

The "Right" Angles. Constructing Upright Posture and the Orthographic View

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To solve the vexing problem of how to determine the height of an Egyptian pyramid, Thales, perhaps the first presocratic philosopher, measured his own height and shadow and then measured the pyramid's shadow to find its height from his own by invoking what may have already been an ancient construct between bodies and buildings, the upright posture at right angle to the flat horizon of the earth.¹ This relation between body and building has been widely invoked, but in each case its character is uniquely shaped by the prevalent view of the body. The body-building trope did not disappear with modernism, but changed with the changing image of the body.² Others have noted the similarities between the white buildings and the white-clad athletes of the 1920's but such parallels extend well beyond stylistic boundaries of the historical avant-garde to notions of function as fitness. The human body is not merely an object given to empirical description, but a cultural construct that changes over time. This paper will consider the character of the body-building trope during the first half of this century.

This study focuses on the Payne Whitney Gymnasium designed by John Russell Pope in 1932 for Yale University — a case for which the body-building relation is palpable. Body-building will be studied through the ideal of upright posture that both constructed this building and conspired to form its occupants. The concept of posture is at once intimately corporeal and wholly abstract. It refers broadly to corollary concepts of order and ideology.

Posture emerged in the first half of the twentieth century as a key aspect of physical education within the framework of hygiene. Hygienic concerns changed from general environmental cleanliness in the nineteenth century to personal hygiene as discoveries in immunology generated a body-based response to germs rather than a general fear of dirt.³ In Pyle's *Personal Hygiene* handbook, the 1904 edition made no mention of posture, but by the 1910 edition, posture had its own chapter. At universities such as Yale, students underwent mandatory posture examinations and training. Physical education, associated at the time with gymnastics more than sports, was just emerging from medicine as a distinct discipline.⁴ As anyone who has participated in "phy ed" is well aware, the locker room is a primary locale for indoctrination into social awareness of one's body.

STATIC WHOLE

The massive Payne Whitney Gymnasium measures over five-hundred feet long with large competition spaces on each side of a central tower rising two-hundred feet with locker rooms and stacked gymnasias. It is a monument of architectural functional fitness which even received an Olympic medal. Its heavy, stone exterior was probably influenced by Pope's pre-immunological understanding of the human body. In the required hygiene course as an architecture student at Columbia University, Pope would have learned the prevailing view of the skin as a solid wall to protect against the

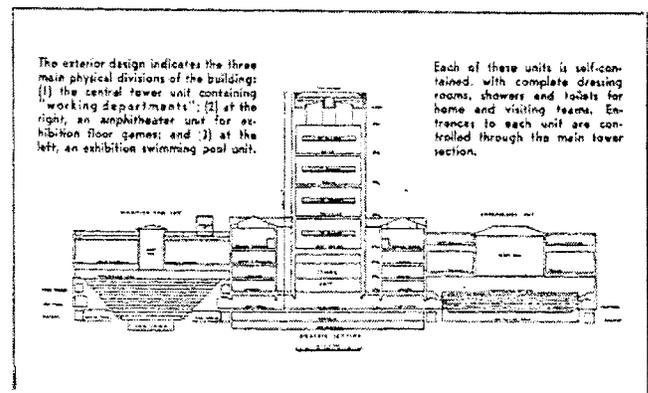


Fig. 1. Payne Whitney Gymnasium diagrammatic section.

unclean environment where the image of the skin as a castle wall was widely invoked.⁵ Breaking the skin with an inoculation needle that opens it to disease germs slowed acceptance of new immunologies.⁶

Payne Whitney Gymnasium incorporated years of research in technical innovations to make the building precisely fit its function. Not only the product of a "scientific" view of upright posture, the building itself was finely calibrated to produce perfect posture in its students. The Director of the Gymnasium, Robert Kiphuth, whose name is memorialized throughout the building, detailed the view of the body that is manifest. The same year that the Payne Whitney Gymnasium opened, Kiphuth published his book *The Diagnosis and Treatment of Postural Defects*. Every freshman entering Yale University was required to undergo a posture examination under Kiphuth's authority. Of the eighty to ninety percent who failed the exam, a specific exercise regimen was prescribed to "correct" their "defective" posture.

Posture studies, called "body mechanics," included the body, like buildings, as part of static mechanics. Posture was a whole body measure of health. Kiphuth used a diagram of an eccentrically loaded column to discuss impacts of poor posture on the body. Poor posture was called "inefficient," following the prevalent machinic view of the body. To correct posture to a "normal" state, exercises were developed to improve particular parts of the body. Kiphuth himself popularized the term "body-building" to emphasize correct body mechanics and named the posture training area in Payne Whitney the "body-building" room.⁷

Underlying body mechanics was the belief that routinized industrial work and unhygienic conditions of the city were a primary cause of illness and malformations of the body. Even athletes were thought to deviate from the ideal norm with excessive training for one activity.⁸ Posture test results were of special concern to military and

industrial interests as the body was understood as a "human motor" subject to fatigue." Politicians still speak of our "military posture." Standardized work was to be achieved with standardized bodies. The cult of science was manipulated to inscribe mechanistic views onto people through their bodies. The noted efficiency engineers, Frank and Lillian Gilbreth, recommended posture charts for home and industry to help reduce fatigue and increase efficiency. The chart shows a person standing with correct posture beside a straight vertical line — the diagrammatic ideal of upright posture.

UPRIGHT WALLS

The posture examination room at Payne Whitney Gymnasium was designed to fix an objective view, the expert's camera freezing a measurable moment of standing upright.¹⁰ The difficulty of measuring posture led to devices to make "objective" the vagueness of what is now conceived of as ever-shifting. Every Yale freshman reported to the examination room in Payne Whitney. The naked student stood on footprints drawn exactly three inches apart and aligned with a plumb line.

The subject was fixed in front of a camera, mounted at right angle to the wall, to create a pure elevational view. Then, various devices such as aluminum pointers or the "conformateur" were applied to the student's back to make the outline of the spine readily available on the photograph. When the photograph was printed, perforations were made at key points in the student body with a dissecting needle and the photograph was placed on a light table to draw specific angles onto the image with dividers and a No. 7 pencil and then measured with a protractor from the plumb line." Posture results were scored on a standardized card and tabulated for statistical analysis. These procedures translated human posture from complex reality through an elevation to a quantitative measure. This representational procedure allowed the student body to be objectively manipulated.

Preceding posture studies was the *aplomb*, deriving from ancient static mechanics, theorized in the Renaissance and later integrated into academic design training. It is also a plumb line corresponding with the human figure to establish the upright posture.¹¹ In painting, the plumb line was often aligned with architectural edges, like the wall in posture training. Charles Blanc wrote in his well-known 1867 *Grammar of Design*:

The body of man, upright on the earth, is a prolongation of a ray of the globe perpendicular to the horizon. The axis of his body departing from the center of the earth, rejoins the heavens.

This axis also becomes the ortho-graphic of the elevation. The system of right angles as projectors in architectural drawing was of course important to Pope. His esquisse sketches emphasized plan and elevation to the exclusion of sections." Not limited to classicism, the *aplomb* was influential in Le Corbusier's thought about the human figure, architecture, and particularly the right angle. Le Corbusier was equally well aware of developments in physical education." Another poem of the right angle is recited in the Yale posture analysis, seeking to inscribe the right angle in the student body.

For the expert instructor Kiphuth, corrective posture training was fundamental to his work. Yet, he argued that the building wall could be his substitute in posture training."

The ever-present gaze of the upright wall as plumb line of the institution defined propriety for the individual student. John Russell Pope's obsessive repetition of axes in plan and elevation traced out the order of the ideal body of the posture photographs onto the body of the building. Payne Whitney Gymnasium is the static, upright whole body of the posture exam and exemplifies its perfection. The central axis of the building tower aligns the entrance under a sculpture of the "normal" ideal body.

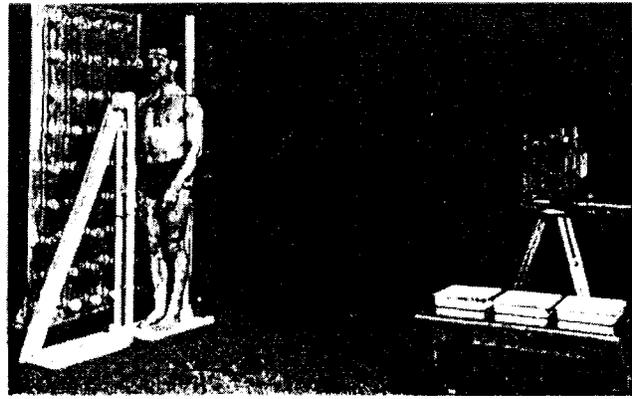


Fig. 2. Posture photograph with conformateur

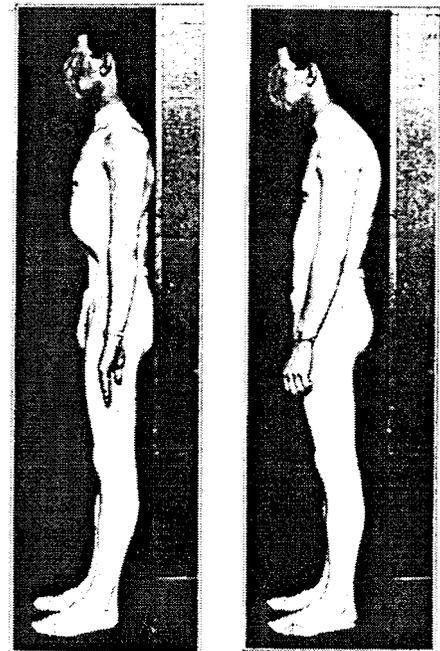


Fig. 81. Same as Exercise 50 without the assistance of the instructor but with wall support. (Exercise 13)

Fig. 82. Extreme relaxed position without wall support. (Exercise 12)

Fig. 3. Kiphuth's use of walls for posture training

LIGHT AND AIR WINDOWS

The Gymnasium building program stressed above all else that natural "light and air are essential in the development of the entire scheme."¹⁶ As the many hygiene handbooks of the time advised, windows in the gymnasium are large, high, and operable. While a massive block on the exterior, the building interior is diaphanous with six major light wells bringing natural light and air into all spaces. Each activity space has windows in at least two surfaces. A bank of elevators lift athletes up to the life-giving sun and air of specialized gymnasiae each with three window walls, culminating in a vita-glass solarium on the roof.

The hygienic windows high up on the tall walls made views impossible. With all but the first floor restricted exclusively for the all-male student body, nudity was widely practiced (*gymnos* meaning "naked"). The germ-killing effect of the sun's rays was believed to work best on exposed skin. Posture tests and corrective training were of course conducted in the nude.¹⁷



Fig. 4. Payne Whitney Gymnasium Body Building Room

FIXED EQUIPMENT

Posture "defects" were "corrected" to a "normal standard" usually under the controlling gaze of an expert. In the nineteenth century, the idea of health changed from "natural" to "normal." Confusing the notions of type and standard, students were measured against statistical standards that described the ideal "normal" body.

Early exercise "appliances" were predominantly built into the wall below windows. "Mechanical exercisers," deployed by Kiphuth in the body-building room, used wall-mounted weights with pulleys attached to wall, floor and ceiling to work specific muscles.¹⁸ Mechanical means were devised to standardize movement to allow the prescription of a definite dose by the physician eliminating "the uncertainty of the human hand." Wall-based appliances were so ubiquitous that a rationale for this approach was not pursued in the literature. Portable exercise equipment became widespread later, an innovation of the military.¹⁹

Payne Whitney Gymnasium achieved fitness through exactitude by overturning the prevailing view of gymnasia as general rooms for all activities to instead, specific rooms designated for particular functions. The paradigm of built-in equipment was painstakingly exploited at the architectural level. Within the deep trusses spanning large competition spaces were built-in squash and handball courts. An unusually large swimming pool was constructed on steel beams suspended on the third floor of the building. Finishes received finetuned attention: cork floors were built into the fencing gymnasium, ceramic tiles were turned reverse side out in the pool to speed turning, and the psychological impact of paint colors on athletic success were tested during design.

Perhaps the most complete unity of function, hygiene, and equipment was achieved in the long narrow corridor to the practice pool where naked bathers had to walk straddling the "crotch spray" which was automatically activated upon entry.²⁰ This feature is still widely

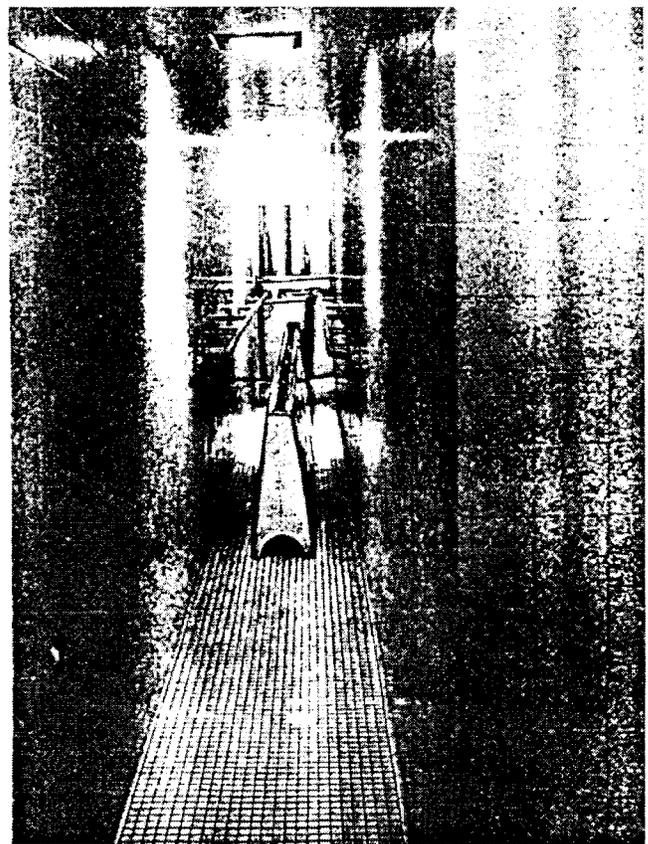


Fig. 5. Payne Whitney Gymnasium Crotch Spray

distributed in Neufert's *Architect's Data*.

Payne Whitney Gymnasium, because of its ideology of functional fitness, has become a museum of the era of posture training, resisting current initiatives in physical education. The fixed, upright body is now an historical artifact. Yet it also allows us to overcome the tyranny of present body-images by reflecting earlier views of the body back to us.

UPRIGHT CHARACTER

Known as the "Cathedral of Sweat," the Gymnasium's exterior appearance was subjected to strenuous national controversy over the collegiate gothic facade that covered its steel structure.²¹ A related debate took place within the planning committee, couched in terms of cost. In a letter to Yale President Angell, the chair of the planning committee wrote:²²

I am inclined to think that architecture such as that of the powerhouse would be very suitable for a Gymnasium. ...You cannot make such a building beautiful — it is simply utilitarian.

Both boiler and body were viewed as machines that transfer fuel into energy for work. Behind these discussions was the question of the proper role of the body in the university and the long tradition of architectural character. The final design clad the building in brick like the power plant, while the rest of the campus was becoming dressed in stone. Pope continued to persevere against brick even after beginning construction and finally succeeded in realizing the project in stone. Pope proposed "English Collegiate Gothic" for the entire campus in his 1919 Yale University plan because "the present contrast of Gothic, classical and modern types of building is disturbing and harmful." Perhaps he feared the mix of styles affected



Fig. 6. Payne Whitney Gymnasium exterior.

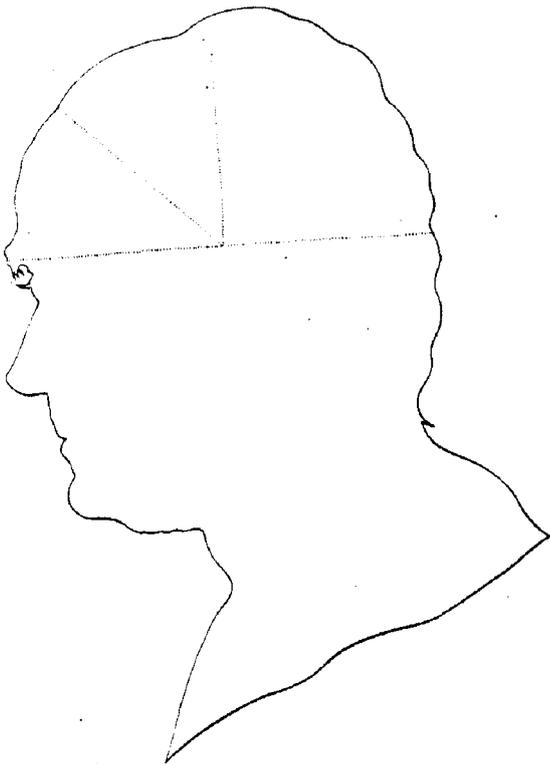


Fig. 7. Lavater's use of the right angle in physiognomic diagrams.

psychological well-being. Proponents of modern architecture utilized the tradition of character as well, insofar as certain building types were considered appropriate without ornament. Industrial buildings have received much attention in this regard, but the role of athletic buildings has not been so fully considered. Yet many sources such as Giedion's *Befreites Wohnen* used numerous athletic examples to describe the new dwelling.

Incised in stone, ringing the Payne Whitney Gymnasium entrance lobby is a poem by Robert Browning with an often-cited phrase "body and mind in balance." In the ideology of posture efficiency, Browning's phrase took on a precise meaning of plumbed and measured control. Pope's view was manifested in his campus plan where the library and gymnasium were balanced and complimentary, each terminating a campus axis, forming a right angle. Following a description of the library as the "intellectual centre," Pope wrote "physical training is as essential as mental and its home is in the Gymnasium."

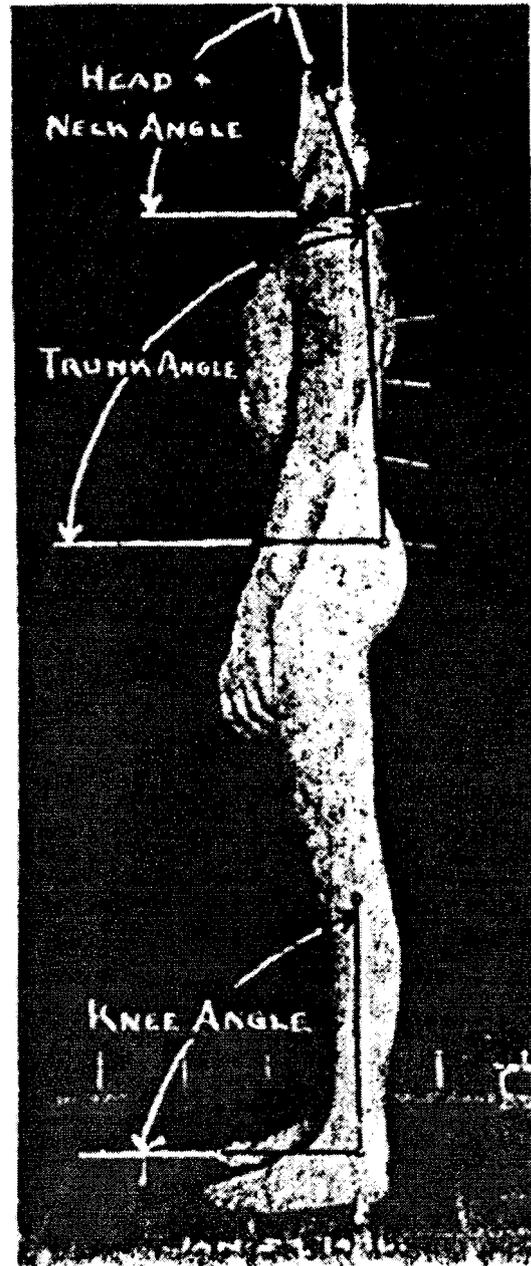


Fig. 8. Posture photograph analysis from Yale University

Posture was shown to be related not only to physical health but also the character of one's mental and even moral health. The widely influential U.S. Department of Labor-sponsored 1931 Chelsea Survey, found that "improved body mechanics resulted in greater improvement in nutrition, health and morale." R. J. Cook, professor of Surgery and Kiphuth's predecessor as director of posture evaluations at Yale, explained that "the advantage of good posture lies not alone in appearance but in general health, general efficiency and improved mental capacity." The medical text, *Body Mechanics in Health and Disease*, with five editions from 1934 to 1952, identified two body types on either side of "normal." The "thin" and "stocky" types were psychologically described. The Slender type was described as: "

Psychologically quick to learn, and, with this, often comes impatience with the slower, heavy type. Such people are inclined to be dogmatic and fanatical; the leaders of move-

ments usually come from among them. They become angry quickly and have a limited endurance but recover from fatigue rapidly.

The three body types were justified scientifically because of differing intestinal length and so food digestion. The "normal" type was not characterized — presumably because these people were thought to be morally balanced leaders. Posture determined the fitness of the population and when a Yale man appeared unfit, he was corrected to achieve the deportment befitting a member of the Ivy League. Although apparently destined for a life of privilege, the Ivy League male was reconfigured to conform to a precise and narrow set of criteria to fit the leadership role expected of him. Exterior appearance was used to create an interior state.

R. Tait McKenzie, Kiphuth's colleague at the University of Pennsylvania, described his corrective work on the basis of objective study, but he had another source only revealed in his personal library: the ancient art of physiognomy. McKenzie's copy of Peter Camper's late eighteenth century treatise has his detailed notes and calculations beside the plates purportedly demonstrating the relation of physique and character. Camper's comparative study of animal and human skulls concluded: "You perceive by this general comparison, that man is the most perfect of all animals... because he can walk, and even sit, in an erect attitude." Camper attempted to accurately and objectively measure the skulls hierarchically aligned in his cabinet of curiosities. He created a wooden frame device with holes for strings to produce accurate elevations and angles from the curving three-dimensional shape of the skulls:²⁵

In order to preserve the true form and relative situations of the parts, I did not view them from one fixed point, but my eye was always directed, in a right line, to the central point of the object, in a manner practiced by masons and architects; avoiding the rules of perspective, by which particular parts are always distorted and misplaced. I viewed the object with only one eye.

While the primary concern of physiognomy was the face, most writers also identified posture as a relevant element of study.²⁶

Lavater used the silhouette as an elevational diagram of the head which could provide measurable angles where the right angle predicted the highest intelligence. His silhouettes have been compared to Blondel's elevations of cornices on human faces." Lavater also described a machine similar to Camper's and predicted a new scientific era of physiognomy resulting from its use. John Russell Pope, as a student of Guadet, certainly knew Blanc's treatise quoted earlier. After describing and illustrating the human as upright posture at a right angle to the earth, Blanc, following the physiognomy tradition, illustrated three face types as three characters, the middle and most valued composed of horizontals and verticals described as "calm."

The elevational view of posture photographs reduced the thickness of three-dimensional life to a flat surface that could be measured and used to standardize individuals into characters. Bruno Latour argues that scientific authority is achieved in flattening reality to create proof through diagrams.²⁸ Compared to the fixed perspectival eye, the elevation as a roving eye held in a right angle relationship to the object is relatively unstudied. Yet it is this eye that is primarily claimed for the architect, from Alberti to Camper and modern architects as well. This roving eye of the right angle achieves validity through its apparent accuracy in revealing "true" relationships.

Today, architecture too often follows a sense of diagrams as reductive because of the dominance of empirical paradigms. However, architectural projection of future imagined objects through an elevation is fundamentally different. We have forgotten that diagrams are also doors to be opened for the soul to take flight. In the orthographic view, while the surface guides the eye in a right angle, what one "sees" is depth, not as measurable length turned sideways,

but as the voluminousness of felt space — reaching from the seen to the unseen.²⁹ Perhaps one could interpret Pope's use of only plan and elevation as the reserving for the imagination the hidden depth of the section, rather than submitting it to mere scientific description. While the reductive diagram reduces depth to measurable surface, the projective diagram allows discovery of depth in the invisible. Although today we see Thales' demonstration, like the viewpoint of the posture camera, as an elevational diagram of similar triangles with the pyramid, his eye, like the sun, looked into the depth of the shadow. It is the thickness of life that flat elevations should project into unseen worlds. This could free people from the authoritative gaze of experts to find their own postures.

The inspection of school children's bodies by medical experts began in the 1890's as preventative medicine and by the early twentieth century the medical profession took authority for the body through expert evaluation; replacing the individual who was no longer a competent judge of one's own health.³⁰ Similarly, posture analysis and training required the expert's specialized view and procedures. The objective orthographic view of the body is available only to the removed observer, not to oneself. Posture was defined through a precise, quantifiable method that in its science disguised the many prejudices it carried forward. During the Progressive Era the expansion of professions such as doctors, physical educators, and architects were justified on technological expertise. This "objective" expertise of the right angle was sometimes used to legitimize questionable practices and preexisting prejudices. Posture training was exercised not only to exclude the other, but even to reshape the privileged. As the elevational view retains scientific authority, it behooves us to be aware of the bodies we imagine inhabiting our buildings and conversely the bodies our buildings construct.

NOTES

- ¹ Michel Serres, "Mathematics and Philosophy: What Thales Saw..." *Hermes: Literature, Science Philosophy* (Baltimore: Johns Hopkins University Press, 1982), pp. 84-97. Vitruvius identified the upright posture as distinguishing humanity from beasts (II.1.2).
- ² Joseph Rykwert, *The Dancing Column: On Order in Architecture* (Cambridge: MIT Press, 1996). Beatriz Colomina, "The Medical Body in Modern Architecture" *AnyBody* (New York: Anyone, 1997).
- ³ Paul Star, *The Social Transformation of American Medicine* (New York: Basic Books, 1982), p. 191.
- ⁴ Roberta J Park, "The Emergence of the Academic Discipline of Physical Education in the United States" in *Perspectives on the Academic Discipline of Physical Education. A Tribute to G. Lawrence Rarick*. George A. Brooks, editor. (Champaign: Human Kinetics, 1981), pp. 20-46.
- ⁵ Steven McLeod Bedford, *The Architectural Career of John Russell Pope* (Columbia University: Ph.D. Dissertation, 1994), pp. 3.7.
- ⁶ Emily Martin, *Flexible Bodies. Tracking Immunity in American Culture — From the Days of Polio to the Age of Aids* (Boston: Beacon, 1994). Lloyd Stevenson. "Science Down The Drain: On the hostility of certain Sanitarians to Animal Experimentation, Bacteriology, and Immunology" *Bulletin of the History of Medicine* 29 (1995) 17.
- ⁷ Oscar Kiphuth and J. Stuart Wickens, "Body Mechanics Analysis of Yale University Freshmen" *Research Quarterly of the American Physical Education Association* 8 (Dec, 1937): 38-48.
- ⁸ Robert J. Kiphuth and Winthrop Phelps, *The Diagnosis and Treatment of Postural Defects* (Baltimore: Charles Thomas, 1932), pp. vi-vii. Robert J. Kiphuth, *How to be Fit* (New Haven: Yale University Press, 1942), p. vii.
- ⁹ Anson Rabinbach, *The Human Motor: Energy, Fatigue, and*

- the Origins of Modernity* (New York: Basic Books, 1990).
- ¹⁰ Oscar Kiphuth and J. Stuart Wickens, "Body Mechanics Analysis of Yale University Freshmen" *Research Quarterly of the American Physical Education Association* 8 (Dec, 1937): 38-48. Yale refined a method developed at Wellesley.
- ¹¹ Charlotte MacEwan and Eugene Howe (Dept. of Hygiene and Physical Education, Wellesley College), "An Objective Method of Grading Posture" *Research Quarterly of the American Physical Education Association* 3 (1932): 144-157.
- ¹² Richard Moore, "Academic Dessin Theory in France after the Reorganization of 1863" *Society of Architectural Historians Journal* 36 (1977): 171. Nadir Lahiji and D.S. Friedman, "At the Sink: Architecture in Abjection" *Plumbing: Sounding Modern Architecture* (Princeton: Princeton Architectural Press, 1997), pp. 35-61. M. Charles Blanc, *Grammaire des arts du dessin Architecture, Sculpture, Peinture* (Paris: Renouard, 1870), pp. 26-36.
- ¹³ Parker Morse Hooper, "Procedure with Clients as followed by the Office of John Russell Pope, Architect" *Architectural Record* 69 (June 1931): 359-362. See also Bedford (1994): 50-56.
- ¹⁴ Richard Moore, *Le Corbusier: Images and Symbols. The Late Period 1947-1965* (1977), p. 2. Dr. Winter, "Le Corps Nouveau" *L'Esprit Nouveau*, 15 (1922): 1755.
- ¹⁵ R. Kiphuth, (1932), p. 145, Figs. 81-2.
- ¹⁶ Everett Meeks, Dean of the School of Fine Arts, Payne Whitney Gymnasium building program, 1923, Yale University Archives.
- ¹⁷ R. Kiphuth, (1933), p. 139.
- ¹⁸ Bernarr Macfadden, *Encyclopedia of Health and Physical Culture, Vol III* (1940), p. 1204.
- ¹⁹ R. Tait McKenzie, *Exercise in Education and Medicine* (Philadelphia: Saunders, 1923), pp. 352, 363, 369, 432.
- ²⁰ R. Kiphuth, (1933), p. 136.
- ²¹ William Harlan Hale, "Art vs. Yale University" *The American Architect* (Jan. 1931), pp. 126-8.
- ²² John Farwell, Chairman of the Architecture Planning Committee, to Yale President James Rowland Angell, (Dec 29, 1922). Angell concurs in letter responding Jan 2, 1923. Angell Archives, Yale University.
- ²³ Armin Klein and Leah Thomas, *Posture and Physical Fitness. US Dept of Labor, Children's Bureau, Publication No. 205* (Washington DC: Government Printing Office, 1931). R. J. Cook, "Results of Exercise for the Correction of Postural Defects" *New York Medical Journal and Medical Record* 117 (Feb 7, 1923): 155. But see Deaver, "Posture and Its Relation to Mental and Physical Health" *Research Quarterly of the American Physical Education Association* 4 (March, 1933): 220-228. And Cureton's rebuttal in "Bodily Posture as an Indicator of Fitness" *Research Quarterly of the American Physical Education Association* 12 (May, 1941): 348-367.
- ²⁴ Joel Goldthwait, Lloyd Brown, Loring Swaim, John Kuhns, *Body Mechanics in Health and Disease* (Philadelphia: Lippincott, 1952), p. 27.
- ²⁵ Petrus Camper, *The Works of the Late Professor Canzper on The Connexion Between the Science of Anatomy and the Arts of Drawing, Painting, Statuary in two books. Containing a treatise on the natural difference of features in persons of different countries and persons of life, and on beauty, as exhibited in ancient sculpture; with a new method for sketching heads, natural features, and portraits of individuals.* (London: Dilly, 1794), pp. 144, 33-4.
- ²⁶ Physiognomists considering posture in addition to Camper include: John Casper Lavater, *Essays on Physiognomy. Translated from the French by Henry Hunter. Three Volumes. in Five.* (1792) Vol. 1, 45. Charles Darwin, *The Expression of the Emotions in Man and Animals* (New York: Oxford University Press, 1998), pp. 236, 242, 244, 263.
- ²⁷ Joachim Krausse, "Information at a glance. On the history of the Diagram" *Tijdschrift voor architectuur* (Amsterdam, 1998): 3-30, 262-5.
- ²⁸ Bruno Latour, "Visualization and Cognition: Thinking with Eyes and Hands" *Knowledge and Society: Studies in the Sociology of Culture Past and Present* Henrika Kuklick and Elizabeth Long, editors, 6 (1986), pp. 1-40.
- ²⁹ Edward Casey, "The Element of Voluminousness: Depth and Place re-examined" *Merleau-Ponty Vivant*, M. C. Dillon, editor (Albany: State University of New York Press, 1991), pp. 1-29.
- ³⁰ Starr, (1982). p. 192.