

# Managing the Built Environment for Health Promotion and Disease Prevention With Maharishi Vastu Architecture: A Review

Global Advances in Health and Medicine

Volume 11: 1–21


© The Author(s) 2022

Article reuse guidelines:

[sagepub.com/journals-permissions](https://sagepub.com/journals-permissions)

DOI: 10.1177/2164957X221077084

[journals.sagepub.com/home/gam](https://journals.sagepub.com/home/gam)

Jon Lipman, AIA<sup>1</sup> , Lee Fergusson, PhD<sup>2</sup>, Anna Bonshek, PhD<sup>2</sup>, and Robert H. Schneider, MD, FACC<sup>3</sup>

## Abstract

**Background and objectives:** The evolution of healthcare from 18th-century reductionism to 21st-century postgenomic holism has been described in terms of systems medicine, and the impact of the built environment on human health is the focus of investigation and development, leading to the new specialty of evidence-based, therapeutic architecture. The traditional system of Vāstu architecture—a design paradigm for buildings which is proposed to promote mental and physical health—has been applied and studied in the West in the last 20 years, and features elements absent from other approaches. This review critically evaluates the theory and research of a well-developed, standardized form of Vāstu—Maharishi Vastu<sup>®</sup> architecture (MVA). MVA's principles include development of the architect's consciousness, universal recommendations for building orientation, siting, and dimensions; placement of key functions; and occupants' head direction when sleeping or performing tasks. The effects of isolated Vāstu elements included in MVA are presented. However, the full value of MVA, documented as a systematic, globally applicable practice, is in the effect of its complete package, and thus this review of MVA includes evaluating the experience of living and working in MVA buildings.

**Methods:** The published medical and health-related literature was systematically surveyed for research on factors related to isolated principles applied in MVA as well as on the complete system.

**Results:** Published research suggests that incorporating MVA principles into buildings correlates with significant improvements in occupants' physical and mental health and quality of life: better sleep, greater happiness of children, and the experience of heightened sense of security and reduced stress. The frequency of burglaries, a social determinant of health, also correlates. Potential neurophysiological mechanisms are described.

**Conclusions:** Findings suggest that MVA offers an actionable approach for managing a key social determinant of health by using architectural design as preventive medicine and in public health.

## Keywords

architecture, symmetry, orientation, direction, east, vastu, vaastu, sthapatya veda, social determinants of health, systems medicine

Received May 14, 2021. Accepted for publication January 13, 2022

## Introduction

To a large degree, health is shaped by the conditions in which people are born, grow, live, work, and age, collectively termed the social determinants of health.<sup>1</sup>

Social determinants of health are responsible for 80% to 90% of health outcomes.<sup>2</sup>

In their seminal article in the *New England Journal of Medicine*, Greene and Loscalzo describe “the long arc of

<sup>1</sup>Institute for Vedic Architecture, Maharishi International University, Fairfield, IA, USA

<sup>2</sup>Professor, Maharishi Vedic Research Institute, Gold Coast, AU-QLD, Australia

<sup>3</sup>College of Integrative Medicine, Maharishi International University, Fairfield, IA, USA

### Corresponding Author:

Jon Lipman, AIA, Institute for Vedic Architecture, Maharishi International University, 1971 Sunrise Drive, Fairfield, IA 52556, USA.

Email: [jon@jlipman.com](mailto:jon@jlipman.com)



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 License (<https://creativecommons.org/licenses/by-nc/4.0/>) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed as specified on the SAGE

and Open Access pages (<https://us.sagepub.com/en-us/nam/open-access-at-sage>).

reductionism in medicine” from the 18th century through the 20th century. However, in 21st-century medicine, molecular reductionism is evolving into postgenomic holism or systems medicine (also called network medicine).<sup>3</sup> These incorporate the geophysical environment, built environment, and the interactome, along with biological networks. Subsequent articles in *JAMA*, *The Lancet*, and *BMJ* argue that key among the disease-health networks are social determinants of health, including the built environment.<sup>1,2,4</sup>

This is an urgent issue for the practice of medicine because the world’s population is projected to increase by 40% by the end of the century.<sup>5</sup> The epidemiologic trend presses the question of whether the hundreds of millions of new housing units that must be built in these coming decades will affect the physical and mental health of humanity for better or for worse. The growing recognition that building design plays a key role in solving humanity’s health challenges has spurred preventive medicine and public health experts to explore potential solutions with architects. In the United Kingdom 26 governmental and non-profit entities have signed a national memorandum of understanding on improving health care through the residential environment.<sup>6</sup> A recent article published by the Royal Society of Public Health examined the potential of architects to improve the population of the United Kingdom’s health and well-being by designing healthier buildings and places.<sup>7</sup>

The importance of a coherent, healthy approach to architecture and planning has been the subject of many studies.<sup>8-10</sup> Within healthcare, “humanistic architecture” is promoted to counter the negative effect of some ill-designed spaces on mental health.<sup>11</sup> Concerns in healthcare design have recently led to the establishment of evidence-based,<sup>12</sup> patient-focused,<sup>13</sup> and therapeutic architecture.<sup>14</sup>

The field of neuroaesthetics attempts to solve intractable problems in health and well-being through architecture, art, and music. It is the focus of the Johns Hopkins International Arts + Mind Lab.<sup>15</sup>

Equally demanded in the field of public health is design that responds to climate change and pandemics, particularly for vulnerable populations.<sup>16,17</sup>

Theories and practices at the nexus of architecture, health, and sustainability have been advanced in the past two decades, including holistic housing,<sup>18</sup> integrated design processes,<sup>19</sup> and integrated building envelope strategies.<sup>20</sup>

In the United States, institutes are dedicated to advancing healthful construction, notably the International WELL Building Institute<sup>21</sup> and the Institute of Building Biology + Sustainability IBN.<sup>22</sup> Through multiple initiatives, the Wellness Architecture Initiative of the Global Wellness Institute is attempting to expand the knowledge of how the built environment impacts human well-being.<sup>23</sup>

Research is being conducted at the Mayo Clinic’s Well Building Lab, and courses on the subject are offered at the Massachusetts Institute of Technology,<sup>24</sup> Columbia,<sup>25</sup> and others. Analysis of the relationship between buildings and brain functioning is promoted by the Academy of

Neuroscience for Architecture.<sup>26</sup> Neuroarchitecture and cognitive architecture are emerging specialty fields that are attempting to document the relationship between the built environment, brain functioning, and human cognition.<sup>27</sup>

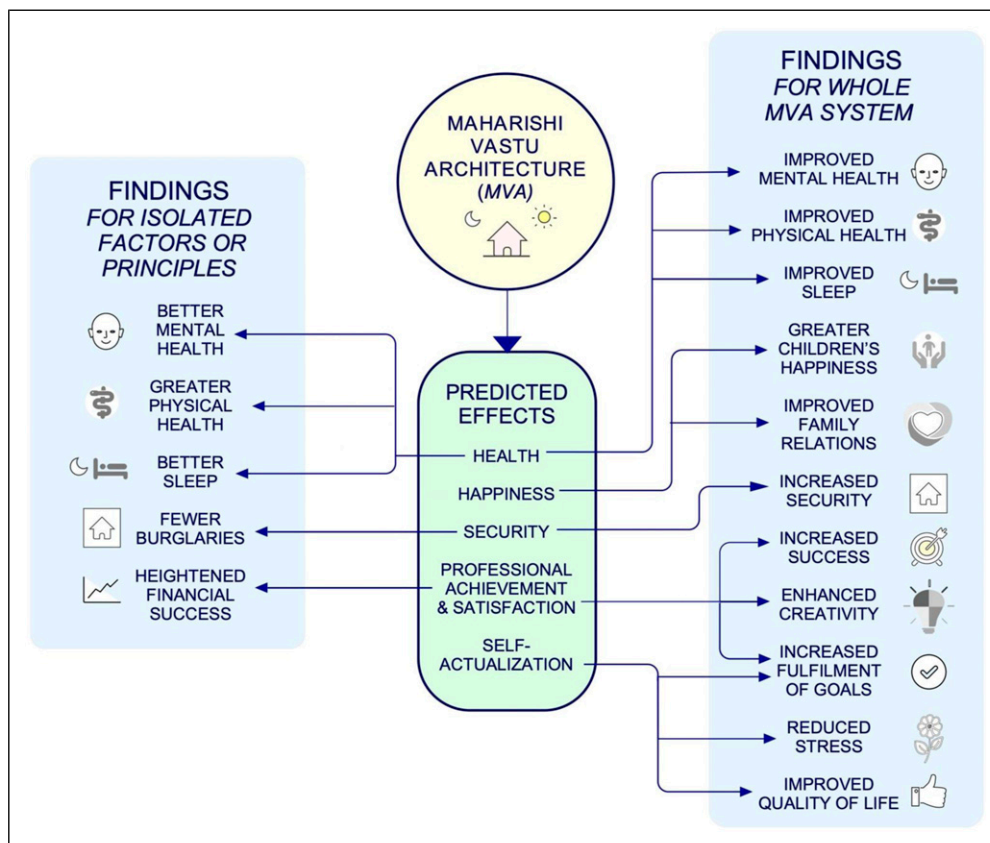
However, outside of the hospital setting, the advances achieved to date in therapeutic architecture are ad hoc and still modest.<sup>28,29</sup> Regarding the impact of architecture, arts, and music on neurophysiology, Susan Magsamen of Johns Hopkins University asserts that “a growing body of disconnected studies has left few high-quality data sets, standardized measures or implementation protocols from which to build.”<sup>15</sup>

In response to the need for an architectural system that improves well-being, including mental and physical health, the literature of Maharishi Vastu architecture (MVA) describes a comprehensive system of architecture and city planning that holistically promotes physical and mental health, social relationships, occupational achievement, and self-actualization.<sup>30</sup> This review evaluates the evidence for whether MVA can advance systems medicine by managing the built environment to promote health and prevent disease.

MVA is derived from the branch of India’s ancient Vedic knowledge known as Sthāpatya Veda or Vāstu Vidya, the “knowledge of architecture.”<sup>31,32</sup> Its primary Vedic texts are *Mānasāra*, *Mayamata*, and *Bṛihat Saṃhitā*. Sthāpatya Veda is described as the architectural intelligence in nature. When coordinated elements of it are applied to the design of buildings or cities the discipline is referred to as Vāstu Vidya or simply Vāstu. MVA is a recent reconstruction of Vāstu and is described as a holistic architecture system which aligns built environments with nature’s intelligence, making human architecture balanced, orderly, and integrated.<sup>29</sup>

Design according to the principles of Vāstu can be seen in the architectural histories of India, Cambodia,<sup>33,34</sup> Indonesia,<sup>35</sup> China, Japan, and Iran.<sup>36,37</sup> MVA, like other systems of Vāstu, utilizes principles associated with the directional orientation (azimuth or bearing) of buildings, communities, and individual residents as they perform common activities in their daily lives, and alignment to the Earth’s direction of rotation. Systems of Vāstu posit an integrated and holistic approach to human needs, “balancing them to bring harmony in life” and “stress-free living.”<sup>38</sup> MVA in addition addresses contemporary environmental hazards as well as elements of design and construction which impact health.<sup>29</sup>

The objective of this review is to examine the health-related research literature on MVA to assess its application to preventive medicine and public health (Figure 1). The review is focused on MVA specifically rather than on Vāstu in general because MVA is a system whose buildings are third-party certified for authenticity,<sup>39</sup> and is practiced solely by accredited graduates of a post-graduate program for architects offered by the Institute of Vedic Architecture and City



**Figure 1.** Summary of findings on Maharishi Vastu architecture.

Planning, is practiced in a highly systematized protocol, is the product of a 20-year research project to ensure authenticity to historical Vedic texts<sup>29</sup>; and incorporates additional modalities to combat environmental hazards of the 21st-century city.

In light of the focuses of systems medicine and social determinants of health, this review examines the studies that evaluate MVA's impact as a comprehensive system of architecture designed to promote health, and discusses how this system may be further evaluated to advance preventive medicine and health-promotion applications.

## Methods

For the medical research literature review, the authors searched all architecture-related articles indexed by MIT's Design Issues, and performed searches in PUBMED, the Building Research Information Database (BRIK), and [Academia.edu](http://Academia.edu), reviewing all entries featuring the terms Vastu, Vaastu, Vāstu Vidya, Maharishi Vastu, Sthapatya Veda, north+south+east+west, azimuth+north, azimuth+east, azimuth+south, azimuth+west, spatial+cognition+direction, space-time+mapping, direction+"frames of reference", orientation+"frames of reference," "solar compass," and "sun compass." The authors have also conducted reviews of this subject in the architectural press, including books on healthy

buildings and biophilic architecture, and additional pertinent publications.

For a background in the theory of Vāstu architecture, the authors reviewed both the recent and historical texts on Vāstu and MVA. The authors examined the primary texts—Acharya,<sup>40</sup> Achyuthan,<sup>41</sup> Bhat,<sup>42</sup> and Dagens.<sup>43</sup> In its review of the contemporary practice of Vāstu the authors studied Batra,<sup>37</sup> Chakrabarti,<sup>44</sup> Fazeli,<sup>35</sup> Nathan,<sup>30</sup> and Venugopal.<sup>31</sup> To cover the contemporary theoretical literature on MVA, the authors reviewed all published books on MVA plus key recorded presentations—Audet,<sup>45,46</sup> Bonshek,<sup>47,48</sup> Bonshek and Hamill,<sup>33</sup> Maharishi Vedic University,<sup>49,50</sup> Hartmann,<sup>51</sup> Institute of Vedic Architecture and City Planning,<sup>29</sup> Maharishi Mahesh Yogi,<sup>52-55</sup> and Nader.<sup>56</sup>

## Results

### *Theory of Healthy Architecture*

MVA is a system of architecture predicted to improve occupants' lives in a wide range of areas. The theoretical basis for this derives from the understanding in Vedic science that there is an aspect of nature's intelligence, Sthāpatya Veda, that establishes the structures of nature in harmony with this inner intelligence. As an example, atoms, molecules, stars, and galaxies have a core at their center (a Brahmathan)

which is proposed to maintain the link between the structure and nature's unmanifest intelligence.

When coordinated elements of the theory are applied to the design of buildings or cities, the result is MVA structures that are posited to be holistic and aligned with nature's intelligence, making them balanced, integrated, and nourishing to their occupants. To accomplish this, MVA incorporates 14 elements identified in various traditional texts of Vāstu plus eight non-historical elements:

Elements of Maharishi Vastu architecture identified in traditional texts:

1. Developing the consciousness of the architect,
2. Building walls aligned precisely to the cardinal directions,
3. Building orientation to the east (primarily) or north (secondarily) (i.e., the entrance is on the east or north side),
4. Designing the floor plan to promote occupants facing recommended directions during sleep and other primary activities,
5. Placing key functions in specified locations in floor plan,
6. Calculating proportions and measurements of building according to a Vedic system,
7. Incorporating ornament and a traditional plinth and finial (kalash),
8. Normally designing with bilateral symmetry, and certain geometric combinations,
9. Incorporating a top-lit central space with the center of the house marked on the floor (Brahmasthan),
10. Enclosing the building within a rectangular fence or wall with gate to east or north,
11. Evaluating the slope of land, location of nearby water bodies, and direction of access to site prior to site selection,
12. Altering the slope of lot and placing water features according to Vedic principles,
13. Setting key steps in construction at times according to formulas for auspicious timings (muhurtas),
14. Building homes within communities that have been designed according to principles of MVA city planning (outside of the scope of this review).

Items 1, 2, 3, 7, and 10 above appear not to be commonly or consistently a part of Vāstu practice today.

Non-historical elements of Maharishi Vastu architecture:

1. Avoiding sick building syndrome and improving indoor air quality via cross-ventilation or at least greatly increased circulation of outside air,
2. Favoring natural and non-toxic materials; protocols to reduce the growth of mold and build-up of mycotoxins,
3. Favoring thick, self-insulating exterior walls composed of vapor-permeable natural materials,

4. Assessing contemporary environmental hazards such as on-site air quality and proximity to cell phone towers and high-tension electrical lines as a part of site selection,
5. Protocols to reduce electromagnetic radiation in building wiring,
6. Promoting flower and organic vegetable gardens in the yard, providing fresh food and a view of nature's beauty,
7. Bringing substantial eastern sunlight into the building.
8. Comprehensive, standardized training; third-party review of designs by accredited peers, and review again by the central, international office; third-party certification of completed buildings.

The international director of MVA, Dr Eike Hartmann, wrote that Maharishi Mahesh Yogi, contemporary Vedic scholar, scientist and teacher, concluded that the surviving practice of the ancient field of Vāstu was reduced in effect because it was incomplete, and so, over 20 years, Maharishi worked to restore its completeness and efficacy in collaboration with members of six major traditional lineages of Vāstu. Simultaneously, he added protocols to mitigate health hazards that had uniquely arisen in the contemporary built environment.<sup>39</sup>

The product of this standardized practice of Vāstu is identified by the term Maharishi Vastu architecture and planning (MVA) (See Table 1). The practice is administered by the Institute of Vedic Architecture and City Planning, Vlodrop, the Netherlands.<sup>29</sup>

### *Introduction to Research Results*

The above-listed elements in MVA have been studied individually and in combination. The authors have identified eleven empirical studies on factors related to isolated elements and four studies on the effects of the complete system of MVA. Some of the isolated elements have been so exhaustively studied that the authors have not addressed them in this literature review. They are:

1. Favoring natural and non-toxic materials,
2. Reducing the possibility of elevated levels of mold,
3. Introducing an elevated quantity of fresh air.
4. Not building in proximity to strong emitters of electromagnetic radiation (EMR),
5. Building to minimize generation of EMR.

Each would require its own literature review to properly address.

### *Research on Factors Related to Individual Elements of MVA*

*Head direction:* MVA proposes that human health is affected by the direction in which a person's body lies—its

**Table 1.** The Elements and systems of Maharishi Vastu architecture.

| Elements taken from the historical texts                                                       |                                                                                 |                                                                                                     |                                                                                                           |                                                                             |                                                               |
|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------------------------|
| Enlightened architect (sthapati)                                                               | Connecting individual life with cosmic life                                     | Orientation towards the rising sun                                                                  | Alignment to North and South Poles and Equator                                                            | Vedic proportions, symmetry, order, and measurement system                  | Placement of buildings and amenities according to natural law |
| <b>MVA-added elements</b>                                                                      |                                                                                 |                                                                                                     |                                                                                                           |                                                                             |                                                               |
| Vedic garden cities and self-sufficient satellite towns free from pollution, noise, and stress | Natural/non-toxic materials, safe electrical environment                        | Vedic lifestyle: Integrated physical and mental wellness, yoga, ayurveda, Transcendental Meditation | Vedic agriculture for fully ripened organic food. Consciousness-based education, Vedic health care system |                                                                             |                                                               |
| <b>MVA-added system</b>                                                                        |                                                                                 |                                                                                                     |                                                                                                           |                                                                             |                                                               |
| Universal system of architecture and city planning in harmony with natural law                 | Development of holistic Vedic consciousness of the architects and city planners | Standardized international training, verified knowledge base and procedures                         | Peer review of work in progress, certification of completed projects                                      | Scientific research on the Vāstu effect and Vedic principles in modern life |                                                               |

orientation—while sleeping, and the direction it faces when engaged in primary waking activities.

Researchers have discovered what is described as an “inner global positioning system (GPS)” in the brain consisting of “place cells” that form a map of the surroundings<sup>57</sup> and “grid cells” that generate a coordinate system and allow for precise positioning and path-finding by the subject. Some brain cells, for example, the so-called place cells, grid cells, and thalamus head direction cells, fire differently based on the direction a subject is facing.<sup>58</sup> In studies on navigating rodents, the head-direction signal was found to play a functional role as a neural compass.<sup>59</sup>

Is azimuth tracking fixed, is it solely endogenous (internal), or is there an exogenous (external) component to it? There are two exogenous candidates for azimuth tracking—the sun compass and the sensitivity to the Earth’s natural magnetic field.

*Solar compass:* The sun is used for navigation (as a solar compass) by insects, crustaceans, fish (Actinopterygii), amphibians, reptiles, birds, rodents, and mammals. Although the sun travels 180 degrees across the sky diurnally, these life forms apparently make chronological adjustments to correct for this. In the laboratory, McDonald found the accuracy of avian use of the sun compass to be  $\pm 3$  to 5 degrees.<sup>60</sup> Similar phenomena were observed by Dacke M et al<sup>61</sup>; Schmidt-Koenig K et al<sup>62</sup>; Foà A et al<sup>63</sup>; Lindecke O et al.<sup>64</sup>

Jang H et al<sup>65</sup> found that many individuals among the Mbendjele people of the Republic of Congo were highly accurate when pointing to out-of-sight targets, with a median error of only six degrees even in a dark forest.

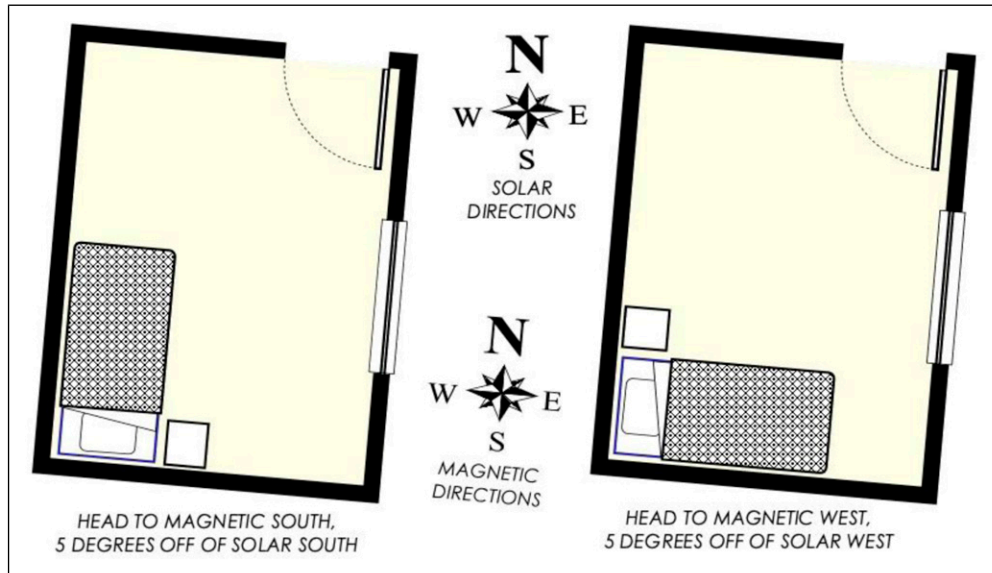
Boroditsky and Gaby<sup>66</sup> found that 100% of individuals raised in a particularly direction-sensitive culture in Australia pointed upon request to each of the four cardinal directions with an accuracy of 20 degrees or better.

*The Earth’s natural magnetic field:* In 1992, magnetic and high-resolution transmission electron microscopy measurements established that clumps of magnetite, a ferromagnetic material—in effect, magnets—exist in most tissues of the human brain.<sup>67</sup>

Research published in 2019 proposes that the human brain’s magnetoreception can distinguish between north and south. The authors write, “Our results indicate that at least some modern humans transduce changes in Earth-strength magnetic fields into an active neural response.” In EEG research, in which human subjects were shielded from all magnetic fields except those that were artificially induced in the experiment, the subjects’ brains responded to an induced field, and did so only when it was propagated from a direction from which the earth’s magnetic field does naturally propagate in that area of the globe. Tracking a known brain wave signature called alpha-ERD established that the brain’s sensitivity to the induced field distinguished the direction from which the field was propagating, leading to the assertion that at least some human brains can distinguish north and south from exposure to a laboratory recreation of the Earth’s magnetic field.<sup>68</sup> Follow-up research is needed to attempt to duplicate these findings outside the laboratory.

*Sleeping direction:* MVA (and Vāstu as commonly practiced) proposes that human health is affected by the direction in which a person’s body lies—its orientation or azimuth—while sleeping. It recommends that persons sleep with their head to the east to promote enlightenment or south to promote longevity (i.e., pillow at the east end or south end of the bed). Head to the west is avoided, and it is most unhealthful to sleep with head to the north.<sup>69</sup>

Rajeswari et al<sup>70</sup> found that when exposing prone human subjects to pulsations of extremely low frequency magnetic field those who were oriented with head to the north (magnetic north which was one degree west of true north)



**Figure 2.** Two similar rooms with different bed orientations. Left: aligned with and towards the Earth's electromagnetic field (south). Right: perpendicular to the Earth's electromagnetic field (west). Magnetic declination at location of study is within five degrees of true north so does not reveal whether the effect is associated with the magnetic field or the direction of the Earth's rotation. Data from study represented by author of literature review.

became restless and aggressive, and their serum cholinesterase levels were significantly increased.

Travis et al<sup>71</sup> performed a statistical comparison with directions of sleep as the grouping variable and found that among the patients of a general practitioner, those who slept at home with their head pointing north had significantly lower scores on a Mental Health Inventory compared to patients who slept in other directions ( $F(1,150) = 9.08, p = .003$ ). This result remained significant when controlling for level of income ( $F(1,153) = 3.98, p = .05$ ).

A study examined whether head direction affects heart rate, blood pressure, and serum cortisol during supine rest. One group of 20 female students was instructed to sleep for 8 hours oriented to the east for 12 weeks and a second group of 20 to the south. Their systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were recorded and serum cortisol (SC) estimated. Rates were modestly higher in the east-sleeping group but not to a statistically significant degree. Each group was then instructed to reverse the direction in which they slept for 12 weeks and the 4 markers were again recorded. All markers were higher by statistically significant amounts: the  $p$ -values for SBP was .007, for DBP—.02, for HR—.004, and for serum cortisol—.0001.

The researchers concluded that sleeping for eight hours in different directions (author's note: west vs east and north vs south) had a clear effect of increasing heart rate, blood pressure and serum cortisol. The effect on diastolic blood pressure, though statistically significant, was only modest.<sup>72</sup> The study did not clarify whether the sleep was during the day or night nor whether alignment was to magnetic or true directions.

In a cross-sectional study by Hekmatmanesh et al,<sup>73</sup> 21 participants slept for two consecutive early afternoon naps in rooms with identical interior design but with the bed in one room oriented with body aligned to magnetic north/south and in the other with body aligned with head to magnetic east/west. (Figure 2). In 2019, magnetic directions in Teheran, Iran where the study was conducted were five degrees clockwise from true directions. The mean total sleep time was 1.63 hours with head to magnetic south and 1.38 hours with head to magnetic west.  $t$ -test results showed significant changes in subjects' brainwaves in delta, theta, and alpha frequencies and increases in the average energy of delta, theta, and alpha bands in the average energy of the three bands in subjects with head to magnetic north/south vs east/west. Changes in beta1 and beta2 were not statistically significant.

The study concluded that sleep with body aligned north/south could be more beneficial than sleep with body aligned east/west. The authors of this review note that all of the subjects sleeping in a north/south orientation were lying with heads within five degrees of true south and all of those lying east/west were lying with heads within five degrees of true west. While such studies explore effects of head direction when asleep, the effect of facing a particular direction during activity has also been documented:

*Effect of head orientation on brain coherence and task performance:* A recent study was designed to ascertain whether there was a difference in brain coherence when people faced each of the cardinal directions, and also to ascertain, when subjects were engaged in a task, whether their performance differed when they faced different directions. The prediction derived from MVA's texts was that researchers would observe superior functioning and brain coherence

when subjects were facing east, which is considered optimum, followed in order, by north, west, and south.<sup>48</sup>

The task was to assemble randomly-selected jigsaw puzzles, while quasi-randomly commencing facing each of the four directions in equal numbers, and proceeding clockwise around a square table to assembling each of the three remaining puzzles. The 28 subjects were blind to the hypothesis and were studied in a room in which window blinds blocked sunlight from passing through the windows.

The task performance portion of the study focused in on frontal beta and gamma waves because these are waves that are particularly associated with focused attention.

There was significant direction-by-frequency interaction in frontal coherence. ( $F(18,504) = 1.8, p = .020$ ). Thus, individual repeated measure ANOVAs were conducted for frontal coherence within each frequency. Significant direction effects occurred only in beta2 and gamma coherence (beta2:  $F(3, 84) = 4.0, p = .010$ ; gamma:  $F(3, 84) = 2.8, p = .045$ ). The significant effects were linear, with larger coherence averages when subjects faced east and north than when facing west and south (beta2:  $F(1, 28) = 6.2, p = .019$ ; gamma ( $F(1, 28) = 5.1, p = .032$ ).

Times to complete the puzzles were averaged within each cardinal direction and compared with repeated measures ANOVA. This analysis yielded a significant main effect for direction for puzzle-completion speed ( $F(1, 27) = 4.8, p = .037$ ): puzzle completion times were faster when subjects faced east or north and slower when they faced west or south.

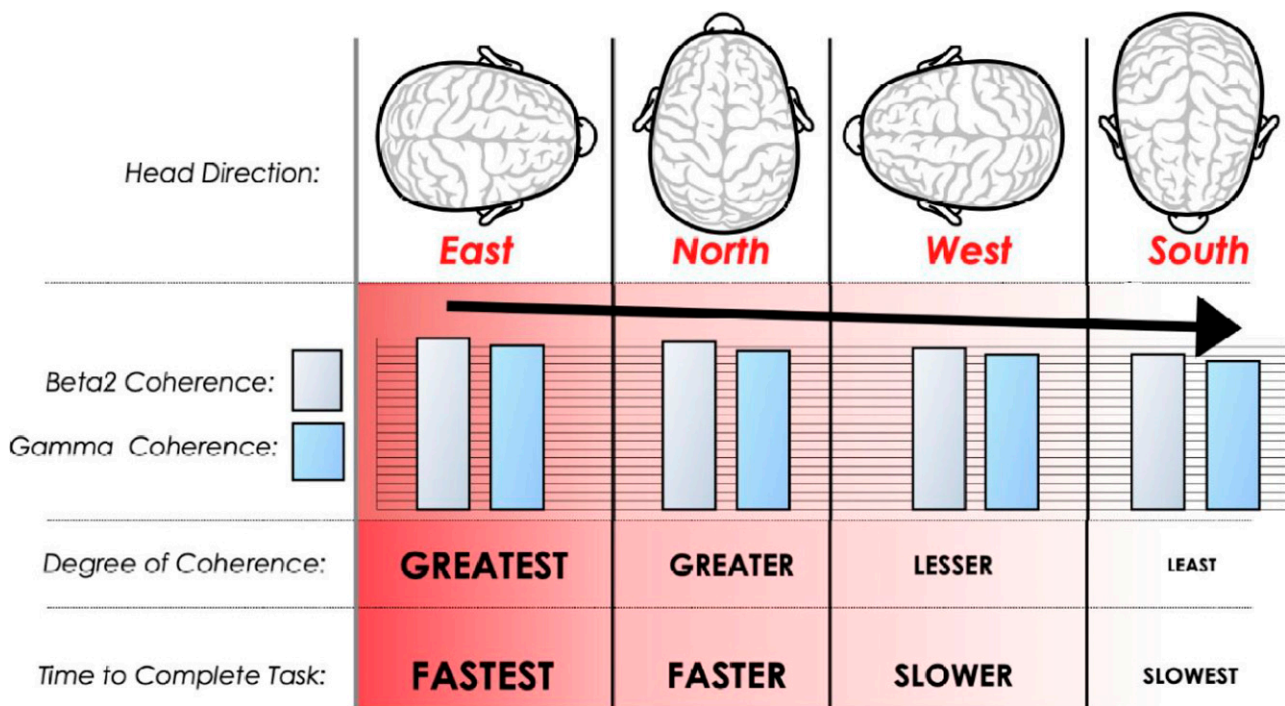
The study concluded that:

- Average time to complete the puzzles was shorter when facing east or north, compared to west or south.
- Brain coherence while completing the puzzles was greatest when subjects faced east, next north, and last, west and south (See Table 2).

The authors concluded that head direction affected speed of performance and levels of beta and gamma coherence, which are the wavelengths associated with focused attention.<sup>74</sup>

*Building orientation:* MVA (and Vāstu as commonly practiced) proposes that not only the body’s orientation but also the orientation of a building affects subjects in a variety of specified ways. In a study of 167 patients attending a private family practice in Ottumwa, Iowa investigating correlations between house orientation and scores of mental health and self-reported financial problems, participants whose homes had south entrances scored significantly lower on a mental health instrument and higher in a financial health instrument than those whose houses had east or north entrances.<sup>71</sup> Using analysis of variance, patients whose homes had south entrances had significantly poorer overall scores on a Mental Health Inventory than patients with north, north-east or east entrances ( $F(1,154) = 4.51, p = .03$ ). Patients whose homes had south entrances also reported more financial

**Table 2.** Graphic summary of results showing the association between head direction and time to complete task and degree of brain coherence.<sup>74</sup> Reproduced with permission of the author.



(N=32) Beta2 P=0.02, Gamma P=0.03, Speed P = 0.37

problems relative to those with north, north-east or east entrances ( $F(1,154) = 4.18, p = .04$ ).

Drawing from a sample of 95 homes in Fairfield, Iowa, the study examined the relationship of house orientation and burglaries and found that there were 75% more burglaries in south-facing houses than of houses facing east, west, or north.<sup>71</sup> A chi square goodness-of-fit tested whether this observed pattern differed significantly from a chance distribution of events (equal number of burglaries in homes with entrances facing either of the 4 cardinal directions). This test revealed the observed pattern differed significantly from chance ( $\chi^2 = 199, p < .01$ ).

*Eastern sunlight:* The salutary influence of sunlight on human health has been well documented (e.g., Carter<sup>75</sup>, Ulrich<sup>87</sup> and Weller<sup>76</sup>), with studies showing its effect, for example, on reducing the likelihood of and improving treatment for rickets (i.e.,) and tuberculosis (i.e., heliotherapy). The reverse is also true: the lack of sunlight is implicated in wintertime negative mood disturbances.<sup>75</sup> The authors found five studies comparing health effects of morning vs afternoon light:

Benedetti<sup>78</sup> compared the historical recovery rates of patients housed in one wing of a hospital. Half of the patients studied were randomly assigned rooms on the east side of a corridor (with east windows), and half rooms on the west side of the same corridor (with west windows), and both sets of patients were treated by the same psychiatrists. It was found that bipolar-disorder patients whose rooms were on the east side of the corridor were released from treatment an average of 3.7 days earlier than the bipolar-disorder patients in rooms on the west side of the corridor.

Reid et al<sup>78</sup> found that individuals who had been exposed to artificial light primarily in the morning had a significantly more ideal body mass index than those exposed to light primarily in the afternoon. The earlier in the day that the light exposure occurred, the greater the positive effect.

Gaddameedhi et al<sup>79</sup> found that the time of day of exposure to ultraviolet radiation was a contributing factor to skin cancer development in mice. The findings translated to the human physiology led to the conclusion that afternoon sunlight but not morning sunlight is a major risk factor for developing skin cancer.

Lewy et al<sup>80</sup> found that artificial bright light therapy has a higher efficacy on winter depression when administered in the morning than in the evening.

Nakade et al<sup>81</sup> concluded that more than ten minutes of morning sunlight exposure in young children might be a necessary component to maintain mental health.

### Research Conducted on Occupants of MVA Buildings

MVA is proposed to be a holistic approach. Will investigations of the system as a whole—rather than of factors related to isolated principles associated with MVA—show more

comprehensive effects upon health, performance, and quality of life?

One recent study on the system as a whole measured how MVA affects the creativity of building occupants. An architecture firm's employees ( $N = 32$ ) were tested for creativity using the Torrance Test of Creative Thinking (TTCT) before and after moving into an MVA office building. Data showed a 50-85% increase in the originality and depth of their creative output.<sup>84</sup>

Data analysis revealed, for example, increased verbal (score 1.90 at pre-test and 3.50 at post-test,  $p = .02$ ) and figural (score 3.56 at pre-test and 5.27 at post-test,  $p = .002$ ) originality of employees' creative output after moving into the MVA building. There was also a significant increase in elaboration of ideas (score 7.53 at pre-test and 10.50 at post-test,  $p = .007$ ) and resistance to closure (score 8.40 at pre-test and 13.53 at post-test,  $p = .008$ ). These findings suggest that employees were "more likely to make the mental leap that makes original ideas possible."<sup>82,83</sup> The post-move tests were conducted three months after employees moved into the building, ensuring that the measured effects could be reasonably attributed to working in the MVA office building. Still the study was susceptible to confounding variables. The number of matched subjects, while enough to lead to statistically significant findings, was modest.

Another study of this population found a significant improvement in the health and well-being of employees after they relocated to the MVA office building.<sup>85</sup> Data shows that there was an 8% higher level of employee health and well-being when working in the MVA building as compared with working in the conventional building ( $p < .05$ ).

The researchers designed a new instrument for measuring workplace health and well-being, from a eudemonic perspective, with an 11-item health and well-being inventory using a five-point Likert Scale in a two-part model that included (a) employee perceptions about themselves and (b) employee perceptions about themselves in their workplace. This research employed a pre-post-test design of 21 matched pairs where the same participant completed the test before and after the move. The health and well-being inventory showed high reliability scores with Cronbach's alpha of .94. A non-parametric matched-pair  $t$ -test analysis was used to compare individuals' change in health and well-being. A one-tail analysis was used given the strong theoretical basis for the directionality of the effect.

In another recent study, Fergusson et al<sup>38</sup> examined the lived experience of occupants of MVA homes. The study consisted of a concurrent mixed-methods study of 158 subjects in 14 countries using a triangulated quantitative and qualitative design to investigate the experience of living in MVA homes. Respondents reported (Figure 3) that living in MVA was associated with improvements in their overall well-being (Cohen's effect size,  $d = 1.48$ ), health (effect size,  $d = 1.06$ ), personal development (effect size,  $d = 1.27$ ), and success (effect size,  $d = 1.21$ ).





**Figure 3.** Summary of descriptive results on MVA, health, and well-being (Fergusson et al, 2020).

In the study, 88% of respondents reported that living in MVA was associated with a higher overall quality of life, 80% found improved physical health, and 71% found improved mental health. Eighty-nine percent of respondents attributed improved quality of life to living in an MVA home, 78% reported improved family relations, 85% reported less stress, 80% reported improved mental health, 88% of parents reported that their children were happier, and 92% reported greater overall success.

These quantitative findings corresponded to, and were corroborated by, qualitative reports of well-being (for example, “It feels like a safe haven, a sanctuary”), health (for example, “...tremendous feeling of upliftment on every level: physically and health-wise, emotionally and spiritually”), personal development (for example, “much better decisions made in this environment by us and others”), and success (for

example, “[MVA results in] better finances and success in work”). The effects were apparently greater for those living in MVA for more than three years: well-being ( $F = 2.02, p = .02$ ), success ( $F = 2.57, p = .005$ ), and overall quality of life ( $F = 1.89, p = .02$ ).

Western solar design (and often Feng Shui) orients buildings to the sun’s southern and northern daylight arcs, which are dramatically different in the Northern and Southern Hemispheres. MVA does not do this; rather it orients buildings worldwide to true east (or very rarely to true north). Fergusson et al (2021) used a cross-sectional quantitative survey of 158 MVA homeowners to investigate whether the quality of life of a home’s occupants varies in Northern and Southern Hemisphere MVA homes when the orientation of the home is solely to true east and not oriented differently to the sun’s southern and northern daylight arcs in the Northern and Southern

Hemispheres. Their research showed that the lived experiences of respondents did not vary in homes located in the Northern Hemisphere (ten countries) vs the Southern Hemisphere (four countries). For example, 84% of occupants of Northern Hemisphere homes agreed or strongly agreed that since living in MVA they had experienced improved well-being, while 89% in Southern Hemisphere homes had done so. Similarly, 78% of occupants of Northern Hemisphere homes agreed or strongly agreed that since living in MVA they had experienced improved increased meaning and purpose in life, while 81% in Southern Hemisphere homes did so. None of the observed differences in quality of life were statistically significant when the location of the home was in either the Northern or Southern Hemispheres, thereby confirming the prediction of MVA.

## Discussion

The authors found 12 studies on isolated components and four studies on the integrated system of MVA (in addition to many studies on the health effects of indoor air quality and EMR not included in this literature review). While the research studies on the holistic integrated system show that living and working in MVA is important for health and quality of life, considered together with studies on isolated aspects of MVA, this review also suggests significant associations between the incorporation of isolated MVA elements into buildings and improved health and quality of life. Such associations include reduced blood pressure, heart rate, serum cortisol, and psychological stress, and improved creativity, happiness, sleep, and sense of security. The frequency of burglaries, a social determinant of health, was also reduced. The findings suggest that MVA offers an actionable method for architectural design to enhance public health.

Some of the studies support the value of isolated elements of Vāstu as it is commonly practiced. However, the authors have located no studies that evaluate the effects of the full system of Vāstu as it is commonly practiced, nor even a uniform set of elements of Vāstu that are incorporated in its common practice. A value of MVA for conducting research is that it is practiced uniformly around the world and therefore has generated a large enough number of subjects to evaluate its effects with statistical significance.

### *The Effects of the Full System*

The findings of four studies documenting building occupants' assessment of living or working in a complete MVA structure<sup>38,82,83,85</sup> are consistent with MVA's assertion that this design system promotes influences of well-being, physical health, mental health, improved family relationships, professional achievement, and self-actualization. These studies apply both quantitative and mixed methods research designs. (See [Table 3](#))

Fergusson et al<sup>38</sup> found each of these measures to be experienced by a substantial majority of the occupants of MVA homes, with increased experience of the qualities

among those who have occupied their homes for more than three years. This suggests that the lived results may develop with time. Moreover, these salutary experiences do not appear to be affected by whether the MVA building is located in the Northern or Southern Hemisphere. The orientation of all studied MVA houses was toward true east and not facing the sun's daylight arc as generally occurs in solar architecture and Feng Shui design.<sup>86</sup> This lends support to the MVA principle that wherever an MVA home is located its orientation to true east results in similar experiences of quality of life. This is consistent with the authors' suggestion that MVA may offer an actionable approach for managing a key social determinant of health worldwide.

The mental health benefit of an increased sense of security was among the most pervasive themes that occupants of MVA homes highlighted, including an increased feeling of safety and protection, and a sense of peacefulness in the home. There are several elements of MVA that have not been studied in isolation but which are understood to be necessary contributors to the results of Fergusson et al, 2020. They will be discussed later.

### *Key Components of the System*

*The human brain computes what direction it is facing—“GPS” neurons.* Travis, et al<sup>74</sup> found that human neurophysiology and behavior are affected by head direction as predicted by MVA. What neuromechanisms may account for this? The likeliest would utilize the human brain's sensitivity to the Earth's magnetic field. This sensitivity provides the brain with a virtual magnetic compass. It was established above that human brain cells contain microscopic magnets.<sup>67</sup> Wang et al.,'s<sup>68</sup> research on human EEG established that humans have magnetic sensors that send signals to the brain, which respond to a magnetic field only when its vertical component is at an angle from the subject commensurate with the actual vertical angle of the Earth's magnetic North Pole from the tested latitude and longitude. This apparent sensitivity of the sensors to the magnetic North Pole constitutes a plausible mechanism for the human brain's ability always to know the direction that the head is facing. (See [Table 4](#), Row 6)

Why should this sensitivity have evolved, and what evolutionary “purpose” may it serve? MVA may provide clues.

*Head direction during focused tasks and during sleep.* Travis et al.,<sup>74</sup> validates MVA's recommendation that for work or study the subject face east or north, finding that average time to complete a puzzle was fastest when subject faced east or north, and brain coherence was greatest. The study proposes that head direction is an important new factor that should be considered by architects, suggesting that head direction “could explain variability in education research—the orientation of the desks in classrooms may influence student alertness and so learning; and variability in business

**Table 3.** Studies on living or working in MVA buildings.

| Authors                   | Pub Year   | Study Design                                                                                                                                                                                                                                                                                                                                       | Controls                                                                                                                                                                                                                                             | No. of Subjects  | Outcome Variable                                                     | Results                                                                                                                                                                                                                                                                                                        |
|---------------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Maheshwari & Werd         | 2019, 2020 | A technical service company relocated from a conventional office building to one designed according to MVA. The company's employees were tested for creativity before and within three months after the move using a pre-post-test design.                                                                                                         | Employer encouraged all employees to participate in this research, Subjects were told it was a relocation study so they would be blind to the hypothesis of this research.                                                                           | 21 matched pairs | Creativity                                                           | Significantly higher scores in verbal originality, figural originality, resistance to closure, and elaboration in MVA office                                                                                                                                                                                   |
| Maheshwari & Werd         | 2020       | Service company relocated from conventional office building to MVA building. Employees tested for creativity before & w/n 3 months after the move using pre-post-test design. Workplace health & well-being measured using 2-part model that included employee perceptions about themselves, & employee perceptions about themselves in workplace. | The company encouraged all of its employees to participate in this research. The employees were told it was a relocation study, so they would be blind to the hypothesis of this research.                                                           | 21 matched pairs | Workplace health and well-being                                      | 8 % higher level of employee health & well-being when working in a MVA building compared to working in a conventional office building                                                                                                                                                                          |
| Fergusson, Nidich, et al. | 2020       | A concurrent mixed-methods survey of MVA homeowners in 14 countries using a triangulated quantitative and qualitative design to examine whether residing in MVA homes contributes to changes in well-being, health, personal development, or success, and whether length of time in MVA is associated with increased quality of life.              | Dependability controlled by asking same question to each participants following same research protocol; trustworthiness maintained by developing line-of-inquiry questions in a way consistent with previously published research on quality of life | 158              | Quality of life and length of time living in MVA home.               | Respondents reported that living in MVA was associated with improvements in well-being, health, personal development, and success. These quantitative findings corresponded to, & were corroborated by, qualitative reports. Effects were apparently greater for those living in MVA for more than three years |
| Fergusson, Bonshek et al. | 2021       | Cross-sectional quantitative survey of MVA homeowners investigated whether quality of life of a home's occupants varies in Northern and Southern Hemisphere with orientation of all homes to east.                                                                                                                                                 | As above.                                                                                                                                                                                                                                            | 158              | Quality of life relative to the location of subject's MVA residence. | The lived experiences of respondents did not vary in homes located in the Northern or Southern Hemisphere                                                                                                                                                                                                      |

**Table 4.** Studies on direction that subject faces, in sleep or during waking activity.

| Authors             | Pub Year | Study Design                                                                                                                                                                                                                                                                                                                                        | Controls                                                                                                                                                  | No. of Subjects | Outcome Variable                                                                  | Results                                                                                                                                                                            |
|---------------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Rajeswari et al.    | 1985     | Supine subjects in magnetic field enclosure were exposed to pulsations of extremely low frequency magnetic field oriented in each of the cardinal directions                                                                                                                                                                                        | Unclear.                                                                                                                                                  | 30              | Behavior, serum cholinesterase level                                              | Supine orientation w/ head to north is stressful: all complained of irritation, confusion, & serum cholinesterase levels significantly increased.                                  |
| Travis et al.       | 2005     | Naturalistic observation study. At an appointment with their family physician, participants completed the Mental Health inventory, the Stress Impact Scale, the Family Concordance scale of the Family Profile, & SF-36 Short Form Survey. The direction in which they slept at home was determined and correlated with the results of the surveys. | All subjects were blind to the hypotheses being tested and did not know the principles of MVA.                                                            | 167             | Mental health, general health perception, family cohesion, financial problems.    | Subjects with head to north during sleep had significantly lower scores on Mental Health Inventory.                                                                                |
| Shrivastava et al.  | 2009     | Human subjects slept nightly for 12 weeks head to south then 12 weeks head to north. Similarly, east then west. Physiological parameters measured before and after.                                                                                                                                                                                 | Not described.                                                                                                                                            | 40              | Heart rate, systolic & diastolic blood pressure, & serum cortisol.                | Sleeping with head to north compared to south increased heart rate, blood pressure, & serum cortisol.                                                                              |
| Hekmatmanesh et al. | 2019     | Cross-section, observation study of electroencephalographic signature in which participants slept for two consecutive days in rooms with identical interior design but with the head in one room oriented to the south and in the other with the head to the west.                                                                                  | None.                                                                                                                                                     | 21              | Delta, theta, and alpha frequencies of brainwaves.                                | Significant changes in brainwaves in delta, theta, and alpha frequencies. Increases in average energy of the 3 bands in subjects with head to south during sleep vs. head to west. |
| Travis et al.       | 2021     | EEG coherence patterns from 32-channel EEG, and time to complete jigsaw puzzles, were compared while seated subjects faced the four cardinal directions.                                                                                                                                                                                            | Subjects recruited so as to be blind to study hypothesis. Each randomly started facing one of the 4 cardinal directions & progressed in either direction. | 28              | EEG coherence patterns & time to complete puzzle as function of facing direction. | Head direction affected both levels of beta gamma coherence and speed of performance.                                                                                              |
| Wang et al.         | 2019     | Human subjects were shielded from all magnetic fields save those artificially induced in experiment. Quantitative EEG techniques investigated whether human brain responds to magnetic field changes similar to Earth's magnetic fields.                                                                                                            | Subjects unaware of the magnetic field shifts and felt that nothing had happened during the experiment                                                    | 36              | Alpha-ERD brain wave signatures                                                   | Human brains collect and process directional input from Earth-strength magnetic field such that brain can tell north from south.                                                   |

research—the orientation of work stations—could affect alertness and so productivity.” (See Table 4, Row 5) The results of four independent studies by Rajeswari et al.<sup>70</sup> Travis et al,<sup>74</sup> Shrivastava<sup>72</sup>, and Hekmatmanesh et al<sup>73</sup> provide consistent evidence supporting the MVA thesis that to improve mental health homes be designed so that beds are oriented with their headboard to the east or south, whereas sleeping with head to the north equates with a stressful environment. (See Table 4, Rows 1–4)

**Primacy of east and eastern light.** Maharishi Mahesh Yogi proposed, “The rising sun means life-giving rays of the dawning sun. It has a great influence when the sun enters the main room, the main entrance, of the house from the east.”<sup>55</sup> MVA recommends that while a house should be well lit naturally from all sides, it particularly favors sunlight from the east. We found no studies that demonstrated superior health outcomes from exposure to west or other over east light. Each of the five studies found in our literature review that looked at health outcomes associated with exposure to morning vs afternoon light proposed that a superior human health outcome is associated with exposure to east or morning light. (See Table 5)

Three of the studies found benefits of east light for mental health: a greater efficacy for treatment of winter depression<sup>80</sup>; a shorter period of treatment needed for bipolar disorder<sup>77</sup>; in conjunction with tryptophan and vitamin B6 intake at breakfast sufficient exposure to sunlight while walking to school in the morning may be necessary to maintain sleep and mental health in children and proper function of the circadian clock.<sup>81</sup> Two other studies suggested beneficial impacts on physical health, specifically body weight and the likelihood of developing skin cancer.<sup>78,79</sup>

**Building direction/orientation.** MVA advocates for buildings to face east (that is, for their front entrances to be on the east side of the building). North is the one other recommended option.<sup>92</sup> Specific effects are stated for buildings with entrances facing each of the eight cardinal and diagonal directions, with the broadest life-damaging influences postulated as coming to bear on the occupants of south-facing houses.<sup>69,88</sup> The findings in Travis et al,<sup>71</sup> that mental health scores, prosperity, and burglary rates are worst in south-facing homes correlate with the MVA prediction that south-facing homes create negative influences in all areas, including problems and suffering. These findings support the siting of buildings such that the direction they face promotes the overall health of their occupants. (See Table 6)

How might these findings be understood? The Earth rotates to the east. Therefore, the Sun, which maintains life on the Earth, approaches us from the east. MVA proposes that a subject is most nourished by the Sun, and most in line with the cosmic structure, when the subject faces or sleeps with their

head toward the east and occupies a home or office that faces east.

### *Theoretical Basis for MVA's Effects*

To begin to identify how the above elements function the authors examine what the system itself identifies as its core mechanisms.

The source of MVA is *Rik Veda*, which is the primal text of the Vedas and is described as embodying ‘wholeness’.<sup>38</sup> Veda refers to knowledge of the fundamental forms and functions of natural law, so MVA can be described as a holistic design and construction system which aligns built environments with complete intelligence, the intelligence of the unified field, by ‘weaving’ the laws of nature into the fabric of ‘human architectural design’ and form, thereby making it balanced, orderly, and integrated such that: “The home of the individual should...be in accordance, or be in line, with the Cosmic structure.”<sup>54</sup>

‘Integrated’ or ‘woven’ in this context means that each manifest expression of design is always connected to every other expression through their mutual connection with the wholeness of the unified field.

The source literature for MVA proposes that the system ties elements of human architecture to nature’s architecture and that this in turn has a connection to human consciousness. Many theoretical physicists accept that the physical universe is the expression of an unmanifest field described in supersymmetric quantum unified field theories,<sup>89</sup> and referred to as the unified field, first posited by Albert Einstein.<sup>90</sup> The forces and particles that comprise the manifest universe, and the laws that govern them, are characterized as emerging stage by stage from this field. The qualities of the field are expressed in sequential “levels” of physical reality; therefore, the universe can be considered to comprise a series of nested expressions of the underlying intelligence of a unified field.

MVA equates the unified field with a field of pure consciousness out of which both the physical universe and human consciousness arise.<sup>48,91,92</sup> This resonates with the theory of Nobel Laureate Roger Penrose, emeritus professor of mathematics, Oxford University, that proto-consciousness is a fundamental property of the universe.<sup>93</sup> Neuroscientists Giulio Tononi (University of Wisconsin) and Christoff Koch (California Institute of Tech and the Allen Brain Institute) have proposed a theory that identifies consciousness as “an intrinsic, fundamental property of reality.”<sup>94</sup>

Similarly, MVA proposes that this field of pure consciousness can be experienced by the human nervous system. The structures and functions of the human nervous system are held to be supported in MVA by designs in tune with pure consciousness and are thus proposed to be a consciousness-based architecture.<sup>95</sup> Maharishi introduced meditation techniques (Transcendental Meditation and the TM Sidhi Program) to maximize this functioning in architects.<sup>48</sup> He considered them necessary for the ideal practice of

**Table 5.** Studies on exposure to east/morning light vs west/afternoon/evening light.

| Authors            | Pub Year | Study Design                                                                                                                                                                                                                                                                                       | Controls                                                                                                                                          | No. of Subjects                   | Outcome Variable                                                              | Results                                                                                                                                                                                                                     |
|--------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Benedetti et al.   | 2001     | Length of hospitalization for unipolar and bipolar depressed inpatients assigned to hospital rooms w/east or west windows. Naturalistic retrospective observation.                                                                                                                                 | Rooms randomly assigned based on first available; same psychiatrists in charge of all patients.                                                   | 415 unipolar & 187 bipolar        | Duration of hospital stay.                                                    | Bipolar in east-window rooms had 3.67-day shorter hospital stay than patients in west-window rooms. No effect on unipolar.                                                                                                  |
| Reid et al.        | 2014     | Evaluate the relationship between body mass index (BMI) and sleep duration and wake timing. There was even distribution of data collection during all four seasons. Time above light threshold and mean light timing above threshold calculated.                                                   | Age, gender, season, activity counts, sleep midpoint, & total sleep time were controlled.                                                         | 54                                | Body mass index.                                                              | Those exposed to artificial light primarily in AM had a significantly more ideal BMI than those exposed to light primarily after noon.                                                                                      |
| Gaddameedhi et al. | 2011     | Ultraviolet (UV) damage leading to skin cancer is removed by the body's nucleotide excision repair system. A rate-limiting subunit of excision repair, the xeroderma pigmentosum group A (XPA) protein and the excision repair rate were examined for daily rhythmicity in mouse skin.             | Control group not subjected to UV radiation.                                                                                                      | 56                                | Excision repair rate of skin.                                                 | In mouse skin there is more DNA replication and less repair in the morning and less replication and more repair in the evening. Exposure to morning sunlight may therefore not be a risk factor for developing skin cancer. |
| Lewy et al.        | 1998     | Assessed AM and evening light exposure in parallel-group & crossover comparisons for subjects with moderate/severe depressive/bipolar disorders w/winter-type seasonal pattern, reporting depression developed during fall or winter and remitted following spring for at least the 2 prior years. | As closely as possible, controls and patients were matched by age and sex. Placebo control lacking.                                               | 51 patients & 49 matched controls | Depression and bipolar disorders.                                             | Morning light is at least twice as strong an antidepressant as evening light in the treatment of seasonal affective disorders.                                                                                              |
| Nakade et al.      |          | Study examined the effects of sunlight on the circadian typology and sleep habits of Japanese children following tryptophan and vitamin B6 intake at breakfast.                                                                                                                                    | Data gathered by questionnaire analyzed w/Spearman's correlational analysis, Wilcoxon signed-rank test, Mann-Whitney U-test, Kruskal-Wallis test. | 816                               | Duration of exposure to sunlight after breakfast w/ tryptophan and vitamin B6 | Sufficient exposure to sunlight after breakfast may be necessary to maintain sleep and mental health, and proper function of the circadian clock.                                                                           |

**Table 6.** Studies on the direction that subject's home faces.

| Authors        | Pub Year | Study Design                                                                                                                                                                                                                                                                                                                                        | Controls                                                                                                                                                                         | No. of Subjects | Outcome Variable                                                               | Results                                                                                                                                                                                                                                                                |
|----------------|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Travis et al.  | 2005     | A naturalistic observation study. Three years of reported burglary records in one city were cross referenced against the orientation of each robbed house. Houses in this city are equally distributed among the four cardinal directions.                                                                                                          | Public crime data reported in the local newspaper was collected without knowledge of orientation of the homes. Therefore, experimenter effects would not account for the effect. | 95              | Orientation of robbed homes.                                                   | Homes with a south entrance had 75% more burglaries than homes with other orientations. Burglarized homes were dispersed throughout the city, and were not clustered into specific areas.                                                                              |
| Travis, et al. | 2005     | Naturalistic observation study. At an appointment with their family physician, participants completed the Mental Health Inventory, the Stress Impact Scale, the Family Concordance scale of the Family Profile, & SF-36 Short Form Survey. The direction in which they slept at home was determined and correlated with the results of the surveys. | All subjects were blind to the hypotheses being tested and did not know the principles of MVA.                                                                                   | 167             | Mental health, general health perception, family cohesion, financial problems. | Patients whose homes had south entrances had significantly poorer Mental Health Inventory scores than patients with north, north-east or east entrances, They also reported more financial problems. Result remained significant when controlling for level of income. |

architecture because they could align the architect's work with nature's intelligence. This was critical to him because MVA itself is understood to align built environments with nature's intelligence.<sup>54</sup>

Examples may help the above theoretical points become concrete. The examples below entail elements of MVA that have not yet been studied in isolation but which are understood to be necessary contributors to the results of Fergusson et al, 2020.<sup>38</sup>

*Homes in line with the cosmic structure.* The key examples of highly complex systems in nature are the network of galaxies and the human brain's network of neuronal cells. Vazza et al,<sup>96</sup> compared their memory capacities and their network, morphological, and structural properties, and concluded that the structures of the individual human brain and of the cosmos are tantalizingly similar. From the perspective of Vedic science this is not a coincidence—a key principle of MVA is that individual intelligence and brain physiology correspond to the cosmic structures.<sup>48,53,55</sup> An MVA building is designed to take into account this relationship, in contrast to non-MVA buildings, which do not and thus generate a dissonant influence on their occupants. This hypothesis provides a useful way of contemplating the wide range of beneficial effects experienced in MVA buildings.

*Cardinal directions.* Geophysicists working in the field of fluid dynamics have identified a standing grid on the surface of the Earth that aligns true north/south and east/west, which results from the flow of the Earth's core fluid and electromagnetic radiation from the Sun.<sup>97</sup> The walls of MVA

buildings are aligned with this standing grid. This alignment is understood to bring enclosed spaces into resonance with the natural environment at the surface of the Earth and thus with nature's intelligence.

*A central zone.* Similar to how atoms and cells have nuclei and the Sun is the stable center of the solar system, ideally a MVA building has a central area called a *brahmasthan*. The brahmasthan is illuminated by sunlight from the four cardinal directions as well as from above, and is understood to anchor the house within the cosmic environment. Brahmasthans and their center points are considered junction points that connect structures to nature's unmanifest organizing intelligence. This gives rise to a pattern of central and lateral symmetry through which MVA designs become analogs for, and resonate with, natural structures.

*Proportions, measurement, and symmetry.* In MVA the proportions and dimensions of buildings and rooms incorporate dimensions<sup>1</sup> that are proposed to impart beneficial influences upon the occupant of the space.<sup>45</sup> via a quality-channeling measurement system known as *ayadi*, which applies four classes of measurement, each associated with one of the four cardinal directions, to key elements of a building.

*Grid, and placement of key functions.* The Vastu Mandala is a pattern used in MVA design composed of a gridded square aligned to the cardinal directions. Its central square locates the brahmasthan, and differing qualities are located in each of the surrounding, outer squares according to nature's unmanifest architecture. These qualities in turn form the rationale for the locations of key rooms.<sup>29,46</sup>

*Development of consciousness of the architect.* The expansion of the architect's consciousness—developing Vedic consciousness—is proposed in MVA to be the foundation of effective design. MVA identifies the architect's own pure, self-referral consciousness (atma) as the same field of natural law that gives rise to phenomenal creation. MVA proposes that consciousness unfolds in countable stages—demonstrated in R̥k Veda, and the 40 aspects of Veda and Vedic literature, including Sthāpatya Veda (the source of MVA). The primary structures and functions of the human physiology are understood to correspond to the 40 aspects of Veda and the Vedic literature and to the celestial bodies including the Sun and the Moon.<sup>56</sup> Thus, it is proposed that through the expansion of their consciousness architects, via their own experience, become progressively more able to design built environments aligned with nature's intelligence.<sup>48</sup>

### **Health Attributes Currently Addressed by Building Certification and Wellness Architecture Organizations**

The published research in the US shows that the health impact of existing wellness architecture systems is modest—much of it confined to reducing stress and distractions, and increasing comfort and well-being.<sup>27,28,98</sup> Overwhelmingly, the existing literature either examines the impact of a very small number of factors upon very few indices of health, analyzes parameters for assessing relationships between buildings and health, or explores the impact of elements of buildings solely upon brain functioning. Not yet considered are the orientation of subjects and buildings or other key elements of MVA.

Organizations that certify buildings commonly include indoor air quality as their only health consideration.<sup>99</sup> In the United States, the sole significant certifying organizations that focus on the health impact of buildings are the Building Biology Institute, the International WELL Building Institute,<sup>21</sup> and the International Living Building Institute.<sup>100</sup>

There is considerable interest within the field of architecture in the relationship between architecture and healthcare; however, these efforts are preliminary. The Design and Health Research Consortium, established by the American Institute of Architects and the Association of Collegiate Schools of Architecture, was an attempt to advance university-led research in the area of design and health. It identified cross-disciplinary initiatives that examine relationships between the built environment and either healthcare, general health, or productivity at 24 US universities and institutes.<sup>101</sup> The General Services Administration's Well-built for well-being studies (for example, Lindberg CM, Srinivasan K, Gilligan B, et al 2018<sup>102</sup>) monitored federal workers' heart activity, physical movement, and sleep quality via human health and environmental sensors and environmental sensors in order to ascertain how various office

conditions and design elements affect physiological stress, physical activity, and sleep quality in office workers.

The Mayo Clinics' Well Living Lab is the first "human-centered research facility" dedicated to studying how buildings and their contents affect human health and well-being.<sup>103</sup> Its published studies to date show that, other than air quality and healthcare delivery, the lab is still focused mainly on how to collect data.<sup>104,105</sup>

The most promising and broad initiative may be the Academy of Neuroscience for Architecture's annual conference, which is now a robust forum for the presentation of the latest research on wide-ranging related subjects in the field.<sup>26</sup>

The authors propose that much more can be learned about the potentially beneficial impact of buildings upon health through greater study of MVA and its elements.

### **Limitations to the Research**

Some studies were limited by the absence of control groups. Most were limited geographically—effects in different parts of the globe, including, for most of the studies, in the Southern Hemisphere, must be researched. Sample sizes were sufficient to obtain statistically significant findings but the research may be considered limited until it is repeated on larger groups.

### **Future Research**

Additional research is needed to fully assess the impact of the complete system of MVA as well as the significance of individual, isolated elements of MVA. Some fruitful efforts would include:

- Repeating the MVA studies discussed above using controls in each case, larger sample sizes, and including more subjects in the Southern Hemisphere,
- Assessing a broader range of health markers on subjects who are exposed primarily to sunlight coming from isolated directions.
- Evaluating additional neurological and performance markers upon subjects while facing different directions performing tasks and during and after sleep.
- Carrying out research to evaluate the MVA principle of room placement.
- Evaluating a broad range of health markers on subjects living or working in MVA buildings in studies with controls.
- Tracking outcomes for matched populations that move into otherwise similar MVA and non-MVA apartment buildings.
- Investigating the effect of isolated MVA elements, especially building orientation, upon otherwise similar retail stores, assessing differences in income, profit, employee retention, instances of theft, employee satisfaction, and healthcare costs.



## Conclusions

The improvements in physical health, mental health, well-being, security, family relationships, professional achievement and satisfaction, and self-actualization reported above in MVA homes and offices are in the areas predicted above by MVA's source literature.<sup>38,85</sup> What may account for the substantial and widespread correlations? The authors hypothesize that it is the holistic integration of MVA's elements.

But, in particular, reported findings are consonant with MVA's predictions regarding the effect upon human subjects of building orientation and human head direction, which raise building orientation and head direction as novel factors to be further studied in the search for ways to improve the effect of buildings upon health.

The impact, for better or worse, of buildings on public health is well documented. Almost two decades ago Evans<sup>106</sup> wrote, "The built environment has direct and indirect effects on mental health." Indeed, the hazards of urban life that are the subject of much of the field of public health are often proposed to have arisen substantially because most architecture and urban design is not adequately integrated with nature (for example: Bowers et al, 2021.<sup>107</sup>; Davis et al 2021<sup>108</sup>). The findings collected in this paper give hope that MVA buildings, with their wide-ranging and profound agenda of alignment with nature, may reduce these hazards.

While more research is needed, the literature reviewed herein raises the possibility that incorporating the technology of MVA into the world's future buildings may significantly reduce disease and promote health.

## Acknowledgments

The authors gratefully acknowledge the contributions of the anonymous peer reviewers, research contributions by Margot Suttman, David Orme-Johnson, and Eike Hartmann, and editing by Karin Matchett. Also, Richard Bialosky, David Ederer, Mandala Village LLC, Ramani and Louise Ayer; Comprehensive Blood and Cancer Center, Bakersfield, California; Jim and Diane Davis; and Jim Danaher. Certain icons in Figure 1 copyright (c) 2013-2017 Cole Bemis. Permission is hereby granted, free of charge, to any person obtaining a copy of Bemis's software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions: The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

## Author Contributions

Conceptualization, Lipman, Schneider, Bonshek; Methodology, Lipman, Bonshek; Software not applicable; Validation not applicable; Formal Analysis not applicable, Investigation, Lipman, Bonshek, Fergusson; Resources not applicable; Data Curation not

applicable; Writing – Original Draft Preparation, Lipman, Fergusson, Bonshek; Writing—Review and Editing, Lipman, Schneider, Bonshek, Fergusson; Visualization, Lipman; Supervision, Lipman; Project Administration, Lipman.

## Declaration of Conflicting Interest

Fergusson, Bonshek, and Schneider declare no conflicts of interest. Lipman is the owner of an architecture and planning firm that promotes and designs structures incorporating Maharishi Vastu architecture (MVA). The firm itself is compensated for MVA consulting but Lipman receives none of the remuneration for MVA consulting work.

## Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

## ORCID iD

Jon Lipman, AIA  <https://orcid.org/0000-0001-9990-5042>

## Note

1. Formulas originate in the Vāstu Vidya of Maharishi Sthāpatya Veda (Maharishi Vedic University, 1998).

## References

1. Escalante E, Golden RL, Mason DJ. Social isolation and loneliness: Imperatives for Health Care in a Post-COVID World. *JAMA Health Forum*. 2020;1:e201597. doi:10.1001/jamahealthforum.2020.1597.
2. Maani N, Galea S. The role of physicians in addressing social determinants of health. *JAMA*. 2020;323(16):1551-1552. doi:10.1001/jama.2020.1637.
3. Greene JA, Loscalzo J. Putting the Patient Back Together - Social Medicine, Network Medicine, and the Limits of Reductionism. *N Engl J Med*. 2017;377(25):2493-2499.
4. Fiandaca MS, Mapstone M, Connors E, et al. Systems healthcare: A holistic paradigm for tomorrow. *BMC Syst Biol*. 2017;11:142. doi:10.1186/s12918-017-0521-2.
5. United Nations, Department of Economic and Social Affairs, Population Division. *World Population Prospects: The 2015 Revision, Key Findings and Advance Tables-Working Paper No, 241*. Paris, UK: ESA/P/WP; 2015.
6. Alzheimer's Society, Association of Directors of Adult Social Services, Association of Directors of Public Health, Building Research Establishment, Care & Repair England, Chartered Institute of Environmental Health, Chartered Institute of Housing, Department of Health and Social Care Foundations, Homeless Link, Homes England, Housing Associations' Charitable Trust, Housing Learning and Improvement Network, Local Government Association of Housing, Communities and Local Government, National Housing, NHS Alliance, NHS England, NHS Property Services, NHS Providers, Public Health England, Royal College of Occupational Therapists, Royal

- Society for Public Health, Royal Town Planning Institute, Skills for Care, St Mungo's. *Improving Health and Care through the Home: Memorandum of Understanding*, 19. England, UK: Public Health England; 2018. PHE publications gateway number 2017861.
7. Marsh R, Pilkington P, Rice L. A guide to architecture for the public health workforce. *Publ Health*. 2020;178:120-123. DOI: [10.1016/j.puhe.2019.09.013](https://doi.org/10.1016/j.puhe.2019.09.013).
  8. Hamill N. Strengthening urban resilience: The case for Maharishi Vedic architecture. *Journal of Maharishi Vedic Research Institute*. 2020;13:73-111.
  9. Wierzbicka A, Pedersen E, Persson R, et al. Healthy indoor environments: The need for a holistic approach. *Int J Environ Res Publ Health*. 2018;15:1-13.
  10. Yu CWF, Jeong Tai Kim J. Holistic healthy building for human habitat. *Indoor Built Environ*. 2011;20(1):3-4.
  11. Chrysikou E, Tziraki C, Buhalis D. Architectural hybrids for living across the lifespan: Lessons from dementia. *Serv Ind J*. 2018;38(1-2):4-26.
  12. Phiri M. *Design Tools for Evidence-Based Healthcare Design*. Abingdon & New York: Routledge; 2015.
  13. Prasad S. Regenerative Agents: Patient-Focused Architectures. *Architect Des*. 2017;87(2):122-127.
  14. Peters T. *Design for Health: Sustainable Approaches to Therapeutic Architecture*. Hoboken, NJ: John Wiley & Sons; 2017.
  15. International Arts + Mind Lab (IAM Lab), the Pedersen Brain Science Institute at Johns Hopkins University. List of Partners. <https://www.artsandmindlab.org/impact-thinking/>.
  16. Hercules WJ, Anderson DC, Sansom M. Architecture-A Critical Ingredient of Pandemic Medicine: An Open Letter to Policy Makers. *HERD*. 2020;13(3):247-252.
  17. White-Newsome JL, Sánchez BN, Jolliet O, et al. Climate change and health: Indoor heat exposure in vulnerable populations. *Environ Res*. 2012;112:20-27.
  18. Drexler HH, Bruce L, El Khouli S, Peat R, Schwaiger E. *Holistic Housing: Concepts, Design Strategies and Processes*. Munchen, Germany: Institut fur internationale Architektur-Dokumentation; 2012.
  19. Keeler M, Vaidya P. *Fundamentals of Integrated Design for Sustainable Building*. 2nd ed.. Hoboken, NJ: John Wiley & Sons; 2016.
  20. Lovell J. *Building Envelopes: An Integrated Approach*. Princeton, NJ: Princeton Architectural Press; 2010.
  21. International WELL Building Institute. <https://www.wellcertified.com>. Accessed January 2, 2021.
  22. Institute of Building. Biology + Sustainability IBN. <https://buildingbiology.comhttps://buildingbiologyinstitute.org>. Accessed January 2, 2021.
  23. Global Wellness Institute. Wellness Architecture Initiative. Accessed 24 December, 2020. <https://globalwellnessinstitute.org/initiatives/wellness-architecture-initiative/>.
  24. Massachusetts Institute of Technology. *New MIT Course Addresses Developing Health-Focused Communities*. New England Facilities Development News. <https://www.high-profile.com/new-mit-course-addresses-developing-health-focused-communities/>. Accessed 24 December, 2020.
  25. Roy L, Kelly L. *Building Sense: Provocations from Neuroscience Syllabus*. New York, NY: Columbia University. <https://cdn.filepicker.io/api/file/OMCZ9JNIRMSCmmzcCKAX?&fit=max>. Accessed December 12, 2020.
  26. Academy of Neuroscience for Architecture. Fifth annual conference: sensing spaces; perceiving space. <http://www.anfarch.org>. Accessed January 1, 2021.
  27. Karakas T, Yildiz D. Exploring the influence of the built environment on human experience through a neuroscience approach: A systematic review. *Frontiers of Architectural Research*. 2020;9(1):236-247.
  28. Johnstone K. This is a great time for therapeutic architecture. *The Psychologist...The Journal of the British Psychological Society*. 2020;33:22-24.
  29. Institute of Vedic Architecture and City Planning. *Vastu Homes and Cities in Harmony with Natural Law*. 1st ed.. MERU, The Netherlands: Maharishi Vedic University Press; 2014.
  30. Nathan V, Williams K, Ostwald MJ. Vastu geometry: Beyond building codes. In: *Architecture and Mathematics from Antiquity to the Future, VOL. 1, Antiquity to the 1500s*. Basel, Switzerland: Birkhäuser Verlag; 2015:375-388.
  31. Venugopal J. Vastu purusha mandala: A human ecological framework for designing living environments. *Advances in Architecture and Civil Engineering*. 2021;2(1):870-877.
  32. Mannika E. *Angkor Wat: Time, Space and Kingship*. Sydney, NSW: Allen & Unwin; 1997.
  33. Bonshek A, Hamill N. Sustaining consciousness and culturing life through the arts and architecture. In: L Fergusson, A Bonshek, eds. *Maharishi Vedic University in Cambodia: Educational reconstruction and social renewal*. 2nd ed.. Oxenford, QLD: Maharishi Vedic Research Institute Press; 2017: 333-388.
  34. Rai Remawa AAG, Santosa I, Zaman BA. Aesthetic and space concept of visual composition in interior and architecture of Bali Madya dwelling. *Cultura*. 2013;10(2):157-168.
  35. Fazeli H, Goodarzi A. The principles of Vastu as a traditional architectural belief system from an environmental perspective. *WIT Trans Ecol Environ*. 2010;128:97-108.
  36. Goodarzi A, Fazeli H. Identifying the principles of traditional Iranian architecture in the light of Vastu Shastra, the traditional Indian wisdom. *J Des Built Environ*. 2014;14(1):1-19.
  37. Batra N, Sangwan V, Mehta M. Positive energy circulation and stress-free living through application of Vastu principles. *Indian Journal of Positive Psychology*. 2018;9(1):83-88.
  38. Fergusson L, Nidich S, Bonshek A, Nidich R. Maharishi Vedic Architecture and quality of life: An international mixed methods study of lived experience. *International Journal of Architecture and Urban Development*. 2020;10(4):1-18.
  39. Hartmann E. Email correspondence with Jonathan Lipman. 2021;29.
  40. Acharya P. *Architecture of Manasara*. Oxford, UK: Oxford University Press; 1933.

41. Achyuthan A, Prabhu B. *Manusyalayacandrikabhāsyam—Engineering Commentary on Manusyalayacandrika*. Kozhikode, India: Vastuvidyapratishthanam; 1998.
42. Bhat M. Varāhamihira's Br̥hat Saṁhitā, with English Translation, Exhaustive Notes and Literary Comments, Part One. New Delhi, India: Motilal Banarsidass; 1981.
43. Dagens B. *Mayamatam*. New Delhi, India: Indira Gandhi Center for the Arts and Motilal Banarsidass Publishers Pvt. Ltd.; 2007.
44. Chakrabarti V. *Indian Architectural Theory: Contemporary Uses of Vastu Vidya*. Richmond, UK: Curzon Press; 1998.
45. Audet R. *Principles of Vastu Planning in the Light of Group Theory: Symmetry at the Basis of the Measurement System*. MERU, The Netherlands: Maharishi Vedic University Press; 2016.
46. Audet R. *Maharishi Vedic Architecture Symmetry*. MERU, The Netherlands: Maharishi Vedic University Ltd.; 2020.
47. Bonshek A. In visible cities: Metaphor? or body and built environment as structure of wholeness. In: A Bonshek, C with Bonshek, L Fergusson, eds. *The Big Fish: Consciousness as Structure, Body and Space*. Bedfordshire, UK: Redopi/Brill; 2007:225-270.
48. Bonshek A. Maharishi Vedic architecture: Vāstu for well-being and security. *Journal of Maharishi Vedic Research Institute*. 2020;13:19-72.
49. Maharishi Vedic University. *Building for the Health and Happiness of Everyone: Creating Ideal Housing in Harmony with Natural Law*. MERU, The Netherlands: Maharishi Vedic University Press; 1998.
50. Maharishi Vedic University. *Maharishi Vedic University: Knowledge for Enlightenment and National Invincibility*. The Netherlands: Maharishi Vedic University Press; 2009.
51. Hartmann E. Master plan to create ideal Vedic India through application of Vedic architecture. In: Proceedings of International Conference to Re-establish Ideal Vedic India. Fairfield, IA: Maharishi University of Management Press; 2015:152-157.
52. Maharishi Mahesh Yogi. *Maharishi Vedic University: Introduction*. Misrod, India: Maharishi Ved Vigyān Vishva Vidyā Peetham; 1995.
53. Maharishi Mahesh Yogi. *Celebrating Perfection in Administration: Creating Invincible India*. MERU, The Netherlands: Maharishi Vedic University Press; 1998.
54. Maharishi Mahesh Yogi. Maharishi global press conference. 2002. <https://www.youtube.com/watch?v=UDbZ7nrDiSE>. Accessed December 12, 2021.
55. Maharishi Mahesh Yogi. The Importance of the Sun in Sthapatya Veda. Videotaped Lecture. August 10, 2005. Vlodrop, the Netherlands; 2005. Available from MIU Video & Tape Library, 1000 N 4th Street, Fairfield, IA 52557. Accessed November 18, 2021.
56. Nader T. Human Physiology: Expression of Veda and the Vedic Literature *Maharishi Vedic*. Vlodrop, The Netherlands: University Press; 2011.
57. O'Keefe J, Dostrovsky J. The hippocampus as a spatial map. Preliminary evidence from unit activity in the freely-moving rat. *Brain Res*. 1971;34(1):171-175.
58. ShineValdez-Herrera JPI, Valdés-Herrera JP, Hegarty M, Wolbers T. The human retrosplenial cortex and thalamus code head direction in a global reference frame. *J Neurosci*. 2016; 36(24):6371-6381.
59. Butler WN, Smith KS, van der Meer MAA, Taube JS. The Head-Direction Signal Plays a Functional Role as a Neural Compass during Navigation Erratum in. *Curr Biol/Curr Biol*. 2017;27(915):12592406-12601267. doi:10.1016/j.cub.2017.03.033. PMID: 28416119.
60. McDonald DL. *Some Aspects of the Use of Visual Cues in Directional Training of Homing Pigeons*. Animal Orientation and Navigation. Washington DC: NASA SP-262 US Govt. Printing Office; 1972:293-304.
61. Dacke M, el Jundi B, Smolka J, Byrne M, Baird E. The role of the sun in the celestial compass of dung beetles. *Philos Trans R Soc Lond B Biol Sci*. 2014;369(1636):20130036. doi:10.1098/rstb.2013.0036. PMID: 24395963.
62. Schmidt-Koenig K, Ganzhorn JU, Ranvaud R. Orientation in birds. The sun compass. *EXS*. 1991;60:1-15. PMID: 1838509.
63. Foà A, Basaglia F, Beltrami G, Carnacina M, Moretto E, Bertolucci C. Orientation of lizards in a Morris water-maze: roles of the sun compass and the parietal eye. *J Exp Biol*. 2019;212(18): 2918-2924. doi:10.1242/jeb.032987. PMID: 19717673.
64. Lindecke O, Elksne A, Holland RA, Pētersons G, Voigt CC. Experienced Migratory Bats Integrate the Sun's Position at Dusk for Navigation at Night. *Curr Biol*. 2019;29(8):1369. e3. doi:10.1016/j.cub.2019.03.002.
65. Jang H, Boesch C, Mundry R, Kandza V, Janmaat KRL. Sun, age and test location affect spatial orientation in human foragers in rainforests. *Proc Biol Sci*. 2019;286(1907):28620190934. doi: 10.1098/rspb.2019.0934. Epub 2019 Jul 24. PMID: 31337316.
66. Boroditsky L, Gaby A. Remembrances of Times East: Absolute Spatial Representations of Time in an Australian Aboriginal Community. *Psychol Sci*. 2010;21(11):1635-1639. DOI: 10.1177/0956797610386621.
67. Kirschvink JL, Kobayashi-Kirschvink A, Woodford BJ. Magnetite biomineralization in the human brain. *Proc Natl Acad Sci U S A*. 1992;89(16):7683-7687. doi:10.1073/pnas.89.16.7683.
68. Wang CX, Hilburn IA, Wu DA, et al. Transduction of the Geomagnetic Field as Evidenced from alpha-Band Activity in the Human Brain. *eNeuro*. 2019;6(2):0483-518. doi:10.1523/ENEURO.0483-18.2019.
69. Institute of Vedic Architecture and City Planning. (IVACP). *How to Build Vastu Homes and Cities*. 2nd ed. MERU, The Netherlands: Maharishi Vedic University Press; 2019.
70. Rajeswari KR, Satyanarayana M, Narayan PV, Subrahmanyam S. Effect of extremely low frequency magnetic field on serum cholinesterase in humans and animals. *Indian J Exp Biol*. 1985; 23(4):194-197. PMID: 3908300.
71. Travis F, Bonshek A, Butler V, et al. Can a building's orientation affect the quality of life of the people within? Testing principles of Maharishi Sthapatya Veda. *J Soc Behav Pers*. 2005;17:545-559.

72. Shrivastava K, Mahajan K, Kalra V, Negi K. Indian. *Journal of Preventative and Social Medicine*. 2009;40(3-4).
73. Hekmatmanesh A, Banaei M, Haghghi K. Bedroom design orientation and sleep electroencephalography signals. *Acta Med Int*. 2019;6(1):33-37.
74. Travis F, Lipman J, Parim N, Hodak P, Leete J. EEG patterns and performance when facing the cardinal directions. *Int J Psychol Stud*. 2021;13-2.
75. Carter S. Rise and Shine: Sunlight Technology and Health. Oxford, UK: Oxford University Press on behalf of the International Epidemiological Association; 2007:4.
76. Weller RB. Beneficial effects of sunlight may account for the correlation between serum Vitamin D levels and cardiovascular health. *JAMA Cardiol*. 2020;5(1):109. doi:10.1001/jamacardio.2019.4336.
77. Benedetti F, Colombo C, Barbini B, Campori E, Smeraldi E. Morning sunlight reduces length of hospitalization in bipolar depression. *J Affect Disord*. 2001;62(3):221-223. doi:10.1016/S0165-0327(00)00149-X.
78. Reid KJ, Santostasi G, Baron KG, Wilson J, Kang J, Zee PC. Timing and Intensity of Light Correlate with Body Weight in Adults. *PLoS One*. 2014;9(4):e92251. doi:10.1371/journal.pone.0092251.
79. Gaddameedhi S, Selby CP, Kaufmann WK, Smart RC, Sancar A. Control of skin cancer by the circadian rhythm. *Proc Natl Acad Sci U S A*. 2011;108(46):18790-18795.
80. Lewy AJ, BauerCutler VKN, Cutler NL, et al. Morning vs evening light treatment of patients with winter depression. *Arch Gen Psychiatr*. 1998;55:890-896.
81. Nakade M, Akimitsu O, Wada K, et al. Can breakfast tryptophan and vitamin B6 intake and morning exposure to sunlight promote morning-typology in young children aged 2 to 6 years?. *J Physiol Anthropol*. 2012;31:11. doi:10.1186/1880-6805-31-11.
82. Maheshwari AK, Werd MRP. Architecture and creativity: Examining the impact of Maharishi Vastu on workplace creativity. *Creativ Res J*. 2019;31(4):371-376.
83. Maheshwari A, Werd M. Creativity and workforce development: A preliminary empirical study of Maharishi Vedic architecture. *Journal of Maharishi Vedic Research Institute*. 2020;13:113-137.
84. Torrance E. *Torrance Tests of Creative Thinking Interpretive Manual*. Bensonville, IL: Scholastic Testing Service, Inc. Scholastic Testing Service; 1984. [https://www.ststesting.com/gift/TTCT\\_InterpMOD.2018.pdf](https://www.ststesting.com/gift/TTCT_InterpMOD.2018.pdf). Accessed December 12, 2020.
85. Maheshwari A, Lipman J, Rainforth M, Werd M. Workplace Health and Well-being: An experimental investigation into the effect of a workplace designed using spiritual principles. *J Manag Spiritual Relig*. 2022;19(1).
86. Fergusson L, Bonshek A, Nidich S, Ortiz Cabrejos J, Nidich R. Sunlight and orientation in Maharishi Vedic Architecture: a theoretical and empirical study of hemispheric effects. *Open House International* 2021, 46; 2021:697-716. doi:10.1108/OHI-03-2021-0071.
87. Ulrich R, Zimring C, Joseph A, Choudhary R. The role of the physical environment in the hospital of the 21st century: A once-in-a-lifetime opportunity. *The Center for Health Design*. 2004;311:9.
88. Musat T. *Manushyalayachandrika*. Kozhikode, India: Vastuvidyapratisthanam Academic Center; 1998.
89. Raby S. *Supersymmetric grand unified theories: From quarks to strings via SUSY GUTs. Lecture Notes in Physics Book Series*. Berlin/Heidelberg, Germany: Springer; 2017.
90. Simon D. *Albert Einstein: Akademie-Vortrage: Sitzungberichte der Preussischen Akademie der Wissenschaften 1914-1932*. Berlin, Germany: Wiley-VCH Verlag GmbH & Co. KGaA; 2005. doi:10.1002/3527608958.
91. Kettle D. Maharishi vedic science and technology: Bringing fulfilment to urban sustainability. *Journal of Maharishi Vedic Research Institute*. 2018;7:53-68.
92. Kettle D, Fergusson L, Wells G. A unified field chart of urban sustainability. *Journal of Maharishi Vedic Research Institute*. 2018;7:69-126.
93. Hameroff S, Penrose R. Consciousness in the universe: a review of the 'Orch OR' theory. *Phys Life Rev*. 2014;11(1):39-78. doi:10.1016/j.plrev.2013.08.002.
94. Tononi G, Koch C. Consciousness: here, there and everywhere?. *Philos Trans R Soc Lond B Biol Sci*. 2015;370:20140167. doi:10.1098/rstb.2014.0167.
95. Nader T. *Consciousness Is Primary: Illuminating the Leading Edge of Knowledge*. Fairfield, CT: Maharishi University of Management Press; 2013.
96. Vazza F, Feletti A. The quantitative comparison between the neuronal network and the cosmic web. *Frontiers in Physics*. 2020;8:491. doi:DOI=10.3389/fphy.2020.525731.
97. Buffett BA. Earth's core and the geodynamo. *Science*. 2000;288(5473):2007-2012.
98. Yale K. Biophilia Study: Keys to Employee Health and Wellness. Buildings-Smarter Facility Management. 2008. <https://www.buildings.com/articles/27792/biophilia-study-keys-employee-health-and-wellness>. Accessed January 4, 2021.
99. US Green Building Council. *LEED Reference Guide for Building Design and Construction*. Washington, DC: US Green Building Council; 2013:24. Version 4.
100. Thomas M. *The Living Building Challenge: Roots and Rise of the World's Greenest Standard*. Portland, OR: Ecotone Publishing; 2016.
101. American Institute of Architects. Design & Health Research Consortium. <https://www.aia.org/resources/78646-design-health-research-consortium?editing=true&tab=create>. Accessed 12 December 2020.
102. Lindberg CM, Srinivasan K, Gilligan B, et al. Effects of office workstation type on physical activity and stress. *Occup Environ Med*. 2018;75:689-695.
103. Well Building Lab, Inc. The Well Building Lab is a collaboration of Delos and the Mayo Clinics. <https://www.welllivinglab.com>. Accessed 2 January, 2021.
104. Jamrozik A, Clements N. IEQ applications: human performance and productivity in buildings. *ASHRAE J*. 2019;61:Jun-19.

105. Aristizabal S, Porter P, Clements N, et al. Conducting Human-Centered Building Science at the Well Living Lab. *Technology Architecture + Design*. 2018;32:161-173. doi: [10.1080/24751448.2019.1640535](https://doi.org/10.1080/24751448.2019.1640535).
106. Evans GW. The built environment and mental health. *J Urban Health*. 2003;80(4). doi: [10.1093/jurban/jtg063](https://doi.org/10.1093/jurban/jtg063). PMID: 536PMC3456225-55.
107. Bowers EP, Larson LR, Parry BJ. Nature as an Ecological Asset for Positive Youth Development: Empirical Evidence From Rural Communities. *Front Psychol*. 2021 12. doi: [10.3389/fpsyg.2021.688574](https://doi.org/10.3389/fpsyg.2021.688574). PMID: 688574PMC8213347. PMID: 34149575.
108. Davis Z, Guhn M, Jarvis I, et al. The association between natural environments and childhood mental health and development: A systematic review and assessment of different exposure measurements. *Int J Hyg Environ Health*. 2021;235: 113767. Epub 2021 May 11. PMID: 33989957. doi: [10.1016/j.ijheh.2021.113767](https://doi.org/10.1016/j.ijheh.2021.113767).