

# Designing from activities. The “ability / difficulty table”, a useful tool to detect the “limit users” in the Design for All Approach

Giuseppe Di Bucchianico<sup>a\*</sup>, Marco Gregori<sup>a</sup> and Emilio Rossi<sup>a</sup>

<sup>a</sup>IDEA Department, University of Chieti-Pescara, Viale Pindaro, 42, 65127 Pescara, Italy

**Abstract.** In the Design for All Approach (DfA), an important phase of the design process consists in the individuation of the so-called “limit users”, that are that particular group of people with the most “critical” features for the autonomous fruition of a system or a product. Generally, however, it is not easy to identify them in a complete and objective way. A clear and complete outline of design requirements with respect to the “normal” use of a service, product or environment, moreover, is of fundamental importance in inclusive design. In fact, we know how bad design, that doesn’t take in account the true “strategies of use”, may lead to situations of handicap, also serious, temporary or permanent, regardless if the user is a “disabled” person or not. In relation to this scenario, the paper shows the results of a research which has developed the “Ability/Difficulty Table” (“A/D Table”), a new tool useful to identify the so-called “limit users” and their needs with respect to different activities, linking the main “difficulties”, expressed by people, with the “abilities” required to carry out in autonomy the investigated activity.

Keywords: design for all, limit users, user needs, design requirements

## 1. Introduction

“Design for All (DfA) is design for human diversity, social inclusion and equality” [3]. This definition, taken from the EIDD “Stockholm Declaration” (European Institute for Design and Disability) represents the fundamental principle underlying the design of environments, facilities, everyday objects and services, usable autonomously by individuals with diversified needs and abilities.

It is a concept, and at the same time, it is a design approach clearly of European character (as such it has been officially acquired by the European Commission). It is certainly strictly connected to the more famous North American “Universal Design”, nonetheless differing with regard to the importance given to accessibility design specific for disabled persons and to the design process, that is based on the wide participation of the “stakeholders” on the whole. Currently, the DfA target essentially refers to “all” humanity, with the complex of its diversities, which not

only are psychophysical, but also cultural or social, permanent or momentary [1].

In the Design for All Approach, human diversity is an enhanceable “resource” rather than a constraint to be considered during the project phase. In this perspective, also the concept of “users” is extended from the “final” players to all the individuals in the entire product supply chain. So, by definition, DfA “includes” the “whole” inside its target: namely, it pursues the satisfaction of the needs, desires and aspirations of “all” individuals who, for various reasons, want and have a reasonable chance of better “experiencing” the product, or of benefiting from its autonomous use. However this “field enlargement” may become a problem for designers, because they are in any case obliged to know the user features and needs, even if strictly referred to specific projects.

This paper presents the results of a research, developed at the School of Architecture, University “G. d’Annunzio” of Chieti-Pescara (Italy), as part of a Master Degree Laboratory in Industrial design on the theme of “Design for All”, whose objective was to

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\* Corresponding author. E-mail: pepetto@unich.it.

define, through a DfA Approach, a design tool useful to simplify the description of the needs reference frame of the “potential” product users, such that it be sufficiently detailed and objective, and easily reset as the project changes.

## 2. Objectives: identifying the “limit” users

In the Design for All Approach, the most important and delicate phase of the entire design process is the definition, sufficiently clear and complete, of the so-called “users-system”. In other words, this means that the designer must know the psychophysical characteristics of users interested in the product “independent use”<sup>1</sup>, above all in relation to the reference scenario, which is the context in which the product will be used. This implies that each single activity has a specific “limit” target, namely those individuals who, in certain contextual conditions and situations of use, represent indeed “the borderline” of the independent use of products and environments. The idea is that, by resolving the project in relation to their characteristics, abilities and needs, it is possible to “include”, with good approximation, all the others.

The problem is just in the continuous variability of the “limit” users, compared to the many possible activities and tasks that represent and characterize each single artifact, whose needs would be redefined from time to time.

The designer, therefore, needs appropriate conceptual and methodological tools with which to identify and define every time, for every contextual situation, activity and task, the “limit” target of a product, a service or a designed environment, in order to be able to describe, with the best possible objectivity and completeness, their needs and, based on these, the project requirements.

The research aimed to develop a tool able to identify the “limit” users in an objective and complete way, for each specific activity or task. The idea is to be able to describe each time the specific needs and to then transform them, eventually, into design requirements.

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<sup>1</sup> Compared to the concept of “self-enjoyment” of the context, please note that the handicap and disability have been defined by the WHO as “a complex interaction between the health of the individual and the influence of the environment surrounding” [7].

## 3. Method

### 3.1. Construction of the “A/D table”

The research has developed the tool here proposed, defined as “Ability/Difficulty Table” (“A/D Table”). It is a tool useful for linking the specific tasks to be performed with a given product or in a given environment and the difficulties expressed from time to time by the various potential users.

In particular, the “A/D Table” is a rather complex scheme, termed “triple-entry scheme”, as it links three groups of variables, which relate to one another two by two. This tool has been synthetically constructed through three different steps of development:

- First step: construction of a matrix relating disabilities reported in scientific literature and their objective and generalized “difficulties”, with respect to physical/operational and cognitive/cultural aspects;
- Second step: description, through HTA (Hierarchical Task Analysis) methodologies, of a complete and detailed list of tasks related to the specific activity that will be tested and of the physical/operational and cognitive/cultural “abilities” requested of users to do them;
- Third step: definition of the overall pattern of the “A/D Table” by interrelating the results from the previous two steps.

### 3.2. First step

The research began with the establishment of a list, of significant size, of potential physical/operational and cognitive/cultural “difficulties”, objective and generalized, expressed by individuals characterized as having the major disabilities reported in scientific literature<sup>2</sup>. The list was also completed, adding to the initial “disabling” conditions, strictly related to human health, some other aspects tied to socio-cultural factors which, if not directly disabling on an health level, may be so with respect to human organizations. The list thus obtained was subsequently briefly reorganized into seven “Macro-classes” of disabling characteristics, that are attributable to: physical disablement, body build, life stages, sensory perceptions, large organ system dysfunctions, social/cultural characteristics, intellectual difficulties. The classes, broken down in this way, despite being, in some cases,

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<sup>2</sup> In particular, reference was made mostly to a classification adopted by the Italian Ministry of Health [5].

extremely reductive and generalizing, have nevertheless provided a sufficiently vast description of the possible target-user disabilities. In parallel a list of significant size has been defined, detailing the difficulties expressed in different disabling conditions, characterized by:

- Physical/operational difficulties, when the disability leads to difficulties, more or less obvious, of a purely motor type;
- Cognitive/cultural difficulties, when referring to possible perceptual disabilities or to disabilities of semiotic/cultural nature.

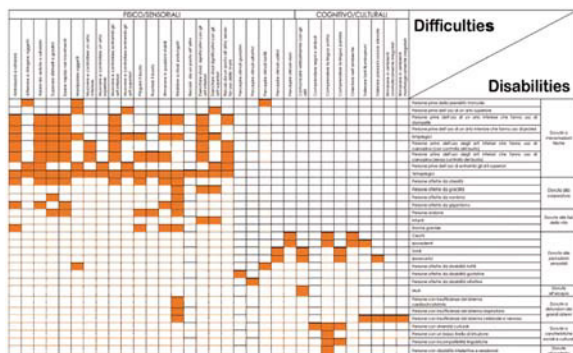


Figure 1. “Matrix of Disabilities/Difficulties”

The range of disabilities and of their relative difficulties has allowed the development of a first matrix of values, defined precisely as “Matrix of Disabilities/Difficulties” (figure 1).

Here, it has been possible to associate, with each “disability” a set of objective “deficits” or “difficulties”, represented in the matrix, as coloured boxes.

3.3. Second step

A second matrix, defined as “Matrix of Activities and Skills” (Figure 2) was subsequently developed.

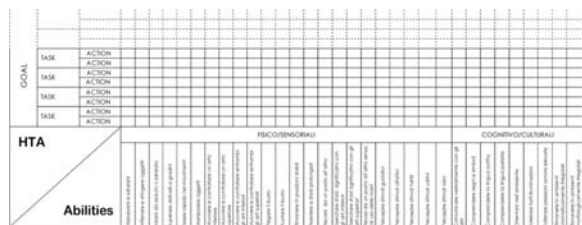


Figure 2. “Matrix of Activities and Skills”

The first group of elements of the matrix, that is extremely variable, refers from time to time to the activity, or rather the task under analysis, broken up

in its elementary actions using the HTA - Hierarchical Task Analysis- method [2]. The second group of elements takes up the same list of “difficulties” used above, but this time they are considered as “capacities” necessary to carry out such activities.

3.4. Third step

The overall scheme that forms the “A/D Table” (Figure 3) is constructed by aggregating the two matrices obtained in the previous two steps. In particular, the element of “connection” is given indeed by the two groups of elements, essentially the same but conceptually different, as defined by the list of “difficulties” and list of “abilities” or “skills”, in the first and in the second matrix, respectively.

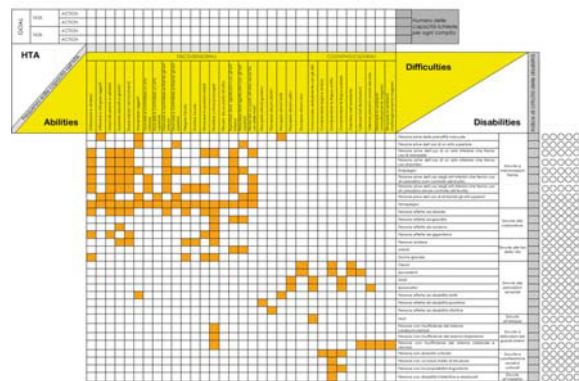


Figure2. The complete “A/D Table”

The scheme is completed with the insertion of a row and two columns, showing three different measures of quantitative assessment, referring respectively to:

- “Frequency of HTA Abilities”, that is the frequency with which individual skills are required during the conduct of the entire activity in question;
- “Number of skills/task”, that is the arithmetic sum of all the physical/operational and/or cognitive/cultural skills that are necessary to perform each single action;
- “Index of the criticality of difficulties”, that is a statement of “the weight” of the disabilities with reference to the activity analyzed.

4. Results: using the “A/D table”

Since this is a triple-entry scheme, the “A/D Table” can be used through various possible “paths”.

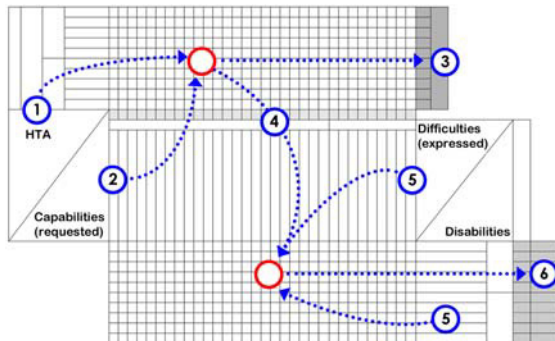


Figure 4. Steps that define the “top-down path” of the “A/D Table”.

Among these, the following describes the “top-down path” (Figure 4):

1: starting from the main activity under analysis, it is necessary to break it down into the various tasks and actions, according to the most typical HTA notations, and to then fit the detailed list obtained in the top left column of the scheme.

2: in the top matrix the tasks and the individual actions should be crossed with the list of skills required to carry them out, highlighting among them, those involved.

3: a first result offered by the scheme is shown in the upper right column values in the upper right, which indicates the arithmetic sum of the physical/operational and/or cognitive/cultural abilities necessary to perform each action. This allows the detection of tasks that quantitatively require more skills to be carried out, providing, thus, a first criterion for reading the most critical points of the project.

4: A second result is given in the row “Frequency of HTA Abilities”, which expresses another quantitative index of evaluation, as it shows the frequencies with which individual abilities are required during the conduct of the entire activity in question.

5: Writing down the frequency number expressed by the “capacity”, in each of the corresponding “colored” boxes in the matrix below (in regard to the respective difficulties), one actually attaches a numerical value to every difficulty.

6: Adding the values related to the difficulties shown in each line of disability, it is also possible to define a hierarchy between different types of disability with regard to the analyzed activity, which is useful for determining the “limit” users.

## 5. Discussion

### 5.1. Two applicative examples

Afterwards, the research verified the use of the “A/D Table” in two applicative contexts extremely different, for type and dimension of action: a domestic kitchen and a 10 meter long sailboat [4, 6]. Thus it has been possible to test its flexibility of use and its utility to facilitate the designer in the investigation of an inclusive requirements outline referred to different categories of products.

In each design context some “critical” activities has been pointed out, i.e. those that more than others need an additional effort, due to the fact of being particularly recurrent or, rather, are those activities involved simultaneously in the development of other tasks.

In fact, it is known that the “critical” activities in the domestic kitchens are those concerning the handling of furnishings and dishes. Therefore, from this point of view, there are the analyses of nine different activities, classified into: preparation of dishes, cooking foods (for what concern boiling, frying, cook with pan, griddle and oven), setting and cleaning the table, and washing dishes. All these activities are set apart through the HTA methodology.

On the contrary, the specialistic literature referred to the sailing field of research refers that the hardest activity is the mobility of people on board. In this case, six different activities have been found, concerning the user’s mobility on board: getting on board (from the quay, from another ship, or from the sea), moving on board (on the deck area or, rather, in lateral passages) and steering the sailboat.

After identifying the most critical users through the “A/D Table”, the designer can set his own design strategy, in order to create an inclusive project. This means that the designer has to choose among the most critical potential users to establish on which specific group he has to focus the project development. Thus, it is up to the designer to determine the “limit” target users of the project, according not only to a specific impairment, but relating to a multiple-disability condition for the independent fruition of the product. This idea, starts from the resolution of those problem related to the most critical users, trying to include also all the potential users in the independent and pleasant product fruition. Furthermore, the “A/D Table” promotes the definition of a clean, detailed and inclusive outline of the product requirements.

In both applicative cases, the repeated application of the “A/D Table” allowed to define very specific design requirements starting from the autonomous use of products by the most “critical” users. This is in complete assonance with the Design for All Approach, based on the enhancement of the concepts of diversity, inclusion and equality.



Figure 5. Design concepts of a “Domestic kitchen for All” and of a “10 m. daysailer for All” applying their respective “inclusive” design requirements.

In particular, both the “design paths” have allowed the development of interesting product concepts, concerning two specific applicative fields of research: the first on a domestic kitchen concept that can make the handling of furnishing and foods easier between the areas that compose it; the second concept on a 10 meters daysailer designed for the facilitation of mobility on board and for sailing navigation (Figure 5).

## 6. Conclusions

The “Ability/Difficulty Table” is a flexible instrument of knowledge with many potential applications: it is a useful operational scheme for the description of

the needs framework of the “limit” user in regards to the Design for All approach.

Sufficiently detailed and objective, conceptually it is based on the idea of being able to analyze “quantitatively” the ability of critical users with respect to a specific activity.

The potentialities offered by the “A/D Table” must be sought first within its relative ease of use, and then within the accuracy of the results which can be obtained: in fact, it shows within an overall activity, the specific tasks or actions that generate physical/operational and cognitive/cultural difficulties for some groups of people.

The “A/D Table”, then, facilitates the construction of an “inclusive” needs framework sensitive to differences among individuals: this is indispensable to identify the Design for All requirements of a system/product.

## 7. Credits

The research described here has been conducted under the coordination of Prof. Giuseppe Di Bucchianico and with candidates Marco Gregori and Emilio Rossi within the “Interior design of sustainable living” Degree Laboratory, academic year 2008/2009, in the School of Architecture, University “G. d’Annunzio” of Chieti-Pescara.

In particular, the operating results of the research have been applied to the following dissertations: “The domestic kitchen for All: enabling solution to facilitate the movement of equipments and food” (advisor Prof. G. Di Bucchianico, Ph.D.; graduant student Marco Gregori), and “10 meters Daysailer for All: sustainable technological solutions for easy navigation” (advisor Prof. G. Di Bucchianico, Ph.D.; graduant student Emilio Rossi).

The figures inserted in this paper are taken from the dissertation theses mentioned above. The present paper has been written from Giuseppe Di Bucchianico (Paragraphs 1, 2 and 3), from Marco Gregori (Paragraph 4) and from Emilio Rossi (Paragraphs 5 and 6).

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