

# ORGANIC, BIONICS & BLOB DESIGN - CONCEPTUAL AND METHODOLOGICAL CLARIFICATION

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## **ABSTRACT**

Industrial design is a young field of science that works together with many disciplines, borrows concepts and constructs metaphors for product characterization and phenomenon description. The meaning of the penetrative or constructed concepts is crystallized over time through academic writings and discussions. Organic, Bionics and Blob Design is an example of such a vague concept. Vague concepts create confusion when the concepts are used in academic texts and in course descriptions, which should be understandable across international research and by exchange students. This article discusses the Tripod approach as a possible method to clarify meaning and as an aid to students' development of a technical terminology. The concepts must be used in the same context, in this example the context is Natural Design, and represent different analytical angles on scientific issues. The three concepts of Organic, Bionics and Blob design meet these conditions to form the foundation for a Tripod Approach. The clarifying question in the discussion of meaning will circle around whether Nature Design poses a "paradigm" for industrial design, in which Organic, Bionics and Blob Design separately constitute "sub-paradigms". The citation marks indicate that this study looks at paradigms as practice fields rather than as research programs. The field for this study is set by a design engineer education with courses that cover the three design disciplines.

*Keywords: Clarification of concepts, tripod approach, organic design, bionics design, blob design.*

## 1 INTRODUCTION

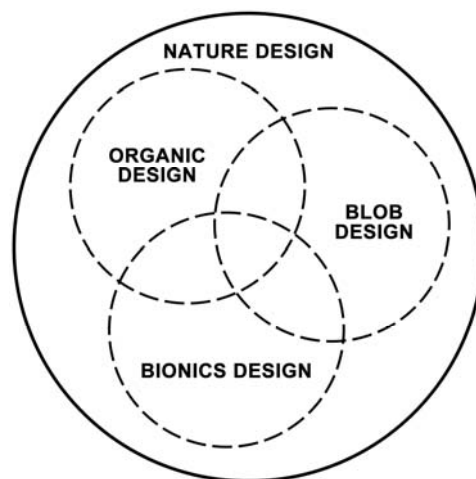
Industrial design is as a research field so new that it still uses a number of borrowed concepts and metaphors in product characterization and the description of phenomena. Design researchers, heads of design educations and heads of study programs have systematically sought to develop a professional design terminology. Researchers build on previous research as e.g. textile designer Anne Louise Bang in her Ph. D. gets both concepts and the bases for her research grip a Tripod approach from textile artist Kaja Tooming's Ph. D. [1]. Headmaster Bjørn Bråten organized a number of discussion events external partners and students alike with the aim of establishing a commonly accepted terminology which could subsequently be finetuned through use, because concepts can only be incorporated in a field through continuous use [2]. Head of studies Jens Overbye found concepts and the clarification of them in the world of pedagogy, science and art and gathered them in the book 'Clarification of concepts', which he distributed to the students [3]. Theme exhibitions in museums such as 'Bionics, people learns from nature', 'Organic Design in Home Furnishings' and 'Nature Design, From Inspiration to Innovation' all contribute to the clarification and disseminating of the concepts [4] [5] [6]. Authors also do this when they, like Steven Skov Holt and Mara Holt Skov, try to characterize products according to different concepts, as they do with "Blobs" [7].

Architect Henriette Houth concludes in her study that the purpose of Nature Design is to give life to inanimate things, so that the things can be experienced alive, in the same way as wax figures in Madame Tussauds [8]. Houth uses the term organic design as a collective term for the above four styles, and thus she provides us with an idea of what the term covers. Architect Petra Gruber discusses the meaning of a similar concept on the basis on the concept biomimetics, with the goal of categorising 'architecture of life' and exemplifying how nature has given answers to function problems or constructive problems [9]. The concepts Organic and Blob Design penetrate into industrial design from architecture and Bionics from the natural sciences. The present investigation is limited to the

design engineer student's theory and practice fields, and therefore the concept of Bionics Design is used instead of only Bionics. Biotechnology, Nanotechnology and similar scientific areas like Bionics are based on living nature viewed as a collected field of knowledge, which Bionics Design then draws on. Before the Tripod approach is developed in this study, it is worth to recall Steven Vogel's observation that nature does well in many areas, but do it on the basis of its own merits and that we have other merits. "Nature's evolved technology represents the only one other than our own to which we have access" [10].

## 2 TRIPOD APPROACH TO CONCEPTUAL CLARIFICATION

In a young science field, where it not has been possible to draw analogies to previous studies, the researchers ought to begin their study with a methodology and conceptual clarification phase. In that connection, many researchers use a hermeneutical spiral approach to reach a clarification of the concepts applied in the initiating model of reading. An archetypal model of reading is the so-called 'Tripod approach', which is a common term for models that are based on three concepts or three distinctive perspectives on the field of study. The experience gathered after each case study contributes to a nuancing of the terms as well as the reading model. Such a pilot study often reveals a need for a further detailing of the investigative grip. Thus, Anne Louise Bang concludes that the observer's role should be assessed in future studies. In this exemplification of the use of a Tripod approach for conceptual clarification, Nature Design was selected as the context. The concepts Organic, Bionics and Blob Design are all based in nature and can be included in the concept of Natural Design. This concept refers to both "model of nature" and its organizing principles as well as to staging of nature with artificial objects and modification of nature. A For exemplification of conceptual clarification a Tripod Approach is established based on preliminary definitions of Organic, Bionics and Blob Design. The preliminary definition of Organic, Bionics and Blob Design is established in Section 2.2, 2.3 and 2.4 with the associated design processes. The latter contributes to the clarification of the "sub-paradigms" in relation to industrial design. A model of the Tripod approach is shown in Figure 1. It shows the overlap in the use of the concepts, which is the reason for the prevailing confusion of meaning.



*Figure 1. Tripod Approach*

Integration of a natural inspired contribution in design process can be derived from Franco Lodato's Biodesign process, which forms an addition to Design Continuum model [11]. A Biodesign process integration implies according to Lodato the following steps: Input from previous stage - Discovery (standard process for observation of nature), Definition (identifying natural phenomena and principles) Implementation (realizing the biological principle), Evaluation (evaluating and comparing) and – passing on to the next stage. Jørgen Kepler and Marianne Stokholm's study reveals that the Biodesign process can either be included in the Design Exploration, (that is the initial fact finding: the investigation of, what? why? and how?) or placed between the Alignment stage and the Learning stage [12]. The specific content of the Biodesign process refers to bionics; therefore the specific content of this phase will be discussed in relation to Organic Design in sections 2.2 and in relation to Blob Design in sections 2.4.

## 2.1 Nature Design

Natural Design as it refers to “the ‘model of nature,’ with its forms, structures, and organizing principles, does not only inspire the widest range of concepts and design processes, but also can be expressed in a broad spectrum of forms and functions.” “Works that do not simply depict or imitate nature but use it as a starting point and reservoir of inspiration for eclectic and innovative responses to the relationship between man and his environment.” [6, p.9]

The standard process for observation of nature, which Lodato refers to is, according to Angli Sachs, developed by people like "Maria Sibylla Merian, who with her examination and illustration of the metamorphoses of insects is the founder of entomology; it continues with Carl von Linné, who revolutionized the systematization and classification of nature with his *Systema Naturae*; Johann Wolfgang von Goethe's work as morphologist; Charles Darwin, founder of the evolutionary theory; the explorer and polymath Alexander von Humboldt up to Ernst Haeckel and his influential illustrations of *Radiolarien* (Radiolaria) and *Kunstform der Natur* (*Art Forms of Nature*). In addition, archiving, cataloguing, and systematization of nature are represented by preparations and models from botanical and zoological collections." [6, p.10] Organic, Bionics and Blob Design all have a Discovery phase that either builds on the observations of others or their methods of observation. Within Organic Design exceptions occur where the designers have put an artistic interpretation on the observed. Whether Lodato's Biodesign phases Definition and Implementation have a different approach than the ones in Organic Design and Blob design will be discussed in Section 2.2 and 2.4 respectively.

## 2.2 Organic Design

On October 1, 1940 the Museum of Modern Art in New York arranged the competition 'Organic Design in Home Furnishings'. After the competition, Elliot F. Noyes tried to define the concept of Organic Design with this: “A design may be called organic when there is an harmonious organization of the parts within the whole, according to structure, material, and purpose. Within this definition there can be no vain ornamentation or superfluity, but the part of beauty is none the less great - in ideal choice of material, in visual refinement, and in the rational elegance of things intended for use.” [5, inside of cover] In order to understand the Organic Design process and its purpose, it is necessary to know that one purpose of the competition was to bring forth the sweeping, feather light lines that appear in nature and that are tied to the human soma. This to break with the strict geometric forms that characterized functionalism, which had just been modern. According to Sachs, the inspiration to the competition was Alvar Aalto's Finnish Pavilion at the New York World Fair (1938-39), which Aalto transformed and turned into an 'organic exhibition'. Aalto's Savoy vase has since become an icon of Organic Design. Eskimo women's leather pants were the model for this vase [13]. Noyes also highlighted about the exhibition that industrial design appeared to be conscious as an art form, with their use of the aesthetic anguish that constituted the apparatus of industry production. And he noted the designers' courage to take up the challenge of experimenting with new solutions, just like Charles Eames and Eero Saarinen did when they managed to create double curved plywood chairs. Thus, Organic Design combined the search for constructive and functional solutions with a decoding of the leading feature and textures from nature to give a product a particular expression or symbolic value, as in Eero Aario's Pony Chair. For this approach design engineers use the concept "tectonics"<sup>1</sup> [14].

The hypothesis that about the Biodesign phases contains the same for Organic Design as for Bionics Design is true for the Discovery phase, because artistic abstractions are generally based on approximations to mathematical curves or formula, at least for industrial designers who use CAD programs in modelling [14]. The model for the Pony Chair, Aario made in Styrofoam and clay; but it retrieves only the main features from a pony and the resilience of musculature is absent. The Definition phase is also adequate for Organic Design, because the preliminary research before the Biodesign stage target the Definition phase towards the clarifying of a leading feature that can unite the tectonic solutions with a whole or ensure that an aesthetic statement is realized in the form. The Implementation phase materializes the leading feature or integrates the aesthetic statements in the

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<sup>1</sup> "Tectonic becomes the art of joinings: Art" here is to"- be understood as encompassing tekne and therefore indicates tectonic as assemblage not only of building parts but also of objects.... as soon as an aesthetic perspective - and not a goal of utility - is defined that specifies the work and production of the tekton, then the analysis consigns the term "tectonic" to an aesthetic judgement".

form. The Evaluation phase includes the designer's artistic ambitions, and like the Eames and Saarinen, an evaluation of their own experimental capacity.

In the courses in Organic Design for design engineers, the students are challenged on their abstraction abilities and they must draw either on their math and/or Cad experience as well as on their sense of space. The decoding of the leading feature is based on the recording of the leading curve (parts) and the sectioning of natural objects perpendicular to the part. Subsequently, the decoded object is transformed into a product, while retaining the feeling of life or the rage of the elements.

### **2.3 Bionics Design**

The introduction to the exhibition "Bionics" it said: "The word 'bionics' was first used in 1958 by Major Jack Steele, an engineer in the US Air Force, to describe making copies of nature and finding ideas in nature. Although the word is not very old, there is no doubt that humans have observed nature to find solutions to technical and design problems for thousands for years." [4, p.5] and "In the last 10-20 years, centres have turn up all over the world where they work on decoding nature's recipes for materials and structures. The centres house eight interdisciplinary environments where biologists, engineers, doctors, physicists and chemists work together." [4, p.6] From this the conclusions can be drawn that the design problems involved are those concerning the natural science fields. And that the methodical approach is attached to each subject field, although many systematics in natural sciences are common or as Lodato put it: "use standard process for observation of nature". The many examples of Bionics reveal that this science field only draws on biology and zoology, and not on nature as a whole. The word Bionics is possibly a contraction of 'bion' that means 'unit of life' and the suffix -ic, means 'like'. Bionics Design deals, according to Holt & Skov, with the technical transformation and application of structures, procedures and development principles of biological systems. This, by its very nature, makes it an interdisciplinary task that combines biology and zoology with engineering, architecture and mathematics [7]. A review of Holt & Skov's many design examples reveal that the used constructional and functional principles do not have reference to nature as opposed to architecture examples. The main feature of Otto dental floss may make references to the human body but its combined holding and cutting tool does not, so this product will be placed in between the Organic Design and Blob Design field in figure 1. The same is the case with Folpo's hand mixer, just to give a few examples. On the other hand, Philippe Starck's WW Stool uses a design principle where the branch splits into three and may be placed in between the Bionics and Organic Design. And Velcro with its working principle from Linden burrs belongs in the Bionics field.

Our course in Bionics Design challenges the student's systematics and innovative abilities. It consists of a problem-based project which must be answered by creating a product that either uses the observed bio-/zoological principles of construction and function or identifies a bio-/zoological principle of construction or function and then finding a design problem which can be solved using this principle [12].

The word Biomimicry shows up if you do a search on Bionics and largely the two concepts reference the same examples. The concept is said to be constructed by Otto Herbert Schmitt as a contraction of 'bios' and 'minieses' meaning, 'life' and 'imitate', respectively. A search on university design courses in Biomimicry shows that they are generally described as having focusing on innovation, in preparation for sustainable solutions to human challenges by emulating nature's time-tested patterns and strategies as a basis for the innovation. As Sustainability matters are not the focus of our Bionics course or present paper, Biomimicry is considered a paradigm which contains bionics.

### **2.4 Blob Design**

Blob Design deals with the design of objects defined by their quintessential fluidity with double curved surfaces, with the exception of the supporting surfaces, which may be plane. Objects that represent buildings are also referred to as "Fluid Architecture" because of the characteristic flowing goopy, drippy, swoopy, seamless, merging, converging, bulging, morphing, overlapping shapes and the absence of sharp edges [7]. Gunnar Aagaard Andersen's 'Portrait of My Mother's Chesterfield' from 1964 can be said to constitute a design icon for the concept Holt & Skov constructed as a contraction of "blobby" and "object" to blobject.

As a paradigm Blob Design belongs in Nature Design because the original inspiration came from corroded beach rocks, the kidney, softbodied animals or organisms and amoeboid cells that appeal with their cuddly, playful and body friendly appearance as shown in Marc Newson's Lockheed Lounge

from 1986-88. The paradigm is developed not until the early 1990s with the spread of 3D design computer programs that are able to describe the geometry of the curved surfaces accurately and produce programs and production equipment, which can handle the extreme individualization of the components [16]. Blob Design remains extremely challenging to design engineers, computer scientists and industry technology development although with the help of 3D printer industrial production is well on the way. The challenge for computer scientists is to create user-friendly programs that can generate the 'blob' shapes that architects and designers request. A 'blob' is a collection of data that control a flowing mass – a flux. The designers are challenged when controlling the movement patterns of the flux and setting the limits for these.

Today the Discovery and Definition phases in Blob Design have much more focus on investigating and understanding opportunities in existing generative computer programs and how these experiments should be decoded than on how studies of nature can help develop new program facilities. The designers have also more focus on using new technologies and manufacturing methods than on contributing to the development of new technologies through their experiments. This concerns the designers who create new products. Contrary to this, Lodato's Biodesign process is useful for designers who work together with computer scientists to create new contributions to computer programs that can generate natural flow or movement patterns. During our course in digital design, the design engineering students tried their hand at 3D flux computer programs alongside architecture engineering students. They tried to create ergonomic furniture, which seems to be as big a challenge as creating a climate-optimized building. Many of the blobjects the designers created were of such a small size and complexity that they could be modelled manually, but as a teaching discipline, Blob Design must differentiate itself from Organic Design. It is precisely the 3D generative computer programs that generate flux that make Blob Design interesting. The discipline also challenged the design engineers' sensibility in a different way than Organic Design, where they have the support of the resilience of musculature or skeletal structures.

### 3 TRIPOD APPROACH TO METHODOLOGICAL CLARIFICATION

Does Tripod approach in design engineering programs constitute a more appropriate method of conceptual clarification and development of a technical language than those mentioned in the introduction? It has not been possible to test whether Overbye's methods are a better alternative for our education, because we do not have a corresponding 'Clarification of concepts'. However, Overbye's has been tested in a single course, where we found the shortage of engineering terminology to be too big, but the method could be used as a starting point for developing one. For the architectural engineering students that participated in the course, the architect Søren Koch's 'Technical terms from the traditional construction' was a good supplement [17]. The program has no tradition for initiatives such as Bråten's with seminars where students discuss multidisciplinary matters and concepts from penetrative research fields, for example from scent and sound design and in collaboration with hospitals and the home care or nursing sector.

The testing of the Tripod approach which combined conceptual clarification and analysis methods was undertaken in connection with the students' preparation of scientific papers. In that connection, the Tripod approach has been introduced as a possible alternative approach for students who chose a theme for their paper which had not previously been addressed in the context of industrial design. The surrounding space, availability of equipment, workshop facilities or access to materials and their impact on the creative process are examples of matters treated by this method. In connection with the preparation of papers, the students participated in seminars, where they were eager to contribute with their observations of diverging concepts. The seminars served as an eye-opener when it comes to obscure use of concepts and the subsequent presentations by the students have not exactly clarified the concepts, but they contributed with qualified suggestions as to the definition of the concepts. The previous Tripod based on Organic, Bionics and Blob Design - without Biodesign process considerations, - was tested as an analytical method based on the assumption that the students would get a clear understanding of the concepts through the courses. Unfortunately, the assumption proved to be false, which is the reason for this attempt to establish a foundation for future clarification.

In previous experiments with the Tripod approach, it worked well when the concepts were associated with a single research field, although the related paradigm was unknown to the field of design.

An example of this is how scents have a memory provoking effect on the innovation process; an approach based on both a multi-sensory and a memory concept, both from one incorporate research

program. The situation was not as simple for the concepts Organic, Bionics and Blob Design, because they are both emerging in the design area and in their original areas. Blob Design is a new paradigm and a practice in relation to new technology and production equipment. The analysis is complicated by the fact that the artist, the architect and the designer affect the development of the common computer programs and they all contribute with blobjects.

#### 4 CONCLUSION OG FUTURE WORKS

Organic, Bionics and Blob Design represent all sub-paradigms in Nature Design. Organic Design in a wide sense draws its aesthetic statements from nature. Bionics Design takes its point of departure in living nature and limits its activities to the natural science fields. Blob Design has only an indirect link to Nature Design with regard to product design, but draws directly on nature's processes and principles for the development of computer programs which generate mass flow. The Blob Design aesthetic statements reflect also flowing cultures detached from nature. Lodato Biodesign process covers Organic Design when the process input is aimed at defining the leading feature. The Biodesign process description covers Blob Design for the design engineers involved in the development of computer programs, but not for the others. From what has been found, it seems probable that Tripod can only be used as an approach to conceptual clarification and analysis when the concepts belong to the same well-established paradigm. This paper can be seen as input to a test of Tripod with Organic, Bionics and Design Blob as basis.

In a course about the development of papers, the students studied subjects that have not previously been the subject for design research and therefore the students needed a proper methodological approach. In this connection, the Tripod approach also appeared suitable as an initiating reading model, based on the first guess at characteristic perspectives of the study field.

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