A happy ambience: Incorporating ba and flow in library design

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Abstract

Much of library design is practical, out of necessity. Librarians contend with myriad changes in how space is utilized due to technologies and expectations of its users. In 'the age of distraction,' the library might still offer a sole space of respite for many users. This paper describes studies from architecture and interior design that may help to increase library users' concentration and scholarship. A room's color, size and shape, acoustics, scent, and presence of nature all influence how people feel and act within a space. Evidence regarding the experience of space, including design for well-being, color and performance, and sounds and distraction, can be used to improve libraries by incorporating aspects of design that promotes well-being.

Introduction

Today's spaces for academic work, reading, and learning often fall somewhere in the continuum between the real and the virtual. Our physical bodies sit in a real space but many interactions with text, other information, and other humans occur online. Libraries are charged with housing and storing both print and online information for both in-person and distant users. This complex mix of physical and virtual information can be difficult to navigate, and can even render the physical library setting distracting. Perhaps the most obvious reason that people go to a library is to check books out, but many people also use the space to study and read. Libraries do offer opportunities to get lost in a text, but they are often noisy and distracting. Digital collections have reduced the footprint of books, offering opportunities to develop peripheral services, such as cafés, makerspaces, and group study spaces (Seal, 2015). Some libraries host yoga classes and house tutoring and other student services. These changes and new services are all a result of economic, technological, and social factors, and they create exciting and vibrant but also physically and mentally noisy spaces.

Libraries are only one product of an increasingly noisy world. Aside from the natural world (which does have its own coded information outside of the scope of this paper), our everyday lives are littered with encoded symbolic information and printed information which is textual and intentional, as well as that which is ambient and incidental (McCullough, 2015). We have informational devices on our shelves, desks, in our pockets, and on our wrists. Information is thus environmental and embodied; printed and fixed; and virtual and fluid. Information surrounds us, oftentimes overwhelmingly so. There are a number of studies we will discuss in the paper that show that such a constant bombardment of information has detrimental effects on physical and mental health, especially on concentration, and ultimately on happiness (Powers, 2011). The purpose of this paper is not to lament modern life, but to consider how spaces can be

manipulated to decrease distraction and enhance connections with texts and ideas. Information overload, cognitive overload, architecture and behavior, library space design, and the human need for concentration provide the framework for the paper into a combination of two key concepts: ba and flow.

Kitaro Nishida described the connection between concentration and space as ba (Nishida, 1992). Ba is, in essence, an ideal space in which the self, or ego, falls away as one is absorbed in communion with other people; it is a space of truth and focus. In the information fields, ba has been used to frame ideal physical and mental conditions for knowledge management (Nonaka & Konno, 1998). Related to the concept of ba is flow, which is a state of absorption and intense concentration (Csikszentmihalyi, 2008). We posit that these two concepts (ba and flow) are ultimately linked to human happiness as states in which the mind is free from both external distraction and internal conflict. Just as the design of hospital interiors can actually affect patient outcomes, library spaces can increase happiness through ba (Schweitzer et al., 2004). What has not been established is if there are aesthetic qualities of space that cultivate absorption, or if that is entirely dependent on the reader's internal motivations and abilities. Is there aesthetic or spatial designs or conditions that can improve the library experience, specifically by reducing psychological noise in the environment? We turn to the literature on related concepts of information overload and cognitive overload, then to information about architecture and design, and library purpose to create recommendations regarding spatial design to enhance the reading experience within library spaces.

Information overload is a state of being that causes anxiety, and which "arises because we have too much information relative to the attentional resources that can be devoted to it" (Himma, 2007). Information overload is a frequently revisited topic within information science, but scientists and theorists across many disciplines have written about its negative effects. For instance, doctors have expressed concern about patients' ability to process and understand a deluge of medical information when ill (Ahmad et al., 2006). Researchers in advertising and consumer studies find that shoppers are frequently overwhelmed with choices, which in turn affects decision-making (see Case & Given, 2016, for many examples of information seeking, overload, and related phenomena). While information overload is not a new concept, it has become a more urgent topic due to the unprecedented level of information and communication technologies that dominates our lives (Levy, 2008). The sense of overload, then, is exacerbated by constant demands on our attention from devices that supply a constant feed of information. This psychological noise presents challenges to our ability to concentrate. An ideal environment would reduce this noise.

Quiet or silence in the environment can enhance people's ability to concentrate. Finding quiet spaces can be difficult, though; students living on campus or in homes with young children, for instance, might have few quiet spaces to connect deeply with texts. Braman (2007) wrote about the negative effects of digital technologies on our ability to concentrate: "silence is increasingly rare … Information overload and other negative effects of the use of digital technologies create ethical problems when they impede our ability to construct reality in a valid and sustainable way" (p 281). Himma (2007), also reflecting on overload, said that "what we really need to solve the problem is sanctuary -

a sanctuary from cyberspace, a sanctuary from information, where we can reflect and meditate on what is truly important" (p 268). There are ways that architects and designers can minimize information overload by manipulating spaces to eliminate the sensation of information overload and create this needed sense of sanctuary.

Cognitive overload is similar to information overload except that it relates to the human's ability to process information. In fact, Kirsh (2000) suggests that information overload is one cause of cognitive overload. Commonly known as cognitive load, cognitive overload occurs when a human is unable to process all of the information they are receiving and is highly studied in education and psychology (Sörqvist et al., 2016; Sweller, 2011). For education, cognitive load is used to identify and help eliminate extraneous factors from learning materials in order to accelerate the transfer of information from working memory to long-term memory. Learners connect with information when they are sufficiently engaged but not overwhelmed (Paas et al., 2004). Optimally, the design reduces all extraneous information so that the learner's attention is directed to the task at hand, as "each channel in the human information-processing system has limited capacity" (Mayer & Moreno, 2003, p. 44). In psychology, cognitive load relates directly to concentration in two ways through selective or focused attention and as the "dynamic mechanism of task-engagement" (Sörqvist et al., 2016, n.p.). The basis of cognitive load and subsequently overload deal with engagement and the degree to which a human can actively block out distraction to maintain focus on a task, regardless if the task is reading, writing, or even physical activity. Overload occurs when a human's brain cannot actively focus or act selectively on information that is used to maintain engagement with a task. In learning, instructional designers artificially limit the nature of learning content in order to enable learners to require less mental processing to maintain engagement. However, they often overlook the learning environment. Kirsh (2000) explains that work environments need to be structured to reduce overload by building on Newell and Simon's (1972, as cited in Kirsh, 2000) notion that one's physical workspace is also an activity space, where cognition flows between the actual environment and the mental structure used to process information. The idea of the messy desk, social tension with a coworker, telephone calls, and numerous factors that occur in the workspace while one is working through a task can be disruptive. Such disruption suggests what Kirsh (2000) refers to as a need to use the physical environment as a cognitive ally through understanding the role of the environment on task engagement.

Architecture's purposes can be studied through the lens of many academic disciplines (e.g., archaeology, psychology, urban or women's studies, semiotics, etc.). Many volumes speculate about the purpose and meaning of architecture dating back to the earliest human habitation. Even without speculation though, we know the purpose of many public buildings, which have signs indicating how individuals should act (Lefebvre, 1991). We know that humans respond to the built environment, that architecture influences our lives and regulates what we do in civilized places. Recently neuroscientists have even pinpointed the parts of the brain that are activated when people look at architecture; neural activity was associated with three components of aesthetic responses: "coherence (ease with which one organizes and comprehends a scene), fascination (a scene's informational richness and generated interest) and

hominess (extent to which a scene reflects a personal space)" (Coburn et al., 2020, p. 217) are demonstrated through cognitive, emotional, and behaviorally-oriented areas of the brain.

Architects use both physical and sociocultural means to influence "behavior by allowing, facilitating, requiring, impeding or preventing various perceptions, thoughts, emotions and acts" (Montello, 2014). Pallasmaa (2014) explains that architects can manipulate physical spaces to design "mental spaces": "Qualities of physical space, behaviour and our mental tuning are interrelated" (p. 82). Architectural elements (such as light, windows, ornament), presence of nature, and even scent (e.g., coffee, incense) impact the way that humans feel and act within spaces.

Thinking about how space influences how humans feel and act shows that architects do not simply design for functionality, but rather for a "kind of life that would most appropriately unfold within and around them" (De Botton, 2008, 73). Spaces can be not passively consumed or experienced but are built to make people into the content of their interiors (Abercrombie, 2018). There are numerous studies indicating that spaces can stimulate higher thinking, which might be of particular interest to librarians working with architects in a redesign (Anthes, 2009). Objective tested parameters for light and spatial organization have been developed that present interior designers with ways to promote subjective well-being (SWB) (Desmet & Pohlmeyeter, 2013). Buildings can also contribute to health, and beautiful buildings hint at the potential: the potential to live a good life, to feel connected, to be productive (Day, 2002). Here, we ask if there are particular design elements within libraries that can elevate engagement, happiness, and even the soul.

Libraries are often beautiful, monumental buildings, imbued with historic gravitas. They are complex working environments that serve many purposes for both workers and visitors. By necessity, they have spaces for administration, technical services, books, and utility and storage; for visitors, they include large and small meeting spaces, play areas, and individual study spaces. They are also mission-driven organizations. Academic library mission statements are largely focused on supporting the institution's curriculum and research (Bangert, 2006), and researchers have found that many students continue to use the library to study and for consultation purposes (Lux et al., 2016). Study carrels have maintained popularity because they help people sustain concentration (Applegate, 2009). Public libraries' mission statements highlight community connections, literacy, and lifelong learning, indicating different spatial requirements from academic libraries.

Every year (since the mid-1900s) the American Institute of Architects has partnered with the American Library Association (ALA) to recognize the best new and redesigned libraries. The awards are printed in a special issue of Library Journal. Reading the words commonly used to describe the buildings can give us an indication of values or design features that are rewarded; for instance, daylight, technology, sustainability, flexibility, and creativity make frequent appearances. The photographs feature light-filled, creative, flexible and multipurpose spaces. This has not always been the case; one hundred years ago, libraries looked different – not only because of style but also

because of purpose. Change is especially obvious in academic libraries, many of which began deconstructing their reference areas in favor of commons areas and computer labs around the 1990s (Beagle, 2010). This trend continues, as libraries continue to move their stacks offsite to accommodate more centralized student support spaces, technology, and consultation and group study spaces.

While activity and creativity are prioritized in library design, this busyness could present a problem for people who go to the library to study and think. Libraries are one of the few spaces where people can find quiet on campus. Researchers have found that just as many students sought quiet study spaces as group-work areas when they went to the library (Yoo-Lee et al., 2013). William Powers puts forth a proposition worth consideration: humans need quiet spaces to think, away from technology's grip. He recounts Plato's dialog of Phaedrus, who explained that he had to escape Athens' busy streets in order to process a speech. (Powers, 2011) compares this retreat to modern self-imposed tech-free days, explaining that the constant cacophony of information coming through our devices impedes our ability to make sense of words, and the infinite connection offered by the devices in our pockets "denies you the very thing you went to the screen for in the first place: happiness" (p. 106). Enforcement of not only no-talking but also no-technology zones might be a key in reducing ambient noise (Massis, 2012).

No-technology zones might prove elusive, though. Many journals are only available online, and people use computers to write or study while using those journals. Researchers have found that this is highly distracting for many users. (Baron et al., 2017) studied university students in five countries, and found that "Nearly 92% said they concentrated best when reading in print, and more than four fifths reported that if cost were the same, they would prefer print for both schoolwork and pleasure reading … they were also more likely to multitask when reading on screen" [Abstract]. (Baron, 2013) found that 90% of students were prone to multitask when reading on screen, whereas only 2% who were reading a hard copy multitasked. Librarians working on spatial redesign might consider how to provide respite from the digital world in parts of the library.

Turning to design, library design books discuss the importance of working with architects and interior designers as well as the community. This relationship is crucial because, while architects hold expertise regarding building and design, librarians have insight into the needs of users and librarians that architects might not consider (Mattern, 2007). There are many studies about what users want in library spaces. For instance, Cha and Kim (2015) found that the amount of space, noise level, crowdedness, comfort of furnishings, and cleanliness were the most important spatial attributes for students in academic libraries. Similarly, Brown says that the most important factor in the interior design of libraries is adjacencies and directing logical movement of people and materials through the building, which is a very functional and practical concern (Brown, 2002). Moving towards the ideas that we tackle in this paper, Worpole's design recommendations include lots of natural light, a warm ambiance, a variety of nooks and crannies for solitary work, clarity of layout, sustainability, zoning, and, interestingly, design for positive behavior (Worpole, 2013). Mathews and Soistmann (2016) go into

great detail about zoning, citing studies from even the 1930s that demonstrate how aesthetics can influence perception and behavior within a space.

Mathews and Soistmann (2016) believe that library buildings are entirely composed of programmable space that can be optimized for better experiences and behaviors, and explain that librarians can function as "choice architects" (p. 32) and principles of interior design (e.g., harmony, contrast, balance, etc.) can improve mood and "nurture the scholarly impulse" (p. 50).

Libraries can accommodate different needs by drawing inspiration from retail and production spaces and can cultivate emotions, including the experience of flow. Unfortunately, the authors stop short of actual recommendations for encouraging flow, or colors for an elevated scholarship, concluding that certain aesthetic experiences (e.g., color) are subjective.

However, we do know that color, comfort, scent, and sound are all important design elements, and it is worth exploring whether these elements can be used to increase ba, or flow. Rather than opening up the entirety of architectural criticism, here we focus on particular interior design elements that have been studied in relation to the subject of this paper, such as concentration, happiness, and thinking. Anthes (2009) explains prior to the 1950s, architects primarily relied on "hunches" in regards to the effects of space on mood, but since the 1960s and 1970s, environmental psychologists have been empirically testing these hunches. Studies in environmental psychology range from the effects of single architectural elements to combinations of elements (Aries et al., 2010; Donovan & Rossiter, 1982), and some studies (Mehta & Zhu, 2009) have examined architecture and color in relation to creativity and cognition. Here, we turn to findings regarding room size and shape, noise, color, light, scent, signage, and presence of nature, speculating also about how these elements might be optimized in library settings.

Room size and ceiling height can influence feelings of awe or intimacy. Classical library design, including many Carnegie building plans (Van Slyck, 1995), includes reading rooms with high ceilings, for aesthetics and symmetry, but also for better airflow. There are psychological effects of high ceilings as well: Meyers-Levy and Zhu (2007) found that people studying in rooms with high ceilings exhibited more abstract thinking while those in rooms with low ceilings exhibited detailed thinking, while Vartanian et al. (2015) found that people were more likely to feel fear in rooms with lower ceilings. Simply looking at the visual differences (see Fig. 1) can elicit a different feeling about workspaces in libraries. High ceilings might be less practical and more expensive, but research supports including higher ceilings in library design.

There is competing evidence regarding the effects of sound and music on concentration. Within the popular literature, one article sums up a number of research articles about the effects of sound on concentration; for instance, baroque music is said to lift the mood of surgeons, and that ambient music can create an atmosphere conducive to studying (Purdy, 2014). Mehta et al. (2012) found that ambient noise (such as the low buzz of a coffee shop or typing in an office) can help some people

concentrate; too much quiet can, itself, be a distraction. Dalton and Behm (2007) systematic review on the effects of noise and music on performance found that music might improve the mood and decrease a driver's tension, for instance, but that it had a negative effect on readers' concentration.

Architects and designers can manipulate and direct sound through design elements such as wall placement and coverings and ceiling shape. A space that is meant to carry sound, such as a concert hall, should have "good reflection of sound in all frequencies" (Roth & Clark, 2013, p. 104) to direct reverberation. Places where people go to study or concentrate, on the other hand, should be constructed to minimize sound. Baffling in the ceiling or walls might minimize sound from bouncing around a room. For example, Alvar Aalto avoided any parallel walls in the Angel Abbey Library in Mount Angel, Oregon to avoid "flutter echo" (Roth & Clark, 2013, p. 104), which happens when conversations bounce "back and forth, causing a buzzing sound" (Roth & Clark, 2013, p. 105).

A library redesign or new build provides an opportunity to reserve some areas as quiet spaces, and also consider methods of reducing ambient noise. Trapani (2007) advises the distracted: "If you can't stand the drop-dead silence of the library but also can't concentrate with lyrics, ambient music's the ticket," reinforcing the misconception that libraries are quiet. We know that libraries serve as refuge and sanctuary (Applegate, 2009; Massis, 2012), but they are often not quiet. Stanwicks (2016) described how the University at Albany, SUNY designated both silent and quiet zones to counteract the encroaching noisy collaborative spaces. Environmental cues, including "matching furniture to noise levels" (Stanwicks, 2016, p. 4) helped them establish and reinforce zones. Research shows that the best solutions are (1) architecturally, by creating spaces in which sound is absorbed (2) through interior design, by establishing zones for silent and quiet zones, and (3) personally, through the use of noise canceling headphones that allow the user to tailor sound experiences are the best solution for this highly individual aesthetic problem.

Color is a focus for interior decorators for aesthetic purposes and because it is a "powerful evoker of moods and physiological response" (Roth & Clark, 2013). Kurt and Osueke (2014) claim that it is essential for architects to understand the effects of colors on human emotions in order to make spaces more functional. Color is often used to create a playful feeling in children's areas, but color's effect on adults is more subjective. Thus, environmental cues used in private environments might be less appropriate for use in public spaces. Shigenobu Kobayashi (1992), color psychologist, identified combinations of color to be used in the environment, media design, and fashion that produce sentiment or feelings, which are explained in his book *The Color Image Scale*. Kobayashi places colors and hues a continuum of soft to hard on the y-axis and warm to cool on the x-axis, explaining that warm-soft colors "have an intimate feeling", and those in the cool-hard section "convey an image of reliability and formality" (Kobayashi, 1992). Red increases tension, heartbeat, and digestion; greens and blues have the opposite effect. Warm colors make large rooms seem cozier or smaller, and cool colors have an expansive effect.
Kurt and Osueke (2014) found that blue interiors can encourage reason, logic, and intellectualism. AL-Ayash et al. (2016) studied the effects of color in the classroom,

related to emotions, heart rate, and performance, finding that blue increased relaxation and calmness compared to other colors. Mehta and Zhu (2009) found that people better performed detailed tasks in red rooms, while creative tasks were better suited to blue rooms. Johnson and Maki (2009) found that students in a white classroom had higher rates of anxiety, negative feelings, and off-task behavior than those in a room with blue and tan walls. Similarly, Küller et al. (2006) found that a colorful work environment produced more positive feelings than a dull environment.

There is not a large body of literature to draw on regarding color in libraries. Metcalf's (1965) *Planning Academic and Research Libraries* contains relatively little about color, beyond stating that there is little agreement about whether libraries should use muted or bright colors. Niedzwetzki (1991) conducted survey research on color and lighting in three Melbourne (Australia) public libraries, finding that while patrons personally prefer to surround themselves with the calming effects of blue, in the library environment they preferred neutral colors. Kobayashi's connection of intellectual, serious, diligent, and quiet are correlated with jade green, aquamarine, and certain grays, while combinations of red, gold, apricot, and ultramarine, for instance, can define dynamic, active, lively, and open spaces, which would be best for a group study space for brainstorming (Kobayashi, 1992). While it is difficult to pinpoint exact relationships between color and hue with subjective behaviors and emotional responses, environmental psychologists understand that color is an important factor in spatial design. The subject deserves more formal testing, attention, and purposeful application in libraries.

There is an inextricable relationship between color and light; one cannot be studied without the other. Color has three dimensions: hue (e.g., purple), value (light/dark), and saturation (bright/dull) (Hanson, 2012). Color is actually a human perception of various wavelengths of light, and there are different kinds of light that can be used in interiors (natural/artificial; task/diffused; incandescent/fluorescent) which will all affect color perception. Unlike color, light has probably been a concern for library architects since they were invented; reading is decidedly sight-dependent. Metcalf (1965) devotes considerable space in his tome to light and lighting. He provides a historical overview of technologies of lighting in American research libraries, explaining that lighting primarily came from the sun until the around the turn of the 20th century, making sunlight the most important factor in library architecture until electric lighting was regularly available. Lighting remains a constant concern in library design. Light itself "creates psychological responses and has a strong physiological effect … in doing close, exacting work - such as sewing or reading - the eyes become strained if there is too much contrast between high light levels in the immediate work area and darkness in the surrounding area" (Roth & Clark, 2013, p. 85), so offices (and presumably libraries) should have high levels of diffused light. Light can also be used to bring attention to details, or manipulated with other architectural elements to create a sense of "mystery and awe" (Roth & Clark, 2013, p. 86). There have been a number of studies that suggest that people are better able to concentrate inside rooms that have good natural light. Natural light regulates the body's production of cortisol and melatonin, and a lack of natural light in workplaces can have negative effects on mental health (Harb et al., 2015), a consideration which is more important for library workers than users.

While scent is not commonly considered in library design, we include it here because of the possible implications for concentration. Scent is normally underappreciated by architects (Henshaw, 2014). In libraries, the musty smell of books on the shelves compared to the sterile odorless technology spaces and the various scents from coffee shops present an array of potential attractors or detractors for concentration in a library space. Unlike retail environments, librarians do not typically focus on utilizing scent to attract and keep users engaged with space. Scents in the library are rather results of their content and use. Newer libraries are described as destination places where people might either work silently for hours or gather for long periods to work on group projects. Food and drink will inevitably be introduced; the scent is a byproduct, with both positive and negative implications.

Scent is commonly used in homes, spas, and churches to enhance experiences, and in other environments, such as hospitals, to mask unpleasant smells. Day explains the power of scent in creating uplifting environments: "aromatherapy is built upon the relationship between scent, state of soul and physiological reactions" (Day, 2002). Might libraries harness the power of scent as well, to aid in concentration? Libraries are often described as smelling of old books, which is actually a breakdown of lignin, which produces a "slight vanilla scent" (Schultz, 2013). Book lovers are drawn to the smell, but if libraries are moving their collections out of the main areas where people work, they could experiment with the olfactory environment to enhance concentration. Madzharov et al. (2018) found that an ambient coffee scent can help people's alertness and performance on an analytical reasoning task, which could prove to be a positive, unintended consequence for the libraries that have installed a coffee shop. Again, this is an area ripe for testing and application.

For further consideration is the use of signs. Signage can help people who are less familiar with all of the library's functions, thereby increasing their comfort through successful and independent wayfinding. In the typical library, signs direct users to the books they seek, the newspapers, the help desk, the children's area, the bestsellers, and the toilets. Other signs tell people not to bathe in the restrooms, to turn off their cell phones, that they must register for their allotted half-hour on a computer, or "as a back-up for rule enforcement if we need to speak to someone about their loud phone conversation or their cheeseburger next to the computer" (Eichelberger et al., 2017, p. 560). While signs are the easiest way to direct behavior, signage should be thoughtfully designed so that it is not distracting or so that it does not take away from the subjective wellbeing that the library is trying to build.

As Mandel (2017) points out, there are numerous studies about wayfinding aids or signage in libraries, but librarians still struggle with the quantity, quality, style, and locations for signage (Eichelberger et al., 2017). Signage can empower users to find their own materials, but if it is overused it becomes clutter. Librarians need to be judicious with signage, in order to reduce visual clutter and create a cohesive and unified feeling (Calori & Vanden-Eynden, 2015) rather than a feeling of disarray that can result from haphazard, handwritten signs cluttering the walls (Stempler & Polger, 2013). Stempler and Polger (2013) suggest conducting a signage audit in order to uncover problems related to "language, design, branding, and overall aesthetic" (p. 122) of

signage. Consistent design, enforced by policy, will ensure that the signage does not distract from the aesthetic that the library is striving to achieve.

The presence of nature, including immersive experiences, such as walking in the woods, to non-immersive, including looking at photographs or houseplants, has been widely studied in relation to restoration of mind and spirit. Rachel and Stephen Kaplan are leaders in research on the effects of nature on mental functioning; they have found that too much "directed attention" causes "impulsivity, distractibility and irritability … [and that] the inherent fascination of nature can help people recover from this state" (Clay, 2001, n.p.). Bratman et al. (2012) reviewed a variety of quantitative studies "of nature experience on human cognitive function and mental health, synthesizing work from environmental psychology, urban planning, medicine, and landscape aesthetics" (p. 119). They specifically looked at benefits of nature relevant to "cognitive capacities (including attention, memory, and impulse inhibition), emotional states (mood), and stress" (p. 121). Attention restoration theory (ART) is especially relevant, as several studies have shown that being in, or exposure to, nature, can replenish directed attention. Studies described in the article cover immersive and passive experiences, various durations, and nature has the power to rest the mind and it reduces stress in both adults and children. Berman et al. (2008) found that natural environments, even looking at photographs or murals of nature, is restorative, as opposed to over-stimulating urban environments. Studies by Shibata and Suzuki (2002) and Park et al. (2016) have demonstrated that plants in indoor work environments can lower anxiety and improve concentration. Such findings should be taken into consideration when designing library environments but can be implemented in a number of ways, (see Fig. 2).

The concept of ba has the potential to marry several problems presented in this study: space, concentration, and knowledge production. There are a number of studies that demonstrate how the design of learning spaces can improve readers' concentration and knowledge production by reducing cognitive load.

Libraries are an ideal space to study because they are commonly used for reading and studying, and they are also contested spaces due to economic, social and technological changes. Nishida (1992) provides a framework through which to build a theory of space for focus. Ba "roughly translated into the English word 'space' or 'space for emerging relationships' in which knowledge is created" (Choo & Neto, 2010). Learning from others (either during a conversation or through their writing) and creating new knowledge is an active process that occurs through concentration, or ba, and there are ideal conditions to cultivate ba. Ba has been repurposed for use across several academic domains, and notably, in knowledge management and architecture. Within the field of knowledge management, much effort has gone into defining the space where new knowledge can be created. There are physical, virtual, and mental spaces that people share (Nonaka & Konno, 1998). Choo and Neto's (2010) literature review and concept map illustrate how ba intersects with knowledge creation and management: there are physical and conceptual spaces that facilitate knowledge exchange. Nonaka and Konno (1998) explain:

Knowledge is embedded in ba. in these shared spaces, where it is then acquired through one's own experience or reflections on the experiences of others. If knowledge is separated from ba, it turns into information, which can then be communicated independently from ba. Information resides in media and networks. It is tangible. In contrast, knowledge resides in ba. (40)

The concept of ba has been explored within architecture as well. Baek (2008) describes Richard Neutra's architecture as an exemplification of ba, as one of Neutra's beliefs was that buildings have the potential to promote human happiness through mutual experience. By marrying all of the elements (wind, fire, water, and light), architecture can provide a "peaceful resting place for the human soul" (Baek, 2008, p. 352). Buildings should be anchored to their surrounding environment, drawing in natural light for multi-sensory appeal. Furthermore, buildings can bring about "a deeper level of communication and sharing" (Baek, 2008, p. 355). This philosophy can extend out of the home to public buildings, such as a school, in which the various places in a building are defined by activity that is centered on mutuality, where people interact in both formal (classroom) and informal spaces (playgrounds). This philosophy indicates that space should not dictate that people or activities are anchored to a specific place within the building, but that people would be sensitive to the purpose of the place because of how it is constructed. The building itself encourages "mutually reciprocal bond that occurs between the different 'I's as situated in the same atmosphere and as affected and embraced by it" (Baek, 2008, p. 358). Interestingly, Neutra was loosely affiliated with Nishida; he frequently spoke in Japan and they crossed paths.

There are different ways to conceive of ba. Ba is a spatial concept because it is a place where people interact in order to make new knowledge. Krahe et al. (2014) explored the concept in relation to conversations in a doctoral program. In this space, there are "diverse individuals and systems interacting and responding to one another to create new knowledge and innovation" (p. 1), which is aligned with knowledge management's interpretation of ba. Interestingly, library space provides an intersection at which to explore the concept of and cultivation of ba across the two fields. The concept of flow offers another, related way to think about mental engagement (Csikszentmihalyi, 2008). Flow is a mental state that occurs when people are fully engaged or immersed in a task, and when a sense of self and time fall away. There are certain conditions that can decrease the likelihood of entering a state of flow, such as anxiety or boredom; however, flow is more closely related to internal conditions. Flow is by definition dependent on expertise. Many of our students are expert readers, but as students, they might not be expert readers in a particular subject area. Is there a possibility that design elements within physical (here, library) spaces might increase flow - the likelihood that they will become so engrossed in a text that they will find that a sense of self and time fall away?

There are a number of tests that could be used to study library users' responses to space. For instance, Sherman-Bien et al. (2011) created an inventory of environmental features in a hospital, and then compared the patient responses to the features using several self-reported scales measuring their feelings in the environment. One of the

tests, the Positive and Negative Affect Schedule (PANAS-C) is appropriate for testing the library environment.

There are many instruments and methodologies that have been developed to measure flow, as well (Delle Fave et al., 2011). Rigorous testing of various architectural and design features within libraries would reveal the best environments for work and study.