A. Wellbeing comes from the right system interactions

Our immediate surroundings interact with our sensory system, extending our perceptions to outside our body. We react to everything we experience on a range of distances. Those reactions in turn govern our behavior. In any system, countless complex interactions determine a comparatively simple set of behaviors for those parts of a system that can act. A space designed for a determined function and use may in fact trigger a totally different behavior, because our body is reacting to that space's geometry, surfaces, details, and complexity in an unexpected way. Rules govern human actions and behavior in spaces, therefore actual use is predicated by the relationship we establish with our environment.

The user fuses with structures in the built environment and becomes part of one system, in which all possible interactions play a relevant role. These include: how attractive each detail, surface, and space is to an individual; how each space accommodates a designated function or group of functions; how one space (useful for a certain activity) links to other spaces; how the physical layout encourages (or inhibits) contact among different users, etc. The system mixes the complex variety of human interactions with details and components of the physical setting. Equal emphasis is placed upon the connections as on all the elements themselves.

We know from psychology and medicine how we interact strongly with the built environment, in ways we are normally not always conscious of. System dynamics consequently control our behavior in different spaces and environmental configurations. This result is more basic than either psychology or medicine, and certainly underlies all of architecture and design.

Adaptive design follows the “transactionalist” or “ecological” approaches in environmental psychology, where human actions couple in an essential manner with complex responses to the built environment. Design begins with the system properties before any other considerations. We are dealing with relationships that determine the system’s actions. Adaptive design analyzes a building's effects on human beings. A building is no longer treated as a stand-alone object divorced from interactive forces with its user, thus reversing 20th century architectural education and practice.
Furthermore, the complex system of building-plus-user is not only a system in space, but also one in time. Geometrical components interact on distinct spatial scales, but we should also design for the different and changing movements of people, users of different characteristic time periods, for the changing time of day, etc. All those temporal scales need to interact in a coherent manner, coordinated rather than restricted by some “designed” form. Then, the complex temporal system can interact seamlessly with the complex spatial system (which are independent for reasons of practicality in the design process) as one space-time system.

B. We need to literally grasp our surroundings

Research in experimental psychology reveals our body's reaction to graspable objects, and representations of such objects in our immediate environment. Our brain identifies surroundings as being accessible to us in an intimate way, a phenomenon called “object affordance”. Neurological and hormonal signals prepare us mentally to touch and grasp articulations or subdivisions that (theoretically) fit our hand. Visuospatial attention is drawn to anything that is clearly defined at around 1 cm up to 10 cm in scale, especially if it has an appropriately graspable shape. This effect is prompted by physical articulations and visual representations, yet goes beyond the strictly visual, since it triggers motor activations in the brain that affect our muscles directly.

Three conditions determine the intensity of this psychological/physiological connective effect, and also whether it has positive or negative implications:

(i) The shape of “graspable” structural elements must invite hand contact (even if that never actually occurs); therefore, sharp, spiky, angular, or otherwise visually unsettling objects signal possible injury when grasped, and repel instead of connecting positively.

(ii) Transparent materials do not define architectural articulations well enough to invite virtual grasping. Those remain invisible to the “object affordance” mechanism; hence the connective effect never takes place.

(iii) The connective effect is strongest for reachable surfaces, and weakest for articulations that may appear graspable but which are outside physical reach. Thus, architectural surfaces showing subdivisions in this “graspable” range of scales situated within accessible, immediately touchable regions connect most strongly.

As proposed here, “object affordance” in architecture acts subconsciously to situate people within any environment. Those persons’ motor neurons automatically react to perceivable articulations and designs in their immediate surroundings. Even if users don’t notice those reactions on the conscious level, the physiological state of their body will nevertheless influence any action performed in that particular environment; including just being there. A positive connection enhances wellbeing and task performance, whereas a negative affordance due to alienating structural details will impact a person’s actions negatively through superimposed anxiety and fatigue.
In his book “The Thinking Hand” (2009) Juhani Pallasmaa discussed this very topic, though more from a philosophical point of view than a scientific one that directly utilizes results from experimental psychology. Even with this approach, his message — coming from a well-respected architect and educator — could have revolutionized design, but didn’t. I believe that there are inherent contradictions in Pallasmaa’s approach. He offers the work of modernist architects as positive examples; nevertheless, I see those rather as negative examples, because they eliminate any built elements that could contribute to “object affordance”. We cannot enter a new, radically adaptive phase of architectural design if we don’t do everything possible to overcome stylistic limitations.

C. Big things depend on little things

Systems theory requires the dependence of scales (different size components) of a system on each other. “The interdependence of scales is only one-way: a higher scale requires all lower scales in order to function, but not vice versa.” (Saltingaros, 2006: page 75). This means that the range of scales corresponding to bodily dimensions — our arms, hands, fingers, eyes, etc. between 1 mm and 2 m — plays a major supportive role in how we use buildings and urban spaces. Ordered structure on these human scales underlies our experience of the entire building, and not just its details or ornament.

A complex system does not work strictly on any single scale, so no scale should be privileged when designing a system. Neither can any scale be eliminated without understanding whether or not it serves a connective or complementary function. Concentrating solely on the large-scale form of a building or urban complex, as is often done nowadays, leads to negative adaptation. In evaluating a design, some intermediate scale may not be entirely justifiable through mechanisms on its own scale (that is, its necessity may not be immediately obvious from purely structural considerations), but it could be adding systemic support to either a higher scale, a lower scale, or both.

The dependence of higher on lower scales in the unified system of building-plus-user argues against minimalist environments. Since the largest forms will be influenced by all the smallest sizes (i.e. all lower levels of scale) in any system, this correct causality is essential in adaptive design. Either the smaller and medium-range elements are present in the correct balance to influence the large-scale structure, or the configuration will be deficient and the ensemble cannot define a system. This sequence “small-influences-large” implies that, as part of a system, the overall shape of a building should depend strongly upon the arrangement of its internal components.

Adopting the systems approach influences design to the extent that it can generate an entirely new architecture for our times. Consider that user wellbeing depends upon all the tectonic elements smaller in size than the human body: i.e. the traditionally ornamental elements in a building. How else to include structural elements corresponding to the range of human sizes from 1 mm up to 2 m? Frames,
trim, moldings, baseboards — all architectural and tectonic elements on the small scale that were eliminated in pursuing a minimalistic modernism — are now encouraged to come back with a vengeance. Not as decoration, nor for stylistic reasons, but because they are needed in a larger complex system.

Most of these components are useful structural reinforcements, and indeed, eliminating them throws a considerable burden on precision required when using only larger tectonic elements. Lacking the smaller architectural scales for the sake of “style” also removes the possibility of useful adjustments on those small scales. That either drives up the cost, or forces us to rely upon large standard-size modules, which severely limits design freedom and adaptability. There is an opportunity to enhance the space’s connectivity and coherence through the smaller scales, linking us (the user) as strongly as possible with built spaces and surfaces.

Adaptive design can begin at the smallest scale, and then assemble the larger design components from the smaller ones. For example, traditional and vernacular urban fabric is a bottom-up evolution of building activity carried out over many generations. The idea is that an adaptive process, often a trial-and-error sequence of design decisions, discovers the fittest configuration for the smaller components in that specific (not generic) situation. The large scale then emerges from the smaller scales, and cannot be imposed. For those who wish to ornament these human scales, the justification is simply doing what comes most naturally to enhance our connection to the environment.

D. Emergent spaces respond to human psychology

Building form is shaped adaptively when all the individual internal spaces — which themselves have been (or should be) designed carefully, following adaptive criteria — cooperate. Designing an environment based upon system interactions begins by considering all possible influences, positive or negative. Optimizing the users’ physiological and psychological wellbeing uses recent experimental results from environmental psychology, and combines them with a store of the healthiest design solutions and typologies that we already know. Those were tried before with evident success.

Here, we are breaking a peculiar taboo from 20th century design of never using anything that resembles a traditional typology. That attitude defeats the attempt to optimize environments by choosing from among all available design options. Keeping an open mind, a student needs to go back throughout history, and search all over the world for design solutions to architectural problems that make the user feel the healthiest. Those solutions are judged by how they affect our physiological and psychological state. Solutions will be selected for re-use if they enhance our wellbeing and state of health, but rejected if they diminish them.

Mixing pure geometry with built elements, together with human emotions and our relations to other human beings, generates emergent phenomena. Those are unforeseen aspects of design, which could contribute either positively or negatively to a user’s experience of a building. Emergent phenomena represent properties of
the system that do not exist in — and usually cannot be understood by reference to — its isolated components. The system contains unexpected effects, which were initially unplanned. We cannot, however, leave emergent properties to chance, because those might turn out to be deleterious to the user’s sense of wellbeing and experience of space.

The way human beings respond to spaces, surfaces, detail, and ornament creates forces that determine how a built structure will actually be used (independently of whatever the architect intended). As long as the design has followed adaptive principles, those unexpected emergent phenomena should hopefully enhance and not detract from the users’ experience of the built structure. In the best of cases, the building, or portions of it, can evoke a “sense of belonging” that accommodates users. In exceptional cases, moreover, this perception could translate into a “sense of wonder”, such as occurs in the great religious buildings of the past.

The opposite approach, where complex effects that actually take place in the system comprising building-plus-user are disregarded, can lead to regrettable results. An abstract design, or even one that looked perfectly fine, but which failed to evaluate — and adjust for — all the human interactions, could turn into a hostile and oppressive environment when built. Adaptivity succeeds when articulations and details at the smaller, human scales interact to define a welcoming environment. Yet those components are either incoherent, or missing in many of today’s buildings. Users will avoid those architectural spaces, or force themselves to use them, possibly to get sick as a result of increased stress levels.

**E. Formalist criteria reduce the system**

Traditional design practices represent a systems approach, having developed before the more recent intellectual separation of the material world from its feedback on human beings. It was only in the early twentieth century that design thinking disconnected human life from the setting in which to carry it out. Crude notions of mechanical efficiency such as the Ford assembly-line method and Taylorism compartmentalized functions for greater efficiency and reduced costs in industrial production. Yet those “savings” come only by isolating human beings from our supporting life systems.

Adaptive design uses interconnectivity on many different levels. The system’s complexity is extremely high. So high, in fact, that it alarms designers who wish to control every aspect of the environment they create. A common reaction is to try and reduce the emerging complexity; to “clean up” everything through some imposed ordering. This includes the following tactics (which get rid of those very elements that make up a system!): (i) Simplify spaces and tectonic elements by eliminating all intermediate and smaller scales. (ii) Align the overall form according to a very simple geometry. (iii) Cut down the visuospatial connections between user and small-scale built structure by adopting a minimalist aesthetic.

Applying formalist criteria towards the goal of geometrical alignment inevitably cuts crucial connections, thus reducing the system. Diminishing the system’s
interdependent relationships also diminishes its value in accommodating human life. Contrary to popular thinking, removing information does not make a structure more useful by making it more generic. Stripping-down a space actually reduces its utility for any use requiring human participation. This is precisely the flaw in environments that have been simplified through misguided top-down interventions.

The largest scale, therefore, cannot be imposed simply by following formal concerns, or as an artistic flourish. There has to be a compromise between geometrical forces coming from both the small and large scales. Room shape, dimension, and volume depend upon the psychology of human perception and physical activities. When an architect just draws a room of some standard size, with fixed ceiling height, window sizes, and placements, it will not "fit" most situations. Neither can someone re-use the same generic module in designing rooms for different uses, different climates, different societies, and different placement within a building in relation to all the other rooms, paths, and spaces.

Many architectural typologies universally adopted since the early 20th century, such as abstract forms and severe geometries, preclude adaptation. They arose from a severely industrial design philosophy, the opposite framework required for generating a complex interactive system. It is difficult or sometimes impossible to retrofit them so as to re-introduce the necessary system components that will take care of adaptive interactions. For example, plate glass curtain walls eliminate visuospatial connectivity with immediate surfaces, and thus degrade adaptivity. They do not help to define an adaptive complex system that connects with human life.

Recent museums of contemporary Art, and some new university buildings with a shiny or twisted high-tech "look", tend to be pure formalist designs. They were designed to make a bold visual statement on the large scale. There is no indication that those designs evolved by integrating human needs and tested solutions, which necessarily occur on the smaller scales. Such buildings are transferred from an artistic expression on the computer screen, in some cases directly to the construction drawings. The components of those buildings are not, as a rule, part of an adaptive system. I would guess that any fit between the physical structure and its users is accidental, if it occurs at all.