

On the rights of the manuscript



MEDELETS NIKITA ALEKSANDROVICH

**FORM FACTORS OF THE PASSENGER CAR
(technological aspect)**

**Speciality 17.00.06 – Technical aesthetics and design
(Art criticism)**

**Synopsis
of the thesis for searching scientific degree
to candidate of art criticism**

Moscow – 2013

The work was performed at The all-Russian research Institute of technical aesthetics

Scientific supervisor: **Grashin Alexander Alexandrovich**,
Doctor of art history, professor,
head of the Department of design theory and
methodology of The Federal State Budgetary
Scientific Institution - The all-Russian
research Institute of technical aesthetics

Official opponents: **Simonenko Alexander Vladimirovich**,
Doctor of the technical science, professor,
laureate of the Russian government prize in
science and technology,
winner of the Russian government's award in
education, honorary worker of science

Obraztsova Tatyana Ivanovna,
Candidate of art criticism, professor,
Director of the Federal State budget
institution of higher education "State
University of Russia. AN Kosygin
(TECHNOLOGY. DESIGN. ART)"

Leading organization: **Moscow state Academy of art and industry
named by S. G. Stroganov**

The dissertation will be defended on September 27, 2013 at 11: 00 at the session of the Dissertation Council D 217.003.01 in The Federal State Budgetary Scientific Institution - The all-Russian research Institute of technical aesthetics by the address: 129223, Moscow, Prospect Mira, 119, All-Russian exhibition center of the Russian Federation, 312, The all-Russian research Institute of technical aesthetics.

The thesis can be found in the library of The all-Russian research Institute of technical aesthetics.

The synopsis was sent out and posted on the website of the Ministry of education and science of the Russian Federation Higher attestation commission and VNIITE on August 26, 2013.

Scientific secretary of the
dissertation council



Manolova O. N.

GENERAL CHARACTERISTICS OF THE WORK

Relevance of the study Automotive design is one of the leading areas of design in terms of the use of new technologies and materials. Currently, technology is one of the determining factors in the development of science and technology. New technologies give birth to new types of materials with certain properties. The widespread use of the concept of technology is associated with changes in the quality of people's life. The term is common not only in the scientific community, but also in everyday life, because the subject environment of a person is somehow connected with technology. Today, there are many definitions of the term technology, each of which is relevant to almost any human activity.

On the one hand, the term, which came from the sphere of exact sciences and production processes, seems far from the issues of design and, especially, art history. On the other hand, the practice of automotive design shows that the design, which is carried out by the designer together with design engineers and technologists and takes into account the features of production, is the most successful. Planning technological processes at the stage of product design, the designer can achieve the correct transfer of the design concept in the form of the finished product, and therefore-the implementation of the planned image and composition solutions and achieve artistic expression of the product as a whole.

The theme of the mutual influence of technology and materials on the shaping of the car is of particular interest to specialists in the field of transportation design, because, on the one hand, affects the overall effects of technology and materials for the product, and with another - to consider automotive design, particularly the design of cars as utilitarian and functional objects of mass industrial production. The presence of a wide range of innovative technologies and materials in the field of automotive design, in recent years, creates a situation in which it is difficult to find the optimal solution for a specific task. Therefore, there is no systematic classification of innovative technologies and materials for their use in project activities in this area. In addition, the formation of passenger cars, as well as the technical and methodological equipment of project activities within many automobile companies, is at a high level, but there is no clear strategy for introducing the most effective technologies and materials into mass production.

The peculiarity of using technologies and materials in automobile design is reflected in the appearance of a passenger car and its design, as well as in technical and operational characteristics. That is why it is obvious that the task of applying new technologies and materials in transformation of the existing volume-spatial composition of a passenger car.

Degree of elaboration of the research problem

From the design point of view, technology is considered as a way of organizing processes aimed at creating artificial objects. The purpose of the technology is to provide production reproduction of projected objects (Collection of works of The all-Russian research Institute of technical aesthetics,

release №11, 1975). New technologies and materials not only optimize the old production, but also form a new technical base of civilization.

At the beginning of the twenty-first century, the automobile became one of the experimental platforms for testing the use of new technologies and materials. Most of the research carried out in the field of the relationship between technology and auto design had either an applied, practical nature, where all aspects were worked out on specific existing mock-up samples, or to date have not been relevant. Interest in the topic of the interaction of technologies and materials was present in many studies by experts in the field of automotive design. Interest in the topic of the interaction of technologies and materials was present in many studies by specialists in the field of automotive design. Serial production of cars created a request for understanding the technological process, its qualitative improvement. Among domestic researchers should be distinguished Aryamov V.I., Brodsky V.Y., Dolmatovsky U.A., Zaitsev I.A., Zakharov A.N., Zelenov L.A., Ikonnikova A.V., Leonichev S.K., Muraviev G.G., Sorokin A.E., Peskov V.I., Podnebesnova S.A., Rozanov N.E., Somov U.S., Shugurova L.M. A special contribution to the development of ergonomic research in mechanical engineering was made by: Chaynova L.D., Munipov V.M. Among foreign researchers in ergonomics, it is worth to mention W. Woodson, D. Conover, Stewart Mackay, Gior Vardl, Nelson J. In these works, the technological issue is considered in great detail, and general ideas about the process of forming a car are given. The influence of design, materials and technologies on the shaping of an industrial product was studied by Bazilevsky A.A., Barysheva V.E., Grashin A.A., Minervin G.B., Runge V.F., and others. Special attention should be paid to the topic of mutual influence of technologies and materials on passenger cars abroad. Of interest are the statements of leading automotive designers published on the Internet and in periodicals such as: Raymond Loewy, Luigi Colani, Patrick Le Keman, Laurens van den Acker, Steve Mattin, Wolfgang Egger, Peter Schreyer, and Giorgetto Giugiaro, S. Pininfarina. and other Scientific work is also based on research in the field of design (six principles of design) by Professor L.A. Zelenov. Marketing research in the field of industrial design was carried out by the following authors: M. Press, R. Cooper, T. Brown, K. Ulrich, S. Eppinger. It should be noted the work of Azrikan D.A., whose works were devoted to design research and design programs. The environmental aspect of passenger car design and its relationship to new technologies is studied by many researchers in the automotive industry, both abroad and in Russia: Markiev M.I., Zaitsev S.A., Daniel J. Holt, John Enrietto, David Kayes, Jim Keller.

However, these studies do not consider technologies and materials in automotive design systemically, but only on the basis of specific examples. The experience of development of innovative technologies and materials and the nature of its influence on the shaping of passenger cars remains beyond the scope of these studies.

Research to identify new properties of materials and create new technologies has gone far ahead, and it is necessary to rethink all those design

methods that were relevant in the twentieth century, since modern technologies and materials are more effective in a number of parameters: environmental friendliness, safety, reliability, and time spent on the product production process. As practice shows, technological innovations have an increasing influence on both the exterior and interior of the car in recent decades. An example is actively developing information technologies. In order to track the dynamics of the use of technologies and materials in the automotive industry, it is necessary to systematize and typologize the main directions in this area.

Goal and objectives of the study

Goal: determine the role of materials and technologies as factors in the formation of a passenger car. To achieve this goal, the following **tasks** must be solved:

1. To carry out a scientific and methodological analysis of scientific approaches to the problem of the evolution of shaping in auto design in the twentieth and early twenty-FIRST centuries, taking into account the use of materials and technologies that are relevant and innovative.
2. To identify the main trends in the use of technologies and materials in automotive design, to demonstrate the integration of technological innovations with the shaping of a passenger car.
3. Systematize the main shaping factors in car design from the point of view of using technologies and materials that contribute to the improvement of aesthetic, ergonomic, consumer and production qualities that increase comfort and safety of movement on a vehicle, develop a matrix of shaping factors for creating passenger cars, taking into account the influence of technologies and materials.
4. Develop and justify a model for creating a passenger car, taking into account the impact of technologies and materials, including innovative ones.

Object of research - design samples of mass-produced passenger cars, as well as design projects of experimental and conceptual models considered from the standpoint of the technologies and materials used in the process of their design and production.

Subject of research - formative and structure-forming factors of passenger car design taking into account used or predicted materials and technologies.

Time limits of the study

Stage 1 - until the beginning of the middle of 20th - Engineering (by Mikhailov S.M. History of design vol. 1, 2.). Stage 2-middle 20th - middle 30th - Art Deco. Stage 3 – middle 30th - late 40th - Streamline. Stage 4 - 50-60th Detroit Baroque (aerostyle). Stage 5 – the middle 60th - the end of 70th - Box style. Stage 6 – from 80th till 90th - Biodesign. Stage 7 - the end of 90th - New Age. Stage 8 - the end of the 90th – the beginning of 2000th - High-Touch.

Hypotheses of the study

1. The development of the theory and practice of automobile design, the creation of the design image of a passenger car is due to current and innovative technologies and materials.

2. Technologies and materials used in the process of creating a passenger car should be considered as important formative and structural factors of design design.

Theoretical and methodological basis of research is general methodological principles of determinism, development, methodological approaches, a comprehensive, systematic, subject, resource, as well as structural and design approach to developing a project design form (Grashin A.A., Lavrentev A.N., Minervin G.B., Sidorenko V.F., Soloviev U.B., Shchedrovitsky G.P.); studies of Zarakovskiy G.M., Munipov V.M. are considered ergonomic parameters, environmental factors in the design form.

Method of research

The dissertation research uses common scientific methods: analysis, synthesis, typologization, modeling, as well as special methods: forecasting styles in auto design, design methods, methods of analyzing the properties of shape, technologies and materials in the designed products, methods and techniques of shaping, methods of design pointed of taking into account production factors, the method of reconstruction of design projects, structural and logical method, historical and chronological analysis of the use of technological innovations in the production of cars. Data processing method: construction of matrices, type orders, tables, diagrams, graphs, content analysis.

Reliability, reliability and validity of the results obtained are provided with compliance of its principal provisions with theoretical and methodological principles and set tasks, selection of adequate methods, a wide source base, successful testing of research fragments in applied design, and implementation of research results in educational programs.

The main scientific results obtained personally by the applicant, and their scientific novelty

In the dissertation research, the main formative factors of passenger car design are considered, taking into account the technologies and materials used in the process of their design and manufacture.

The theoretical analysis of scientific approaches to the problem of the evolution of shaping in auto design in the XX - early XXI centuries is carried out.

The existing design innovations in the modern automotive industry are presented and systematized.

The classification of technologies is carried out taking into account the specifics of production of passenger cars.

The main trends in the use of technologies and materials in automotive design are revealed, and the integration of technological innovations with the shaping of a modern passenger car is demonstrated.

New concepts of "formative technologies" and "not formative technologies" are introduced, and the essential characteristics of definitions are revealed.

The main formative factors of design in automobile design from the position of using technologies and materials that contribute to improving

aesthetic, ergonomic, consumer and production qualities that increase environmental friendliness, comfort, and safety of movement on a vehicle are established.

It is proved that the technologies and materials used or predicted in the process of designing or manufacturing a passenger car are considered as important formative and structure-forming factors. The design of a passenger car is developed on the basis of trends in the development of scientific and technical progress and formative factors: cross-cutting (General), viewed throughout the historical existence of passenger cars and specific, appearing at a certain stage of the development of auto design with the advent of new technologies and materials.

A matrix of formative factors for creating passenger cars has been developed, taking into account the influence of technologies and materials.

A model for creating a passenger car has been developed and justified, taking into account the influence of technologies and materials, including innovative ones. The model is a correct scientifically based tool for analyzing and synthesizing shape formation in the process of designing and creating a car. The description of the structure of the projected object assumes a methodical display for designers in a visual graphic form: the sequence and relationship of the main processes (stages and stages) of design, production, operation (consumption) and subsequent disposal of the product; design requirements for consumer properties, structure and shape of a passenger car; the content and meaning of the main factors of shaping, considered from the point of view of the materials and technologies used. The developed Model attaches great importance to the image of the design object, which must have an associative-cultural, constructive-technological and compositional-plastic integrity, since the image is the most productive and methodically active model of the future passenger car, since it contains ideas about the relationship of a person with the object of consumption and the environment. Moreover, the Model allows you to design with the expectation of economic efficiency, social significance, ergonomic and high aesthetic qualities of the product.

Specific guidelines have been prepared for the design of passenger vehicles based on modern technologies.

The personal contribution of the applicant consists in direct participation at all stages of the research process: in analyzing the problem in the scientific literature, studying the degree of its relevance, and determining the conceptual apparatus. At the stage of implementation of the empirical research, the author developed methodological tools that allow testing research hypotheses and clarifying the content characteristics of the model. at the empirical stage, the author processed, analyzed, generalized and interpreted the results of the research; the main publications on the completed work have been prepared, and the dissertation research has been completed.

The following provisions are made for protection:

1. The design of a passenger car is developed on the basis of trends in the development of scientific and technical progress and formative factors:

cross-cutting (General), viewed throughout the historical existence of passenger cars and specific, appearing at a certain stage of the development of auto design with the advent of new technologies and materials. Technologies and materials in the design of a passenger car are divided into form-forming and non-form-forming. They have different types of influence on the appearance of a car (direct and indirect).

2. The model of creating a passenger car taking into account the influence of technologies and materials is a correct scientifically based tool from the point of view of analysis and synthesis of the formation and design of a passenger car.
3. The factors of passenger car formation established in the course of the study are a serious resource for developing new conceptual models of passenger cars, taking into account the influence of technologies and materials (current and innovative), and determining promising directions for the development of the passenger car industry.

Theoretical significance of the work

The dissertation research made it possible to generalize the existing scientific and methodological experience in the field of auto design, to form a full-fledged scientific base and to put it as the basis for research on the features of forming a passenger car using technologies and materials.

The retrospective analysis of the development of new technologies and advanced materials in parallel with the demonstration of their influence on the formation of the appearance of the car can be used for research and educational purposes, as well as for further theoretical constructions.

The main provisions of the dissertation, as well as the recommendations proposed in it, can be used as a scientific basis for analyzing and determining the directions of development of the design design of a modern passenger car.

The main factors of shaping cars under the influence of technologies and materials identified in the study can be widely used in research on the theory and methodology of car design, as well as used in the process of teaching students in design-oriented universities.

Practical significance of the work

Identified in the study of the basic forming factors and developed a Model for creating a passenger car with the influence of technologies and materials, classification of technologies and materials can be applied in practice, the real design in industrial production and concept cars.

The main form factors and the Model for passenger cars can be used as a working material for the development of strategy, corporate identity, brand companies, range of products and can be recommended as a basis in marketing research manufacturers.

Testing and implementation of research results

The main scientific conclusions of the dissertation were presented by the author at the III scientific forum of designers "Influence of innovative technologies and materials on car shaping" (Moscow, 2012), the IV scientific forum of designers "Vehicle shaping. Figurative aspect" (Moscow, 2013)

scientific and practical conference "Young science. Automobile Faculty 2011" the article "The role of super graphics in auto design", scientific and practical conference "Color in design" with the report "Color and its influence on the design of passenger cars" (Nizhny Novgorod, 2012), the sixth international forum "Design - Enlightenment 2011" (Kharkiv, 2011), scientific forum "Semiotics in design" (Nizhny Novgorod, 2011), at the round table "What is industrial design?" as part of the Russian participation in the fifth annual world day of industrial design with the report "Environmental principle of passenger car design" (Moscow, 2012, The all-Russian research Institute of technical aesthetics), at the round table dedicated to the celebration of the world day of industrial design (Moscow, 2013, The all-Russian research Institute of technical aesthetics) with the report "Industrial design as a priority of the state industrial policy". Various aspects of scientific research were included in the collections of articles of the all-Ukrainian scientific and practical conference "Visualness in the context of cultural practices" (Cherkasy, 2011). The materials of the dissertation were discussed at extended meetings of the Academic Council of The all-Russian research Institute of technical aesthetics (2011, 2012, 2013).

The results of the research were published by the author in the following magazines: Natange Interoffice-FMD, in collections of materials: III and IV scientific forums of designers; Scientific and practical conference of students, postgraduates and young scientists of the automotive faculty of the Moscow State Industrial University (MSIU) Young science Automotive Faculty 2011; XII international scientific conference "Current issues of modern technique and technology»; including in reviewed magazines from the Higher attestation commission list (Scientific opinion, Human capital, Automotive industry, Design. Materials. Technologies). Total number of printed sheets: 14.2 p.s.

Information about the research fragments is published on the Internet in the form of separate articles: Advertology. The science of advertising. We don't buy a car, we buy emotions. 3.07.2013 (Advertology: [advertology.ru] URL: <http://www.advertology.ru/article116228.htm>)

The materials of the research work formed the basis of competitive tasks performed by the author of the study on automotive topics: 2012 BMW Group Urban Driving Experience Challenge <https://forge.localmotors.com/pages/competition.php?co=77#entries&tab=design-brief> 2011 DESIGN A CAR UNLIKE A CAR <http://designet.ru/education/career/?id=45031> 2011 international concept contest "Youth Time" "Space and the future of humanity" <http://designet.ru/competition/international/?id=44794>, VENCER Design Contest Join the victory 2012 <http://vencer.nl/>, Sketch Fighter SPD 2012, Sketch Fighter SPD 2013, Sketch Fighter IED 2013, Transportation 2050 Design Challenge Wacom, The competition "Car for the President", Design challenge Design dok-ing xd interior, and also used when creating a course project at the Italian school of transport design IED in 2012 by D. A. Tarelkin, were reflected in Gogolev's diploma project Convertible car in 2030 (the concept of a convertible passenger car 2030 from materials with shape memory).

Separate sections of the presented dissertation research formed the basis of educational disciplines for the preparation of masters of the course "Methods of vehicle design", "Technical component of vehicle design", "Basics of vehicle layout", taught at the Department of "Vehicle Design" at Moscow state Academy of art and industry. S. G. Stroganov.

Structure of the work

The dissertation consists of an introduction, 3 chapters, a conclusion, a list of references, and a graphic applications.

MAIN CONTENT OF THE THESIS

The **Introduction** justifies the relevance of the chosen topic, identifies the theoretical and methodological basis, the object and subject of the study; formulates hypotheses, the purpose and objectives of the study; discusses the scientific novelty, theoretical and practical significance of the study; provides provisions for protection.

Chapter 1. "Influence of technologies and materials on the evolution of car shaping" We consider the nature of the influence of technologies and materials, including innovative ones, on the formation of a car on the example of concept cars and passenger cars of mass production.

In the second half of the twentieth century, a completely new phenomenon arose that was not characteristic of previous historical periods: the morphology, structure, and appearance of many products began to experience a very significant influence of those technologies that can not be attributed to the formative ones. These technologies affect the design not directly, but indirectly (for example: light and strong bodies based on composite materials, Chevrolet Corvette C1 (1953-1962), Citroen Mehari (1968), Lancia Sibilo (1978). From design point of view, these two groups of technologies - formative and not formative should be considered separately.

Each technology generates its own closed class of forms, and together they potentially contain all the variety of conceivable forms (Bazilevsky A.A., Barysheva V.E. Design. Technologies 2009).

During developing a design project, technological processes are usually defined in a common way, fixing in principle the technology in accordance with which the products are designed. This fixation of the production technology, together with the formal elaboration of the design project, is quite sufficient for the subsequent construction on this basis of already working production processes (Bazilevsky A.A., Barysheva V.E. Design. Technologies 2009).

The essence of the technology is reflected and imprinted on the form itself (a series of forms), setting the distinctive visual characteristics of the product, this is the essence of shaping technologies.

Formative technologies are design and production technologies that contribute to the design and mass production of industrial products with improved operational, consumer, technological, and structural properties.

However, it happens not so often, when the shape of the product is rigidly set by the available technology. The process goes in the opposite direction: the need for new forms has an active impact on the development of production, dictates the search for new technological techniques and materials.

Not formative technologies are design and production technologies that have a little or no effect on the product morphology. The peculiarity of such technologies is aimed at transforming the internal, technical structure of the product, its design. As well as formative technologies - they are aimed at multiple reproduction of products.

Not formative technologies used in the creation of a passenger car, when visually assessing its external shape, are not as noticeable as the formative ones, and are not as large-scale. Moreover, these are technologies whose influence only slightly affects the aesthetic properties of the product. For the most part, they are associated with the replacement of structural elements, parts, miniaturization and microminiaturization of controls, the introduction of information and communication environments in the design object, heavy-duty materials, etc. This allows you to simplify and optimize the shape of parts and components of an industrial product, and in some cases even simplify the design and replace components with universal modules.

The introduction of alternative energy sources and new engines is hindered by the fullness of sales markets for automotive products that run on hydrocarbon fuel. Large automakers have economic justifications for the production of cars with internal combustion engines. The transition to a qualitatively new level of technological production dictates the need to modernize the existing one. Innovation is not every innovation or innovation, but only one that seriously increases the efficiency of the current system (Miloslavsky I.G., 2009). It should be noted that the peculiarity of innovation is that it allows you to create additional value with a focus on implementation.

In the context of the automotive industry, innovative technologies are technologies that are most in demand by the market during a certain period of time. There are several criteria that determine the degree of innovation of a car brand, namely: competitiveness in the global car market; modern robotic production; rapid change of the model range due to automated production and the introduction of CAD/CAE / CAM modeling.

Modern technologies in the automotive industry can be classified according to the following criteria: 1) technologies related to communications and communications; 2) various types of devices and ways to display information; 3) energy sources and power plants; 4) innovative materials and coatings; 5) principles and effects of movement; 6) methods and methods of management; 7) lighting; 8) methods of implementing design design; 9) technologies related to the processes of obtaining and processing materials and forms.

As a product of a complex technological process, the car is constantly undergoing changes, from setting design tasks to optimizing Assembly on the conveyor, which is reflected in its appearance.

The influence of technologies and materials on the design of the car can be divided into two groups.

- 1) Direct influence, in which there is a visible change in the morphological structure of the vehicle (a direct change in the quality of utilitarian and functional characteristics of the car and its volume, size; radical changes that affect the figurative and plastic solution of the body, replacement, unification of nodes and aggregates; integration of individual blocks into single modules. (Bugatti Type 57SC Atlantic 1936, Lincoln Zephyr 1936, Sbarro Osmos 1989, Renault DeZir 2010).
- 2) Mediated (indirect) influence on the morphology of the object, as a rule, does not imply changes. Thus, in contrast to the first group, there are no visible changes under indirect influence, but they are expressed in changes in physical, technical, and operational parameters, such as weight, strength, structural rigidity, the use of new materials for the body, etc. (1978 Lancia Sibilo (Bertone)).

The external shape of the car depends largely on the design and layout, on the materials used and manufacturing technology of the body, chassis, glazing, lighting components, etc.

In turn, the emergence of a new form makes us look for new technological techniques and new materials. Analyzing the historical development of the automotive industry, we can see the following trend.

As innovative technologies and materials appeared and were introduced into production, the figurative and plastic solution of the vehicle changed. Only the basic layout of the main structural elements remained unchanged.

Passenger cars from the point of view of the sphere of production can be classified on the following grounds:

- character (type) of production;
- type of construction materials;
- method of processing materials.

As an example, protective coatings on the body and on the glazing of the car that improve performance. Another typical example is the restyling of the BMW 3 series in 2009, the hood of which is based on the stamp of the previous model in 2006, but added two forming lines on the hood, made by rolling rolls.

By the nature of production, passenger cars are divided into concept cars (demonstration models) and production models.

According to the type of structural materials, passenger cars are based on the body structure of which light metal alloys are used (Audi A6 2011);

- passenger cars based on heat-resistant, impact-resistant and wear-resistant polymer materials (Lexan) (1978 Lancia Sibilo (Bertone));
- passenger cars based on heat-resistant, impact-resistant and wear-resistant polymer materials (Lexan) (1978 Lancia Sibilo (Bertone));
- passenger cars that traditionally use steel as the basis for their body structure (LADA Priora);

Technologies and materials were a key factor in shaping the development of the automotive industry.

Conclusions for chapter 1.

1. The technological aspect of designing a passenger car is one of the defining ones, since many parameters of the future product, including its appearance, depend on it.
2. Technologies and materials have both a direct and indirect influence on the formation of the design object. Under direct influence, there is a visible change in the morphological structure and external shape of the vehicle. With indirect influence, visible changes are usually not observed, but they are expressed in changes in physical, technical and operational parameters.
3. Technologies are divided into form-forming and non-form-forming. Shaping technologies are design and production technologies that result in a visible change in the morphology and appearance of the car. Non-formative technologies are design and production technologies that have little effect on the morphology of the product.

Chapter 2. “The role of imagery in the design of a passenger car, taking into account the influence of technologies and materials” The author substantiates the relationship between the created design image of a passenger car and the technologies and materials used and predicted.

In addition to technological aspects, other factors influence the formation of the car. When designing any industrial product, the designer faces the problem of finding an image. The image consists of many factors. The image does not always follow from the functional purpose of the thing, sometimes it is based on the characteristic features and features of an object or phenomenon that is not logically related to the direct functional purpose of the projected object.

In European schools of transport design and automobile companies, the search for imagery at the initial stage is associated with analytical work: strategy development, analysis of the market situation, consumer preferences (they study the socio-cultural characteristics of the environment for which the vehicle is intended, select a target group, and also look for inspiration in things that are detached from the car). For example, the image of the car, originally conceived by the designer, could be inspired by the property of water or the smooth lines of the sea wave, which were embodied in the plastic body.

In the automotive industry, the project image is laid at the stage of analysis of the initial project situation and marketing research. When designing a car, the designer must focus on the consumer. The ergonomic factor is an integral part of the design in this context. When creating the appearance, you must take into account the perceptual factor, means, how the vehicle will be perceived by the consumer. Whether the car will generate positive emotions and encourage you to buy and form intentions to drive a vehicle. In many ways, it depends on the current image, since the first thing that a person pays attention to and evaluates when "getting acquainted" with a new object is the appearance.

Project image of the passenger car (Soloviev U.B. and others., Method of artistic design. – Moscow.: The all-Russian research Institute of technical aesthetics, 1983.) - this is a complete art and design form of a passenger car, in which all the parts are coordinated with each other and with the whole in accordance with the content expressed in this form, in other words, it is a subject - expressed meaning in a specific model of a passenger car.

In a situation when we design a serial passenger car, in addition to general issues of ergonomics, safety, manufacturability, and economic factors, there is a question of determining its consumer properties. It is important at this stage to determine how effectively the product will be sold in a particular country or region, what technologies and materials will be used in the production of a passenger car, including innovative ones, which forms the design image of the vehicle.

The image of the car also depends on the gender factor. In addition to the points related to the direct production of the product (design parameters, choice of layout scheme, choice of engine type, choice of protective and decorative finishing materials, configuration), there is a parameter that is responsible for who the designed car will be addressed to: a man or a woman. As a rule, this parameter is more based on the stereotypical attitudes that exist in society - men's and women's attitudes to things are different. In this case we are not talking about funkcionalno-the target class of the car (who is it designed for men or women), and artistic expression of the product of those associative relationships that arise at the mention of gender roles, for example: male type (rude, aggressive, pragmatic, rational, large size, clear symmetry and austerity, minimalism svetovanje of decision, brutality, conservatism in the use of composite plastic solutions, simple forming techniques, absence of decorative elements in the decoration). A good example here is the Mercedes-Benz g-class geländewagen SUV. Women's type (smooth, soft, fluid forms, small dimensions, as a rule, these are cars of A, B class, luxury in interior decoration, rich color scheme, compactness, miniaturization, expression in appearance. For Example: Nissan Micra, Audi A2.

Speaking about the image of a passenger car, it is impossible not to mention the typology of consumers, since this factor affects the design of the vehicle. The author of this research paper offers a typology of consumers according to different classifications. For example: by social and psychological characteristics (by level of education , by personality type, by income, by age, by gender); classification by social status (individuals, families, intermediaries, middle class, upper class.

Conclusions for chapter 2.

1. The shape of a car is significantly influenced by the figurative aspect. The design image is formed on the basis of the compositional and stylistic solution of the designed product. In the automotive industry, the project image is laid at the stage of analysis of the initial project situation and at the stage of development of the project concept, marketing research.

2. The paradox of the design image of a passenger car is its duality. On the one hand, we observe the image of a vehicle as an initially developed utilitarian and functional structure. On the other hand, the image is built under the influence of ideas and concepts of modern design, new materials and technologies.
3. The specificity of the search for imagery depends on the specific task set for the designer. As a rule, in conceptual developments, the role of imagery is given a leading place, while in the search for the form of a new model of a serial car, the main point is social, including socio-economic, consumer, technological and functional aspects.
4. The image structure and transformation of a modern passenger car of the same class, layout or body type largely depends on the introduction of innovative technologies and materials into production. The image of the car also depends on the gender factor.
5. The image factor is a factor that affects not only the aesthetic component in the design of a passenger car, but also the structural and functional structure.

Chapter 3. “The main formative factors in the design of a passenger car, current trends”

As a rule, shaping factors are the result of the influence of scientific and technological progress, environmental problems, road safety issues, as well as changes in consumer preferences.

In the practice of design design, there are a number of design requirements that determine the consumer properties of the finished industrial product. These requirements must be met when designing an industrial product throughout its entire life cycle. In the process of developing an industrial product, the designer constantly addresses these requirements (Minervin G.B. Architectonics of industrial forms. 1974). The Genesis of these requirements depends on the specific socio-economic characteristics of production and consumption. At the same time, the main attention is paid, on the one hand, to the function, ergonomics and utilitarian component of the product, and on the other - to minimize labor costs and materials. When designing, there is a relationship between design requirements and shaping factors. Here, the main shaping factors are considered in the context of the influence of materials and technologies on the shaping of a passenger car.

1. The utilitarian-functional factor. The main function of the car as a means of transportation has not lost its relevance. The wide spread of the idea of an individual vehicle has led to the creation of individual vehicles that are tailored to the needs of a wide variety of consumers. At the same time, the formation of a passenger car directly depends on and adapts to the behavior of each of the specific types of consumers. In this regard, when designing a passenger car, it is necessary to take into account a whole range of utilitarian, functional and ergonomic issues related to the operation of the product. At the same time, the creation of a car is carried out at the level of the dialogue between the person and the product. The utilitarian-functional factor includes

the design of the "thing-person" relationship, the user interface, as well as the development of an emotional - behavioral scenario of interaction between the subject and the object of design.

2. The ergonomic factor. At all stages of design, a person is the main link around which the process of creating an industrial product is carried out. The human-machine connection is clearly shown through ergonomics. The space in which we live today is permeated with an information field. All work at different levels is based on interactive technologies. The advantages of this are obvious: speed of decision-making, optimization of processes, ease of operation, rapid exchange of information, ease of access, mobility. Therefore, the car, like any other object from the subject environment, did not remain without attention of IT technologies. Most modern passenger cars are equipped with such automated systems that significantly facilitate the driver's control, as well as provide communication with the outside world. GPS Navigator, immobilizer (anti-theft electronic device that deprives the car of mobility), Parktronic (Parking radar), WI-FI Internet access, not to mention the fact that the car can be controlled by itself without the participation of the driver (developed by Google).

3. Social factor. One of the most important factors. The social factor expresses the socio-cultural requirements imposed on the product in terms of compliance with its social needs and purpose. It covers a wide range of tasks related to people and cars, as well as ergonomic criteria. This is a motivating principle, without which no project task is complete, since at this stage the target audience, price niche, needs, expectations of the consumer are identified, and the goal is set for which all further work on creating a passenger car is unfolded. At every stage of creating a car, from idea to implementation, the designer constantly focuses on the needs of various social groups.

The etymology of the word "car", the literal translation of which is "self-moving", emphasizes the independence of the owner, who moves freely and at his own discretion. Such a specific quality of the car could not but affect its shape. Plastic car bears the features of its owner, who chose this form of car, expressed his preference for a very specific function and driving conditions. So, plastic becomes a carrier of specific information, which is expressed in a certain language. The wide spread of the idea of an individual vehicle has led to the creation of individual vehicles that are tailored to the needs of a wide variety of consumers.

At the same time, the formation of a passenger car directly depends on and adapts to the characteristics of the preferences of a certain social group of consumers.

4. Safety factor. The exterior shape of the car is also strictly regulated by international safety standards. Thus, the front of the car must have certain slopes and protrusions, as well as made of shock-absorbing materials that guarantee a reduction in the risk of pedestrian injury when hit. At the moment, technologies are being developed that are non-formative and indirectly affect the design, which are focused on security. Various devices for preventing collisions and

emergency approach to other road users, parking sensors, emergency automatic braking devices.

An excellent example is the security system offered by Subaru.

With the help of a laser, it is possible to distinguish even bicycles in heavy rain and snow, which are known to have weak protection in road traffic, and this is a big plus for cameras. The Subaru Eyesight security system has two cameras instead of eyes. In addition to the two CCD cameras, the system is a "brain", i.e. the corresponding microprocessor, equipped with software for driving the car, image recognition, and the engine that controls the 3D image. This system monitors the situation on the road, taking into account the spatial component of the road surface and roadway.

At the beginning of the implementation of Eyesight technology on public roads in traffic jam mode, there was a request "to improve the response to acceleration a little more", but 2 hours, three, a week of driving gives a reliable high level of safety. At a critical moment, the car issues a warning, and, in addition, it seems to stop itself.

5. The aesthetic factor. The aesthetics of industrial forms plays an important role in shaping the appearance of the product. As a rule, the aesthetic factor is influenced by the requirements of production and consumption. The aesthetic factor is aimed at improving properties of the products, its external and internal structure means and methods of project design, namely: the compositional form-finding, harmonizing its elements, organization of the spatial structure by means of composition, to achieve compositional integrity. The purpose of the aesthetic factor is to harmonize the shape based on the existing morphology of the product. The aesthetic factor is one of the main formative factors. The content of the product expressed in the form is shown only through the aesthetic factor.

6. The image-emotional factor. Recently, the importance of the image-emotional factor for mechanical engineering has been increasing, since it is associated with both social and aesthetic factors. Due to the fact that the technical and technological equipment of many automobile companies is at a fairly high level, you can draw attention to the product and compete on a figurative and emotional level. The car "reflects the emotional energy" that the consumer expects from it. In practice, mass-produced mass products always differ (with rare exceptions) from conceptual developments. This is most typical for auto design. Therefore, there is such a phenomenon as "inertia" of forms, which is characterized by a consistent transformation of the design and shape of the product on the basis of already developed and well-proven in practice images. The "inertia" of forms is based on stereotyped thinking and consumer perception. Raymond Loewy - a well-known American designer developed the principle of MAYA - Most Advanced Yet Acceptable. When designing an object, the designer must balance between originality, which makes it possible to stand out among competitors products, and novelty, which would be understandable to the consumer.

In fact, it is no longer the car itself that is being sold, but the feelings and experiences that the consumer will get from owning a car. The etymology of the word "car", which literally translates as "self-moving", emphasizes the independence of the owner, who moves freely and at his own discretion. Such a specific quality of the car could not but affect its shape. Plastic car bears the features of its owner, who chose this form of car, expressed his preference for a very specific function and driving conditions. Thus, plastic becomes a carrier of specific information that has a certain figurative and emotional language.

The image-emotional factor includes not only the external component (the aesthetic value of the car's appearance, brand style, build quality, finish), but also a set of significant aspects that affect consumer preferences: the prestige of the brand of the chosen car, the image component, reliability and comfort of movement. So, the car from a simple means of transportation turns into a kind of accessory, endowed with a certain semiotic meaning and for the implementation of original design solutions, it is necessary to introduce new technologies and materials.

7. The stylistic factor. The stylistic factor is considered together with the aesthetic one and is its component. Each car brand has its own clearly recognizable style. All shaping is built in accordance with this style. From the forties to the late sixties of the last century, automotive design developed under the rather lighthearted slogan: "through interest and surprise to the joy of possession". Management beginning in the design fade into the background. At that time, styling prevailed, the task of which was to influence the consumer through subjective experiences.

The current state of development of new cars is characterized by a variety of layout solutions and body styles. There is a process of development in a spiral, the process of rethinking the layout schemes, technologies and design known in different periods of the car's history. All this is filled with new content in the form of modern achievements in materials, technologies, and structures. At the same time, since the beginning of the 90s of the 20th century, we can note a surge of completely new elements of body styling, the appearance of key design solutions that dramatically changed the appearance of cars, which became possible with the advent of new materials and technologies.

8. Environmental factor. The environment in which we live, as well as everything around us, is undergoing changes. Historically, the passenger car was used in large cities. This was primarily due to the fact that the first car factories were located within the industrial districts. The growth of cities, the accelerating pace of life of the population required the creation of a fast car for citizens. The environment in which the car was used influenced its formation. As cities became larger, the requirements for passenger cars changed, which affected their formation. Safety of movement, possibility of parking lots, compactness, including from the point of view of movement in the general flow of cars, the use of eco-friendly energy sources and materials, ease of construction for more economical fuel consumption, stylistic connection with the surrounding

elements of the urban environment were reflected in the appearance of passenger cars.

9. Ecological factor. In modern conditions, most automakers are puzzled by the improvement of the environmental situation of the environment. Of course, the hydrocarbon fuel is not infinite, and therefore there is an active search for alternative energy sources. So, cars are gradually being re-equipped with hybrid power plants, electric motors, motor wheels, hydrogen fuel cells, engines running on compressed air, ethanol, methanol, natural gas, biodiesel and solar panels, and even water and carbon dioxide (SAIC Leaf 2010). International environmental standards make adjustments to the production of passenger cars. Recently, all international car shows have electric vehicles. Noise reduction is one of the tasks of the design factor. Thus, in the strategic program for the introduction of priority automotive technologies and environmental protection technologies in Japan until 2025, one of the points is a twofold reduction in car noise compared to the level of 2000.

10. Constructive factor, production and technological. Unification and aggregation have been firmly integrated into the automotive industry since the opening of the Ford Assembly line. Modern mass industrial production is impossible without automation, unification and typification of many processes. At its core, the car is a prefabricated structure, often assembled at different production sites. This Assembly system proved to be the most efficient and cost-effective, and therefore has an innovative character.

Many manufacturers try to save money on component parts, and therefore the same parts are transferred from model to model, sometimes being replaced with new ones. The same thing happens with platforms. So, to save on production, automakers are making new models based on existing vehicle platforms. Therefore, unification and aggregation are an integral part of the design process.

To solve the issues related to optimization of design work on the design of a passenger car, the dissertation research suggests a model for creating a passenger car, taking into account the influence of technologies and materials, including innovative ones. As a basic model, the scheme of formation of industrial forms proposed by Minervin G.B. (Minervin G.B. Architectonics of industrial shapes. Release 2 1974.). The model allows you to analyze the initial data at each stage of design, to identify: consumer properties (functionality, strength, easy of use, economic accessibility, attractiveness of appearance, style acceptability, aesthetic properties, social and utilitarian properties) and consumer preferences, production requirements, operational requirements, socio-economic features, form factors. The model is a complex multi-level structure consisting of interconnected elements. The first level of the structure consists of a set of basic design requirements for an industrial product (passenger car), which also includes production and consumption requirements, which take into account such points as consumer properties and industrial production capabilities. The second level shows the influence of the main shaping factors on the content and shape of the product (car). The third level

consists of a set of principles and requirements of compositional work (this includes techniques and means of composition, which determine the structure and external shape of the finished product).

Conclusions for chapter 3.

1. The shaping of a modern passenger car is the result of the synthesis of many factors and trends that contribute to the appearance of qualitatively new innovative products on the global automotive market. The formative factors of designing a passenger car are a complex multi-level system, within which the search and creation of original design solutions is carried out. The process and methods of creating a car shape as a complex system is carried out taking into account a variety of trends. The following are the main factors that account for the process of shaping a passenger car under the influence of technologies and materials: 1. The utilitarian-functional factor; 2. The ergonomic factor; 3. The social factor; 4. The safety factor; 5. The aesthetic factor; 6. The image-emotional factor; 7. The stylistic factor; 8. Environmental factor; 9. Ecological factor; 10. Constructive factor, production and technological.
2. The model of creating a passenger car, taking into account the influence of technologies and materials, is a correct scientifically based tool from the point of view of analyzing and synthesizing the formation and design of a passenger car.
3. The factors of formation of passenger cars established during the research are a scientifically based resource for the development of new conceptual models of passenger cars, taking into account the influence of technologies and materials (relevant and innovative), and determining promising directions for the development of the passenger car industry.

The **Conclusion** summarizes the conclusions made at the end of each Chapter. The conclusions of the dissertation are intended to help clarify ideas about the impact of technologies and materials (relevant and innovative) on the creation of promising areas in the field of design and engineering of passenger cars.

In the dissertation research, the main shaping factors of passenger car design are considered, taking into account the technologies and materials used in the process of their design and manufacture. The theoretical analysis of scientific approaches to the problem of the evolution of shaping in auto design in the XX - early XXI centuries is carried out. The existing design innovations in the modern automotive industry are presented and systematized. The classification of technologies is carried out taking into account the specifics of passenger car production, the main trends in the use of technologies and materials in automotive design are identified, and the integration of technological innovations with the formation of a passenger car is demonstrated. Technologies and materials used or predicted in the process of designing or manufacturing a passenger car are considered as important formative and structural factors. The design of a passenger car is developed on the basis of

trends in the development of scientific and technological progress and formative factors: cross-cutting (general), viewed throughout the historical existence of passenger cars and specific, appearing at a certain stage of the development of car design with the advent of new technologies and materials.

In this thesis carried out the systematization of the main formative factors of design in automotive design from a position of use technologies and materials that improve the aesthetic, ergonomic, consumer and industrial qualities that enhance environmental friendliness, comfort, safety of movement on the vehicle, presented in the developed matrix forming factors in creating cars with the influence of technologies and materials, introduced a new concept of "Formative technologies", "Not formative technologies», the essential characteristic of definitions is revealed. After an in-depth analysis of most technologies and materials, formative factors were proposed, taking into account the influence of materials and technologies on the design of a passenger car: image-emotional, environmental, stylistic, industrial-technological, utilitarian-functional. In addition, passenger cars are divided by technological and production characteristics: the nature of production; the type of used materials; the method of processing materials.

The Central scientific result of the dissertation was a Model for creating a passenger car, taking into account the influence of technologies and materials, including innovative ones. The model is a correct scientifically based tool from the point of view of analysis and synthesis of shaping and design of a passenger car. It was created for the purpose of presenting the project idea and its further implementation in a material form. A description of the structure of the designed object suggests methodical screening for the designers in graphic form: the sequence and interrelation of the main processes (stages and phases) of the design, production, use (consumption) and disposal of the product; design requirements to consumer properties of the car; the contents and meaning of the basic factors of forming, with reference to the used materials and technologies as the important factors of such shaping. In this model, great importance is attached to the image of the design object, which must have associative-cultural, structural-technological and compositional-plastic integrity, since the image is the most productive and methodically active model of the future passenger car, since it contains ideas about the relationship of a person with the object of consumption and the environment. Moreover, the model allows you to design with the expectation of economic efficiency, social significance, ergonomic and high aesthetic qualities of the product.

Technologies and materials, as one of the factors of design design and shaping, play an important role in production. The nature of their influence on the design of the exterior shape of a passenger car is ambiguous. This influence can be direct or indirect, and depends on the tasks that need to be solved in a given situation. In the context of creating the morphology of the product, artistic and plastic solutions to its form, technologies are conditionally divided into formative and not formative. Forming factors directly depend on the state of the technical process, the development of innovative technologies, the inertia of

traditional applications, as well as on the materials used in production. Non-formative factors are usually not shown or expressed in the plastic forms of the project. They almost do not participate in the formation of the concept, but only change or improve the utilitarian-functional, aesthetic, technical, ergonomic, and consumer properties of the product.

Based on the results of the dissertation research, specific methodological recommendations aimed at designing a passenger car with regard to technologies and materials were prepared. Separate sections of the presented dissertation research formed the basis of educational disciplines for the preparation of masters of the course "Methods of vehicle design", "Technical component of vehicle design", "Fundamentals of vehicle layout", taught at the "Transportation Design Department" of Moscow state Academy of art and industry named by S. G. Stroganov.

AUTHOR'S PUBLICATIONS ON THE TOPIC OF THE DISSERTATION RESEARCH

Publications in peer-reviewed magazines, confirmed by by High Attestation Commission of Ministry of Education and Science of Russian Federation

1. Medelets N.A. Problems of searching for new stylistic solutions in the domestic automobile industry. / Automotive industry. - Moscow.: Mechanical engineering, - 2012. - №10 0,25 printed sheets.
2. Medelets N.A. Influence of gender factor on the formation of car design. /Human capital. - Moscow.: Buki Vedi, - 2012. - №7 (43) 0,3 printed sheets.
3. Medelets N.A. Environmental principle of passenger car design. / Design. Materials. Technologies. – Saint Petersburg.: State University of Technology and design. - 2012. - №4 (24) 0,5 printed sheets.
4. Medelets N.A. Trends in the design of passenger cars on the example of AUDI lighting technology. Scientific journal. Scientific opinion - Saint Petersburg.: Saint Petersburg University consortium. - 2013. №2. 0,5 printed sheets.

Scientific publications in other publications

5. Medelets N.A. The role of an supergraphic in the car design / Youth science AF 2011/ - Moscow.: Moscow State Industrial University., - 2011. 1,6 printed sheets.
 6. Medelets N.A. Color and its influence on design of passenger cars. / Natange Fashion Marketing Design – Moscow.: Natange Interoffice - FMD, - 2013 №30 0,25 printed sheets.
 7. Medelets N.A. Influence of innovative technologies on car design. Third scientific forum of designers. Collection of materials. – Moscow.: Union Print – 2011. 0,25 printed sheets.
 8. Medelets N.A. Monograph. The interaction of design, materials, technology on a passenger car. – Saarbrücken.: LAP LAMBERT Academic Publishing – 2013. 10,3 printed sheets.
 9. Medelets N.A. Industrial design as a priority of state industrial policy / XII International scientific conference “Actual questions of modern techique and technology”. Collection of reports/ - Lipesk.: Gravis – 2013. 0,25 printed sheets.
- The entire amount of printed sheets of the whole publications: 14,2 printed sheets.

Internet resources:

Medelets N.A. We don't buy an automobile, but we buy emotions

http://vk.com/designilove?w=wall-26484484_890

<http://awards-4-you.livejournal.com/23609.html>

http://www.journal.art4you.ru/blog/news/nikita_medelets_my_pokupaem_ne_avtomobil_my_pokupaem_emotsii/

<http://www.novate.ru/blogs/show/ART4you/?act=newrecord&preview=1&persistent=aQAYBgqUO8ebx1egSRTk1uF39vsxykPA>

http://www.advmarket.ru/counter/archive_news.php?id_news=1198

<http://www.advertology.ru/article116228.htm>

Synopsis
of the thesis for searching scientific degree
to candidate of art criticism

Medelets Nikita Aleksandrovich



FORM FACTORS OF THE PASSENGER CAR

(technological aspect)

Scientific supervisor:
Doctor of art criticism, professor
Grashin Alexander Aleksandrovich

Production of original sample
Medelets Nikita Aleksandrovich

Signed for printing at 26th of August 2013. Format 60x84 1/16
Office paper. Offset printing.
Conditionally printed sheets.1,8.
Edition 140 copies. Order №