# Bringing Time to Space:
## Isovists, Time-to-Contact Arrays, and Consciousness

An extended abstract of a presentation to
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by

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As the Call for Papers for this Workshop states, and as I here elaborate, architecture's involvement with *time* (as over space) is beginning to escape orthodox Modernist tropes. These tropes, created by the Futurists, Constructivists, and Cubists of the early 20th century and then systematized, mid-century, by architectural historians like Siegfried Giedion and Bruno Zevi, proposed that *time* for architecture was nothing more or less than *movement* through *space*, architecture's chief medium. Thanks to steel, reinforced concrete, glass, and more glass, *modern* architecture could now reveal the *simultaneity* of events happening everywhere in the city, as well as revel, expressively, in the look and feel of speed, flow, and change. The validity of the mission was underwritten deeply (if vaguely) by several advances: the discovery of X-rays in 1895 (which allowed people to look through opaque objects and so see "everything all at once" as though from a higher dimension), by the theory of spacetime developed by Hermann Minkowski in 1908 and then Albert Einstein in 1916 (who fatefully named it "relativity"), and, of course, by the culture-wide sense of the acceleration of all mechanical and social processes. One had only to look around. The pace of life was picking up. Distances were shrinking not only by virtue of rapid transportation but by virtue of global wireless and telephone connectivity. Everything was linking to everything else. All that was "solid" was "melting into air" just as Marx had predicted.

A hundred years later, with easy air travel, TV, the Internet, GPS, ubiquitous digital devices, CAD software, and structural glass, these Modernist tropes still circulate. Celebrated architects prioritize not only transportation systems, ramps and ramped floors, escalators, elevators, catwalks, internal "atria" with dramatic overlooks, plan openness, and primary attention to *flows* of people and goods (this as though every building were an airport), but to prioritize too the apparent movement of buildings themselves by such formal means as

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[1] This presentation consists of illustrated selections from a longer, not-yet-published paper of a similar title.

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streamlining, extreme and multiple transparencies (many of which aim to “blur the boundary between inside and out-”), unstable-looking or gravity-defying shapes, vertiginous perspectives, evolved-looking assemblages of small elements, and heaving or twisting geological, avian, and marine morphologies. Such buildings might also offer *actual* self-motion in the form of large, mechanically mobile parts and/or massive media displays. In every case “rooms” are an afterthought, the result of slicing up general space—and usually the less desirable parts—with regard to access and egress.

Isovist theory, which this presentation introduces, is remarkably adept at illustrating and analyzing the spatial experiences of moving observers, and so adept too at demonstrating that *time* is indeed the protagonist architects hoped it would be of truly *modern* architecture.

But isovist theory can do more. For time enters and enlivens buildings in other ways as well, ways having to do with the felt duration of our days relative to a building’s, with the seasons, wind, and sound, with purpose, desire, memory, and history, with upkeep, re-use, and construction as *processes*, with sacrality and futurity, community and continuity; serendipity, *kairos* and Rooms. On this more phenomenological view, events and objects do not so much *take* place and *take* time as *make* them: make the space and time they need to happen “in,” make the space and time they need to keep being what they are, or becoming something new. We are speaking of time as understood by Leibniz, Hegel, Husserl, Bergson, James, Bachelard, and Merleau-Ponty: time understood neither *un*-scientifically nor, as twentieth century physics and its popularizers would have it, as the fourth dimension of a vast, in-itself-empty and motionless if gravity-bent *frame of reference*.

The understanding of time developed by the philosophers just named, although it never coalesced into a single codified theory, offers a more human focus. With consciousness itself as the central mystery, it focuses on our evolved biological bodies, on our bodies’ environments, and on our social interactions with other beings. All three together produce *erfahrung*, which is our experience of the facts and happenings of the world as they redound to our knowledge of and skills in it (as when we assure others that we are “experienced”), and *erlebnis*, or “lived-experience,” which is comprised of the cumulative impressions, moments, situations, occasions, encounters and episodes we have personally lived *through*. These educate and enskill us too, but at more subtle, more complex levels. In both modes, *erfahrung* and *erlebnis*, time is understood to be generated *by* events. Time does not serve, except trivially, as a mensurator from outside and after the fact, like a coach telling a breathless trainee what her just-completed lap time was. Rather, the time her running “took” was the time her running *made*; and so too was the time the coach’s stopwatch “took” actually the time *it* made (but meagerly by comparison). Lived time, in its complexity, accumulates in tension and dissipates in release; it speeds up and slows down relative to other “runners,” and its moments, left and right, overlap quite fluidly. Bergson called such time *durée*. Durée does not tick along indifferently, stupidly, unchangingly. Indeed, it does not “tick.” Only clocks do that, which are special, evolution-

resisting, wear-resisting, amnesiac mechanisms that tick regularly only in comparison to other clocks, and with no cosmically correct or provably self-consistent clock against which to calibrate all the others, except that we *appoint* one to do so.

Time as made by non-clocks can be examined nonetheless. It can be examined scientifically by neuroscientists, poetically by artists, or logically by philosophers. Their methods and conclusions can be held up to each other, or better, combined into a *single* understanding of time, one *linkable* to physics and cosmology to be sure, but not reducible to them. This Time was the dream of Bergson, who was a mathematician by training, and Bachelard, who studied physics and chemistry before turning to the philosophy of science and then to the philosophy of the imagination.

The combination of approaches just discussed is, I think, essential to advancing the art of architecture because architecture is the discipline where science and art meet for purposes higher than momentary amusement. “Bringing time to space” as the title of this talk promises to do, fairly requires us to put architecture’s objective and poetic sides together. And *that* entails, I try to show, thinking about *place* rather than space, about *isovists* rather than place(s) in conventional terms, and about *time-to-contact arrays* (TCAs) rather than isovists alone. Isovists are objective *and* experiential; as are time-to-contact arrays. With these two concepts in hand, we can draw a new picture of the relation of “time” to “space” in architecture—which is to say, of *durée* to place.

The experience of moving in and around buildings remains important to this new picture, but with different existential concerns than would appeal to architects who, to their credit, are interested in “the human experience,” but think that constant physical motion and extraordinary geometrical dynamism is the best their art can offer. We embark instead on a voyage into the heart of what Don Ihde called “experimental phenomenology,” with an emphasis on time. We want to understand how time is made, how time is felt, and how time passes when—and perhaps, especially when—we stand or sit quite still, pay attention to where we are, and feel rewarded for doing so. The long-term goal is this: to help architects design places that might not be especially exciting to move through, but from which people can draw sustenance for life.

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This much in background and motivation. The presentation begins by discussing the distinction between *descriptive* (“is”) and *prescriptive* (“ought”) phenomenology. Since my presentation alternates between the two (and so, very likely, do others’) we need to ask: can architectural thinkers enamored of science avoid Hume’s “is/ought” Guillotine? I aver: probably not.

I go on to describe how lived time has been represented spatially. Lived time is parsed and labeled rather like inhabited space is, often with considerable consequence. Take the case of calendars and “planners.” Here, via interesting transformations of planetary movement

(which I will try to outline) linear time is folded and wrapped to create a two-and-a-half-dimensional landscape—a temporal *site*—which can be treated architecturally to good effect. I give the example, undertaken by a prominent architecture firm, to revivify its office life after Covid, using the Week as a recurring "architemporal" site.

The presentation then turns to the central topic of the paper: how *time is made and experienced in space*. We start with the more familiar-to-architects sequence, namely, how *space is made and experienced in time*. Enter the science of *isovists*, launched in 1979. Isovists are the uniquely-shaped volumes of space visible from any and every point in an environment. We discuss the basic axioms of isovist theory: points, radials, measures, paths, and fields. We distinguish between *visible* and *accessible* isovists. The software package "ISOVIST" is demonstrated in real time.

Back to the argument. In the conventional view, as well as in basic isovist theory, time "enters the equation" only on the occasion of real movement by an observer. The *time-to-contact array* (TCA), however, allows time to enter the experience of observers who are essentially at rest. To do this, vision is seen as an extension of touch, either scanning the world like radar or sonar, or moving freely over it, at a distance, as though our eyes had hands.[3] In TCA form, the isovist becomes not an ordered set of *distances*, but an ordered set of *times*—times-to-contact (i.e. touch). The TCA as a whole creates a "temporal volume" (this is a new idea) around every free observer, the shape of which takes into account both the observer's actual speed, $\boldsymbol{s}$, and the speed of his or her imagined-possible motion, $\sigma$ (sigma). We realize that the assessment of *accessibility* in isovist terms—which we earlier did commonsensically, intuitively—actually derives from TCA's, from perceived patterns of contact-times. TCA's have time built into them, time embodied, in fact, as *durée*. Assessments of visual distance ("space") are quite different: they are given instantaneously, everywhere, and are without time or *durée*. The two taken together, however, yield a new and interesting environmental variable called *motor containment* (*MC*). This will be explained. MC varies in degree from zero to one hundred percent. It is one of the felt qualities of *all* places and has its own, rich phenomenology. Examples are given. In result, the term "accessibility" in design practice takes on new and quite profound meaning.

The presentation then turns to taking a closer look at the variables of the time-to-contact array (TCA) formula, and in particular, at $\sigma$ (sigma). We find that when $\sigma$ behaves normally, and sometimes pathologically, it describes recognizable states of mind or consciousness, some pleasant, some not: for example, the world pressing in, the world drifting away, being young, being old. We start to understand why Modern architects of the early 20th century

[3] Cf. the "emission theory of vision," going back to Empedocles and Euclid, where beams emitted by the eye make contact with the world around and so enable vision. It was replaced by the modern theory of "intromission" (light enters the eye). But the earlier theory lingers in intuition, actual behavior, and the effectiveness of LIDAR technology in robotics.

were captivated by ***s*** rather than $\boldsymbol{\sigma}$.[4] (The exception was Le Corbusier, who moved from one to the other as he aged.)

With isovists and TCA's, are we describing the *world* or the *mind*? Somehow both. The feeling of time passing, flowing, or unfolding, of it humming or being generated as on a loom, seems central to the nature of consciousness itself. Among the metaphors commonly used to describe consciousness: there is the *stream* metaphor (William James), the string or *strand* metaphor (Michael Kubovy), and the global-workspace (or *theater*) metaphors (Francis Crick). I describe them briefly. Isovist theory with its TCA extension offers a fourth. With its links to the classical laws of space, time, motion, gravity, directed attention, friction, and touch—laws that have shaped the life of terrestrial animals for millions of years—isovist theory offers a bridge for designers, a bridge to what it's like to be human not only in a "state of nature," running in pursuit or escape, but paused, reflecting on the marvel of just being here alive and well among friends, either outdoors or indoors in windowed rooms, knowing where we are, who we are, what we are doing, and what we are thinking about. Works of *architecture* are paused beings too of course, simpler that we are, but not stupid. They envelope us with time nonetheless: theirs, entwined with ours.

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[4] If there is time, I will show how cinematographers have tapped into the difference between ***s*** and $\boldsymbol{\sigma}$ by deploying the Vertigo Effect, a camera technique invented by Alfred Hitchcock.