

Mobile Bathroom – Ideas and Solutions

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Abstract. The trends based on modern technologies and joining hygiene, recreation and other additional functions in the bathroom space, indicate that it is not the place that meets only hygienic needs, but it can be an independent multifunctional module equipped with extra features which conventional bathroom does not provide. The basis of this solution is the ability to locate it anywhere - if necessary, the ability to transfer and install it in the new space.

The consequence of thinking about the hygienic-sanitary space in this way is a flexible, modular shaping of bathrooms and the introduction of mobile elements of equipment, that in addition to their output function, receive additional abilities to adapt them to the changing requirements of users, and the possibility of transformation and portability after their installation.

Thanks to the advanced technology used in multifunctional and mobile sanitary devices, modern bathrooms and their equipment can ensure, anywhere and even in a small space, comfort and safety related to personal hygiene and the corresponding aesthetics of the interior, for all users - children, the elderly, the disabled and other people requiring special, extra care.

Keywords: Mobile bathroom · Modular bathroom · Portable bathroom · Multifunctional devices

1 Introduction

Currently, activities related to hygiene and personal care require more and more space and equipment. New other purposes of bathroom also require new elements and additional space for their location and space associated with their use. The freedom of shaping the bathroom is limited not only by its size, but also the need to connect to the plumbing. Not everywhere you can place a bathtub below the floor level, not always you can find a place for the sauna. However, thanks to modern technology, changes in the needs and preferences of people following under the influence of fashion or new lifestyle, can be variously included in the existing and planned interiors, by adapting them to contemporary requirements. With advanced technology, modern equipment can provide, even on a small area and in a small space, widely understood comfort of personal hygiene and the corresponding aesthetics of the interior.

The observations and analyzes the latest trends in shaping the hygienic-sanitary space confirm that the contemporary bathroom can not only meet the diverse needs of its users, but should also have certain characteristics that affect the way their

implementation and degree of satisfaction. Desirable features of contemporary bathroom include multi-functionality, mobility, flexibility, modularity, transformability, portability, adaptability, adjustability, space-saving, compactness.

The multifunctional device is a combination of functions and tasks that are traditionally provided for several individual devices. This combination reduces the space occupied by separate mono-functional appliances and allows for extra space. Taking into account the limitations of bathrooms area especially in multi-family residential buildings, both in newly designed and existing (adaptation), retrieval of space in bathroom is very important from the point of view of the demand for physical space for users.

Mobile bathroom is equipped with flexible devices which allow to easy maneuvering after mounting, with the possibility of moving, changing location and functioning in different interiors. The solution in the form of a bathroom with the equipment contained in a container that can be moved is also defined as a mobile bathroom.

2 Mobile Bathroom in the Past

The first attempts to create a mobile bathroom appeared in the thirties of the twentieth century with the development of industrial production. Although many of the concepts of prefabrication appeared at the time - one-piece components and entire bathrooms - it was mostly about the use of the basic advantages of prefabrication, which was the ability to combine all the necessary elements to develop a complete facility for hygiene. Then began the pursuit of a properly designed and fully equipped hygienic and sanitary facilities that would be comprehensive and coherent, both in terms of functionality and design. Application of new materials and experimental prefabrication of certain elements were directed towards reducing the costs of manufacture and use. As a result of numerous analyzes and the consideration of the issue by many designers, small functionally designed cabin began to spread.

In 1938, Richard Buckminster Fuller created a completely sealed unit *The Dymaxion Bathroom* that could be moved and adjusted in the middle of the prefabricated structure of its *The Dymaxion House*. It consisted of two parts: in one of them was a bathtub with shower, in the second part was a sink and toilet. The whole thing was made of nickel-coated copper plate, although Fuller had planned the use of plastic, and its appearance alluded to the submarine. The device was patented in 1938 and could be produced in the factory and installed in homes by simply connecting to the water supply and sewage system. At the same time leading architects working in France, Edouard Jeanneret, better known as Le Corbusier, who thought that the bathroom should be a machine for washing the body, and Charlotte Perriand, at *the World Exhibition* in 1937 showed their famous "sanitary cabin" intended for use in hotels. This cabin produced by Jacob Delafona contained a sink and toilet, which could be converted into a bidet and shower. Later, in 1970, Charlotte Perriand presented a different version of the bathrooms. It was made of PVC and intended for the winter sports resort in Les Arcs. With the help of Breton, a producer of polyester bathroom equipment for the Navy, Charlotte Perriand designed a complete bathroom, which was shaped in one piece and supplied ready to install. The entire cabin consisted of the modeled bathtubs, sinks, shelves and toilet, together with

all accessories, even lighting. The idea was also sold successfully in hotels in Japan, a country with a strong tradition of bathing and where space saving solutions are necessary [3] (Figs. 1 and 2).

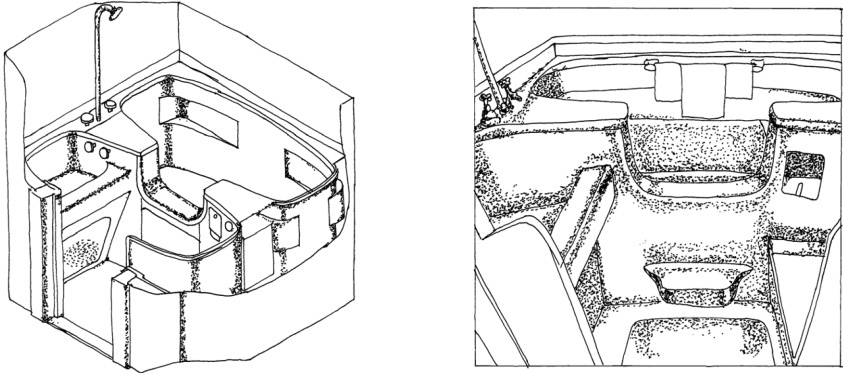


Fig. 1. The concept of integrated bathroom *Dymaxion Bathroom* designed by Fuller in 1938 (Source: own work based on 7, 10).

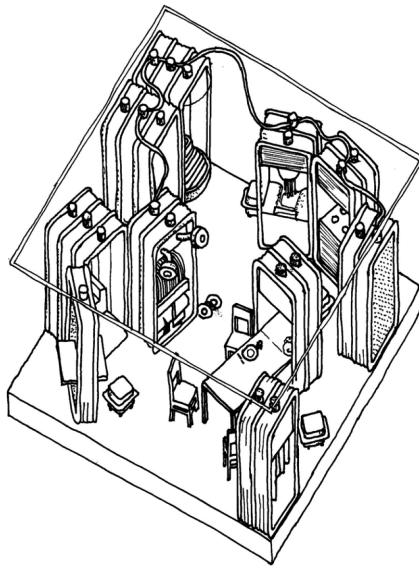


Fig. 2. Example of the use of container furniture designed by Ettore Sottsass in 1972 (Source: own work based on 7).

The perception of living space with an area of hygiene and sanitation was gradually changing. Similarly, the general relationship of man with the surrounding objects, which in addition to new forms gained new functions was increasingly becoming different. Already in the mid-seventies the goal of many leading designers was creating such

elements of housing equipment and facilities that could be moved and quickly adapt to other places.

In 1972 the exhibition *Italy: The New Domestic Landscape* at the Museum of Modern Art in New York exposed a number of surprising solutions. Some designers presented proposals of mobile functional modules that could be assembled together in any configuration and independent of the system of walls. Ettore Sottsass submitted container furniture. Any configuration of containers with a specific residential function, also hygienic and sanitary, allowed for various spatial combinations [7, 8].

Total Furnishing Unit designed by Joe Colombo, consisting of many interconnected residential segments, was another interesting proposal at the exhibition. Locating all residential and sanitary functions in the possible smallest space, in the block with an area of over a dozen square meters and their ability to adapt to the current needs and requirements of users, was a milestone in terms of conscious shaping of home space. Rectangular volume of no more than twenty cubic meters, contained a kitchen, bathroom, bedroom and living room and could fulfill all functions inserted into any space and connected to the mains and sewage system. The new approach to the way of shaping residential buildings was the result of a mechanistic consideration of the majority of issues relating to human. People from the days of *the Industrial Revolution* were surrounded by more and more machines and accustomed to their presence, and even began to live in them [7].

3 Multifunctional Bathroom Facilities

Search for a combination of several functions in one facility in order to expand hygienic and sanitary spaces resulted in a devices that resembled modern machines in both appearance and character.

Multifunctional modules inclusive toilet, bidet, sink, shower, joined together by a common outlet and sometimes partially closed water cycle allow for any placing them in the bathroom, while ensuring the necessary water, sewer and often electricity connections.

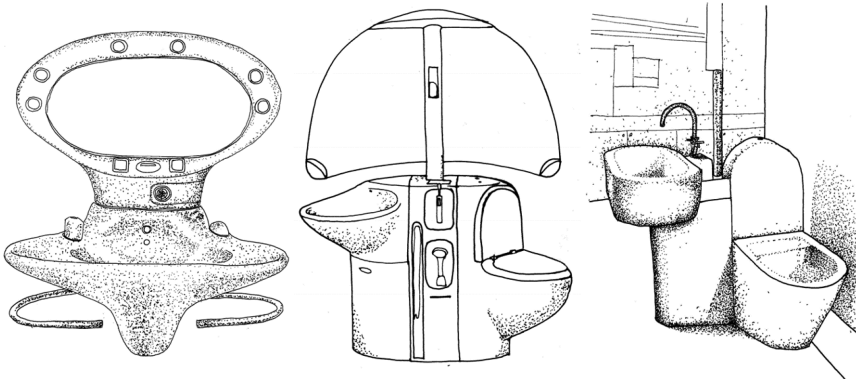


Fig. 3. Multifunctional bathroom configurations - sink integrated with mirror, lighting and accessories, combination of sink and toilet (Source: own work based on 7).

The lighting, radio, electric toothbrush and sensors that control water temperature and flushing the toilet may be an additional elements.

Other examples of multifunctional hygienic and sanitary devices are so-called “bathroom hybrids” or combinations of sinks and toilets or sinks and urinals. These objects have a special system water saving and are equipped with an additional tank for waste water coming from the sink, which can be reused to flushing [5] (Figs. 3 and 4).

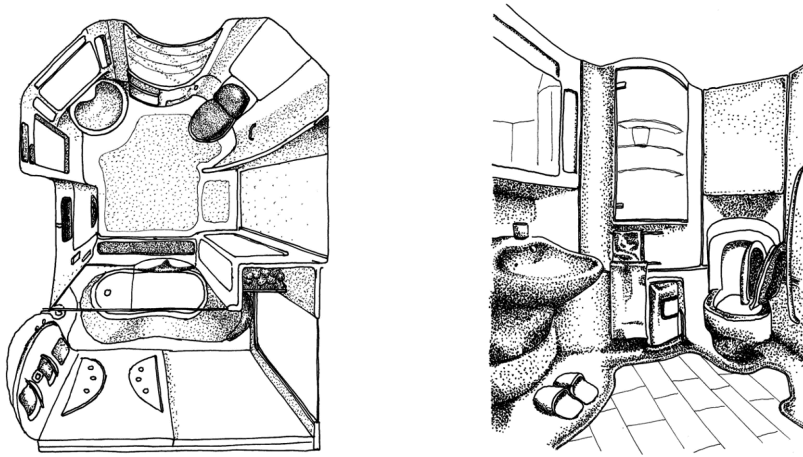


Fig. 4. Hygienic and relaxation capsule designed by Fabio Lenci in 2000 (Source: own work based on 6).

The object in which a number of technical achievements have been applied and properly adapted to the bathroom area, is hygienic and recreational capsule, designed by Fabio Lenci and presented at the exhibition *Linee d’acqua* during the *Milan Trade Shows Mostra Convegno Expocomfort* in 2000. Bathroom created by Fabio Lenci is based on already known and currently used technologies. And although applying them to such an extent in the hygienic-sanitary space seems still quite unusual, further domestication process when users will be directly confronted with modern technology in the near future is inevitable. Fabio Lenci considering wide problem of hygiene and recreation, gathered all the technological innovations, combined them in a small space and prepared for the role of the bathroom that seems to live their own “electronic” life. Undoubtedly, such understanding of hygiene and healthy lifestyle may in the near future to revolutionize the bathroom. It will no longer be a facility used only for hygiene purposes, but it will become an independent module, that will be equipped with functions which traditional bathroom has not had so far. The basic principle of this solution is the ability to locate it anywhere - if necessary, the possibility of moving, installing and adjusting it to a new apartment.

The consequence of thinking about domestic space in this way is the use of a flexible equipment, which in addition to its essential function, obtains additional abilities to adjust to the changing needs of users. It is not too complex, as regards the “mobile” elements of bathroom equipment, that is, for example, furniture and accessories, but all

starts to become complicated when the use of the facility require a permanent connection to the water and sewage systems. In this respect, hygienic and sanitary space and its equipment is a real challenge for designers and builders. Built-in, concealed systems that are simply in terms of assembly and allow for reorganizing the whole bathroom without destruction, without breaking existing walls and building new ones, appear to be one way in response to the need for changeability and adjustability. This solution greatly simplifies the adaptation of the existing interior. Adjustable concealed frames can help you set the bathroom devices at the proper height. Many of the appliances can be easily removed and installed in the new location. These include, among others, multifunctional shower bars and panels that can be easily removed and changed, light shower cabins with the ability to move and function in almost any interior, bathtubs, which can be transferred to any place, portable saunas [6, 8].

4 Mobile Devices

The next step in direction of flexibility, adjustability and easy adaptability are mobile devices that allow you to maneuver them and regulation after their installation. These include shower bars with adjustable height and shower panels and sets additionally equipped with rotating nozzles to provide multiple variants of shower.

Mobile sink placed on special guides, so that it can be moved up and down, thereby adjusting its height, is another convenient and ergonomic solution. The folding portable shower cabins are mobile devices that can also be very useful.

Analysis of various ways of adapting equipment to the needs of users indicates that most of multi-functional and mobile elements of equipment is designed for all users of the bathroom, including children and disabled. Additionally, we can see solutions that specifically meet the needs of users who require special, extra care. Example of actions increasing both comfort and safety of user is the toilet with a slide-out shelf supporting feet. This support makes possible not only comfortable and safe use the toilet by children, but also it allows posture correction of an adult during this action. Special sink applied to the bidet,

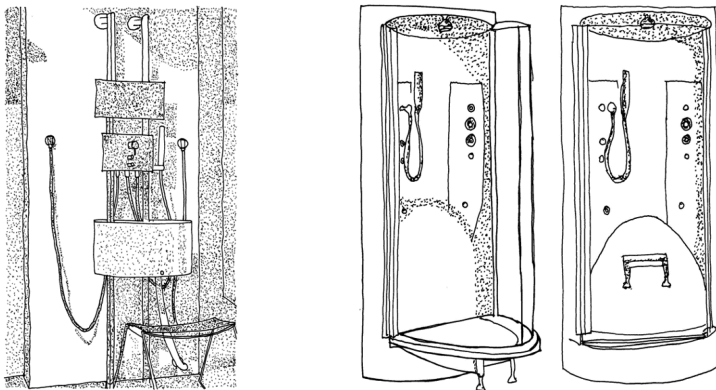


Fig. 5. Mobile devices - sliding sink, portable shower cabin (Source: own work based on 9, 14)

folding and reducing its size to the dimensions of a small suitcase is another convenience for small children getting to know the rules of personal hygiene. Some companies offer a little bigger suitcases, or even trunks, in which bathroom accessories can be packed and transported. Such solutions, however, are quite extraordinary, perhaps intended for those users who are used to “living out of a suitcase” [6, 8, 15] (Figs. 5, 6 and 7).

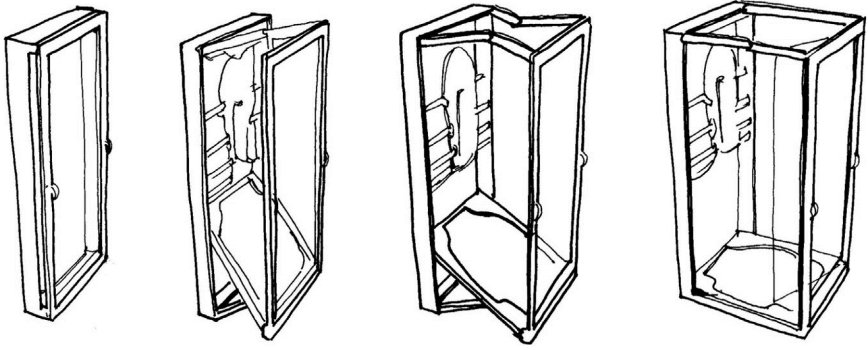


Fig. 6. Mobile devices - folding, portable shower cabin (Source: own work based on 14)

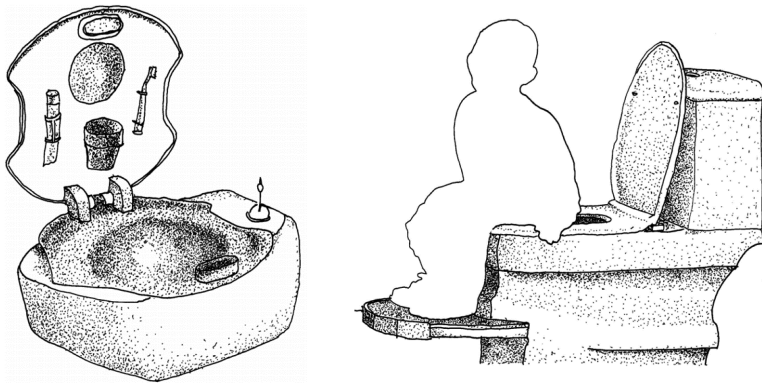


Fig. 7. Interesting mobile bathroom equipment designed not only for children (Source: own work based on 8).

5 Mobile Bathrooms - Modules, Cabins, Boxes

Among the concepts of mobile bathrooms we find many examples of compact, modular, portable, space-saving and at the same time fully equipped and functional objects and structures that contain all the necessary hygienic and sanitary elements. The important thing is the simple principle of the transformation of the individual elements. Their preparation for use and hiding after working should not be too complicated and uncomfortable. Free user access and ease of use are essential for the proper functioning of such facilities.

Mobile, portable bathrooms often taking the forms of multifunctional modules, cabins and boxes are intended to place into small available spaces in apartments and houses. They can be attached with minimal construction, installation and mounting work.

Aquabox designed by Massimo Brugnera is one of the interesting solutions that have come into view recently. In this compact bathroom in addition to the basic functions of hygiene and sanitation we can also find features ensuring wellness of users. They have for use: adjustable rain shower, function of sauna, color therapy. The interior of “box” is complemented by appropriate lighting. The facility is environmentally friendly and in line with the concept of sustainable development of contemporary bathrooms. A special system of water saving allows to purify waste water coming from the sink and shower, and collect it in a 80 l tank. The purifier and tank are parts of the whole system inside the object. The reclaimed water can be recycled and reused to flush the toilet bowl, or for other needs in the household [2] (Fig. 8).

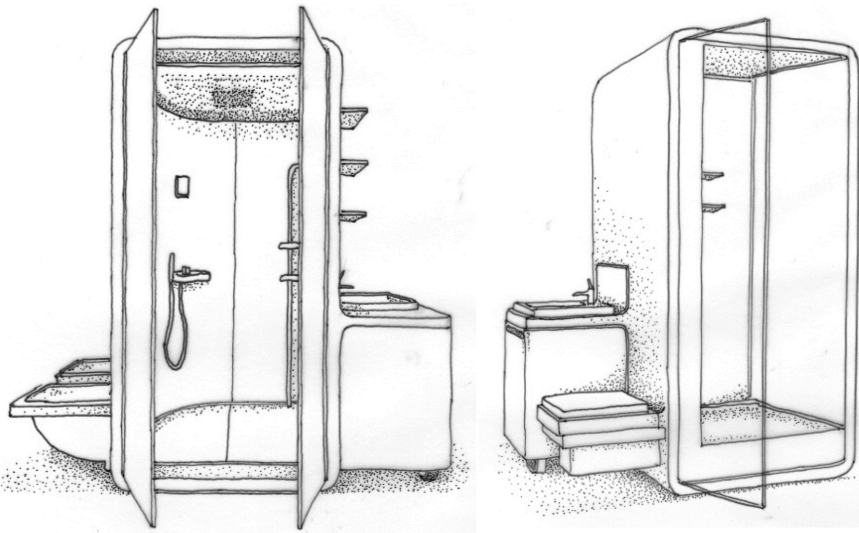


Fig. 8. *Aquabox* - compact bathroom designed by Massimo Brugnera (Source: own work based on 2).

Another example of mobile bathroom is *The Roca Box*, one of the winning projects in the Roca Jumpthegap 2009 Contest. Designers from Valencia created “Box” - modular bathroom system that consists of different types of modules: one containing a toilet and sink, the next including a shower, a small seat and two shelves with towel racks and another module which is a space-adding element containing additional floor space and storage. The last closing segments can be opened or completely locked by a solid wall or wall with the door. Module consisting the basic elements of bathroom equipment, the toilet and sink, is able to work independently of the other parts as a simple bathroom. *The Roca Box* is ecologically oriented saving water and energy. It includes additionally water tanks and heat pump. Water used in the shower and the sink is stored in the water tank which supplies the toilet cistern. The heat pump utilizes the warm, humid air from the inside of the bathroom to heat

the space and water. This modular eco-friendly functioning bathroom is low on space, but at the same time high on efficiency [11, 13] (Fig. 9).

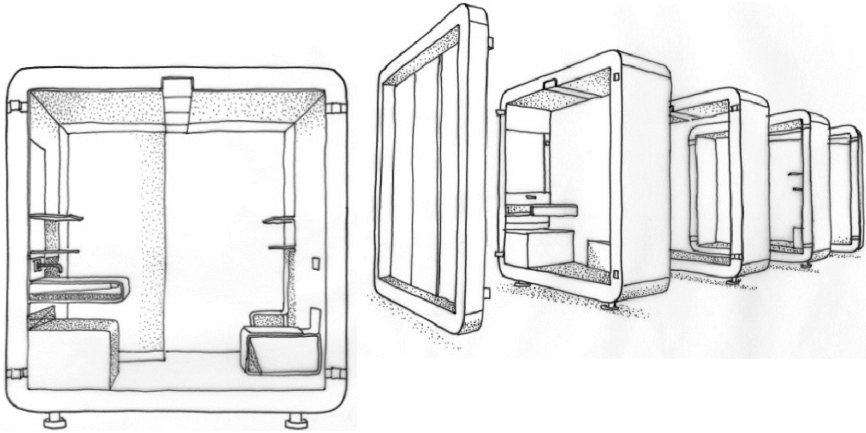


Fig. 9. *The Roca Box* - mobile, modular bathroom designed by *Yonoh Studio* in 2009 (Source: own work based on 11).

The manufacturers of *Design Odyssey* have proposed a mobile, modular and transforming bathroom facility that is not a cabin or a box, but it is all-in-one rotating fixture or rather fixture set which contains several hygienic and sanitary functions. This object consist of a series of “vertebrae” that are stacked on one another. Each level rotates independently and fulfills a different tasks: wc supplemented with compartments for toilet accessories, sink and basin complemented with built-in soap dispenser and standard mixer tap, storage spaces and cistern topped off by a shower elements with pull-out shower heads. This space-saving vertical bathroom facility is the perfect solution that allows to pack everything into an incredibly small space and provides the ability to apply it even in the surface limited places. Its capacity to rotate of individual elements enables different settings and configurations that can be adjusted to need of user and to size and shape of the bathroom [4] (Fig. 10).

Mobile bathroom is a solution that can be very useful in cases where living space is very limited and we have a small surface to organize hygienic and sanitary part of the apartment. As it turns out, sometimes even one room can guarantee the possibility of doing all the tasks and functions necessary for everyday life. Among the many examples of mobile sanitary facilities that save the space we can find such solutions, which provide total access to the devices when necessary, and then can hide them. Proposals of bathrooms with the possibility of such a metamorphosis may be different. An interesting and convenient solution is to organize the whole system on a regular grid composed of repetitive elements - modules, in which are inscribed various parts of bathroom facilities. Sink, toilet, shower disappear in the structure of the entire system and layout. The other modules are used to storage and concealment of plumbing and electrical connections. The individual appliances and all system are integrated with one wall structure creating design idea of modular, transformable, space-saving bathroom. It simple and aesthetic

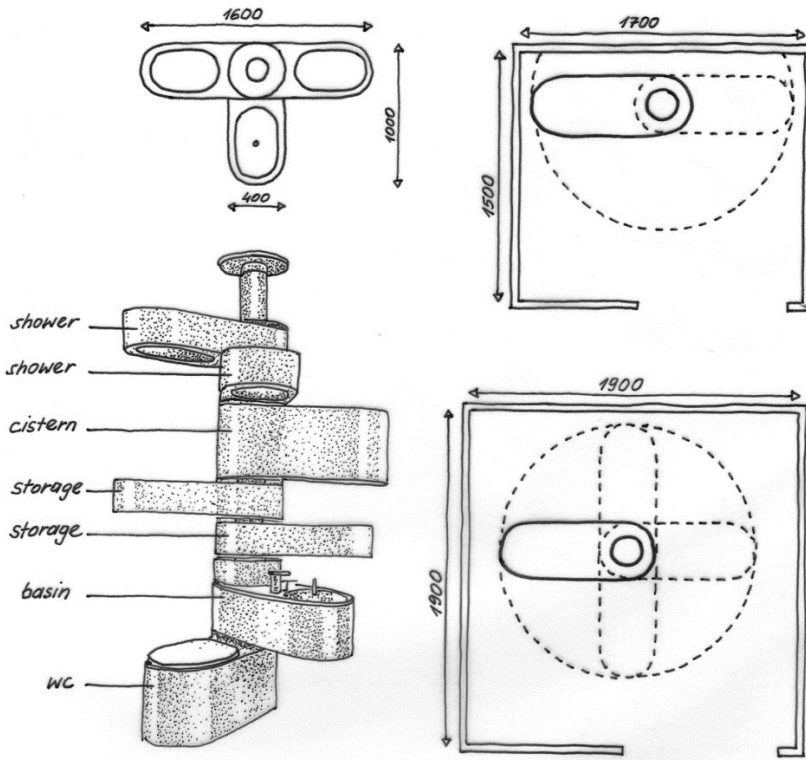


Fig. 10. Mobile bathroom design idea created by *Design Odyssey* (Source: own work based on 4).

solution based on regular divisions provides the simplicity and convenience of using facilities and offers a unified design concept for both the bathroom and the whole room [1, 12] (Figs. 11 and 12).

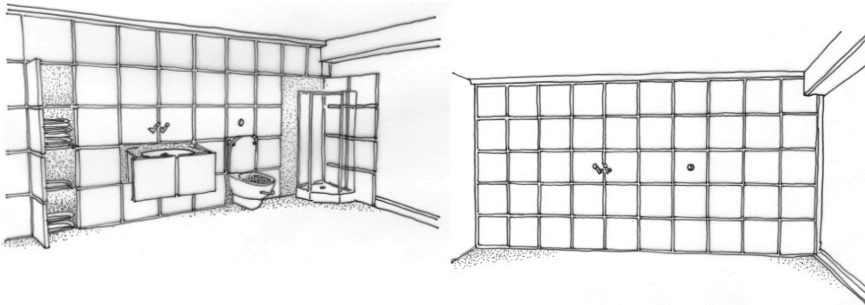


Fig. 11. Example of modular, transforming bathroom design (Source: own work based on 1)

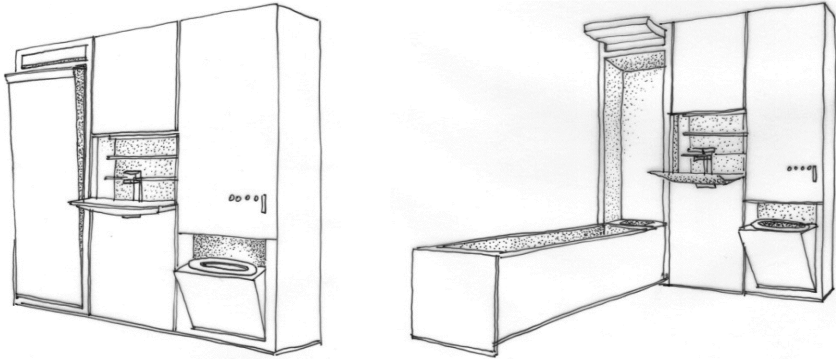


Fig. 12. *Cirrus MVR* - mobile, space saving bathroom designed by Michael Trudgeon (Source: own work based on 12).

6 Conclusion

Research and analysis in the field of mobile bathrooms lead to different ideas and solutions. There are many examples of multifunctional devices that combine the tasks normally provided for several separate appliances. Multifunctional devices allow to save bathroom space which is often very limited.

Other examples, in the form of portable, flexible, transforming devices, or entire compact bathroom cabins with equipment, are shaped in a way that ensures the ability to function in different places, and the ability to easily adapt to changing needs and requirements of users.

The widely understood mobility of the bathroom objects is determined by the following features:

- the ability to fulfill the necessary functions and tasks, not only basic health, hygiene and sanitary functions, but also additional associated with wellness, relax and recreation,
- the ease of access and comfort and safety of using,
- the ability to adapt to changing functional and physical possibilities and needs of users,
- the flexibility in shaping the functional and spatial arrangement in relation to the user needs and the size, shape and type of interior,
- high technical and material quality providing usability, reliability, durability and aesthetics,
- minimizing the cost of installation, maintenance and modernization,
- consideration of environmental criteria and environmental friendliness.

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