

# **ADEX<sup>®</sup>: A TOOL FOR A COMMON REPRESENTATION OF DESIGN CONCEPTS AND DESIGN ARGUMENTATION IN A CROSS-DISCIPLINE COLLABORATION**

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## **ABSTRACT**

This paper is about the representation of design concept in the early design steps. One of the most important challenges for the designer is to generate, under time constraint, relevant concepts, which are going to become real products with the least possible of alterations during their development.

The good efficiency of the teamwork lays partially on the designer's ability to express all the relevant knowledge that permit a common vision on the product project among the team members, and to make understandable the relations between the formal, structural, physical and semantic details guaranteeing the respect of the specificities and claims of the design proposal.

The aim of this study is to contribute building a method supporting the design formalisation and argumentation tasks, helping the designer to express significant relations between the signs he/she puts in the product, and the physical characteristics realising it, understandable in a multidisciplinary team.

In order to support the designers to express as much as possible their knowledge about the design proposals, we propose a semiological tool that enable to 1/explicitate the implicit knowledge that is important for further product development, 2/build the argumentation of every design proposal regarding the semiological values, and help common representation during the concept evaluation step. On the basis of 3 industrial design projects and one design workshop, we seek whether the tool helps the designers to solve current problems during the design process, or brings them too much complexity.

*Keywords: Industrial design, perception, semantics, design concept, evaluation, cross-discipline collaboration*

## **1 INTRODUCTION**

In the industrial design process, one of the roles of product design is to propose innovative concepts that will be perceived as new daily benefits by the consumers and the users. Designers have to take into account the last progresses in technology as well as the most recent social evolutions, and express through design concepts functional, sensorial, emotional, cultural, and historical values that really meet the users requirements. The implementation in the product of its physical characteristics, subjective aspects such as emotions or the Kansei, the symbolic aspects [1] or other more objective aspects such as functional or formal has been attempted in numerous studies and industrial research. Nevertheless one can see that the parties do not possess

at a given time (t), a complete vision of the project or of the product, whether it be on an operational or a strategic level. Thus, it is not unknown for the designer's intention in his/her initial drafts to be misunderstood or misinterpreted by the development players and for it to disappear by lack of explicit communication. In the same way on a decisional level one can 'forget' several aspects nonetheless clearly explained in the task list simply in order to save costs or time.

In a previous study [2], we have shown the mechanisms of the characterisation of objects by 7 different industrial partners. In this study we provide support at different stages of the design process both for the designers during their prospective research of concepts and for the decision makers during the appraisal and development stage of choosing.

## **2 RESEARCH CONTEXT AND METHODOLOGY**

The project has been led within the framework of the postgraduate program in industrial design of the Technological University of Compiègne (DESS of Industrial Design and Product Design).

The research work has been initiated 3 years ago, [3] after analysing the young designers community's request, needing to master their design communication in the later phases of the product development. In both contexts of in-house designers as well as external designers, misunderstanding often occurs during the design evaluation step, while the designer has to promote the design proposal's performances and requirements to other firm members.

### **2.1 Objectives**

The objective of this work is to investigate what could be a cross-cultural referential for product design process.

The first objective of this study is to present a way to support the designer's creativity centred on the users and on product-user-context interaction in the early stage of design process. It aims to help the designer to master the semantic dimension of the design proposals.

The second objective is to propose a structure that could support the communication of the design proposals from the designer to the other communities of practice (i.e. mechanical engineers, business scientists, etc), allowing to take into account in the design assessment stage all the performances the designer has implemented.

### **2.2 Hypotheses**

The methodology adopted is based on different hypotheses regarding the current advanced design process.

The more and more complex industrial product development's context, involving an increasing number of various industrial partners, lead the designers to develop more structured way to communicate the newness of their design proposals, in a way that fit their interlocutor's culture, language and point of view.

A common reference (a guidance for designers on how to express the product's requirements) could contribute to the success of the product development by minimizing the time to market through better understanding among the industrial partners.

### **2.3 Experimentation**

We have experimented the tool ADEX<sup>®</sup> in four different application cases, two in the automotive design sector, one in the household electrical appliance sector, and one in

the sport sector for the design of a leisure product. This paper presents in details the application of ADEX<sup>©</sup> to the innovative leisure product design. We have been using:

1. Traditional design process
2. ADEX<sup>©</sup> tool in the last stage of the project,
3. Finally we compare the concept's communication made by the designer without the tool and with the tool.

We therefore can estimate qualitatively the contribution of such a tool in the design process, in the concept's explanation step as well as in the assessment one. The experiment lead us to seek whether the tool support communication in cross-discipline collaboration and in which stage of the design process.

### **3 WHY DEFINE PRODUCT'S IDENTITY IN THE EARLY PHASE OF THE DESIGN PROCESS?**

There are many examples from the product design industry where the lack of requirements and design specifications in the early phase of the design process lead to post-market problems [4]. From our point of view, so far the design process is well structured regarding the functional analysis and technical aspects, but has poor guidance regarding the global coherence and product/service's affordance.

The approach proposed in this paper aims at highlighting the product identity seeking process, in complementarity between the functional analysis method. The study concerns an experimental design case of an animal-towed sled.

This project was planned over 5 months. During the requirements capture stage, the use of the functional analysis method, helped in the definition of the product's functions and for the design brief.

#### **3.1 Limits of the functional analysis for new product design**

This method allowed us to define the situations of life, the surrounding elements of the product, to qualify the services to be done by the product. The first module of this method, the scenario of use, aims to determine, in an exhaustive way, the key-phases of the cycle of use of the product. This essential stage can be considered as a general base of the product design practice. Following modules, which serve for estimating and for characterizing the services, insure the translation of the user's expectations into the product's functions.

This first step led us to produce a design brief which defines in very clear way some of the user's expectations.

However from the early stage of the creative stage of this new product, we could notice the lack of diversity in the design proposals regarding the production of concepts. We get only shapes, combined with other shapes, that nevertheless were alike and looked like black boxes that nobody could guess what they were for.

We could point out the necessity to characterize not only the functions of use in term of results but especially in term of perception and interactions and between the user and the product during the various situations of use of the product.

#### **3.2 How to support establishing the semantic identity of the product ?**

At this stage of the project, even the user's typology and the context of use has been defined, we needed to mark out, to bring criteria and to argue precisely regarding the semantic aspects [1] [2] which we were going to invest. We have to define the sign that we want to be perceived by the users.

The referential ADEX<sup>©</sup> has been used as a tool stimulating the creativity, between the functional brief stage and the creative concrete phase. It allowed :

- to structure the formal knowledge on the project,
- to establish guidelines for the design,
- to assert a user-centred point of view, and several conceptual views,
- to master the creative phase by excluding or by deepening tracks of reflection,
- to propose a textual and formal vocabulary of perceptive criteria through the association of images of products collected in domains which can be very different from the treated domain,
- to share this knowledge – new vocabulary on the subject - among the whole team.

The definition of the product semantics brings benefits not only at the operational level, for the design group, but also at a strategic level, for the company who can so validate the correspondence and equivalence with its communication strategy.

As K.W.Johnson [5] mentioned, for stimulating the communication among engineers and designer in the industry, the establishment of a table of generic vocabulary could contribute to characterize the common representation of the product involved.

Criteria	Key-words	Reference images
Global communication of the service done by the product	Simple, clear Intriguing (breakthrough)	
Communication of the comfort of use values	Reliable, not binding The sat favors the stroll through the transmission of the animal's walking rhythm	
Communication of a global coherence	Main of the services are understandable at the first	
Communication of complexity : does the product require from the user a precise know-how	blick. The shape is organised in definite volumes that explicate the functions:human>animal>luggage>wheel  Every public, familial reasonable	

Figure 1. One of the ADEX<sup>®</sup> views on the communication of the concept

The use of the ADEX<sup>®</sup> in the upstream phase of formalization supports the definition of a precise semantic field of investigation, dissociated from the field of the functions, it allows to envisage the product through various aspects on the quality that we wish to be perceived. We associate, to every criterion of the referential, a key-word or a key-sentence determining the orientation that we wish to give to the project.

This tool gives key to establish a "brief for the perceived value" of the product, what constitute a working base for the formalization, enabling to reach really coherent and communicating values.

With this support we have specified the accessibility as being the main feature of the product, inducing the status of the user, centred, in all the situations of use, on the accessibility and open space.

So far the ADEX<sup>®</sup> is a stage that serves as a base in the design internal creative process. During this process, the formal concepts are going to appear. ADEX<sup>®</sup> helps to take position in all the design choices and concept's assessment. In the first step it helps to defend a point of view regarding the end-user (the tool takes the form of 5 coloured cards families), whereas the second step helps the designer to express tacit knowledge in an explicit way for engineers. (See files in figure 5 above). In this step, we focus on how the designer argue and legitimise these choices and the product specifications to an industrial interlocutor.

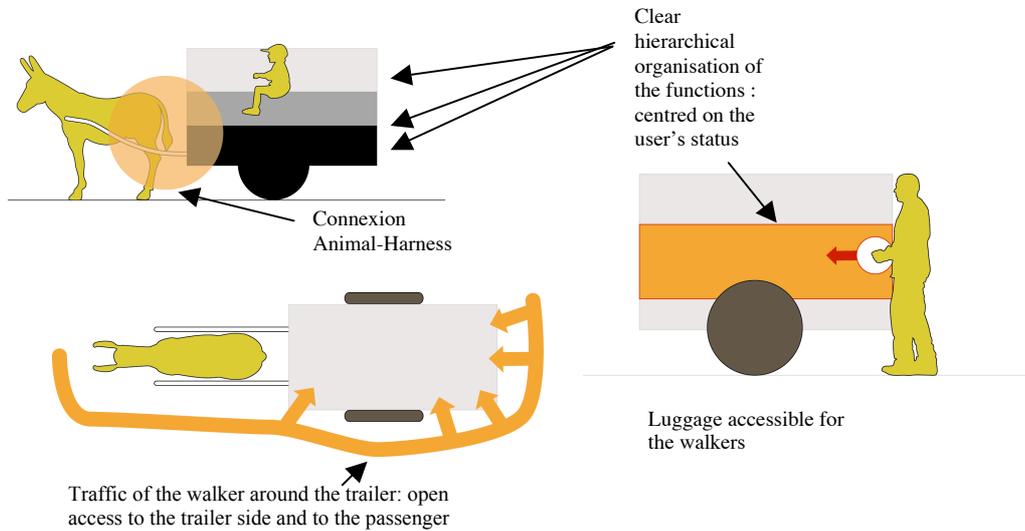


Figure 2. Highlights on the user status defined with ADEX<sup>®</sup>

Furthermore, we investigate what are the means for the designer to be sure the message he/she put in the product have been understood in the right way by the mechanical engineer or engineer of development.



Figure 3. Formalisation without the tool (1,2) and with the tool (3, 4)

#### 4 HOW CAN THE DESIGNER GUARANTEE THE CONTINUANCE OF THE PRODUCT DESIGN CONCEPT IN THE LATER PRODUCT DEVELOPMENT?

In the later stage of design process, once started the embodiment and the detailed design, the designer is facing with the question of how justifying the product's technical specifications regarding semantics, perception and use. The ADEX<sup>®</sup> is used as a common reference tool that gather together 5 types of information regarding the product, understandable by designers as well as engineers. 1/The five criteria or axes of investigation established in a previous research [2] allow to define the main claims of the product, regarding the use, the aesthetics, the technological achievement, the

relation to the environment and to the other products. 2/The keywords emphasizing the status of the product regarding each criterion. 3/The key-images, illustrating product references in other sectors. 4/The focus on details of the designed product, CAD models, sketches or drawing that highlight a technical principle and illustrate what formal detail the product should integrate. 5/The focus on details that the product should absolutely not carry, otherwise the product could change its identity drastically.



Figure 4. CAD modelling

Every criterion is explained in the full study report, as well as keywords and image references that are associated. These elements are complements towards the work of formalization, expressing the compromises that have been done, and bringing an important contribution to express some part of the product identity. In the same way, images of the project (CAD, model or drawings) are associated to each criterion. They are focused on details transcribing the formal intentions. To this weft is added an entitled frame: " what not to do ". As for the graphic charters where in the same way are shown in an explicit way solutions that would risk to be envisaged by industrial partners, this frame refers through images or text to solutions that should be absolutely avoided. It is a definition by the negative of the criterion. This information is compiled in a concise and relevant way in order to reach quickly the necessary information and allow several levels of reading.

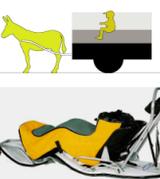
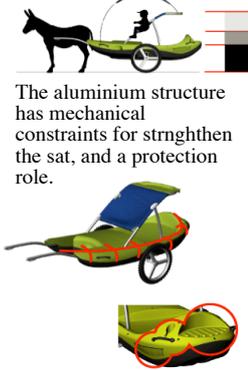
Criteria	Key-words	Reference images	Focus on details to do	Not to do 
User's status	Status linked to the hierarchical organisation of the product components.	 The user is associated to the practice as element of the leisure system	 The aluminium structure has mechanical constraints for strngthen the sat, and a protection role.	<b>Do not cover the rear area by a shell, nor reinforce the structure by additional pipes.</b>  <b>Do not hide the luggage nor remove the accessories storage</b>

Figure 5. One of the ADEX® views on the communication of the product

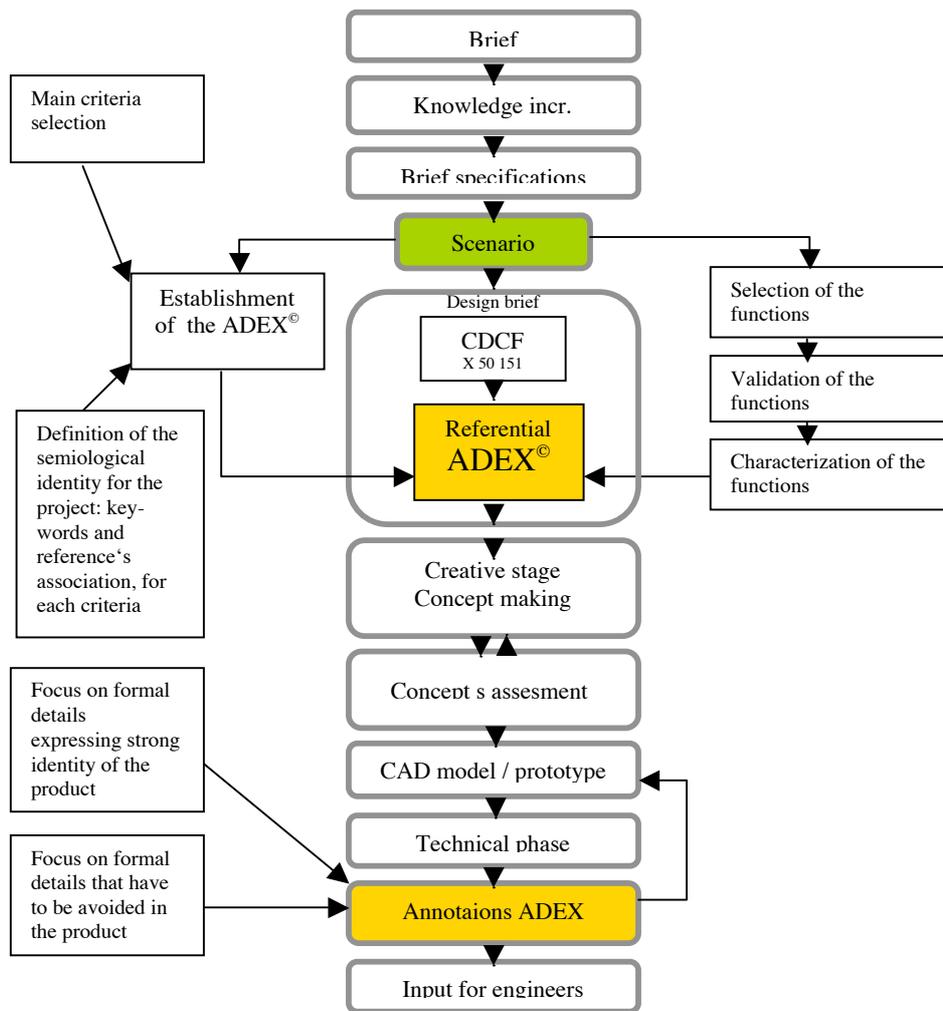


Figure 6. Contribution of ADEX<sup>®</sup> in both early and later phases of the design process

The objective of this stage is to highlight the major features of the product, in order to avoid the misunderstanding that could occur in the technical definition stage, and could be fatal for the company. We are demonstrating that the semiotic coherence of the product is due to the expression of an intention in each of the details of the product. It corresponds to the various identification levels of the product, which proposes A. Warell [6], in the analysis of the visual perception of the forms of the product and its syntactic organization.

However, the proposed method is relevant regarding the communication of a common identity among a range of products from a same brand.

Comparing to other methodologies, and according the users feedback, the method respects the global vision of the designer, encourages to think original concepts, supports the design assessment while giving the key to translate in an industrial language. Some users requested to use the method for industrial case during their professional training.

This method has been tested on innovative products, and present interest on new product such as the harness one, where we are facing a new practice, in strong break with its genealogy and for which the formal characters are completely to be defined. The necessity of communication in a project being dependent to the newness of the project i.e. its formal, cultural and technical level, ADEX<sup>®</sup> insuring the communication of the key points and the global coherence of the formal aspects has been very useful. Lastly, the ADEX<sup>®</sup> guideline represents a set of textual and visual annotations that also insure the traçability of the choices of design during the design process. Occurring twice in the study, it guarantee the continuance of the project and offers a history of the taken parts of the design. It results an improvement of the design response quality regarding a definite problem, but also a long lasting concept product development process, that highlights the history of the concept choices (emphasized concepts as well as refused), that could be helpful in further projects.

#### **4 CONCLUSION**

Our aim was to contribute supporting the designer to express significant relations between the signs he/she puts in the product, and the physical characteristics realising it, understandable in a cross-cultural collaboration. The ADEX<sup>®</sup> guideline presents several convergent interests. On one hand it allows to structure the creative steps regarding the semiological definition of the product. On the other one, it is a communication tool during the project especially in its later phases of development. The flexibility of its use, allows various communities of practice such as designers and mechanical engineers to share a common design project referential that follows the product in all its development phases, and grows as one goes along. The flexibility of its use allows to create an index card of the product's evolutionary identity, which express in precise formal details the identity and the claims of the product. The resulting document can also serve as a base for the elaboration of a commercial communication because it specifies the key points of the product.

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