

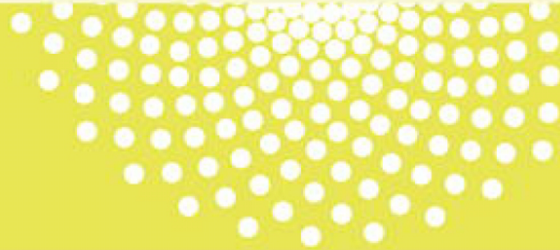


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Editors:

Tareq Ahram

Waldemar Karwowski

Dylan Schmorrow

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Editors:

**Tareq Ahram
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Dylan Schmorrow

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Design for Inclusion. Differences and similarities between *DfA* and *UD* in the field of Sailing Yacht Design

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Abstract

In the last decades, some design methods based on the inclusion's principles have been developed. The most important are: Design for All (DfA), Inclusive Design (ID) and Universal Design (UD). They have been employed in a wide range of sectors, also in the nautical one, and, in particular, in the design development of small sailboats (less than 10 meters long). In this contribution we will show the first result of a Ph.D. research developed in the Architectural Department of Chieti-Pescara (Italy) aiming at defining the design guidelines of an inclusive small sailboat. To obtain this, two of the principal disciplines of "Design for Inclusion" (UD and DfA) have been compared. Thanks to this comparison, a "comparative table" was developed, based on UD Performance Measures and DfA requirements, useful to analyze small sailboats. It will be used in the future phase of the research, in order to understand what are the weaknesses and strengths of the small sailing boat according to "Design for Inclusion" theory. In fact, thanks to this comparative table, it is possible to verify what are the boat elements that satisfy all UD and DfA requirements and what are those to be improved.

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1. Introduction

“Design for Inclusion” is an *umbrella term* that encompasses different design methodologies, which are based on the principle of "inclusion". The most important are Design for All (DfA), Inclusive Design (ID) and Universal Design (UD). They were developed to meet the needs of contemporary society. Today diversity in age, culture, abilities and disabilities is indeed greater than ever. On the other side, “Design for Inclusion” can be based on the following assumption: "no-standard users" are always the vast majority.

Designing an environment, a product or a service for the "standard man" (that is perfectly healthy and intact, fully alert, attentive and informed, with a mastery and a logical and rational behavior in most situations in life and work) means to exclude many people from their use. So, the aim of “Design for Inclusion”, as its name suggests, is to include so many people as possible in the use of a product, a service or an environment.

At the beginning DfA, UD and ID are born to meet the needs of disabled people. But over the years, also the idea of disability has changed. In 2001 the WHO (World Health Organization) defined it as an experience that everybody could live in his life and not only a problem of a small group of people. This new point of view on disability influence also the design field. Disability starts to be seen as a dynamic concept, resulting from the interaction between individual skills and the conditions of the surroundings in which such skills are manifested. In other words: “good design enables, bad design disables” [1].

This new way of looking at products, environments and services influenced different design fields, such as the nautical one. The sailing sport, historically considered the prerogative of a little part of people with cultural, economical and physical duties, now becomes to be used by everyone, even by disabled sailors.

Starting from the 80’s, several sailboats were created or adapted for disabled sailor. Only in the last ten years, yacht designers changed their mind about “Design for Disability” and started to think about design for so many people as possible. Indeed, in the early 90’s we started to speak about “*sailing for everyone*”. The aim become the same of “Design for Inclusion”: to make usable sailing sport without age, sex, abilities, disabilities or social condition differences.

Thanks to this new point of view, several boats were born in the last years, influenced by “Design for Inclusion” disciplines. For example the "Skud18", designed according to UD principles; "Neo 495", "Dam 5.5 for All", designed according to DfA methodology, etc. The interest of the nautical sector in this methodologies is rapidly increasing. But today specific design guidelines useful to design an inclusive small sailboat are not yet available.

2. Purpose of research

In this contribution, the results of the first phase of a study developed at the G. d’Annunzio University of Pescara (Italy) will be described. The ultimate aim of this research is to develop a framework of design guidelines for inclusive small sailboat.

To obtain this, the principal discipline of “Design for Inclusion”, that are UD and DfA, have been examined and compared. This will allow, in the following research steps, to apply these results in a small sailboat analysis.

In particular, the study is based on the assumption that there are differences and similarities between UD and DfA. In scientific literature, this two methodologies are often evaluated in the same way and they are frequently used as synonymous. For example somebody states that: “ nowadays the concept of Design for All is identical to strategies known by different names in certain geographical areas, such as UD, ID” [2].

On the contrary, others states that all methodologies, despite having a lot of points in common, “ have differences too, that preclude an exact equivalence” [3]. So, the debate on this issue is currently in progress in the scientific community.

Furthermore, in someone else opinion “ there are strong local and regional differences and approaches, driven by cultural, historic and economic factors that give Inclusive Design many differing flavours, and often also names that reflect those shaping factors” [4].

So when we speak about “Design for Inclusion” theory, we must consider the area of their origin and of their differences.

3. Method

In particular, in this contribution we will consider the UD and DfA approaches. We shortly describe them by definition, aim, design method and analysis product method.

3.1. Universal Design

UD is defined by R. Mace as: “the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design” [5]. In his opinion, the intent of universal design is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost. Universal Design benefits people of all ages and abilities [6]. UD design method focus on 7 principles: equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, appropriate size and space for approach and use [7]. All these 7 points help designers to look back on current design and to improve future plans.

In order to identify potential areas of improvement for a product and to identify particular strengths of a product such as for marketing purposes, the “Center for Universal Design” of North Carolina University draw up “*A Guide to Evaluating the Universal Design Performance of Products*”, in 2003. The purpose of this document is to provide a procedure to evaluate in which way products satisfy the guidelines and Principles of Universal Design. These Measures are not intended to be used as a “score sheet” to calculate overall totals or averages as a measure of a product’s usability. Rather, this chart provides a type of graphic profile of usability features.

The Performance Measures are based on the seven Principles. They are divided into a set of 29 statements. These statements guide assessment of the usability of products by people with a diverse range of capabilities and in a wide variety of circumstances. The Performance Measures are not intended to serve as a substitute for user testing or as a method of empathizing with users who have disabilities. However, this tool may help to identify needs for user testing and to develop effective and appropriate testing procedures [8]. In the next section we will see how we create a new table analysis based on this Measures.

3.2. Design for All

DfA was defined in the Stockholm declaration of the international association "EIDD-Design for All Europe" as “design for human diversity, social inclusion and equality” [2]. The aim is to enable all people to have equal opportunities to participate in every aspect of society. The DfA approach consists of a process made of two different steps: meta-design and design. The first phase includes: idea conceiving, analysis of the users and of their desires, briefing. The second phase includes: design briefing, creation of a prototype to test with users; once the most-qualifying-for-most-people solution is found, it is possible to realize the project [9].

In the last years, the association "Design for All Italy" has established two quality labels (Quality and Start) in order to “certify products, environment and systems that express DfA method with no contradiction in terms” [10]. A product, an environment and a system, to obtain the DfA labels, must adopt some principles and verify different requirements. The principles are: to endorse human diversity; to promote social inclusion and equality; the use of product is easy and pleasant for all potential users; the use of product does not discriminate neither physically nor psychologically; it’s nice; it’s socially, environmentally, economically sustainable; the aim is to improve the quality of life. The requirements are 27 (in the appendix A we make a list) and they are classified into four categories: physicality; feeling-and-sense; comprehension and process. All of them must be verified with respect to the target user. The research developed a new table analysis based on this requirements.

3.3. Comparison between DfA and UD products evaluation method

It is important to understand what are the strong and weak points of a small sailing boat about “Design for Inclusion” disciplines, in order to develop a framework of guidelines related to small sailboat design that are really inclusive.

For these reasons, primarily a comparison table (appendix A) was developed, in which the DfA requirements are listed on the right and the UD Performance Measures are listed on the left. In particular, it is possible to see how the same or similar assertions of UD and DfA have been placed side by side. For example: “enabling prehensility” is placed near to “this product can be used with either the right or left hand alone”.

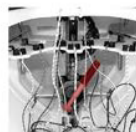
In “A Guide to Evaluating the Universal Design Performance of Products” we can read: “not all Measures apply to all products and some interpretation may be required to apply some of the Performance Measures. [...] Depending on the nature of the product, some Universal Principle may not apply, and it may sometimes be more effective to apply them out of order” [8]. So, as you can see in appendix A, we have changed the order of 29 UD statements, based on four requirements categories of DfA (physicality, feeling-and-sense, comprehension and process). Obviously, the relations created in this comparative table are in function of the following research. The mentioned comparative table shows also the differences and similarities between DfA and UD products evaluation method. We will examine them in detail in the last paragraph. Now we’re going to explain how comparison table will be applied in a small sailing boat analysis.

We consider the 2.4 mR keelboat, as an example. This small sailboat is very stable. The helmsman is positioned in the middle of the hull. The biggest part of his body is under the waterline. The weight is not important during navigation in close-hauls in the wind. So he can stay in his position without sticking out the hull to set off against swaying. Furthermore, rigging from the cockpit allows the helmsman to steer sails without changing position. According to the helmsman abilities, the tiller bar can be changed by a joystick or steering pedal system. In 2000 in Sidney the 2.4 mR became official single-person keelboat for Paralympic Games. These targets were achieved thanks to 2.4 mR technical features, that allow able and disabled people to sail. Today, men, women, young and old, able and disabled sailors can race together, into a unique open class. This is the reason why we have chosen the 2.4 mR as a case study.

We can consider a small sailing boat as a system composed of a variety of elements (tiller, sail, running rigging, etc.), that are steered by one or more crew members. In the sailboat of the example, there is only one sailor. He has to perform all the duties by itself: steering, trimming sails, racing tactics, etc. [11]. To make a complete analysis, we can employ the previously mentioned comparative table in all boat elements and we can test on different users. In short, in the image n°1 we have mentioned only some points of the first part of the table that refer to *physicality*. Among the different elements we have decided to analyze the steering system.

DESIGN FOR ALL	Not applicable	Agree	Neutral	Disagree	Steering system	Disagree	Neutral	Agree	Not applicable	UNIVERSAL DESIGN	NOTES
• Alternatives offer to handling and use.		●			A.			●		• Every potential user can find at least one way to use this product effectively.	
		●			B.			●			
		●			C.			●			
• Minimal precision required.			●		A.		●			• This product facilitates (or does not require) user accuracy and precision.	
			●		B.		●				
			●		C.		●				
• Enabling prehensility.		●			A.			●		• This product can be used with either the right or left hand alone.	
		●			B.			●			
	●				C.			●			
• Compliance with different needs of wellness.		●			A.			●		• This product can be used comfortably (e.g., without awkward movements or postures).	
		●			B.			●			
		●			C.			●			

ILLUSTRATION



A. Vertical arm



B. Horizontal arm



C. Pedal system

Fig. 1. Application of the comparative table to the 2.4 mR different steering systems.

As written before and as you can see in the figure, there are different ways to steer the 2.4 mR. The classic tiller bar can be replaced by a vertical arm (A), a horizontal arm (B) or by a pedal system (C). Each one can be analyzed using the table in image 1. As you can see, DfA requirements and UD Performance Measures can be used in every element. You can flag the appropriate boxes to indicate how much user agree or disagree with each statement. Some Performance Measures or DfA requirements may be considered “Not Applicable” to the product. For example, in the pedal system (C) it's not possible to apply the statement “this product can be used with either the right or left hand alone”. It may be helpful to write comments in the space provided along the right side of the figure 1 about specific properties of each product. Strength and weakness of DfA requirements and UD Performance Measures can be pointed out in the same place with respect to each element.

According to this example each part of the boat can be analyzed paying attention to all the statements of UD and of DfA in the appendix A.

4. Results

4.1. Achieved results

In this phase of the research we have achieved some significant results. Indeed, the comparative table allowed us to underline the most significant theoretical differences and similarities between the UD and the DfA analysis method. For example: there is a relevant difference in design process.

DfA products, environments or systems must meet several requirements. One of these requirements is a well defined design process, that calls for: (see appendix A) design method accuracy; accuracy in production chain; principle DfA extension to all value-added chain; advertisements which have to sponsor the product-system-environment and DfA philosophy. On the contrary, there isn't a specific design process to follow in Universal Design Performance Measures. It is enough to hold by the 7 universal principles mentioned before. That's why, from this point of view, there is not correspondence between the two methodologies.

In the part of the table referred to the *physicality*, each requirements of the DfA correspond to several and different features of the UD (see appendix A). For example four UD requirements correspond to the DfA sentence “in compliance with safety features”. On the other hand, some items of the DfA have no correspondence with UD requirements in the category *feeling and sense* (for example tactile contrasts, sensation of taste, olfactory stimulus, etc.). As a result, it seems that the two different methodologies are very similar but, when you examine in depth, you will realize that there are so many relevant differences (such as the difference about the design process) and less relevant differences. The comparative table we have now examined, partially shows the dissimilarity between the theories. There are other items which are very important to consider and to be evaluated when you compare UD e DfA. Here you will find a summary board organized according to the following categories: *user, design process, the participation of the users to the design process, the aim*.

- *Users*: DfA users are “real people” parted in two: dependent and autonomous. “Dependent” is people with so much critical peculiarities that they can't use a system or a product by themselves. “Autonomous” is people that can use any system, independently of the help of another person [9]. UD users are “people of all age and abilities” [5].
- *Design process*: DfA has a two part process: meta-design and design. The first phase includes: idea conceiving, analysis of the users and of their desires, briefing. The second phase includes: design briefing, creation of a prototype to test with users; once the most-qualifying-for-most-people solution is found, it is possible to realize the project [10]. UD doesn't call for a real design process. Products, services and environments are realized in accordance with the 7 Universal Principles.
- *The participation of the users to the design process*: in UD, the users participate to every phase of the process. In DfA not only the users participate to the process but also all the others subjects (e.g. the sellers, the buyers, etc.) with a holistic approach [9].

- *The Aim:* DfA wants to create social inclusion thinking for all. The UD intent is to simplify life for everyone by making products, communications, and building environment more usable by as many people as possible. So, DfA is much more interested in social inclusion than UD [5].

4.2. Expected results

The analysis model developed in figure 1, is still in test phase. So it is not possible to show complete and reliable results about boats analysis in this phase of the research. Anyway, the purpose of the comparative table is to realize how close or how far a boat is from UD or DfA requirements. Starting from this, we will try to endorse all the elements of the analyzed boats that will prove to be compliant to design for inclusion. Similarly we will try to solve still existing problems. In the last phase of the research, according to these results, it is supposed that the design guidelines for an inclusive small sailboat will emerge.

5. Conclusions

Leisure sailing is a sector in which the search of performances amplifies the questions related to the use of placements and equipments. “Technical and spatial problems remains one of the most important problems to take into account during the design process of a sailboat. Moreover, the design process seems even more problematic when we consider the diversity and heterogeneity of potential users who might want to use a boat [12]. To design a small sailing boat that satisfies the “Design for Inclusion” requirements (accessible to all, simple and enjoyable to use, harmless, not discriminating, etc.) it is very difficult. In any case, it’s necessary to have not only a clear idea of the small sailboats state-of-the-art, but also of the differences between “Design for Inclusion” disciplines. The comparative table of UD and DfA, allows to understand what are the boat elements to be implemented according to the different methodologies.

Acknowledgements

This paper refers to the results achieved within the first phase of a Ph.D. research whose draft title is “Design for Inclusion in sailing yacht. Guidelines DfA-based to design small sailboat”. This research is going to be developed at the Department of Architecture of G.d’Annunzio University of Chieti-Pescara (Italy) (Ph.D. student Jessica Lagatta; Tutor Prof. A. Vallicelli; co-tutors Prof. M. Di Nicolantonio and Prof. G. Di Bucchianico). The various paragraphs of the present paper can be considered the outcome of a common discussion and a collective review among authors. In particular, the various paragraphs can be attributed to: Prof. Andrea Vallicelli (abstract, paragraph 1), Prof. Massimo Di Nicolantonio (paragraph 2, 5), Ph.D. student Jessica Lagatta (paragraph 3, 4).

Appendix A. Comparative table between DfA requirements and UD Performance Measures.

DESIGN FOR ALL	PHYSICALITY	UNIVERSAL DESIGN
<ul style="list-style-type: none"> • Enabling prehensility. 	<ul style="list-style-type: none"> • This product can be used with either the right or left hand alone. 	
<ul style="list-style-type: none"> • Minimal required efforts. 	<ul style="list-style-type: none"> • This product can be used by someone who is weak or tired. • This product can be used without repeating any motion enough to cause fatigue or pain. • This product can be used without having to rest afterward. 	
<ul style="list-style-type: none"> • Minimal required precision. 	<ul style="list-style-type: none"> • This product facilitates (or does not require) user accuracy and precision. 	
<ul style="list-style-type: none"> • Minimal required ability. 	<ul style="list-style-type: none"> • All potential users could use this product in essentially the same way, regardless of differences in their abilities. 	
<ul style="list-style-type: none"> • Alternatives offer handling and use. 	<ul style="list-style-type: none"> • Every potential user can find at least one way to use this product effectively. 	
<ul style="list-style-type: none"> • Personalization system offer. 	<ul style="list-style-type: none"> • This product can be used by persons who use assistive devices (e.g., eyeglasses, hearing aids, sign language, or service animals). 	
<ul style="list-style-type: none"> • Use of techniques and technical solutions to meet the requirements and skills of the users. 	<ul style="list-style-type: none"> • Potential users could use this product without feeling segregated or stigmatized because of differences in personal capabilities. 	
<ul style="list-style-type: none"> • In compliance with anthropometric differences. 	<ul style="list-style-type: none"> • There is enough space to use this product with devices or assistance (e.g., wheelchair, oxygen tank, or service animal). • It is easy for a person of any size to see all the important elements of this product from any position (e.g., standing or seated). • This product can be used by a person with hands of any size. 	
<ul style="list-style-type: none"> • In compliance with safety features. 	<ul style="list-style-type: none"> • Potential users of this product have access to all features of privacy, security, and safety, regardless of personal capabilities. • This product draws the user's attention to errors or hazards. • If the user makes a mistake with this product, it won't cause damage or injure the user. • This product prompts the user to pay attention during critical tasks. 	
<ul style="list-style-type: none"> • In compliance with different needs of wellness. 	<ul style="list-style-type: none"> • This product can be used comfortably (e.g., without awkward movements or postures). 	
FEELING AND SENSE		
<ul style="list-style-type: none"> • Chromatic contrasts. 	<ul style="list-style-type: none"> • This product can be used without sight. 	
<ul style="list-style-type: none"> • Sound contrasts. 	<ul style="list-style-type: none"> • This product can be used without hearing. 	
<ul style="list-style-type: none"> • Tactile contrasts. 		
<ul style="list-style-type: none"> • Sensation of taste. 		
<ul style="list-style-type: none"> • Olfactory stimulus. 		
<ul style="list-style-type: none"> • Kinesthetic perception. 		
COMPREHENSION		
<ul style="list-style-type: none"> • Self-explanation of use-operation 	<ul style="list-style-type: none"> • This product is as simple and straightforward as it can be. • An untrained person could use this product without instructions. • The most important features of this product are the most obvious. • Product features are arranged according to their importance.. 	
<ul style="list-style-type: none"> • Semantic code use for use-operation comprehension. 	<ul style="list-style-type: none"> • Any potential user can understand the language used in this product. 	
<ul style="list-style-type: none"> • Aesthetic- formal quality. 	<ul style="list-style-type: none"> • This product appeals to all potential users. 	
<ul style="list-style-type: none"> • Natural orientation implementation. • Multi-sensory communication. • Cross-cultural and cross-linguistic communication. 	<ul style="list-style-type: none"> • This product provides feedback to the user. 	
<ul style="list-style-type: none"> • Documents for use in accordance with listed requirements. 	<ul style="list-style-type: none"> • The features of this product can be clearly described in words (e.g., in instruction manuals or on telephone help lines). 	
PROCESS		
<ul style="list-style-type: none"> • Design method accuracy (subjective investigations, test with users, etc.) 		
<ul style="list-style-type: none"> • Accuracy in production chain. 		
<ul style="list-style-type: none"> • Principle DfA extension to all value-added chain. 		
<ul style="list-style-type: none"> • Advertisements which have to sponsor the product-system-environment and DfA philosophy, preventing unfavourable perspective, especially even if they are discriminating. 		

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