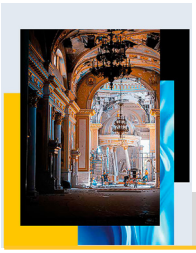

CULTURE AND CONTEMPORANEITY
Journal homepage: https://contculture.com.ua/en
Article's History: Received: 05.09.2025 Revised: 01.12.2025 Accepted: 22.12.2025 Published: 29.12.2025

ISSN 2226-0285 **Vol. 27, No. 2, 2025**

UDC 7.012:745:504.06 DOI: 10.63009/cac/2.2025.37

Viktor Shtets
PhD in Art History, Professor
Lviv Polytechnic National University
79013, 12 Stepan Bandera Str., Lviv, Ukraine
https://orcid.org/0000-0002-2436-762X

Oksana Melnyk*
PhD in Art History, Associate Professor
Lviv Polytechnic National University
79013, 12 Stepan Bandera Str., Lviv, Ukraine
https://orcid.org/0000-0002-1579-6705

Form-generating potential of recycled materials in product design

Abstract. The relevance of the study was due to the need to rethink the role of secondary materials in 21st century design in the context of both environmental feasibility and the search for new approaches to form creation that promoted experimentation, individuality, and a departure from mass production standards. The aim of the work was a comprehensive study of the potential of recycled materials as a form-generating factor and identification of the principles that determine the form and image of an object in the practice of object and environmental design. The results of the study showed that recycled materials act as an active form-generating factor and influence the constructive logic, composition and figurative language of products. The work identified three form-generating approaches (material-deterministic, constructive-modular, associative-figurative) the synthesis of which formed a multidimensional functional, visual and semantic structure of a product design, contrasting unification with creative experiment. The involvement of recycled materials in design activities stimulated the rethinking of the material culture of design, forming a more conscious approach to the selection of design materials and the process of their further utilisation. Furniture, lighting and experimental objects by European and Ukrainian designers were studied, as well as student projects that demonstrated different ways of integrating recycled materials into design. Particular attention was paid to the interaction of the physical properties of the material with the form, spatial organisation and imagery of the product. It was analysed how such materials can become a carrier of history, texture and emotional richness of the object. The practical value of the work lies in the possibility of applying the proposed typology and methodology for analysing recycled materials in design, educational and scientific activities for the well-founded formation of concepts and implementation of objects in the field of ecological and object design

Keywords: shaping; environmentally responsible design; experiment; design meaning; material-driven design

INTRODUCTION

In the 21st century design, recycled materials were considered not only as an ecological alternative, but as a full-fledged resource for creating new figurative, plastic and semantic. Historically, its use was driven by economic crises, material shortages and avant-garde experiments. Recycled materials were becoming a means of forming a

Suggested Citation:
Shtets, V., & Melnyk, O. (2025). Form-generating potential of recycled materials in product design. *Culture and Contemporaneity*, 27(2), 37-47. doi: 10.63009/cac/2.2025.37.

*Corresponding author

systematic experimental visual language that combined ethical, ecological and aesthetic values. Scientific research in the field of design had mainly focused on the environmental, technological and economic aspects of the use of secondary materials, in particular in the context of sustainable and circular design. Foreign authors emphasised the extension of the life cycle of products and a responsible attitude to materials. In particular, J. Chapman (2021) developed the concept of emotionally durable design, in which the material acted as a factor in forming a long-term connection between the object and the user. A design approach, where the material was considered as an active element of form-generating was presented in the work of O. Pedgley *et al.* (2021). The authors highlighted how materials themselves can influence the formation of creative design solutions, highlighting their physical properties, textures and traces of previous use as integral components of the design process. This study showed that innovative solutions in design were often the result of experiments with materials and the context they contain. In the Ellen MacArthur Foundation (2016) material reuse was treated as part of a design strategy. This approach emphasised understanding the properties, history, and potential of materials to inform design decisions and create meaningful, long-lasting solutions. By viewing secondary materials as active participants rather than simply substitutes, designers were encouraged to explore innovative forms, textures, and functions that respond to both ecological and cultural contexts. J.A. Mesa *et al.* (2022) examined the connection between product design, durability, and circularity opportunities. The authors emphasised the need to integrate material characteristics such as strength, modularity, and repairability into the design process, which will be an important aspect and meet the requirements of sustainable development. Researcher W.R. Stahel (2019) emphasised the importance of material durability and reusability, and argued that creating durable products reduced environmental impact and directed the economy on a more sustainable path. Researchers M.A. Idrisi & R.M. Singari (2025) investigated how biodegradable and recycled materials can be effectively used in modern product design, taking into account their physical properties and aesthetic potential. At the same time, despite such developments, the form-forming potential of recycled materials and its impact on the figurative structure of a design object remained insufficiently studied.

In the Ukrainian scientific discourse research had also mainly focused on the environmental feasibility of the design and production process. The article by V. Rakochyi & O. Iurchyshyn (2025) examined the use of recycled materials in the production of souvenir products. However, this process was analysed from the point of view of greening production in the context of sustainable development. K. Kyselova (2022) considered the concepts of ecological design as the basis for the formation of value and ideological guidelines for the activities of designers, manufacturers and consumers. Scientist's research interests were centred on the idea of a closed cycle of human-nature interaction, which involved the use of materials with low environmental impact and their minimisation. The researcher also focused on the gradual shift in consumer practices from a product ownership model to a usage model. Therefore, despite the presence of a significant number of works that highlighted the environmental, technological, and social aspects of the use of recycled materials, the issues of its shaping potential, the influence of the material on the figurative structure and artistic language of a design object remain insufficiently systematised and require in-depth theoretical understanding. The purpose of the study was to identify the form-generating potential of recycled raw materials in modern design practices and determine the patterns of its influence on the formation of the spatial and figurative structure of objects. The objectives of the work were: 1) development of a typology of secondary materials as a design resource; 2) formation of a methodology for analysing form-generating strategies; 3) identification of characteristic design techniques in object design. The scientific novelty of the study lain in the systematisation of form-generating design approaches in design practice, when working with recycled materials and substantiation of its role not only as an ecological alternative to traditional materials, but also as a determining factor in the visual language of the object.

MATERIALS AND METHODS

The research methodology was based on a comprehensive approach to the study of recycled materials as an active factor in form-making in design. At the theoretical level, historical and comparative methods were used to understand the development and features of the use of recycled materials in design. At the empirical level, visual observation was employed to examine existing product design examples, including works by renowned European designers Piet Hein Eek (Waste-stacked stool, Old-windows cabinet, Bucketseat-in-scrapwood-low, Tube chair), Gijs Bakker (Peep show wallpapers), Tejo Remy (Chest of drawers, Rag chair), Stuart Haygarth (Tide), Yuya Ushida (Sofa_XXXX). Also, it was analysed projects by Ukrainian designers Ivan Stefanyuk (Ammunition box table), Stas Kadochnikov (Night-light Predator), YOD Group (Lamps Downed Drone) made from spent ammunition, as well as design projects by students of Lviv Polytechnic. The analysis focused on their formal structure, compositional logic, material properties and the ways in which previous use or contextual associations influenced the formation of form. This made it possible to systematise characteristic approaches to working with recycled materials, identify recurring material-driven form-generation strategies, and examine the interplay between material properties, construction, and visual expression. Morphological and compositional analysis were used to identify the features of shaping, material organisation and visual and figurative expressiveness of objects created using recycled materials. Morphological analysis involved an assessment of the physical and

structural properties of recycled materials and their influence on the organisation of the design examples. This helped to reveal the connection between the physical characteristics of materials and the structural and spatial solutions of the product design examples. Compositional analysis allowed to identify the influence of the material on the artistic expressiveness, harmony, and integrity of the visual image of the design objects. Semiotic analysis was used in the work to reveal the semantic and symbolic potential of recycled materials in form-generating, which allowed to identify the figurative, cultural and ecological meanings embedded in the material, as well as their impact on user perception. The use of these methods in combination allowed to assess the role of recycled materials in creating form and image and develop recommendations for their effective use in modern design practices.

RESULTS AND DISCUSSION

In Ukrainian and international design practice of the 21st century, recycled materials such as plastic, textile remnants, recycled wood and metal elements, as well as discarded household items, are increasingly used as a resource for experiments with form and visual expressiveness in product design. The use of these resources enables designers to integrate environmental sustainability with artistic expressiveness in their practice, fostering greater ecological awareness among consumers. Recycled materials contribute to the emergence of new visual paradigms in design, where the emphasis shifts from the purely functional role of materials to their visual potential and capacity to convey semantic and emotional meanings. In this context, recycled materials function not only as an ecological alternative to conventional resources but also as a key factor of creative transformation, opening new possibilities for the development of design solutions, moving away from standardised or typical design methods and forming of a diverse visual identity.

In Ukrainian design, in the context of wartime destruction, which exacerbates environmental and economic challenges, the use of secondary materials is becoming particularly relevant. The simplest example is the production of camouflage nets from textile remnants, which solves functional and social needs, and also stimulates a complete rethinking of the properties of the material. The material basis for innovative design is the so-called "fragments of war" – fragments of weapons, cartridges, tubes, ammunition boxes, etc. (Rakochyi & Iurchyshyn, 2025). The War Artists Union (2023) exhibition project, which opened in Kyiv in October 2023, showcases design objects and works of art from fragments of military equipment and equipment collected by volunteers. Among them are furniture by Ivan Stetsyuk, lamps by Stas Kadochnikov, Roman Velihursky, Serhiy Demchenko, and other designers, who demonstrate the transformation of these fragments into functional objects – memory carriers that have emotional and symbolic meaning. Thus, it was worth to note that even the remnants and materials of military conflict can be reinterpreted formally and constructively and transformed into artifacts that have a new function and artistic meaning and preserve memory.

In the development of industrial design in different periods, especially during economic crises, resource constraints encouraged designers to creatively rethink materials and became a catalyst for new design solutions. In the 19th century in Great Britain, everyday objects from textiles to furniture not only served daily needs but were also often reinterpreted and adapted to new functions. For example, furniture and metalwork companies offered their repair and "recycling", stimulating a culture of reuse, and home textiles acted as resources that were modified for new needs (Wynne & Yates, 2023). In the 20th century, the "shabby chic" design trend emerged, popularising the use of worn, restored or artificially aged objects, but the roots of this aesthetic stretch back to the times when old household items were given a new life due to economic conditions. It was a practical approach to saving, which gradually acquired aesthetic significance. At the turn of the 19th and 20th centuries, avant-garde artistic movements, including Dadaism and Marcel Duchamp's Ready-Made, demonstrated conceptual approaches to the reuse of materials, transforming everyday objects into works of art. This changed the perception of a household or industrial object from being seen as a mere physical artifact to being understood as a work of art created through the reinterpretation and transformation of an everyday object (Pettersson, 2019).

In the 20th century, economic and social crises, particularly those associated with World War II and post-war restrictions, significantly affected design practice and the availability of materials. In the United Kingdom, due to the shortage of wood and metal during and after the war, the government initiated a programme of standardised production of furniture and household items from available materials in order to maximise the efficient use of available resources (Reimer & Pinch, 2013). Although this programme, like other post-war programmes was focused on standardisation and saving of primary materials, rather than on the direct use of recycled materials, they laid the foundation for further understanding of the use of materials as a design strategy. In the United States, during the Great Depression and wartime raw material shortages, rural housewives transformed cotton feed sacks into clothing and household items, demonstrating the emergence of a new domestic design (Adrosko, 1992). Despite such purely utilitarian practices, at the academic level, in particular at the Bauhaus school, ideas focused on the study of materials and their formative, expressive and imaginative potential also developed (Whitford, 1984).

In the 1960s and 1970s, growing environmental awareness and and criticism of mass production contributed to the emergence of artistic experiments that used waste as a key material for creativity. Entire artistic movements were formed that appealed to working with waste. The junk art movement embraced the use of household garbage,

industrial residues, and randomly found objects as an aesthetic form-generating resource. This practice demonstrated a critique of consumerism and declared a rethinking of values in art in general. Representatives of Neo-Dada, in particular artist Robert Mallary, created sculptures from found materials and urban garbage. Jean Tinguely used found mechanical fragments in his work. For example, in the work "Homage to New York", the reinterpreted and recycled mechanical fragments formed kinetic assemblages, losing their original purpose and acquiring a new artistic meaning (Singh, 2023). These examples demonstrate that secondary materials not only provide functional and economic feasibility, but also acquire artistic characteristics, which once again proves the relevance of studying their form-generating potential.

The aforementioned artistic and design practices have become the basis for modern concepts of circular and material-oriented design, where recycling and upcycling are considered as a strategy for expanding figurative language, a factor in innovation, experimental solutions, and the formation of new typologies of objects (Pedgley *et al.*, 2021). Based on the analysis of historical practices and modern concepts of circular and material-oriented design, it is advisable to form a methodology for studying recycled materials as a form- generating design resource. Thus, for the analysis of design objects, such key features of the material as the type, origin of the material and the degree of processing, functional role in the project, form-forming potential and semantic load can be distinguished (Table 1). This approach will allow classifying the used secondary materials and assessing their impact on the figurative structure of the object. For example, metal waste and polymer fragments can perform a constructive role, textile residues can perform a decorative function, and paper packaging can be recycled and used as a plastic material.

Table 1. Typology of recycled materials as a design resource in 21st century design

Category	Subcategories	Explanation/Function
Material type	Metal, wood, textile, polymer, paper, composite	Defines physical properties, structural strength, and form-making potential
Origin and processing level	Industrial waste, household remnants, packaging, structural elements	Indicates the material's origin and the need for additional processing or adaptation
Functional role in the project	Primary structural component, decorative element, carrier of idea or semantic accent	Determines the role of the material in the project and its impact on perception
Form-making potential	Geometry, compositional structure, spatial arrangement	Assesses how the material influences the form, spatial organisation, and visual coherence of the object
Semantic and emotional meaning	Cultural codes, historical allusions, ecological or social	Shows the material's ability to convey additional meaning and evoke emotions

Source: developed by the authors

The proposed typology creates a kind of analytical framework for comparing examples and identifying characteristic form- generating techniques in modern object design. Within the framework of this study, the analytical interest is focused precisely on the form- generating potential of recycled materials as a key task of the study. Instead, semantic, emotional and functional aspects are considered as such, which complement and clarify the analysis of formal solutions, but are not an independent subject of detailed consideration within the framework. The form-generating potential of recycled materials in design practices is determined primarily by their initial physical and mechanical characteristics (strength, plasticity, texture, density), the degree of previous transformation (from fully preserved to recycled, defragmented) and traces of previous use (wear, deformation). That is, the existing geometry, structure, scale and surface properties can limit or, conversely, stimulate design solutions. Under such conditions, the role of the designer shifts from constructing a form from scratch to interpreting the existing material situation and rethinking it in a new functional context. Such an approach is consistent with the concept of material-driven design, within which the material itself determines the direction of form-generating solutions (Karana *et al.*, 2015). In such projects, the form of the product is often the result of a compromise between preserving the integrity of an existing material fragment and the need to integrate it into a new compositional system. This leads to the emergence of modular and assemblage structures, where form is made by combining ready-made elements, rather than their complete processing. Such approaches are characteristic of DIY practices (Rognoli *et al.*, 2018).

An important aspect of form-generating in projects using secondary materials is the expressiveness of the material texture and traces of previous use on the objects of recycling. Scratches, deformations, surface irregularities, colour inhomogeneities or wear of the material are often not eliminated, but are intentionally preserved and integrated into the visual language of the object. In this way, form generation goes beyond purely constructive tasks and acquires a figurative and communicative function, where the material acts as a carrier of experience and history. In this sense, recycled materials shape not only the physical form of the object, but also its visual identity. Analysis of contemporary design projects allowed to identify several typical form-generating strategies based on the use of recycled materials. It can combine them into the following groups: 1) material-driven form generation. The form of a

new object is directly subordinated to the existing physical, mechanical and visual characteristics of the secondary material; 2) structural-modular form generation. The form of a new object is determined by the combinatorics of individual elements while preserving their formal properties in a new compositional structure. Form generation is determined by the principle of repetition of elements and the principle of assembly; 3) associative-figurative form generation. The form of a new object is built on the basis of semantic and visual associations related to the previous function or cultural context of the recycled material.

The identified formative approaches demonstrate that design using recycled materials goes beyond random or purely utilitarian solutions and emerges as a conscious system of design thinking. Within this system, material limitations are not only overcome, but also reinterpreted as a productive resource that stimulates the emergence of new formal languages, figurative interpretations, and experimental design strategies. Material-driven form generation is based on the principle of direct dependence of the design form on the existing physical, mechanical, geometric and structural characteristics of the recycled material. In such projects, the designer does not impose a preformed image on the material, but works with the already existing form of the reused object, its scale, thickness, curvature, traces of wear or deformation. The shape of the object arises as a result of adaptation to the given material parameters that limit, but at the same time direct the design process. This strategy is typical for working with large or difficult-to-process elements – wooden beams, construction waste, metal profiles, body parts, industrial containers. In such projects, preserving the integrity of the material is economically and environmentally expedient. In this case, shaping takes on the character of an interpretation of the material, rather than its transformation, and the material itself acts as an active "co-author" of the design solution. The practices of Dutch designers, in whose work secondary material acts as the initial condition for form generation, are indicative of a material-determined strategy. Thus, in the works of Piet Hein Eek, the form of furniture is directly determined by the physical parameters of the recycled materials used – remnants of building structures, dismantled panels and windows, industrial fragments (Fig. 1).

a b

Figure 1. Material-driven form generation created by Piet Hein Eek
Note: a – waste-stacked stool, b – old-windows cabinet
Source: Kooku gallery (n.d.)

The designer fundamentally preserves the dimensions, thickness, texture and traces of the previous use of the material, avoiding its complete processing. As a result, the shaping of form occurs by arranging already existing elements, and the visual image of the object directly reflects the origin of the material and the process of its assembly. In the designer's works, furniture and interior items demonstrate how the physical and structural properties of secondary materials (for example, dismantled windows) can directly determine the form of the object (Kooku gallery, n.d.). A similar approach can be seen in the project of the designer Tejo Remy (Droog, n.d.) "Chest of Drawers" (1991), where the form of the object is determined by a set of used drawers of different origins and sizes (Fig. 2, a). In another famous object, "Rag Chair" (1991), the shape of the object is not formed in advance, but directly determined by the physical characteristics of the textile fragments: used fabrics, collected in one material block, determine the volume, softness, rhythm and proportions of the seat. The designer deliberately chose not a unified textile, but preserves the heterogeneity of the rags, allowing their different thickness, texture and size to form the overall composition. In this example, the secondary raw material (rags) does not adapt to a given form, but becomes a determining factor in its emergence. In fact, this chair demonstrates not so much its physical form as an idea – any junk can become the carrier of a new aesthetic after the designer reveals the formal and figurative possibilities hidden in it. The "Rag Chair" is a classic example of how material properties (fabric composition, softness, tactility, bulk) are organically integrated into the final design form, while maintaining their own presence (Fig. 2, b).

Figure 2. Material-driven form generation created by Tejo Remy
Note: a – chest of drawers, b – rag chair
Source: Droog (n.d.)

Structural-modular form generation is based on the principles of repeatability and combinatorics, which allows integrating secondary materials or recycled objects into modular spatial or structures. The form of an object is created by assembling individual elements of the same type or compatible into a single system, where the key role is played by constructive connections, rhythm and logic of assembly. Within the framework of this strategy, recycled objects – old parquet, packaging elements, pallets, household items, standard industrial parts acquire a new functional and compositional meaning thanks to a modular approach to their use. Form generation here is determined not so much by the individual properties of a separate object of recycling, but by the rules of their combination, which opens up opportunities for transformation, adaptation and reuse of objects in different contexts.

Demonstrative examples of structural-modular form generation are the works of the Dutch designer Piet Hein Eek, in which secondary materials are integrated into clearly structured, repetitive systems. In a series of benches and tables made from used metal pipes or fragments of wooden parquet, the form of the objects is determined by the principle of modular assembly of standard elements into stable structural configurations. Individual fragments of the material retain their original geometry and traces of previous use, but thanks to rhythmic repetition and a unified logic of connections, they form a coherent composition. In this case, the secondary material becomes part of a system where the form generation is subject not to the uniqueness of each element, but to the rules of their combination (Fig. 3, a, b). A similar principle can be traced in the works of the British designer Stuart Haygarth, in particular in lamps created from serial household items – plastic spoons, glasses, elements of plastic packaging or other standardised components of mass production. The formation of such objects is based on the multiple repetition of the same type of elements and their combination into spherical or cascading structures, where the rhythm, density of combination and method of attachment are crucial for the final form. Recycled materials lose their original function, but acquire a new spatial organisation and visual quality due to modular formation (Fig. 3, c). Thus, within the framework of the structural-modular strategy, recycled materials and objects of processing are considered not as separate unique fragments, but as elements of a system capable of scaling, transformation and re-interpretation into new design forms.

Figure 3. Structural-modular form generation created
Note: a – Piet Hein Eek, Bucketseat-in-scrapwood-low, b – Piet Hein Eek, Tube chair, c – Stuart Haygarth, Tide
Source: Kooku gallery (n.d.), Design Boom (n.d.b), Stuart Haygarth (n.d.)

Associative-figurative form generation focuses on the semantic potential of objects of processing and recycled materials and appeals to their ability to act as carriers of social, cultural, humanitarian, and environmental

meanings. In suc h projects, the material most often retains recognisable features of its previous functional context, but receives a new meaning and visual reading. The form is subject not only to constructive logic, but also to a figurative narrative. It can emphasise the ideas of environmental responsibility, criticise consumerism and overproduction, form a memory of the previous life of things or social processes associated with their origin. Thus, form- generating takes on the character of a visual message, and the material becomes a key semantic sign. The "Sofa_XXXX" projected by designer Yui Ushida represents the shape of a sofa, but the idea is subordinated to the ecological theme. The designer used chopsticks, which are thrown away by the millions every day, turning them into a repetitive constructive element, but the main emphasis is on the figurative and semantic function of the material used. This is a critical image of consumerism and an attempt to rethink waste as a resource for creativity, where each element of the material retains traces of its previous life and at the same time becomes part of a new message. Such a form generating combines ecological reflection, artistic expression and functionality, and the project becomes a carrier of new meaning, forcing the user to think about their own attitude to material resources (Fig. 4, a). The wallpaper project by Dutch designer Gijs Bakker raises the issue of ecology and human memory. In this project, old wallpapers remain on the walls, and the designer suggests not to dismantle them, but to apply new ones on top of them with large holes through which the previous layer will be visible. This strategy allows to preserve traces of the material's previous life, its texture, colour, history of use, and, at the same time, forms a new composition and visual language. The holes become a kind of "windows of memory" through which the material's past becomes an active element of the new image. Thus, the final product, in addition to a new function and image in the environment, makes the user think about the life cycle of things and the value of more sustainable solutions in design. The project demonstrates that design can be functional, artistic, and conceptual at the same time, integrating memories of the past, thoughts about the present, memory, and ecology into a single visual structure (Fig. 4, b).

a

b

Figure 4. Associative-figurative form generation created by Yuya Ushida and Gijs Bakker
Note: a – Sofa_XXXX, b – Peep show wallpapers that allow to preserve the previous wall covering
Source: Design Boom (n.d.a), Gijs Bakker Design (n.d.)

During the war in Ukraine (2022-2026), secondary materials predictably become a valuable resource for rethinking and recycling. This is influenced not only by the economic situation but also by the growing amount of spent ammunition, packaging, etc. One of the most appropriate strategies for using these resources is material-deterministic shaping. It involves minimal intervention in the basic form, but thanks to a well-considered design and artistic solution, it helps to adapt it to new functions and give it new meaning. It is important that the original form of the material retains noticeable traces of its origin and the object is perceived not as an abstract thing, but as a carrier of human experience in wartime. Among such examples is the design of a table made of military ammunition boxes, the author of which is Ivan Stefanyuk. The original form of the ammunition boxes is completely preserved and determines the main functional and aesthetic component of the project (Fig. 5, a). Another project where the initial form of the material became the basis for the design solution is the night lamp by designer Stas Kadochnikov "Predator". A fragment of an anti-ship missile and a fragment of a tank shell casing are compositionally combined into a single form and transformed into a holistic plastic image, in which the aggressive mechanics of military artifacts are reinterpreted as an expressive artistic form. The integrated light module enhances the association with a living organism. As a result, the object combines the function of a lighting device with an expressive figurative metaphor, where the material retains its historical tension and memory. That is, the project also corresponds to associative-figurative shaping (Fig. 5, b). Ukrainian design studio YOD Group transformed empty shell casings used by anti-aircraft tanks to protect Kyiv from drones into a series of lamps "Downed Drone". In the project, the designers consider the most important factor to be the story of creation and a certain symbolism – which shows that light conquers darkness (Fig. 5, c).

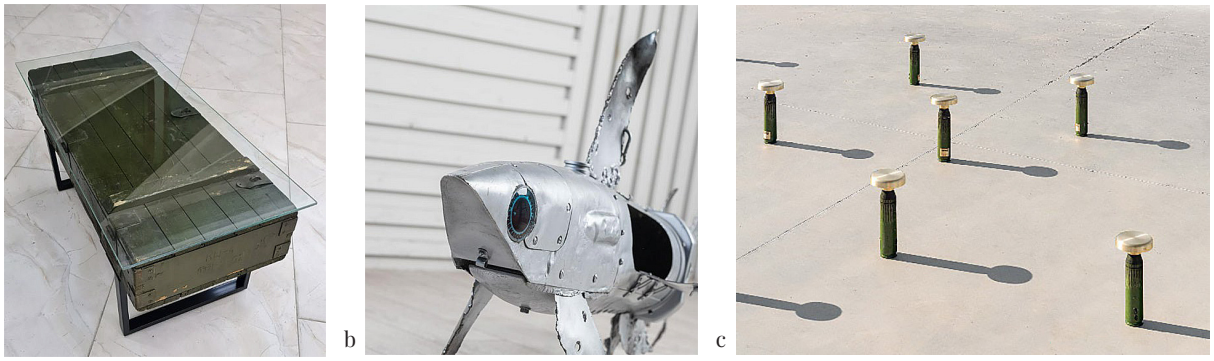

Figure 5. Projects of Ukrainian designers using waste from the military industry
Note: a – Ivan Stefanyuk. Ammunition box table, b – Stas Kadochnikov. Night-light Predator, c – YOD Group. Lamps Downed Drone
Source: A. Laycock (2023), War Artists Union (n.d.a), War Artists Union (n.d.b)

The analysed examples demonstrate that a material can simultaneously determine a new construction and form of an object, emphasise the rhythm and repetition of its elements, and at the same time carry a certain social or ecological message. In the design practices of the 21st century, the form-generating approaches defined above rarely exist in isolation. Material-driven, structural-modular and associative-figurative shaping are often synthesised in one object and create a multidimensional visual language. It is this interaction of different form-generating strategies that creates the opportunity for experimental conceptually deep projects, where the object acquires not just a function, but becomes a carrier of ideas, images, and new scenarios of perception. This blurring of boundaries is especially noticeable in student projects, when the search for a new form is combined with the study of the material itself as a source of ideas and meanings. In student works, the experiment often takes place on the border between conscious pre-design analysis and intuitive discovery. The material is studied, its constructive, form-generating, visual characteristics are tested, and its ability to evoke associations and form a certain figurative logic is also investigated. The "Vtor" organiser chairs by Vladyslav Rakochyi are based on the understanding of large-sized industrial packaging for medicines and remnants of textile materials.

The result is material-determined form formation, where the object grows directly from the logic of available materials (Fig. 6, a). Anna Skitska's project "Cinema Lamp" was created using material-deterministic and structural-modular methods of shaping, since it is the film and the rhythm that arises from its repeating fragments that determine the spatial structure and light plasticity of the object. But it is worth clarifying that this project also corresponds to associative-figurative form-generating, since film is a rarity that is almost not used in everyday life today, but it contains memories and family photo archives, so the object is perceived as a creative interpretation of the theme of memory (Fig. 6, b). The theme of memory is also revealed by Andriy Gromyk's project "VFD clock", where the main form- generating element is a vacuum-luminescent indicator. The idea of the clock is to form such a structure with a time mechanism that will be completely functional, but the design and form consciously appeal to the aesthetics of early electronics and household appliances of the late 20th century. In this project, the material and technological element become a means of understanding time not only as a physical quantity, but also as a cultural phenomenon. The object records the transience of technical solutions and at the same time gives them new life in the current design context of the 21st century (Fig. 6, c).

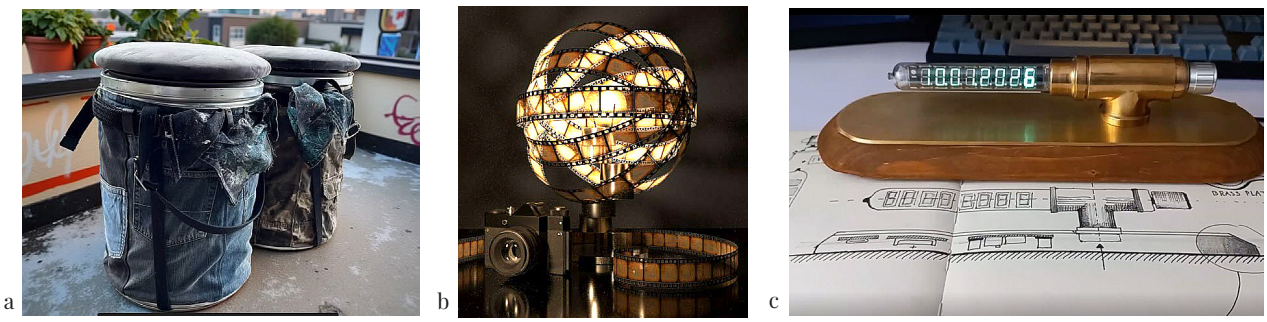

Figure 6. Examples of form-generating experiments with recycled material
Note: a – V. Rakochyi "Vtor" organiser chairs, b – A. Skitska "Cinema lamp", c – A. Gromyk "VFD clock"
Source: photo by the authors

The examples considered allowed to assert that working with secondary materials in design goes beyond the boundaries of a purely technical or ecological task. It appears as a research practice in which the material acts as a constructive basis, a shaping factor and a carrier of figurative and semantic meanings. Student projects are especially indicative in this sense, where the combination of an analytical approach and experiment allowed to reveal the potential of synthesising various form-generating strategies in real design. C. Bakker *et al.* (2019) linked the reuse of materials with the possibility of forming new types of constructive logic of the object, determined by the properties of secondary raw materials. In turn, J. Frajová & A. Opálková Šišková (2022), studying vortex plastic, showed that it can be not only an environmentally significant resource, but also the basis for creating new interior items and accessories. The physical properties and technological potential of this plastic can shape the design logic of final objects. Thus, the study illustrated how recycled polymers go beyond utilitarian use and become an active factor in creative and constructive solutions in the design of objects.

Researchers M.F. Ashby & K. Johnson (2014) considered the material as a carrier of visual, tactile and associative characteristics that directly affected the formation and perception of the object. In this context, the choice and subsequent transformation of the material appeared as a conscious design decision that can determine the figurative integrity of the designed object, in particular in cases of using recycled materials with a distinct material "memory". Researcher T. Fry (2009) emphasised the need to rethink material culture through the prism of the long-term consequences of design decisions, where the material was considered not just as a resource, but as an ethical and cultural factor of design. This approach emphasised that the reuse of materials for new figurative and semantic solutions in design, especially in conditions of limited resources and crisis socio-economic contexts, becomes not only a means of saving, but also a tool capable of forming additional symbolic and cultural value. The form-generating characteristics of recycled plastic have been considered in interdisciplinary studies at the interface of materials science and design (Veelaert *et al.*, 2017; Ragaert *et al.*, 2020). Upcycling in textile design had been analysed as an effective strategy for combining environmental responsibility and creative experimentation in study by Z. Liu (2025). In dissertation, S. Lee (2019) explored the use of furniture waste in design as a sustainable design strategy. The author showed that reusing materials not only reduced the environmental footprint, but also stimulated creative experimentation and new approaches to form. A number of studies raised the issue of durability of industrial products and product life cycles. T. Cooper (2016) argued that the choice of materials in product design must be responsible, and this, in turn, affected design strategies and consumer practices. In Ukrainian scientific discourse, the issue of using recycled materials in design was considered mainly in the context of implementing environmentally-oriented approaches and principles of sustainable development in design activities. The research of N. Lytvynenko *et al.* (2022) focused on upcycling practices in clothing design and the formation of new aesthetic approaches within eco-design. Despite the existence of such studies, the issue of the shaping potential of recycled materials, the ability of the material to influence the figurative structure and artistic language of a design object, remains insufficiently studied and systematised and requires further theoretical understanding.

CONCLUSIONS

The study showed that at the end of the 20th and the beginning of the 21st centuries, the use of recycled materials in design became systemic and ceased to be limited to utilitarian or environmental considerations. Recycled materials were increasingly considered as a full-fledged design resource that directly affects the formation of the structure, spatial organisation and conceptual image of the object. The physical properties of recycled materials, in particular, structural parameters, geometry, scale, texture, traces of previous use set the logic of design decisions and direct the process of form-generating into an experimental and emotionally and semantically rich stream. During the study, the material-driven, structural-modular and associative-figurative approaches to form generation using recycled materials were theoretically distinguished. The research analysed furniture, lamps, and experimental objects by European and Ukrainian designers, as well as student works that demonstrated different approaches to the use of secondary materials in form-generation. At the same time, it was found that in these real projects, the form-generating approaches formulated in the research most often function in conjunction, and their synthesis formed a multidimensional functional, visual, and semantic structure of the design object. In the future, form generation based on recycled materials appeared as a holistic system, where the properties of the material became the starting point for the formation of constructive and figurative solutions. This allowed to consider secondary raw materials as an important factor in the development of not only environmentally responsible and material-oriented design, but also one that resisted the unification of mass production and opened up space for experimental, authorial and collectible forms. Further research could focus on studying how the properties of recycled materials affect the perception and imagery of the designed object. An important issue is also the creation of practical models and methods for their use in design.

ACKNOWLEDGEMENTS

None.

FUNDING

None.

CONFLICT OF INTEREST

None.

REFERENCES

[1] Adrosko, R. (1992). The fashion's in the bag: Recycling feed, flour, and sugar sacks during the middle decades of the 20th century. In *Textiles in daily life: Proceedings of the third biennial symposium of the Textile Society of America* (Vol. 557; pp. 129–138). Earleville, MD: Textile Society of America, Inc.

[2] Ashby, M.F., & Johnson, K. (2014). *Materials and design: The art and science of material selection in product design* (3rd ed.). Oxford: Butterworth-Heinemann.

[3] Bakker, C., den Hollander, M., & van Hinte, E. (2019). *Products that last: Product design for circular business models*. Amsterdam: BIS Publishers.

[4] Chapman, J. (2021). *Meaningful stuff: Design that lasts*. Cambridge; London: The MIT Press.

[5] Cooper, T. (Ed.). (2016). *Longer lasting products: Alternatives to the throwaway society*. New York: Routledge.

[6] Design Boom. (n.d.a). *Yuya Ushida: Sofa_XXXX*. Retrieved from https://www.designboom.com/design/yuya-ushida-sofa-xxxx/?utm.

[7] Design Boom. (n.d.b). *Piet Hein Eek: Tube chairs*. Retrieved from https://www.designboom.com/design/piet-hein-eek-tube-chairs/.

[8] Droog. (n.d.). *Rag chair by Tejo Remy*. Retrieved from https://www.droog.com/projects/rag-chair-by-tejo-remy/.

[9] Ellen MacArthur Foundation. (2016). *The circular design guide*. Retrieved from: https://www.ellenmacarthurfoundation.org/circular-design-guide/overview.

[10] Frajová, J., & Opálková Šišková, A. (2022). Secondary raw plastic materials in applied design. *Materials Science Forum*, 1063, 227–232. doi: 10.4028/p-i1l2s6.

[11] Fry, T. (2009). *Design futuring: Sustainability, ethics and new practice*. London: Bloomsbury Visual Arts. doi: 10.5040/9781350036079.

[12] Gijs Bakker Design. (n.d.). *Peep show*. Retrieved from https://gijsbakker.com/project/peep-show.

[13] Idrisi, M.A., & Singari, R.M. (2025). Investigating the use of biodegradable and recycled materials in product design: Lifecycle analysis and environmental impact assessment. In *14th international conference on design history and studies, ICDHS14 "Cultures of design"*. New Delhi: Indian Institute of Technology Delhi. doi: 10.13140/RG.2.2.28908.42887.

[14] Karana, E., Barati, B., Rognoli, V., & van der Laeen, A.Z. (2015). Material driven design (MDD): A method to design for material experiences. *International Journal of Design*, 9(2), 35–54.

[15] Kooku gallery. (n.d.). *Piet Hein Eek. Kooku selection of designer works*. Retrieved from https://www.kookudesign.com/designer/98/piet-hein-eek.

[16] Kyselova, K. (2022). Sustainability is the main trend of modern design. *Ukrainian Art Discourse*, 3, 37–44. doi: 10.32782/uad.2022.3.5.

[17] Laycock, A. (2023). YOD Group turns Ukraine air-raid shells into lamps to symbolise that "light always wins". *Dezeen*. Retrieved from https://www.dezeen.com/2023/07/11/yod-group-ukraine-shell-lamps/.

[18] Lee, S. (2019). *Sustainable design approaches using waste furniture materials for design practitioners*. (Doctoral thesis, Buckinghamshire New University, Coventry University, Buckinghamshire, London, UK).

[19] Liu, Z. (2025). Integrating design for recycling and upcycling strategies in sustainable textile innovation: Toward a circular economy model for material recovery and creative reuse. *Advances in Humanities Research*, 12(3), 35–39. doi: 10.54254/2753-7080/2025.24260.

[20] Lytvynenko, N., Voronina, M., & Lavreniuk, O. (2022). Reusing of materials in clothing design. *Bulletin of KNUKiM. Series in Arts*, 47, 177–185. doi: 10.31866/24101176.47.2022.269635.

[21] Mesa, J.A., Gonzalez-Quiroga, A., Aguiar, M.F., & Jugend, D. (2022). Linking product design and durability: A review and research agenda. *Heliyon*, 8(9), article number e10734. doi: 10.1016/j.heliyon.2022.e10734.

[22] Pedgley, O., Rognoli, V., & Karana, E. (Eds.). (2021). *Materials experience 2: Expanding territories of materials and design* (1st ed.). Oxford: Butterworth-Heinemann.

[23] Pettersson, R. (2019). Marcel Duchamp, concept and context. *ResearchGate*. Retrieved from https://surl.li/leafpy.

[24] Ragaert, K., Huysveld, S., Vyncke, G., Hubo, S., Veelaert, L., Dewulf, J., & Du Bois, E. (2020). Design from recycling: A complex mixed plastic waste case study. *Resources, Conservation and Recycling*, 155, article number 104646. doi: 10.1016/j.resconrec.2019.104646.

[25] Rakochyi, V., & Iurchyshyn, O. (2025). Sustainable design: Integration of recycled materials into the production of souvenir products. *Bulletin of the Lviv Polytechnic National University. Series of Architecture*, 7(1), 77–86. doi: 10.23939/sa2025.01.077.

[26] Reimer, S., & Pinch, P. (2013). Geographies of the British government's wartime utility furniture scheme, 1940–1945. *Journal of Historical Geography*, 39, 99–112. doi: 10.1016/j.jhg.2012.07.003.

[27] Rognoli, V., Ayala-Garcia, C., & Aversa, H. (2018). *DIY-materials. Technological approach of materials for design*. Milan: Politecnico di Milano.

[28] Singh, S. (2023). History of the use of waste materials in visual arts: Concept and roots. *ShodhKosh: Journal of Visual and Performing Arts*, 4, 143–150. doi: 10.29121/shodhkosh.v4.i2CDSDAD.2023.593.

[29] Stahel, W.R. (2019). *The circular economy: A user's guide*. London: Routledge.
[30] Stuart Haygarth. (n.d.). Retrieved from http://www.stuarthaygarth.com/works.
[31] Veelaert, L., Du Bois, E., Hubo, S., Van Kets, K., & Ragaert, K. (2017). Design from recycling. In E. Karana, E. Giaccardi, N. Nimkulrat, K. Niedderer & S. Camere (Eds.), *EKSIG 2017: Alive. Active. Adaptive*. Delft and Rotterdam: Design Research Society. doi: 10.21606/eksig2017.109.
[32] War Artists Union. (2023). *Art from the fragments of war: Exhibition opens in Ukraine's capital featuring artifacts made from weapon and equipment debris*. Retrieved from https://surl.li/ahcpfj/.
[33] War Artists Union. (n.d.a). *Table made of an ammunition box. By: Ivan Stetsiuk*. Retrieved from https://wau.art/work/table-made-of-an-ammunition-box/.
[34] War Artists Union. (n.d.b). *Night light "Predator". By: Stas Kadochnikov*. Retrieved from https://wau.art/work/night-light-predator/.
[35] Whitford, F. (1984). *Bauhaus (World of art)*. London: Thames & Hudson.
[36] Wynne, D., & Yates, L. (Eds.). (2023). *Victorian material culture*. (Vol. 4). Milton Park: Routledge.

Віктор Штець
Кандидат мистецтвознавства, професор
Національний університет «Львівська політехніка»
79013, вул. С. Бандери, 12, м. Львів, Україна
https://orcid.org/0000-0002-2436-762X

Оксана Мельник
Кандидат мистецтвознавства, доцент
Національний університет «Львівська політехніка»
79013, вул. С. Бандери, 12, м. Львів, Україна
https://orcid.org/0000-0002-1579-6705

Формотворчий потенціал перероблених матеріалів у предметному дизайні

Анотація. Актуальність дослідження зумовлена необхідністю переосмислення ролі вторинних матеріалів у дизайні XXI століття в контексті як екологічної доцільності, так і пошуку нових підходів до формотворення, що сприяють експерименту, індивідуальності та відходу від стандартів масового виробництва. Метою роботи було комплексне дослідження потенціалу перероблених матеріалів як формотворчого чинника та визначення принципів, що зумовлюють форму й образ об'єкта у практиці предметного та середовищного дизайну. Результати дослідження показали, що вторинні матеріали виступають активним формотворчим фактором і впливають на конструктивну логіку, композицію та образну мову виробів. У роботі виокремлено три формотворчі підходи (матеріально-детермінований, конструктивно-модульний, асоціативно-образний), синтез яких формує багатовимірну функціональну, візуальну та семантичну структуру дизайнерського об'єкта, протиставляючи уніфікацію творчому експерименту. Залучення вторинних матеріалів у дизайнерську діяльність стимулювало переосмислення матеріальної культури дизайну, формуючи більш усвідомлений підхід до вибору матеріалів і процесу їх подальшого використання. У дослідженні проаналізовано меблі, освітлювальні та експериментальні об'єкти європейських і українських дизайнерів, а також студентські проєкти, що демонструють різні способи інтеграції вторинних матеріалів у дизайн. Особливу увагу приділено взаємодії фізичних властивостей матеріалу з формою, просторовою організацією та образністю виробу. Проаналізовано, яким чином такі матеріали можуть виступати носіями історії, текстури та емоційної насиченості об'єкта. Практична цінність роботи полягає у можливості застосування запропонованої типології та методології аналізу вторинних матеріалів у дизайнерській, освітній і науковій діяльності для обґрунтованого формування концепцій та реалізації об'єктів у сфері екологічного та предметного дизайну

Ключові слова: формотворення; екологічно відповідальний дизайн; експеримент; смислове наповнення дизайну; матеріально-орієнтований дизайн