

THE KITCHENS OF THE PAST, THE MODULES OF THE FUTURE: THE EVOLUTION OF KITCHEN DESIGN AT THE DAWN OF THE DIGITAL AGE AND TODAY

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Abstract:

The history of kitchen design is a fascinating reflection and perfect imprint of social changes and technological development. In our presentation, we draw a parallel between the analog design processes of the past and the digital possibilities of the present. We will examine how the conception of a kitchen took place before the age of digital technology, with particular attention to the emergence of fitted kitchens in workers' housing. The material holdings of the Furniture Industry Development Institute provide significant assistance in this regard. We point out that although cost-effectiveness was already a goal for the lower social strata at that time, the initial social resistance to modular kitchens shows a significant difference compared to their current global spread. Today, raster-based fitted kitchens have become the most popular solution precisely because of their cost-effectiveness, bridging social and regional differences. In our presentation, we will explore the social and technological background of these parallels, highlighting the key aspects of the evolution of kitchen design.

Key words: *kitchen design evolution, modular kitchen, social changes, sustainable manufacturing, technological development.*

INTRODUCTION

The kitchen, as the heart of the modern home, is a perfect imprint of social and technological change. Over the centuries, it has evolved from a simple, functional space for cooking into a central hub for family and community life. This evolution accelerated particularly in the 20th century, when industrialization and the Industrial Revolution brought the rationalization and optimization of household work into the spotlight. The theoretical foundations for this process were laid by Christine Frederick in her work *Household Engineering*, who applied the principles of scientific management (Taylorism) to domestic work, underscoring that the kitchen was no longer just a place for cooking but a "workplace" where efficiency was paramount. (C. Frederick 1923).

OBJECTIVES AND METHOD

In this study, we draw a parallel between two defining eras of kitchen design: the analog era before digital technology and the modern era filled with digital possibilities. Our research relies on the material holdings of the Furniture Industry Development Institute, which provide insight into the development of modular kitchens in Hungary. (*Sopron University Central Library and Archives - Central Archives*) Our goal is to demonstrate how kitchen design took place in the past, while also highlighting the initial social resistance to modular systems, which stands in stark contrast to their widespread acceptance today.

Our analysis concludes that while the demand for cost-effectiveness was present from the beginning, digital technology brought a true breakthrough, making raster-based systems the most popular and flexible solution. Our study reveals that the evolution of kitchen design is not just about technology but also about the close interaction between changing social needs and their impact on everyday life. The methodology used is based on analysis and comparison.

For this, our presentation will begin with an analysis of the development and characteristics of fitted kitchens during the analog era, exploring the design processes, social context, and technological limitations of the time. We will then transition to the digital age, examining how contemporary tools and technologies have transformed kitchen design, enabling new possibilities in both functionality and aesthetics.

ANALYSIS OF FITTED KITCHEN

The concept of the modern fitted kitchen has its roots in the early 20th century, when functionality and rationalization became the guiding principles of design (E. Szabó & M. Branczik 2016). The idea of making household work more efficient, already successfully applied in industrial production, was extended to the layout of kitchens. A pioneer of this movement was the Frankfurt Kitchen, designed and built between 1926 and 1930 by Austrian architect Margarete Schütte-Lihotzky for small worker apartments (E. Szabó & M. Branczik 2016; MIA 2004) "where kitchen equipment transformed into industrial products will enter the minimal dwelling of the new architecture" (Kopp 1990:56). This kitchen was a precursor to today's modular systems: it condensed cooking and food preparation into a tiny, yet exceptionally well-thought-out space, reducing the distances required for movement and the time needed for the work process (E. Szabó & M. Branczik 2016). The core principles of its design were deeply rooted in scientific management (Taylorism); Schütte-Lihotzky studied the dining cars of trains and galleys of ships to minimize movements and achieve maximum efficiency (MIA 2004).

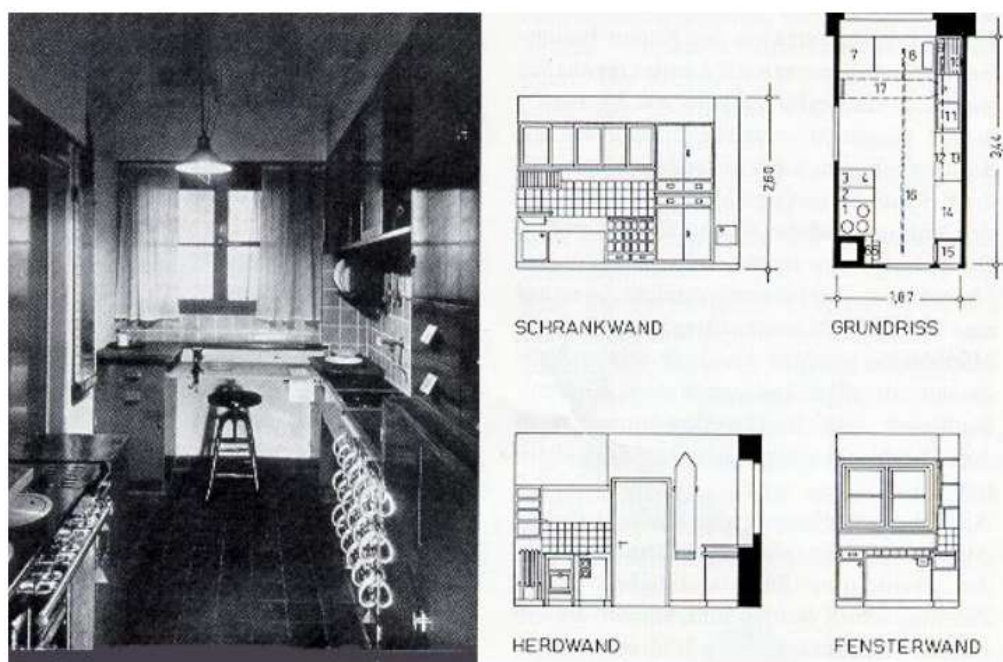


Fig. 1.
Frankfurt Kitchen (Ungers 1983:70): Views of cupboard walls, stove and window; plan.

The designed kitchen was extremely space-saving and easy to clean. Its characteristic features included a dish-drying rack above the sink, labeled aluminum storage bins for spices and ingredients, a movable ceiling light, a pass-through window to the dining room, and a modern electric stove that symbolized the era's modernity. (Fig.1.) The kitchen was mass-produced, with approximately 10,000 units installed in new apartments to alleviate Germany's housing shortage after World War I (MIA 2004; Hidden Architecture 2016). The Frankfurt Kitchen also became a symbol of the transformation of women's roles, as its goal was to reduce the time spent on housework after a day of factory work. However, feminist critics later pointed out that the kitchen ultimately became a space of confinement, preventing more than one person from using it at a time (E. Szabó & M. Branczik 2016).

In Hungary, the idea of the fitted kitchen gained momentum during post-World War II housing programs, when mass housing construction and space efficiency became primary considerations (S. L. Tóth 2006). Following the post-war nationalizations and mergers, the intellectual foundation for the woodworking industry was laid in the 1950s. Research, development, design, and testing institutes were established, as was higher education in the woodworking field. Among these was the Furniture Industry Development Institute (further: BIFI), founded in 1950 as the Wood Industry Production Planning and Design Office (S. L. Tóth 2006). Its primary objective was to assist state-owned companies with small-scale operations in transitioning to mass production.



Fig. 2.
Furniture Industry Development Institute
Documentation paper seal (Photo: V. Nagy 2025).

BIFI became a key centre for wood industry research and development, placing great emphasis on creating standardized elements suitable for mass production (*Dr. D. Levente 2012*). Operating under the Ministry of Light Industry, BIFI regularly involved the Institute of Product Design and Manufacturing Technology at the University of Sopron in its development tasks, thus helping to establish modern manufacturing solutions (*Dr. D. Levente 2012*). The modular kitchens designed by BIFI allowed factories to produce complete kitchen sets quickly and affordably, which were easily adaptable to apartments of various sizes. The documentation of this work, including original design drawings and technical specifications, can be found in the archives of the Sopron University Central Library and Archives, in the 41st collection, representing fundamental sources on the era's design principles and kitchen layouts. This material is also part of the doctoral research materials by Vivien Nagy, titled: "Research on the Traditional Values of Hungarian Industrial Furniture Design, and the Exploration of Opportunities for their Further Development" (*Sopron University Central Library and Archives - Central Archives*).

We tend to label housing estates as boring or gray, but even in Budapest, there are a few exceptions. For example, the Óbuda Experimental Housing Estate, built in the early 1960s, whose history succinctly presents one of the possible answers to the post-war housing shortage. The newly built small apartments also brought many innovations in the field of interior design. Due to their size, they could only be furnished with light, small-sized room furniture and built-in wardrobes; the first built-in type kitchen furniture was designed for these small kitchens. The use of built-in furniture opened a new chapter in the history of interior design. The exhibition held at the Óbuda housing estate is almost a symbol of the symbiosis of housing construction and the furniture program, which aimed to introduce and gain acceptance for the new types planned. The furnishings of László Mózer, Zoltán Kemény, József Peresztegi, and others were also exhibited. However, the advantages of the new were shown in contrast to the old, heavy-style interiors. It is surprising that after this, while the public's consumption culture visibly changes, the factory structure is slow to follow suit. It's an astonishing fact that, as one of the leading figures of the Wood Industry Production Planning and Design Office (the former predecessor of BIFI), Zoltán Kemény writes in the early 60s, only three "modernly conceived" pieces of furniture were available on the market: the *Varia*, the "Hangulat" (*eng: mood*), and a kitchen (*Z. Kemény 1961; Dr. M.R. Antal & V. Nagy 2025*).

This kitchen was none other than one of the kitchens from the previously mentioned Óbuda Experimental Housing Estate. An exhibition on the Óbuda Experimental Housing Estate and its accompanying book dealt with the kitchen in detail, which is why the Kiscelli Museum purchased and meticulously documented an original kitchen unit from one of the houses on the estate.



Fig. 3.
Óbuda Experimental Housing Estate Kitchen (Kiscelli Museum 2014): Kitchen furniture.

The kitchen furniture (Fig.2.) is based on a basic kitchen unit, which is made up of a sink table, a cabinet table, and a stove placed next to each other. Upper storage units, shelves, and appliances can be added to this arrangement depending on the floor plan. The basic unit measures 550x550x800 mm, and the 900 mm counter height is provided by a 100 mm plinth that runs along the entire length of the installation. The designers built numerous practical elements into the furniture: the pull-out, plastic-coated countertops and the handled

storage drawers are clearly reminiscent of the Frankfurt Kitchen created in Germany in the 1920s. A particularly innovative solution was the shower faucet used at the sink, which was considered a pioneering and practical idea for its time. This type of kitchen furniture was a frequent feature in the architectural literature and interior design exhibitions of the era (*Kiscelli Museum 2014*).

The evolution of the kitchen from a standardized, functional space to a personalized social hub reflects a fundamental shift in Hungarian housing culture. Driven by a move away from centralized planning towards a market economy and enabled by modern technologies like CNC and 3D design, the kitchen has become a central expression of individual taste and social connection. It is no longer just a place for domestic work, but a core component of a modern, holistic lifestyle.

SOCIAL ACCEPTANCE AND RESISTANCE

The perception of panel apartments and housing estates remains divisive to this day, and the academic literature contains contradictory opinions about them. Miklós Sulyok, who writes on this topic, stated the following in the 2020 literary journal *Apokrif*: "If I were to dip my pen in vitriol, I would call the panel housing estates tragic mementos of the decay of international modernist architecture. Le Corbusier's urban vision came true in the countries of existing socialism and Scandinavian social democracy" (*M. Sulyok 2020*).



Fig. 4.

Panel kitchen (Fortepan/ Horváth Péter 2022): A normal day in the panel kitchen.

The panel program, which Ádám Németh called a "social experiment with two million participants," had a significant impact on Hungarian housing culture and communities. Although the housing estates were created as a massive and quick response to the post-war housing shortage, the planners' goal was not only to provide housing but also to create a new, modern lifestyle based on hygiene, comfort, and functionality (*Á. Németh 2020*).

The adjustment to the new, industrialized environment was not seamless at first. Residents arriving from traditional rural or urban settings faced a radically new lifestyle, where community life was confined to stairwells and shared spaces, which could have a dehumanizing effect (*M. Sulyok 2020*). According to the ideology of the era, modern, built-in kitchens and communal services like laundries aimed to "liberate" women from housework so they could become full-fledged members of the workforce. The example of the Budafok experimental housing estate illustrates this effort well, where according to the planners' intentions, residents hardly did any housework, as it was organized into a central service center (*M. Branczik 2011*). Anikó Preisich, an interior designer, had the idea at the end of 1970 to ask people about their needs regarding panel houses, especially since two-thirds of the country's population was planned to be housed in such apartments. The survey was completed by questioning 449 residents and was published the following February. The survey highlighted that people desired a more spacious, social area. 83% of families wanted an eat-in kitchen, 10% wanted a separate dining nook next to the kitchen, and 4% wanted a dining room. Only the remaining 3% were satisfied with their kitchen's current setup. The research confirmed that the kitchen was the most frequently used room in the apartment, where the housewife spent most of her time and where family members came and went multiple times a day. This data clearly demonstrated that central planning and real social habits were not in sync (*A. Preisich 1970, Dr. Kardos 2022*).

During the socialist era, the kitchen was primarily a functional space where efficiency and space-saving dominated. The goal was to rationalize housework, so kitchens in panel buildings appeared as standardized,

built-in units. However, after the change of the political system, the image of the kitchen fundamentally changed under the influence of the Western lifestyle and housing culture. The demand emerged for a home not to be merely a place for sleeping and housework, but a space that becomes the center of family and social gatherings.

The rise of the "American kitchen" expressed a new need for individual freedom and self-expression. While housing types and furnishings were heavily standardized during the socialist period, the spread of the market economy enabled residents to tailor their homes to their own tastes and needs. The kitchen, opened to the living room, allowed cooking and entertaining to be part of a shared social experience rather than a separate activity. This change also impacted women's roles, as the hostess was no longer isolated in the kitchen but could remain with family and guests.

The American kitchen is therefore not merely an architectural solution but a cultural symbol that embodies a modern, individualistic lifestyle, social interaction, and the reinterpretation of the apartment as a home. Driven by technological advancements and globalization, materials and machinery became available that made previously unimaginable custom solutions possible. Modern technologies, such as CNC milling and 3D design, revolutionized furniture manufacturing. People no longer simply wanted kitchen cabinets; they desired an aesthetic, comfortable, and practical lifestyle experience. Kitchen appliances were no longer just functional objects but became design elements that reflected the owner's personality and style. The demand for individual taste, comfort, and representation became the driving force behind kitchen design, moving away from the original, puritanical functionalism of modernism.

THE TRIUMPH OF MODULES: THE DIGITAL AGE

According to a study by Rame et al. (2023), the furniture industry has undergone a profound transformation due to the proliferation of digital technologies, which have brought about revolutionary changes in modern kitchen manufacturing. Product modularity and innovation have become crucial for increasing the efficiency of the supply chain, as they have enabled products to be easily customized to customer needs. The development of manufacturing technologies is at the heart of the digital revolution. The integration of Computer Numerical Control (CNC) machines has enabled unprecedented precision and efficiency, reducing human error and material waste. This precision also allows for the execution of complex designs that were previously difficult to realize, which is crucial for the production of custom kitchen cabinets. Furthermore, 3D modeling software has redefined the design process. Today, designers can create and modify intricate models digitally in a virtual environment, accelerating prototyping and production preparation (Rame et al. 2023).

Technological advancements have not only transformed manufacturing processes but have also allowed kitchen design to be more responsive to people's changing, age-related needs. The research by Maguire et al. (2014) highlighted that the kitchen plays a critical role in maintaining the independent lives of older people, yet standardized kitchens often fail to meet their physical capabilities. The study revealed common problems such as difficulties with bending and reaching, deteriorating eyesight, and reduced dexterity, which hinder the completion of kitchen tasks (Maguire et al. 2014).

The triumph of modules lies precisely in their ability to bridge the gap between standardized solutions and personal needs with the help of modern technology. While users previously had to adapt to the kitchen's characteristics, digital design and manufacturing now allow the kitchen to adapt to the user. The principles of inclusive design can now be implemented in practice, as technology supports customized dimensions, adjustable elements, and ergonomic solutions, transforming the kitchen from a mere aesthetic space into a well-utilized, lifelong one (Maguire et al. 2014). Modern manufacturing technology, such as CNC machines and digital design, enables not only precision and efficiency but also sustainability. Instead of the previously massive yet wasteful materials, optimized, thinner board-based materials have become widespread, reducing the demand for raw materials. In contrast to "fast fashion" furniture, modern, digitally-designed modular systems strive for durability and a long lifespan, aligning with the principles of the circular economy. This makes the triumph of modules a symbol not only of technological advancement but also of a radical change in design philosophy, where the kitchen is no longer an obsolete mass-produced product but a durable, adaptable, and continuously modifiable space that meets the user's evolving needs (Nagy et al. 2023).

The digital transformation has not only affected manufacturing lines but has also revolutionized the design process, allowing kitchen designers to easily turn unique, modular concepts into reality. Through modern digital tools, design has become more precise, faster, and more interactive, fundamentally changing the communication between the designer and the client.



Fig. 5.

Kitchen design in a 3D software (V. Nagy 2024): Family house kitchen design.

At the heart of this process are 3D design software programs (Fig 5.), which enable the realistic, virtual modeling of kitchens. Visualization has become key, as photo-realistic images (Fig 6.) and virtual walkthroughs allow the client to view and refine every detail of their future kitchen-be it the texture of the materials, the harmony of colors, or the ergonomic layout-before manufacturing even begins.



Fig. 6.

Kitchen render image (V. Nagy 2024): Family house kitchen design.

These programs are closely linked to CAD/CAM (Computer-Aided Design / Computer-Aided Manufacturing) systems. Designs created with CAD software can be automatically converted into instructions that CAM systems forward to the production line's CNC machines. This seamless digital chain ensures that the unique modules envisioned in the virtual space are manufactured precisely and with minimal waste. Additionally, integrated ERP (Enterprise Resource Planning) systems optimize the entire business process-from ordering to production and logistics-further increasing efficiency and reducing costs.

RESULTS AND DISCUSSION

Based on the sources presented and the trends analyzed, the most important lesson from the evolution of kitchen design is that the industry has undergone a radical paradigm shift. Fundamental differences can be found between the kitchen design approaches of the second half of the 20th century and the current digital age. The "type furniture," which was closely tied to the past and based on industrial standards, resulted in the uniformization of home interiors. These kitchens prioritized efficiency but did not take into account the user's unique physical characteristics or personal preferences. In contrast, modern kitchen design follows the principle of inclusive design. 3D visualization and CAD/CAM systems enable the complete customization of the kitchen. The kitchen is no longer a rigid "catalog product" but a flexible, adaptable living space that can be adjusted to the user's changing needs. Sustainability has also become a central element, as digital design and manufacturing (e.g., CNC machines) enable the optimization of material use and the minimization of waste, at the same time opening the way for long-lasting, adaptable products.

The directions outlined in this study also open up new perspectives for future research. As part of this, the examination and systematization of materials from the Furniture Industry Development Institute is an ongoing project. This work, which we plan to complete at the beginning of next year, will allow for a more comprehensive understanding of past furniture design trends, with a particular focus on the evolution of kitchen design.

Furthermore, a redesign process is an integral part of the research, in which we aim to rethink past functional designs using modern technology. During this redesign, which will be realized with the tools of parametric design and 3D printing, we will combine classic layouts and forms with the latest requirements for customization and sustainability. In doing so, we not only build a bridge between the past and the present but also pay a worthy tribute to the professional legacy of old designers, demonstrating how traditional design can become relevant and competitive again in the 21st-century digital industry.

CONCLUSION

In the digital age, the identity of the kitchen has fundamentally changed: from a functional, hidden workspace, it has become a central, open living area of modern homes. The triumph of modules is not only evident in the optimization of manufacturing but also in the fact that, through digital technologies, the kitchen can become a faithful reflection of the user's unique lifestyle, social needs, and aesthetic ideas. Thanks to 3D visualization and flexible manufacturing processes, kitchen design has transformed into a creative, personalized dialogue where function and design mutually reinforce each other to serve individual comfort and lifelong usability.

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