Immediate Systems in Architectural Research and Praxis

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Abstract

Immediate Systems are defined as systems that overcome the limitations of remote design by embedding design and implementation in situations of use. This paper extends the theoretical framing of IS and traces three approaches towards IS in architecture: as adhocist mode of action, as acceleration of design transfer and as human-architecture symbiosis. These three approaches consider the same phenomenon from different perspectives respectively, that of the lived experience of the user-designer, that of the designer's methodology and technology, and that of ecology.

Keywords

immediacy, immediate systems, design by use, design environments, design methods

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Introduction

The aim of architecture is to adapt the environment according to human wants and needs. In praxis however, architectural processes are detached and slow to respond to actual needs. Design usually takes place in environments which are spatially and temporally separated from construction, and both design and construction are separated from actual use. To the degree of this remoteness architecture must rely on hypothesis. In the words of architectural historian and critic Mario Carpo, this is the essence of design "*as it has been known since the Renaissance: design is a predictive tool, it models something before it happens.*" (Carpo, 2017)

Digitally-driven mass customization, performance optimization and building information modeling and management are well-discussed and employed praxes in architecture which emerged in the wake of the digital revolution (Kolarevic, 2003) (Kalay, 2004) (Carpo, 2017). They are foreboding what has been called the fourth industrial revolution, aimed not primarily at increased production capabilities but instead at unprecedented levels of flexibility, adaptability and integration. Products and services are increasingly linked with one another and their environment, driven by the ability to cater directly to customer wishes, affecting the value creation chain and effectively inverting the relationship between industry and its customers (Sendler, 2013, 2018). Whereas the first three industrial revolutions provided increasingly economic answers to the question 'how' to produce, the fourth industrial revolution increasingly links design and production to situations of end-use, offering value by answering the 'what' and 'why' questions in exhaustive detail.

Immediate Systems

Immediate Systems (IS), as defined by the author (Friedrich, 2020), can be conceptualized as a special form of Human-in-The-Loop Cyber-physical Systems (HiLCPS) (Schirner, Erdogmus, Chowdhury, & Padir, 2013). They are comprised of interacting digital, analog, physical, and human components, forming systems where people and environments are bound in a tight loop between human intention and immediate adaptation. They embed design and implementation in situations of use, overcoming the limitations of remote design.

Recapitulating prior framing of IS (Friedrich, 2020), IS offer interaction in the style of direct manipulation (Hutchins, Hollan, & Norman, 1985; Shneiderman, 1983), and leverage the psychology of the Immediacy Effect and Flow Experience (Keren, 1995; Nakamura & Csikszentmihalyi, 2009).

As conditions were named that IS are meta-systems binding user and environment, provide a tight feedback loop between intention and adaptation, establish and maintain a state of continuously available adaptivity and can include any combination of multiple modalities, e.g. temporal, spatial, tactile, embedded, intentional or procedural.

Framed as habitat (May & Kristensen, 2004) or environmental niche, and related to Gibson's original Theory of Affordances (Gibson, 1986), IS offer the affordances to shift boundaries between self and environment, afford creative immediacy and afford furnishing the environment with new affordances.

Awareness, guidance, intimacy, embeddedness, mastery and re-framing are additional affordances or characteristics, that were discussed and derived from examples (Graham, 1993; Keinonen, 2009; Martino, 2006; Roberts, 2014; Shneiderman, 1983; Weschler, 2009).

Immediate or Mediated?

The term immediate here is used to incite multiple connotations:

- as indicating a quality of human experience,
- as a quantitative difference in speed relative to conventional approaches,
- indicating a discrete qualitative difference obtained through methodical or technological improvements that cut middleware,
- as continuous integrated end-to-end process, in which intention and action may not be limited to one locus but be distributed across the entire system and
- as the state of being of an emergent system, which constitutes itself in the relationships of all its parts all at once.

While these connotations may each be legitimate, one should be aware that the notion of immediacy is often perceived as semantic construct with no relation to the real world. *Immediacy* eludes our grasp in its paradoxical nature. Any immediacy in space and time can itself be recognized only through the mediate knowledge of physiology; any immediate experience is inseparable from sub-conscious inference and interpretation; and if immediate ideas exist, they cannot be differentiated from prior knowledge. Understood as absolute absence of mediation, the notion of *immediacy* falls prey to scientific realism (Wallraff, 1961).

Applying this phenomenological critique to a discussion on media technology, the argument can be made that an attempt to achieve immediacy by means of technological mediation is paradoxically a hyper-mediacy. For example, attempts to create intuitive user interfaces that make themselves invisible ('transparent immediacy'), are in turn embedded in human's conscious efforts to manipulate a high-tech apparatus (Bolter & Grusin, 1999).

Martin Heidegger's famous example of using a hammer (Heidegger, 1967, pp. 68-70) shows how technology mediates an immediate experience of the world. A person that puts a nail in the wall works on the nail, while the hammer, being ready-at-hand, withdraws itself from attention. It is only in malfunction that is no longer ready-to-hand. As a hammer is bent it becomes conspicuous and asks for our attention again. According to Heidegger, this readiness-to-hand is the mode being of equipment, which is revealed only in use. The ancient Greek term for things matches this understanding of the world, it is *prágmata*, that which one encounters in praxis. Heidegger's texts are ontological, the matter of his philosophy is not the properties or relations of things that exist in the world but their very existence. Putting down the hammer allows for other modes of reflection and perception, but equipment reveals its being only and immediately through its use. In this sense, inversing the skepticism of Wallraff, the mediate is primarily immediate, only to be recognized in malfunction. This recognition of the primarily immediate as mediate is not reserved for equipment: a hammer may break, but so may a hand.

The equipment ready-to hand never is on its own, but always situated in an equipment totality. The hammer is bound to the nail by its adequacy for putting it into a wall, and similarly is bound into the equipment totality by references in-order-to. In the context of previous framing of IS it is tentative to draw a brisk parallel to Gibson's Theory of Affordances. Affordances too are situated neither in the user's perception nor an object's independent reality, they only exist and are to be revealed in a relationship of use. Yet affordances are not limited to the being of tools or equipment; everything and substance could afford something.

Approaches to IS in Architecture

In order to situate IS within architectural history and theory, three possible readings of the effects of IS in architecture will be discussed:

1. New adhocism, a mode of action where the environment is adapted ad-hoc using any means available, possibly utilizing but not dependent on any pre-existing technology or framework.
2. Accelerated design transfer, as consequence of evolving information and communication technologies, which lead to increasing interaction density between humans and their environment in combination with an expansion of their environment due to increasing interactions between the systems of which it is constituted.
3. Human-architecture symbiosis, which arises as consequence of cyber-physical systems which include both humans and the built environment.

These three readings offer different angles on approaching IS, with adhocism being situated in the context of the user, design transfer in the context of the designer and human-architecture symbiosis as perspective on technological mediation in the built environment, not as artifact but systemic. They have in common that they all originate in the 60s and 70s and were deemed newly relevant a generation later. The different perspectives are offered to indicate that IS touches on the subjects of design participation and user empowerment, on design methodology and design technologies, on habitats and human-technology relations. The reader may be familiar with one or several of these subjects, which can be considered as stepping stones towards a better understanding of different facets of the main theme of IS.

New Adhocism

In the early 70s, Charles Jencks proposed architectural *adhocism* as strategy to overcome the disjunct between the needs of the individual and generic design solutions; the ideal of adhocism thus is the immediate fulfillment of purposes. Jencks argued that by taking initiative and combining parts ad hoc, the individual could overcome the distance and estrangement caused by specialization, bureaucracy, and hierarchy. In doing so, the individual would not only answer their immediate needs but create, sustain and transcend themselves (Jencks & Silver, 1972, p. 15).
Adhocism preached the power of improvisation where technological means and social conventions failed to support the fulfilment of human purpose. As manifesto it walked the line between parody and political agitation for a more participatory architectural praxis, a more democratic style, through the application of readily available technological means.

In 2008, Matthew Fuller and Usman Haque (Fuller & Haque, 2008) proposed a *new adhocism* on the urban scale: the production of cities *beginning immediately with building and construction*. Any form of design or planning, sketching, modeling, or brainstorm session should be discarded. Their place should be taken by activities performed on actual building materials and thought processes expressed at full scale, immediately on the artifact inhabited. Fuller and Haque took the ideas of the 60s and 70s, including the adhocism of Jencks and the concept of underspecified architecture of Pask, who proposed to design buildings as evolutionary systems (Pask, 1969; Haque, 2007). They combined them with contemporary technology and best praxess that emerged in open source software development, embracing modularity and granularity to simplify re-use and re-development.

The New Adhocism approach is no longer fully dependent on make-shift solutions, as systems and components can passively, actively and pro-actively adapt and be adapted to custom causes.

Accelerated Design Transfer

Architect and researcher Richard Foqué introduced the concept of *design transfer* (Foqué, 1975, 2010) in analogy to the concept of *technology transfer*. Design transfer indicates *how a new design affects its environment and spreads out in time*. Foqué related design transfer to the concepts of *densification of human space* (Skolimowski, 1969) and *expanding environments* (Hall, 1962). *Human space* is described by the interactions between a human being and their environment; its density is measured by the number of patterns in which one is required to participate. The concept of *expanding environments* entails that constituents of natural and man-made systems interact in increasing numbers, affecting each other's behavior fundamentally.

According to Foqué, the evolution of information and communication technologies cause the expansion of interaction environments and the densification of human interaction space to augment one another, leading to an increasingly complex design situation. Foqué calls this an *explosion of the design situation* which coincides with the *implosion of design transfer time* caused by the radical *acceleration of design transfer*. Both developments contribute to a situation of design impotence which necessitates a new conceptualization of design activity and its methods.

In the new situation, leveraged by the Building Information Modeling (BIM), the traditionally consecutive phases of briefing, design, construction and operation are linked to one another. They enter a continuum where they can overlap and increasingly merge, resulting in an interactive designing-building process, in which previously consecutive activities are integrated and executed concurrently.

The account of Foqué bears similarities to Kalay's (Kalay, 2004) descriptions of the design process becoming a *network of design* which includes manufacturing, marketing and distribution organizations, and also a *distributed design process* which spans across professions, organizations and geographic locations. Both developments challenge the traditional hierarchy of the design process. Furthermore, embedded and networked computing devices in building components and machines for production and assembly can respond to occupant's needs as they arise, resulting in reduced waste and more efficient building and use.

The acceleration of design transfer, which coincides with the replacement of linear processes with networked concurrent processes, includes material fabrication and construction. According to Achim Menges (Menges, 2015), construction is becoming not only *computerized*, i.e. automated for the sake of improved precision and efficiency, but increasingly *computational*, i.e. an indeterminate process of materialization which extends the design process and is driven by cyber-physical feedback. As Menges states, predictive modelling may eventually be replaced by continual (re)construction, as design and materialization merge. "This potential fusion of the processes of design and making provides a considerable challenge to both established design thinking and current design techniques."

Menges's account of cyber-physical making however does not mention the users who interact with these systems, for example the architect, the builder, the inhabitant. Ultimately, it is them who pose a need for building, who set up and maintain the systems, who are bound into the ongoing process. As phenomenon of the fourth industrial revolution (Sendler, 2018), cyber-physical making ultimately would not stop at merging design and materialization but be driven by the far end of the value chain.

Accelerated Design Transfer shifts architectural praxis from a linear, sequential process towards processes executed in parallel, as a network of simultaneous activities, in which humans and things together compute, connect, sense, actuate and communicate.

Human-Architecture Symbiosis

In his 1960 article *Man-Computer Symbiosis* (Licklider, 1990, pp. 3-4), Licklider predicted the development of computer-human symbiosis, a kind of man-machine system positioned between mechanically extended man and autonomous artificial intelligence. The first aim of this development is to make machines that help *formulate technical problems*, for example machines that help identify the questions to the answers they provide or machines which cooperate in intuitively guided trial-and error procedures. The second aim, which Licklider considered closely related, is to develop machines that can participate in real-time processes in order to achieve *immediate man-machine communication*.

The cybernetic architecture movement of the 60s and 70s explored the architectural potential of the emerging computation revolution. The 1969 article *Cybermation* (Rabeneck, 1969), for example, considered the limited capabilities of then already existing automated mass-customized production in the building industry to answer changing demands. *"Imagine we can improve the built environment through developments in performance design and industrialized building, but that people's need of change accelerates faster than our ability to satisfy it. Our predictive ability remains inadequate. […] Buildings ought to allow any degree of change over time […] given the constraints of our current technology"* (Rabeneck, 1969, p. 497).

By applying computational systems to the design, construction and use of architecture, the notion of *human-architecture symbiosis* can be posited between modernist architecture, whose development was driven by the mechanically extended capability of industrialized production, and futuristic visions of artificially intelligent built environments which are autonomous and self-reliant. The Architecture Machine Group of Nicholas Negroponte was one of the pioneers in exploring cybernetic architecture. On the most extreme end existed the idea of architecture being artificially *intelligent, self-producing* and *autogenic* (Negroponte, 1975, pp. 144-145). The more conservative concept of a *designer-machine symbiosis* (Negroponte, 1969) maintains the remoteness of the designer, and therefore requires a machine that is able to work with missing information (Negroponte, 1970). An approach that encompasses user, technology and designer directly is the agenda of *making the built environment responsive to me and you* (Negroponte, 1975), which in context could be understood as *human-architecture symbiosis*.

Architects and architectural researchers aim to make the built environment increasingly adaptive (Eastman, 1972; Yiannoudes, 2016) and interactive (Fox & Kemp, 2009; Oosterhuis, 2012), by embedding intelligent (Cheng, 2016) and robotic (Menges, 2015; Oosterhuis & Bier, 2013) constituents, affecting conception, construction and use. Human-Architecture Symbiosis, as HiLCPS, makes the built environment more adaptive and responsive by establishing systems where designers, users and technological artifacts strive for a dynamic fit in their ecological niches amidst changing balances between them.

Bringing IS into Praxis

The research effort in IS originated at the Hyperbody group at Delft University of Technology. Situated originally in the department of Design Methodology of the faculty of Architecture, the group investigated non-standard and interactive architecture. Leading visions of adaptive built environments were given with the concept of *e-motive* environments (Oosterhuis, 2002; Oosterhuis, 2003), which are relatively coherent and relatable to the inhabitant, and with the paradigm of out-of-control *swarm architecture* (Oosterhuis, 2006). Within Hyperbody's educational and research agenda, a series of prototypical IS, or components of IS were developed. For the protoSpace collaborative design laboratory, a data exchange system was conceptualized and prototyped as graphing tool for actionable relationships between parameters in different

software applications. The system would allow users to construct ad-hoc real-time information feeds between diverse and specialized applications used in the daily work of building industry professionals, and bind them to live parametric models made in the swarm architecture paradigm (Oosterhuis et. al., 2008). Another field of investigation were prototypes of CAD modeling tools that offer real-time volumetric design exploration, and should allow users to interactively model and ad-hoc reconceptualize geometry, topology and components of architectural assemblies (Friedrich, 2007, 2009). A combination of these techniques with digital fabrication and interactive building components lead to the most encompassing IS prototype, an attempt to realize an open-ended building system that encompasses simultaneous design, adaptation, construction and reconfiguration as interaction possibilities embedded in the built environment (Friedrich, 2013).

Conclusion and Outlook

The application of IS in architecture can be understood in a threefold manner: an adhocist mode of action, as accelerated design transfer, and as human-architecture symbiosis. These three approaches consider the same phenomenon from different perspectives respectively, that of the lived experience of the user-designer, that of the designer's methodology and technology, and that of ecology.

The ongoing digital revolution and emergence of ubiquitous computing, and cyber-physical systems may affect the form and feasibility of each of these readings:

A The New Adhocism approach is no longer fully dependent on make-shift solutions
B Accelerated Design Transfer may shift architectural praxis from sequential process towards a network of simultaneous activities
C Human-Architecture Symbiosis may emerge as a reading of HiLCPS with the agenda of making the built environment more adaptive and responsive

Research in IS re-examines these visions in their historical context and in the context of new technology. As was discussed, it is primarily through praxis that humans encounter the world. Design research that is limited to the technological mediation perspective of design technologies is in danger of falling back onto remote design thinking. IS research is an attempt to escape this circularity, it seeks to unveil the hidden affordances of design-by-use praxis.

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