening of a disease would be considered a worthwhile investment if applied to a large population suffering high risk of such disease; meanwhile the same screening would be much less cost-effective for another population group who is at substantially lower risk of the disease. As research studies have found in some cases where existing treatments are just as resource-effective as their preventative counterpart, it is no surprise that said researchers have consistently cautioned against the presumption that preventative practices are definitively the better alternative[15]. However, since there are preventative interventions recognized to be valuable for both clinical effectiveness and cost-effectiveness, such as use of aspirin to prevent heart disease, childhood immunization, and certain type of cancer screening to high-risk groups, the cost-benefit case should always be made for the appropriate implementation of preventative interventions, rather than the premature speculation of them as either the dominant or subordinate practice in the future of healthcare.

Preventative interventions can be difficult to implement due to the myriad of potentially suitable options on the individual or collective basis. Defined by Hugh R. Leavell and E. Gurney Clark, they can be generalized into three levels[16]. Perhaps most closely reflecting the literal meaning of "prevention", primary level prevention focuses on disease avoidance at a pre-pathological state. Secondary level prevention aims for disease treatment at its pre-symptomatic state via early diagnosis and intervention. Tertiary level prevention attempts to optimize post-symptomatic rehabilitation. Within each level, there is a vast variety of treatments and modalities spanning from conventional medical practices to Complementary and Alternative medicine (CAM), although most commonly known to the general public are immunization, screening,

and awareness education that induces positive change in behaviors and lifestyle.

While the availability of preventative health may depend on public health policies, healthcare organizations and practitioners, its usage prevalence is largely influenced by determinants such as service accessibility, universality, cost, health awareness and socioeconomic status of the care recipient. For instance, as chronic disease, infectious disease and injuries are inversely correlated with socioeconomic status[17], a population of lower income and education is often unable to take advantage of preventative practices due to out-of-pocket cost as well as limited understanding of the conditions that best suit their interest. Even for those with health insurance coverage who can afford various preventative interventions at their own expense, an adequate understanding of the nature and effect of those interventions are still required to make informed decisions. Therefore, in order to realize the full potential of preventative healthcare, or to improve upon current measures, care recipients must first possess sufficient awareness and knowledge of their options, and then have reasonable access to these options both physically and financially.

Without the extensive knowledge of medical professionals, it is obviously challenging for the average care recipients to identify the type and frequency of preventative services that would best contribute to their desired health outcome. Based on the massive quantity of available medical information and interventions, it is sometimes difficult for even experienced physicians to make the most "appropriate" recommendation. In these cases, better-informed patients will not only more effectively participate in the doctor-patient consultation within the average 12-minute doctor visit, but also be more capable of taking ownership for their health in the long run[18]. As such, there has been a progressively intensifying demand of medical knowledge amongst healthcare recipients who seek more proactive engagement in the event of their own healthcare[19], consequently pointing to the inevitable emergence of "expert patients"[20].

The surging demand for medical information has not gone unnoticed by the healthcare market. Healthcare corporations, IT giants and pharmaceutical companies have all offered their respective innovations in response to this demand. The following case studies examine three of the leading innovations germane to healthcare informatics services. They are although not exclusive to the practice of preventative healthcare, would nonetheless transform its current nature and practical application.

1.3 Case Studies

1.3.1 WebMD

Originally founded in 1996, WebMD is renowned for its web-based health information platform that provides health news, advice, medical statistics and a research engine. Its user niche includes anyone with an access device and connection to the Internet who is interested in rapidly and conveniently retrieving relatively reliable healthcare information. (Figure 4-6) In an age of information technology where the means to knowledge grew reliant on networked resources and communication, for example the Internet, WebMD can considerably impact the conventional processes of healthcare access and delivery. In February 2014, the WebMD Company has announced its record of 156 million unique visitors per month and 3.17 billion page views per quarter. Deducting from this, the same healthcare recipients who would have otherwise directly consulted their primary care physicians



Figure 4: WebMD smartphone interface. Symptom Checker, 2015



Figure 5: WebMD computer web interface, 2015



Figure 6: WebMD Symptom Checker, 2015

are likely to now turn to the guidance of online informatics for their health concerns, either prior to, after, or completely instead of conventional doctor-patient interaction.

The publicly accessible information that WebMD offers at free cost to its site visitors not only encourages recipients' self-curation of healthcare events, but also acts as an extended form of primary and secondary level of preventative service. Working with certified healthcare and editorial professionals with verified credentials, WebMD has presented itself as a highly reliable source of medical information. Though financed by advertisement and third-party contributions, which may bias its information in favor of its sponsors, WebMD has been and will continue to influence the becoming of countless "expert patients", redefining the future doctor-patient relationship.

1.3.2 IBM Doctor Watson

As a global technology giant, IBM has been investing in the development of a cognitive technology that in principle

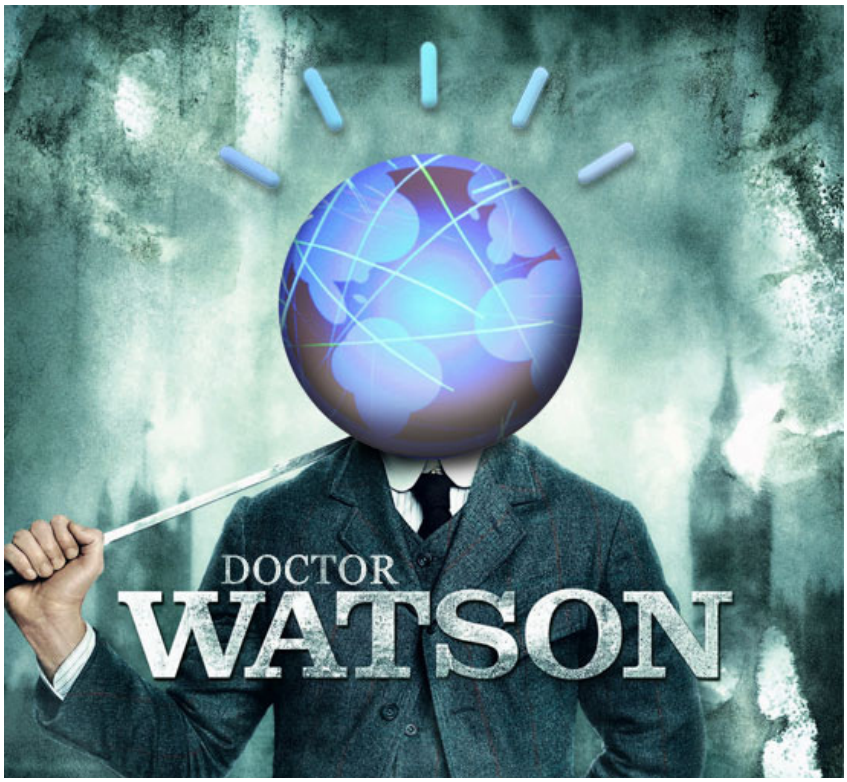


Figure 7: Doctor Watson, digital artwork. *Source*: Phil'sStockWorld

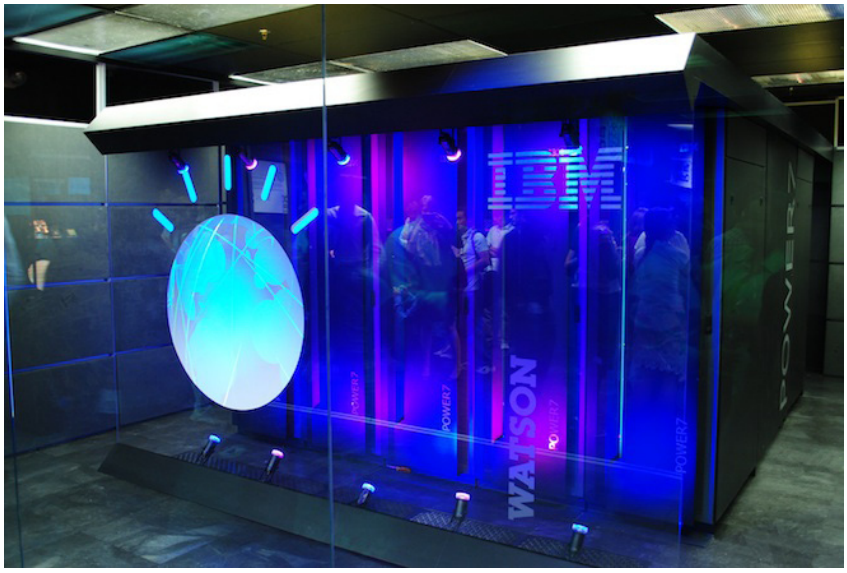


Figure 8: IBM's Watson computer, Yorktown Heights, NY. *Source*: Clockready, Wikipedia.

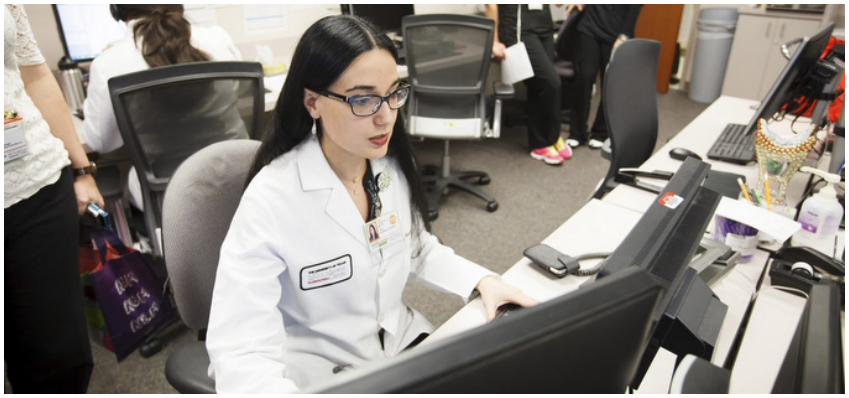


Figure 9: Dr. Tina Cascone demonstrates the Oncology Expert Advisor System powered by IBM Watson at the Thoracic Center at MD Anderson Hospital in Houston. *Source*: Michael Stravato, Washington Post.

mimics the perceptive capacity of the human brain- Watson (Figure 8). As an artificially intelligent supercomputer system, it is designed to understand the natural language, to generate hypotheses based on applicable data, to make decisions and to learn from the consequences of its past decisions. When defeating Ken Jennings in a game of Jeopardy in 2011, Watson first showed its unparalleled ability to store, analyze and effectively use massive quantity of data in real-time problem-solving scenarios. Soon after its initial success, IBM recognized its immense potential and value to the field of healthcare, and proceeded to develop it as a tool for future clinical decision-making, hence the creation of Dr. Watson[21].

With its ability to quickly parse through and accurately extract relevant information from a quantity of data beyond the reach of human doctors, Dr. Watson signifies to some the possibility of a technology eventually performing medical diagnosis and consultation independent of human healthcare professionals[22]. In addition to its computational capabilities, Dr. Watson represents drastic change in the form of healthcare that can be ever more universally delivered (Figure 9). Via the use of ICT interfaces, certain aspects of the physicality of healthcare move to cyber space. On the one hand, the extent of healthcare digitization by Dr. Watson far eclipses previous endeavors such as electronic patient record and monitoring where the digitization primarily assists administrative and organizational functions. On the other hand, the once exclusivity of medical knowledge begins to disintegrate in the same way that prevalent Internet usages led to exponential increase of open resources. In principle, Dr. Watson is a portal that supposedly collapses time and distance restraints of healthcare access, connecting virtually any patient to any relevant medical resource. Once the infrastructure hardware is set up, the operational cost per diagnosis for Dr. Watson can be as marginal as an iPhone user asking Siri for answers. The consultation process itself is as self-curated as it can be without the patients becoming doctors themselves.

However in real practice, there are many uncompromising conditions that must be met in order for Dr. Watson to begin fulfilling its intended functions, let alone replacing human healthcare professionals any time soon. Regardless of how much medical data Dr. Watson has to perform a diagnosis, it must always first accept a series of input conditions from the patient, including personal medical history, symptoms, description of relevant events etc. These input criteria not only heavily depend on pre-analytic processing, hardware diagnostic equipment and clinical tests results, the proper translation of these test results to Dr. Watson is crucial to the validity of its output diagnosis.

The limitation of Dr. Watson becomes immediately apparent: the availability and the accuracy of “preliminary diagnosis” that defines the ground of computer-automated diagnosis.

The former requires access to diagnostic hardware facilities such as laboratories and imaging centers, meaning that the spatial and infrastructure pre-requisite to maximize the advantage of Dr. Watson is the pervasiveness of these supporting clinical facilities, which should be universally and conveniently assessable to all care recipients. Ideally, the more co-located and integrated these supporting facilities are with Dr. Watson, the more efficient and economical the entire clinical process will function as a system. The latter relies on the expert interpretation of physicians[23], medical specialist, clinical technicians and at the very least, expert patients who are both willing and capable of being liable for the outcome. It is only when all of these underlying conditions are meet that Dr. Watson's can begin impacting the future of healthcare towards prevention and self-curation.

1.3.3 Theranos

Theranos is a California-based health-tech company currently in the process of reinventing traditional medical laboratory service with its innovation in microfluidics technology. While little has been published about the technology itself to protect the company's intellectual property, its acclaimed principle characters include the replacement of venipuncture with finger-stick retrieval of micro blood sample for lab testing, the ability to perform more than two hundred types of lab test using the same micro sample (Figure 11-12), the secured wireless transmission of test results to doctors and patients,

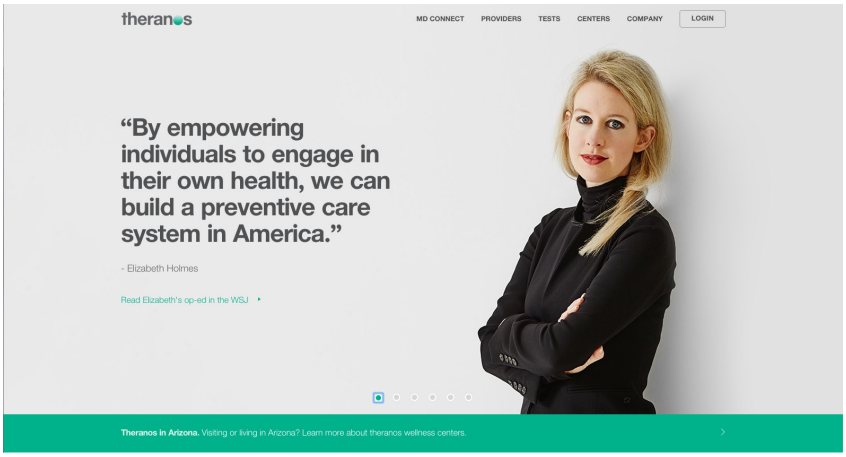


Figure 10: Theranos website featuring founder Elizabeth Holmes

and achieving all of the above at substantially reduced cost and time compared to conventional laboratory procedure.

Beginning the integration of its facilities with Walgreen's, a large-chain pharmacy retailer, Theranos extended its services closer and closer to communities and neighborhoods. Its increasing locational proximity to healthcare recipients further complements the user-friendliness and economy of its technology, making it conveniently accessible to the general public both physically and financially. It has been speculated that these factors combined, will contribute to the widespread dissemination of actionable healthcare

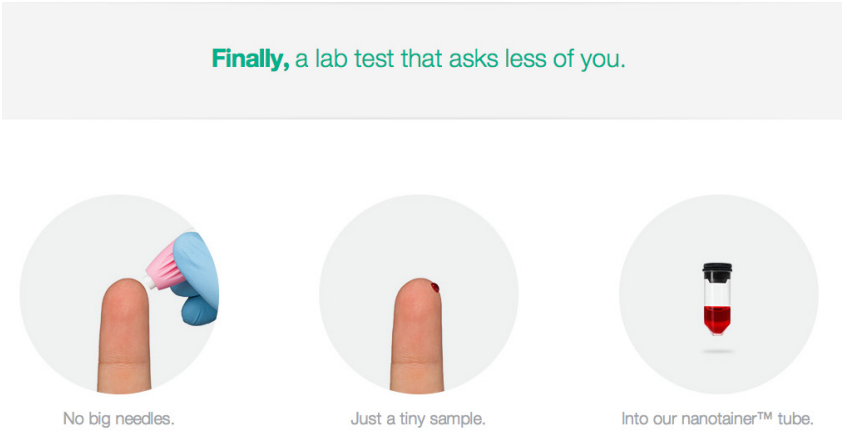


Figure 11: Theranos blood sample collection illustrated steps. *Source*: Theanos Company website

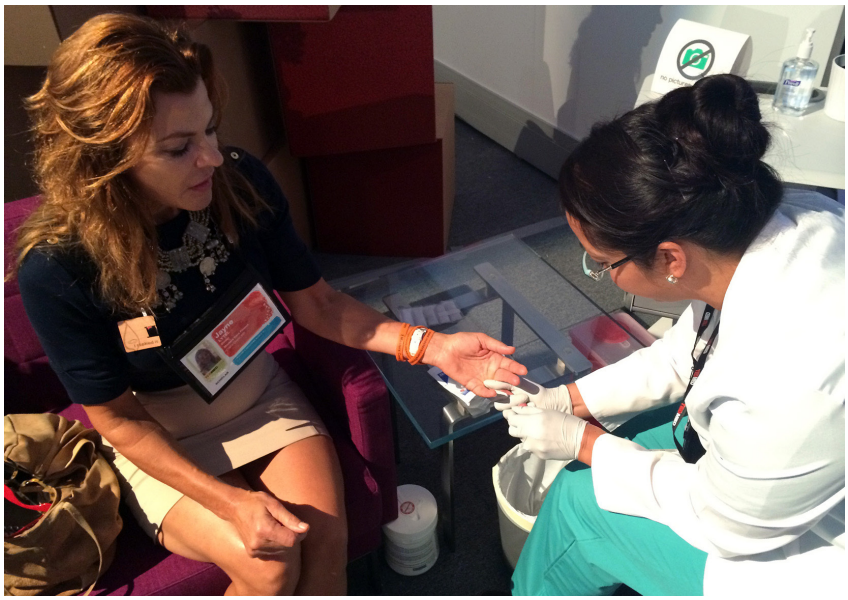


Figure 12: Theranos blood sample collection by a phlebotomist. *Source*: Powers, Jayne. Masters Core Fitness.



Figure 13: Theranos service counter at local Walgreen's. *Source*: Kevin Loria, Business Insider

information to the average individuals, and hence effectively promote preventative healthcare practices.

As a disruptive technological innovation, Theranos has at least two foreseeable urban-spatial consequences: the obsolescence of existing laboratory facilities that operate based on traditional phlebotomy, and the emergence of hybrid medical facilities that is the co-location and/or fusion of Theranos laboratory with other types of healthcare services of pervasive physical access locations. In order to maximize its potential to the healthcare industry and to care recipients, the operation of this technology will continue to seek partnership with private or public institutions. By permeating such networks, Theranos could become the ubiquitous

healthcare supporting facility, an integral component of the large healthcare infrastructure that provides data to drive an estimated 80% of clinical decisions (based on current usage of the same data)[24]. While any provider of healthcare services can equally benefit from Theranos' technology, it would make the biggest difference to automated diagnostic services such as WebMD and Dr. Watson. With easily obtainable laboratory test results from Theranos, previous usage limitations of WebMD and Dr. Watson are diminished, allowing greater freedom and confidence in the self-curation of healthcare by expert patients.

While these case studies present different aspects of healthcare development, they mutually imply a general movement towards the self-curation of healthcare in both preventive medicine as well as conventional medicine, that the individual's growing interest in understanding and in taking charge of one's own health, will define the procedure and structure of future healthcare. The individual's natural desire to preserve wellbeing and the tendency to do so by the most convenient, effective and economic means, had always been present in any healthcare system. But now they will be better fulfilled than ever, with the aid of technologies that promise much-improved access to both health informatics and diagnostic services. This will redirect the emphasis of healthcare approaches from the remedy of illness to the endorsement of health. The individual is thus the answer to the challenges of healthcare.

Having identified the need for individuals to be more informed and actively engaged in healthcare events, a series of corresponding social and environmental conditions must exist to meet that need. Whether to expand the degree of health education for the general public, or to heighten their participation in various types of healthcare services, there must first be a place and a moment that shape the occurrence of such actions. In addition, when such actions are to target an entire population, their place and moment must also belong to a system capable of supporting actions of such scale. The facility of hospitals, clinics and medical wellness centers had been the primary setting for healthcare activities. However,

with the emergence of expert patients and the anticipated transformation of future healthcare practices, these facilities will become insufficient at a faster rate than what is currently driving their unsustainable facility renewal process[25]. It is time to explore other architectural opportunities as the new place and moment that would more suitably accommodate the demand of tomorrow's healthcare[26].

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Chapter 2

Opportunity: Public Libraries at Ready

2.1 Architecture of Health Education

Architecture has always acted as the physical vessel that carried and performed the intended purposes of its users, with its function and form combined to create its building identity. Whether the form followed the function or vice, versa, architecture earns its distinct types based on these inter-dependent variables. So when one variable changes, so do the other and the overall building identity. In the case of healthcare, now that medical functions are anticipated to engage awareness education as well as patients' self-curation, its architectural form and identity must consequently be reflective of and contributing to those transformed functions.

Both the education and the self-curation healthcare fundamentally require access to sufficient quantity and quality of information, regardless of the form in which the information exists. Particular to the subject of healthcare, such information may be provided in print media, digital media, communication with healthcare professionals, diagnostic test results, and even behaviors and conditions of one's own body. As such, the architectural conditions that accommodate the access to these types of information seem to demand a place of physical storage and of user interaction. More specifically, this means storage space for hardcopy information and for equipment that access digital information, as well as activity space that facilitate the close interaction between recipients and their care providers. Current healthcare facilities already struggle with accommodating rising medical demands due to spatial, financial and other resources constraints[1]. To bypass these same constraints, architectural opportunities for future healthcare practices containing additional services components should be sought within other existing

infrastructure of our built environment.

Cities of all ages and sizes are invariably supported by a set of underlying infrastructures and networks that are responsible for the operation of basic activities. Hospitals, transportation terminals, schools and community centers are all part of their respective network, with distributed location to service all members of the public. Prompted by contemporary interest in the idea of mixed-use, it became common that many of these once-homogenous networks integrated with each other for increased diversity, attraction, financial support and operational efficiency. Each resultant programmatic synergy produces the potential for a new form of architectural space, such as mixed-use transit hub and Multipurpose Community Learning Centers (MCLC)[2] etc. With the same strategy, healthcare can also benefit from synthesizing selected functions with other networks of amenities.

Aligning the functional needs and intended purpose of the transforming healthcare services, public libraries immediately emerged as an attractive candidate of programmatic synergy. Being a social institution, public libraries from the 19th century onwards possess the value, service structure, as well as building facilities readily receptive to expanded functions[3] such as healthcare informatics and awareness education. Generally supported by public funding, the core mission of the public libraries to serve public interest established its universal access and free cost of basic services to its users, making it an ideal setting for the promotion of healthcare education at the scale of an entire population.

2.2 Healthcare and the Public Libraries

From the perspective of health service providers, the public library is already a repository of knowledge for literacy service that encompasses most subject fields including healthcare[4]. To introduce the component of healthcare literature of any other form would only be a matter of intensifying the library's current volume, with apparent practical economy. According to Frank R. Allen, " libraries exist and continue to prosper because people value place and proximity, and

because there is an economy and efficiency in agglomerating related functions and services in close physical proximity to one another[5]. Although this additional volume might be used in the same way as other literary resources in the library, the act of this addition would make the biggest difference to health promotion in that, a substantially increased amount of healthcare literature now acquired an effective channel[6] to reach its intended audience. Public libraries are built with service locations much more evenly distributed in each neighborhood (Figure 14-15), compared to healthcare facilities that are selectively centralized due to various factors. Embedded in nearly every neighborhood in New York and offering an uncommonly broad range of services[7], their ubiquitous presence ensures that all members of the public have reasonable and fair access to public library services in terms of travel distance and convenience. Particularly in the case of New York City, a 20-minute walking distance (Figure 16) from every public library already covers most parts of the city, clearly indicating the libraries' potential as a service infrastructure to pervasively deliver healthcare awareness to the general public.

Equipped with print resources, digital resources, readily available ICT infrastructure, as well as human resources for management, the building facilities of the public libraries also present desirable conditions to host healthcare awareness activities. The rapidly expanding medical knowledge base with a doubling rate of every 18 months[8] requires constant updating, a process highly reliant on both the supply of information by providers and the management of information by recipients. The public libraries as experienced information bearers already have an extensive network of databases to upkeep necessary updates of medical information[9]. Librarians who were already curators and interpreters of general information needs[10] can now maximize their expertise with the subject of healthcare, by not only compiling useful resources, but also by providing guidance to relevant and dependable healthcare information. At a time when the openness of the Internet makes available massive volume of unstructured information, the act of discerning between more and less trustworthy sources has a seriously impact on information users, especially in regards

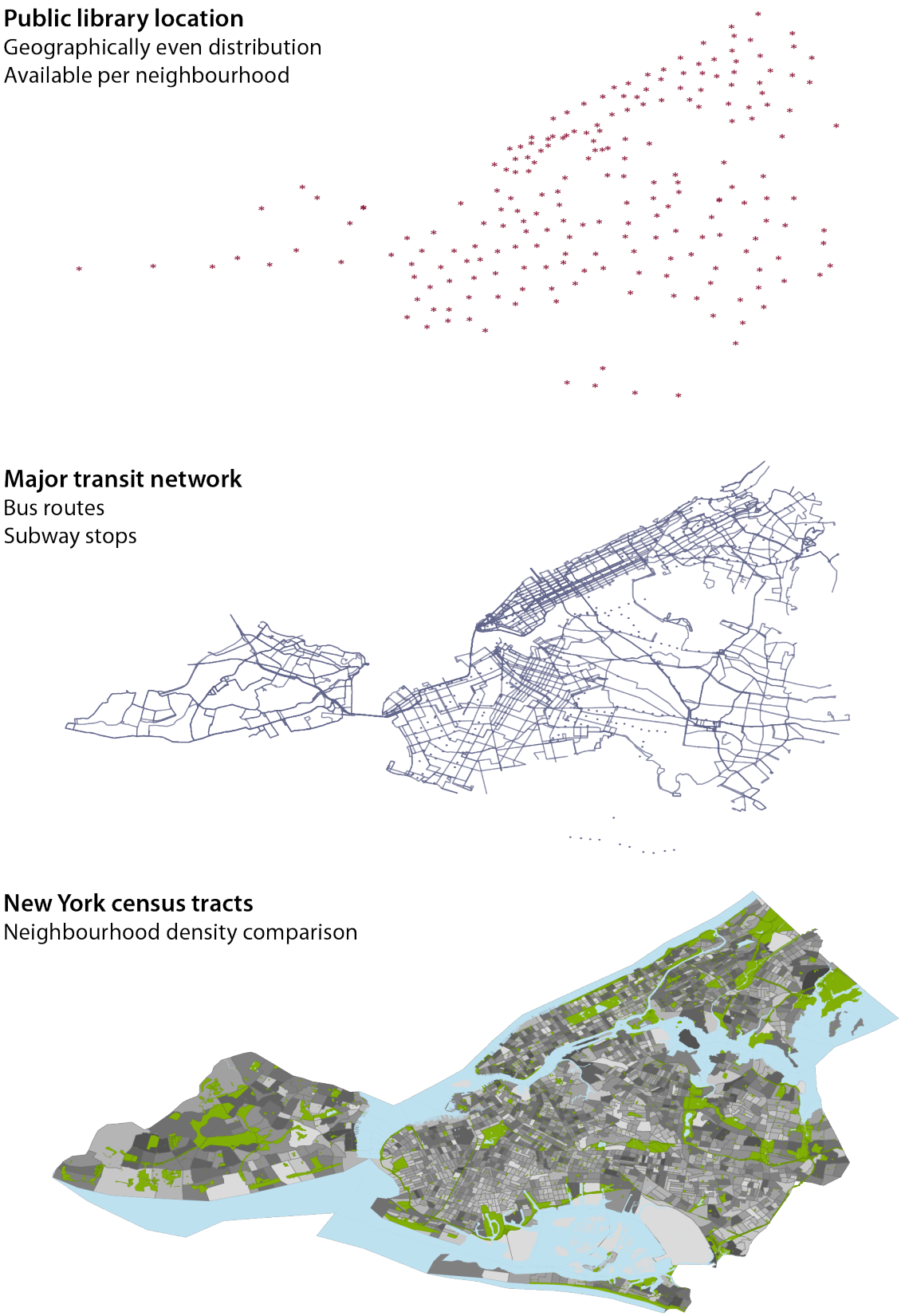


Figure 14: New York City infrastructure (public library locations, major transit routes, and census tracts)

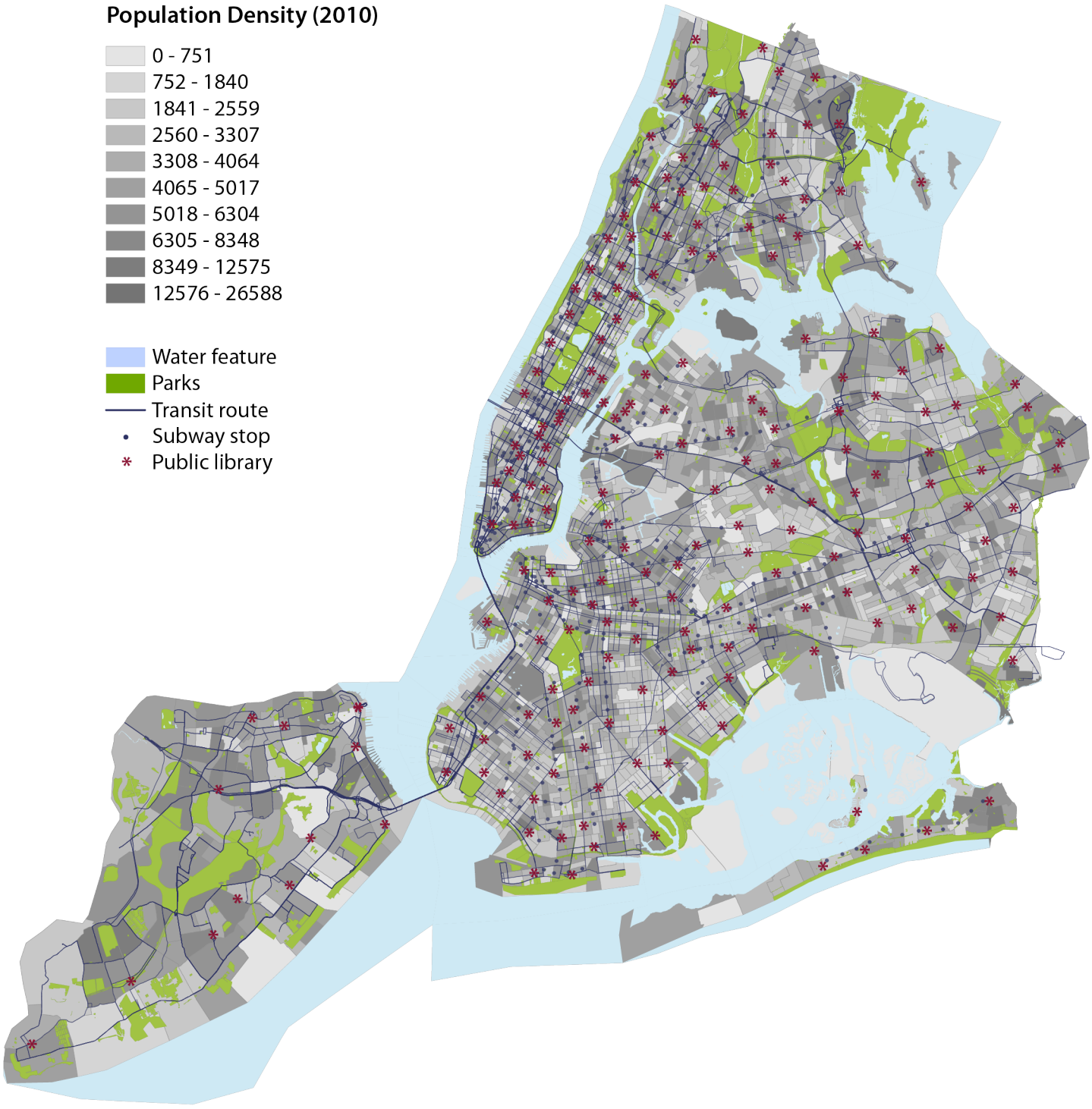


Figure 15: New York public library infrastructure, overlaying service locations and major transit routes on population census tracts

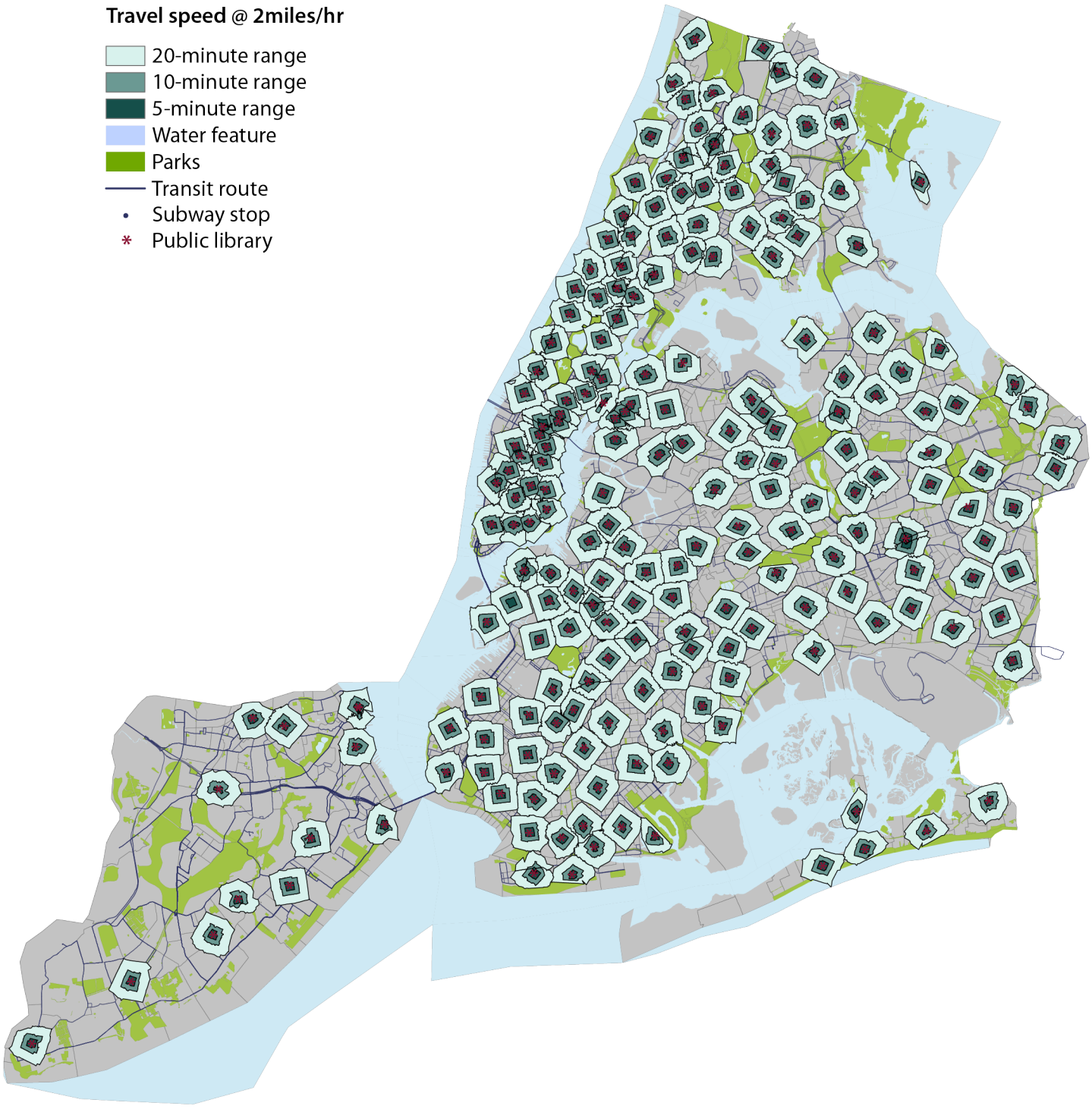


Figure 16: Map of New York public libraries walkable range.

to healthcare. To have librarians and medical librarians as the steward of medical information would therefore minimize the risks of inaccurate and unreliable information misleading the general public.

From the perspective of the general public, both as public library users and as healthcare recipients, the public libraries as new places to engage healthcare activities could substantial increase the accessibility of healthcare services. Beside the obvious locational proximity of the public libraries to their users, the major advantage of the healthcare-library integration comes from the convenience of simultaneously accessing two important social services. For some families this may only be a timesaving alignment of their healthcare, educational and recreational activities, but for others this introduces appealing opportunity in their routine use of the library to participate in beneficial healthcare activities. As John S. Brown puts, "the library is a place to catalyze curiosity"[11], now this curiosity can be effectively oriented towards healthcare to improve the health of a population.

Economically, the provision of selected healthcare services inside the public libraries could be a cost-effective way to improve public health, as opposed to having to create new healthcare facilities or expand old ones for the same purpose. Politically, this gesture positions certain aspects of healthcare as fundamental social welfare similar to the nature of public library services. By being universally offered at minimal or no cost to the public, these aspects include awareness education, consultation and diagnosis with primary physician, all of which would advance the act of self-curation and consequently optimize preventative healthcare at a large scale. These services as social welfare can be particularly beneficial for the low-income population, for whom, lack of health insurance and other financial barriers act as deterrents against necessary medical attention. A 2014 Gallup survey indicates that in the U.S., 33% (Americans) have put off medical treatment because of cost[12]. Often it is exactly this type of population who is most vulnerable to health issues and requires large volume of healthcare resources and assistance[13]. Without being appropriately informed in an affordable way, these people

who intentionally or unintentionally delay their healthcare actions inevitably suffer higher risks and consequences.

Naturally, many people have already sought assistance from the public library to become more informed. For as early as the 1980's, public libraries in the U.S. have consistently faced growing demand for medical information. According to the American Library Association, (even back then) 10% of the ten million reference questions the public libraries answered every week were health-related[14]. Whether for parsing through overwhelming quantity of healthcare data on the Internet or other media, for identifying useful information of appropriate literacy level, or for being able to ask doctors the right questions, public libraries seemed to be the first go-to resource for answers (Figure 17). In response to this social behavior, many public libraries have established Consumer Health Information (CHI) centers and expanded librarianship in order to evaluate, manage and disseminate quality healthcare information. A very successful example of this is Maryland's Wheaton Public Library, one of the oldest healthcare information centers in the U.S., which emerged out of resident's demand for a place to obtain personal health care information without having to visit a doctor's office or healthcare clinic[15].

However, these libraries' literature-based solution to inform the populations largely still undermines the libraries' potential to more profoundly promote healthcare as a self-manageable event for individuals. In addition to information resources, the public libraries have an abundance of spatial resources that could effectively facilitate care recipients' interaction with medical professionals, with assistive diagnostic technologies, and with laboratory testing services. The physical space of the public libraries, whether old or new, is uniformly designed not only for the moment of accessing information, but also for the duration of using information. From the general reading rooms of late 19th century libraries to the multipurpose activities rooms of contemporary community libraries, greater variety and amount of user spaces are constantly created and added to library buildings, including individual study carrels, reading tables, open seating areas, meeting

THE CHALLENGE *of* PROVIDING CONSUMER HEALTH INFORMATION SERVICES *in* PUBLIC LIBRARIES

INTRODUCTION

One of the biggest challenges today's librarians face is an insatiable consumer demand for health information.

Personal health care management has become a big business. Consumers are bombarded with information on television and through other media sources that say it is possible to live longer and be healthier by taking better care of themselves. A plethora of health care information books, Web sites, television programs, magazines, CD-Roms, DVDs and videos explain how to improve health by eating smarter, exercising more frequently and improving management of treatments associated with chronic illnesses. Studies in medical journals suggesting new and often counter-intuitive approaches to health care are cited constantly on television news programs.



It's not surprising that Americans are hungry for health information. According to recent studies, the average doctor's office visit in this country lasts 12 minutes. With limited time to ask questions, the more patients are informed about specific medical conditions affecting their health, the smarter the questions they will ask their doctors. And the place that many people go to find answers to their questions, and other health information is their local public library. In some communities, hospital and medical libraries also provide services to the public.



The role of the librarian has expanded to meet this need. Only a small percentage of America's 16,000 public libraries have the funding and resources necessary to establish and maintain the specialized consumer health information centers that some libraries or library systems have established. Yet all public libraries, whatever their size or resources, must attempt on a daily basis to answer telephone and in-person requests, and provide health information materials and guidance to members of their communities.

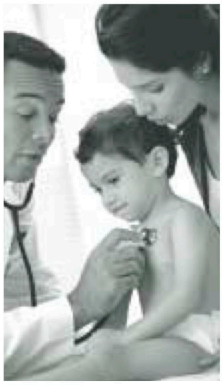


Figure 17: Introductory page in the report "The challenge of providing consumer health information services in public libraries" by American Association for the Advancement of Science

rooms, workshops, and even auditoriums. Offering a range of private and shared environments, these spaces that were once meant for general learning can now also be the solution to different types of healthcare education.

Architecturally, these spaces consist of rooms of different sizes and degrees of enclosure that could easily be converted for other uses by a change of interior finishing, furniture and user content. With them, the majority of public libraries should already be sufficient to support many primary healthcare functions in terms of spatial volume and adaptability. For instance, a typical family doctor's office is not necessarily different from a meeting room in the public library in terms of permanent architectural elements. The noticeable differences exist in the layout, storage of equipment, furniture accessories and certain building fixtures. Even the waiting rooms for clinics share similar design criteria as library reading areas in terms of design quality and comfort. Therefore depending on the type of healthcare service, only minimal architectural change may be required on the library building for it to accommodate primary healthcare functions such as physical exams, diagnosis and consultation. It is also worth noting that, since the conventional use of the library is particularly static in comparison to the highly dynamic use of hospital (healthcare type) building[16], the juxtaposition of its long service life period with healthcare buildings' short service life could potentially create a mutually beneficial dichotomy in the resultant architectural form.

The public libraries' considerable spatial and functional adaptability have long been recognized and exploited by social organizations of all kinds. Evolving with qualities and features of community centers, the public libraries are often seen as the problem-solving agent that could serve to accommodate anything from adult learning center, employment center, to rentable community meeting rooms and registration platform for social services. So, as many reasons as healthcare providers may have to integrate their services with the facility and operation of the public library, why should the public libraries welcome such integration when they have many other partnership options?

With the emergence and prevalence of digital media as new means to communicate information, many have predicted a decline in public libraries' future. The accessibility of electronic resources continues to dismiss the need to physically retrieve information, thus reducing the main reason people visit public library facilities. Although this alone would not cause the public libraries and its printed resources to be obsolete in the future, but the infrequent or lack of usage from certain parts of the population does impact the public libraries' importance to the community. This could perhaps explain why policy makers and economic officials felt justified to curtail funding for the public libraries, despite the libraries' claim of user and service increase[17]. Both in the U.S. and in Canada, even the most prominent public libraries have experienced funding shortages in the recent years.

Therefore it is always in the public libraries' best interest to further strengthen its societal impact, and to operate with such remarkable and quantifiable relevance to the population that sufficient funding cannot reasonably be denied. In past and current practice, the public libraries have formed partnerships with non-profit organizations and various

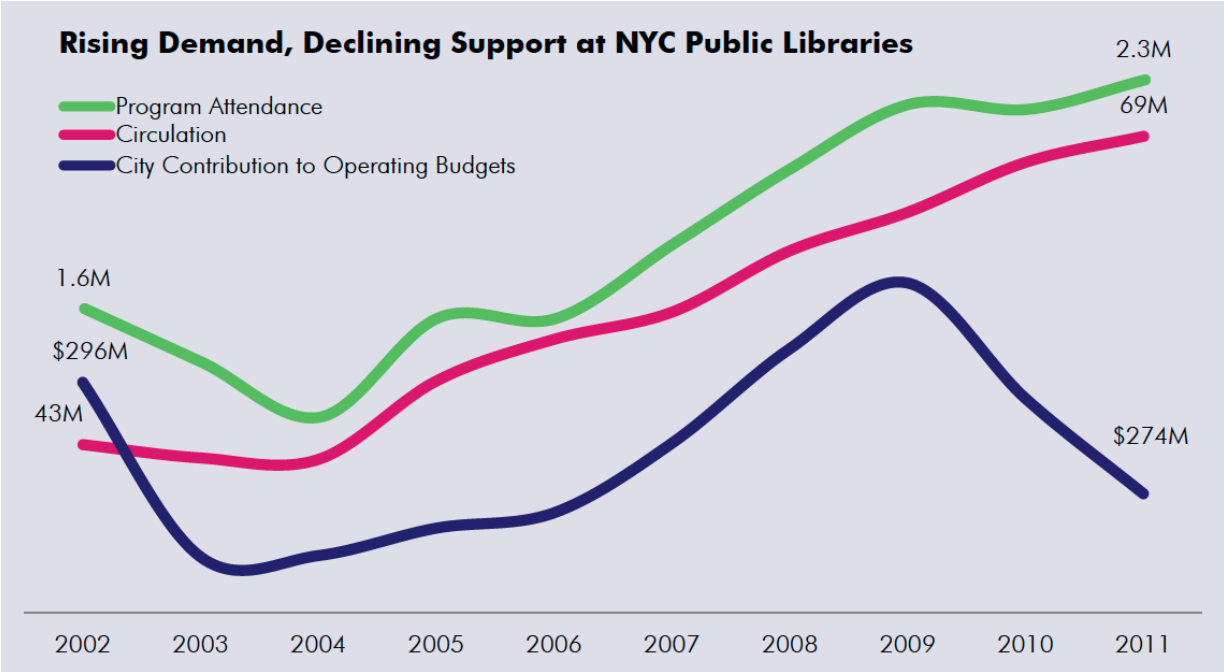


Figure 18: Graph of rising demand and declining support at NYC public libraries. *Source*: IBO; Financial Management system; CPI Inflation Calculator.

community agencies in order to expand its services and obtain funding. However, these endeavors typically occur at a small scale, too discontinuous and inconsistent to benefit the larger network of public libraries.

Healthcare services on the other hand, as a hybridizing partner of the public libraries can magnify libraries' value as an entire social infrastructure, bringing stable funding to them. The advantage would be evident in two sequential parts. First, when healthcare components such as primary examination, automated diagnosis and laboratory work become additional services of public libraries, these functions that are most universally needed and frequently used will attract visits from atypical library users. By being presented convenient opportunities to use the library's resources while accessing healthcare services, healthcare recipients are encouraged to both become better educated about health as well as to have a more interactive relationship with the public library. Gradually, the paired access of primary healthcare and the public libraries will become instinctive to common users, a regular routine in their life.

Second, individuals' frequent regular visit to the public library, for both library and healthcare services, would create favorable circumstance for the library to systematically collect information about the community it serves. Such information may include anything from population census and de-identified healthcare data, to collective topics of interest and usage behaviors. With proper extraction and compilation, these data that were previously largely undisclosed or difficult to collect, can become part of a rich GIS database to better predict the community's future needs in healthcare and in other resources. Because these data are community-specific and consistently accrued, their validity and high accuracy would directly improve the effectiveness of anticipatory measures implemented after using these data. This evolves the nature of librarianship from the mere provision and maintenance of found information to include the generation of information.

As a result, public libraries will also contain mini data centers

to store and structure these data, and technically qualified staffs that curate them. The privileged data ownership, the capability to generate and interpret data for more extensive applications will initiate a new role for the public library as master curators of actionable information. Relying on this powerful information to forecast various resource allocation for the operation of the city, government agencies and policy makers will gain an increased appreciation for the functions of the public libraries, and hence be incentivized to ensure stable funding for them and their healthcare components. For the public libraries, even as they transform into or become part of community centers, their core function as the keeper of a society's collective knowledge and universally shared resources will persevere through times of dominating electronic media, or of economic recession. Therefore, for financial advantage as well as social prominence, the public library will be motivated to welcome a physical synthesis with primary healthcare services.

2.3 Brooklyn Public Libraries: The Pacific Branch

Without building brand new integrated healthcare public libraries, the insertion of healthcare services within existing public library facility inevitably means the act of renovation. While spaces inside the public libraries have become increasingly flexible and multi-purposed, their current positions and conditions still require a degree of redesign and reconfiguration, before being able to accommodate healthcare functions in a manner beneficial to both staff and users. But just as public libraries are all different in facility space, architectural characters and building conditions, each library has varying need for renovation and strategy to renovate. Therefore, in order to realize the proposed healthcare-library integration, a unique public library with urgent renovation needs has been chosen as the first opportune testing ground- Brooklyn Public Library (BPL) Pacific Branch in New York (Figure 19-23).

The BPL Pacific Branch was the first Carnegie library that opened to the public in Brooklyn, in 1904. Designed by Raymond Almirall, the library's Beaux-Arts architecture



Figure 19: Brooklyn Public Library (BPL) Pacific Branch, front exterior



Figure 20: BPL Pacific Branch, back exterior



Figure 21: BPL Pacific Branch, stack's and reading room

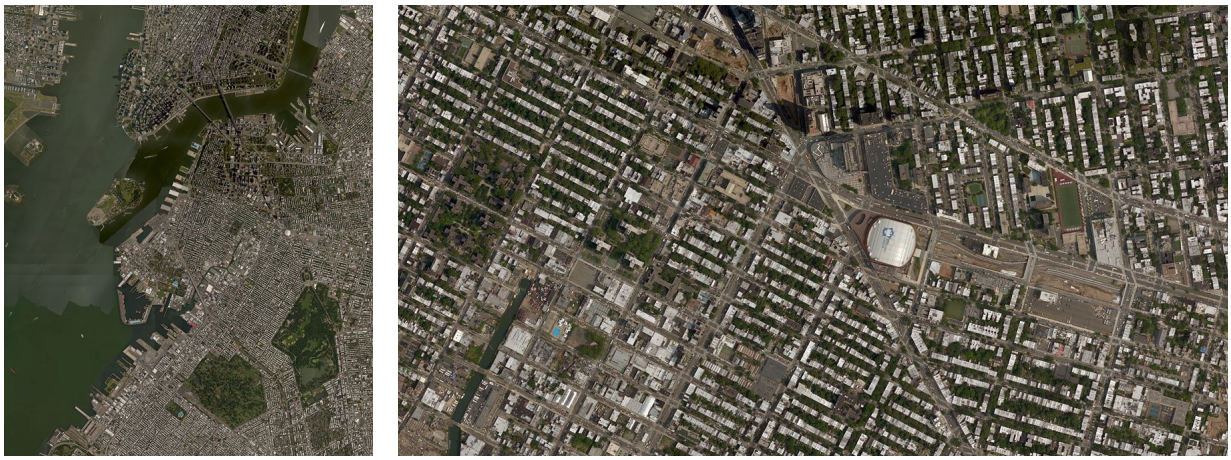


Figure 22: Satellite image of Brooklyn New York, urban scale (left) and neighborhood scale (right)

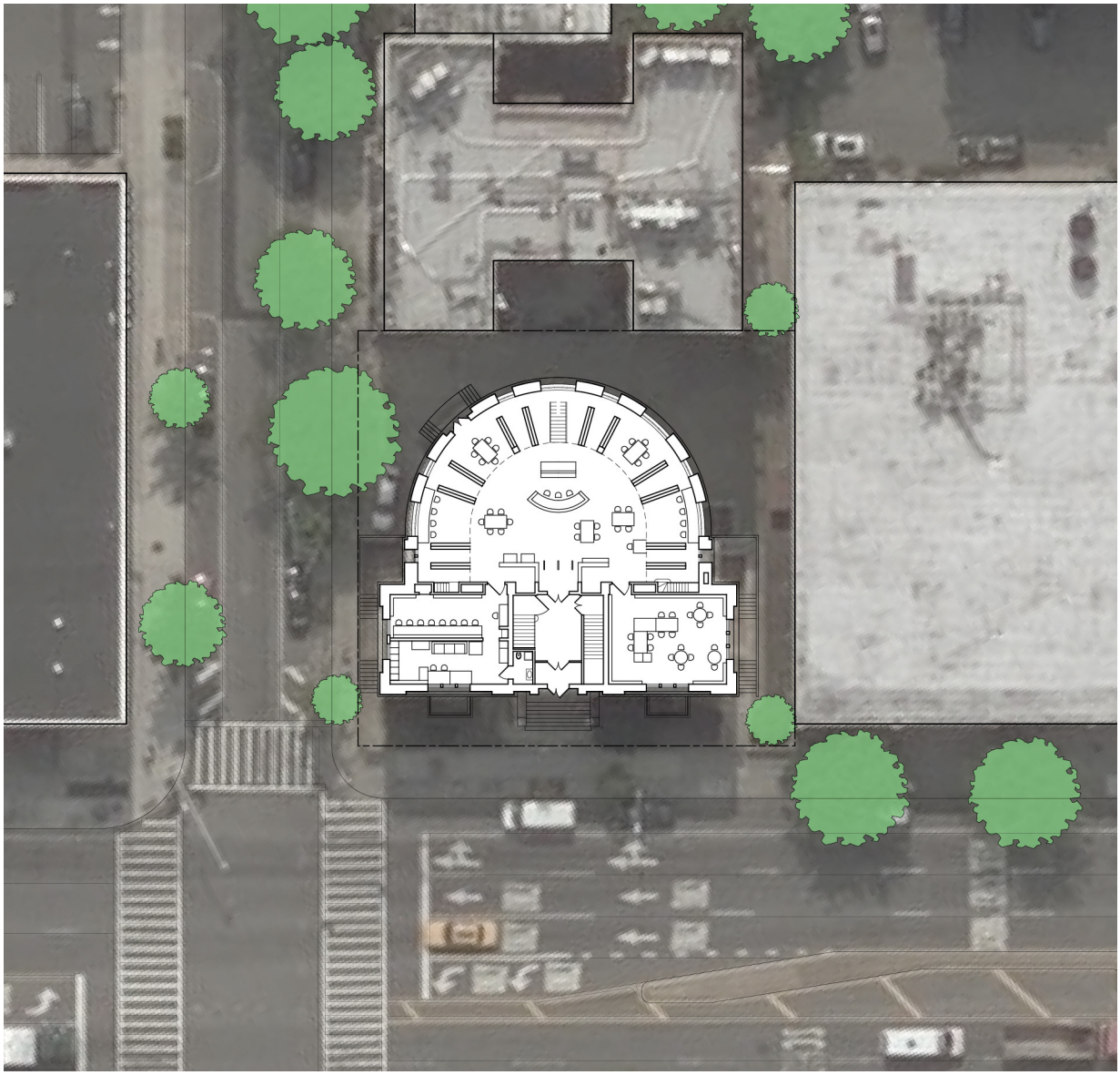


Figure 23: Satellite image of Brooklyn New York, BPL Pacific Branch site.

has served its surrounding neighborhood for more than 110 years despite having three times suffered damage from nearby railway construction and fire hazards. After 1973 when it narrowly escaped demolition thanks to its cultural and social significance, the building underwent extensive renovation that extended its building life until present day.

However, being a building facility that is "leaky, overcrowded, poorly air-conditioned and honeycombed with small office spaces librarians no longer use"[18], this library is once again faced with imminent closure, building sell-off and subsequent demolition. The effort of community activists, whether in 1973 or 40 years later in 2013, could only delay the decision to abolish this library[19]. Without addressing the fundamental cause that depreciated the library building, the historical value of its architecture may soon lose out to its functional dilapidation, a common precursor for building closure and demolition. As identified by BPL's executive staff and regional manager, this building is currently handicapped by a variety of issues including limited accessibility, inflexible layout, visually segregated spaces that restrict usage and significant infrastructure repairs. With a renovation cost adding up to approximately 10 millions dollars[20], and still only able to solve the library's immediate problems, BPL's intention to sell the building for a better and more economical replacement becomes intuitively logical and reasonably practical.

Funding aside, the preservation of this public library branch, its location and its architecture depends on a renovation that will not only recover considerable amount of its functional value, but also implement architectural qualities that help the building last long into the future. As such, BPL Pacific Branch represents an ideal opportunity to explore the maximum advantage of the proposed healthcare-library integration – Library Plus+, an intervention that benefits healthcare, the public library and their users. Beginning with a detailed analysis on the existing building conditions of the Pacific Branch, the following chapter will outline key programmatic criteria of Library Plus+, propose an ideal renovation strategy, and graphically express its design development.

The New York Times | http://nyti.ms/14gugHw

N.Y. / REGION

A Deal Spares a Brooklyn Library, for Now

By **JOSEPH BERGER** JUNE 18, 2013

The 109-year-old Beaux-Arts library near the Barclays Center has been given a reprieve.

The Brooklyn Public Library had been **planning to sell** its Pacific branch on Fourth Avenue at Pacific Street to a private developer in order to raise money toward the $300 million needed for repairs and long-delayed maintenance of its branches, now numbering 60.

But officials said late on Monday that the Pacific branch would be spared from sale and demolition, at least for the near future, as part of a deal to win City Council approval for a 32-story residential and cultural tower opposite the Brooklyn Academy of Music that will contain a new library.

Figure 24: New York Time article announcing BPL Pacific Branch spared

Brooklyn's First Carnegie Branch Gets a Reprieve, but Fate Remains Murky

By Norman Oder on June 20, 2013

The Brooklyn Public Library's (BPL) first Carnegie Library, the Pacific Branch, has been spared from sale and demolition after all—but perhaps only for a brief while. Then again, new political leadership in the city may make a difference, regarding not only this building but libraries in general.

Council Member Letitia James, who represents the area where a new library to replace the branch would have been located, secured an agreement to decouple the sale of Pacific from a mixed use plan. But the library's response does not rule out a sale in the future.



The Pacific Library Branch of the Brooklyn Public Library (photo by Norman Oder)

Figure 25: Library Journal article announcing BPL Pacific Branch spared

313	45	Pacific (District 39)	9,950,000
314		ADA Compliance	3,000,000
315		Boiler	750,000
316		Exterior Restoration	600,000
317		HVAC	750,000
318		Interior Renovation	3,000,000
319		New Furniture & Equipment	600,000
320		Safety and Security Enhancement	250,000
321		Windows	1,000,000

Figure 26: A list of repairs needed for BPL Pacific Branch. *Source*: Matthew Taub, Brooklyn brief.

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Chapter 3

Architectural Integration: Library Plus+

As Winston Churchill said, "first we shape our buildings, thereafter they shape us." It was with the desire to curate knowledge that libraries were built to "shape" our intellects; and it was with the desire to sustain or attain higher level of health that healthcare facilities were built to "shape" our physical wellbeing. Each has throughout history evolved substantially, as institutions and as building forms, triggered by the changing purpose and expectation of its user audience and stakeholders. Now with the growing expectation to achieve better health and healthcare through self-curation and preventative practice, both of which depend on the individual's health literacy and access to self-assisted diagnostic services, an interesting commonalities emerged between healthcare and public library functions. To motivate the spatial and functional integration of healthcare and library services, these conceptual commonalities seek specific programmatic identity to acquire form and presence within the existing public library facility. Only then can they begin to reinvent our perception of and participation in healthcare, and to reshape us as human beings.

Starting from the most apparent programmatic commonality between healthcare and library services-health literacy, the production of such literacy requires two things: the means through which literacy is delivered, and user's motivation to engage with these provided means. While most public libraries already provide a certain extent of health literacy service, mainly informatics resources of print or digital format, their architecture as building facilities offer little motivation for users to actively access them. In other words, library visitors with no specific healthcare intentions would unlikely be inspired to take advantage of available health literacy resources. It is therefore the design intent of Library

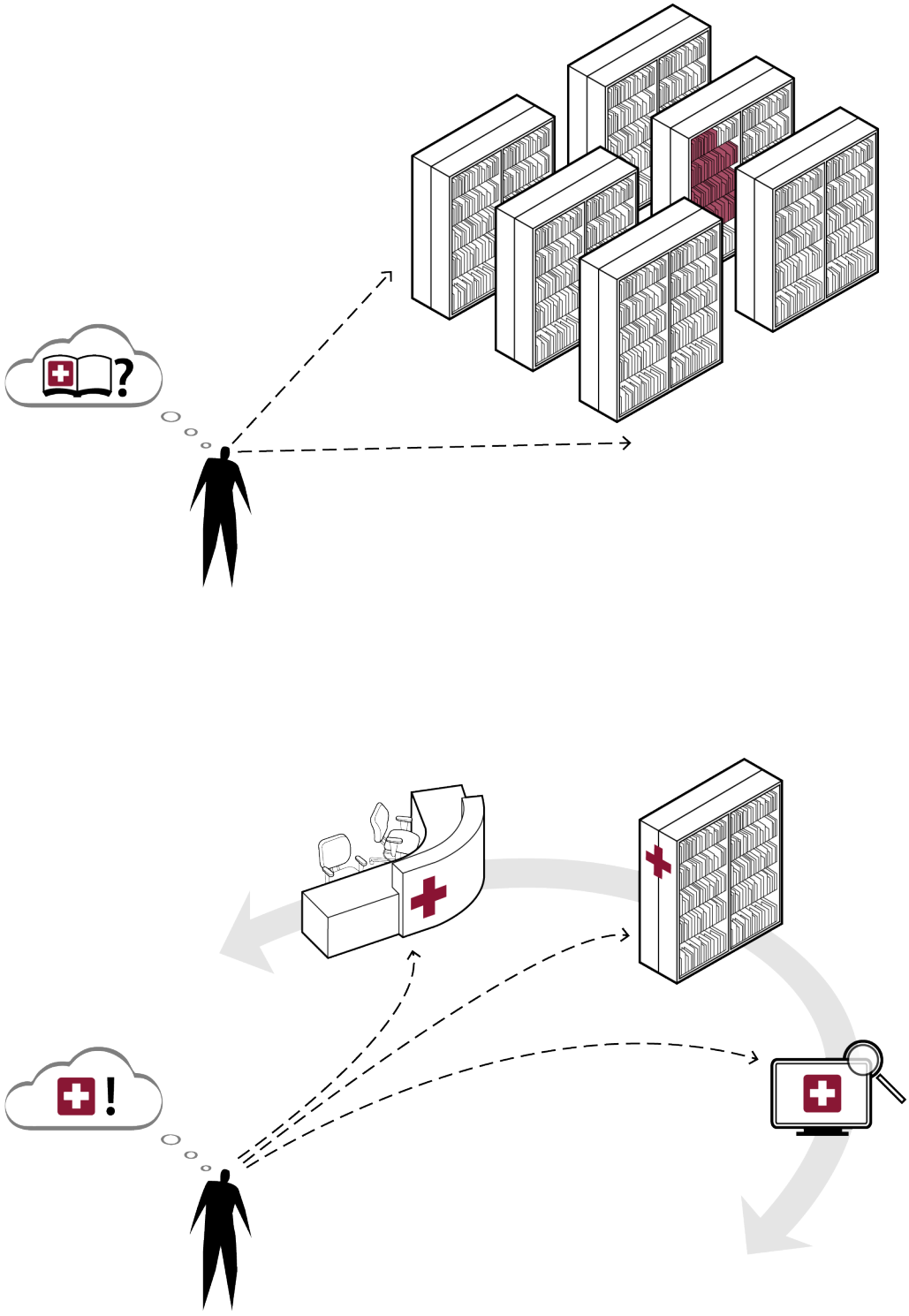


Figure 27: Diagrammatic access to health literacy resources, between conventional public library (*top*) and proposed public library with integrated health literacy services (*bottom*)

Plus+ to define an architectural intervention that would maximize user engagement with health literacy, popularize the integrated healthcare-library services, and in the end create expert patients who are in better control of their own healthcare events (Figure 27-28).

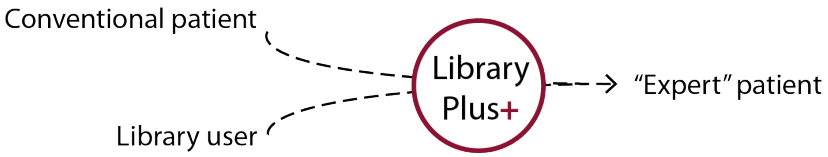


Figure 28: Conceptual creation of the "expert patients"

The best learning combines the most current available information with thorough background knowledge[1]. Based on the three general learning styles for any form of knowledge (visual, aural, and kinesthetic), literacy may be accomplished in a variety of ways not limited to conventional access of information primarily based on visual and aural learning process. Particular to health and healthcare, a matter of physical dimension, the kinesthetic learning experience of using medical diagnostic equipment may more effectively contribute to the improvement of one's health literacy. For example, reading the description and seeing images of a physical condition such as sick sinus, may only increase an audience's ability to identify its symptoms; but using ECG to diagnose the pattern of the audience's beating heart in real-time, could profoundly elevate his comprehension of that physical condition in direct relation to his own health. The translation and application of health information in practice that is personally performed by the individual make it both practical and appealing to become health literate. As user-friendly medical technologies continue to develop, encouraging and normalizing the act of self-diagnosis, individuals are empowered to more proactively involve in their care events.

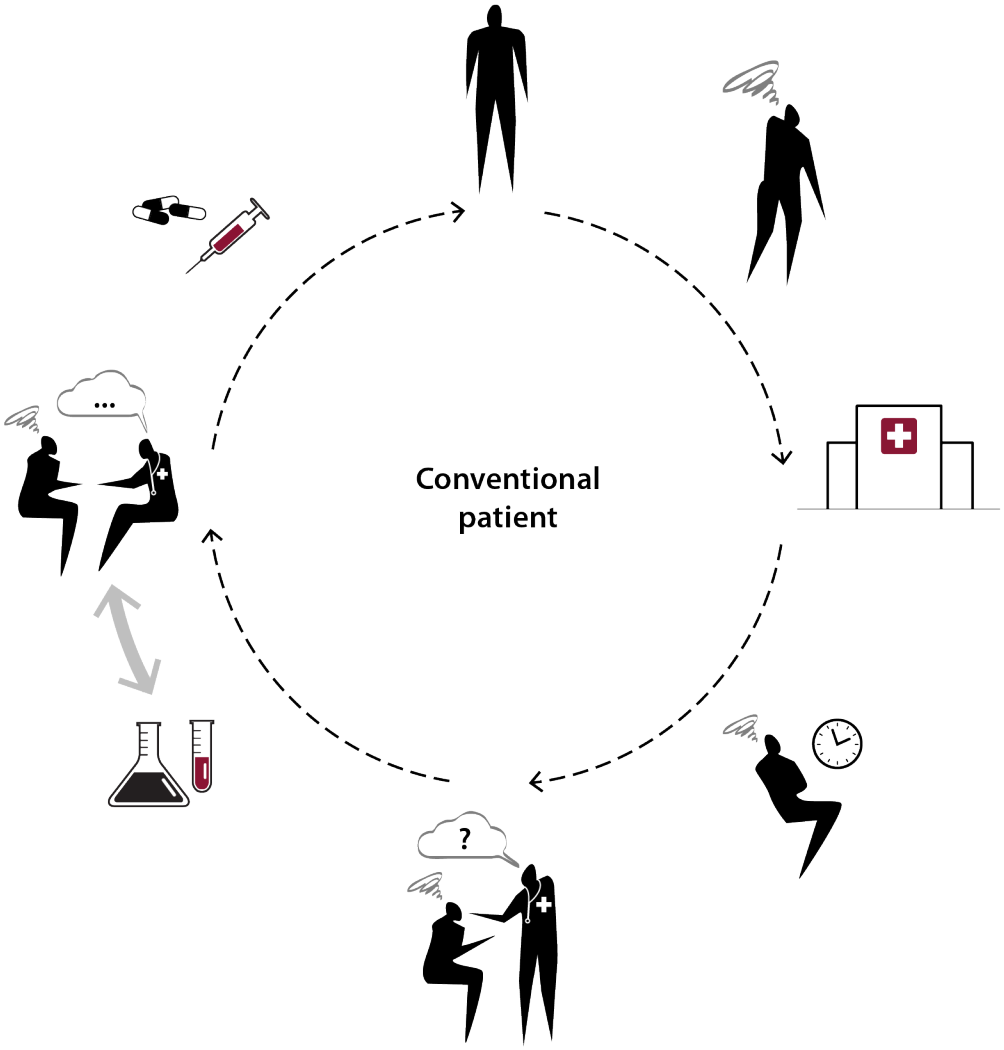


Figure 29: Existing healthcare process with lengthy wait time and repetitive diagnosis and consultation

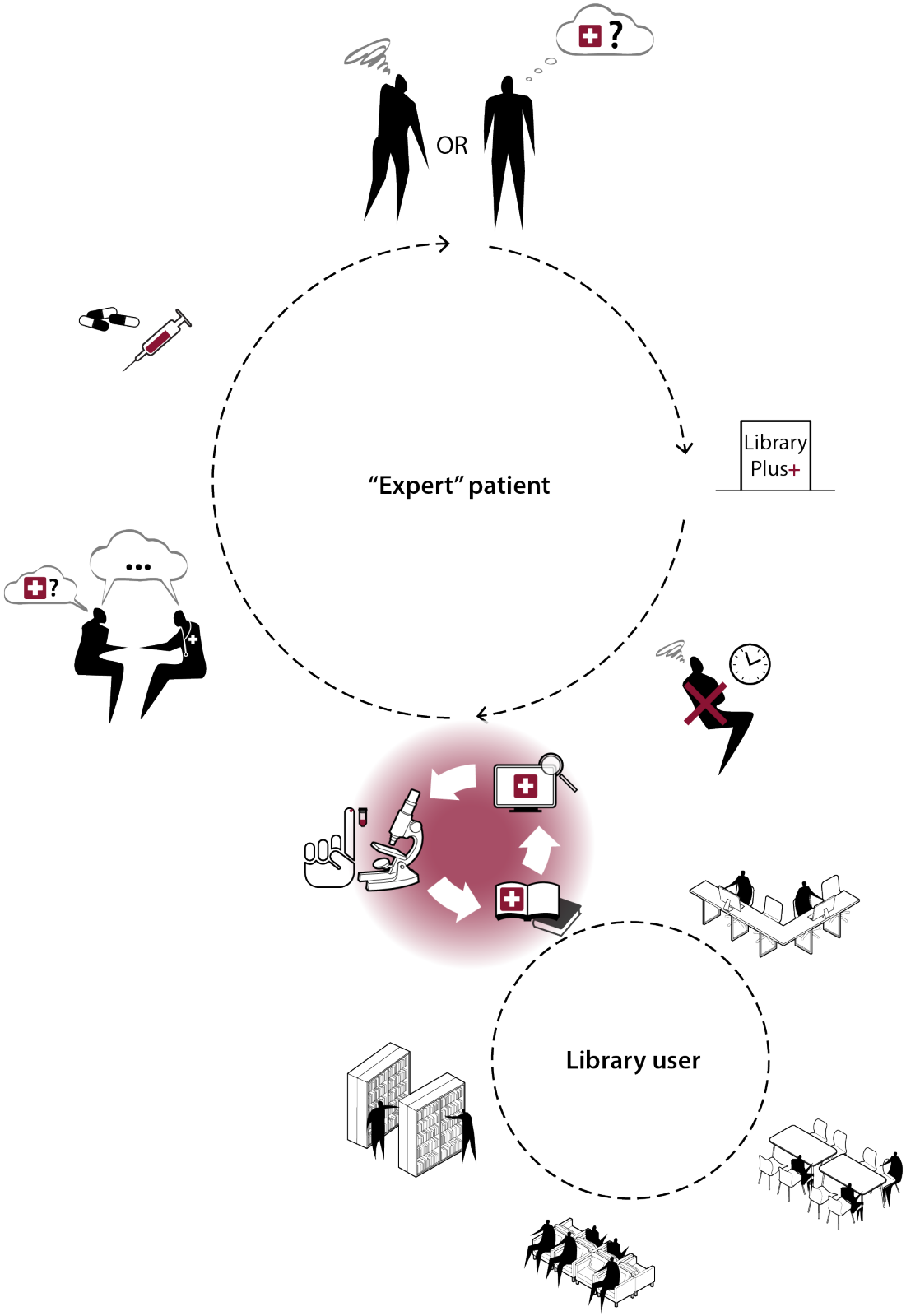


Figure 30: Improved healthcare process with effective wait time spent on health literacy and self-diagnosis

The increased patient involvement should be reflected in two ways: 1) productive communication between patient and medical professionals regarding healthcare options, and 2) efficient process to obtain diagnostic/laboratory test results necessary for prescription. Compared to a typical doctor visit, patients should have the opportunity to make use of the often-inevitable wait time to benefit actual consultation. This includes obtaining relevant medical knowledge so that concerns can be effectively raised to and addressed by doctors, and, obtaining appropriate diagnostic test results in advance so that repetitive yet unproductive consultation face-time may be minimized (Figure 29-30).

Therefore the key programs required for healthcare-library integration are: community clinic, laboratory, library service with enhanced health literacy resources and a data center (Figure 31). As indicated by the name of the proposed integration, Library Plus+ shall fundamentally remain as a public library institution and facility, with the added programs serving as its "plus+" to redefine its expanded content and scope of services (Figure 32).

The first three programmatic components drive the spatial form of the integration, facilitating the majority of healthcare user activities, while the data centre provides the underlying software infrastructure for the others, managing the flow and storage of information towards their respective interests. Medical information, usage patterns and other relevant data that are collected as a result of the integrated service operation, can be returned to the system, updating available resource databases, and continuously advancing the quality of both health literacy and healthcare services delivered. Interpreting from the typical spatial composition of each of the proposed program categories, the following functional program is proposed as partial design guideline, to be applied appropriate to the specific conditions of BPL Pacific Branch.

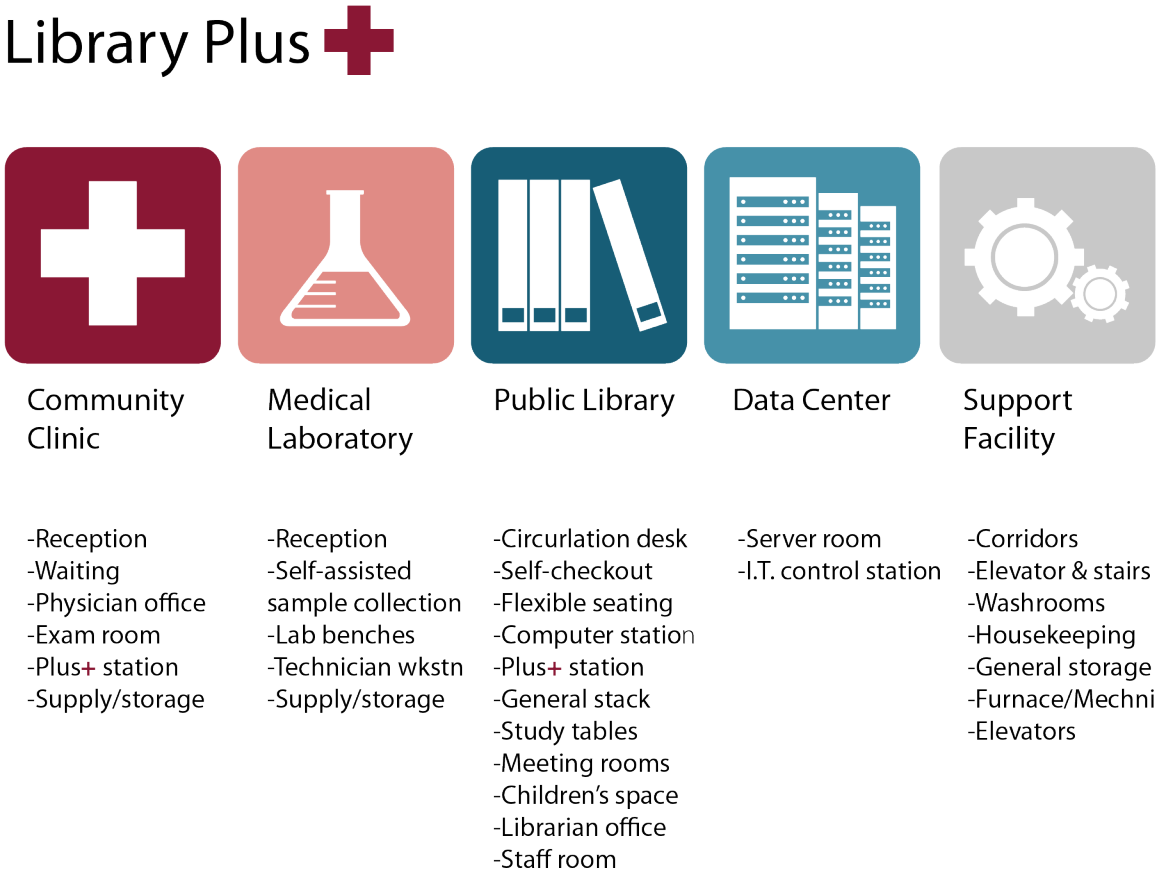


Figure 31: Proposed Library Plus+ programmatic categories

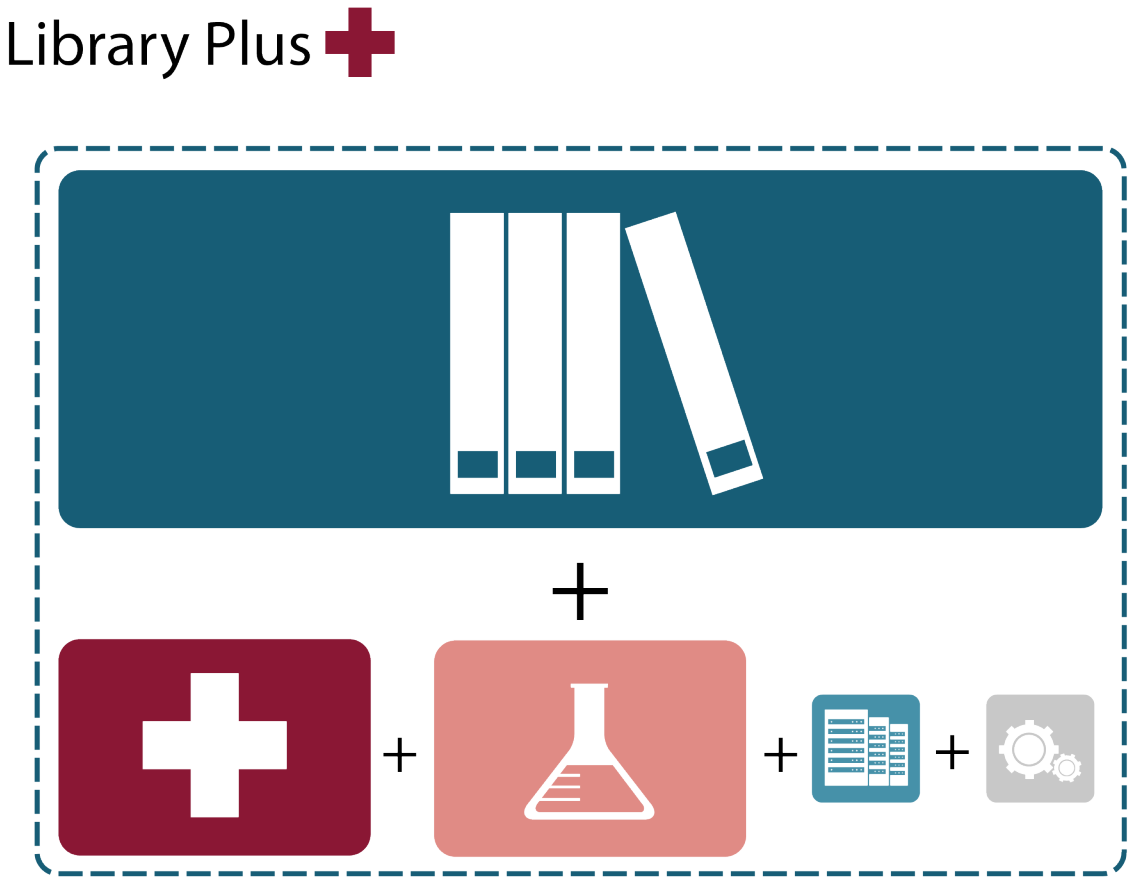


Figure 32: Proposed Library Plus+ programmatic hierarchy

3.1 Existing Library

The BPL Pacific Branch is a suitable representation of public libraries whose architecture bore witness to the operational and programmatic changes of the public library as an institution. Originally designed assuming the criminal intent of general readers, its semicircular layout containing the radial stack room, reading tables and circulation desk all in one space, closely resemble the prison architecture of Jeremy Bentham's Panopticon. Acted as the "inspector's lodge", the delivery desk scrutinized the movement of every reader in two levels of divided reading alcoves. Later, as the need to increase public libraries' social usefulness removed their administration's tendency to separate users into smaller groups for better control, the library's surveillance-oriented architecture outlived its usefulness. With revised functional and consequently architectural purpose, the radial stack devolved from an effective spatial invention to a flaw that limited the library's usage flexibility and potential for expansion[2]. While later public libraries adopted open layouts that both encouraged users' positive social interaction as well as preserved the libraries' architectural value through increased adaptability, the Pacific Branch barely kept pace with this changing spatial demand through superficial renovation and maintenance.



Figure 33: Historical photograph of BPL Pacific branch, 1905. *Source*: Archi/Maps

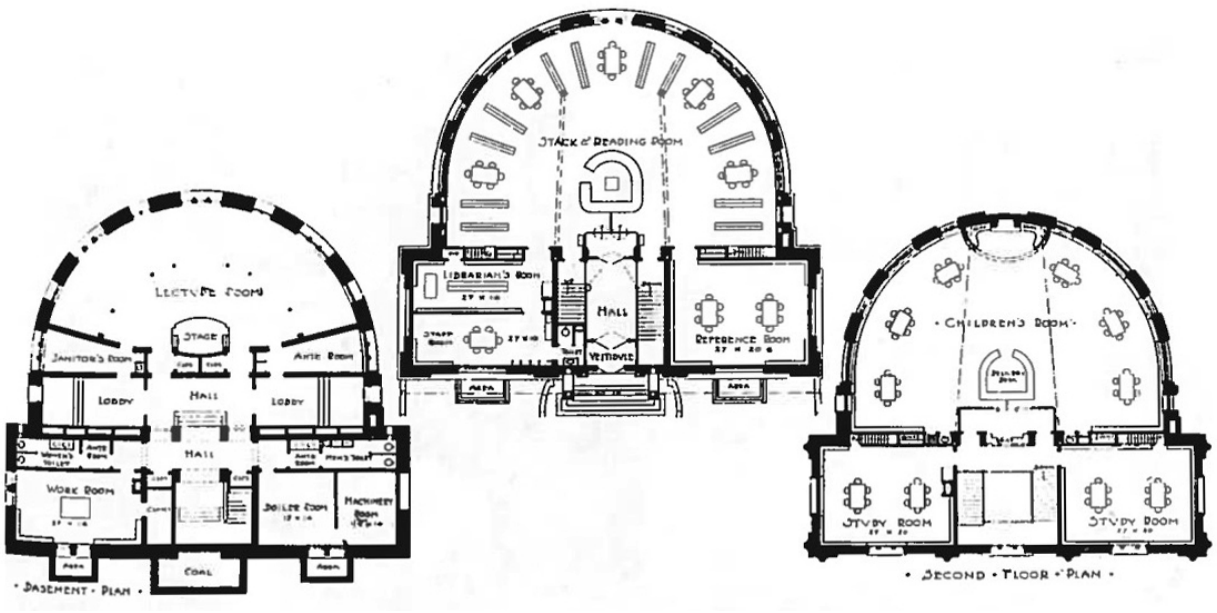


Figure 34: Raymond F. Almirall, BPL Pacific Branch, Brooklyn, c. 1997, (left) basement, (center) first- and (right) second-floor plans. Brickbuilder 16 (May 1907): plate 78.

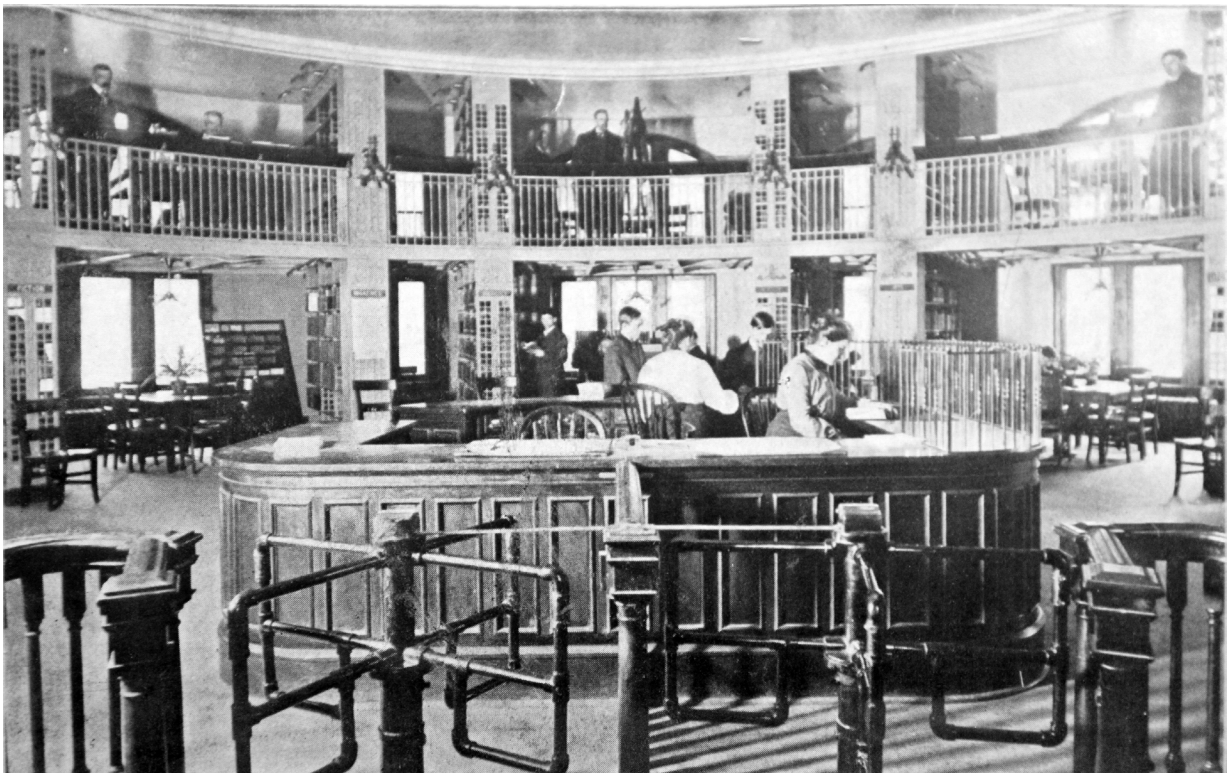


Figure 35: Raymond F. Almirall Architect, BPL Pacific Branch, 1905. *Source*: Brooklyn Collection

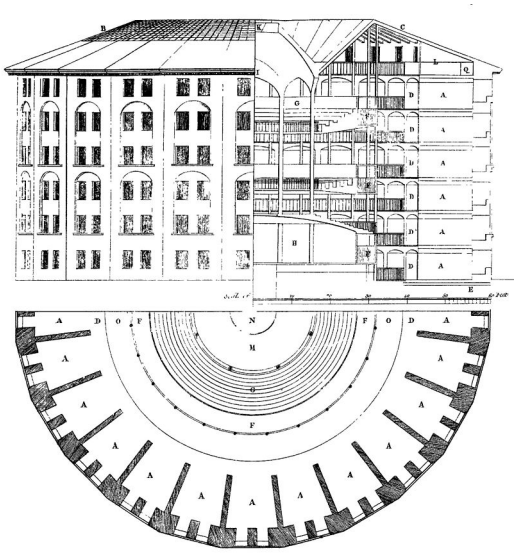


Figure 36: Elevation, section and plan of Jeremy Bentham's Panopticon penitentiary, Willey Reveley, 1791



Figure 37: Stateville Correctional Center, Illinois, 1990. Photo by Lloyd DeGrane. *Source*: Roosevelt University

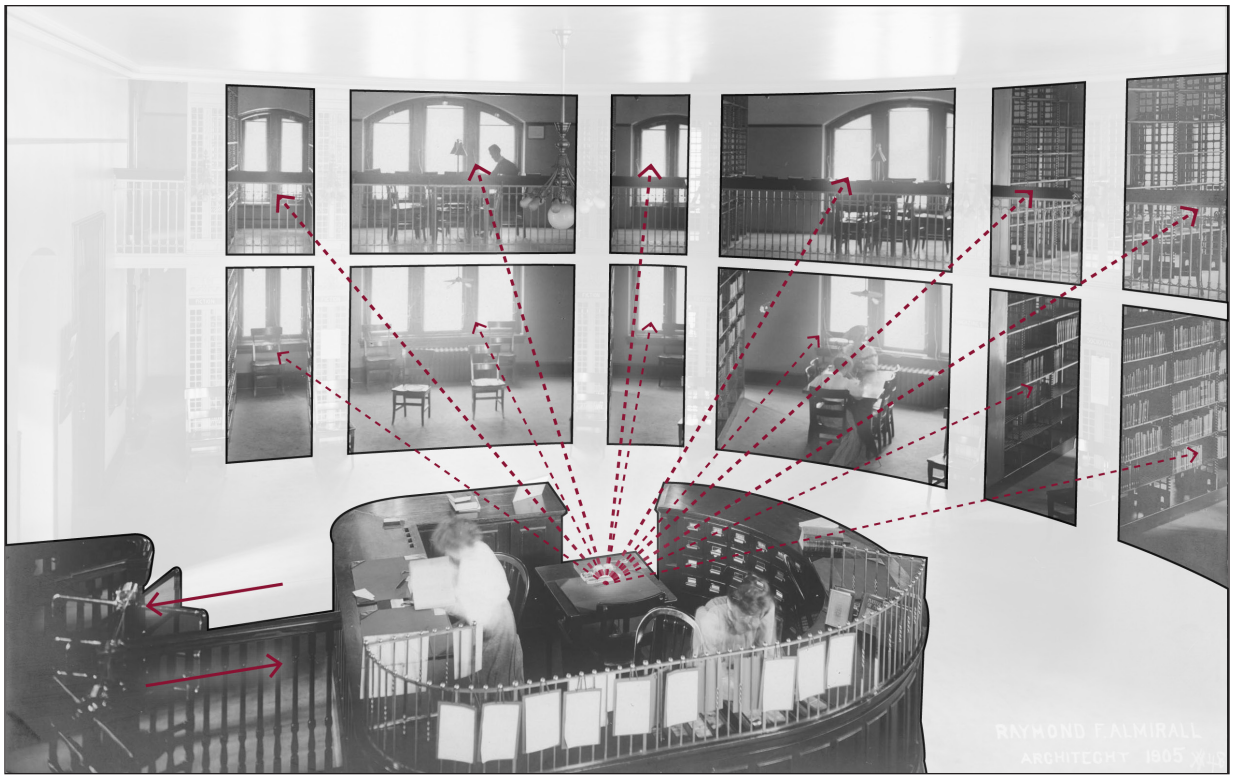


Figure 38: Central delivery desk monitoring two levels of reading alcoves in radial layout, replicating the functional concept of Jeremy Bentham's panopticon prison design.

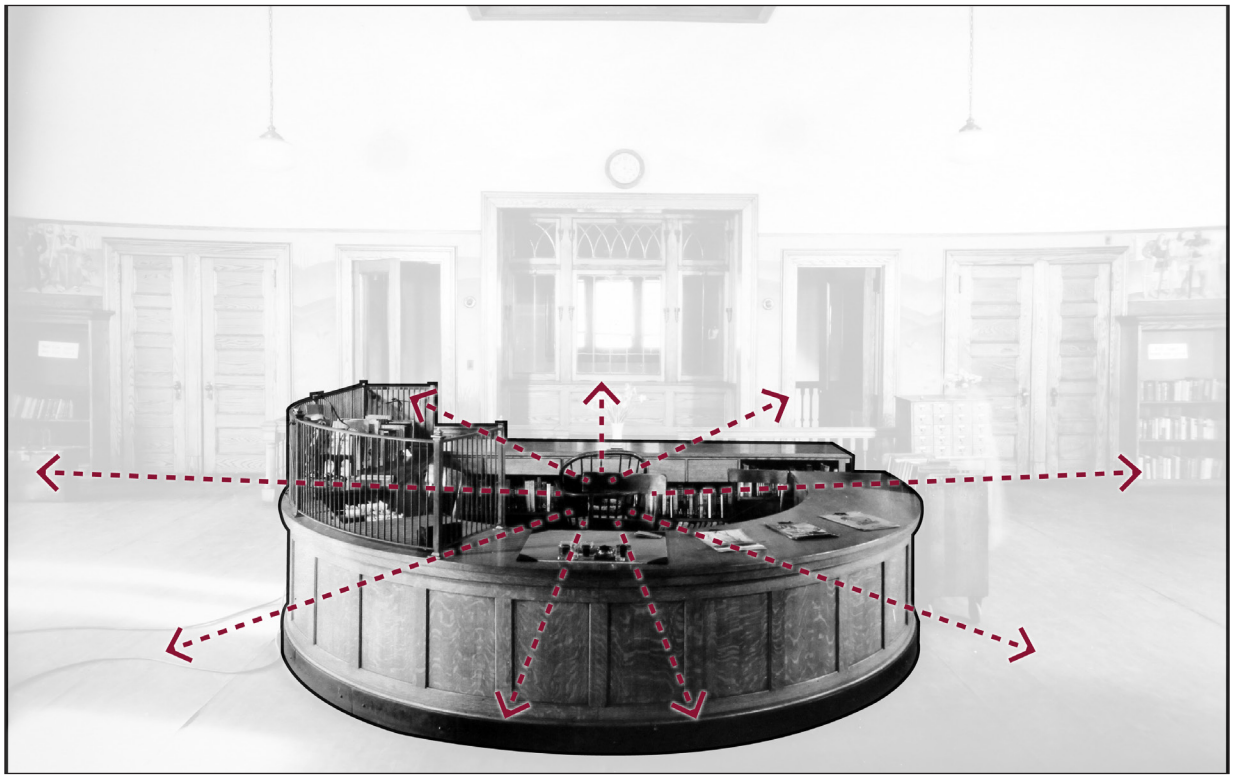


Figure 39: Second floor delivery desk



Figure 40: Second floor children's space delivery desk monitoring peripheral shelves and reading tables.

These "bandage" renovations that never substantially recovered the library's fully functional state, only aggravated its perceived degree of dilapidation, and overlooked the value of more transformative renovation strategy that could save the library's architecture and the public space it provides for the community. Currently, the overall layout of the Pacific branch is as isolating for its users as back it was in 1904. The library administration was forced to accommodate the majority of its users and activities within the main reading space on ground floor. Available spaces on the second floor as well as in the basement that are visually secluded, remain habitually vacant due to lack of staff supervision. Even access to the washroom facilities on the basement level requires borrowing a key from the staff for safety reasons. In addition to Americans with Disabilities Act (ADA) non-compliance that already cripple the library's universal accessibility, this limited access to more than 62% of its user space is an ominous warning of the library's future survival.



Figure 41: Raymond F. Almirall Architect, Brooklyn Public Library, 1905. *Source*: Brooklyn Collection.



Figure 42: Main space, Brooklyn Public Library Pacific Branch, 2015



Figure 43: Children's Room (*ground floor*), Brooklyn Public Library, 1946. *Source*: Brooklyn Collection.



Figure 44: Children's Room (*ground floor*), Brooklyn Public Library Pacific Branch, 2015



Figure 45: Pacific Branch - Children's Room, Brooklyn Public Library, 1905. *Source*: Brooklyn Collection.



Figure 46: Second floor large meeting room, Brooklyn Public Library Pacific Branch, 2015



Figure 47: Pacific Branch - Children's Room, Brooklyn Public Library, 1938. *Source*: Brooklyn Collection.



Figure 48: Second floor large meeting room, Brooklyn Public Library Pacific Branch, 2015

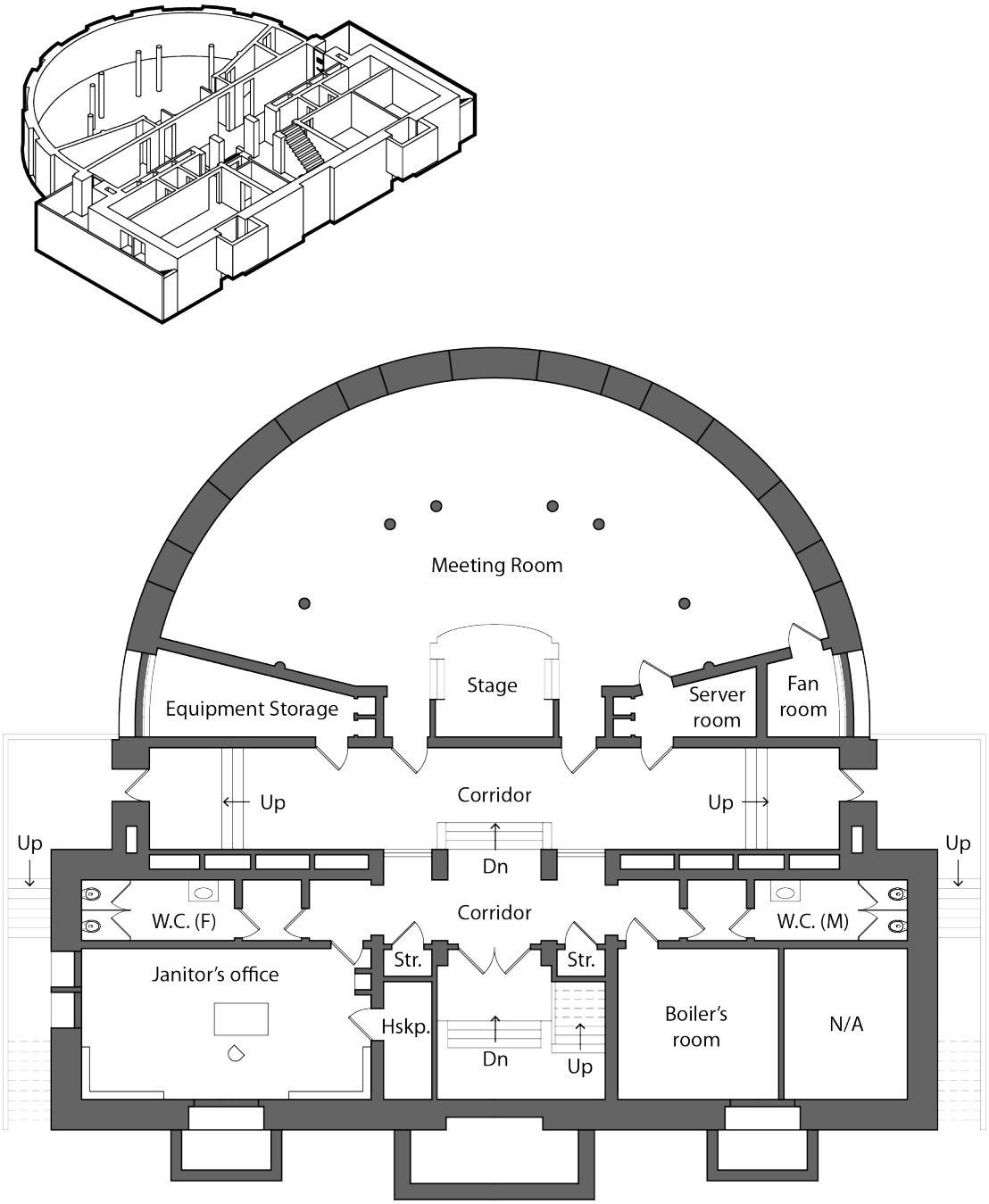


Figure 49: Existing basement floor



Figure 50: Basement meeting room



Figure 51: Basement lower corridor (*North*)



Figure 52: Basement lower corridor (*South*)



Figure 53: Public washroom (*female*)



Figure 54: Equipment storage



Figure 55: Janitor's office

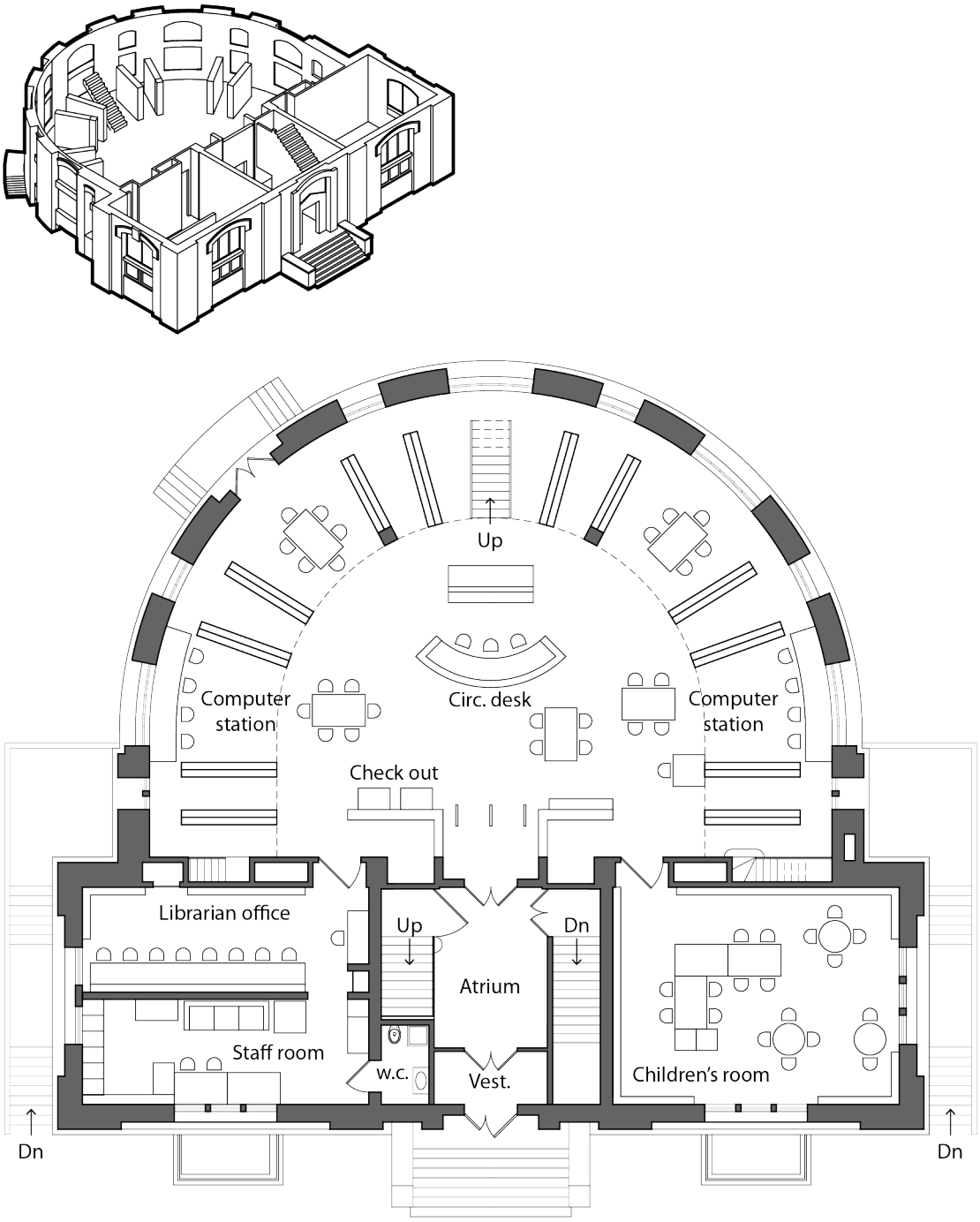


Figure 56: Existing ground floor



Figure 57: Main reading room and general stack



Figure 58: Children's Room

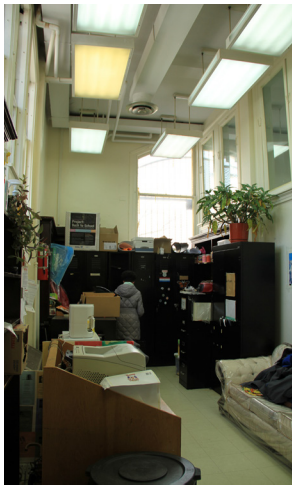


Figure 59: Staff room



Figure 60: Librarian's office

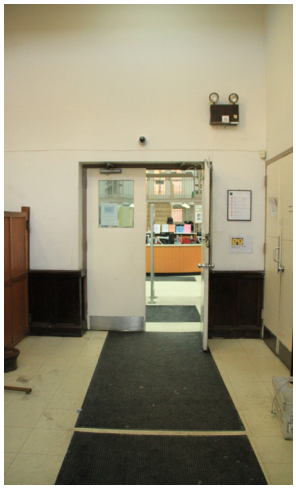


Figure 61: Atrium



Figure 62: Vestibule (*from inside*)

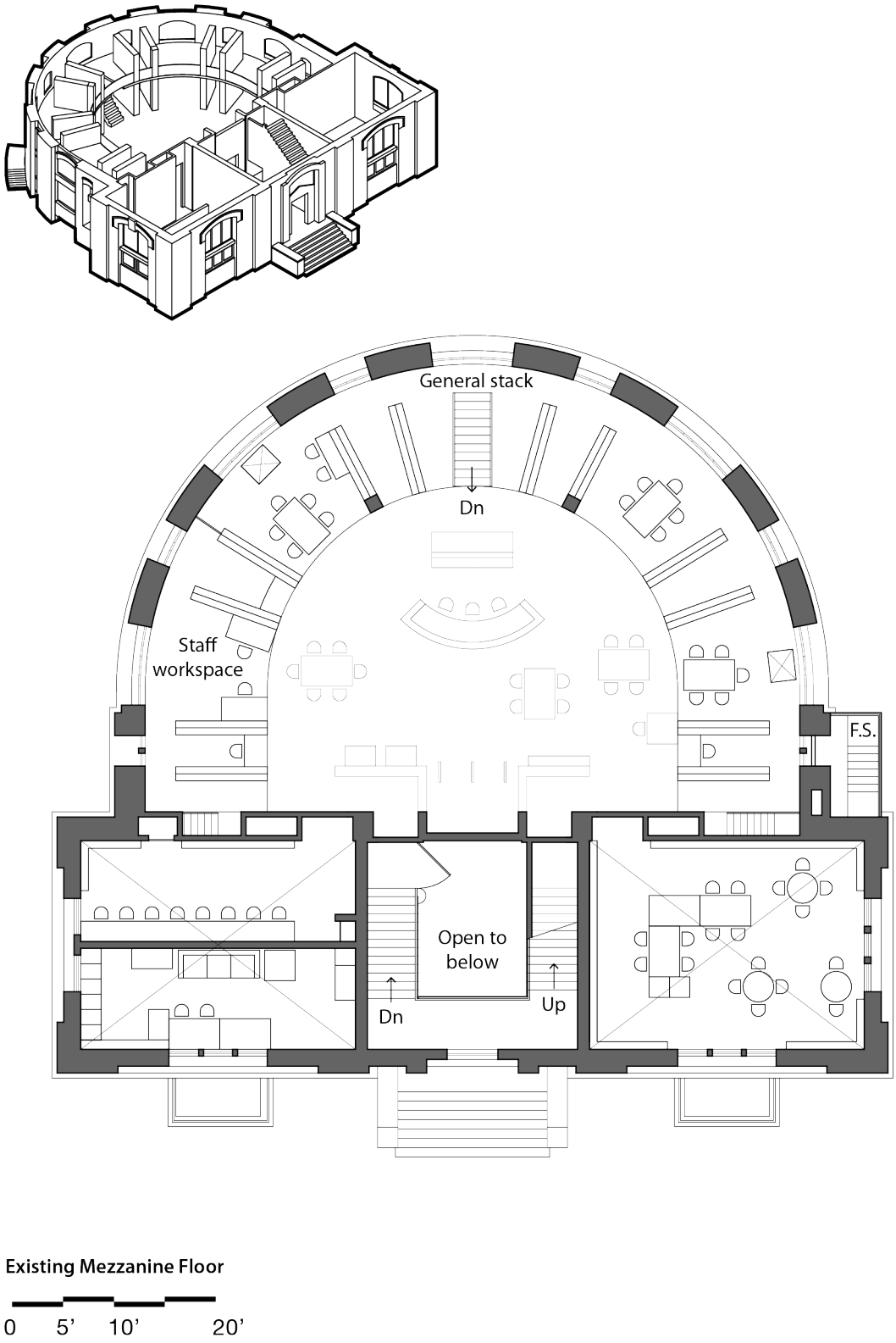


Figure 63: Existing mezzanine floor



Figure 64: Mezzanine study alcove (*with single table*)



Figure 67: Stack isle & reading alcove



Figure 65: Mezzanine study alcove (*with shared table*)



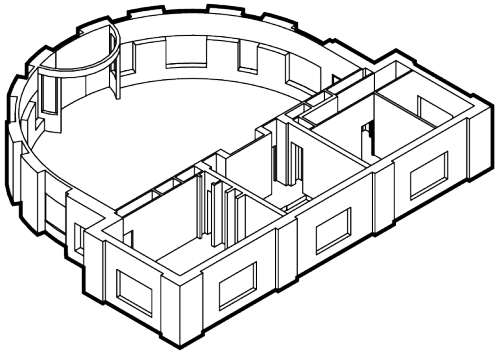
Figure 68: HVAC unit

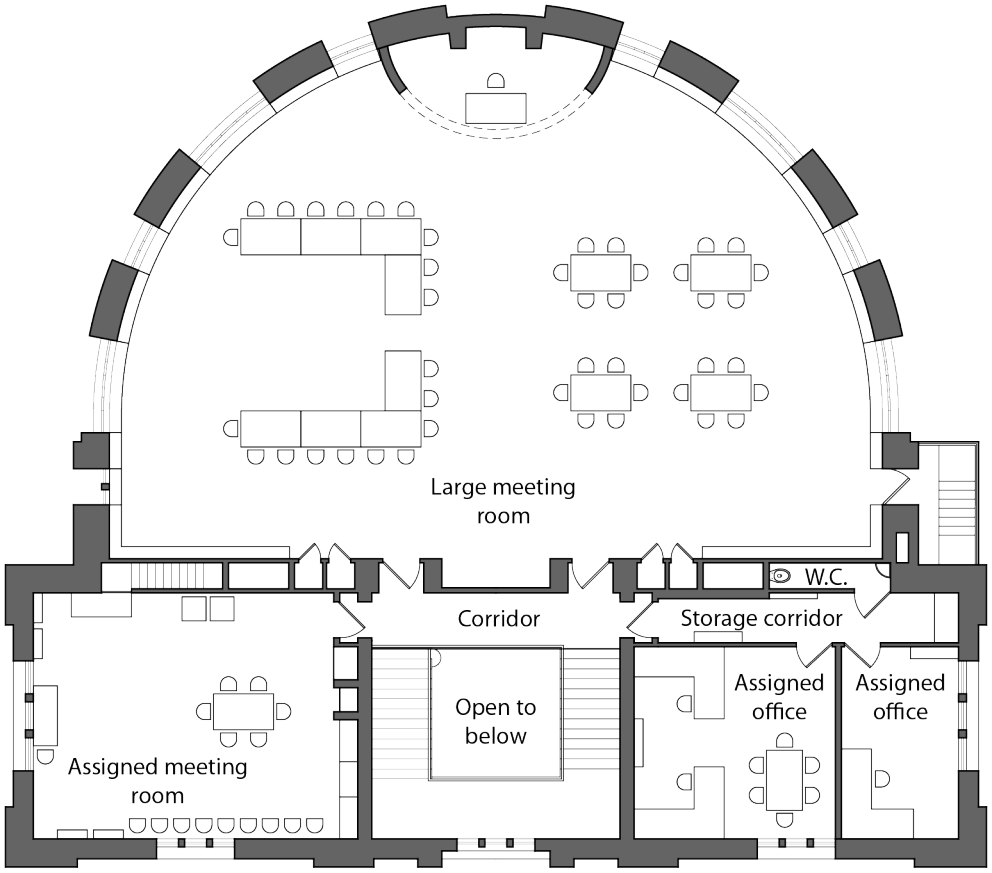


Figure 66: Main stairs to mezzanine



Figure 69: Secondary stairs to mezzanine





Existing Second Floor

0 5’ 10’ 20’

Figure 70: Existing second floor



Figure 71: Second floor large meeting room



Figure 72: Corridor (2nd floor)



Figure 74: Main staircase (*open atrium*)



Figure 73: Staff stairs to 2nd floor



Figure 75: Assigned meeting room



Figure 76: Storage corridor



Figure 77: Assigned office

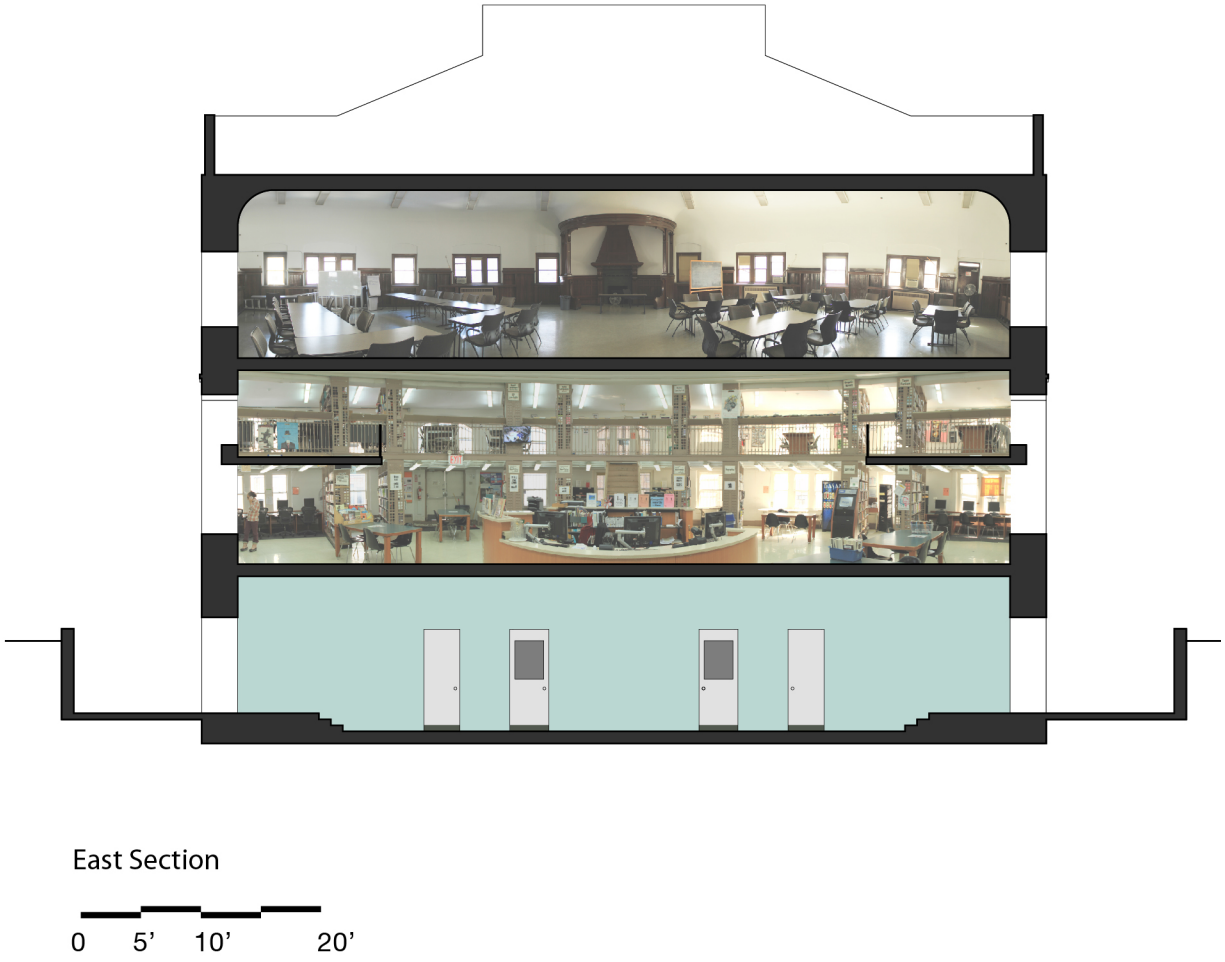


Figure 78: Existing east section with site photo underlay

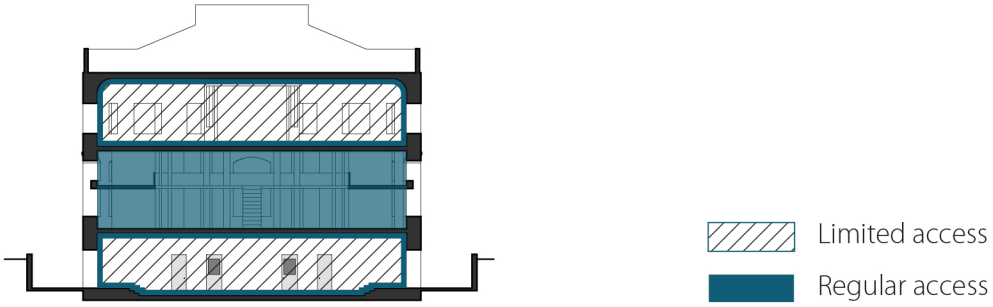


Figure 79: Existing east section access breakdown



North Section

0 5’ 10’ 20’

Figure 80: Existing north section with site photo underlay

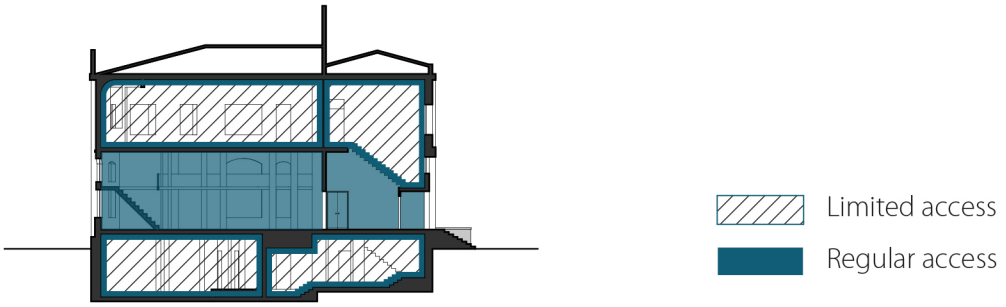


Figure 81: Existing north section access breakdown

	Level	Program	Area (Sq.ft.)	% of Category	Usage
User space					
	B	Meeting room	1413	17%	Limited
	G	Children's room	567	7%	Regular
	G	General stack & reading space	2307	28%	Regular
	M	General stack & reading space	908	11%	Regular
	2	Large meeting room	2408	30%	Limited
	2	Assigned meeting room	546	7%	Limited
		Subtotal	**8149**	**64%**	
Admin space					
	B	Janitor's office	382	20%	Regular
	G	Librarian office/staff room	673	35%	Regular
	M	Librarian work room	326	17%	Regular
	2	Assigned offices	426	22%	Limited
	2	Storage corridor	101	5%	Limited
		Subtotal	**1908**	**15%**	
Facility space					
	B	Equipment storage	122	15%	Regular
	B	Server room	66	8%	Regular
	B	Fan room	50	6%	Regular
	B	Washrooms	232	28%	Regular
	B	Boiler room	213	26%	Regular
	B	Housekeeping room	53	6%	Regular
	B	Storage closets	26	3%	Regular
	G	Staff washroom	37	5%	Regular
	2	Staff washroom	23	3%	Limited
		Subtotal	**822**	**6%**	
Circulation					
	B	Stairs & Corridors	1077	60%	Limited
	G	Stairs & Corridors	346	19%	Regular
	M	Stairs & Corridors	236	13%	Limited
	2	Stairs & Corridors	135	8%	Limited
		Subtotal	**1794**	**14%**	
		Total Net Area	**12673**		

Figure 82: Existing spatial program

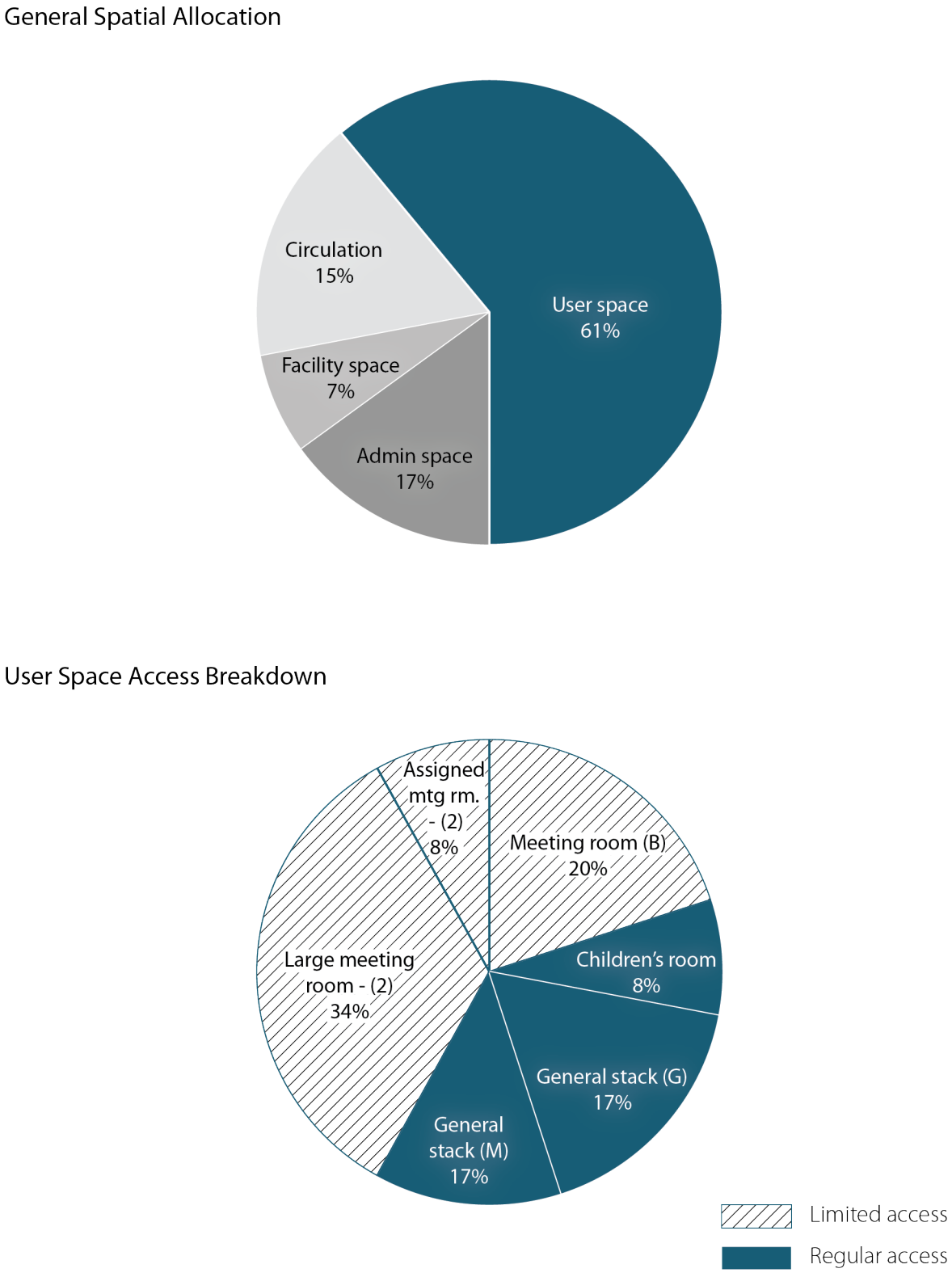


Figure 83: General spatial allocation (*top*) and user space access breakdown (*bottom*) pie chart

3.2 Library Plus+ Design Strategy

The goal of Library Plus+ is to improve healthcare by combining it with health literacy service of the public library, both proposed to take place within the existing library building. It is therefore up to the architecture of that building to spatially accommodate and actively facilitate the integrated functions. In addition to the mere provision of kinesthetic learning environment, self-diagnostic space, laboratory and clinic spaces, the library architecture must encourage their individual or combined usage through building form or spatial organization, which shall maximize visual exposure of and convenient access to its spaces. A clear display of the library's programmatic content, both the typical and the newly introduced healthcare services, allows all users to acknowledge the full extent of all resources available to them, and emphasizes their approachability and easy access through visual and physical proximity.

Applying these design considerations to the current Pacific branch library building that needs to be renovated by preserved, there are interesting overlaps that show opportunity to transform the biggest existing building limitation into a design strategy for the Library Plus+ integration. The original building design based on the concept of the Panopticon has already achieved ideal visual exposure of its target space, that the users and their activities could be maximally monitored by authoritative figures – the library administration. Since the proposed visual exposure is of the library's spatial content by users instead of library administration, the Panopticon design concept can be inverted and further implemented throughout the building to suit current proposal (Figure 84). This way, new design goals can be realized while preserving the historical values and the essence of the building's original architecture, as it is important that the Library Plus+ as an additive intervention transforms, rather than destructively replaces its host.

Whereas the current Panopticon layout of library's main reading space positions the circulation corridor along the building periphery, exposing cell-like reading alcoves (user

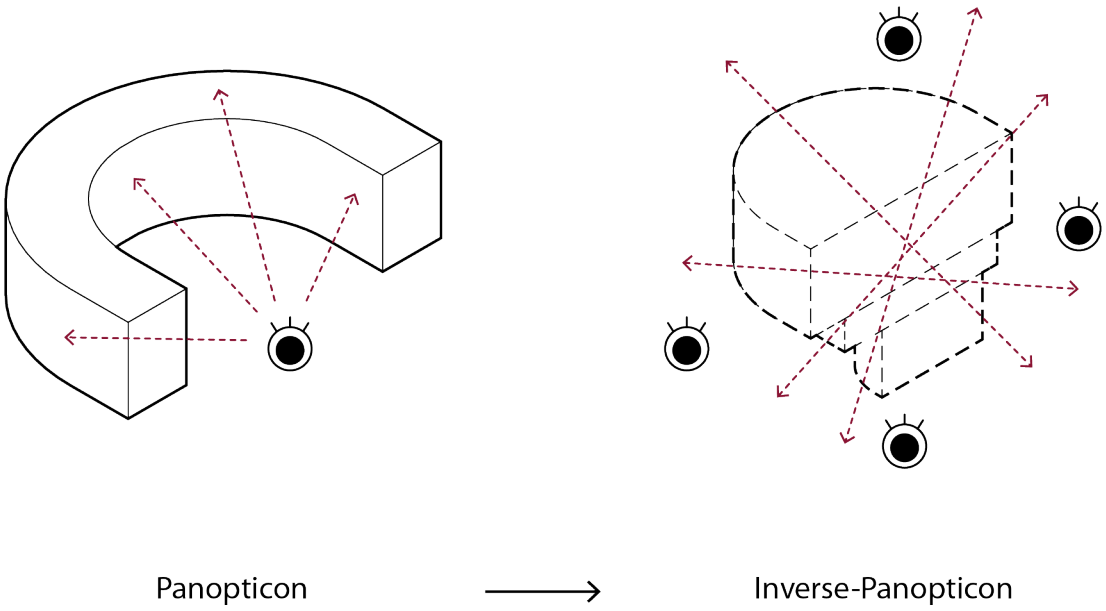
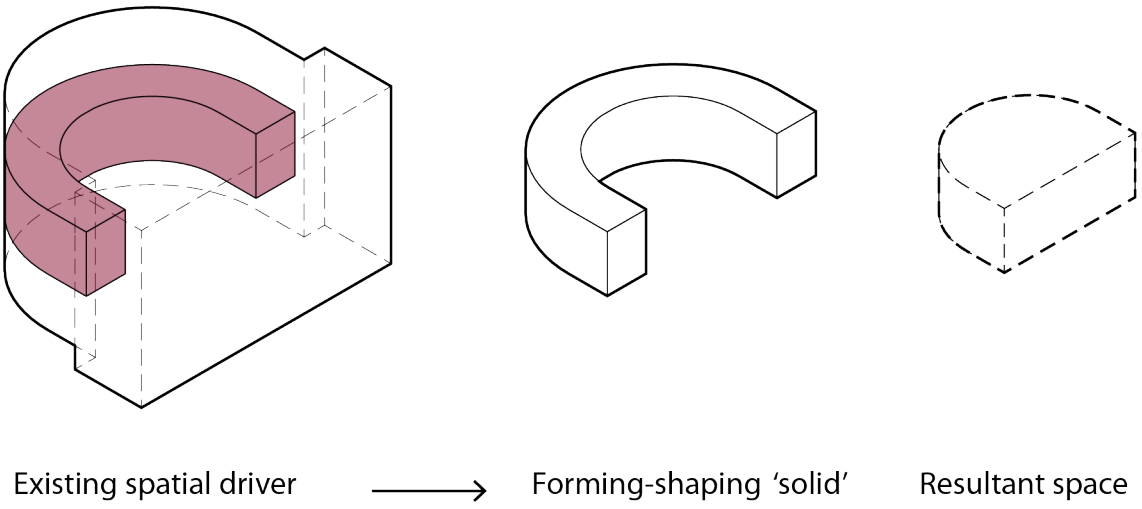


Figure 84: Panopticon becoming inverse-panopticon to change the library's interior visual relationship



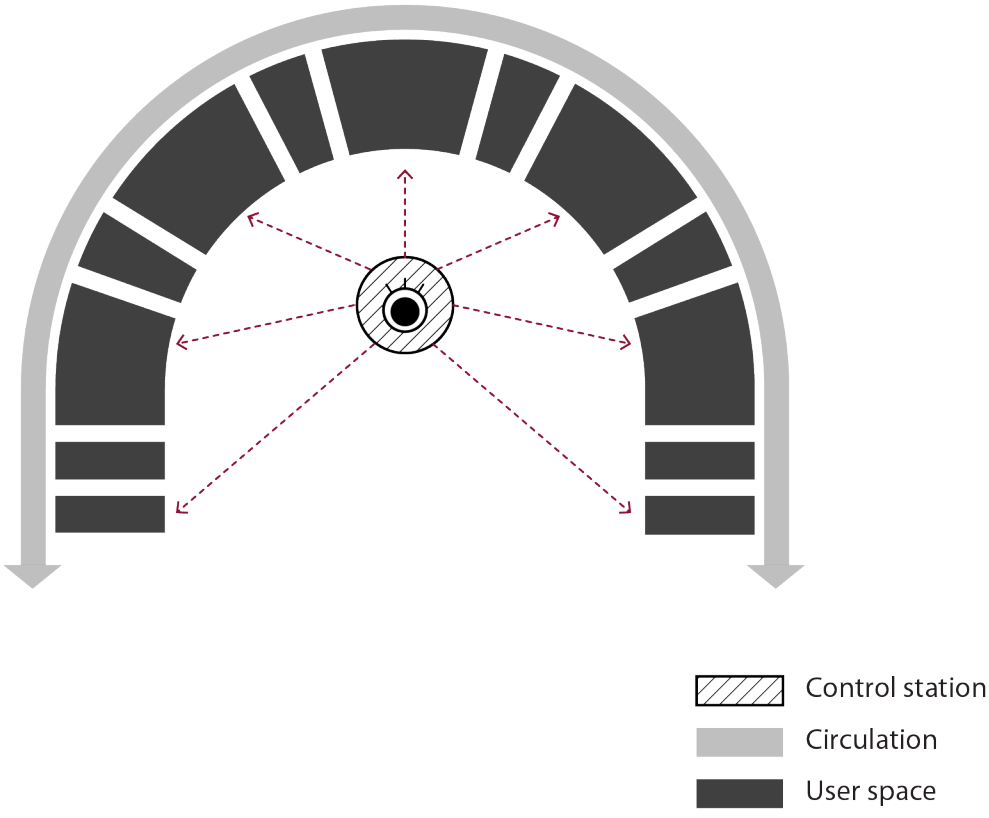


Figure 85: Existing design concept analysis, formation of space by the architectonics of the structural stacks

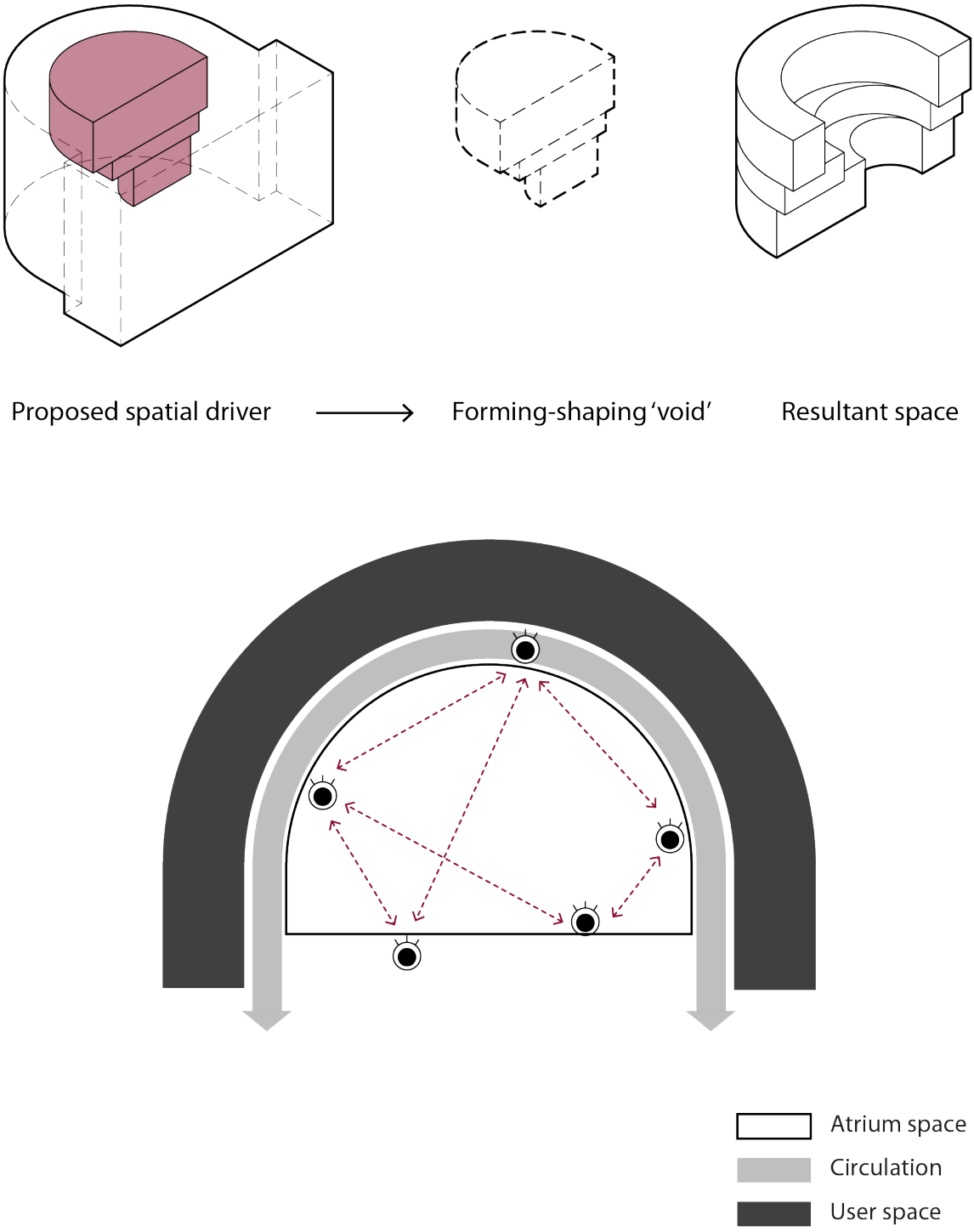


Figure 86: Proposed design concept, formation of space by the volumetric shape of a tiered-atrium

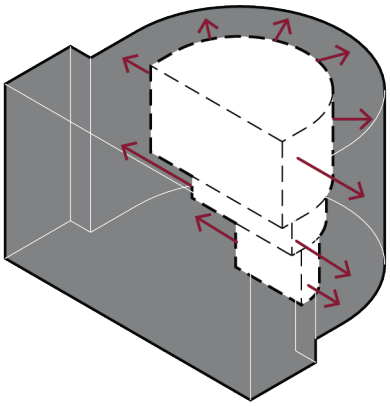


Figure 87: Spatial "driver"

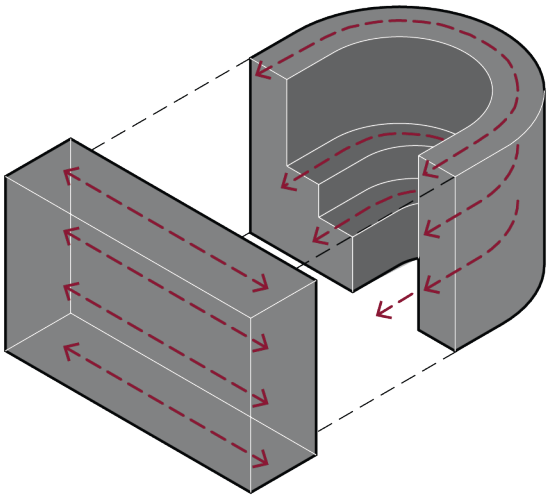


Figure 88: Form-driven flow

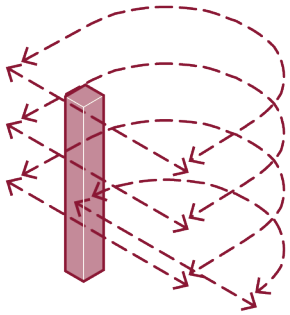


Figure 89: Circulation pattern

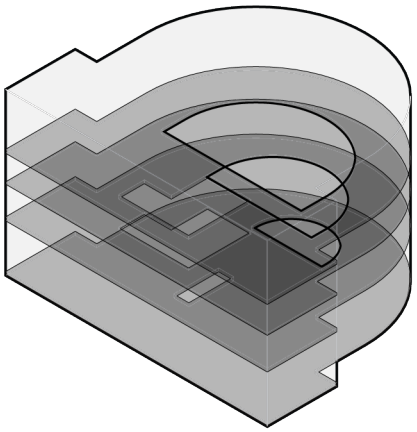


Figure 90: Resultant building interior

space) directly to staff control desk at the centre, the proposed inversion shall relocate user spaces to the building periphery, exposing circulation corridor to the centre where more user space or an atrium space will replace the former control desk. Inheriting the semi-circular geometry of the existing library, the added atrium will volumetrically traverse the entire building, with progressively enlarged opening as floor level increases, forming a tiered-atrium at the heart of the library, which acts as the "driving" agent of the library's overall spatial organization (Figure 85-90).

The position and shape of this tiered-atrium more distinctly emphasizes the contrasting spatial qualities within the library: 1) a visually open semicircular volume containing the majority of library and health literacy resources, such as shared seating/waiting space, regular computer or health research stations; and 2) a more visually and acoustically separated rectangular volume containing the clinic's exam spaces, the library's administrative offices, the conference room and the children's reading room. This tiered-atrium is also intended to function as a social condenser, attracting visitors who enter the library into its semicircular volume, where through visual access they can comprehensively understand the library's spatial and resource content, and be oriented to programs of their interest (Figure 90). As a result, users whose original intention might have been exclusive to either the library or healthcare functions may be inspired to also use the other programs simply due to having acknowledged their availability and convenient access. In the long run, as users continue to benefit from this mixed usage and accept it as a norm, healthcare and health literacy service will be fully integrated, not only as a physical co-location of interacting programs, but also as a prevalent combined scope of activity.

Although many functional programs of Library Plus+ can be technically identified within one key programmatic category, certain are crossovers that intentionally attract mixed user types, creating health literate patients and average individual who proactively engage with their own health and healthcare (Figure 91). Unique to the concept of Library Plus+, these programs are as follows: 1) medical research and self-

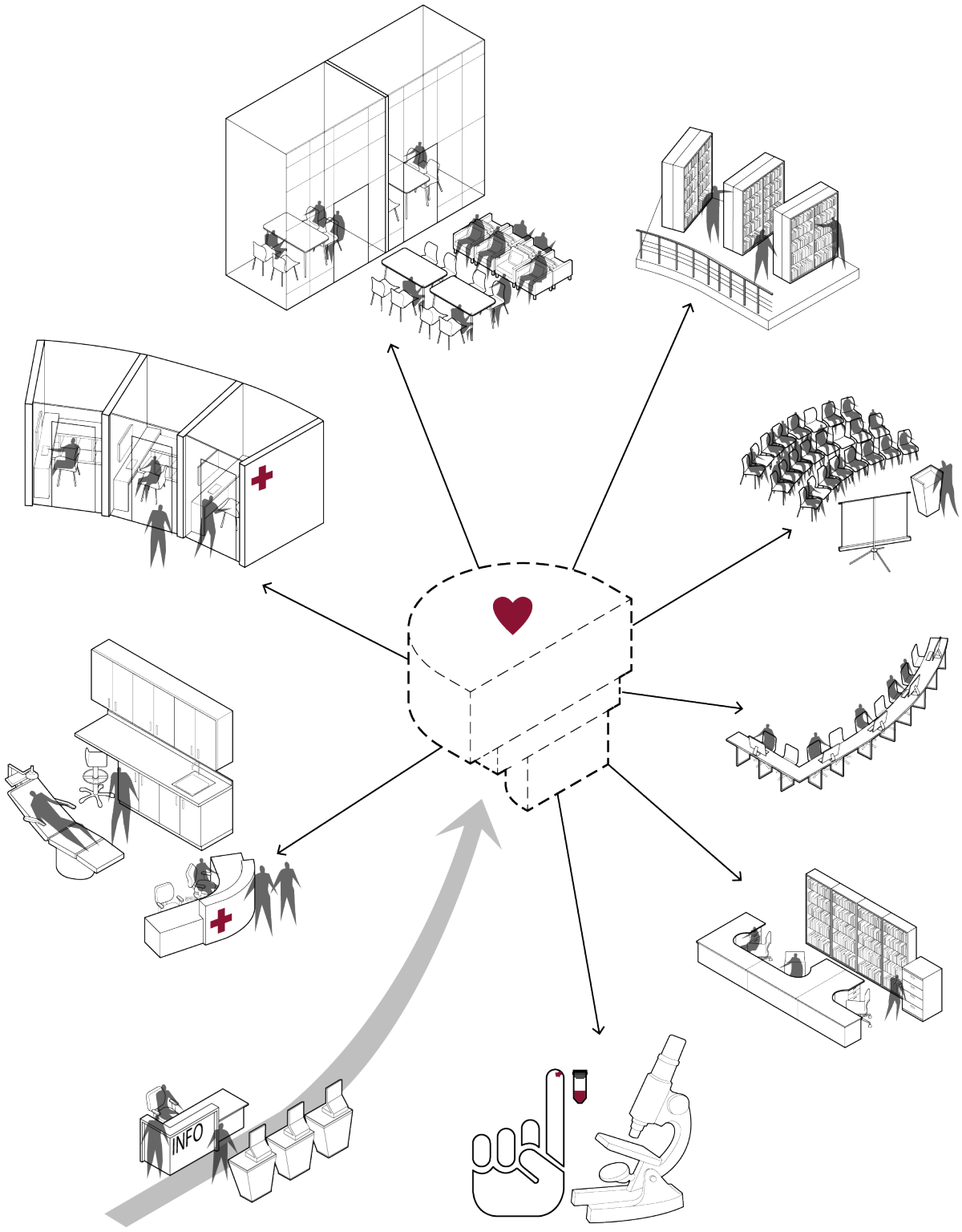


Figure 91: Proposed conceptual layout of essential programs

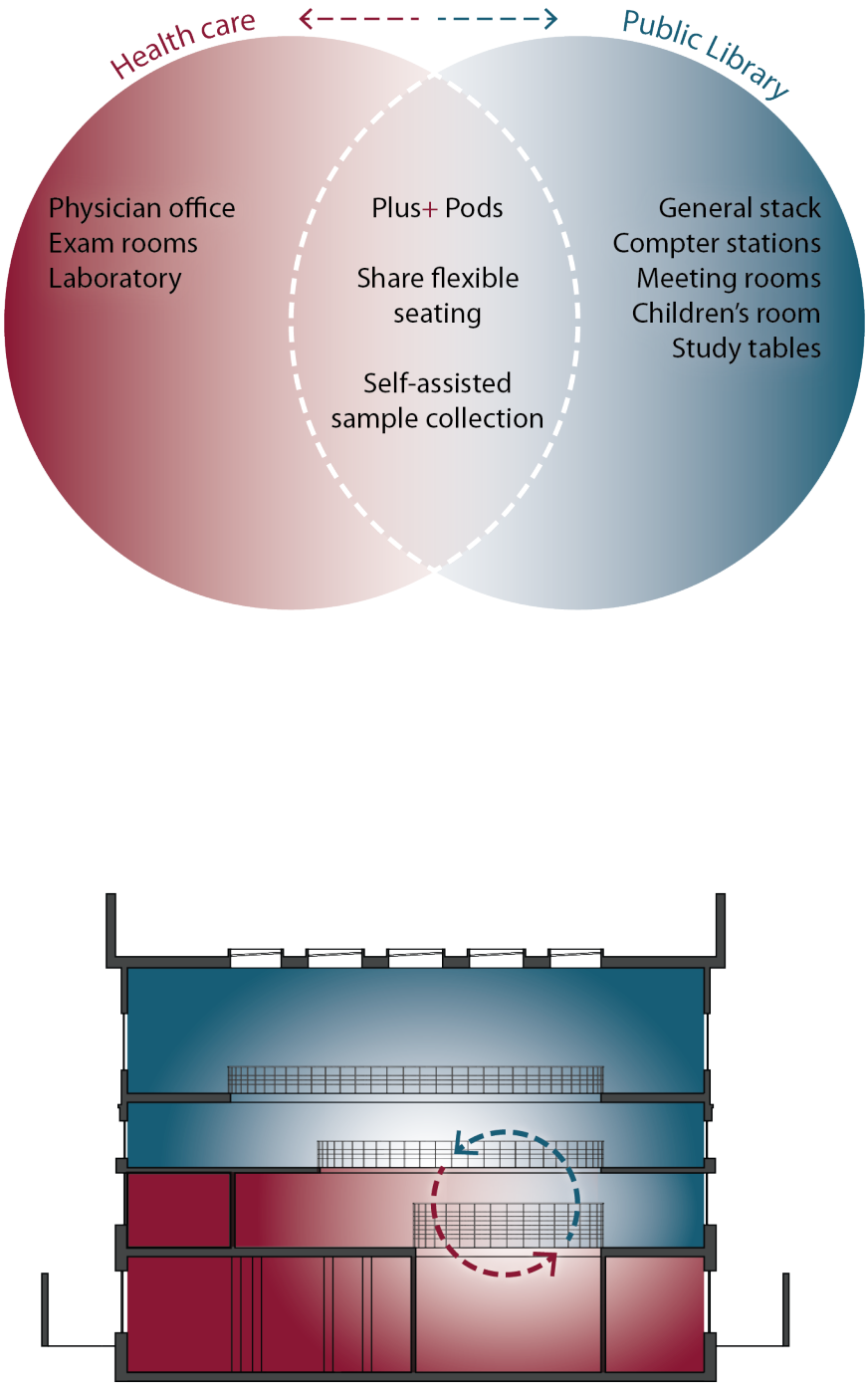


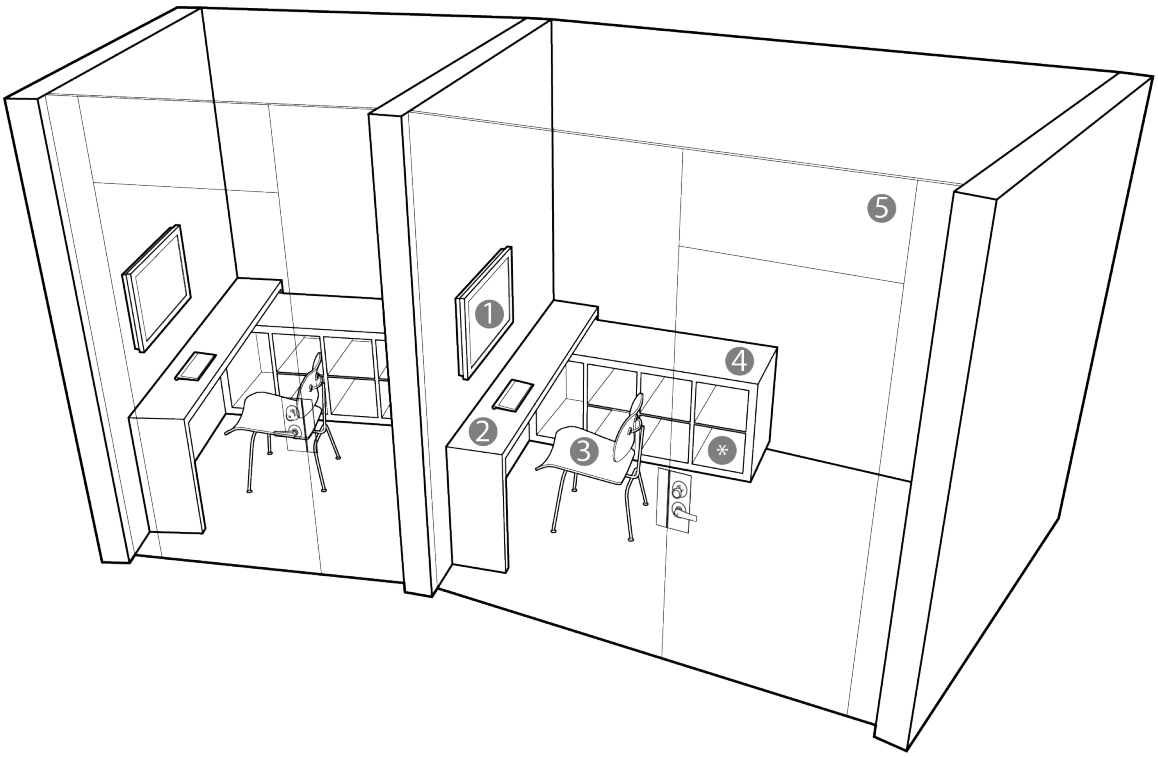
Figure 92: Program crossover between healthcare and public library functions

diagnostic stations – Plus+ Pods; 2) Flexible seating area that serves both as general reading space of the library function, and as waiting room for the clinic function; and 3) Self-assisted laboratory sample collection area.

3.2.1 Plus+ Pods

Inspired by the case study of WebMD and Dr. Watson, Plus+ Pods are enclosed individual stations containing a computer research terminal with plug-in medical diagnostic equipment. In addition to enabling users to conduct health-related research from reliable resources curated by the public library and its affiliated information providers, these Plus+ Pods enhance users' healthcare understanding through the use of medical diagnostic equipment such as blood pressure monitor, pulse oximeter, ECG machine etc. As more mobile and user-friendly diagnostic equipment become technically available, they can be implemented into these Plus+ Pods, creating a kinesthetic learning environment for "expert patients" who are not only able, but also willing to self-curate their own healthcare events to a more advanced degree (Figure 93).

Virtually connected to healthcare informatics networks, while helping care recipients obtain general medical knowledge and personal health status, the Plus+ Pods also act as collection terminals of healthcare data. With proper identification and de-identification, crucial data can be compiled for the better interpretation and anticipation of a community's future healthcare needs. Through these Plus+ Pods and their combined usage with the clinic and laboratory services, Library Plus+ becomes an effective generator of information that is publicly owned and universally available. Furthermore, information retained or generated as a result of Plus+ Pods' operation will be continuously supplied back into the system's informatics database, as newly acquired knowledge to update the existing. Thus, the resource capacity of the Plus+ Pods will always be expanding, becoming more capable to help medical professional or expert patients who use them for both research and automated diagnosis.



1 **Plus+ Terminal**
- Wall-mount computer with
- Audio-visual input and output
- Connection ports for plug-in diagnostic equipments

2 **Working Surface**
- Abuse-resistant, microbial surface
- Keyboard/mouse/input devices

3 **Single seat**
- Generic chair
- Wheel chair turning radius for accessible Plus+ Pod

4 **Shelving Unit**
- Configurable shelve dimension
- Storage space for diagnostic equipements

5 **Enclosure Glazing**
- Electric privacy film
- 75% selective transparency during pod occupancy and usage

* **Diagnostic Equipment**
- Implemented to Plus+ Pods as needed and based on technological availability
- Replaceable unit types
- Mobile equipment dimension
- Connection to Plus+ Terminal
- Example: blood pressure monitor, pulse oximeter, ECG and EEG machine, mobile ultra-sound unit, thermography machine, PeeK Vision eye exam equipment etc.

Figure 93: Plus+ Pods components breakdown

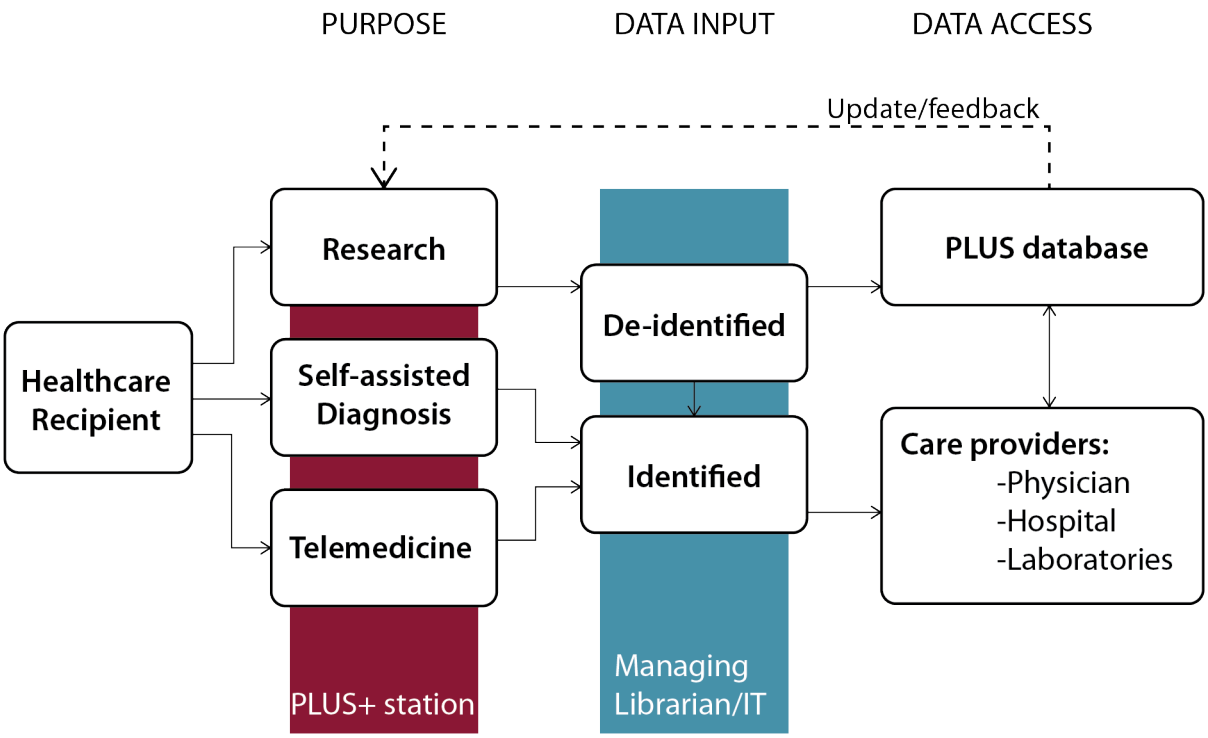


Figure 94: Plus+ Pods medical data collection process

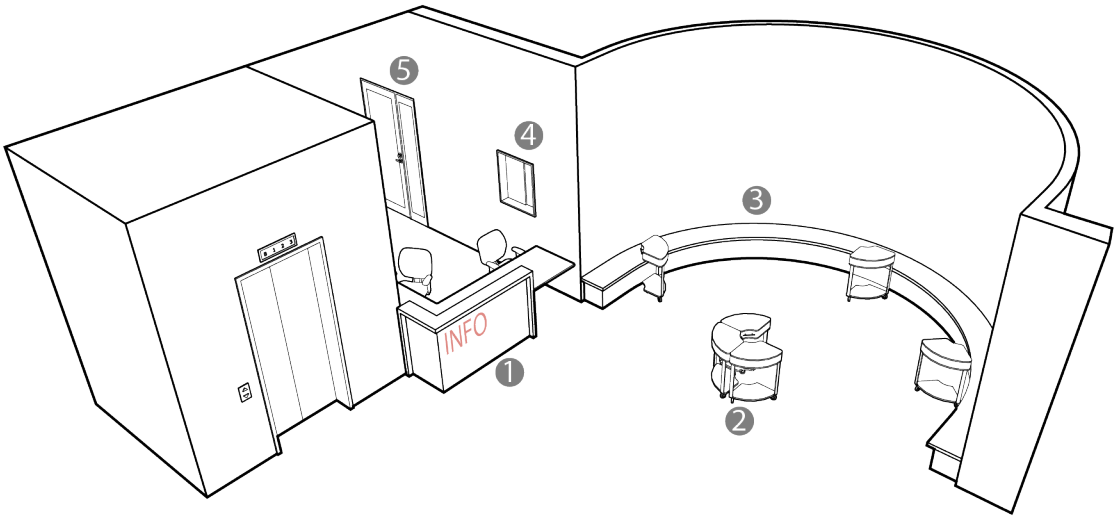
3.2.2 Shared flexible seating

Despite having similar furniture arrangement to the existing library's general reading space, this shared flexible seating area proposed as one of the crossover spaces for Library Plus+ is a primary platform that mixes library users and healthcare users before they become the same individuals. Located on the ground floor and immediately adjacent to the tiered-atrium, it is architecturally an open space that could accommodate various types of seating such as worktables and bench seating. Functionally, it is a threshold that stages visitor's access to the clinic, the Plus+ Pods, the laboratory as well as the library function.

Library-only users may continue to occupy these seating as a shared user space for reading, while healthcare users, patients in particular, are likely to enjoy its socially engaging atmosphere compared to the typically dreary clinic waiting room. By dissolving certain aspects of the former clinical activities within a public library setting, not only can positive distractions be provided to healthcare recipients during their visit to the integrated community clinic, but also and more importantly, an extended range of healthcare clinical activities maybe normalized as part of any individual's average-day routine.

3.2.3 Self-assisted Sample Collection

The case study of Theranos technology has implied the user-friendliness of future laboratory service, and the feasibility of patients self-directing certain portion of medical diagnostic such as fluid sample collection. As the finger-prick method largely reduced the skill level required to obtain blood samples, informed patients would be able to adequately perform the collection procedure with minimal guidance from registered nurses or laboratory technicians. Based on the advertised key features of Theranos, the sample collection process that is more uncomplicated than a flu shot has rather few spatial requirements, and can be accommodated in less private settings. Library Plus+ design proposal for BPL Pacific branch locates this self-assisted collection space at the base of the tiered-atrium, visible from other parts of the library yet not particularly demanding attention. Through



1 Laboratory Reception
- Information desk/ administration
- Lab staff workstation
- Container dispensing/submission

2 Utility Tables
- Work surface
- Tool drawer: gloves, misc. accessory, hygiene supplies

3 Semi-circular Seating
- Self-assisted sample collection area

4 Pass-through Window
- Sample transfer

5 Main Lab Entry
- Staff access

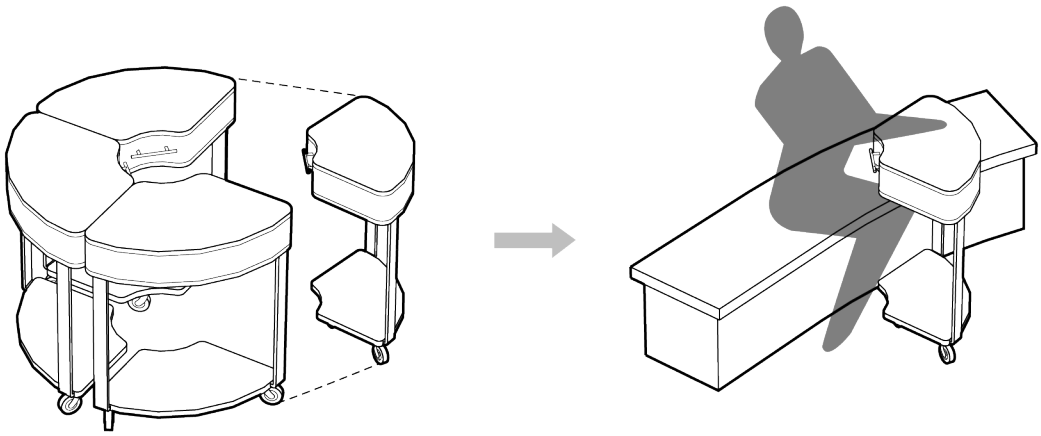


Figure 95: Self-assisted laboratory sample collection area

such openness, the user-friendliness of self-assisted sample collection activity is demonstrated to its potential audience, encouraging growing participation (Figure 95).

Being key components of Library Plus+, these three spaces encourage user access and interaction at any point during conventional consultation process with medical professional, as well as during the individual's self-initiated, exploratory health research. In practice, such user access could eliminate the time expense of physicians sending patient to outbound diagnostic and laboratory facility for specific test results, and the inconvenience of expert patients obtaining health information, prescription for lab test and the actual lab test all at different locations. Reflecting one of the design intents of Library Plus+, in using these functions now available at the existing public library facility, care recipients gain the opportunity to be active and to make their clinical wait time meaningful to their health and healthcare.

3.3 Library Plus+ Design Development

Considering the spatial content of the existing BPL Pacific branch, the typical components of independent community clinic and laboratory, as well as the extrapolated crossover programs specific to Library Plus+ integration, the following adjacency matrix is proposed to structure the relationship between various program spaces (Figure 96-97). The four key program categories are first divided based on user audience: laboratory and data center that primarily engage staff activities, and clinic and library that engage common visitors. Within each category of spaces, preference for physical proximity is established based on current standard of practice. For instance, the organization of the clinic suite follows conventional staging of patients, from clinic reception to waiting, and to physician's office or private exam rooms with controlled entry. Likewise for the laboratory, without available information on the precise functional requirements of a service such as Theranos, the proposed spatial composition is a theoretical interpretation of medical laboratory facilities in general, accounting the process of registration, sample collection and receiving, and internal lab work. Crossover programs that are

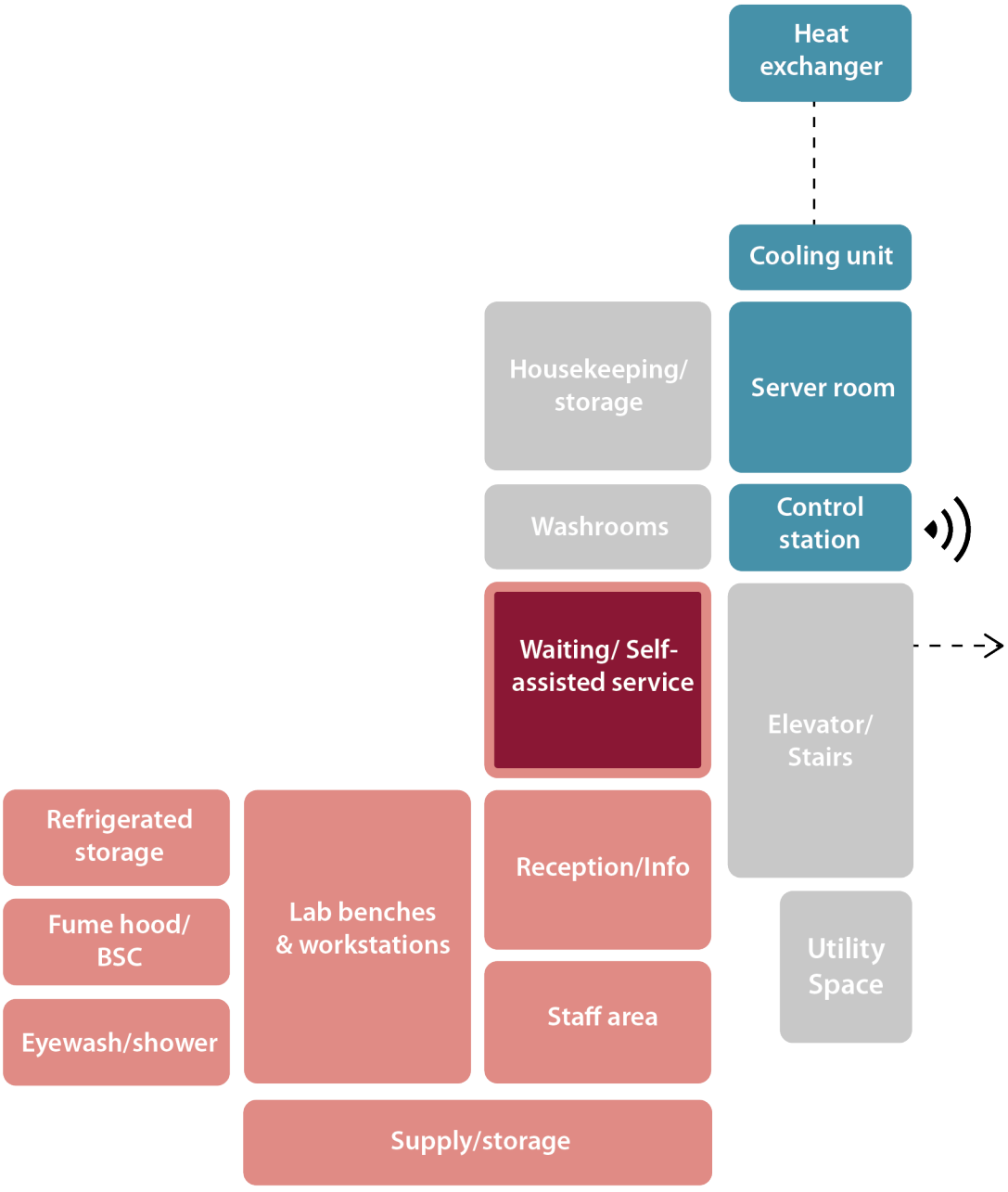


Figure 96: Proposed program adjacency matrix, laboratory and data center

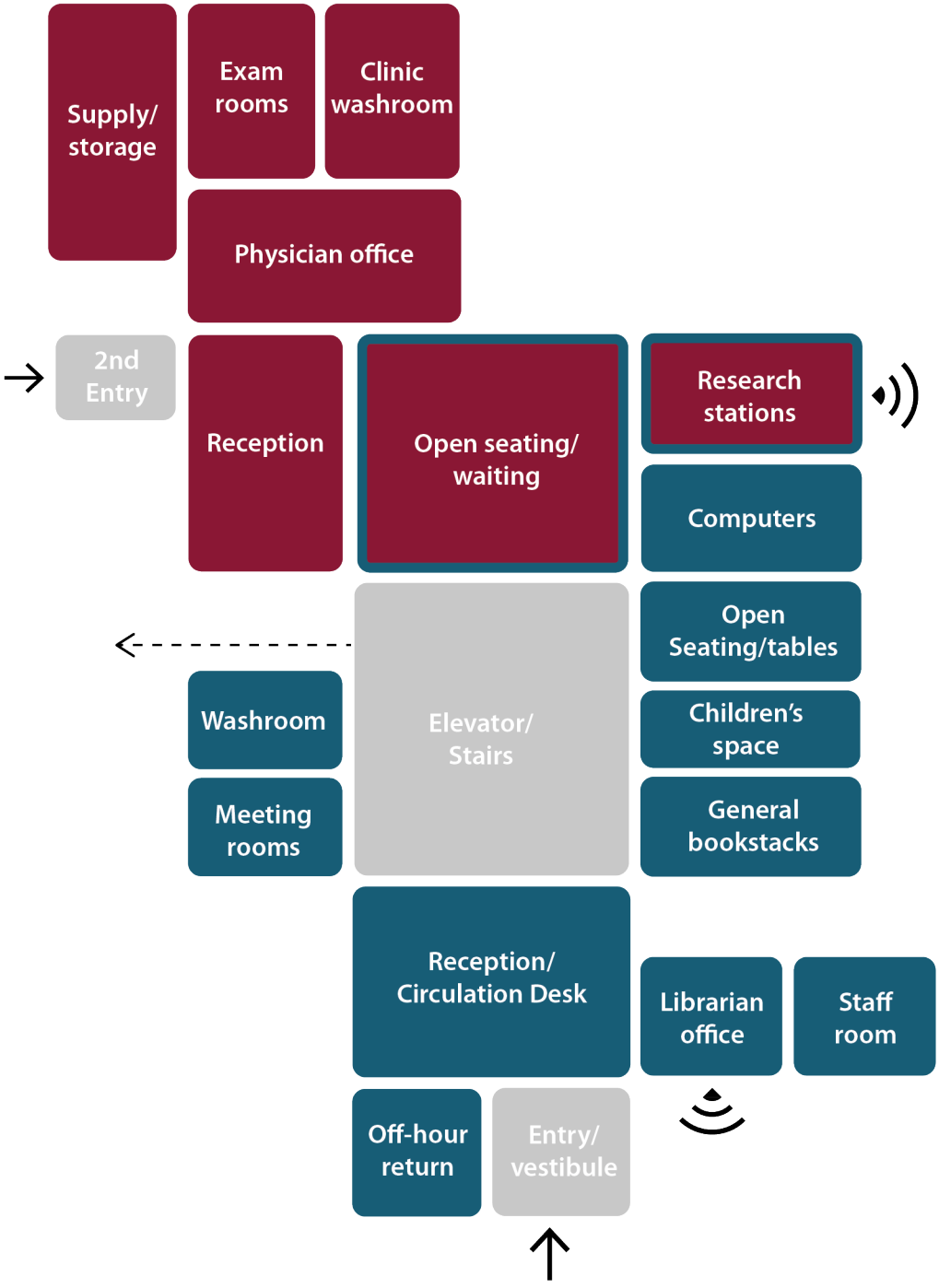


Figure 97: Proposed program adjacency matrix, public library and community clinic

meant to initiate active interactions between major program categories are positioned interstitial to relevant categories, providing either direct physical connection or indirect connection through vertical circulation.

A prototypical application of this adjacency matrix to the Pacific branch library renders an intuitive spatial allocation of key program categories between four available floor levels. Laboratory, data center and general building facility spaces that anticipate limited number of visitors are located in the basement, with separate staff entry and alternative patient entry from exterior. Community clinic, digital resources of the library and the library's administration that expect to receive the majority of visitors are located on the ground floor, with the intention to immediately engage users arriving from the street. The remainder top two levels maintain typical public library functions, assigning spaces of higher acoustical volume below those that prefer quietness.

In addition to projecting the programmatic needs of Library Plus+, the execution of the proposed design strategy recognizes the restorative nature of renovation as opposed to new building replacement. It therefore attempts to take maximum advantage of existing conditions in order to perform minimum amount of change in actual construction, while still transforming the library's interior space for a much-improved spatial functionality. The proposed restorative renovation measures include: recovering the original basement exterior windows, providing new window wells for better basement daylighting, and maintaining the majority of existing structural components (with the exception of structural bookshelves). While these help preserve the architectural characters of the existing library building, a few additive or reformative renovation measures are inevitable to resolve the library's practical challenges such as wheelchair inaccessibility and limited visibility between certain occupied spaces. These additive or reformative measures include: introducing elevator shaft to vertically connect all floors, creating floor opening on ground and existing second (new third) floor plate, rebuilding existing mezzanine floor, and providing roof skylights and an accessible ramp at the front

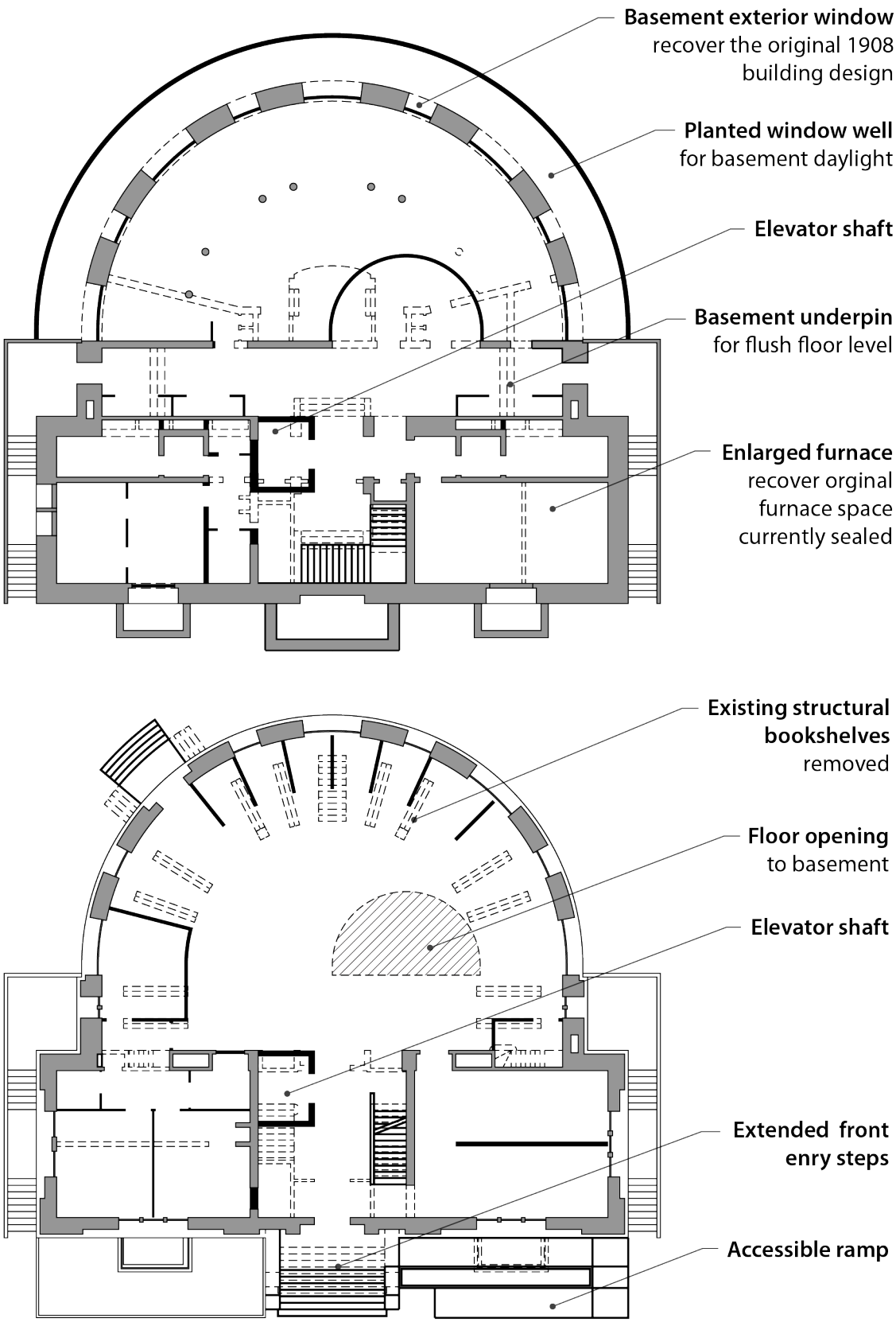


Figure 98: Renovation plans. Basement (*top*) and ground floor (*bottom*)

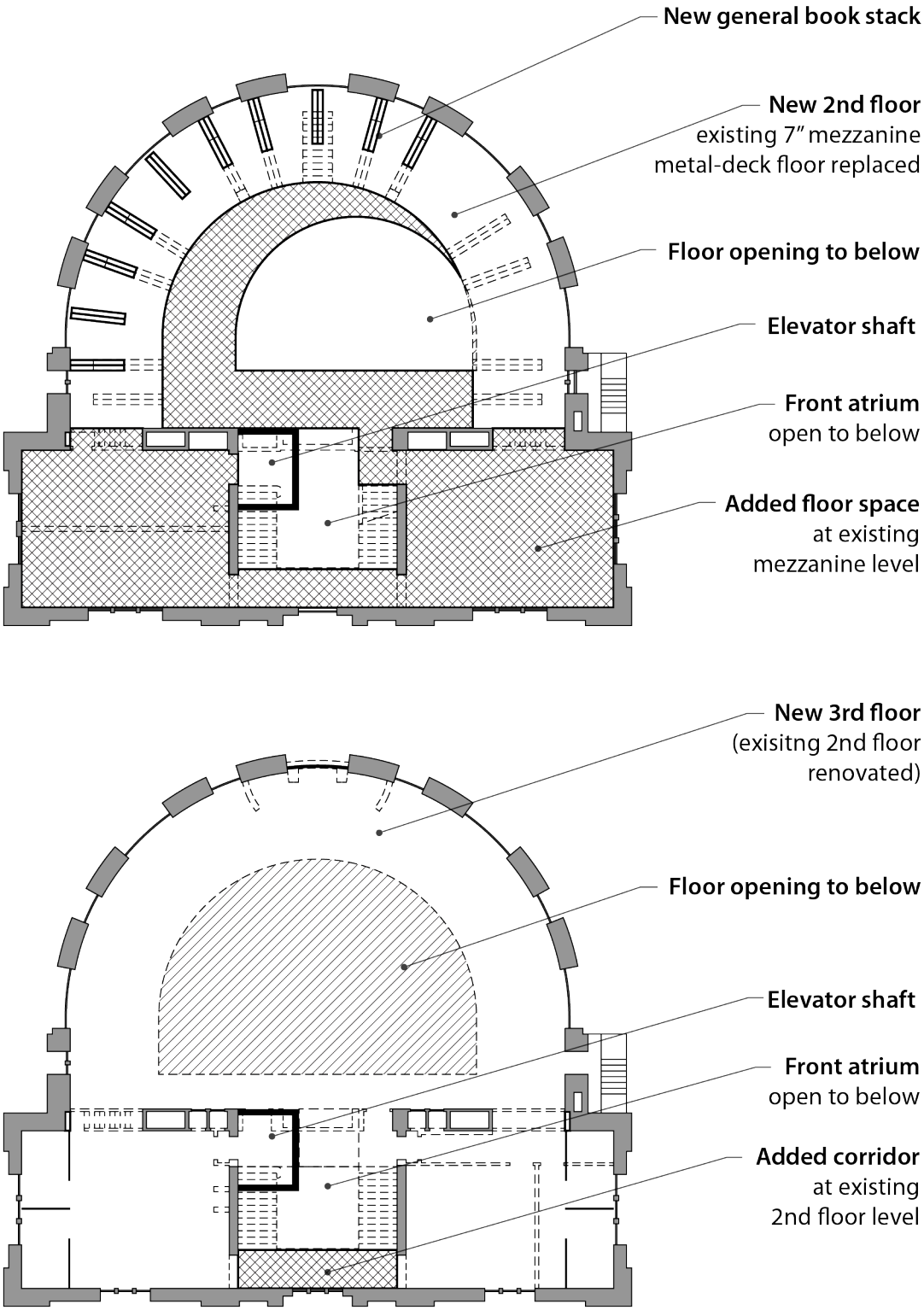


Figure 99: Renovation plans. New second floor (*top*) and new third floor (*bottom*)

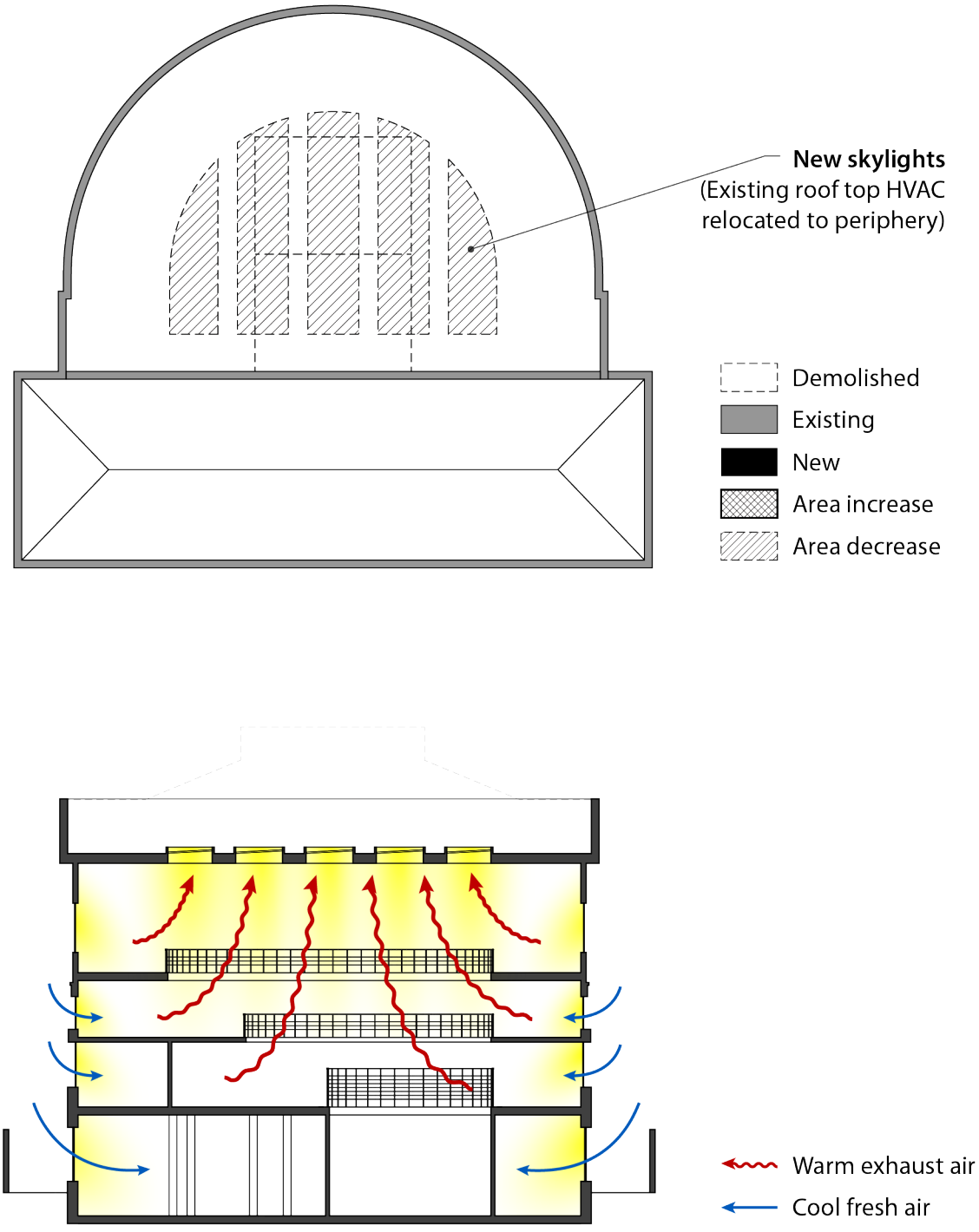
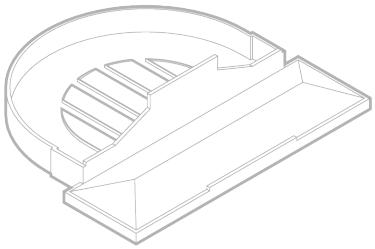
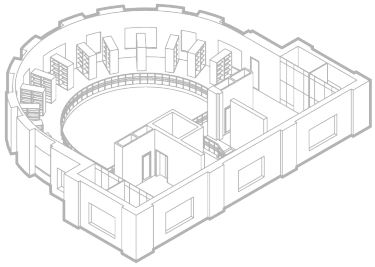
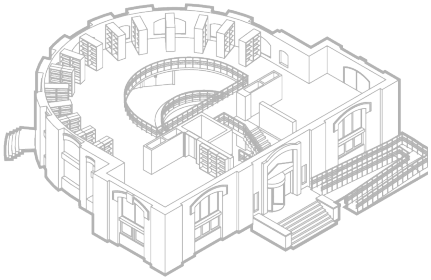
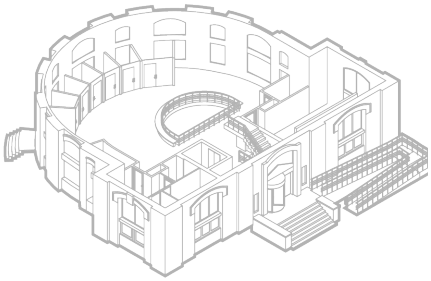


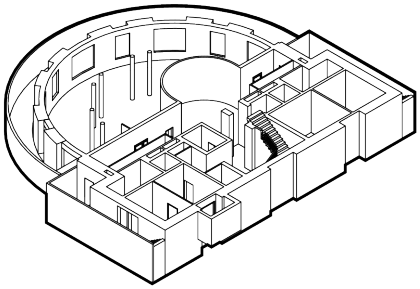
Figure 100: Renovation plans. Roof plan (*top*) and diagrammatic section (*bottom*)

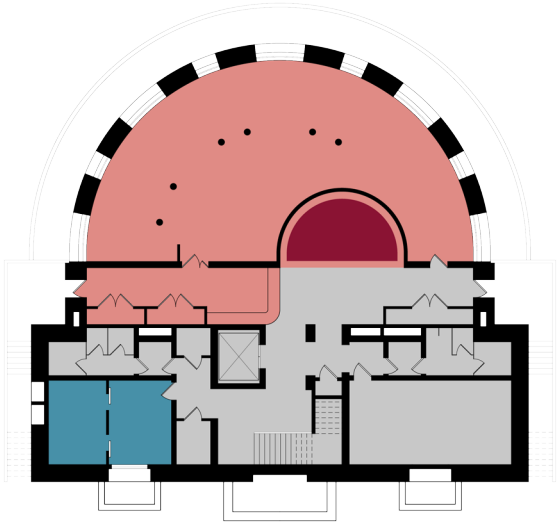












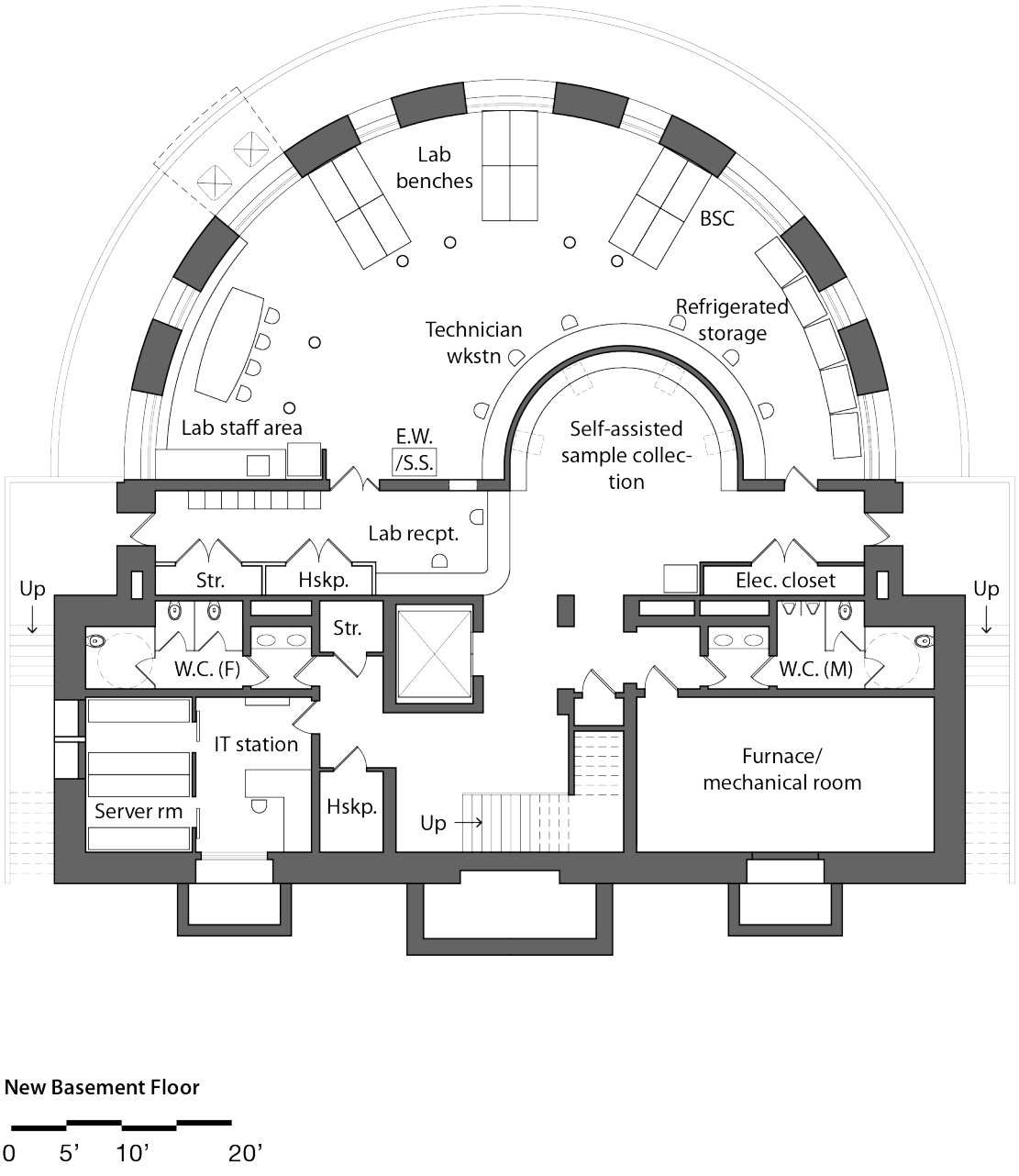
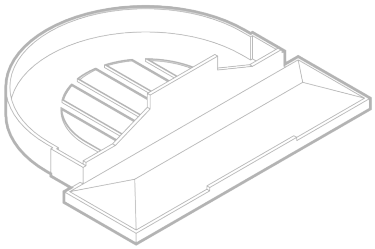
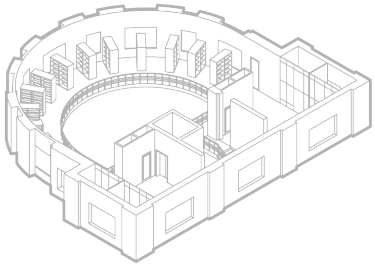
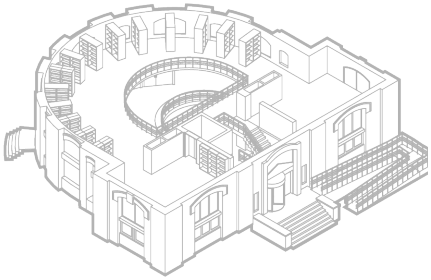
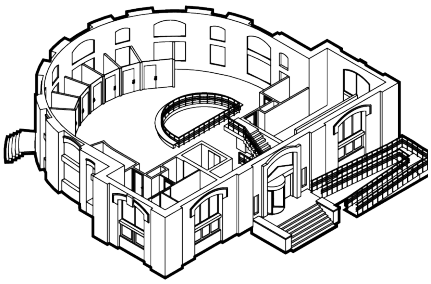


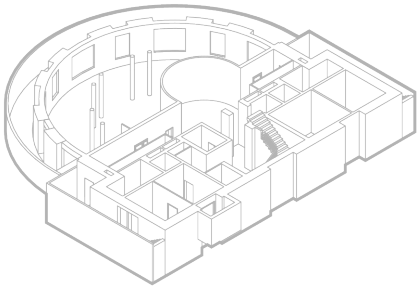
Figure 101: Library Plus+ basement plan, with program zoning diagram

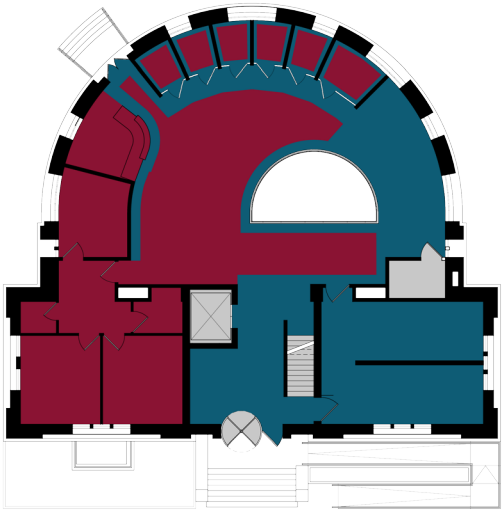












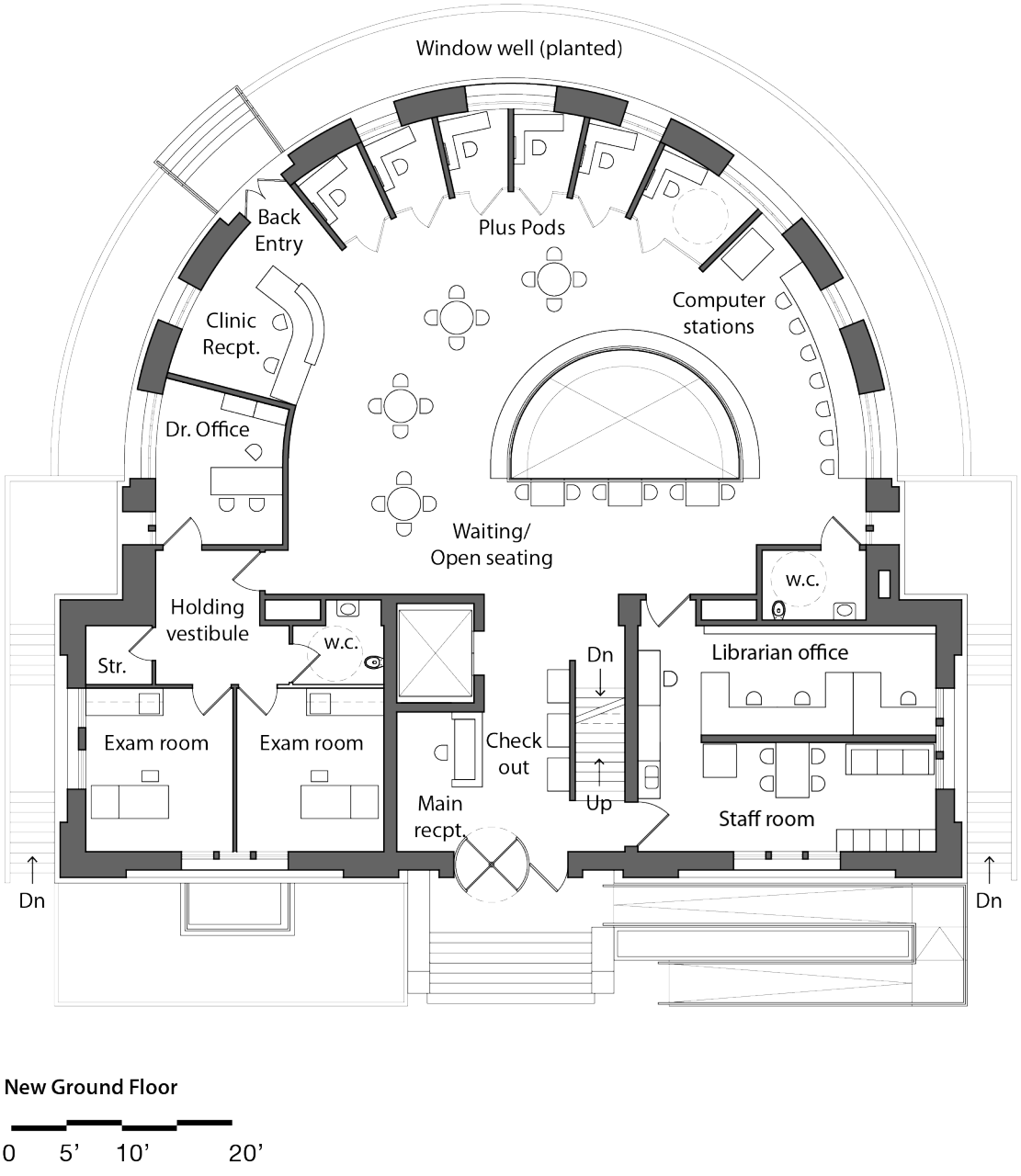
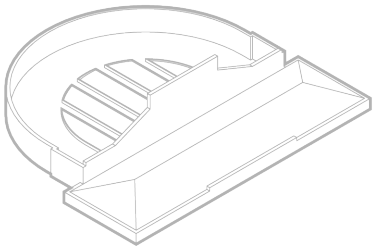
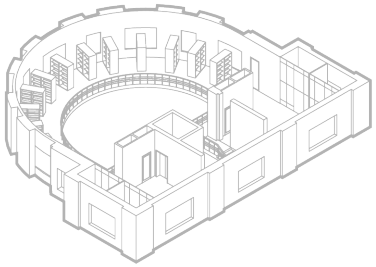
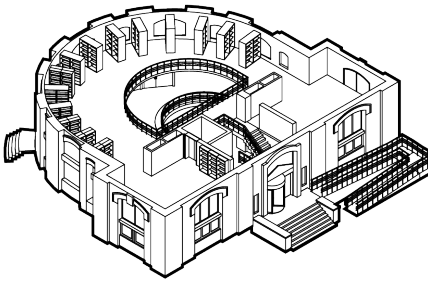
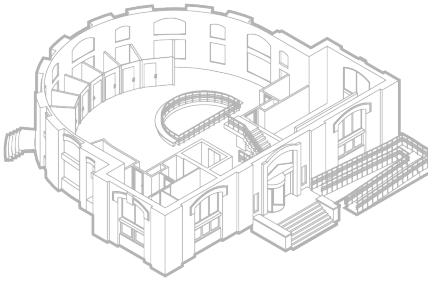


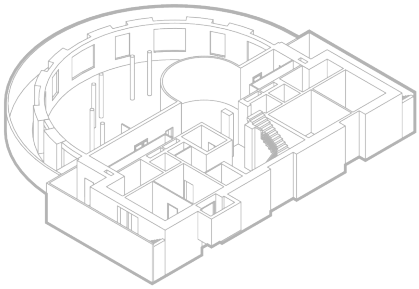
Figure 102: Library Plus+ ground floor plan, with program zoning diagram

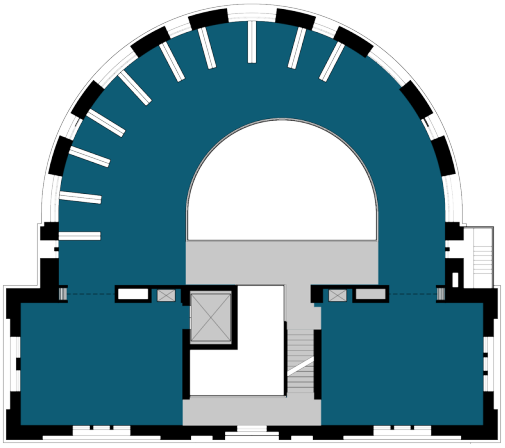












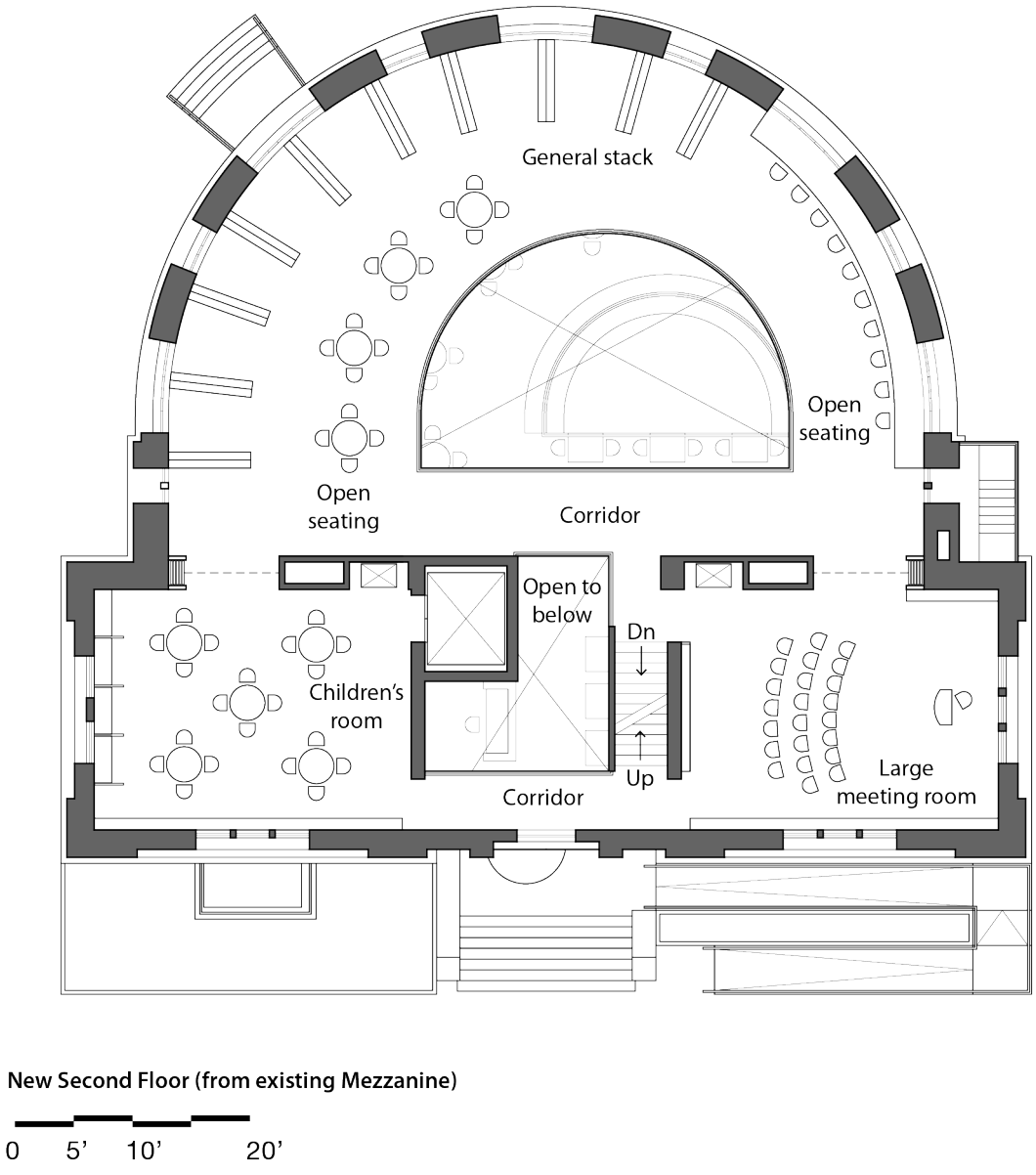
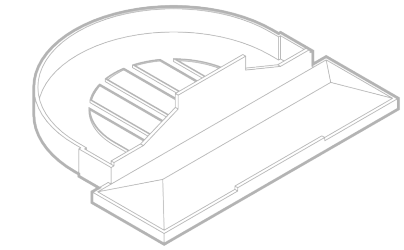
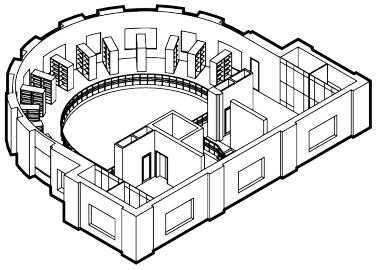
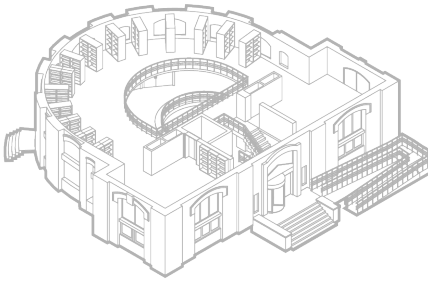
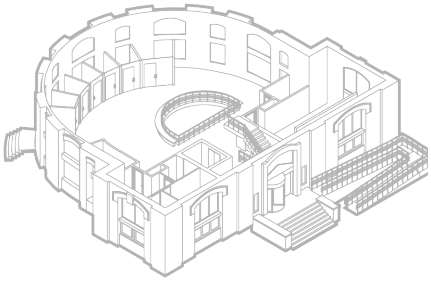


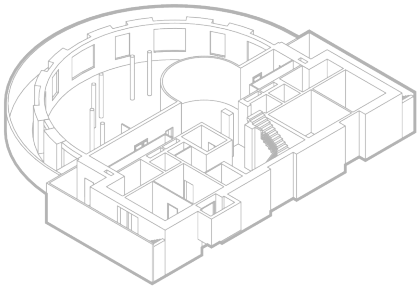
Figure 103: Library Plus+ second floor (existing mezzanine floor) plan, with program zoning diagram

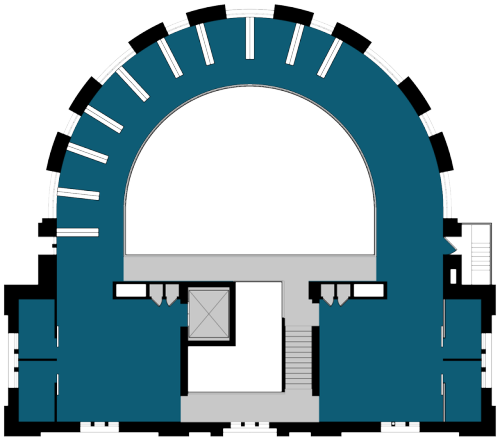












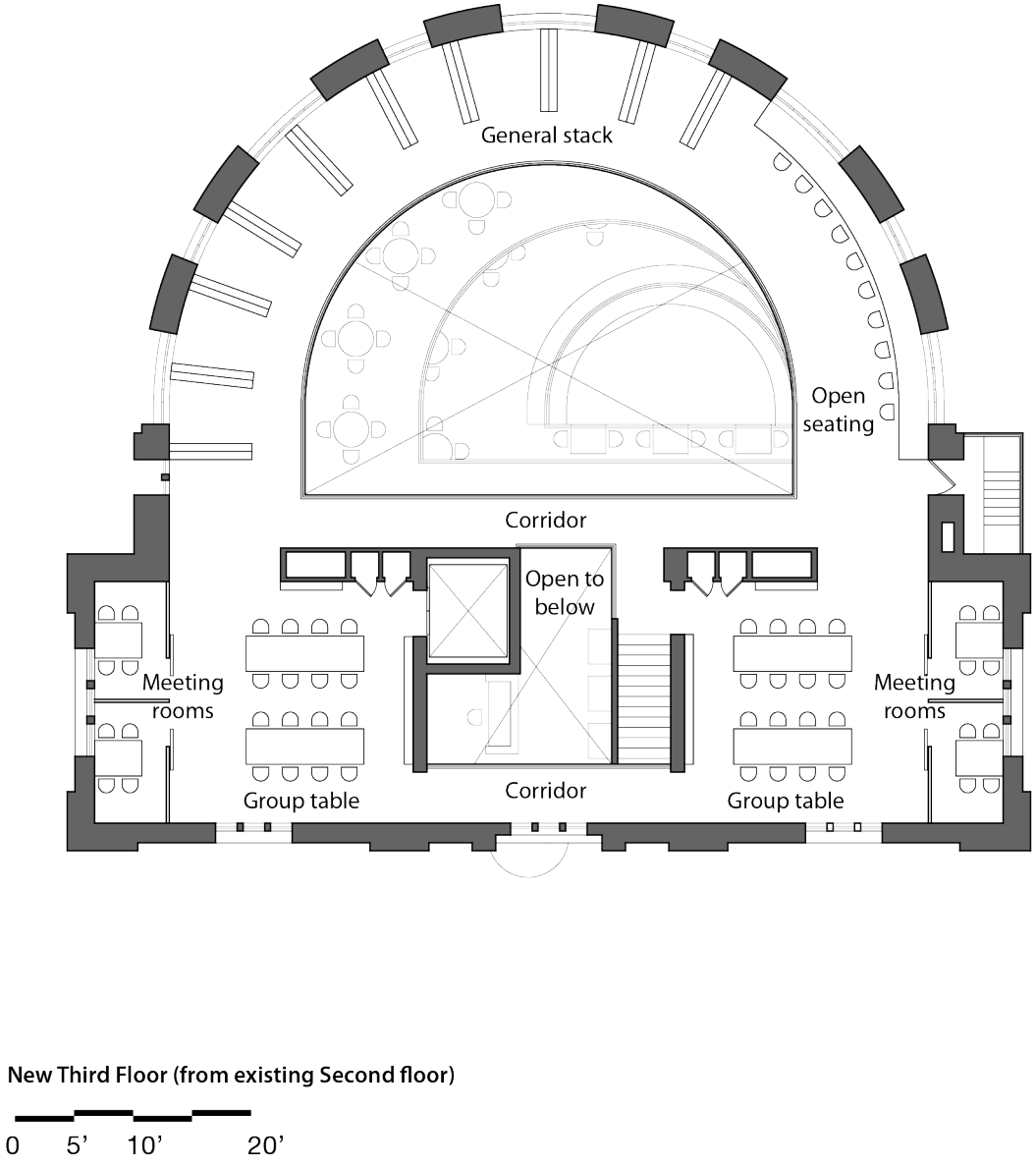
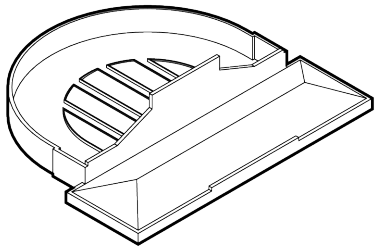
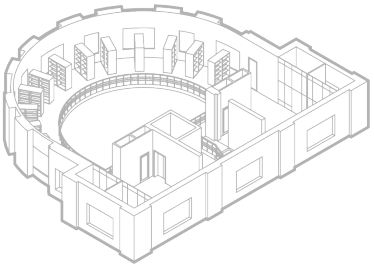
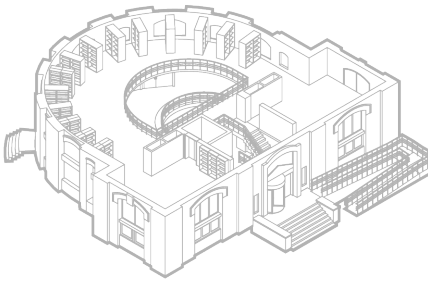
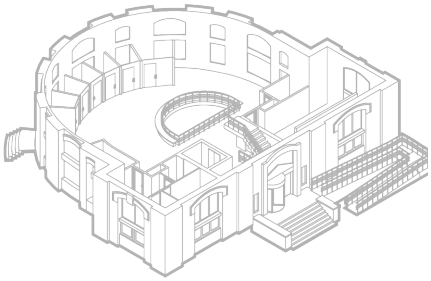


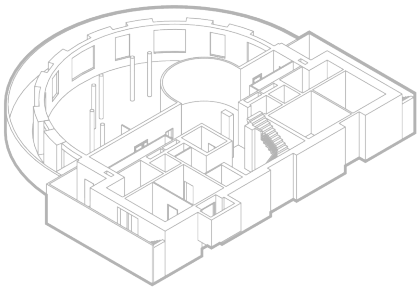
Figure 104: Library Plus+ third floor (existing second floor) plan, with program zoning diagram











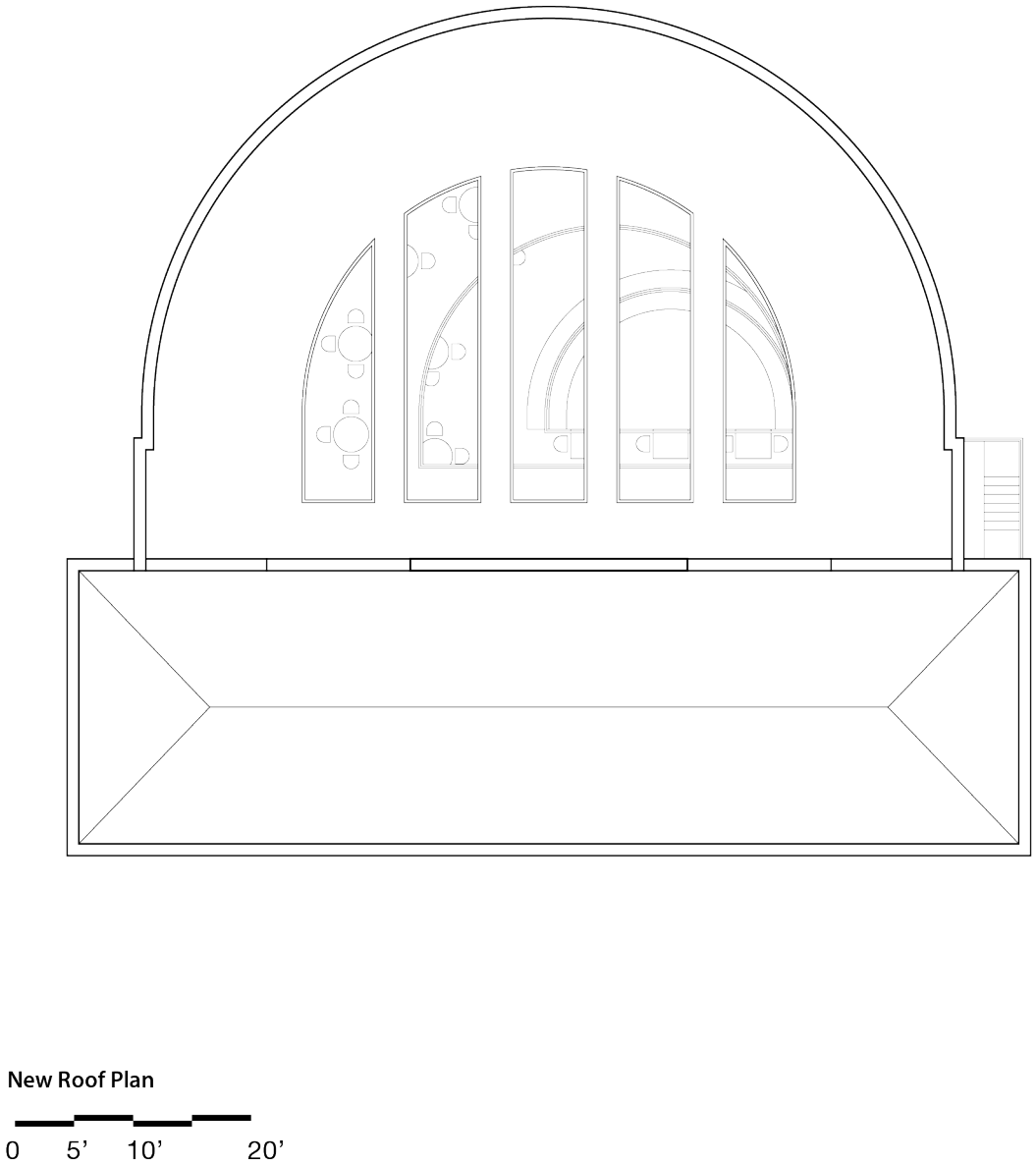
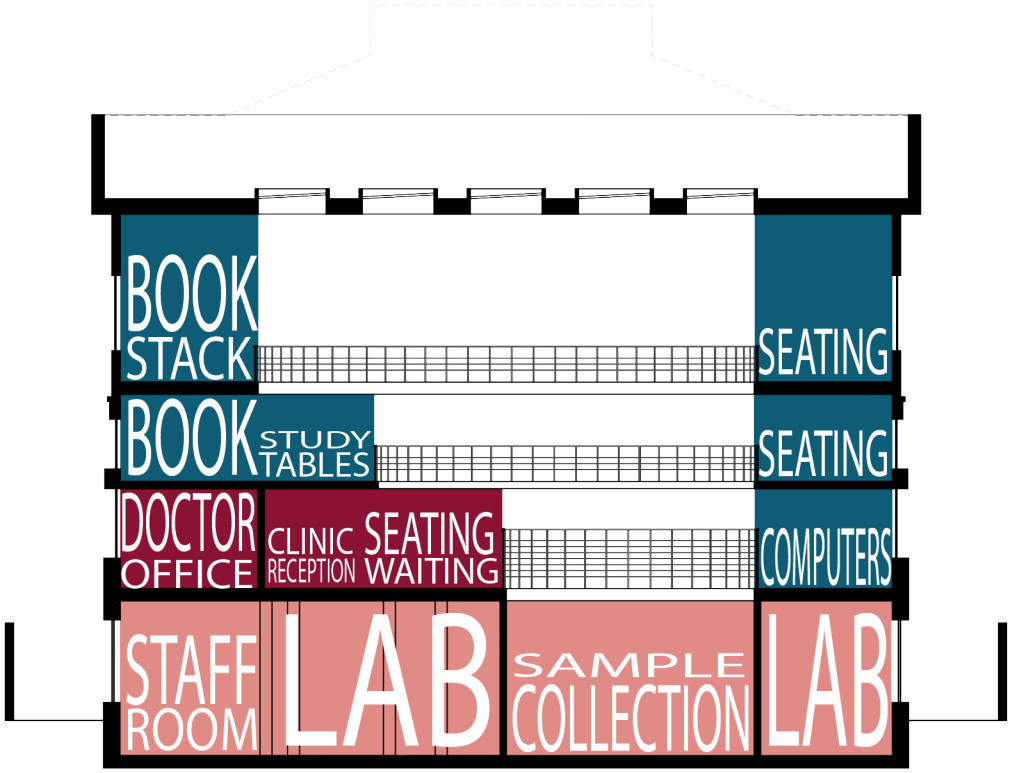


Figure 105: Library Plus+ roof plan showing new skylights


BOOK STACK
SEATING
BOOK
STUDY TABLES
SEATING
DOCTOR OFFICE
CLINIC RECEPTION
SEATING WAITING
COMPUTERS
STAFF ROOM
LAB
SAMPLE COLLECTION
LAB

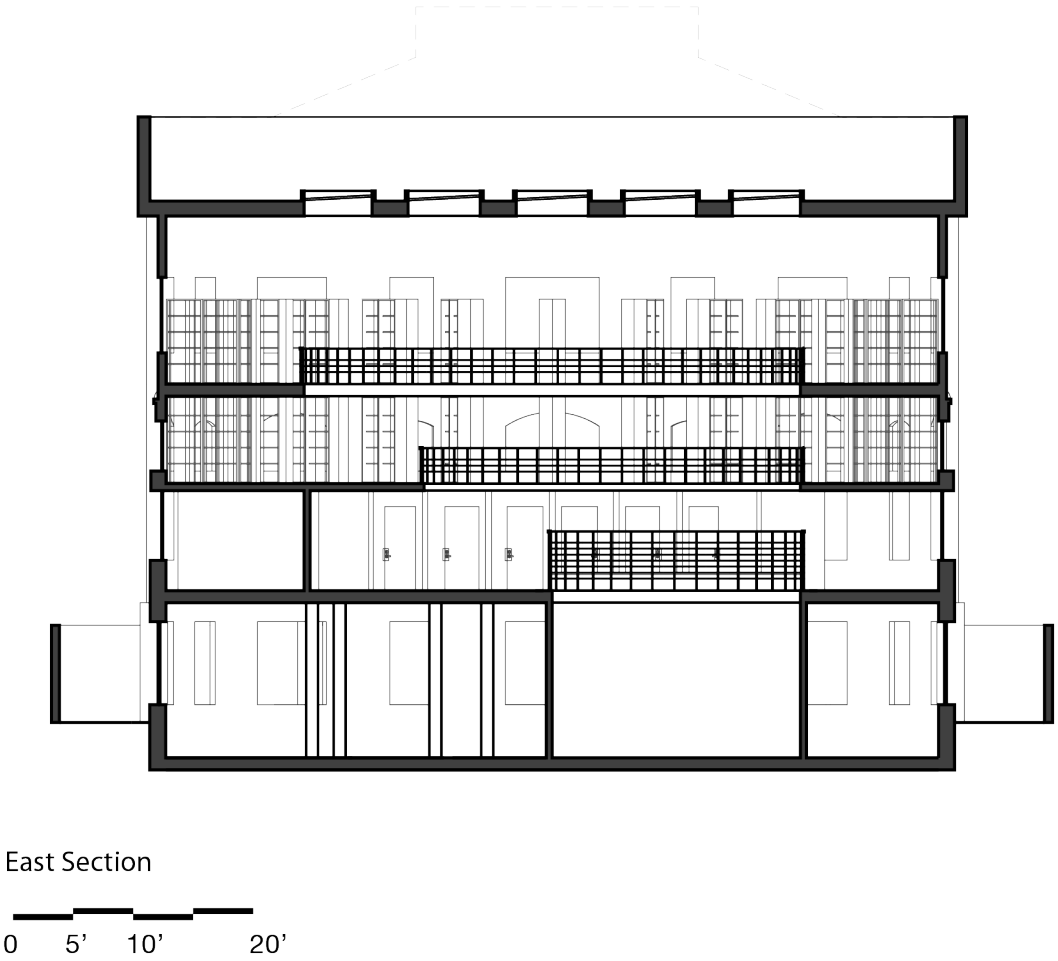
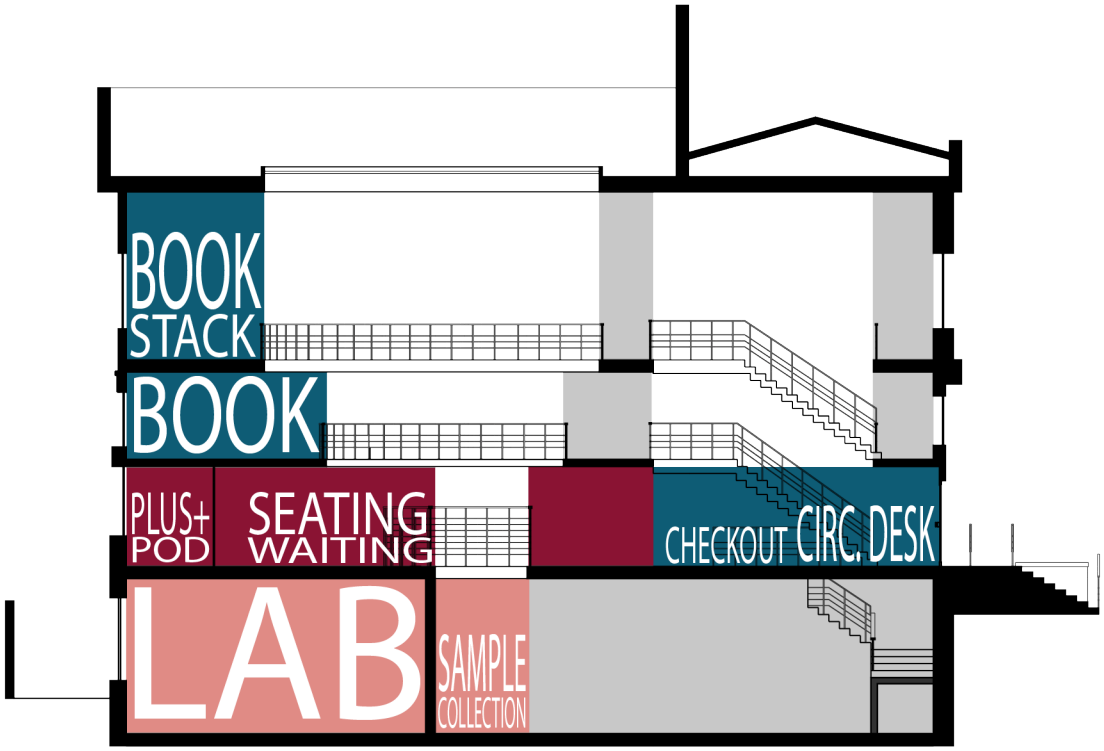


Figure 106: Library Plus+ east section, with program zoning diagram


BOOK
STACK
BOOK
PLUS+
POD
SEATING
WAITING
CHECKOUT
CIRC. DESK
LAB
SAMPLE
COLLECTION

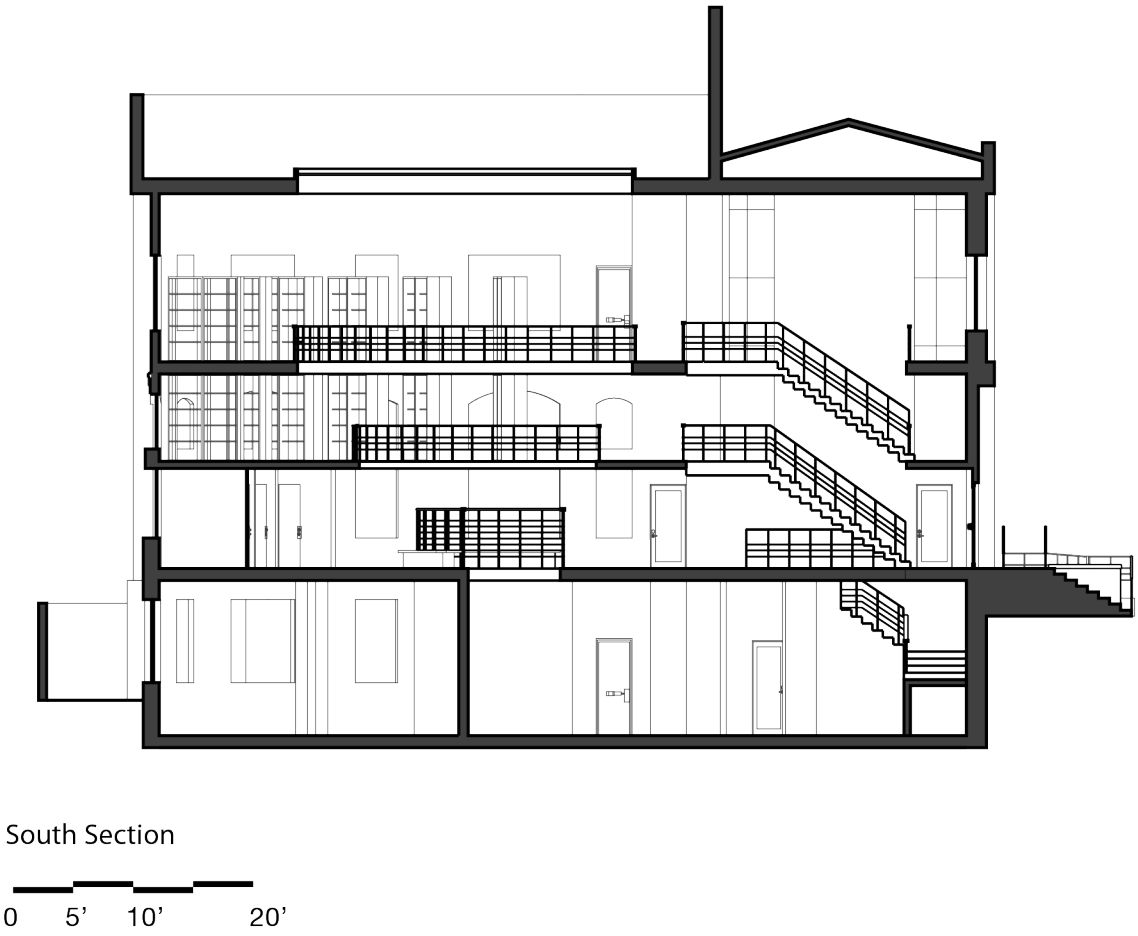


Figure 107: Library Plus+ south section, with program zoning diagram

PROGRAM		LEVEL	AREA (SQ.FT.)	% CATEGORY	USAGE
1.0 Community Clinic					
1.1	Clinic reception	G	206	21%	Healthcare
1.2	Physician office	G	158	16%	Healthcare
1.3	Holding vestibule	G	131	13%	Healthcare
1.4	Exam rooms	G	398	40%	Healthcare
1.5	Clean supply storage	G	33	3%	Healthcare
1.6	Patient washroom	G	57	6%	Healthcare
	Subtotal		**983**	**7%**	
2.0 Medical Laboratory					
2.1	Laboratory reception	B	116	6%	Healthcare
2.2	Self-assisted sample collection	B	402	19%	Healthcare
2.3	Main laboratory	B	1505	73%	Healthcare
2.4	Housekeeping	B	26	1%	Healthcare
2.5	Storage	B	26	1%	Healthcare
	Subtotal		**2075**	**15%**	
3.0 Public Library					
3.1	Circulation Desk	G	100	2%	Library
3.2	Self-service check out	G	98	2%	Library
3.3	Librarian office	G	281	4%	Library
3.4	Staff room	G	276	4%	Library
3.5	Computer stations	G	222	3%	Library
3.6	Plus+ research stations	G	284	4%	Plus+
3.7	Waiting/ open seating	G,2,3	1558	24%	Plus+
3.8	General stack	2,3	944	15%	Library
3.9	Children's room	2	582	9%	Library
3.10	Large meeting room	2	586	9%	Plus+
3.11	Small meeting rooms	3	248	4%	Library
3.12	Study tables (open)	2,3	1331	20%	Library
	Subtotal		**6510**	**47%**	
4.0 Data Centre					
4.1	Server Room	B	138	48%	Plus+
4.2	I.T. workstation	B	150	52%	Plus+
	Subtotal		**288**	**2%**	
5.0 Support Spaces					
5.1.1	Corridors	B	719	18%	Facility
5.1.2	Corridors	G	397	10%	Facility
5.1.3	Corridors	2	802	20%	Facility
5.1.4	Corridors	3	891	23%	Facility
5.2.1	Washroom	B	270	7%	Facility

5.2.2	Washroom	G	61	2%	Facility
5.3	Housekeeping	B	43	1%	Facility
5.4	General storage	B,3	65	2%	Facility
5.5	Boiler's room/Mechanical	B	382	10%	Facility
5.6	Electrical closet	B	41	1%	Facility
5.7	Elevators	B,G,2,3	268	7%	Facility
	Subtotal		**3939**	**29%**	
	Total Net Area		**13795**		

entrance (Figure 98-100).

Following Library Plus+ design strategy and renovation considerations, the resultant layout of the library with newly introduced programs and integrated space, redefine the Pacific branch as Pacific branch Plus+. From the exterior, the architectural characters of the building remain mostly unchanged, with minor modifications to existing windows and doors. However from the interior, the overall spatial organization, program allocation and circulation pattern have been comprehensively transformed. Visitors will travel their old ways and arrive at the same library location, but now interact with the library building in an entirely different way, and with increased frequency. While the programmatic additions give visitors new reasons to physically engage with the public library, it is the improved architectural experience that will ensure the success of such initially explorative engagement, for it to eventually become a permanently accepted norm. Such is the long-term goal of Library Plus+, that the architecture of public libraries as a vessel facilitating healthcare-literacy integration, would ultimately improve the health of a population through the increase of knowledge and awareness that impacts the individuals' action and lifestyle.

Endnotes

1. Webb. *Building Libraries for the 21st Century.* 111.

2. Van Slyck, Abigail Ayres. *Free to all: Carnegie Libraries & American Culture, 1890-1920.* (Chicago: University of Chicago Press, 1995), 120-122.



Figure 108: Library Plus+ exterior render


BROOKLYN·PVBLIC·LIBRARY
ESTABLISHED·1896

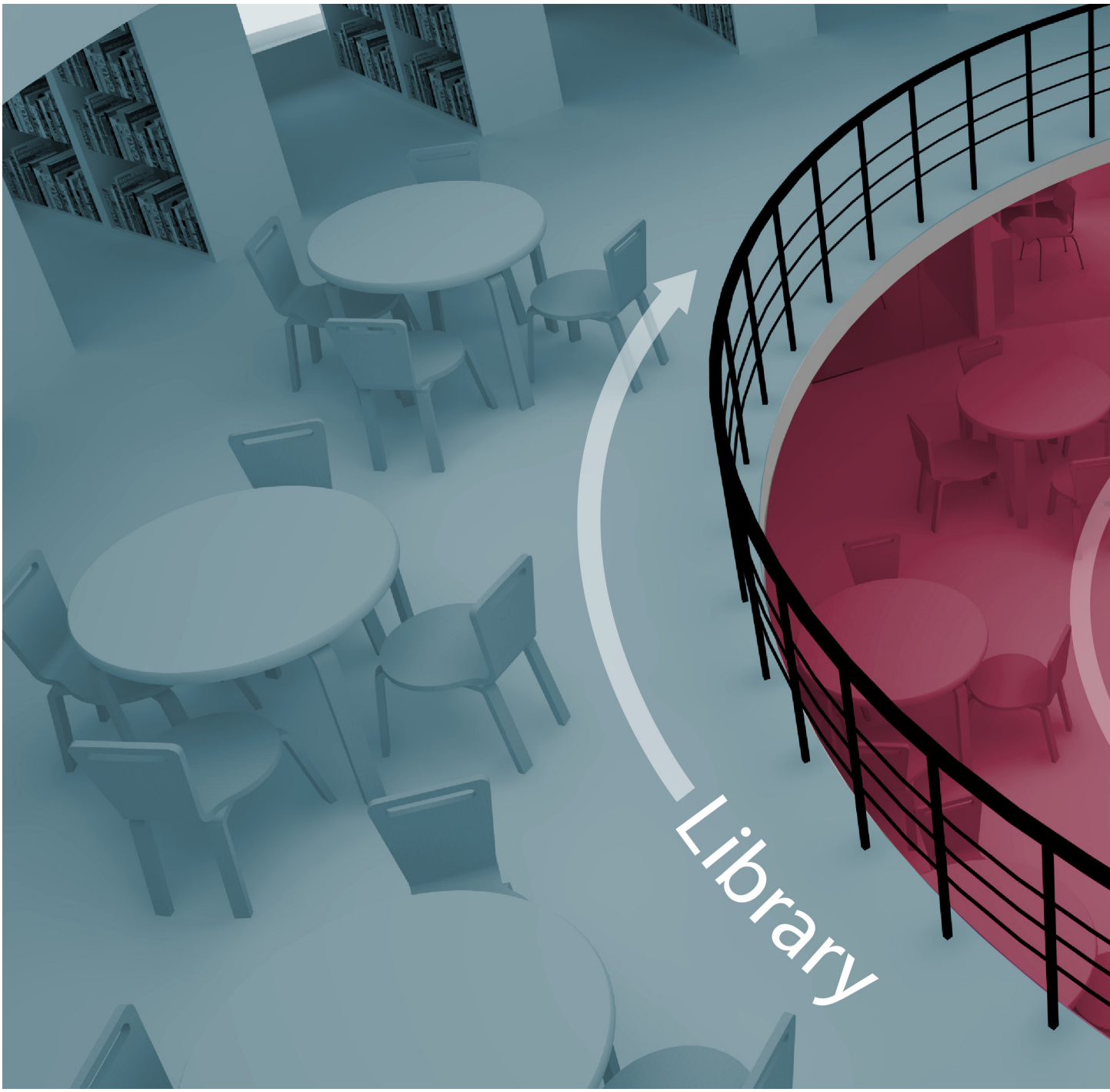


Figure 109: Library Plus+ tiered-atrium view, with colors indicating program zoning

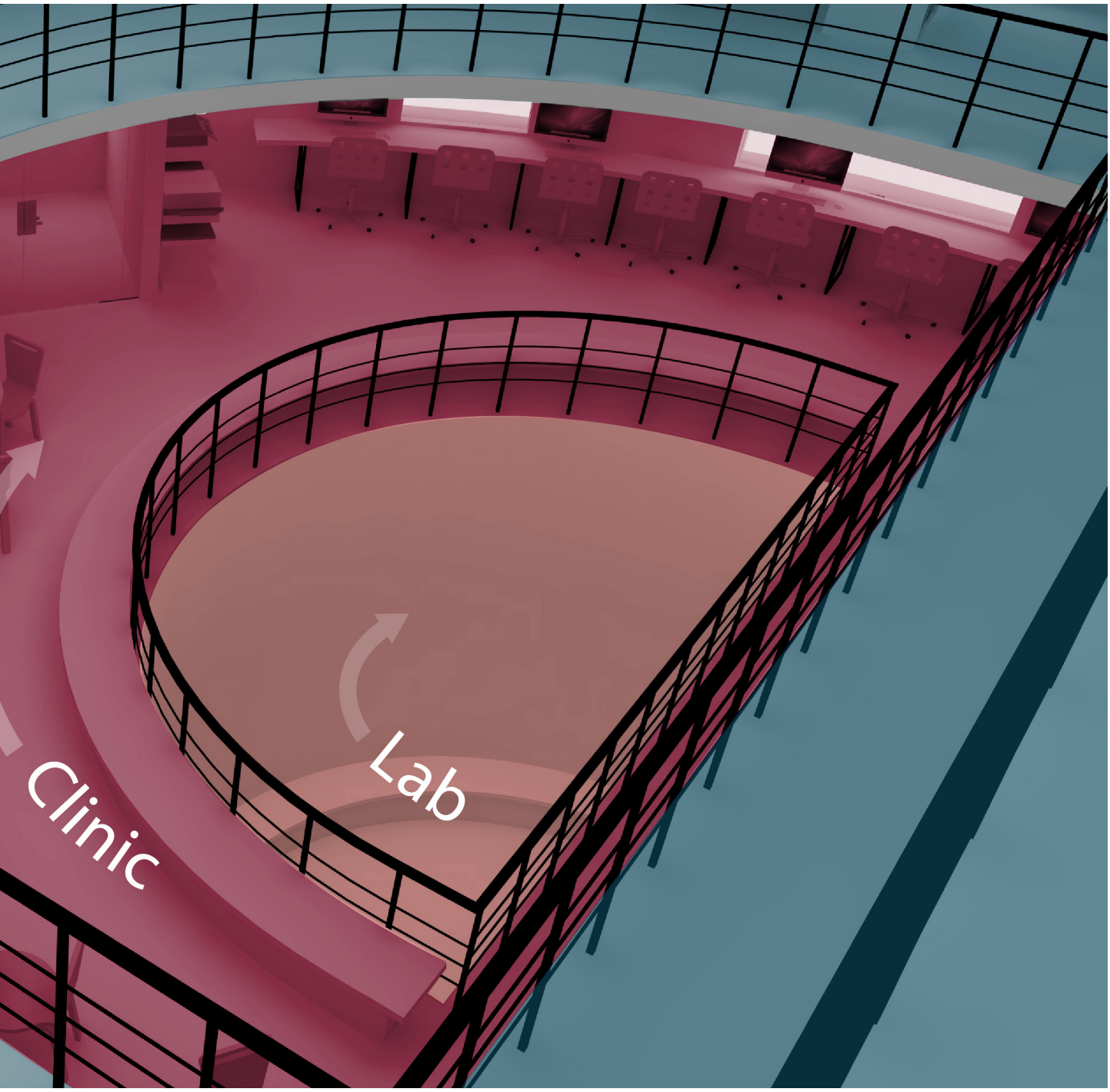

Clinic
Lab



Figure 110: Library Plus+ tiered-atrium interior render (*view from third floor*)





Figure 111: Library Plus+ tiered-atrium interior render (*view from second floor*)





Figure 112: Library Plus+ interior render (*view from inside a Plus+ Pod*)


Prescription: Watson
How healthcare can benefit from Watson's unique capabilities
THE IDEA
APPLICATIONS
LABS
MORE STORIES
OMRON

Conclusion

As the founder of Theranos Elizabeth Holmes believes, the individual is the answer to the challenges of healthcare. When sufficiently and timely informed, the individual can change his or her own health outcomes. However, our current medical practices and healthcare system haven't fully acknowledged or explored this potential by making actionable healthcare information conveniently accessible to the individual. While a massive amount of medical information is available on the Internet, retrieving both reliable and personally relevant information is still often a challenge. Without involving healthcare professionals, the individual has very limited access even to some of his own medical data, including diagnostic and laboratory test results. Only very recently did access to certain laboratory test results become available to patients in parts of the U.S. and Canada. Even so, expert interpretation is needed to convert these results into actionable information. Consequently, we as individuals are heavily reliant on the services of medical professionals and the healthcare system rather than on ourselves to accomplish desired health outcomes. In relinquishing active participation in our own healthcare, we continue to diminish the possibility that we could be the most effective solution to our health and healthcare problems.

Healthcare architecture, or the way architecture spatially accommodates healthcare activities, was narrowly regarded as the provision of clinically specialized settings. Although this is a valid view on healthcare architecture at large, its exclusive dedication of healthcare architecture to clinical procedures largely undermines the uninvestigated potential of architecture to support healthcare. Particularly when the increasing and changing patient demands continue to exhaust the functional capacity of existing healthcare infrastructure,

a radically transformative intervention is needed to redefine what future healthcare architecture may alternatively be.

Growing interest in preventative medicine and in self-curated healthcare already suggested a favorable basis to re-interpret healthcare architecture – healthcare reinvented through active engagement of the individual. In the same way that passive and dependent care recipients imposed certain limitations on existing healthcare architecture, active care recipients could resolve those limitations as well as mitigate unforeseen challenges. But in order to be active, and most importantly, effectively active in healthcare, the individual must first be capable of performing an appropriate extent of self-curated care. It is exactly in recognition of this need to empower the individual that Library Plus+ was proposed as a design intervention that integrates healthcare and the public library. Taking place within the existing public library facility, its underlying goal was to improve the health of a population by providing adequate actionable healthcare information to the individual, and by encouraging and regularizing his or her health learning and self-diagnosis, both of which would redefine healthcare, its service demands and its architecture.

The impact of Library Plus+ is proposed to take place progressively. First, an increased health literacy will enable and incentivize the individual to actively engage in his or her own healthcare, whether through self-directed preventative practices, or through effective communication with medical professionals. With a co-located and spatially integrated health literacy and primary care service environment, the overall volume of healthcare demand for a population could be largely reduced. Second, individual care recipients will be incrementally more prepared to perform wider and more complex range of self-curated healthcare activities such as automated diagnosis, laboratory sample collection, and basic interpretation of medical test results. Becoming expert patients, individuals who have once benefited from the convenience, the efficiency and the successful outcome of this integrated service, will continue to use it as an accepted form of service. Accessing Library Plus+ will then become an intuitive process to receive healthcare, transforming the

conventional view on both healthcare and the public library. Third, the operation of this integrated service will allow collection of health data from its user population, which with proper management will continuously improve the service performance of Library Plus+. Lastly, in addition to benefiting the individual's personal healthcare, Library Plus+ could make a substantial impact on a society's healthcare infrastructure as a whole. By facilitating a reinvented healthcare driven by active user/patient participation, valuable information can be generated to accurately forecast future healthcare needs of a population or community, also allowing conventional healthcare architecture to promptly and adequately respond to changing service demands.

However, as only the initial experiment speculating on the effects of a healthcare-library integration, Library Plus+ in its design execution faces numerous practical limitations. Regardless of its theoretical value and relevance, the proposed hybridization is immediately provocative because of its component programs' conventionally divergent spatial characters and purpose. Healthcare facilities demand scrupulous staging and spatial separation necessary for infection prevention and control, whereas public libraries in the contrary tend to encourage collective gathering and interaction. Therefore, while the hybridization of these two very different programs may de-institutionalize healthcare's clinical setting, and encourage healthcare activities in a socially engaging environment, it risks compromising the proper functional performance of both healthcare and the public library.

For instance, in order for patients to benefit from health literacy and self-diagnosis services as part of their regular healthcare, there must first be a moment and a place where certain aspects of their clinically controlled, private environment are relinquished, in exchange for the social experience of the public library that collectively inspires health literacy and self-diagnosis activities. As this moment and place also intend to motivate regular library users to concurrently engage in the same activities, the inevitable mixture of user types with varying states of sickness or health raises an alarming question

of potential contagion. Particularly when Library Plus+ is proposed to be a prevalent building type and practice, likely attracting a higher number of visitors including both patients and library users, the resultant hybrid library is at risk of becoming yet another site for "hospital-acquired" infection.

Therefore the design of Library Plus+ must first mitigate this risk of contagion through architectural elements such as dedicated circulation corridors, privacy screens and zones of varying degrees of access. Then, to directly address its fundamental intent to improve people's health, the design must also consider aspects of building science that ensure appropriate ventilation, thermal comfort, and natural daylighting etc. In addition to programmatic contents, the health of a building is an equal contributor to the health of its occupants. A healthy building naturally promotes the health of its occupants by providing a comfortable physical environment, as well as by spatially facilitating healthy behaviors. For example, when staircases within a building are well designed with daylighting and view to the exterior landscape, they encourage walking as an alternative to using the elevator, and thus contribute to the physical wellbeing of its occupants.

Evidently, as every public library differs in architectural character and in existing conditions, implementing these healthy design considerations could be very challenging for some older and smaller public libraries, compared to newer libraries that are already built with better spatial adaptability and building performance. But in either scenario, the programmatic interface to achieve an architecturally unified Library Plus+ building, will always struggle to negotiate between spatial compartmentalization and de-compartmentalization that are useful to healthcare and library services respectively. The resultant architectural unity is likely subject to and based on the needs and comfort level of a particular library's user community, which not only in the first instance defines the appropriate form of its programmatic interface, but also slowly transforms it over time. Therefore, in order to evaluate the effectiveness of a Library Plus+ design, or the feasibility of such hybridization itself, further

research is needed to interpret the behaviors of its target population while interacting with existing healthcare and public library facilities. What spatial conditions can be added or removed from these settings without impairing essential service functions? Is there any existing spatial similarity between healthcare and library facility that may be combined for improved service efficiency? When would functional consolidation be more beneficial than redundancy to the design of Library Plus+, and vice versa?

The search for these answers, whether or not they support the idea of Library Plus+, will reveal other opportunities of hybridization that could contribute to improving the health of a population. Where the scope of this thesis included only the schematic design stage of a sample Library Plus+, similar investigations can be made for Subway Plus+, Education Plus+, Supermarket Plus+ and Community Center+. While each of these other potential hybrids has its own advantages and shortcomings, by evaluating all of them against one another, perhaps a more optimal hybrid type healthcare architecture could emerge.

Ultimately, Library Plus+ or any other building type Plus+ is only one more step towards a self-curated healthcare, the beginning of a process in which architecture guides us to reclaim our potential in shaping our own health outcomes. Throughout this process, we may have public librarians to index healthcare resources for us, medical librarians to lead to us to relevant medical information, and medical professionals to assist us where we have reached the limit of our own capability to take actions. But as individuals, we are still always responsible for our own healthcare within whatever newly defined architectural environment of healthcare, lest it undergo the same cycles of functional obsolescence as current healthcare facilities. Although it is not immediately clear if and how long it might take for Library Plus+ or a similar hybrid architecture to noticeably improve the health of a population, as long as general interest in preventative and self-curated healthcare persists, healthcare architecture will continue to evolve until it can stably accommodate such interest.

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