DESIGN GUIDE LINES FOR ORTHOSIS DESIGN

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§1 INTRODUCTION

During the author's BSc thesis (Dijkstra, 2016), the design for a 3D printed splint was further developed. After finishing the project, the key directives were bundled in these guide lines for orthosis design. They can, however, be applied in a much broader perspective. Although some are rather specific, they all strive to make the designer focus on usability in the broadest sense of the word.

§2 ABSTRACT

Seven guidelines for design of personal products are given. They respectively focus on ease of use and accessibility for physically disabled/able users (I, II, III), clarity (IV), durability (V, VI), and strive against the need to shame for empowering objects (VII).

§3 GUIDELINES

ACCESSIBILITY

I Clear closures

Whenever a closure is used in a product, make sure that the user is able to use it – both on a cognitive and on a physical level. Prevent him from unintended misuse.

II Support for physically disabled users

Make it possible for users to use the product without any further devices. Contrary: provide him with all the tools needed for use and necessary maintenance.

III Extra support for extra disabled users

Users might be even more disabled than accounted for. Make the product compatible with easy to use and widely available tools to further simplify its use.

CLARITY

IV Clinging parts

Make it clear to the user when the product is correctly closed. To do so, give him audible and visible feedback. Make him unable to tighten an aid too tight by giving elements a hard stop.

V Cleanable

The product has an intense relation with the user's body. Enable the user to clean the product thoroughly and quickly, without making him wait for the product to rinse or dry.

DURABILITY

VI Durable

Unregarded the intended life of a product, make it durable. Either elements and their connections should withstand longer than expected use, or they should be easily replaceable by the end user.

AMENITY

VII Visually attractive

The users of the product are physically disabled. They use the product hoping to be empowered, not to be embarrassed by it. Make the visual design align with the goals that are reached by the product itself.

§4 RELEVANCE

While an explosion of tools and products for personal assistance is on the verge, the need for well-designed products increases. A user hardly ever requests an entirely new product; he just wants his problems solved. The guidelines in this article help product designers to (re)gain focus on their users and make their products actually usable for now and the future.

§5 EVALUATION

Products can be evaluated using the index based on the guidelines from this article. Although the

scale is endless, the grade for any product based on the table below, gives an indication of its relative usability for personal use.

GL	Measure
I	$7\ (1 - F_{avg})$ F: average required power for normal use in N
II	$6\ (j_{avg} / 10\ 000)$ *j*: the average number of days that the product will possibly stand without external support
III	$5\ (j_{avg} / 10\ 000)$
IV	$4\ (v + a)$ *v*, *a*: number of visible or audible clues
V	$1 - (3\ (c\ d_{avg}\ s))$ *c*: percentage clean after every routine clean-up, compared to its out of the box sterile level d_{avg}: duration of a routine clean-up *s*: number of suggested routine clean-ups every month
VI	$2\ \Sigma(l / k\ n_p)$ Σ: the sum of the relative replace-ability *l*: expected life time (years) *k*: costs of a spare part, as percentage of the original product price n_p: the number of parts
VII	$1\ g_{avg}$ g_{avg}: the average grade users give to rate the product's visual appearance (1 (low) … 10 (high))
	Index = sum of measures above.

§6 FURTHER RESEARCH

These guidelines conclude the work and research on splints produces by additive manufacturing and were formulated and completed during the final stages of the main research. They lack scientific proof. Furthermore, their application in other fields should be studied in more detail. The guidelines can in the future be elaborated, generalized or specialized for broader use.

The final result could possibly be formatted as a ready-to-use checklist. The evaluation above is obviously fictional, but might be a starting point.

§7 REFERENCE AND FURTHER READING

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