



DESIGNPILOT - a Web-Based Design Innovation Method for Integrating Design Methods into the Development and Design of Products, Services and Interactions

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DESIGNPILOT - a web-based design innovation method for integrating design methods into the development and design of products, services and interactions

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Abstract

Design is a central factor in the digital transformation. On the one hand, products are changing rapidly, on the other hand, working methods in product development are changing. The future concept "Industry 4.0" needs an accompanying "Design 4.0". The DESIGNPILOT offers a complex set of digital tools that can make an innovative contribution in agile development environments.

The DESIGNPILOT is a web-based design innovation method that structures development processes, enhances creativity and optimises and promotes interdisciplinary collaboration. The web app aims to combine creative thinking and a systematic approach to effectively solve complex problems. The system was developed by Professor Wolfgang Schabbach as part of his research and teaching in the Integrated Product Design course at Coburg University of Applied Sciences.

As a navigator through creative problem-solving processes, the DESIGNPILOT promotes divergent thinking and cognitive activities that oscillate between analytical reflection on the one hand and intuitive-associative thinking on the other - an essential feature of any creative process. In this way, it conveys design know-how and supports cooperative planning at the same time.

In a figurative sense, the DESIGNPILOT represents a "**laboratory of design**". It awakens the discovery mode in the users - lightness and experimentation with ideas are combined with discipline and a structured approach.

The DESIGNPILOT divides the design process into 8 phases and leads through all stages of product development, also iteratively. Review tools are available to check the design and the current project status (project phases and milestones). Users have a TOOLBOX, a "digital toolbox", with 180 tools and 77 creativity techniques. DESIGNPILOT is designed as a web app and runs on all user interfaces and devices (PCs, tablets, smartphones). Access to the TOOLBOX is free of charge and without registration. (www.designpilot.info).

Keywords:

Design innovation method; Epistemological and problem-solving creativity; Design as a way of thinking and acting.

1. Introduction

Design is a central factor for the success of companies. It unfolds its potential particularly effectively where products are developed in an interdisciplinary way - in mixed teams of designers, engineers, market researchers, sociologists, material scientists or occupational physicians. In design research, there is a consensus that product designers have a central role to play in multidisciplinary teams. Inherently interdisciplinary - with a broad knowledge of design, technology, marketing and business administration - they are predestined for the role of "catalyst" in the product development process.

Up to now, however, suitable instruments have been lacking in practice to catalyse and control the highly complex development process in interdisciplinary teams. Instead, many designers, engineers and marketing experts go through the multi-layered process of product development only "by instinct". In the process, often only the first-best solutions are found instead of the best ones. Unstructured design processes often neglect the integration of new technologies or the consideration of alternative usage scenarios.

Moreover, many tasks are so complex and the amount of information to be processed is so large that a purely intuitive approach solves the design problems only inadequately. With the DESIGNPILOTEN, a digital tool was developed that supports designers and their partners in the interdisciplinary development process and initiates innovations.

2. DESIGNPILOT - a "digital toolbox" for problem solving and planning action

The DESIGNPILOT is like a "digital toolbox" that integrates into a computer-supported product development process in the sense of simultaneous engineering and promotes agile project management. It also promotes the creativity of the developers by stimulating both a systematic approach and associative, emotional and impulsive design thinking.

The art of creativity is always a balancing act between systematic work and intuitive, associative inspirations, between analytical and emotional thinking. This balance between critical reflection and spontaneous imagination must be maintained throughout the entire development process. In doing so, the DESIGNPILOT supports and accelerates the two central processes in design:

- **Problem solving** (universal, i.e. independent of the respective design task and economic sector)
- **Planning action** (interdisciplinary in development teams)

2.1 Problem solving

Problem-solving processes are creative processes that take place in steps: A problem must first be analysed, initial ideas developed. This is followed by several design phases with feedback loops up to the final design and series production.

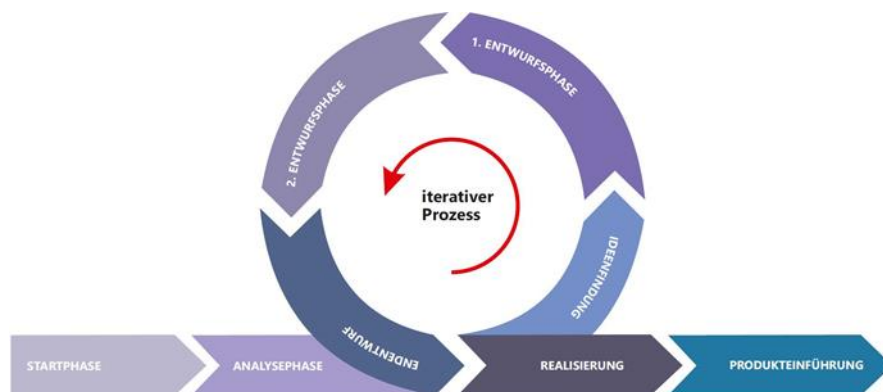


Fig. 1. Iterative work process

(Source: Prof. Wolfgang Schabbach, Coburg University of Applied Sciences)

The tasks are very different. The design of a hair dryer, for example, requires a different approach than the design of products for communication in the domestic environment. Thanks to its universal orientation, the DESIGNPILOT Designer can guide designers through both processes. Important elements here are the stimulation of the designers' creativity and the strengthening of their problem-solving competence.

A combinatorial "space of design knowledge"

Every designer acquires a certain reservoir of design knowledge in the course of his or her professional life. It promotes innovation when creatives constantly expand their individual repertoire so that they can react flexibly to a wide variety of problems.

For this purpose, the DESIGNPILOT provides a large digital "space of design knowledge" that goes far beyond individually acquired know-how. Its databases contain a large reservoir of about 4,650 user-friendly prepared analysis methods, design practices, best practice examples and creativity techniques.

Individually adapted to the respective project, the users select relevant tools. The requirements of the current project determine the selection of the respective

methodological coordinates. Not every tool is suitable for every project, but the database is broad enough and the level of abstraction sufficiently high to cover all tasks.

The wide range of methods, examples and knowledge in the combinatorial space of the DESIGNPILOT's design knowledge expands the horizon of the individual designer or user and leads him to go beyond previous personal experience in his considerations. Problems are solved by selecting the most appropriate available means for achieving them. Goal iteration is part of process management.

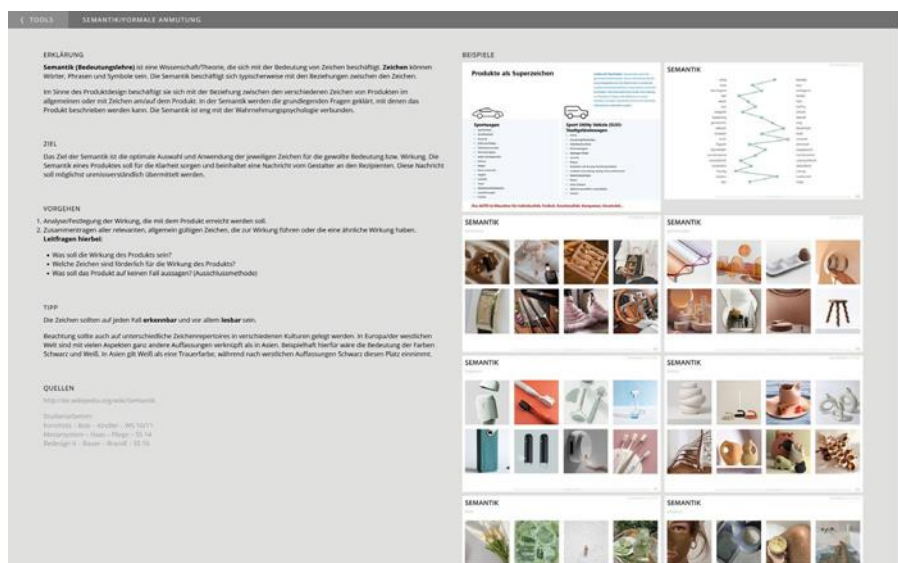


Fig. 2: Exemplary structure of the TOOL "Semantics"

(Source: Prof. Wolfgang Schabbach, Coburg University of Applied Sciences)

Promoting divergent thinking

Design processes are always "search processes": the search for suitable methods of analysis, technical solutions, creative tools or design practices. As described above, the DESIGNPILOT offers a large combinatorial "space of design knowledge" that can be individually adapted to the respective project and searched for suitable knowledge and alternative methods. It is designed so that designers and other developers can be inspired by a wide range of practices in the TOOLBOX of design knowledge.

Starting from one point (the current project), designers can let their thoughts wander in completely different methodological directions - this creates space for so-called "divergent thinking". Divergent thinking is one of the most important criteria for creativity. In contrast to "convergent thinking", which logically aims at exactly one solution,

divergent thinking always produces several possible solutions. Creative people are characterised by their ability to think laterally, also called lateral thinking. Applied to designers, this means that they can, for example, transfer solutions that have proven successful in one industry to another industry in a modified form and thus create innovations. New things are often created when knowledge from different areas is unexpectedly combined. Therefore, the DESIGNPILOT includes cross-sector solution examples for each of the 180 TOOLS.

Designers working with the DESIGNPILOT can be inspired by the tools and examples from different industries. For example, a designer in the "Technology Trends" category might discover that "miniaturisation" would be a surprising approach to solving one of his design problems. It often happens in creative processes that creatives discover relationships to each other in what were initially quite distant realisations that lead to completely new solutions.

"Knowing that and knowing how"

In problem-solving strategies, a distinction is made between the categories "Knowing that" and "Knowing how". While "Knowing that" refers to a rather static body of knowledge, "Knowing how" means a skill that is gained through personal experience. In the DESIGNPILOT, both forms of knowledge are intertwined. "Knowing that" is represented in the DESIGNPILOT by its encyclopaedic knowledge on topics such as "analysis", "target groups", "design practices" and many others.

The "knowing how" of designing, however, is imparted in the DESIGNPILOT while working with it. "Knowing how" is experience and intuitive knowledge that can only be gained in a continuous process. The architecture of the DESIGNPILOT is geared towards such knowing-how processes. It imparts implicit knowledge for professional designing by operationalising the following features of creative processes:

- Structuring problem-solving processes in all their complexity, vagueness and contradictoriness.
- Process management in individual phases with feedback loops
- Activation of analytical thinking (left brain)
- Activation of pictorial and creative thinking (right brain)
- Dovetailing intuitive-unconscious and reason-based thinking in planning
- Permanent oscillation between logic and fantasy as a constituting factor of every creative process
- Self-reflexive thinking in the design process
- Help with thinking blocks and creative crises
- Designing in the context of social interactions in interdisciplinary teams

In this way, the DESIGNPILOT imparts a "know-how" that gradually becomes functionally effective and increases cognitive design performance in design processes.

Transparent problem solving in the development team

It is above all the structuring elements in the DESIGNPILOT that drive the creative process. Unfortunately, planned action is often neglected in design processes. The myth of a non-"comprehensible" artistic creative power in the context of design is still current. But a hazy artistic pathos is not enough as an explanatory model for solution-oriented creativity - especially not when designers work in interdisciplinary teams with other experts. Because then all participants must come to common solutions in a permanent exchange during a successively developing process. This works much better if design is not carried out in a "black box", but transparently in a process of knowledge in which everyone participates across disciplines.

2.2 Planning action

Product development is a highly complex process that is more effective and successful when all those involved proceed in a structured manner. Concepts and objects created for people have multi-perspective characteristics and requirements. That is why designers, technicians, engineers, market strategists and others work in interdisciplinary teams on most industrially manufactured products. Combining engineering knowledge with sociological, economic and psychological insights in an interdisciplinary innovation process is of enormous importance in practice.

Where product development has to be coordinated in multidisciplinary teams, a high degree of structure is needed. But this is often lacking in practice. It would be desirable if approaches to solutions were developed more "approximately simultaneously" by the different experts, whereby analysis, synthesis and evaluation processes between designers, engineers and marketing experts can continually converge.

In practice, however, designers are usually involved too late in the development - as a kind of "cosmetician" in the final phase of the process. This has a detrimental effect on the quality and cost structure of a product. Here is an example: An essential element of all design processes is the recognition of the needs and wishes of the users of a product (user-centred design). This step should be carried out as early as possible in the development phase, with the obligatory participation of designers as "advocates of the users".

If designers are involved too late in product development, the following undesirable developments often occur:

- If the influence of the "research and development" department is predominant in product development, the products become technically overloaded (example: Household appliances with bloated electronics whose operation is hardly comprehensible to anyone).
- When the marketing department's share is in the foreground, the new products

often represent only pseudo-innovations (example: wet razors with more and more blades)

The DESIGNPILOT is a software that brings designers and their partners together in an interdisciplinary development process from the very beginning and supports joint planning activities throughout the entire process. The aim is to think of the product as a conceptual unit from the very beginning of the development process. Only then do you have the chance to do justice to products in their entirety and create true innovations. Unfortunately, this happens far too rarely in practice. Already in the all-important conception phase - 70% of all life cycle costs of a product are invested in this phase - there is too little interdisciplinary cooperation in the companies.

The consequence for product development: too much re-design, too much facelifting, too many copies of competitors, too many me-too products, but too little independent innovation. Companies often only react to the market. Considerations of technology, distribution and investment costs predominate. There is too little holistic thinking in product development. It is done almost incidentally, too much out of day-to-day business, too little conceptually.

Process management in eight phases, iterative in design cycles

The DESIGNPILOT is an instrument that takes a holistic view of product development and makes its processes manageable for the development teams by operationalising them. The system functions as a tour guide that divides the design process into eight phases, from the start phase to the market phase. It thus offers the development teams a structure that enables all participants to proceed in a planned manner.

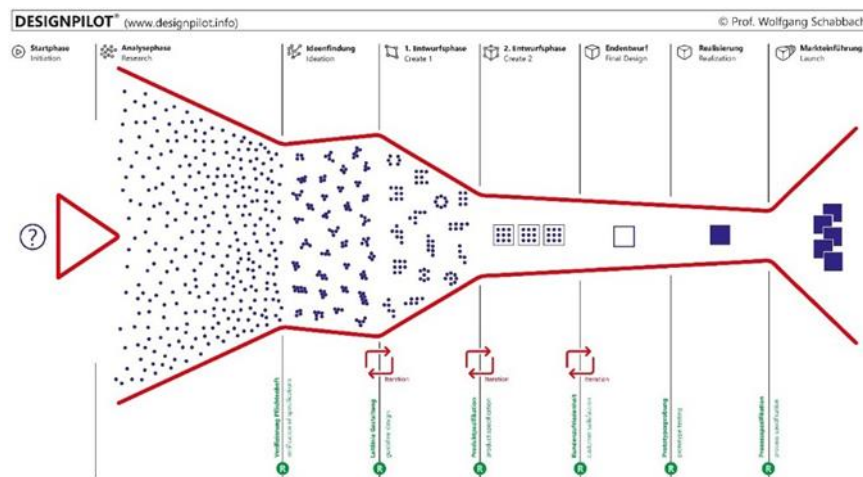


Fig. 3 Iterative DESIGNPILOT - flow chart

(Source: Prof. Wolfgang Schabbach, Coburg University of Applied Sciences)

Special attention is paid to the phases "start", "analysis", "brainstorming" and "1st create phase", as this is where the integrated overall concept of the product or service is developed. Clear phases with defined key data for schedules prevent the team from getting bogged down.

The DESIGNPILOT's process guidance suggests what to do in which phase. How it is to be done varies, of course, from case to case, depending on the industry and the degree of complexity of the task. The system provides a variety of TOOLS that can be used flexibly and extended by further variables of all departments involved in the process in the sense of a methodology of agile development. The problem-solving activities do not follow a rigid pattern, but are organised around a problem-centred application for each project.

The process structure in 8 phases offered by the DESIGNPILOT is helpful. It does not provide a static or finite model. Rather, the system provides a realistic and adaptable process model, the concrete design of which is always renegotiated within the framework of the interaction in the interdisciplinary team, depending on the task - but this is done on the secure "foundation" of the process structure suggested by the DESIGNPILOT.

This structure has been developed in many product development processes of the "Design and Construction" department within the framework of third-party funded projects with industry. It has been shown that the planned procedure in phases with feedback loops enables very effective work and can lead to integrated, innovative product concepts, especially in the conception phase. The structured procedure increases creativity and avoids delays and wasted efforts in the team.

Communication platform

The DESIGNPILOT organises the communication in the interdisciplinary development team, which without support often runs haphazardly and incompletely. A corresponding user interface supports the exchange. The aim is to be able to involve external experts in addition to the core development teams, depending on the task at hand. The DESIGNPILOT provides the tool in the form of a communication platform. The respective use and design of the communication tool result from the concrete project and its requirements. The tool itself is flexible and can be used across all sectors.

3. Use in design teaching

For 8 years now, the DESIGNPILOT has been used in the teaching of the Integrated Product Design course at Coburg University of Applied Sciences. The design students learn how to work with the DESIGNPILOT in the subject area "Design and Construction". After just one complete design session using this method, the students have a higher level of problem-solving competence for subsequent projects. They have learned a "know-how of designing" that leads to particularly creative results.

The products they develop in the process come from very different industries: From thermo-catalytic process engineering plants for the sustainable conversion of biogenic residual and waste materials to product concepts for biometric gait monitoring of Parkinson's patients.

The DESIGNPILOT can achieve this diversity because it offers a universal creative toolkit for idea generation and problem solving. Idea generation is not so much a quality in itself. Rather, it is a path that paves itself as you walk. The DESIGNPILOT supports this process.

3.1 Empirical evidence of significant increase in students' problem-solving competence

Students who work with this method significantly increase their problem-solving competence and thus also the quality of their designs. This has been shown by empirical experience after the introduction of the DESIGNPILOT into teaching.

The students' product ideas are also developed in cooperation with companies. Some of the students' results are so excellent that they make it into series production during their studies as part of student research projects at well-known companies. In individual cases, the DESIGNPILOT has enabled Coburg design students to develop patentable ideas.

3.2 Didactics

Working with the DESIGNPILOT not only leads to qualitatively better design results for the students. Almost incidentally and intuitively, they also learn the "craft" of designing. The software-supported, customisable user interface has a supporting effect. It is characterised by a "joy of use" philosophy and ensures that students find easy access to the methodology and enjoy working with it.

In general, the DESIGNPILOT promotes key competences such as creativity, mental flexibility, thinking in processes and contexts, communication skills, thinking differently, imagination, curiosity, the desire to experiment, stamina, project orientation, interdisciplinary work, team spirit...

In particular, it trains the students' ability to reflect and thus also their repertoire of solutions for complex problems. The app thus implements exactly what Salustri and Eng called for in 2007: "Professional designers bring to bear their training, their experience, and a body of knowledge (...). To use all this material, the professional designer must be aware of it, and so must intentionally act at a metalevel as well, by reflecting on his design activities, selecting tools and methods, and adapting his personal design process to suit the moment" [1].

4. Benefits for Companies

Design plays an important role in the digital and ecological transformation process of the entire economy. Classic development structures with narrowly specialised training and time-consuming linear processes are often overwhelmed by the pace of progress. Multidisciplinary and agile ways of working are needed. New concepts such as "cross-innovation" or "design collaboration" stand for this.

The DESIGNPILOT enables companies to realise these forward-looking methods in cross-industry or cross-disciplinary collaboration with creative professionals. The challenge in interdisciplinary cooperation is often the development of a common language level on which an exchange of the most diverse experts can take place. Here, the DESIGNPILOT not only provides a suitable communication platform, but also supplies the tools to structure and control highly complex interdisciplinary processes.

In the following, the advantages that the DESIGNPILOT creates for business enterprises are listed in detail.

4.1 Strategy tool for systemic innovation

The DESIGNPILOT organises the product development process by bringing together all the competences of a company. Product and design innovations in interdisciplinary teams and a systemic approach to complex problems are made possible. The web-based app brings structure, plannability and transparency to the development process.

4.2 Common communication platform

The DESIGNPILOT offers a software platform for interlocking development departments. In this way, individual projects, as well as projects that can be worked on in a team, can be designed clearly and transparently.

4.3 Simultaneous and cooperative work

The DESIGNPILOT enables simultaneous engineering, as interdisciplinary cooperation can be organised through the common, digitalised communication platform, also with external partners - thus product development can be shortened, effective coordination optimised and the quality of the design development process increased.

Interdisciplinary prejudices are to be reduced and entrenched corporate structures countered with open, transparent interaction (agile development).

4.4 Acceleration of development processes

The DESIGNPILOT increases productivity by reducing the complexity of development projects. Lengthy developments are accelerated, the plannability of the design process is optimised and risks and costs are minimised.

4.5 Increasing the quality of design

The early involvement of design in research and development leads to an increase in the profitability of product development through profitable unique selling propositions, a high degree of innovation and optimised customer satisfaction with a consistently user- and customer-oriented design strategy.

4.6 Design-centred process management

By working with the DESIGNPILOT, companies can benefit from the interface and problem-solving competence of design-centred process guidance.

4.7 Universal and standardised innovation procedure

The DESIGNPILOT can be used universally as a standardised innovation procedure that can be applied to all products and services in all industries. It is a digital tool that can be seamlessly integrated into a completely computer-aided product development process.

5. Benefits for Designers

How creatives can not only increase their own potential with the DESIGNPILOT but also strengthen their position in development processes is shown in detail in the following.

5.1 Increasing creativity

Every designer acquires a certain reservoir of design knowledge in the course of his or her professional life. It promotes innovation when creatives constantly expand their individual repertoire so that they can react flexibly to the most diverse problems. The DESIGNPILOT supports designers in their design method competence. More experience in analysis, planning, design and creative methods leads to more innovation in product development.

5.2 Encouraging "different" thinking

Creative people are characterised by their ability to think differently. This means that they can transfer solutions that have proven successful in one area to other areas in a modified form and thus create innovations. New things often emerge when knowledge

from different sectors is unexpectedly combined. The DESIGNPILOT offers a large "combinatorial space" that can be searched for alternative methods.

5.3 Help with thinking blocks and creative crises

The DESIGNPILOT offers help with creative bottlenecks and dead spots in the design and development process.

5.4 Better manageability of highly complex design tasks

The DESIGNPILOT structures the highly complex process of product development from the initial phase to serial production. By guiding the process in individual phases, the DESIGNPILOT supports creatives in solving design tasks in all their complexity, vagueness and inconsistency.

5.5 Strengthening the position of designers

Through design-centred process management (designers as catalysts within interdisciplinary product development), the DESIGNPILOT strengthens the position of the designer in interdisciplinary development teams.

5.6 Better order processing

The DESIGNPILOT assists in communication, structures and systematises product development with the client or customer and supports the solution of complex tasks.

5.7 Increased effectiveness and acceleration of development processes

The DESIGNPILOT networks and organises the members in development teams. It provides an overview of project content and progress, improves communication and increases productivity by reducing the complexity of development projects.

5.8 Universal and cross-sectoral application possibilities

The DESIGNPILOT has a universal repertoire of analysis, planning, design, drafting, construction and creative methods that can be used across all sectors for all creative tasks.

5.9 New strategic competences in innovation processes

With the DESIGNPILOT, designers can take on additional strategic tasks in innovation processes. In addition to support in classic design competence, it enables designers to generate problem-solving and strategic knowledge in order to more actively shape re-thinking and change processes.

References

1. Hugentobler; design as a way of acting. S. 13 (2010)