Interactive Buildings: The Case for Interaction Narratives

Interaktívne budovy: Prípad pre naratívy interakcie

Henri Achten

Interakcia s budovami je nevyhnutne spojená s potrebou ich adaptácie a zmeny. Zmeny sa objavujú v rôznych časových intervaloch. Zvyčajne v desiatkach rokov sa menia obyvatelia, v cykloch rokov sa menia ich potreby či činnosti a spôsoby využívania budov sa zasa obmieňajú v závislosti od ročných období, majú svoj týždenný i denný rytmus, a veľa rôznych vecí sa v budove udeje aj počas dňa.

Pokrok súčasných technológií prenáša ponímanie interaktívnej architektúry do celkom inej roviny. O budovách už musíme uvažovať ako o aktéroch, nie ako o pasívnych schránkach. Architektonický diskurz by teda mal obsahovať výskum a poznanie napríklad výpočtových či kognitívnych vied, interaktívneho navrhovania.

V tejto štúdii uvedieme stručné kritické čítanie z takých zdrojov, čo sa obvykle nezaraďujú do architektonického diskurzu, ale na pochopenie interaktívnej architektúry majú nosný význam. Ich čítaním potvrdzujeme, že interaktívne naratívy predstavujú prístup, ktorý umožňuje utvoriť takýto koncept architektonicky produktívnym spôsobom.

Výskumov „smart domácností" a „inteligentných prostredí" s hlavným zameraním na energeticky optimálne a udržateľne výkonné stavby sa už realizovalo mnoho. Udržateľnosť je isto veľmi potrebná, no ukazuje sa, že v hre je mnoho ďalších faktorov, čo môžu podnietiť inú orientáciu správania ako len energetický výkon. Viacerí výskumníci uviedli rôzne faktory ovplyvňujúce úspech responzívnych systémov:

a. Walldén a Mäkinen tvrdia, že prijatie inteligentného prostredia závisí nielen od užitočnosti, ale aj jednoduchosti používania, dôveryhodnosti, od sociálneho vplyvu, ako aj od spoločenského postavenia a s ním súvisiacich kultúrnych, ekonomických a právnych faktorov;
b. Tay a kolektív pozorovali, že v súvislosti so spoločenským akceptovaním robotov začnú hrať dôležitú rolu atribúty ako úloha zamestnania, rodu a osobnosti robota;
c. Partala a Saari vyvodzujú, že úspešné prijatie technológie záleží na emočnom dizajne rovnako ako na funkčnosti a užitočnosti;
d. výskum automatických exteriérových tieniacich systémov realizovaný Meerbeekom a jeho tímom zasa viedol k určeniu štyroch používateľských profilov na lepšie funkčné využitie (minimálny, bežný, aktívny a systémová kontrola s manuálnym ovládaním).

Zo spomenutých výskumov tak môžeme vyvodiť, že neexistuje „univerzálna veľkosť, ktorá by pasovala na všetko". Potrebujeme rôzne spôsoby interakcie, čo by si takéto budovy mali osvojiť. Prináša to však otázku, ako má stavebný systém zistiť, ktorý štýl interakcie je najvhodnejší a ako má interaktívnym spôsobom reagovať na rôzne podnety od používateľa. Ak sa zameriame na skutočnú interakciu s používateľom, systém musí byť intímne previazaný s používateľovými skúsenosťami, túžbami a očakávaniami.

Jeden z prístupov, ktorý ponúka ucelený pohľad na túto tému, predstavila Maria Lehman. Lehmanovej práca je zameraná na senzorický dizajn v zdravotníckom prostredí. Uvádza, že ľudské poznanie je multisenzorické a že pre úspešné navrhovanie je nevyhnutné dobre poznať naratívy ľudí v budovách. Z nášho pohľadu je koncept, ktorý opisuje Lehman, pre interaktívnu architektúru mimoriadne vhodný. Podporuje stabilné rozvíjanie udalostí medzi používateľom a budovou – umožňuje jednoduchý spôsob interakcie a pre používateľa ho robí prijateľnejším či „čitateľnejším", a tým i veľmi príťažlivým. Navyše nabáda na konzistentné zdôvodnenie premeny rolí medzi používateľom, budovou a vzťahom, medzi budovou aj človekom a posilňuje rozhodovací proces ako prepínať z jedného interaktívneho štýlu na druhý. Koncept naratívu – rozprávania – je veľmi blízky scenáru, ktorý architekti často používajú pri premýšľaní o možných využitiach ich ešte nezrealizovaných myšlienok.

Navrhujeme „naratív interakcie" ako organizáciu okamihov interakcií medzi používateľom a systémom sledujúcim príbeh, ktorý je zhodný so štýlom interakcie. A interaktívny systém má „interaktívny naratív" na prepínanie medzi interaktívnymi štýlmi – podľa príbehu, ktorý je v zhode s očakávaním používateľa. Budúca práca musí riešiť fyzické prototypy, ktoré sa konfrontujú s realitou i s ľuďmi a ktoré sú zasadené „v divočine".

Introduction

The lifespan of buildings extends for a long time. During this life-time, changes occur along various time scales – the inhabitants will change, usually in cycles of decades; the needs of the inhabitants change in cycles of years; their activities and ways of using the building change per season; they have their weekly and daily rhythms, and during the day many different things happen inside the building. This principle applies for all types of buildings; domestic, work, industry, entertainment, and so on. Changing buildings often is costly, involving much time and labor; therefore, the physical alteration of buildings is avoided rather than embraced. Yet conventional design methods are ill-equipped to take the changes described above into account, nor are there methods able to deliver building designs that appropriately incorporate such changes. Some attempts have been undertaken to deal with change, mainly through conventional means.[1] Advances in contemporary technology have brought the notion of interactive architecture to a completely new level. We need to conceive buildings as agents, not as passive technology containers. In consequence, the architectural discourse should include research and understanding derived from computer science, interaction design, cognitive science, and many other disciplines. In this paper, we provide a concise critical reading of such sources, to arrive at our claim that interaction narratives form an approach to unify such concepts in an architecturally productive way.

Interaction in architecture until contemporary disruption

Since the late 1980s, technologies have developed that make it possible to effect dynamic change in building (components). Examples of such technologies include media facades, kinetic structures, ambient environments, smart homes, among many others. Early experimentation made use of these technologies in short loops, meaning a sensor set; a controller deciding on some action based on the sensor information; and an actuator or device that displays or acts in some way. Media facades are the oldest examples of such systems (for example "Zeitgallery" by Christian Möller in Frankfurt, 1992.[2] In this paper, there is not enough space to elaborate on the historical development of such systems. We can note, however, that today the technological loops have become more extended and complex through technologies such as the Internet of Things, wearables, and Cloud computing.[3] These technologies tend to converge, greatly expanding the potential of interactive architecture.[4] The complexity of communication chains has led some researchers to call these systems ecosystems.[5]

The case for interaction

Many architectural interactive systems have already been developed, mostly as installations, art pieces, or additions to spaces. Much of this work is informed by technological opportunity and experimentation. Still, we lack a comprehensive approach to understanding from an interaction perspective. The most notable exceptions from the architectural point of view are Michael Fox,[6] who has created several interactive buildings in the past two decades, and Robert Kronenburg,[7] who investigates the fundamental aspect of change in architecture. There is rising awareness from the field of Human-Computer Interaction (HCI) towards the field of architecture (most strongly defended by Malcolm McCullough's book *Digital Ground*[8]), but the two fields are still quite separate.[9–11] Given the recent nature of phenomenon of interactive architecture, there is no conclusive evidence yet that unambiguously states the (dis)advantages of interactive architecture. However, some experimental work does provide us with clues about this dilemma. Schnädelbach and team built a bio-feedback based interactive prototype, called *ExoBuilding*,[12] and conducted several experiments while measuring physiological responses from users. They note a positive effect on the users in the physiological sense, while on the other hand most users found the explicit bio-feedback disturbing and unpleasant. David Coyle et al. note several systems for mental health interventions that have positive effects on people, for example, online treatments, mobile support, therapeutic computer games, virtual and augmented reality exposure therapies, relational agents, and robotic companions.[13] Niels Wouters et al. analyzed in more detail the spatial and social aspects dealing with successful engagement of people with an interactive installation.[14] They identify encounters, triggers, and activation loops as important mechanisms in establishing and sustaining interaction.

Limitations of contemporary interactive systems

The developments described in the previous section have led to the creation of dynamic, responsive, and interactive buildings. From each step in the progression from dynamic to interactive, the building has an increasing amount of user involvement in the changes that occur in the building. In research literature, we can find many different terms for responsive building, with each specific and different meanings: Building Automation Systems, Smart Homes, sentient buildings, adaptive buildings, dynamic buildings, kinetic architecture, intelligent buildings, and portable buildings. In our research, we are particularly concerned with *interactive* buildings. Interactive buildings support a meaningful exchange of information between the user and the building, and the exchange influences changes in both the user and the building.

A lot of research has been done on "smart homes" and "intelligent environments", with the major focus of this work placed on energetically optimal and sustainable well-performing buildings.[15] To be sure, sustainability is very important, but there are strong clues that there are many more factors at play that would promote other behavior orientation than energy performance alone. Walldén and Mäkinen[16] note that acceptance of smart environments depends not only on usefulness, but also on ease of use and trust, on social influences, as well as broader cross-societal cultural, economic, and legal factors. When we engage in an interactive exchange between a user and a system, the interaction takes on a deeper meaning than just "pressing buttons." People will attribute personality traits to the system, so the system will be perceived increasingly as a social thing. In this sense, Tay et al.[17] observed that concerning social acceptance of robots, attributed characteristics such as the implied occupational role, gender, and personality of the robot play an important role. Partala and Saari[18] conclude that successful technology adoptions depend on emotional design as much as functionality and usefulness. How this emotional design should be achieved remains an open question. From the work of the researchers above, we may infer that interactive systems need a variety of roles to best support the user.

In the field of interaction design, the concept of "*user experience*" expresses a more user-grounded orientation in how systems and people may relate.[19] Although the concept of user experience is widely used in the field of Human-Computer Interaction, there is no generally accepted definition of user experience so far. Marked differences persist in its conception and application, based on geographical location and background.[20] What seems to play an important role in the success of an interactive system is the sense of the "locus of control"[21] – meaning the degree to which an individual reflects about his/her capabilities to exert control in an environment. As a more concrete example, Meerbeek and his team[22] found many inadequacies in automated exterior blinds systems, and in consequence defined four different user profiles that perform better for the user (minimal, regular, active, and system control with manual override). The recognition of multiple user profiles is important, and it leads to the (yet unanswered) question of the dynamic choice of the proper user profile. Concerning the integration of interaction in the architectural design process, Houben et al.[23] claim that successful integration of an interactive system in architectural design projects can only be achieved when architects perceive the said systems as a material that they can approach in much the same way as they aim to express an architectural message.

Interaction has social implications as well. Mostly, interactive installations are conceived between a system and a single user. However, evidence from research shows that with an increasing number of people, the nature of the interaction changes as well. For example, the "honeypot effect,"[14] is the phenomenon that people who are engaged with a system stimulate by-passers to observe and ultimately engage with the system as well. Claes and Vande Moere[24] demonstrate how identical displays compared in a public setting and isolated setting, using a narrative and without a narrative lead to difference in comprehension and ease of use. Valkanova et al. demonstrate the impact of citizen-driven data visualization on perception, behavior change, social awareness, and public participation.[25]

Judging from the previous discussion we may conclude that there is no "one size fits all." Systems may have different goals: apart from performance, interactions may be also geared towards sustaining, servicing, symbolizing, and entertaining. Systems can engage in different styles with the user, such as in an instructive way, as a conversation, series of manipulations, or in an explorative way.[26] Mark Meagher stresses the "poetic potential" of responsive architecture, and notes that "...architects must develop a deep understanding of multiple types of change in buildings."[27] Cameline Bolbroe argues for a shift in attention away from the object to an "act of inhabitation," dealing with temporality, memory, learning, and emergence.[28] It seems evident that we need to know the various interaction styles that an interactive building may adopt. This introduces the question as to how the building system would figure out which interaction style is the most appropriate, and how different interaction styles may be adopted in an interactive manner with the user.

The "interaction narrative"

Settling on the proper interaction style with a user seems to be intimately bound with the user's experience, desires, and expectations. One approach that offers an integrated view of this question is discussed by Maria Lehman.[29] Lehman's work is based in the domain of sensory design in healthcare environments. She notes that people's experiences are multi-sensory and that for a successful design, it is necessary to connect well to the narrative of people in the building. In a healthcare situation, the narrative includes things as "contemplation, visitors, sleep, recovery milestones, exercise, activities of daily living, medication, distraction, education, transition home, and pain management." A narrative, in other words, is a coherent story of the inhabitant, which needs to be supported by the activities or interactions of the building. In the more specific case of cancer treatment, Gillian Hayes and her team[30] have noted that "…New technologies must accompany people on this journey while accommodating huge shifts in uses needs, motivations, energy levels and goals." We can generalize this finding to areas outside healthcare. Already in 1999, Per Galle argued that a proper description of design should not be object-based but action-based – a notion which has strong links with the concept of narrative.[31]

In our view, the concept of narrative as described by Lehman is very relevant to interactive architecture. It has a strong appeal because it enforces a consistent unfolding of events between the user and the building – thus it supports individual interaction styles by making them clearer or "readable" for the user. Additionally, it enforces consistent reasons for role-switching between the user, the building, and the user-building relationship, thus supporting the decision process regarding how to switch from one interaction style to another. The concept of narrative is very close to the notion of the scenario, often used by architects to speculate about possible uses of their yet unrealized designs.[32 – 35]

Usually, narrative is associated with words and story-telling, as can be readily seen in books and movies where the narrative is the prime structure. As such, there is an extensive body of research on narrative in its written, spoken, and visual form. Our focus is on the role of narrative in technical systems, allowing us to ignore narrative as a story-telling device in itself. Interactive narratives are stories, usually encountered in computer games or installation art, where the user experiences a narrative through a storyline. Quite a lot of research and development has been invested in this kind of application,[36] although there is relatively little investigation of the user experience of such narratives.[37] Narratives have been advocated in computer system development as early as 1993 by Hasse Clausen.[38] Currently, narratives have been integrated into the discipline in the narrative of use cases,[39] which is the systematic approach for describing scenarios in software development since 1999.[40] Moving closer to architectural design, Li-Shin Chang notes that a narrative does not need to be in the form of words but can contain objects as well, for example in landscape narratives.[41] Scott Davidoff et al. observe in the context of control in smart homes for families that just handing over control of the devices is not sufficient, but that the system should support families to control the things what they value the most: "*their time, their activities, and their relationship*."[42]

Based on the discussion above, we propose that an "interaction narrative" is an organization of moments of interaction between the user and the system following a story that is consistent with an interaction style. Additionally, the interactive system has an "interaction narrative" for the way that it switches between interaction styles – yet all the while following a story that remains consistent with user expectations.

With interactive architecture, we are fundamentally changing our understanding of buildings compared to almost all architectural thought of the past centuries. The most notable exception to this is the work[43] by Cedric Price (1935 – 2003) and Gordon Pask (1928 – 1996).[44] Interaction narratives have the potential to unify technologies, aesthetical, and social aspects in a meaningful way. By respecting a narrative in the design process, it may be avoided that unbalanced attention goes to singular aspects of interaction, such as showcasing technology, or installations that do not deepen people's understanding of the built environment. It must be noted that the implications of this change are unclear. It will require an orchestrated effort from architects, researchers, legislators, clients, and people to advance our understanding.

Our claim here is theoretical, which obviously forms its main weakness. The real impact of interactive architecture cannot be studied through the theoretical approach alone. Future work must confront the physical prototypes that confront reality and people, and must be assessed "in the wild."

Conclusion

Creating an interactive building should be more than the disassociated compilation of many responsive components in a single building. The notion of "interaction narrative" allows the design team of interactive systems to bring all possible moments of interaction into a coherent whole. Since a narrative contains a sequence of events, it also forces designers to consider user interactions as they should happen one after each other, and how they could guide the user from event to event. This understanding may lead to easier understanding and acceptance by the future users of such systems.

As we now stand at the beginning of interactive buildings, a lot of work and experiments are still ahead of us. This position paper makes the case for interaction narratives as a promising future direction. Whether it will truly fulfill this potential can only be found out by prototyping, user testing, and implementing designs in real buildings.

PROF. DR. IR. HENRI ACHTEN

DEPARTMENT OF ARCHITECTURAL MODELLING
FACULTY OF ARCHITECTURE
CZECH TECHNICAL UNIVERSITY IN PRAGUE

Thákurova 9
160 00 Prague
Czech Republic

achten@fa.cvut.cz

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