

**ZHYTOMYR POLYTECHNIC STATE UNIVERSITY
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KAMIANETS-PODILSKYI IVAN OHIENKO NATIONAL UNIVERSITY
DMYTRO MOTORNYI TAVRIA STATE
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ADMIRAL MAKAROV NATIONAL UNIVERSITY OF SHIPBUILDING
NGO VINNYTSIA CITY ORGANIZATION FOR SOCIAL DEVELOPMENT
OF SPECIFIC CATEGORIES OF VULNERABLE YOUTH «PAROSTOK»**

DIGITALIZATION OF ECONOMICS: INTER-DISCIPLINARY AND INTER- BRANCH APPROACH

Manual

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Reviewers:

Dalia Streimikiene – Professor of Vilnius University;

Edmundas Jasinskas – Professor of Lithuanian Sports University;

Arturas Simanavicius – Associate Professor of Lithuanian Sports University;

Sergiy Lehenchuk – Doctor of Economic Sciences of Zhytomyr Polytechnic State University.

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The manual disclose the essence economic development in digital era, the content of the involvement of countries in the global digital economy. The processes of transformation in a new digital reality and the indicators of the effective development of the digital economy of the countries, with special attention on inclusion, has been researched.

The textbook is recommended for individuals who already hold a graduate degree, current students who have bachelor degree and continue their education on Master level Programs in “Social and behavioral sciences”, “Management and Administration”, “Information Technologies”. It will be useful for stakeholders – employers, businessmen, businesswomen, governmental institutions, non-governmental organisations for digitalizing of the processes in business and economics.

The authors are responsible for the content and presentation.

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Ganna IEFIMOVA, Doctor of Economic Science, Professor
Viacheslav IVATA, PhD in Economics, Associate Professor
Svitlana MARUSHCHAK, PhD in Economics, Associate Professor
Valerii KOMYSHNYK, Associate Professor
Admiral Makarov National University of Shipbuilding,
9, Geroiv Ukrainy av, Mykolaiv, 54007, Ukraine
Tetyana GOROKHOVA, PhD in Economics
Pryazovskyi State Technical University,
19, Dmytro Yavornytskyi Avenue, Dnipro, 49005, Ukraine

Chapter 8

DESIGN THINKING FOR DIGITAL TRANSFORMATION

Content

8.1. The concept of design thinking: principles, process, empathy: understanding human needs and shortcomings.

8.2. Cognitive distortions and their effects of human activity.

8.3. Idea generation: techniques and tools for conceptualizing solutions.

8.1. The concept of design thinking: principles, process, empathy: understanding human needs and shortcomings

In user experience design, it's crucial to develop and refine skills to understand and address rapid changes in users' environments and behaviors. The world has become increasingly interconnected and complex since cognitive scientist and Nobel Prize laureate Herbert A. Simon first mentioned design thinking in his 1969 book, *The Sciences of the Artificial*, and then contributed many ideas to its principles. Professionals from a variety of fields, including

architecture and engineering, subsequently advanced this highly creative process to address human needs in the modern age. Twenty-first-century organizations from a wide range of industries find design thinking a valuable means to problem-solve for the users of their products and services. Design teams use design thinking to tackle ill-defined/unknown problems (aka wicked problems) because they can reframe these in human-centric ways and focus on what's most important for users. Of all design processes, design thinking is almost certainly the best for "thinking outside the box". With it, teams can do better user experience research, prototyping and usability testing to uncover new ways to meet users' needs.

Design thinking's value as a world-improving, driving force in business (global heavyweights such as Google, Apple and Airbnb have wielded it to notable effect) matches its status as a popular subject at leading international universities. With design thinking, teams have the freedom to generate ground-breaking solutions. Using it, your team can get behind hard-to-access insights and apply a collection of hands-on methods to help find innovative answers.

In essence, design thinking:

1. Revolves around a deep interest to understand the people for whom we design products and services.
2. Helps us observe and develop empathy with the target users.
3. Enhances our ability to question: in design thinking you question the problem, the assumptions and the implications.
4. Proves extremely useful when you tackle problems that are ill-defined or unknown.
5. Involves ongoing experimentation through sketches, prototypes, testing and trials of new concepts and ideas.

Large enterprises and corporations, representatives of private small and medium-sized businesses, academic and government institutions and organizations are faced with the need to create innovative products and services to satisfy existing stakeholders in the relevant field of activity. The key to the

successful implementation of innovations is a high-quality justification of the chosen strategy and an effective system of monitoring its implementation.

At the core of the design-thinking methodology are interdisciplinary approaches to stimulating innovative processes aimed at improving existing products, services and processes. According to scientist Michael Luchs, design thinking is a systematized method of collective work to identify and creatively solve a problem.

A comprehensive approach to design thinking as a tool for finding ways to satisfy stakeholders based on involvement allows you to expand the possibilities of applying tactics used in the fields of art, architecture, engineering and technology, which are characterized by the use of design methods. Design Thinking Theory and Practice has been gaining popularity and has been increasingly used in management and business administration academia over the past few decades.

The goal of design thinking is to solve the most complex, multifaceted and unresolved problems with systemic impact (Roberts, 2000; Churchman, 1967; Rittel & Webber, 1973).

Organizations in this section act as social units or a collective of individuals, which was created purposefully to achieve specific goals, with the aim of solving a problem by creating a new product or service (Etzioni, 1964, p. 3).

Design thinking is seen as the use of methods and research practices to solve problems outside the boundaries of architecture or engineering. **Design thinking** is a method of developing products, services, and services oriented to the consumer (user), which is based, first of all, on consumer demand, and secondly, on the possibilities of technical implementation and economic possibilities.

Characteristic features of design thinking are:

- immersion in the consumer experience;
- detached approach to defining the problem;
- focusing on personal scenarios of behavior and actions.

In order to solve the problem and determine an effective solution, it is necessary to conduct research, focus on the “pain points” of stakeholders, generate an alternative set of ideas, choose the best alternative, create a prototype and test it. The constructive-thinking method describes the tactics of performing these stages and the tools necessary for each of them.

Hasso Plattner and David M. Kelley, who are the founders of the Hasso Plattner Institute of Design (a design school that combines management and business practices with traditional engineering techniques), systematized the methods of design thinking. They investigated the stages of the creative process, the center of which is the consumer, and substantiated the approaches to using design thinking in business.

In 1969, Herbert A. Simon in his book “Sciences of the Artificial” defined design thinking as the process of transforming existing conditions into desired ones. Thus, design thinking is a process that is always focused on creating a better future and finding new tools for solving complex problems in a variety of areas, focused on the target group of users.

Since the 1990s, thousands of people have studied design thinking individually and in groups. Among the notable initiators of this trend are the design and consulting firm IDEO and the Hasso Plattner Institute for Design Thinking at Stanford University. Design thinking was depicted in various schemes: as an open spiral, a curved loop, a double rhombus or a series of rings. Regardless of which diagram to draw this process, in design thinking methodologies we constantly come across two central ideas or principles.

There was a certain development of the theory and practice of design thinking, given in the form of a chronology in the Table 8.1.

Table 8.1 – The development chronology of the design thinking theory and practice

Period	Characteristic
<i>1</i>	<i>2</i>
By the 1960s	The origins of design thinking lie in part in the process of creative techniques of the 1950s.

Continuation of Table 8.1

1	2
1960s	The first known books on the methods of creativity were published by William J.J. Gordon (1961) and Alex Faickney Osborn (1963). The 1962 conference on systematic and intuitive methods in mechanical engineering, industrial production, architecture and communications, London, Great Britain, aroused interest in the study of design processes and the development of new design methods. Books on methods and theories of design in various fields are published by Maurice Asimou (1962) (engineering), Christopher Alexander (1964) (architecture), L. Bruce Archer (1965) (industrial design) and John Chris Jones (1970) (product and system design).
1970s	Don Koberg and Jim Bagnall, in their book <i>The Universal Traveler</i>, were the first to develop “soft systems” to solve the problems of “everyday life”. Horst W.J. Rittel and Melvin M. Webber publishes “Dilemmas in a General Theory of Planning”, which show that the problems of design and planning are evil problems, in contrast to the “manual”, individual disciplinary problems of science. L. Bruce Archer expands the study of design ways of knowing, arguing: “There is a constructive way of thinking and communicating that is different from scientific and scientific methods of thinking and communication and is as powerful as scientific and scientific research methods when applied to his own types of problems”.
1980s	The development of design, human-centered, and the growth of design-oriented business management. Donald Shen publishes a “reflective practitioner”, in which he seeks to establish the epistemology of practice embedded in the artistic, intuitive processes that [design and other] practices bring to situations of uncertainty, instability, uniqueness and conflict of values.
1990s	The first symposium on research in the field of design thinking is held at Delft University, the Netherlands, in 1991. IDEO consulting agency for design thinking is formed by combining three industrial designs of the company. They are one of the first design companies to demonstrate their design process based on design methods and design thinking.
2000s	Beginning of the 21st century, brings a significant increase in interest in design thinking, as the term becomes popular in the business press. Books on how to create a more design-oriented workplace where innovation can thrive have been written for the business sector, including Richard Florida (2002), Daniel Susan (2006), Roger Martin (2007), Tim Brown (2009), Thomas Lockwood (2010), Vijay Kumar (2012). The design approach is also expanding and adapting to solve service design problems, marking the beginning of the service design movement. In 2005, Stanford University’s School of D. School began teaching design thinking as a universal approach to technical and social innovation.
2010s	2018 – In Harvard Business Review, Jan Lidtke argues that “design thinking works” in business.

Design thinking has certain characteristics. First, design thinking is human-centered. First of all, it takes into account the needs and desires of people, not the

proposals of companies or artistic ideas. Human-centered design thinking involves observation, conversation, research, and collaboration.

Secondly, design thinking is based on a creative worldview, openly exploring certain issues, rather than looking for a specific path to these results. During this creative process, you need to ask questions, visualize ideas, create material prototypes and tell stories about people, ideas and results.

These key principles are people-centeredness and creative worldview and support a lively and changing process of design thinking.

For each stage of the process, design and thinking is characterized by the passage of two phases:

- divergent comprehension;
- convergent processing.

The divergent phase (from the Latin *divergere* – diverge) consists in finding a set of solutions to the same problem.

The convergent phase (from the Latin *convergere* – converge) consists in the exact use of instructions for solving the problem.

Characteristics of the design thinking process and the main stages

Innovation is seen as the embodiment of the process to be updated in the organization and designed to create new products and services (Bessant, Lamming, Noke, & Phillips, 2005), is a mechanism for solving key problems. To effectively innovate, strengthen competitiveness, organizations in recent decades have increasingly turned to the use of design thinking as a product development process (Lockwood, 2010; Johansson-Sköldberg et al., 2013). Design problem solving is a powerful method of creating innovative products and services that can solve existing problems of various industries.

Sydney A. Gregory, in *The Design Method* (1966), states that design thinking is “a method of designing a model of behavior used to create things that do not yet exist. The science is analytical, and the design science is constructive”. In this context, design is used as an engine of a product, system, creation of services that

meets the needs and challenges of the client or end user.

The idea of the fundamental, practice-oriented method of design thinking is the ability to adapt the existing experience of solving the problem, taking into account the achievements of socio-scientific research, various groups of the population and existing trends.

Tim Brown defines the process of design thinking based on three elements that are not consistent, but intersect: inspiration, idea and realization. He noted this position in the work “Change by Design” (2009). This definition of design thinking is based on the work of Lawson (1980), Rowe (1987), Archer (1979) and Cross (1991, 2001). This design approach notes three **key elements** that can be repeated, may overlap, and may not be consistent (Brown & Wyatt, 2010):

- inspiration;
- idea;
- implementation.

The first key element is the creation of ideas with participation and empathy on the part of designers for relevant stakeholders. This empathic process can find out which stakeholders are relevant, which are not mentioned, and what system dynamics are in question. In addition, interaction with stakeholders (whether they are the end user) leads to more innovative results (Holmlid, 2009). This element aims to define a need (Faste, 1987), in which the designer studies the explicit and implicit desires and requests of the client, creates a user solution that meets these requests. A search exercise file is required throughout the design process; however, in terms of the inspiration of the IDEO process (Brown, 2009; IDEO, 2011), is a central function that allows you to create ideas, solutions and approaches to solving a client’s problem.

The second key element is one form or another of prototyping, iteration and verification. This can be described as a period of quick, gradual testing of ideas that can be quickly tested and analyzed. This element can be described as reasoning (Brown, 2009), with a clear emphasis on the transformation of ideas

into specific products, services or systems. The stage of an idea in design thinking can be repeated endlessly since ideas are repeatedly comprehended and transformed by the physical in different forms to verify and evaluate their compliance with the desired goal.

The third element is implementation, which is also reflective and repetitive, which consists of studying each idea, testing and affirming the success or failure of an idea in order to continue and create better, more sophisticated goods or services. This process consists of experience-based learning can be described as reflective (Schön, 1988) and serves as a driver of the process of design thinking. Reflective practice (Schön, 1988, 1983) links elements of inspiration, ideas and implementation (Brown, 2009) design thinking in the context of stakeholder needs, with an emphasis on reflection, improvement and empathy.

Theoretically, the design process is split into three main phases, but in practice you can start with any and move as you like.

Step one is to observe. You need to look, listen, ask questions and collect data. Observation requires patience, care, and humility. Conversations with users develop empathy and give insights. Workshops push to develop design together with stakeholders whose views may diverge. Researching the lifestyle of a particular community deepens knowledge about it. The foundation of these methods are the values of human-centered design.

The next step is to imagine. At this stage, it is necessary to generate many ideas, sort them into groups, look for connections and analogies and decide how to move on. In this way, human-centered research is combined with creative thinking, opening our perception to unexpected concepts.

The third step is to create. Here creative action comes to the fore. Creation is a direct and physical process. Through prototypes, you can show how the product will work. Storyboards (storyboards) give users an idea of how they will be able to interact with the device. Role-playing embodies a service or process in social and physical aspects. Each creative method begins with the question: how

a design solution or insight can help real people. Each prototype or narrative serves as a tool to communicate with users and stakeholders.

At the heart of design thinking is the search for ideas. Creative methods in design play the role of a set of defined actions that the team performs to search for an idea.

The Stanford School of Design divided the process of design thinking into several stages (Fig. 8.1):

1. *Empathy* – immersion in the problem issue and user experience.
2. *Focusing* – the formulation of a specific, significant task that can be solved.
3. *Idea generation* – generating ideas and choosing a solution.
4. *Prototyping* – creating a model for testing certain solutions.
5. *Testing* – receiving feedback and determining the best solution.



Fig. 8.1 – Algorithm design thinking

The presented method of design thinking consists of five stages, each of which refers to a divergent or convergent phase. Divergence consists in expanding the angle of view, collecting all the finds and ideas. Convergence involves narrowing the focus and choosing a priority idea to be tested, worked out in the following stages.

The process of design thinking is iterative, that is, the developed idea is immediately subject to verification, the result obtained is used as an experience to find the best solution.

As a result, we note that the term design and related words are used in the text with the meaning – design, engineering, development and reproduction. The reorientation of cognitive processes in professional activity from analytical methods to a creative approach faces various kinds of problems, the main of which is cognitive distortions of human consciousness.

Questions for self-control:

1. Explain what the essence of design thinking is?
2. Describe the main goal of applying design thinking.
3. What are the key features inherent in design thinking?
4. What is the essence of the divergent phase of design thinking?
5. What is the essence of the convergent phase of design thinking?
6. How are elements such as inspiration, idea, realization related?
7. What stages of the design thinking process are selected by experts?
8. What is the essence of empathy in the process of design thinking?
9. What is the purpose of creating empathy maps?
10. Explain what the essence of empathy is?

8.2. Cognitive distortions and their effects on human activity

The effect of cognitive distortions on human consciousness

Design thinking is a creative process of a person's professional activity, because of any process of information processing, he encounters certain features of consciousness. Most often these are cognitive distortions.

Cognitive (the process of information processing by our consciousness) distortions are understood as systematic errors in thinking or pattern deviations that arise on the basis of dysfunctional (incorrect) beliefs embedded in cognitive schemes and are easily detected when analyzing automatic thoughts. The existence of most cognitive distortions has been described by scientists, and many have been proven in psychological experiments. Cognitive distortions are an example of evolutionarily formed behavior. Some of them perform an adaptive function since they contribute to more effective actions or faster decision-making. Others apparently come from a lack of appropriate thinking skills or from the inappropriate application of skills that have been adaptive in other settings.

Cognitive distortions can occur due to various causes, in particular:

- “failures” in the processing of information (heuristics – a scientific branch that studies the specifics of creative activity);
- “mental noise” – talking to oneself;
- limited brain ability to process information;
- emotional and moral reasons;
- social impact.

Distortions associated with behavior and decision-making unnecessary concern for success.

Amplification – investing more effort in achieving the goal than necessary, an attempt to “kill a fly with a sledgehammer”. Option – excessively detailed planning in the absence of sufficient source data and the presence of strongly influencing the result of uncertain or random factors.

Acceleration – performing work at a speed greater than necessary or even acceptable. In the latter embodiment, literally and figuratively: running through a minefield.

Advancement is an unreasonably early start of action to achieve the goal. Bias towards the search for information is the tendency to look for information even when it does not affect the actions or the result.

Exaggeration of the probability of individual cases.

Generalization of individual cases – groundless transfer of characteristics of private or even isolated cases to their large sets. There are many types of this cognitive distortion, the classic version is a conspiracy theory.

The effect of contrast is the amplification or underestimation of the value of one object when it is compared with the contrast object just discovered. For example, a person is happy that he bought something inexpensively in a store, but ceases to rejoice after he discovers another, little-known store in which the same thing is 2 times cheaper.

The Baader-Meinhof phenomenon or the illusion of frequency – newly

recognized information that appears again after a short period of time, is perceived as extremely often repeated.

Reassessment of the significance of individual cases.

Deviations in the direction of the result – the tendency to judge decisions by their results, instead of assessing the quality of decisions by the circumstances of the moment in time when they were made (“winners are not judged” by the “judgment of the survivor”).

Reassessment of influence – the tendency of people to transfer the duration or intensity of the impact of an event on their future experiences.

The focusing effect is an error in predictions that occurs when people pay too much attention to any one aspect of a phenomenon; causes errors in the correct prediction of the usefulness of the future result. For example, focusing on who is to blame for a possible nuclear war distracts attention from the fact that everything in it will suffer.

Reassessment of their capabilities.

The effect over confidence is the tendency to overestimate their own abilities. The illusion of control is the tendency of people to believe that they can control or at least influence the outcome of events that they cannot really influence [4].

The advantage of zero risk is the advantage of a controlled, but potentially more harmful (due to its more frequent occurrence) situation over the opposite due to the reassessment of the possibility of control. That is, the person, for his part, believes that he completely gets rid of the risk (in fact, without having full control), while on the part of statistics this is a reduction of only one, not the greatest risk to zero. For example, most people would prefer to reduce the likelihood of terrorist acts to zero instead of reducing accidents on the roads, even if the second effect gave more saved lives [5]. Another common example is iatrophobia: many people are more afraid of complications of medical interventions than diseases and deaths because of these diseases arising from lack

of treatment (for example, anti-vaccination).

The Dunning-Kruger effect – people who have a low level of qualification, draw erroneous conclusions, make unsuccessful decisions and at the same time are not able to realize their mistakes due to the low level of their qualifications. In the mid-1990s, in the city of Pittsburgh, a well-dressed man in the middle of the day and without hiding his face robbed a bank. When he was caught (and it only took one day to do so), he couldn't hide his surprise. "How was I identified?" – Asked. "After all, I generously smeared my face with citrine!" although it looks like a joke, it is true: two friends of that mister, whose name was Wheeler, assured him that citrine would help hide his facial features, making him invisible. To prove that it is, they smeared it with lemon juice, then took a photo of him, erased his features from it – and that Wheeler calmly went to business, thinking that no one would recognize him.

The news then received wide publicity and served to ensure that Cornell University social psychology professors David Dunning and Justin Kruger became interested in the case and asked themselves the following question: is it possible that a person's incompetence does not allow him to see that he is incompetent? Professors Dunning and Kruger conducted an experiment in which they asked several volunteers to assess their level of competence in the following areas: grammar, argumentation, logic and humor. So, they found that the stupider a person was, the less aware they were of their gaps. And vice versa: competent people tended to underestimate themselves very much. Dunning and Kruger also noticed that there is a connection between incompetence and quackery, and proved that fools rate themselves so highly that they always consider themselves surprisingly intelligent. Something similar happens with knowledge.

The more ignorant a person is, the more it seems to her that he knows everything, and with a lot more strongly opposed to learning something new. This is what some call the "arrogance of ignorance". Or, as popular wisdom says, the fool of the sea is knee-deep. So, when wisdom is prudence, restraint, and doubt,

ignorance is the insolence of antonyms: it is reckless, reckless, intolerant. When I was young, I was often confused by the fact that that fools are absolutely certain of themselves. For the chronically insecure person who your submissive servant is, the one to whom everything was clear was synonymous with the leader. And the big problem is that in fact it is. Many fools are born leaders, you just need to give a look at the world of politics: individuals with astonishing self-confidence and the same arrogance utter insubstantial nonsense. And since aplomb is very often confused with intelligence, it turns out that many people follow them.

The most interesting thing about this phenomenon is that a significant part of these people are by no means fools. They only think that if so many people follow this Gamel pied piper, then there is some reason for that. In addition, when a pied piper manages to convince a certain number of people, there is a cumulative effect – no one thinks anymore, everyone goes into no matter what abyss. And we hardly noticed that in this way, it seems, the realm of fools was established. Many of us ask ourselves how it is possible that people succumb to such incredible nonsense that we see every day: profess delusional conspiracy theories, create all sorts of internet-inspired silliness: from selfies in the mouth of a volcano to the belief that the earth is flat; and they also issue and maintain crazy laws that are contrary to basic common sense... There is not one explanation, there are many phenomena that contribute to the fact that folly is rotten among us (moreover, reinforced by the multiple and distorting mirror that it is social networks). I don't know what Dunning and Kruger will say now about the consequences of the effect named after them almost thirty years ago. If then they were surprised that the man, relying on his own folly, robbed the bank, smearing his face with lemon juice, now they would be dumbfounded, making sure that this effect, according to which "a person's incompetence does not allow him to see that he is incompetent", is no longer a hilarious exception to that Wheeler, but stands in the way of becoming the norm.

It is necessary to recognize that we are all carriers of cognitive distortions

and to use it correctly. Anyone who will avoid this recognition will lie to himself and make the same mistakes repeatedly.

Reassessment of the significance of one's own opinion / position / choice.

Distortion in the perception of the choice made – excessive perseverance, attachment to one's choice, perception of it as more correct than it really is, followed by its justification. For example, attempts to find implicit advantages in the purchase and thereby justify it in the presence of another, more suitable product that for some reason was not purchased.

The effect of acquaintance with the object is the tendency of people to express unreasonable sympathy for an object only because they are familiar with it (patriotism, the effect of involvement in the creation of the object).

Irrational escalation – the tendency to remember your choice as more correct than it really was.

Blindspot on distortions – easier detection of deficiencies in other people than in yourself. In this case, a person is inclined to protect his thoughts. Methods of protecting one's opinion in such distortions are usually:

- selection or adjustment of the hypothesis to the measurement results;
- the tendency to seek or interpret information in such a way as to confirm previous concepts;
- unconscious manipulation of the course of research to identify the expected result;
- considering only those facts that are consistent with expectations.
- the tendency to assert oneself in one's rightness contrary to testimony, which is contrary to a person's initial stable beliefs. Because of this effect, which has acquired the name of the *opposite result*, it can be difficult to convince the interlocutor of the dispute, even if you provide him with strong evidence that refutes his position.

Other types of cognitive distortions.

The effect of authority is the tendency to attribute a higher appreciation to

the opinion of an authoritative figure and to a greater extent depend on this opinion. *Man is used to relying on the truth of authority than the authority of truth.*

Decorating the past – the tendency to evaluate past events more positively than they were perceived now when they actually happened.

The “curse of knowledge” is the difficulty for more informed people when trying to view any problem from the point of view of people less informed.

Professional deformation is a psychological disorientation of the individual during professional activity. The tendency to look at things according to the rules generally accepted for one’s profession, rejecting a more general point of view.

The effect of ownership is the overestimation of the value of the purchase immediately after its acquisition. Its consequence – the rejection of loss – the negative utility that is associated with the loss of an object turns out to be more than the utility associated with acquiring it. People, knowing the benefits of the thing due to them, are more upset about its loss than they would rejoice at its finding, to which they did not think about this thing and, accordingly, did not consider its benefits.

The need to complete and the advantage of holistic subjects – the need to achieve completion in an important question, get an answer and avoid feelings of doubt and uncertainty.

Regulation is the trap of continuous orders for oneself to do something, instead of sometimes acting impulsively, spontaneously, when it is more acceptable, when looking for something new, for example, during vacation, rest.

The status quo is the tendency of people to want things to stay about the same.

Procrastination – systematic unjustified postponement, delaying the beginning of inevitable work.

Time-saving bias – human tendency to erroneously estimate the time, which can be saved (or lost) because of an increase (or decrease) in speed.

Planning error – the tendency to underestimate the time of execution of tasks,

the cost and duration of the implementation of projects, especially new, complex, large, unique. *A special case of a planning error found expression in Murphy's law: "Any job requires more time than you think".*

Socially conditioned distortions. A large group of distortions associated with behavior and decision making. For example, distortion in their own favor:

1. *Distortion in favor of one's group* is the tendency of people to give preference to those they consider to be members of their own group.

2. *Selfish error* is the tendency to recognize greater responsibility for successes than for defeats.

3. *Fundamental attribution error* – the tendency of people to explain the behavior of other people with their personal qualities, underestimating situational factors, and at the same time overestimating the role and strength of situational influences on their own behavior, underestimating the personal aspect.

Distortions associated with probabilities and stereotypes. Many of these cognitive distortions are often studied in relation to how they affect business and how they affect experimental research. Common mistakes due to misunderstanding of the essence of accidents, for example:

1. *The primacy effect* is the tendency to overestimate initial events more than subsequent events.

2. *The recency effect (proximity aberration)* – the tendency to value recent events more than earlier events.

3. *The Hawthorne effect* is a phenomenon in which people observed in a study temporarily change their behavior or performance. Example: increasing labor productivity in a factory when a committee comes to study labor productivity in this factory.

Distortions related to memory errors, for example:

1. *The self-reference effect* is a phenomenon in which memories encoded with reference to the self are better recalled than similar information without reference to the self.

2. *Egocentric distortions* – remembering the past in a self-aggrandizing manner, for example, remembering exam grades better than they were, and the fish caught – bigger.

3. *False memory* is a memory disorder expressed in false memories.

4. *The disinformation effect* occurs when the reproduction of episodic memories becomes less accurate due to post factum information.

Hindsight bias

Regarding the importance of influencing professional decisions in the field of financial and economic activity in the conditions of digital transformation, among cognitive distortions there is an effect after knowledge or hindsight error.

Effect after knowledge, Hindsight bias – a cognitive distortion, a tendency to perceive events that have already happened or facts that have already been established as obvious and predictable, despite the lack of sufficient primary information for their prediction. An error after knowledge can lead to distortion of memory processes, in particular, processes of restoration and reproduction of past experience, leading to false theoretical conclusions. Thus, this effect can cause serious methodological problems at the stages of analysis and interpretation of the results of experimental studies. The after-knowledge effect is dangerous in forensics – it can influence the expert's conclusions along with other cognitive distortions. Other names: “I knew it from the beginning”, “I knew it like that”, “So I knew it!”, “English I-knew-it-all-along”, hindsight, retrospective determinism, retrospective distortion.

According to Hartmut Blank and his colleagues, all hindsight errors existing in the literature can be reduced to three independent processes: the effect of inevitability, the effect of predictability, and memory distortions. All three phenomena are different possible manifestations of the hindsight error, which can occur both separately and together.

The first phenomenon – the effect of inevitability – reflects a retrospective increase in the subjective probability, or perceived inevitability, of a particular

outcome. In other words, when a person learns about how the event ended, this outcome begins to seem more likely or inevitable to him than before he acquired this knowledge.

The second phenomenon is the effect of predictability: people tend to believe that they knew everything in advance or were able to predict how this or that event would end. B. Fischhoff called this effect “I-knew-it-all-along”.

Finally, the third phenomenon is memory distortion. After receiving an answer to any question (for example, “What is the length of the Danube River?”) or after receiving information about the outcome of an event, the knowledge in memory is distorted, adapting to the received information about the correct answer.

In the literature, the hindsight phenomenon is most often associated with the effect of predictability, followed by the effect of inevitability and processes of memory distortion. H. Blank notes that these phenomena do not reflect the same phenomenon, since, first of all, different psychological processes are at the basis of each of them. Thus, at the basis of the effect of inevitability are the processes of creation and modification of cause-and-effect models of the event. In hindsight, people construct and add new cause-and-effect relationships in such a way that the outcome seems predetermined.

The effect of predictability, in turn, is associated with processes such as a person’s perception of the extent to which he was able to predict a certain outcome. For example, drunk drivers may recognize in retrospect that after six glasses of whiskey the probability of getting into a car accident is very high, but they will also be convinced that they were unable to foresee such a possibility when they were drunk. Finally, memory distortions are governed by various memory processes, especially such as binding (“fitting”) memories to the actual outcome of the event and restructuring initial assumptions. Moreover, the inevitability effect may also help to cope with the disappointment of undesirable consequences (“I had no chance”). The effect of predictability, in turn, serves the

function of self-affirmation (for example, promotes the perception of oneself as an informed person, including in the eyes of others). In addition, subjective predictability (or unpredictability) performs the function of self-protection (maintenance of positive personal identity) in case of perception of a negative result for which a person can be responsible. For example, owners of stocks that have crashed in price believe that they were not able to foresee the failure in advance. Memory distortions, according to some authors, can be considered as a byproduct of knowledge updating processes and thus can indirectly affect the function of knowledge updating.

The hindsight bias is based on the same limitation of cognition. This limitation is manifested in a person's dependence on current knowledge when trying to recall or reason about available information, regardless of whether it is about one's own state or about another person's state. This is the key limitation underlying the hindsight fallacy.

The hindsight bias has similarities to other memory distortion phenomena, such as the misinformation effect and false memories in autobiographical memory. All three variants of memory distortion are the result of a three-stage process. The specifics of each process for the three cases may differ, but they all end with one or another psychological manipulation or alteration of memories.

The first stage is different for the three phenomena, but in all three cases there is some kind of event present in the first stage: the event that happened (misinformation effect); an event that did not happen (false autobiographical memories); a statement made by a person about an event he remembers (hindsight fallacy).

The second stage consists in increasing the information that a person receives after the event has occurred. In the case of a hindsight error, the new information is reliable and clearly presented to the person, while the additional information in other cases of memory distortion is false and presented to the person in an ambiguous and possibly manipulative form.

The third stage includes restoration in memory (“remembering”) of primary information. A person prone to the hindsight error or misinformation effect must recall the original information, while a person with false autobiographical memories will create memories of events that did not actually occur.

Research shows that a person tends to make the hindsight error even when he is aware of the existence of this effect and has a desire to overcome it. It is impossible to completely overcome the hindsight effect, but there are ways to weaken it. One of them is consideration of possible alternative explanations of the event and openness to different points of view. The only way to reduce the effect of hindsight in experimental conditions is to force yourself to think about alternative explanations that may be correct.

Prevention of the impact of cognitive distortions

Thinking is a useful activity, necessary for solving problems, analyzing, comparing, studying, planning, etc. But very often the mind wanders where it wants, occupying attention with trivial and unimportant questions and useless thinking that wastes your time and energy. Critical thinking is an integral part of design thinking, its component.

Indeed, there is no consensus on any known definition of intelligence. The reason, perhaps, is that this word is associated with different qualities. In history, there are many examples of people unanimously recognized as intelligent in such diverse fields as science, technology, art or philosophy.

Defining intelligence as “the ability to reflect, plan, solve problems, think abstractly, grasp complex concepts, remember quickly, use accumulated experience”, scientists conducted an analysis of research and concluded that people endowed with high intelligence have more chances to protect themselves from various kinds of prejudices.

To reveal a high level of intelligence, one should remember the ability of some people to abandon the established patterns of their era and act in a new way, not being satisfied with what seems obvious. Galileo, Darwin, Einstein, as well as

Kant and Descartes were such dissenters. They questioned the prevailing ideas and simplified interpretations of the world order. Intelligence in that case was accompanied by critical thinking, the ability to intellectually oppose the dominant system of concepts, an attempt at ideological processing and, in general, any form of dogmatism.

Critical thinking is often confused with intelligence, but it is not the same. Critical thinking is a set of cognitive qualities that allow us to think rationally, considering a certain goal and the readiness to apply these qualities at the right time. Critical thinkers have flexible thinking and look for evidence that supports their beliefs and recognize attempts to mislead them. Critical thinking means the ability to overcome any cognitive biases (e.g. hindsight bias, confirmation bias).

Man by his nature is irrational and this in certain aspects hinders us, creates obstacles on the path of life. Not all beliefs are stupid, absurd, or dangerous. Some of them can be constructive, such as *believing in yourself, in your abilities, in your worth, in life and in other people*.

The risk of falling under the influence of dangerous beliefs is connected with the need to find the meaning of life at any cost. If someone gives us an explanation that fits our worldview or frees us from independent search, it is easier for us to accept it. But the greatest danger of irrational beliefs is that they tend to align with our intuitive expectations. Since ancient times, people have believed in strange things, and many have tried to fight them.

Despite all his intelligence, education and critical thinking, no human being is immune to stupid prejudices – mainly because people have a hard time believing in randomness. To look for *fate, fatality, intrigue, conspiracy, good or evil intention in random events* is a universal mistake.

If it is not possible to particularly increase the level of your intelligence, you can learn to develop critical thinking.

Informing people about cognitive distortions and biases and encouraging them to avoid them is not enough to get rid of them. To avoid them, it is very

important to understand how an alternative result could have been obtained. We need confirmation – evidence, and this is achieved through obtaining information – knowledge. On the way to critical thinking, the first thing a person needs are to realize his nature and accumulate knowledge and experience.

Acquiring knowledge (acquiring experience) is a physically difficult process for our brain, so in approximately 80–85 % of people it (the brain) will resist this process. The solution is to constantly train yourself, as a person, and the brain as its main part. The first stage will be planning your day.

Questions for self-control:

1. What methods of analyzing consumer behavior are used at the stage of empathy in design thinking?
2. Expand the content of the concept of consumer profile
3. What are cognitive distortions?
4. What are the types of cognitive distortions?
5. What are the main techniques for counteracting cognitive distortions?
6. What is critical thinking?
7. Define intelligence

8.3. Idea generation: techniques and tools for conceptualizing solutions

Goal setting and motivation as elements of critical thinking

In order to achieve the set goals, tasks, or increase one's efficiency in general, a person first of all needs to understand how the brain works.

So: modern neuropsychology and psychoanalysis claim that 2 systems are responsible for the thinking process in our brain – the subconscious (unconscious state) and consciousness. They are marked by system 1 – unconsciousness and system 2 – consciousness. System 2 is our conscious thoughts, the voice in our

head, in fact it is the person we consider ourselves to be. This is a system that can carry out instructions and a sequence of actions (for example, multiply 7 by 14). System 2 is very hard to start (actually lazy) it is slow but attentive and can find a bug.

System 1 is our unconscious part (subconscious mind), an incredibly fast system that processes a huge amount of data that enters our brain, it selects the most important of them and discards the extra, and most of it. It works automatically (in the background) without us, that's why it was called the subconscious. We do not even understand the scope of her work. For example, when you see some text, it reads it even before you try to read it. It automatically adds information for completeness of perception. This is the library of our memory, and system 2 is a short-term memory that can simultaneously hold 4–5 new concepts.

Learning is essentially the formation and grouping of new information into known designations, that is, the transfer of work from system 2 to system 1. That is, in fact, it is a system of repetition.

Frequent, conscious repetition leads to the accumulation of databases of system 1. It was Sigmund Freud who popularized the idea of the unconscious. He formulated the statement that: the perception that behind our ideas, thoughts and actions there are unconscious motives beyond the control of our will. Further, Carl Gustav Jung developed this statement and concluded that people are very strongly influenced by things that are not controlled by their consciousness. This is how our brain has evolved to use our resources in a better way. For repetitive tasks, we have developed an automatic system for their execution to save the limited capabilities of system 2 for those things that really need our full attention.

How to train your mind to achieve efficiency

No one can live without a routine, if you don't have one, you can't maintain your psychological health! For example, you can choose a time to get up in the morning, any, but one thing and be sure to stick to it, it will have a positive effect

on your mood.

Setting a goal for oneself is a problem when a person sets a task for himself and does not fulfill it. Again and again he formulates the task and postpones it for later, formulates it again and postpones it again. How to solve such a problem?

First, you must agree with yourself what you want and what you will get for it. Such work must become part of your routine, otherwise it will not work, because you are not your own servant, you must negotiate with yourself. This is motivation. You have to motivate yourself to do the work through incentives. You need to start by determining the number of hours during the day wasted on meaningless activities. Make a schedule for yourself and stick to it. But consider that the main rule of the schedule is not a prison. Ask yourself about the ratio of responsibility to reward and move on. You need to make a schedule so that you get the best possible day for yourself and you are satisfied with it, and the most important thing is that you are not in a worse position compared to the beginning of the day based on the results of your work. And even if you did everything as you wanted, you will be able to fulfill your plan by no more than 50–70 %, but this is already significantly more than 0. And even if these percentages will be smaller, you should try to achieve positive growth dynamics in the following periods. This will make you efficient and you will see your own results and be amazed at your achievement.

Second, start writing. Writing is thinking, if you have an idea, put it on paper, and the first thing you will see is some flaws in the formation of the idea itself. Ideas expressed in writing allow a person to learn to think and clearly convey his thoughts. Advanced thinking allows you to be more effective.

Identifying the problem and assimilating input information

To achieve goals, a person needs 2 things – diligence and intelligence. Two complex elements that are difficult to measure and even more difficult to determine their impact on achieving results. Modern science does not provide an answer to the question of how to increase intelligence and diligence. These

complex questions lie in the plane of a person's personality. Take IQ as an example, any attempts to develop exercises to increase it have failed. Indeed, many techniques, methods and principles of solving complex problems were developed, and people used them very effectively, but changing the problem and the situation brought everything back to the beginning. Accordingly, humanity has not achieved progress in increasing human intelligence. Therefore, each person works on the balance of these elements within the framework of his personality or personalities, which actually creates a successful adaptation of a person to the surrounding environment. It can be characterized in such a way that a person will look for such a field of activity where his specific features of perception, temperament and behavior will meet the requirements of this field (self-realization).

In any field, self-realization is the process of solving certain problems, or choosing the optimal solution or direction. The only way to choose the optimal way to solve the problem is to determine the content of the problem. After creating an empathy map, focusing is carried out – this is a transitional stage that involves processing all the collected information. An empathy map is a graphic diagram in the center of which is the consumer, surrounded by various information blocks depending on the task. The main task of creating an empathy map is to create a detailed portrait of the ideal consumer of a particular product. At the same time, the center of the empathy map can be not only the consumer, but also an idea, task or problem to be solved.

Focusing is the next stage of the design thinking process. At this stage, a clear concept of the project is revealed. All that was heard and seen is gathered together, a complete picture is formed from the received information, in which the most important is determined. At the focus stage, conclusions are drawn based on the information gathered in empathy mode, and a concept is created that will be implemented in the project.

The content of focusing consists in formulating a question that should be

related to the problem. This is a statement that focuses on the conclusions made in the process of observation, an image that is formed based on certain characteristics of various objects. The focusing mode is also called “point-of-view” (POV). The main problem of this stage is to avoid cognitive distortions of “points of view” (Fig. 8.2).

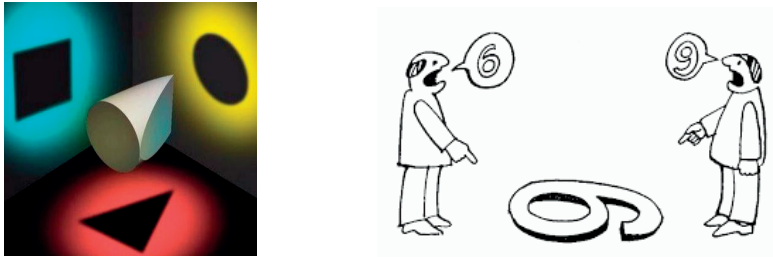


Fig. 8.2. The problem of information perception through “point of view”

Focusing is a deep understanding of what was collected in the process of observation. Focusing is critical and allows for an explicit expression of the problem that needs to be solved based on the information collected about people’s lives.

The information with which we work, the samples that are available to us, do not reflect the whole picture, but only what we received and perceived. Accordingly, you need to be able to go beyond this framework, keep in mind that the data that is available is always incomplete, and this inevitably leads to various kinds of distortions.

The process of finding new ideas

The next stage is the **generation of ideas**. At this stage, the search for a solution to the problem, which was defined earlier, is carried out. At this stage, it is important to generate the whole range of possibilities, there is no place for one correct idea. Idea generation is the development or development of new ideas that contribute to the possibility of creating new ideas. There are many ways to organize a constant search for ideas. The main components of the search for new products are the analysis of sources and the application of creative methods of

obtaining ideas.

The process of generating ideas should be aimed at expanding the possibilities of solving the problem and looks like branching into all possible concepts and results that can be applied as an alternative solution to the problem. The basis for creating a prototype and an innovative solution is the representation of participants in the design thinking process.

The use of different methods of generating ideas allows you to avoid potential complications and get benefits, namely:

- avoid obvious solutions and increase the innovative potential of the idea;
- use the collective representation and strengths of the team;
- to open entire areas that were previously left out;
- provide flow (quantity) and flexibility (diversity) of innovative solutions.

In order to generate ideas, prototyping or creating a layout based on bodystorming is used – this is a variant of “brainstorming” with an emphasis on generating ideas and creating unexpected inventions through physical research and interaction, creating intellectual maps, sketches, etc.

The creation of an idea occurs through a combination of rational thoughts and emotions based on established limits, the presentation of context and the consideration of unrelated ideas.

The search for new ideas begins with the method of “silent brainstorming”. After that, ideas are discussed and developed. All formulated ideas are subject to verification of their viability by applying evaluation criteria and using filters.

Procedure for selection, sorting and structuring of basic ideas:

1. Formulation of selection criteria. If there are several criteria, then each of them must have a certain weight. The criteria allow you to preserve the innovative potential accumulated in the mode of generating ideas.

2. Selection of an idea by voting (the danger of voting may be that if the majority supports the idea, then the enthusiasm of the rest of the team may fade).

3. Prototyping and testing its functionality. To search for ideas, it is

appropriate to use brainstorming sessions, sketches, drawing up intellectual maps or building a layout. Any way is good, the main thing to remember is that the generation of ideas should be clearly separated from their evaluation. Under this condition, the presentation can be limitless.

As an effective tool for finding new ideas is Boyd's "ooda loop" or killing speed. U.S. General Charles Krulak characterized John Boyd as a high intelligence officer. A specialist who made an unsurpassed contribution to American martial art and was one of the central architects of military thought reform. It is this model of behavior that competitive decision-making on the battlefield – time compression, and its use as its ally "OODA Loop" began to be applied in civilian life due to its effectiveness and highly competitive environment.

A military mental model known as the "OODA Loop". It is also called the "Boyd Loop". It is a practical concept of rational thinking of military leaders to function effectively in confusing or chaotic situations. It helps to quickly make the right decisions in a combat situation. The abbreviation "OODA" stands for simply. Observe is to observe. Orient is to navigate, decide is to solve. Act is to act.

The word "loop" involves repeating these steps repeatedly until the situation is resolved or ended. Each repetition of one stage provides more information for the next, turning it into a feedback process.

Observe. Information alone is not enough. The observation stage requires the transformation of information into a general context. A particularly important leadership skill is the ability to determine which information is just noise and irrelevant to the decision at hand. If you want to make good decisions, you need to master the art of observing what's around you.

Orient. To navigate, it is necessary to recognize any obstacles that may interfere with other parts of the "Boyd loop" cycle. What does orientation do in this context? First, it allows to associate oneself with reality: to see the world as

it really is. As free as possible from the influence of cognitive biases and simplifications. Without unnecessary details, but not primitive either. To his colleagues, John Boyd recommended the use of the process of “deductive destruction”. Pay attention to your own assumptions and biases. Then find fundamental mental models to replace them. In this way, you always learn from the mistakes made and do not continue to repeat them.

Decide. The previous two steps provide the foundation needed to make an informed decision. If there are several options at hand, you will have to use your observation and orientation to choose one. The best possible.

Act. There is a difference between making decisions and implementing them. Once you decide that it’s time to act, it’s worth checking your decision. The results and consequences will indicate whether your decision was correct or not. Having received information about this, you will return to the first part of the “loop” and begin to observe anew.

In sports, there is a proverb that extends quite well to war: “Speed kills”. If you know how to be agile, adequately assess an ever-changing environment, and adapt quickly to it, you will always have an advantage over any adversary. Even faster than lightning.

Suppose you need to work fast. What then? You can learn something from fighter pilots. For them, any seconds of undue hesitation can cost lives. Pilots have many solutions and processes that they can juggle when they are in air battles. They move at high speed and must avoid enemies by tracking them. And also to maintain contextual knowledge of goals, terrain, fuel and other key variables.

Start applying the “Boyd loop” in your everyday decisions. Just watch what’s going on! Believe me, you will notice things that you did not pay attention to before. Before you draw a conclusion from the information received – stop. Pause for a short break. Consider your mental biases, get more information, and be sure to think about the consequences.

Like any practical action, if you do something right, the more you do it – the

better you will succeed later. After a certain time, you will begin to make the best (high-quality and correct) decisions in full. You will see faster progress. And as Colonel John Boyd would say, you're going to start something "better to do in your life, not just be someone".

Like all good mental models, this knowledge works in other areas, even outside the military: it is actively used by special services, lawyers, doctors, businessmen, politicians, law enforcement agencies, marketers, coaches, etc.

Methods for generating new ideas

The method of associating ideas is based on the use of the capabilities of the senses of a person (hearing, sight, touch) and his mental abilities to form the desired ideas. Observing, listening or feeling a particular real object, a person is able to move away from his image and imagine another that has a certain similarity, but is fundamentally different from it. The associated original and valuable idea is captured and used for further study. During the observation and formation of the idea, the properties of the real and imaginary object are analyzed. Based on logical reflections and direct comparison of these properties, the necessary decisions are made. It is clear that this process involves the availability of accurate answers to a number of specific questions. It turns out, in particular, the advantages and disadvantages of the design of the product, the possibility of its use under new conditions or the implementation of a large-scale (increased, reduced) modification of the product. The possibilities of changing the external design, layout or principles of the product, replacement of materials, etc. are also studied. Answers to these questions allow you to create an image of the future object.

The method of generating ideas is based on the systematization of data on the development of a certain type of product in the past and on the logical analysis of these data to determine possible directions for product development in the future. Common means of generating are diagrams and matrices of ideas, the so-called brainstorming (brainstorming method), heuristic methods.

The method of generating with the help of a diagram of ideas involves the use of appropriate graphic material that synthesizes the past experience of the formation and development of the type of product in question. The method of generating using a matrix of ideas is associated with penetration into the morphology (composition and structure) of the product. It is considered more productive because it allows you to get more combinations of ideas, including alternative ones. The latter contributes to finding fundamentally new solutions. Morphological analysis is based on the construction of a matrix of characteristics of the object of forecasting and their possible values, followed by sorting out and evaluating the variants of combinations of these values. It is implemented based on the construction of the so-called morphological block, which was proposed by the Swiss scientist F. Zwicky in the late 50s.

The procedure of morphological analysis is a sequential sorting of possible combinations of different characteristics (in our example, physical principles and technical solutions).

The sequence of stages of morphological analysis is as follows:

- the problem is described as a whole (no solutions are offered);
- the problem is decomposed into several components (for example, the parameters of the object are determined – shape, packaging material, contents);
- for each parameter, several possible options are offered (known and those that have not yet been used in the goods on the market). In this case, a matrix is compiled, the so-called morphological box, in the first column of which all the parameters are listed, and on the right in the same row are alternative solutions;
- parameters and alternative solutions are combined (each solution consists of a set that requires one option from each parameter); the optimal solution, from the point of view of the company, is selected and implemented.

The method of morphological analysis is very useful for the design of new products, as well as for determining the possibility of patenting the main parameters in order to “block” inventions that may appear in the future, and block

competitors' path to imitation of innovation.

The brainstorming method proposed by A. Osborne in the late 30s and as a method is very simple. It assumes the following stages: preparatory; idea generation; analysis and evaluation of ideas.

There are several methods of brainstorming and its modifications:

- classic brainstorming;
- anonymous brainstorming;
- didactic brainstorming;
- destructive and constructive brainstorming;
- technique of creative cooperation.

Anonymous brainstorming. Directly brainstorming is carried out before the meeting. Participants are asked to formulate and write down all ideas related to the problem on a piece of paper and give them to the presenter. The presenter presents ideas consistently, without naming the authors, and the group develops and improves these ideas.

Didactic brainstorming (Litt technique). Before the meeting, the formulation of the problem is known only to the presenter, who leads the participants to the problem gradually during, as a rule, a series of meetings: at first they are introduced only to the general aspects of the problem, then additional information is displayed consistently, as a result of which the problem is solved completely.

Destructive and constructive brainstorming. Brainstorming is carried out in two stages. At the first stage, all the shortcomings of the existing solution to the problem are highlighted, and at the second, a search for new, better ideas is underway.

Technique of creative cooperation. With this method, group work is changed to individual. First, a group brainstorming session is held for 10–15 minutes. Then the participants individually (5–10 minutes) think about the problem, write down new ideas. Improve the proposals made during the discussion.

The conference of ideas is a modification of the brainstorming method,

which is characterized by a higher pace of meeting and involves benevolent criticism in the form of remarks and comments. All ideas are recorded in the protocol, but the authors are not indicated. A variation of this method is the Hilde Ideas Conference, Discussion 66, Method 635. *Hilde Ideas Conference*. Both employees who are aware of the problem and newcomers who are able to put forward new fresh ideas are attracted to the conference of ideas, since traditional approaches to solving it do not gravitate over them. Skeptics or specialists who believe that they know everything better than others should not be invited to a conference. The chairman, whose status during the conference is equal to others, should maintain a relaxed atmosphere, steadily moving towards the goal.

Discussion 66 (a series of buzzing voices). Participants are divided into groups of six people, each independently of the others prepares his own solution to the problem or works out a position on a specific issue. In each group, the presenter, protocolist, speaker is determined. Group work lasts approximately 6 minutes. After that, all groups gather for a plenary session, at which a new view of the problem can be selected, which is again discussed separately for a short time.

Method 635. The group, which consists of 6 participants, analyzes and clearly formulates the problem. After that, each of the participants within 5 minutes enters into the form 3 proposals for solving the problem and passes the form to his neighbor, who takes into account the proposals of the predecessor and notes three more of his own proposals. They can arise as a result of certain associations with recorded decisions or be completely new. After all participants have processed the forms, the process ends. The time given to ponder in the last phases can be extended.

The next method of generating ideas is synectics. This is a really effective method of finding ideas proposed by V. Gordon.

Synectics – search for ideas of new products based on the use of analogies from other areas of life. The basis of synectics is brainstorming, in which

specialists in various fields of activity are invited to participate. A group from one assault to another accumulates experience in solving the problem. The main techniques used in the synectic assault are based on analogy:

- direct (how tasks similar to data are solved);
- personal (try to enter the image of the object given in the task and express yourself from this position);
- symbolic (give a figurative definition of the essence of the task);
- fantastic (how this task would be solved by fairy-tale characters).

The method of control questions. This method is implemented using a list of questions developed by A. Osborne, T. Eiloir, D. Pearson, G.L. Bush and others. The list proposed by A. Osborne includes 9 groups of questions:

1. What new application can be offered for the object?
2. What another object is similar to this and what can be copied?
3. What modifications can be obtained by rotating, bending, twisting, turning, changing functions, color, shape, contour?
4. What in a technical object can be increased (size, strength, number of elements, etc.)?
5. What in a technical object can be reduced (compacted, compressed, accelerated, narrowed, crushed)?
6. What can be replaced in a technical object (element, material, drive, etc.)?
7. What can be reworked in the object (scheme, layout, order of work, etc.)?
8. What in the object can be done the other way around?
9. What new combinations of elements are possible?

The method of verbal associations. When we are looking for needs that can be met, or working to improve an existing product, form of service, ideas can suggest words. The method of verbal associations consists in methodical compilation and re-reading of a list of words and concepts until a word suggests a new idea. The source of verbal associations can be dictionaries, journals on trade problems, technical literature.

Heuristic methods are based on associative abilities, intuitive thinking and the ability of a person to control it. These methods include various rules and recommendations that help solve problems without first evaluating the results. The most common heuristic methods include methods of analogy and inversion.

Methods of analogy reflect the natural desire of a person to imitate, that is, to reproduce in the elections the characteristics of objects, processes and phenomena of the environment, as well as mental abilities and physical properties of his own organism. The desire to establish the identity and divergence of objects of wildlife and the tools created by man accompanies the individual at all stages of creative activity. They are still looking for analogies between an airplane and a bird, a manipulator and a human hand, a cybernetic device and a human brain. Taking in general, generalized heuristic methods of analogy, depending on the specifics of the object of imitation, are divided into two classes: methods of imitating objects of inanimate nature, methods of imitating objects of wildlife (man and other biological beings).

In modern practice, the *method of precedent* is widely used. It involves the use in the new product of an original and effective functional principle that was applied in previous models. For example, vending machines, cash registers.

The *method of constructive similarity (the principle of the matrix)* is the basis for the design of goods, which is a geometric (linear, plane or volumetric) analogy of existing ones. For example, a few cars built on a common structural basis, a series of electrical household products.

The *method of reintegration (the method of “Ariadne’s thread”)* is also used in creative activity, which contributes to the creation of a new complex product by analogy with a relatively simple one. It is known that the rocket engine of F. Bandera was developed by analogy with a blowtorch. For the development of consumer goods, the pseudomorphization method is very often used. According to this method, products are created that are similar in shape to existing ones, but have a different functional purpose. The purpose of such a product is to create a

misconception about its true function. For example, a pen in the form of a lighter-gun, a lighter-gun, a radio-wallet.

Methods related to the imitation of wildlife objects are widely used to generate ideas. For example, the paleobionics method takes the silhouettes of fossil animals (walking excavator) as prototypes for new products.

The method of biomechanics is based on the reproduction in the developed goods of the principles of the mechanics of the movement of creatures (helicopter).

The bioarchitecture method uses for new products the shapes and proportions inherent in wildlife objects (for example, heating radiators, fences and other structures). When designing products that artificially reproduce the functions inherent in man, they use the method of biocybernetics. Recently, in research practice, the methods of bionics have been widely used – a science that studies the laws and principles of the functioning of a living organism to create artificial technical systems. Automated self-learning systems, robotically technical devices, devices for pattern recognition – this is not a complete list of applications of bionic algorithms.

The logistical also includes methods of alternative search, based on the integrated use in the process of searching for ideas of new products of such techniques that form alternative pairs in the form of “reception – antireception”. For example, magnification-decrease, hyperbolization-miniaturization, macroidealization-microidealization.

The method of inversion (from the Latin rearrangement) also plays an important role in finding ideas for new products. It involves the search for solutions in directions opposite to those generally recognized for similar objects. For example, the method of inversion of working materials and substances involves the replacement of their traditional types with non-traditional ones. This provides the ability for the product to perform new functions or increases its usefulness. The method of inversion of the shape of the object involves a change

in the operational properties of the product due to deviations from traditional solutions. For example, an airplane with folding wings, a hydrofoil boat. If it is necessary to take into account the contradictory requirements for structural materials at the same time, the inversion method is also used.

Gamestorming is a set of practices to facilitate innovation in the business world. The presenter directs the group towards a specific goal through play, a structured activity that allows you to think freely, even playfully. The word “gamestorming” is a neologism about the use of games for brainstorming. Games can be seen as an alternative to a standard business meeting. Most games involve 3 to 20 people and last from 15 minutes to an hour and a half. The game pauses some of the usual life protocols and replaces them with a new set of interaction rules. Games may require multiple props, such as sticky notes, poster, markers, random shots from magazines, or thoughts of provoking objects. The game’s skills include asking questions (discovery, managing, experimenting, closing), structuring large diagrams, sketching ideas, merging words and drawings into visual language, and most importantly, improvising to select and conduct a suitable game or invent a new one. Gamestorming is used to explore user experience, social media marketing, innovation, product development.

Questions for self-control:

1. What is the significance of the day map element?
2. What is goal achievement analysis in the day map?
3. How motivation is realized in the critical thinking system?
4. What are the basic techniques for creating solution concepts?
5. What is the focus content?
6. What are the methods for generating new ideas?
7. What is Boyd’s Loop?
8. What is the purpose of dobistorming as a prototyping tool?

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