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# **SPACES OF INTERACTION**

# ABSTRACT

The use of interactive elements created by the possibilities offered by new technologies has a strong impact on the immediate human environment. This article reflects on interactive functions used in architecture and applied art. Interactive activities are often associated only with electronics, while they can manifest themselves both in human relationships and on the line of man-space-object. According to cultural experts, interactivity is the interaction between two sides, during which new meanings should be created. Such actions transform the passive attitude of their recipient, activating the person and making him or her an active participant. This type of phenomenon is described by media experts as a culture of convergence. The first chapter of the article deals with interactivity which is closely related to communication. This term means the interaction of two or more communicating entities. This type of exchange can be carried out by means of various technological media or manual actions in the human-environment relationship. A chronological account of evolution regarding interactive solutions related to applied art is presented here. The next chapter refers to architecture equipped with computational capabilities, advanced electronic, mechanical and material technology, so that it can interact with man and his immediate surroundings.

Objects created in the trend of hi-tech style were presented as pioneering examples of such solutions. Objects designed by Richard Buckminster Fuller, Cedric Price, Charles Eastman, Renzo Piano, Richard Rogers, Norman Foster, David Fisher and Zahy Hadid were described. The examples presented show that architecture equipped with interactive elements should serve man, facilitate human life and exist in harmony with the environment.

## **KEYWORDS**

interactions; interactivity; culture of convergence; organizing; structuring; memorization; inheritance; action and reaction; participation; non-trivial activities

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# Spaces of interaction

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## Interactivity in reference to applied art

Interactive activities are often associated only with electronics, while they can occur both in human relationships and on the line of man-space-object. According to cultural experts, interactivity is the interaction between two sides, during which new meanings should be created. Joke Brouwer and Arjen Mulder aptly quote this definition: "Interaction characterizes every existence. Bodies and objects form connections, form networks and then, through interaction, lead to organization, structuring, memorization and inheritance. Interaction is often seen as a process of action and reaction between existing bodies and objects but it is a too narrow view. Interaction prompts bodies and objects to change and create variations. Interaction is not a deformation of existing forms but rather an additional information, informing, development of forms." The wording comes from a work published on the occasion of the Dutch Electronic Art Festival in 2007, titled *Interact or Die!!*. The definition of a culture of convergence, which concerns active human participation in events caused by the influence of media systems, e.g. the Internet or television, is important. The concept of convergence is presented by Henry Jenkins in his book titled *The culture of convergence. A clash of old and new media*<sup>2</sup> where he describes it as an active participation in cultural and political events through specially designed spaces. This applies in situations where the recipient does not merely take

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<sup>1</sup> P. Zawojski, *Dokąd zmierza sztuka nowych mediów. DEAF i Ars Electronica 2007*, „Opcje” 2007, nr 3.

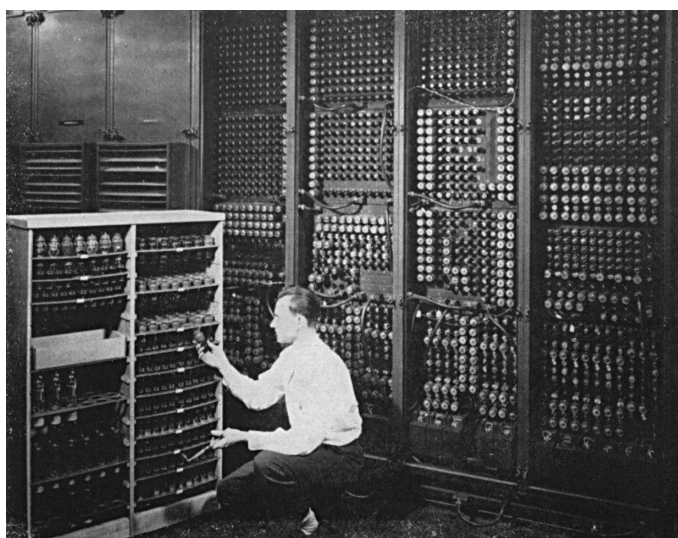
<sup>2</sup> H. Jenkins, *Kultura konwergencji. Zderzenie starych i nowych mediów*, tłum. M. Bernatowicz, M. Filiciak, Warszawa: Wydawnictwa Akademickie i Profesjonalne, 2007.

a passive attitude, but participates in the process prepared for him and becomes both a creator and an individual interpreter.

This article will present a historical review of the emergence of the concept of interactivity related to applied art. Advances in information and communication technology solutions enhance interaction. In addition to simple electronic solutions, devices are used the operation of which is based on a computer system. We are talking about all kinds of touch screens, virtual reality glasses, multimedia tables, motion sensors, mobile devices or multi-element multimedia sets. Users sometimes do not realize it when the real world starts connecting to the virtual world. Man begins to function in cyberspace, that is, in an illusion of the real world created through the Internet and information devices.

The first computers should be mentioned at the outset of considerations regarding the sources of media interactivity. Until 1975, ENIAC (*Electronic Numerical Integrator And Computer*)<sup>3</sup>. It was built by J.P. Eckert and J.W. Mauchly in 1943-1945 at the University of Pennsylvania (USA). The first unit occupied 140 square meters and was used mainly for ballistic calculations, weather forecasts, calculations related to the production of nuclear weapons or the study of cosmic radiation.

Photo 1 ENIAC. Źródło: ENIAC, <https://pl.wikipedia.org/wiki/ENIAC> (accessed on 26/04/2019)



Replacing a bad tube meant checking among ENIAC's 19,000 possibilities.

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<sup>3</sup> ENIAC, <https://pl.wikipedia.org/wiki/ENIAC> (dostęp 26.04.2019).



It is currently being determined whether any other such solutions were previously developed, such as the ABC (Atanasoff-Berry Computer) also built in the USA, at the Iowa State University, the Colossus in the UK <sup>4</sup> or the German machines of Konrad Zuse<sup>5</sup>. I will not delve into other historical discoveries such as the first calculator from 1878 built by the Spanish inventor Ramón Verea because, going down this path, we can come to a wrong conclusion that with most of the discoveries related to electronics there is human interaction. Within the meaning of the definition of interactivity given at the beginning of the chapter, not every electronic equipment is interactive. Not always such inventions can be considered the beginnings of interactive solutions simply because they are able to respond to a message sent by man. To move away from similar comparisons, media experts use the term “non-trivial” actions, as a result of which the human-machine relationship contributes to the

**Photo 2: Cyberspace. Film frame from *Mr. Robot*.**

Source: <https://www.filmweb.pl/serial/Mr.+Robot-2015-733795> (accessed on 26/04/2019)



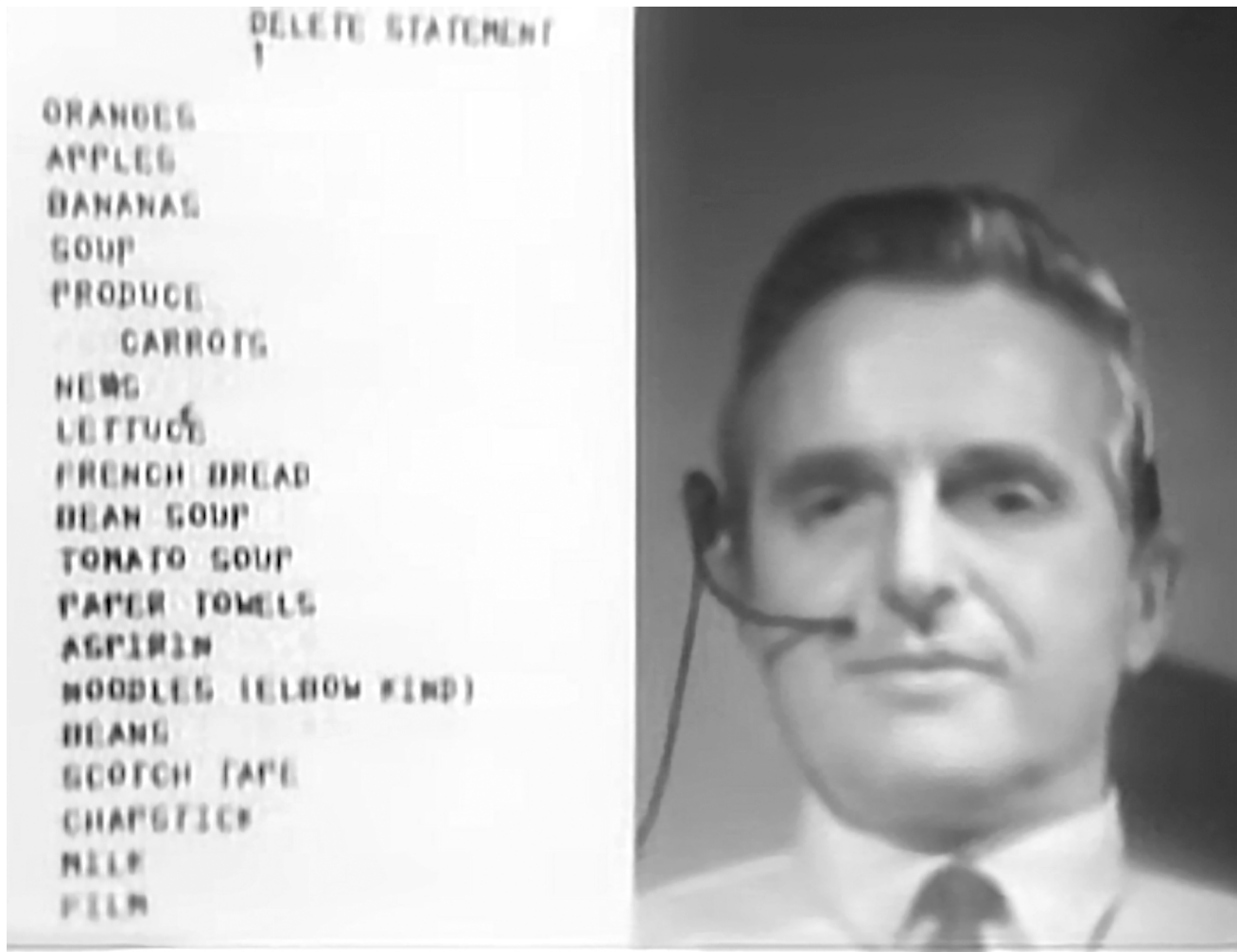
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<sup>4</sup>Colossus, <https://pl.wikipedia.org/wiki/Colossus> (dostęp 26.04.2019).

<sup>5</sup> Konrad Zuse, [https://pl.wikipedia.org/wiki/Konrad\\_Zuse](https://pl.wikipedia.org/wiki/Konrad_Zuse) (dostęp 26.04.2019).

Photo 3: Douglas Engelbart during the conference on “The Mother of All Demos”

Source: [https:// www.youtube.com/watch?v=yJDv-zdhzMY&t=652s](https://www.youtube.com/watch?v=yJDv-zdhzMY&t=652s) (accessed on 26/04/2019)



emergence of new meanings<sup>6</sup>. The essence of interactivity is the cultural aspect that causes in a person a certain kind of surprise or participation in the discovery process. Media expert Henry Jenkins describes modern culture as participatory, bringing together many media that are involved in the process of striving for a goal other than just technological possibilities<sup>7</sup>.

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<sup>6</sup> M. Filiciak, A. Tarkowski, *Alfabet nowej kultury. I jak interaktywność*, <https://www.dwutygodnik.com/artykul/362-alfabet-nowej-kultury-i-jak-interaktywnosc.html> (dostęp 26.04.2019).

<sup>7</sup> H. Jenkins, *Convergence Culture. Where Old and New Media Collide*, revised edition, New York University Press, 2008.



The genesis of modern multimedia solutions goes back to the hippie 1960s. While pop culture was developing in California promoting sexual freedom and drug use, futuristic visions of a personal computer were being developed in the community of enthusiasts of new technologies. Visions of the time are already a part of everyday life. In 1968, at a conference in San Francisco, Douglas Engelbart first presented a preview of a computer operating system featuring windows, hypertexts, links and video conferencing. The conference was registered and called “The Mother of All Demos”, became an inspiration for companies such as Xerox or Apple.

All of the demonstrated elements have become the foundation of the global process of creating emails, Skype-type applications, and Google-like browsers. Participants of the meeting stated that Engelbart was under the influence of drugs, especially since he handled the entire presentation with a handheld controller, which he called a “mouse”. The accusations did not come out of nowhere, as at the time Engelbart defended the claim that LSD was a substance that had a beneficial effect on the human mind. Probably not without such support, the modern mouse was created and patented in 1970. Engelbart never received much benefit from this; his invention was ahead of the possibilities at the time, the patent expired in 1987, and then the Stanford Research Institute resold the license to Apple for about \$ 40,000. Engelbart and his own team known as the “Augmentation Research Center” worked on the idea of a personal computer and conducted research on communication through the virtual ARPANET network, which became a precursor to the Internet. He wanted to create a computer operated using its display. This work on the graphic user interface became the basis for Apple Macintosh and Microsoft Windows operating systems only in the 1980s and 1990s.

In 2017, the Design Museum in London displayed an exhibition entitled “California: Design Freedom”<sup>8</sup> that answers the question: how has California gained such a strong influence on contemporary design? The exhibition shows how counterculture ideas of the 1960s have evolved into a culture of new technologies in the Silicon Valley and how Californian design has become a global phenomenon. Exhibition curator Justin McGurin comments on the exhibition in these words: “When we think of Californian design, we mean Charles and Ray Eams in terms of the mid-20th century modernism. During the exhibition we wanted to focus on what was next and show how the hippie movement, combined with the culture of hackers, developed tools for personal liberation.”<sup>9</sup>. The

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<sup>8</sup> *California: Design Freedom*, <https://designmuseum.org/exhibitions/california-designing-freedom> (dostęp 26.04.2019).

<sup>9</sup> *Designers on acid: the tripping Californians who paved the way to our touchscreen world*, <https://www.theguardian.com/artanddesign/2017/may/11/design-museum-california-designing-freedom-tech-design> (dostęp 26.04.2019).

Photo 5: Personal computer: Apple Macintosh, 1984

Source: <https://designmuseum.org/exhibitions/california-designing-freedom/make-what-you-want>  
(accessed on 26/04/2019)

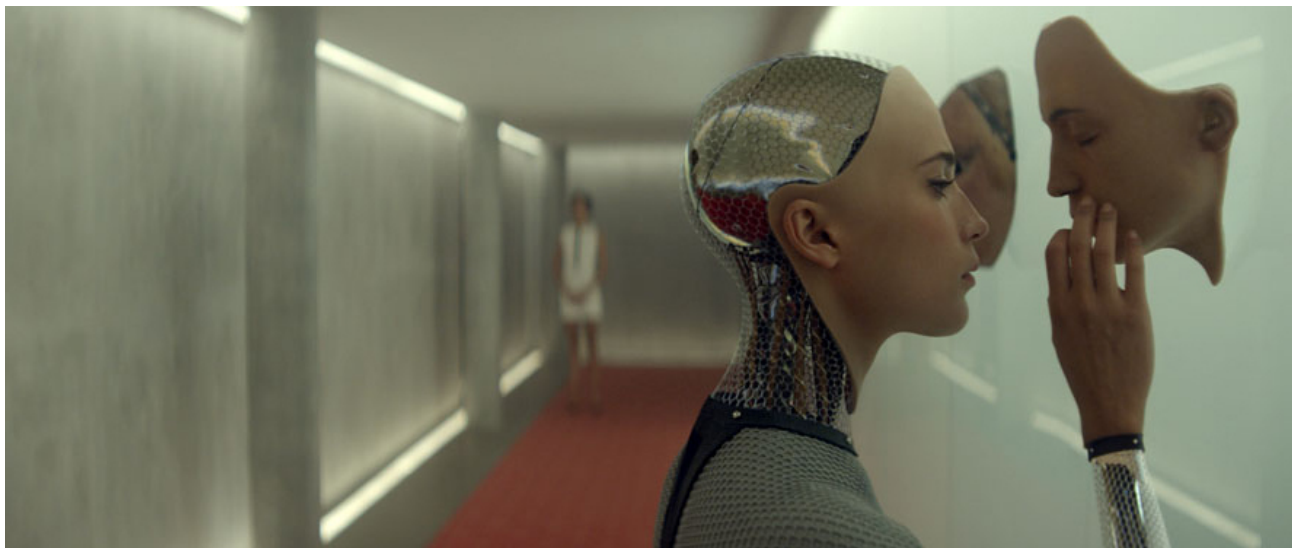


ideas that Douglas Engelbart, Steve Jobs and Steve Wozniak worked on cemented the modern look of the personal computer interface. It is thanks to them that the operation of the device is intuitive, the appearance of documents resembles a white sheet of paper, the launch screen brings to mind the desktop, while unnecessary documents can be easily removed by dragging them to an icon that looks like a trash can. All the solutions that Silicon Valley developers and designers have been working on take us into the realm of cyberspace.

Speaking of all kinds of electronic hardware supported by the built-in chip, we use the generic word multimedia. This term means devices transmitting information in the form of interconnected audio or visual recordings. The meaning of the word comes from the Latin *multum* and *medium*. Current technological solutions allow you to freely combine the image with sound, sometimes even with smell or taste. All these connections are aimed at better providing information to the public or enriching everyday life through entertainment. Thanks to the ability of multimedia equipment to

Photo 6: Artificial intelligence. Film frame from “Ex Machina”.

Source: <https://www.filmweb.pl/film/Ex+Machina-2015-686419> (accessed on 26/04/2019)



connect to the Internet, they become an intermediary between the real world and cyberspace. Constantly improved devices allow for easier and more precise operation, and increasingly also replace people in everyday tasks. Devices become autonomous and are therefore referred to as equipped with artificial intelligence. The term was formulated in 1956 by John McCarthy. The term was then elaborated by Andreas Kaplan and Michael Haenlein who described AI as “the ability of a system to correctly interpret, learn from, and use external data to perform specific tasks and achieve goals through flexible adaptation.”<sup>10</sup>

This wide range of scientific research related to computer science, philosophy, neurology and psychology leads to the realization of human dreams about machines endowed with human properties and even surpassing them. Colloquially, the term about the use of AI in electronic devices is not always used in relation to relevant interactive solutions. Often only a repeatable algorithm determines the ability of the device to respond to an impulse input by a human. The development of AI research aims to create mechanisms that can respond on an ongoing basis to events unforeseen in the system programming process.

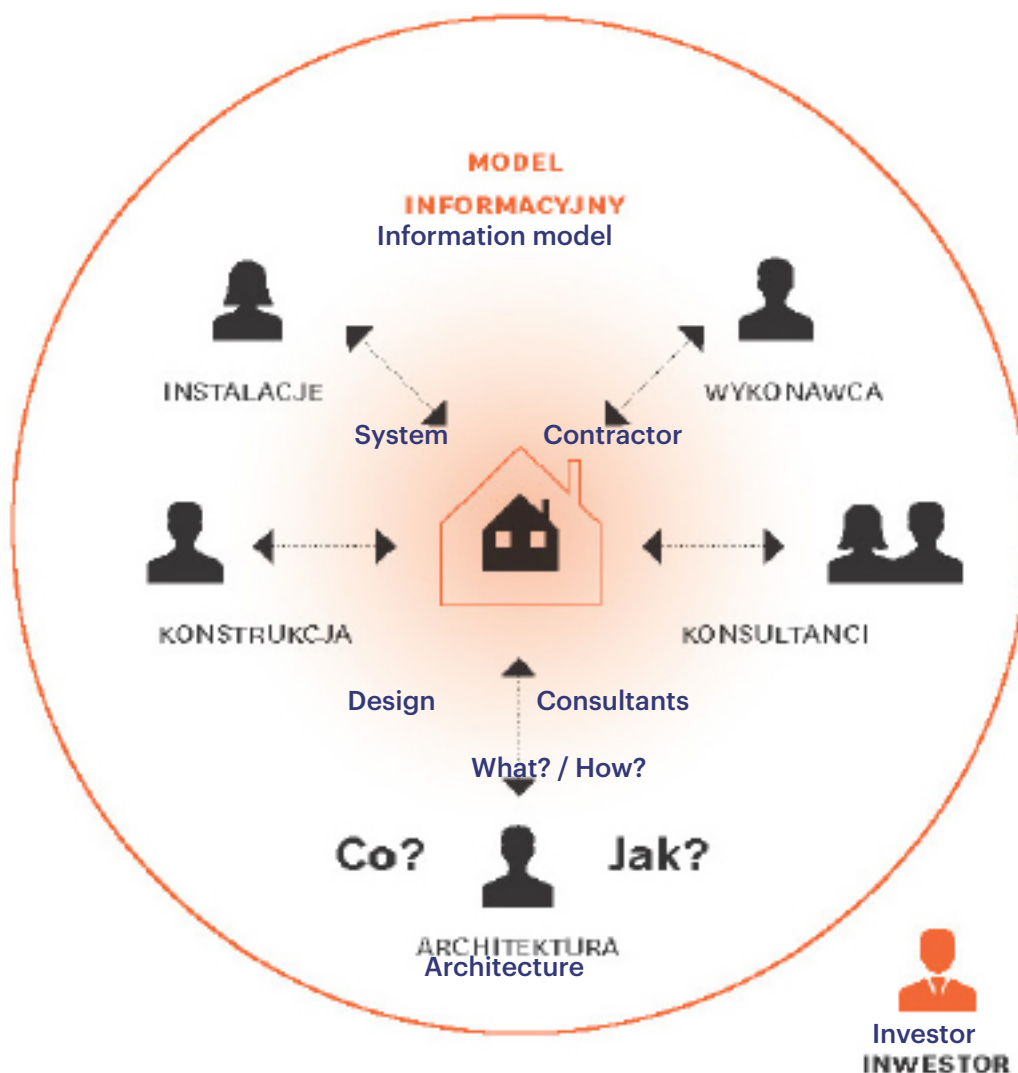
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<sup>10</sup> *Artificial intelligence*, <https://www.sciencedirect.com/science/article/pii/S0007681318301393> (dostęp 26.04.2019).

## Architecture as a medium of interactions

Interactivity in architecture is strongly intertwined with the hi-tech style. This trend belongs to the group of postmodern styles. Its origins can be seen in the first half of the 20th century, when architects became interested in groundbreaking machine design solutions, space exploration or the latest telecommunications technology, mainly computer. Extensive inspiration spurred the desire to use new technological solutions when designing architecture. This development was accompanied by exploratory ways of using glass, concrete or steel, used as a building material. More electronic solutions were used, e.g. automatic blinds, air conditioning, hydraulic control systems or the first solar panels. Such elements strongly influenced the appearance of the building, both internal and

Illustration 1

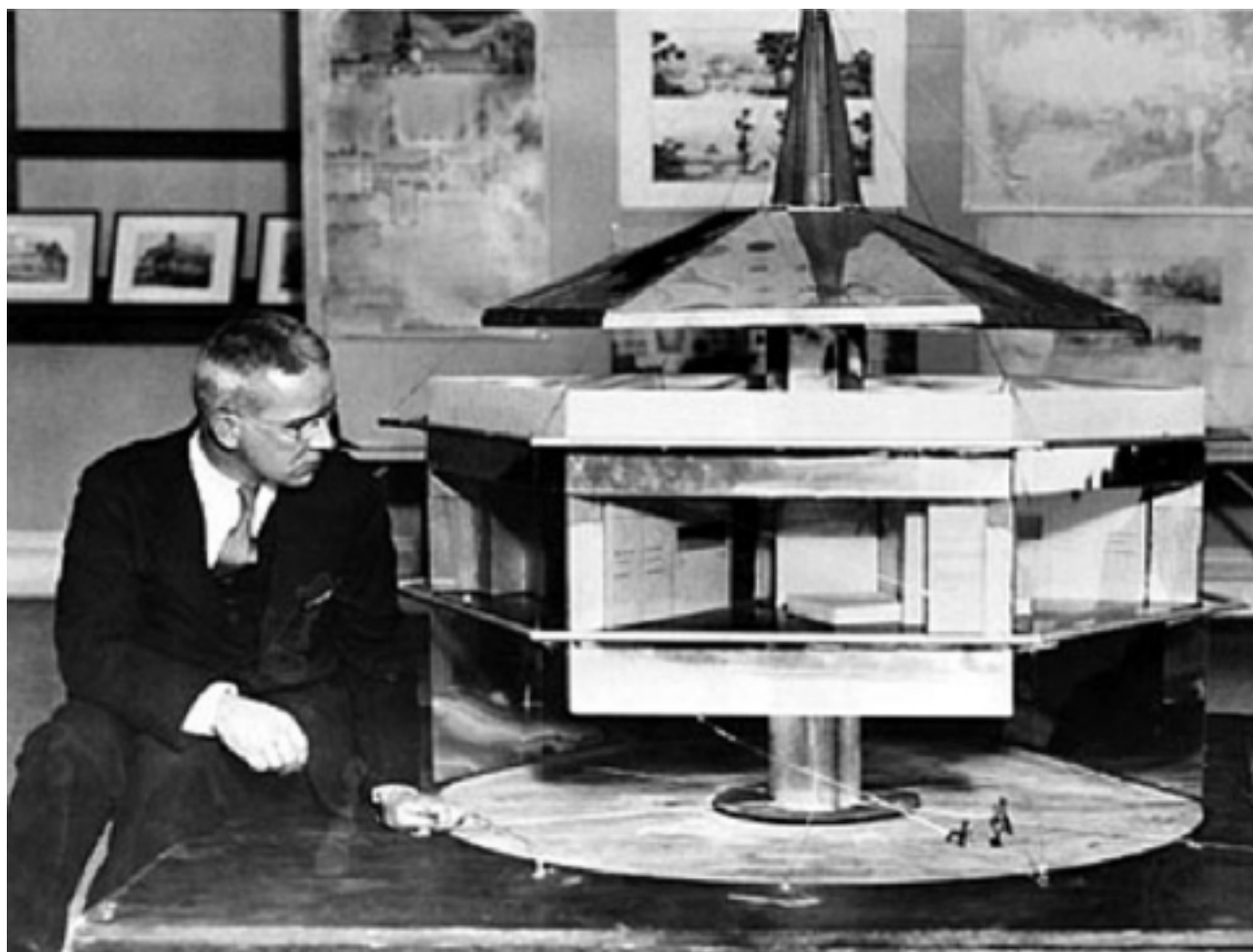


external, and its construction. Designers did not hide the latest technological solutions; on the contrary, they boasted of the steel structure, air conditioning system or other technical elements, leaving them in view, without the use of finishing linings or parges. The increasing use of escalators and elevators has improved vertical communication. The electronics integrated within a single system gave the possibility of better controlling and programming many functions. All such solutions are related to the concept of “smart building”.

American engineer, inventor and philosopher Richard Buckminster Fuller is considered a pioneer of the hi-tech style<sup>11</sup>. His projects were called “futuristic” and were known as early as in the 1920s.

**Photo 7: Richard Buckminster Fuller and his Dymaxion House of 1927**

Source: [https:// pl.pinterest.com/pin/112308584430763723/](https://pl.pinterest.com/pin/112308584430763723/)



<sup>11</sup> J. Pile, *Historia wnętrz*, Warszawa: Wydawnictwo Arkady Sp. z o. o., 2004.



Many works were stopped at the stage of prototypes called by him “Dymaxions” (the term was created from a combination of the words “dynamic” and “maximum”). Fuller was one of the first to use electronics and mobile elements in architectural designs. His Dymaxion House of 1927 had a centrally located duct through which electrical lines were routed. We now know that interactivity often involves mobile elements that create a user-modifiable interior. Such an example is the prefabricated bathroom designed by Fuller, which can be transported as a single unit and, thanks to the integrated hydraulics system, installed anywhere. The object seemingly far from our notions of interactivity draws attention to the technology that allows architecture to adapt to human needs.

The concept of architectural interaction emerged in 1964 when Cedric Price, on the example of the Fun Palace project, described architecture as a form of service that allows configuration according to the requirements of its users. This project has never been implemented. Price argued that architecture should serve a person for as long as he or she needs it. If its function is no longer valid, the building should be demolished and another building built in its place. According to Cedric Price's wish, the Inter-Action Centre building was demolished after his death. Important in the discussion about the future of architecture was Warren Brodey's *The Design of Intelligent Environments: Architecture Soft* published in 1967. Brodey described a self-organizing intelligent architecture environment that meets users' expectations<sup>12</sup>. Similar research was conducted by architect Charles Eastman who, in 1972, presented an adaptive system through which architectural objects can receive information from the user and adapt themselves to the current situation. Eastman is also considered one of the first developers of the application of the BIM system for the implementation of architectural projects<sup>13</sup>. The development of information technology has had a strong impact on designers, resulting not only in the use of computer software that supports building functions but in how design and implementation work is carried out. In the early 1970s Eastman created a system called Building Product Models, and its modern version is the Building Information Modeling (BIM). The system consists in the digital recording of the architectural design in the form of a 3D model. This method allows you to build a building virtually and develop a range of functionalities and technologies of execution. The concept of “building information modeling” provides for the creation of a digital version before construction begins in order to eliminate any problems. The digital recording of the project in the form of a 3D model contains much more information than a flat drawing. So prepared project goes into the hands of many specialists and can

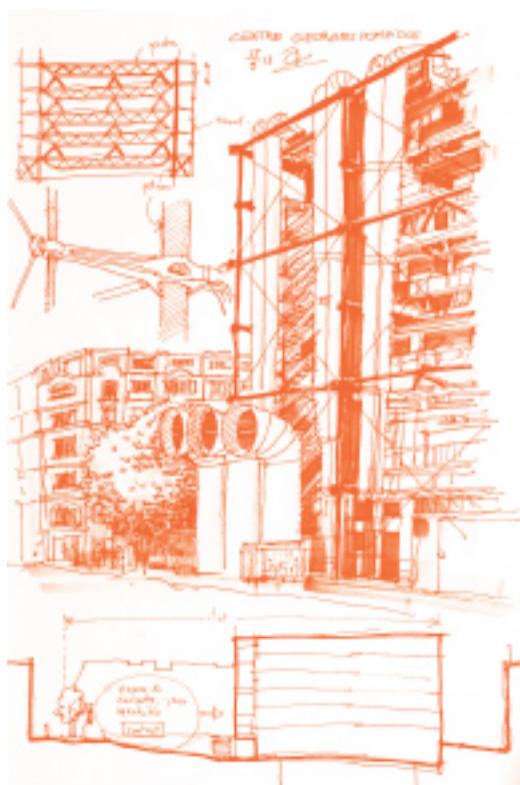
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<sup>12</sup> W. M. Brodey, *The Design of Intelligent Environments: Architecture Soft*, „Landscape” Autumn 1967.

<sup>13</sup> P. Bujak, *BIM – geneza i praktyka*, <http://www.iwb.com.pl/projektowanie/bim-geneza-i-praktyka>.

be tested in virtual reality. This allows future interactions in the projected facility to be precisely designed and to not only respond not only to human signals but adapt, for example, to changing climatic conditions. Following this trail, interactivity will also appear between the environment and the object. Thanks to the BIM system, the prepared 3D model of the building can also be part of a mobile application or of other computer software that is used to operate the interactive object.

**Illustration 2**



A very important point in the evolution of interactive architecture is the Centre Georges Pompidou building in Paris. This Paris' icon of the hi-tech style designed by Renzo Piano and Richard Rogers show similarities to the Fun Palace in Paris, as Cedric Price's designs inspired many creators. The architects, working on the cultural center, were guided by the idea of free creation of space and of moving its elements. In 1977 a multifunctional building was put into operation, which is designed to adapt to various functions and events organized within the cultural institution. Under one roof there is a museum of contemporary art, a source library, an industrial design centre and a centre for music and acoustic research. In addition to these basic institutions, there is also a bookstore, theater, restaurant, office space and a children's playroom<sup>14</sup>. The building gives the

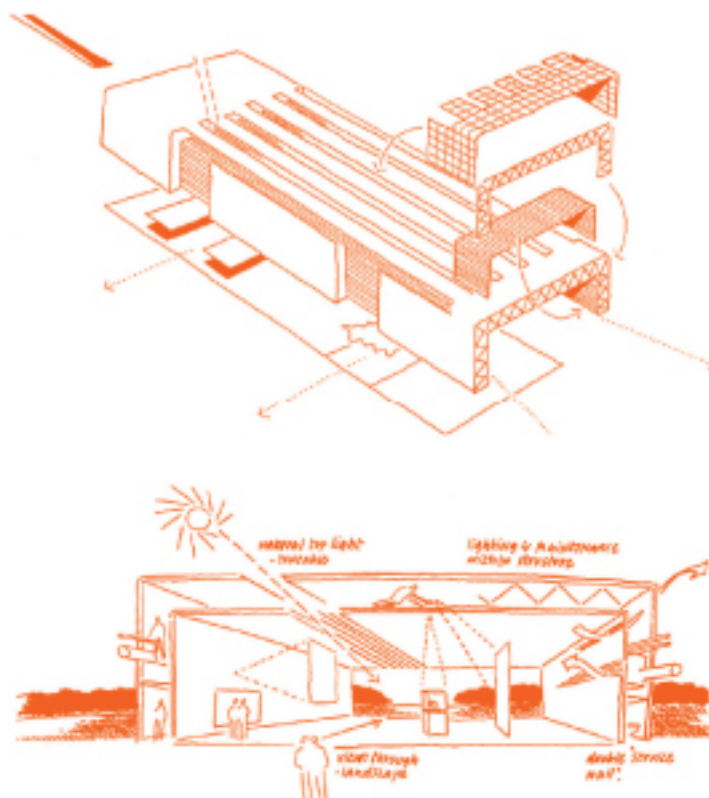
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<sup>14</sup> M. Irving (red.), *1001 budynków które musisz zobaczyć*, przeł. E. Balcer i in., Poznań: Publicat 2007, s. 604.

impression of being turned “inside out” through hi-tech-specific outdoor systems, located on the façade, giving the interiors more opportunities to change the arrangement. This is also facilitated by the system of moving walls and partitions. The building meets the needs of users by being able to adapt to a specific situation. Not everything is done with the help of computer software. The object is interactive because it can adapt to different situations but, for this to happen, the users need to do a lot of manual work.

Norman Foster is another architect whose work is part of the hi-tech trend. A good example is the Sainsbury Center for Visual Arts built in 1978. This is a gallery with a collection of artworks by Robert and Lisa Sainsbury. The basic structure made of prefabricated steel, covered with notched aluminum panels, creates a building founded on a rectangular plan. The main exhibition space is a large hall the span design of which is free from partitions that would confine the interior. The lighting was mounted under the vault on a steel truss, also giving the possibility of personalization. Rest and recreation rooms or offices do not interfere with the main function as they were placed between the aluminum panels and the structure of the building. In this case we are also dealing with a flexible interior giving a lot of arrangement possibilities through modification.

**Illustration 3**



When thinking of architecture as a tool that should do the work, designers pay attention to fine-tuning all the functional elements. Architecture is designed to serve man, make human life easier and exist in harmony with the environment. In search of contemporary architectural icons, the discussion is not only about the visual aspects but also about those characteristics that determine the quality of the task performed. Space optimization, the use of mechanical elements, mobility, which allows the movement of entire systems, and computer systems that control the entire object create a building that is a coherent organism designed to serve people. Similar trends can be seen in David Fisher's design of the rotating skyscraper for Dubai. In his concept the building reacts to changing environmental conditions and rotates individual levels, following the sunlight and wind direction. Another example is the Institute of the Arab World in Paris, completed in 1987, by Pritzker Prize winner Jean Nouvel. The façade of the building is filled with electric shutters changing under the influence of sunlight, which let a desired amount of light into the interior. There are many examples of mobile architectural solutions but it is impossible not to mention the Chanel Contemporary Art Container, the exhibition pavilion designed by Zaha Hadid. The building traveled around the globe for two years, acting as a banquet, exhibition and promotional venue.

Every year similar examples arrive because some solutions become standards when designing public facilities. Auto-opening roofs for stadium construction, movable walls in display buildings or green solutions in passive houses are increasingly being used. Summing up this part of the article, it can be concluded that architecture equipped with computational capabilities and with advanced electronic, mechanical and material technologies can interact with people and their immediate surroundings.

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*Designers on acid: the tripping Californians who paved the way to our touchscreen world*, [https://www.theguardian.com/artanddesign/2017/may/11/design-museum-california-designing-freedom-tech-design?CMP=share\\_btn\\_fb](https://www.theguardian.com/artanddesign/2017/may/11/design-museum-california-designing-freedom-tech-design?CMP=share_btn_fb) (accessed on 26/04/2019).

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