DYNAMICAL DESIGN OF PRINTED PRODUCTS: THE METHODS OF ARTISTIC IMAGE TRANSFORMATION

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In the study we presented the complex analysis of theoretical and practical aspects of the print design as the innovative phenomenon in the design culture. We proved that the form and image transformation in the printed industry contributes to the activation of consumers' attention and the increase of the informational message perception quality. We analyzed the pop-up phenomenon in the historical context and described the features of different paperfolding techniques that provide visual dynamics. On the base of the printing samples analysis we formed the classification of dynamical visual systems and considered the main methods of the image transformation in the terms of printing production. The results of the theoretical study were implemented in the series of the dynamical leaflets on social issues.

Keywords: dynamical design, print design, visual dynamics, transformation, movement, artistic image.

Introduction.

The rapid development of the society, informatization and computerization, a change of people's ideologies, and scientific and technical progress determine the gradual loss of interest to usual printed production. Therefore, designers have the issue to solve that is to find new design concepts, which will help them rethink the ways of attracting consumers' attention to printed information.

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Nowadays it is really popular to use various artistic innovations related to the transformation of shape and meaning, which improve visual communication due to the using of printed media and make it more dynamical. Calendars, magazines, books, leaflets, postcards, and packages, which are able to transform from planar forms to three-dimensional ones and vice versa, have been invented. They have some movable elements and constructions, which create interesting design concepts. Due to the using of modern technology, printed products are more dynamical, pictures become volumetric instead of the plane ones, some elements can be moved, the shape and content of visual message changes as well as the nature of its interaction with people. The understanding of printed production not only as a static object, but a process, reveals the ability of such design systems to the long-lasting communication. It causes the increase of quality of informational message perception and remembering with the help of dynamical visualization. Meaningful and visually plastic constructions are aimed at the formation of open and clear design object. The analysis of the kinds of dynamical changes is an essential part of the study for the further formation of the theoretical base and practice of the system design for visual communication in general.

We consider the printed production with the dynamical elements simultaneously as the process of creating the information, transferring it by the means of visual language and visual perception of images, which have great emotional coloring. Metaphoricality and associativity become the base of the printed production aesthetics. In this case dynamics is an important project characteristic that provides the formation of the multioptional area for communication. Dynamical images cause the increase of the number of visual contexts and widen the possibilities for the interaction with people. The difficulties of dynamical visual communication design are related to their experimental nature and the necessity to predict the results of perception. That is why the theoretical rethinking of dynamic aspects in printed production design is a promising design direction.

Nowadays, the topicality of dynamical design objects proves that the 21st century shows the new necessities and communication possibilities of printed production. The game fundamental, which became the base of the postmodernism, involves people to the active interaction. Sudden transformations of shape and content became the driving force of dynamical objects formation and they require the study of their design specifics. The

absence of the systematized information about design of various kinds of printed products, which have dynamical qualities, made this research actual.

Dynamical printed production appeared in the culture of Ukraine not a long time ago, but in the world it is a popular way of attracting consumers' attention to the visual message. The scientific researches of this phenomenon are close to the issues of technology of paper design objects creation, design features of some printed products and general concepts of dynamics and movement, graphic design and visual communication design.

The art of creation of paper objects, which have the ability of transformation, is connected with the development of paper modelling technology. The practical aspects of different folding techniques, especially origami (N. Robinson [35], V. Palacios [32]), cutting through (N. Salnikova [13], Ho Huu An [21]) and appliqué (E. Rottger [37], D. van Dommelen [24]), show the features of creation of paper objects, which are able to transform. The studies of L. Biliakovych and O. Chorna [1], who analyzed the main origami types, revealed the criteria of their formation and features of artistic expression are very informative. In addition, the technology of the work with paper is close to the issues of layout as the main modelling method, which is related not only to the shape transformation, but the imaginative one as well (N. Skliarenko, O. Pasichnyk [16]).

The researches of dynamic printed production are related to the issues of the analysis of movable books construction and the pop-up approach development. (N. Sbitneva and N. Velychko [14], D.-L. Way, Y.-N. Hu and Y.-S. Tsai [39], M. Korolchuk [7], M. Yefimova [6]). However, they contain fragmentary information about the features of printed products dynamical design in general.

The important thing for design developments of dynamical printed products is the concept of movement, which is manifested through the creation of the real or imitative dynamics in design (I. Kuznetsova, V. Sirak [8]). The concept of dynamics is revealed in the context of the issues of design of objective and spatial environment (S. Myhal [9]). V. Semkin considers figurative and morphological transformation as the design tool, which helps to optimize the functional, morphological and figurative functioning of the object in certain situations [18]. The issues of transformation are related not only to the formation of printed products, but clothes design (N. Ostapenko, T. Lutsker, M. Kolosnichenko [11]), jewellery design (M. Vynnychuk, M. Kolosnichenko,

V. Musiienko, A. Antoniuzhenko [4]), architectural design (N. Bondar, K. Kolomiiets [3]), etc. We analysed the studies, which proves the versatility of dynamical design possibilities during the artistic image creation.

The using of dynamics in printed products design is aimed on the improving of visual communication quality. In this context we consider the following issues, such as the correlation of the concepts of graphic design and visual communication design (J. Frascara [26]), the strategy and methodology of communicative design (M. Aakhus [20]), really important. The design theory and practice research is caused by the necessity of the deeper understanding of the differences between various kinds of communication and learning of the complicated ways of consumers' reactions (P. Messaris [31]). That is the reason why designers have to constantly search for new design methods. They strive to achieve longer and more effective interaction with a consumer.

Nowadays, there is lack of papers that show the methods and features of dynamical design in the printed production design. There is only the confirmation of visual dynamical systems availability, and therefore, their analysis had the describing nature. Such a situation revealed the necessity of the study of formative and visual transformations in printing industry, which includes the complex of methods of artistic images creating and methods of dynamical design.

Statement of the problem.

The aim of the study is discovery of the methods of artistic image transformation in the printed production design.

The study objectives are the following ones: 1) to analyse the role of dynamics in design and the evolution of pop-up phenomenon; 2) to describe the origins of paper modelling techniques, which provide the dynamics of printed production elements; 3) to form the classification of dynamical visual systems and describe the methods of the artistic image transformation; 4) to reveal the features of the design developments of printed products on the example of dynamical leaflets of social topics.

The essential factor to achieve the set aim and objectives during the scientific study is the systematic approach. It helped to consider the dynamical design of different kinds of printed products as synthetic phenomenon, which provides high level of communication. Comparative-historical

method is used for the analysis of technological paper modeling methods in East and West cultures in the historical context. Empirical methods, such as observing, comparative analysis and synthesis of available samples of movable design objects, make it possible to reveal their design features and rethink fundamentals of dynamical design. Artistic and graphic, structural and compositional, artistic and figurative design analyses as study methods help to learn the specifics of modern dynamical visual systems design. We used the method of generalization and systematization to form their classification and analysis of the ways of artistic image creation. It is an essential aspect for the further formation of the theoretical base and practice of dynamical visual communication design.

The selected topic is important for Ukraine, because today dynamical visualization of information is a globalist trend. This study will provide the renovation of the dynamical design methodology and improvement of methods and techniques of printed production creation.

Results of the research and their discussion.

The results of the analysis of different kinds of printed production with movable elements and constructions prove that their usage changes the nature of the design object perception and determines the ways of its artistic image creation. The use of the movement in the composition of such creations makes it possible to combine the artistic image and the technology of its embodiment harmoniously.

The visual language of the modern printed production simultaneously is the design object and communication channel. Creative ideas of formation and imaging by the means of dynamics create the wide range of possibilities for various types of visual communication.

The dynamics as the opposite of static is associated with the movement and transformation. We consider dynamics as an organization of the area, volume or space, where purposeful movement, emotional or physical tension and force are displayed [22]. It becomes an important means of printing industry design with movable elements and dynamical constructions. In the world design practice such design objects are characterized by the term pop-up (from English – to appear unexpectedly, to emerge) [14].

The evolution of pop-up as a design method starts from the rethinking of the method of information visualization. Visualization (from Latin *Visualis* –

that is perceived visually, descriptive) is a process of data presentation as the clear image for the effective understanding; shaping of any object, subject, process, etc. Visually volumetric presentation of abstract data is used to improve people's perception.

The desire to make a planar image volumetric caused the emergence of books with movable elements in the 13th century [25]. In the 18th century due to the work of the English typographer Robert Sayer (1765) movable books in the format of metamorphosis, which were created according to the flap-moving technology called lift-the-flap, appear [14]. The first and the most famous Sayer's creation was *Harlequins*. It was the book with the illustrations of theatrical pantomimes; Harlequin was the main hero in them (Figure 1, a). By moving the paper flaps, you could watch the amusing situations from Harlequin's life. In the 19th century Ernest Nister and Lothar Meggendorfer renovated this technique in Germany and the United Kingdom, and subsequently books with movable elements and volumetric elements gained popularity in the European book publishing for a German, English and American readership. In the first half of the 20th century the creation of volumetric books turned into the real art that was characterized by the term pop-up. The term pop-up appeared in the 1930s in the USA for the first time [25]. Chicago publishing house Blue Ribbon used it on the book publishing market to mark pop-up books (Figure 1, b). In the second half of the 20th century pop-up gained popularity in Europe. In 1956 Czech illustrator Wojciech Kubashta (Vojtěch Kubašta) created his first pop-up book *Little Red Riding Hood* (ARTIA publishing house, Prague) (Figure 1, c) [36].

Subsequently he gained the popularity as the volumetric illustrations creator not only in the Czech Republic, but in England and the USA as well. The illustrator became successful because of the books, such as *The Christmas tale* (Figure 1, d), Cinderella (Figure 1, e) and *Snow white*. His illustrations represented three-dimensional pictures that looked like as small theatre. They had a complicated structure with movable elements, flappers and little wheels.

In the 20th century pop-up becomes move various due to the artists who begin to use this technique in the fashion industry, design and business. The spread of the advertisements moved pop-up into the sphere of business relations.

In the last decades of 20th the technique of volumetric books creation becomes more various and creative. It happens because talented artists create


a


b


c


d


e

Figure 1 – Lift-the-flap technology in the books:
a – R. Sayer Harlequins, London, the 18th century;
b – C. Carey Cloud, Harold B. Lentz Puss in Boots, New York: Blue Ribbon Press, 1934; c – W. Kubashta Little Red Riding Hood, 1966;
d – W. Kubashta The Christmas tale, 1950s;
e – W. Kubashta Cinderella, 1961


a


b


c


d

Figure 2 – Pop-up Lighting: lamps-origami from the designer Chen Bikovski, Israel

volumetric catalogs, books, films advertisements, presentations of architectural buildings, etc. The representation of postmodernism in the sphere of artistic creativity is the conceptual pop-up art that requires not an emotional reaction, but an intellectual understanding, and presents itself as a pop-up lighting (Figure 2) and a pop-up installation. Now marketers have been using the pop-up technology for almost twenty years to attract the audience's attention.

Pop-up visualization improves the information perception due to the volume creation. Pop-up makes it possible for the graphic image to reach a new quality level, increases the ability of people's visual system to see realistic models, and helps us to perceive them as the art works (Figure 3).

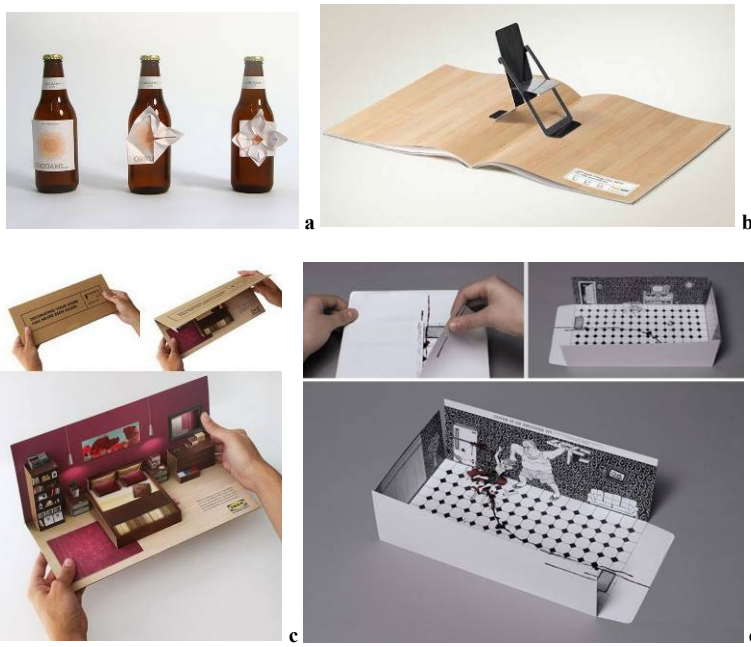

Figure 3 – Pop-up technique in printing industry:
a – the beer label *Origami*, Clara Lindsten; b – the centrefold from the magazine, the furniture advertisement of NHA Xinh Furniture, Grey Group agency, Hochiminh City, Vietnam; c – the IKEA booklet, Kuwait; d – the Chinese organization booklet against domestic abuse *Cover it or Uncover it?*, DDB Shanghai agency, China

Therefore, pop-up can be considered as the volumetric visualization of data, schemes, and models, which are used for the fast and clear reflection of system information. Today's ideology and the artistic form of world perception caused the further development of pop-up in the modern art and design culture.

The base of the dynamical formation in the printed production design is the usage of the dominant paper modeling techniques, such as folding (origami), cutting through (kirigami, vytynanka) and application. Their research is important for the understanding of the pop-up specifics and the ways of dynamical design.

The paper folding technique was invented in China, and it was soon used in Japan [32]. The Japanese borrowed a lot of things from the Chinese culture, so they took over the origami art as well. The paper was mainly used by noblemen. Not everyone could afford it because of the high cost and complexity of production. People were making kites, umbrellas and other small things from it. Over time these paper creations received a Japanese name that is origami (which means to fold paper) [35]. Origami is the art of different figures and shapes folding from paper. There are some analogues in England (paperfolding), in Spain (papiroflexia) and in Germany (papierfalten) [10]. The origami technique uses a few different types of bends, but they can be combined in a big number of various ways and create really complicated figures. Usually origami figures are folded without cutting and from a square sheet of paper; its sides can be of different colours.

The technique of paper folding became wide-spread all over the world and people started using it in clothes and decorations making. A lot of world-famous designers more and more often pay attention to unlimited origami possibilities. New origami types appeared, such as modular, mosaic, curvilinear, 3D origami and others [17]. They help to create dynamical compositions from one sheet of paper (classical origami) or from a huge number of small modules (modul origami).

The origami folding technique is widely used in advertisements (Figure 3, a), package design, books, etc. From the middle of the 20th century pop-up furniture and pop-up clothes, which can be easily transformed, began to appear all over the world.

The base of modern dynamical printed products creation includes not only folding process, but also cutting (cutting through). We can consider the vytynanka and kirigami techniques as the beginning of cutting through methods.

During 7th and 12th centuries, when scissors and paper appeared in China, the era of vytynanka (from words "cut", "cut out") started [21]. These are ornamental house decorations that are cut out openwork or in silhouette by scissors or knife from white or coloured paper. Chinese women pasted traditional paper patterns of flowers, dragons and other symbols on windows. In Western Europe vytynanka looked like applications on the sheet of paper. Slavic people used them as the decorative element [19].

People started using Ukrainian vytynanka as the house decoration only in the middle of the 19th century [5, p. 107]. The vytynanka of this period is distinguished by high artistic skill. In each region and a lot of areas it gained specific local features due to the choice of material, form, silhouette, technical perfection, feeling of rhythm, proportions, ornament, etc. The brevity and elegance of figurative means are the vytynanka's features. Technically they are created with scissors or special tools, such as knife, hatchet or others, which are handed down by masters from generation to generation. The material for the creation is white or colourful paper. According to the technological and artistic features we divide vytynanka types into openwork vytynanka and silhouetted ones. In openwork vytynanka the image can be seen in cuts, but in silhouetted vytynanka the image in a silhouette. Depending on the technology of creation we distinguish single (from one sheet of paper) and complicated (multi-layered, from several sheets of paper) vytynanka. Nowadays, single and complicated vytynanka are used in advertisements, where they harmonically combine cut silhouette and openwork picture into a single whole image (Figure 4).

The eastern analogue of vytynanka is kirigami (from Japanese – to cut paper) in Japan. Kirigami is the art of creation of figures and postcards from paper of different form with scissors. The Japanese architect Macaxipo Chatani is believed to be the kirigami founder [21]. Now designers use the kirigami technique to create interior decorations and during pop-up objects creation. To create kirigami people use sheets of paper or thin cardboard, which are then cut and folded. Cutting makes it possible to create various scenes that have the reality effect due to the fast transformation from planar to volumetric form.

In design of printed production with movable elements the application (from Latin – applying) technique is used as well. The overlaying of details on a background is performed with some glue, which provides the creation of

Figure 4 – The technique of cutting out/cutting through in printed production design:

a – Osim poster, the social issue of the technological fatigue, Hong Kong; b – products package *Help cure hunger in New York*, the USA; c – the magazine with cut pages, National Association for the Blind: Donate eyes.

several layers of the object. Application appeared in the 16th century in France, where there was a paper silhouette fashion, and it spread rapidly in all the European countries [24]. Originally, straws were used for the application. Then people started to use cloth or leather pieces, paper and sunflower seeds, cereals, nuts, etc. instead of straws. These materials make applications look volumetric.

The synthesis of different paper modelling techniques became the base of the dynamical design objects development, which is based on the transformation. Transformation is the changes of initial forms and parameters during the existence and exploitation process. The main characteristics of the products dynamical form are the relations of content and form; their structural parameters are multiple ones. The integrity of dynamical product perception is provided by the synchronization of transformations, which are created on the level of volumetric and spatial structure and the figurative solution. A dynamical printed product gains the ability to change its spatial characteristics. Therefore, it forms new aesthetic properties and ways of communication. Visual communication is implemented on the individual, group, and mass levels due to the increase of dynamics.

The individual level of communication is designed for the interaction with each person individually. Firstly, dynamical images create the great opportunity for your own presentation by developing a portfolio. Thus, Sebahat Karcı has presented Pop-Up Portfolio (Turkey), in which they shown their works in industrial and graphic design [34]. Secondly, individual

communication is the important aspect of the educational activity [2]. The vivid examples of it are visual pop-up aids and pop-up encyclopedia. For instance, dynamical visual information about volcanic activity and it specific features, which is presented in the *Pop-Up Volcano* encyclopedia attracts people's attention (Figure 5, a). It is easier and more interesting for children to study and understand the properties of natural objects in the volumetric form. Encyclopedia *Prehistorica: Dinosaurs Pop-up Book (Dino Unit Study)* includes the research of dinosaurs' groups in the game form. All the pictures of ancient animals are volumetric and dynamical. They are placed on the centerfold and immediately appear after the book is opened. All the necessary information about animals is on the book pages (Figure 5, b).

Group communication between an organization and consumers is created due to the advertisements and other marketing programs for promoting goods to the market. For example, *Lacoste* have levelled up their advertisements, because they implemented the visualization of information with the brand history as the pop-up process [29] (Figure 6). The playful hand-made dynamics was created to celebrate the launch of new *Lacoste* fragrance and research the composition of assets and ingredients of the firm.

Mass communication level is considered as the life style that is implemented to the society. Pop-up technology is used to create releases of new films, cartoons, theatres or music albums for the entertainment industry. People create these products with some animated elements and use dynamics as the design means.

Figure 5 – Pop-up encyclopedias:
a – *Pop-Up Volcano*, Fleur Daugey; b – Encyclopedia *Prehistorica: Dinosaurs Pop-up Book (Dino Unit Study)*, Robert Sabuda, Matthew Reinhart

a b c

Figure 6 – Lacoste dynamical book – *A LIVE pop-up story*, Wildvertising agency, Ink Studio, France, 2014

Dynamical design methods became the base for the creation of animation in cartoon making and advertising. The famous modern cartoon Zack and Quack is created with the using of pop-up technology (Figure 7, a). The history of the Honda brand was recreated according to the pop-up technology; in it motorcycles and cars are sometimes getting out of a pile of papers and sometimes hiding behind them [27] (Figure 7, b-d). In analysed samples the main pop-up technology characteristics are multifunctionality and transformability that make it possible to create vivid artistic images.

We have analysed more than 300 samples of printed products with movable elements and ways of transformation of their artistic images.

a b c d

Figure 7 – Pop-up technique for the animation creation:
a – *Zack and Quack* cartoon, 2016;
b-d – the advertisement video *Paper* by *HONDA*, RPA agency, 2015

Therefore, we believe that there are constructive-kinetic, symmetrical, conditionally volumetric and image-kinetic visual systems according to the results of the analysis (Figure 8). These four groups of dynamical design systems are distinguished by different methods of form transformation that provides the creation of new content and image. Dynamical form of printed products is perceived as the system of movable elements of different level, which are concurrent conceptually, connected by communicative links and able to affect the content. Basically, it is material and spatial manifestation of the visual communication content.

The biggest group of dynamical printed products is ***constructive-kinetic visual systems***. They are multifunctional material structures that are able to change their form and image due to the using of various transformation methods, especially folding, disconnection, combination, rotation, stretching. Kinetic transformation (from Latin – that causes movement) is manifested in the dynamics of details, movable elements, in formation and image creation of design objects.

Folding/unfolding is a common design method that gives inexhaustible possibilities to create images of multifunctional forms. The process of transformation from a plane into a volume is used in design of pop-up books (Figure 8:1), leaflets, packages (Figure 8:2) and other printed products. It is aimed at the change of structure and tectonics of design objects. Kinetic pop-up transformation can be observed in the design of the book *ABC3D* by the designer Marion Bataille [33] (Figure 8:1). The specifics of using of dynamical printed products are the emergence of a new system quality that is indicative factor in package design. Accordingly, transport packaging, made from a thick cardboard, is folded into the hanger that can be fully used (Figure 8:2). *Nescafe* brand and Paris division of *Geometry Global* (WPP) have implemented the unique project *Pop-Up Cafe* within the campaign *Everything starts with Nescafe* [28]. The coffee brand has added an unusual element to their advertisement that is paper cups. In such a way consumers were able to combine useful with pleasure; they not only found out about the brand, but also had a cup of coffee.

Designers consciously expand the functions spectrum to extend the period of package use and give it the second life [38]. The disconnection method makes it possible to implement the ecological function of products. We observe it in the design of shopping packages Lee by Indian agency

Happy Creative Servioes, which is called *Never Wasted Bag* (Figure 8:3). Its typical feature is the possibility of transformation into different useful things, such as pencil holders, bookmarks, calendars, games, photo accessories, etc., after the bag is cut along the dotted lines [30]. Methods of folding and disconnection are the main ones to solve the issues of material saving and extending the duration of objects use; they make it possible to get the maximum aesthetic effect with minimum means. Dynamical design objects involves a consumer to the game during which the volumetric and spatial form creation. Business cards-transformers become real artistic works as the ways of self-presentation and as mini advertisement. Extraordinary design, additional functions and the possibility to get new artistic structures during construction effectively attract consumers' attention and are well remembered.

A big number of business cards and packages, which can change images, are created with the methods of combination and rotation. Retractable elements provide the transformation of typography (Figure 8:4) or the picture nature (Figure 8:6) due to the mechanical movement. The playing nature of the interaction helps to find creative solutions for printed products and create the effect of the picture animating with movable parts of the image [23]. The integration of a product and a package is not only aimed at the structural transformations, but it has the emotional colouring that is changed with the gradual usage of product (Figure 8:5).

Volumetric and spatial structures of dynamical visual systems are distinguished by the ability to change their basic form an infinite number of times. The rotation method has the wide range of possibilities to create different artistic images on the rotated objects, especially on the cups for drinks (Figure 8:6). Folding, combination and rotation are sometimes connected in one design system to create the informative dynamical message.

Stretch/compression is the unique innovative design method for printed products that is based on the possibility of a deformation of elastic material under load. Nowadays, plastic properties of materials and technological features of printing on every surface make it possible to experimentally search creative design solutions. Therefore, designers created a business card for a pulmonologist and printed it on rubber balloons. To read the text, written there, a client should inflate a balloon, so they are training their lungs (Figure 8:7). Creative using of stretch or compression transformation

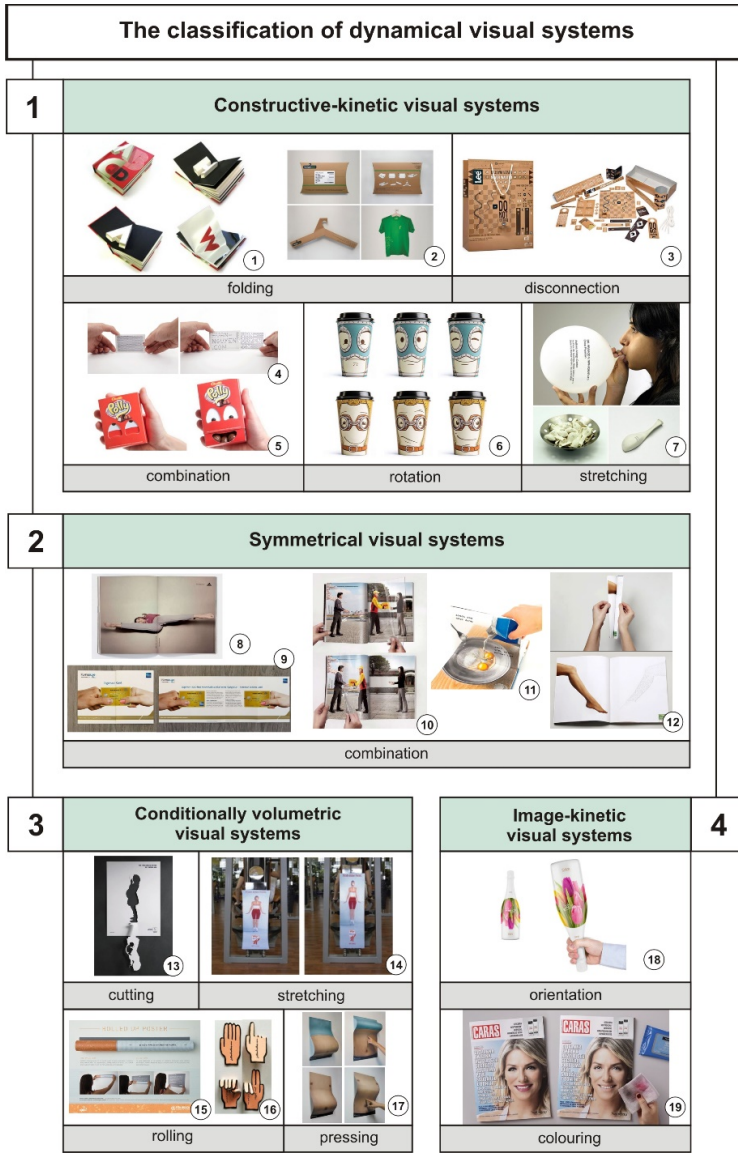

Figure 8 – The classification of dynamical visual systems

contributed to the multifunctional design object formation and the increase interaction with consumers.

The second group of dynamical printing industry is ***symmetrical visual systems***; in their design the combination method gets the new meaning. Symmetrical visual systems creation is based on the mirror symmetry geometry that is well implemented in design of book and magazine products. Bilateral magazine centrefolds are the perfect places to create dynamical images. The unfolding and flipping process itself already is the action that is reinforced visually. Such an example is the advertisement series of the sport brand *Adidas Forever* [40]. The forward and back movement of the page is symbolic and it represents the easiness of trainings (Figure 8:8). Metaphorical and associative links between the graphic printed image and the structural organization of the centrefold cause the formation of dynamical artistic images. The pages, which have additionally folded parts, are used to achieve a better associative similarity in printed products design. The artistic image in this case is created not by flipping, but expanding pages to length (Figure 8:9). For the creation of such a page the paper format is bigger than basic edition size. The transformation of a composite image into the expanded one is used to convey a metaphorical action of products cutting, opening the door, increase in the volume of goods, etc.

Symmetrical visual systems gain the new content during the flipping of the extra page that is transparent or paper with cut elements. The flipping of these pages changes the content of the artistic image during combination; it adds or hides certain visual elements. During the combination of the basic and additional image the new content is formed and there is a possibility of the other way of informational message reading. For example, the delivery service DHL uses the transparent sheet of PVC paper to visualize the service speed no matter how a person flips the page (Figure 8:10).

Designers create pictures with the illusory volume effect instead of three-dimensional paper models and illustrations from the groups of structural and kinetic visual systems. They are really close to the reality due to the usage of symmetry fundamentals. The emergence of the three-dimensional object happens due to the addition of a mirror coating on one of the sides of edition pages. The vivid example is the alternative Japanese book *Today's Dessert is* [41]. While reading, a person should create the right angle between the pages to have the correct mirror image (Figure 8:11). In such a way the combination

of illustrations, which are situated on the adjacent pages, is created and a three-dimensional picture appears, so people can interact with it easily.

One more way for the creation of a dynamical artistic image is applying an adhesive layer to one of pages of printed products or the using of point gluing of paper elements (Figure 8:12). It helps to demonstrate the action of tearing in real life. At the same time broken elements are formed or separated parts are stuck to the adhesive layer.

The third group of dynamical visual systems is ***conditionally volumetric*** ones. They are planar compositions that gain the illusion of the volume due to the cutting, stretch, folding and pressing. The modification of the material surface and projecting the object above the plane happens because of the cutting; during it the great role is played by the harmonious combination of the cut and silhouetted images (Figure 8:13).

The stretch method for the conditionally volumetric systems is used to show elongation and compression of a graphic image (Figure 8:14). The mechanical properties of material become important for the creation of the artistic image, because they give the possibility to resist loads and characterize the ability to deform and plasticity. For example, the creative team of Demner, Merlicek & Bergmann agency from Vienna created the business card with female breasts due to the usage of a rubber tab between two layers of paper. This conditionally volumetric business card for the doctor of plastic surgery Hajnal Kirpov allows the visitor to choose the breasts size on their own [12]. To do it they need to put fingers in special rubber dimples.

The using of the paper feature to roll makes it possible for designers to make models of rolled up objects, for instance, to imitate cigarettes in the social advertisement against smoking (Figure 8:15), or create the illusion of a volume and dynamics for different design objects (Figure 8:16). We can also change a plane to the conditionally volumetric form by the method of pressing. The design of posters that are hanging and people want to place them properly shows one more way to involve people to the active interaction (Figure 8:17). This type of posters is called push-up posters. They gained the popularity as the effective means of outdoor advertising that rapidly attracts people's attention and involve them to communication.

Image-kinetic visual systems are the fourth group of dynamical systems that demonstrate the transformation of the artistic image of an object without

the transformation of its shape. The image is created in two ways – when the orientation or colouring of object is changed. The vivid example is an image that has another essence in different spatial position (for instance, the combination of a champagne bottle with the flower bouquet (Figure 8:18)). Moreover, the colouring change helps to show radically different message concept due to the erasure of applied paint (Figure 8:19).

The dynamics in the printed products design becomes the distinctive feature of postmodernism era. Printed production with dynamical elements represents spontaneity and unusualness, which are based on the fast shape transformation that involves in a game and has the emotional colouring.

Dynamical design practice: the implementation issue.

The results of the scientific study have not only scientific, but practical value. Lutsk national technical university student Tatiana Klymiuk has designed several samples of social advertisement on the topic Radiate well-being! (2020), which is based on the theoretical research of dynamical printed products and the ways of their transformation. The advertisement is aimed at the attracting people's attention to the main social issues that are related to humanity, the desire to help, education of consumption culture, etc. [15].

The idea of the design development is based on the combination of the metaphor for action – radiate and the noun with the abstract meaning – well-being. This concept to be open-minded and share happiness and love with others can be seen in the whole work and is implemented in dynamical leaflets. Well-being is associated with the right actions, health, happiness and love. Therefore, within the *Radiate well-being!* concept these associations helped to create three thematic series of dynamical socially aimed leaflets.

1) *Radiate well-being* series make people consider helping stray animals and everyone who need help. The series is represented by two leaflets, in which the methods of valve extension and folding/unfolding are used.

2) *Radiate health* series shows the problem of lack of vitamins in people's meals. The series is represented by three leaflets in the fruit shape. The method of folding/unfolding is used to create the visual dynamics of the shape.

3) *Radiate happiness* series attracts attention to the harmonious upbringing of children and family love. The social advertisement shows that it is important to spend some time with people who are near you – to smile to the close person, buy a toy for your child or those children who cannot afford it. In such a way you will share happiness and positive emotions. In

dynamical leaflets the images of the sun, toys and heart are visualized. The methods of folding/unfolding, pulling out and rotation helped to find the optimal construction of the advertisement according to the image.

The best solution for the idea implementation as the series of innovative leaflets was the choice of a movable construction based on the constructive-kinetic system properties. The detailed description of each dynamical leaflet and their constructive features helps to understand the possibilities of different ways of dynamical products shape and image transformation to visualize creative concepts.

Radiate well-being series is represented by two dynamical leaflets – *Give a home to a four-legged friend* and *Help stray animals*. The size of two-sided leaflets is 210×100 mm. The concept is based on the house image.

On the one hand, a house is the materialization of ideas about well-being, cosiness, comfort, and protection. On the other hand, it is not only a fortress, but the inner world of a person that is filled with kindness. The author shows the contrast of two situations, which are on a street and in a house, by the characters' emotions and colour.

Help stray animals leaflet is transformed for the planar form into the volumetric one due to the folding/unfolding method that corresponds to the pop-up technology (Figure 9). The visual information, which shows the ways to help the dog shelter, is placed on the back of the leaflet.

Give a home to a four-legged friend dynamical leaflet suggest taking a dog home a taking care of it. Structurally, it contains retractable elements. Due to the picture of grass that is connected to retractable flappers, the animals disappear from a street and appear in a house (Figure 10). Technologically, movable elements are attached between the printed front and back sides, which are manufactured separately. The base is folded in the right angle and all additional elements are glued to it. The far the glued element is from the bend, the further it will be after the opening of the leaflet. This technology increases the customers' interest to the social advertisement.

Radiate health series shows the problem of lack of vitamins in people's meals (Figure 11). The series includes three leaflets that look like fruit, such as a strawberry, an apple and a pear. The motto *Health is natural vitamins* is placed on each design object. The leaflets, created by the folding method, are planar when closed. Each leaflet becomes volumetric due to the transformation of the inner form that looks like an accordion that is formed according the

Figure 9 – Dynamical leaflet *Help stray animals*, T. Klymiuk, 2020

fruit silhouette. The colourful paper folded in such a way is glued to the base. When the leaflet is opened, the paper accordion opens as well and looks like a fruit. The shape, colour, and look of the fruit are associatively concurrent with the motto that visualizes the source of natural vitamins.

Radiate happiness series is based on the image of a family as kind family relations; in their atmosphere a personality is born and formed. The using of dynamical form of leaflets greatly presents physical and sociocultural change

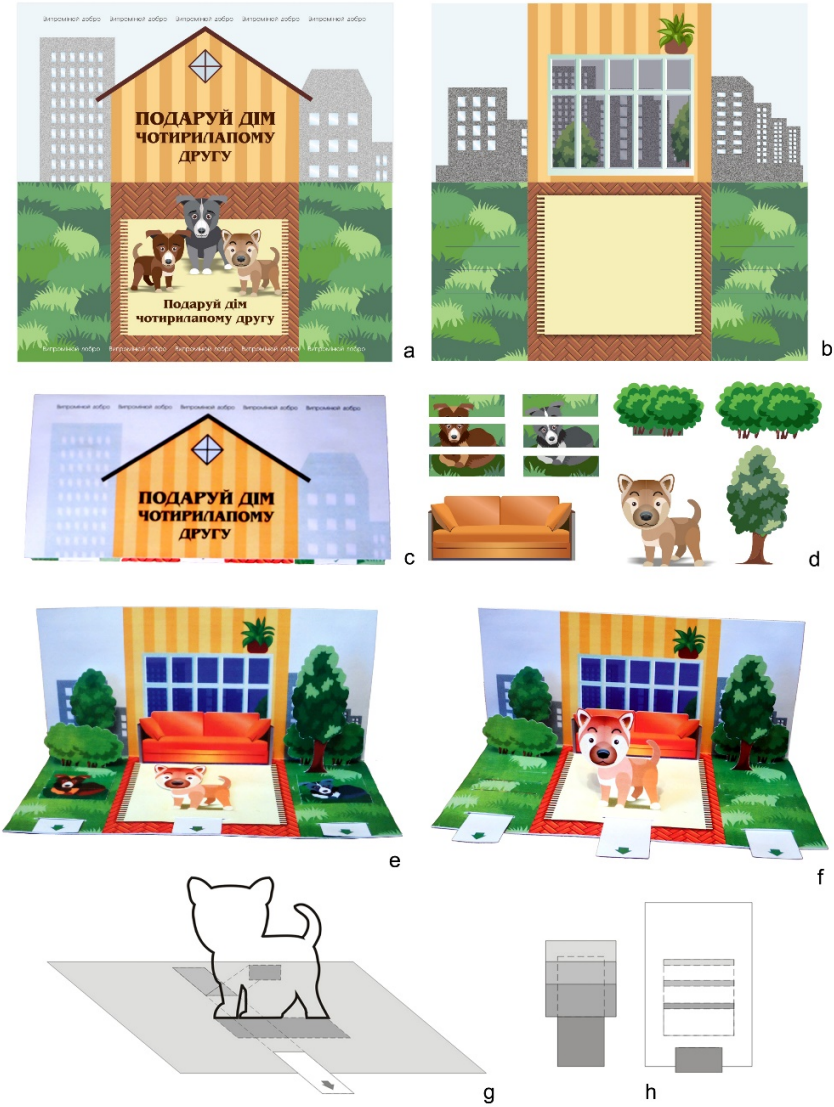

Figure 10 – *Give a home to a four-legged friend* dynamical leaflet, T. Klymiuk, 2020

of generations, which provides the possibility the society existence. The leaflets of *Radiate happiness* series are planar, but they contain movable elements. The series includes three leaflets – *Give a smile, Give a toy* and *Give love*.

Give a smile dynamical leaflet suggests being sincere, share a positive mood, and spend time with close people. The image of sun that comes out from behind the clouds is associated with the smile appearance on a person's face. The development has overhead layers with cuts; the movable elements are implemented there. Due to the retractable flapper, which is connected to the sun, the image movement is created (Figure 12).

Give a toy dynamical leaflet suggests spending more time with children, play with them and help orphans and poor children. It is created by the folding/unfolding method. After opening the image of the teddy bear appears. The creating of the leaflet is quite simple. We fold the base in the middle, like a book. The picture of a toy is also folded vertically and two diagonally and is glued to the base. It provides the possibility to fold/unfold the toy rapidly. In such a way a lot of leaflets with different images can be created (Figure 13).

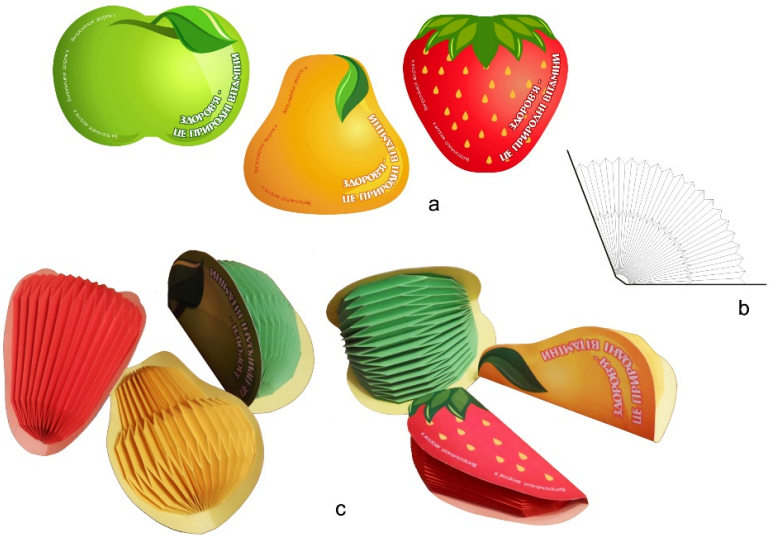

Figure 11 – *Radiate health* dynamical leaflets series, T. Klymiuk, 2020

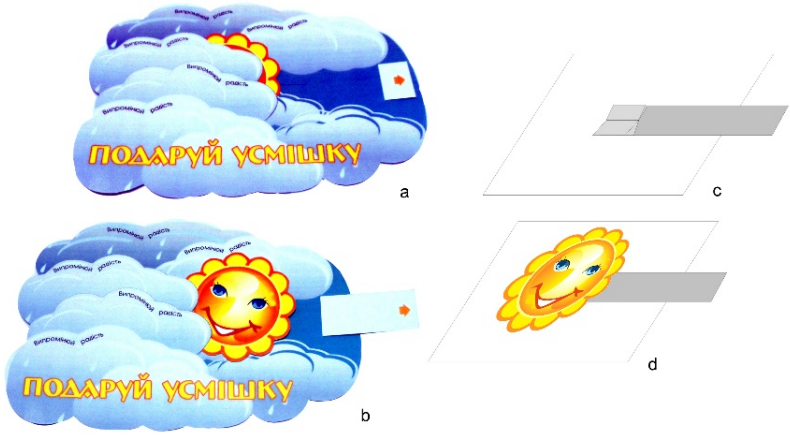

Figure 12 – *Give a smile* dynamical leaflet

Figure 13 – *Give a toy* dynamical leaflet

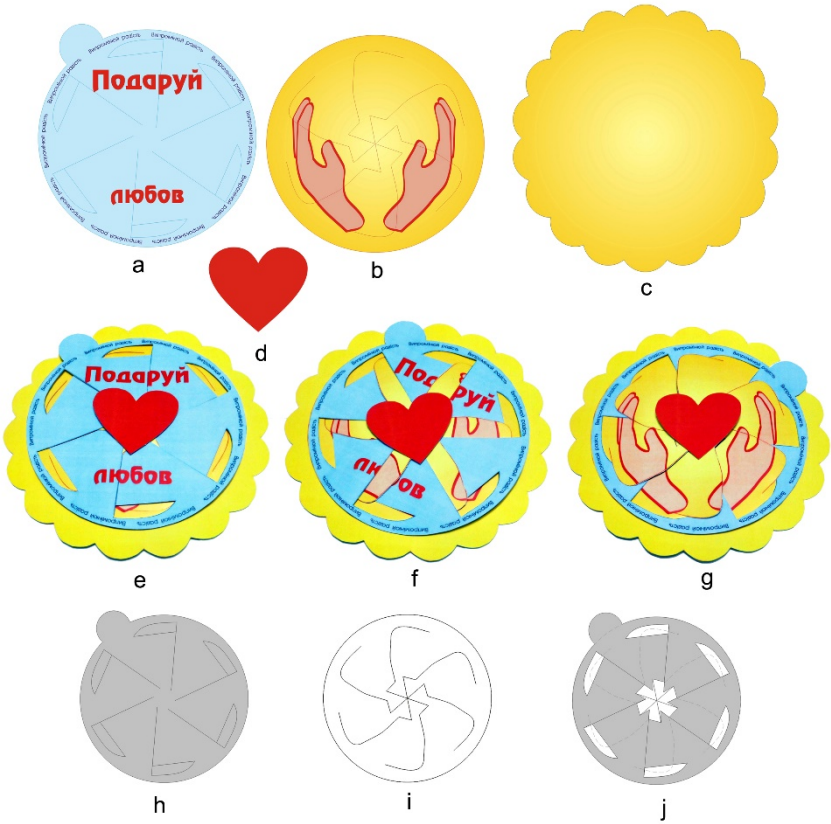

Figure 14 – *Give love* dynamical leaflet

Give love leaflet construction is based on the rotation of two paper circles that transform the picture (Figure 14). They are cut according to the particular scheme and nested into each other. The lower circle is attached to the base. Rotating the circles reveals the image of hands holding a heart.

This design development of social advertisement objects is essential for the formation of the culture and communication of people. The series of dynamical social leaflets includes the creating of advertisement media in such a way to actively attract people's attention. The advertisement promotes the humanity as one of the main human virtues. The unusual

dynamical design helps to understand the promoted issue better and save the leaflet for longer.

Conclusions.

In the study we revealed the theoretical and practical issues of the formation of dynamical visual communication in the printed production design. We proved that the changes in the structure and construction of design objects cause the transformation of their artistic image. It increases the quality of information perception and attracts consumers' attention. Nowadays, dynamics as the composition means in the printed production design widens the spheres of usage and includes package design, design of the book and magazine products, outdoors advertisement, and design of industrial objects, cloths and environment. Due to the dynamical visualization information is perceived as a game object and has the emotional colouring. The possibility of the transformation of the planar graphic image into the volumetric one became the base of the pop-up phenomenon development that is based on the kinetics fundamentals. The incipience and development of pop-up in the design and artistic culture is considered as a synthesis of paper modelling techniques. The pop-up essence is manifested in the context of the transformative formation that provides the dynamics of printed production elements.

In the study we formed the classification of dynamical visual systems in printing industry that allowed dividing them into the following groups, such as constructive-kinetic, symmetric, conventionally volumetric and image-kinetic systems. The ways of the transformation of the artistic image (folding, disconnection, combination, rotation, stretching, cutting, rolling, pressing, orientation or colouring change) helps to create the visual effect of the volume and movement.

We presented the development of the dynamical social leaflets series, in which various techniques and means of design were used, that was based on the theoretical research. Modern technology of the dynamical images creation, which is used there, is able to increase the communication of a person with design products. Consequently, the results of the work helped to form the base for the renovation of dynamical visual communication design methods in general and some of their aspects, which are related exactly to the printed products design.

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