

Requirements needed in European household appliance performance standards to improve ease of use of appliances by older people and people with disabilities

Addendum to FINAL REPORT

**ANEC R&T Project 2010
ANEC-ML-2010-0044**

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1. Introduction and background

This Addendum is the result of further research and comment following the delivery of the ANEC R&T project ANEC-ML-2010-0044, which conducted a study into ergonomic data needed for European household appliance performance standards to improve the requirements for the ease of use of appliances by older people and people with disabilities.

The further research includes re-visiting the guidelines for font size and contrast of text within the i-design3 project, funded by the Engineering and Physical Sciences Research Council (EPSRC), and also a student project conducted by an ergonomics final year student at Loughborough University. This student project conducted user research to compare the proposed values for controls with users' comments on good or poor design and whether they are easy or difficult to use (qualitative data), and measurements of the controls on users' own appliances (quantitative data)

2. Control recommendations and user research

Based on a critical review of available literature and anthropometric data, recommended values were made in the ANEC R&T project for controls of household appliances (Nicolle, Maguire and Clift, 2011). A recommendation for further research suggested that the proposed values be assessed with a range of older and disabled users and various floor-standing and movable or hand-held household appliances. Therefore, a follow-on user-research project was undertaken by a final year Ergonomics student in the Loughborough Design School at Loughborough University (Baverstock, 2011).

The quantitative and qualitative data from the user research were compared with the values proposed for the ANEC report. It may be suggested that users' preferences for larger controls could have increased the recommended values. However, given the small user sample and the fact that users' preferences are multi-factorial, the recommended values have not been revised. The reasons for a user's preference may not be due to the size of the control alone and could be due to other reasons, e.g. the serrations on the knob may be more pronounced or the visual feedback or resistance may be better. Also, familiarity with a particular appliance over many years often prompted participants to say their appliances were satisfactory, even though they had problems with usability.

The authors recommend that, where the surface area of the control panel will accommodate it, the value at the top end of an acceptable range should be aimed for. Further research is needed to determine the control panel surface area ratio to the size and number of controls that can be placed upon it. Designers need to be encouraged to use larger dimensions, where possible and within practical limits, in order to accommodate the greatest number of people. Designers should also be encouraged to re-think how they are going to package a product in order to accommodate the recommended values. For example, if the control panel is not large enough to accommodate a usable button or dial, then perhaps the appliance should be re-designed in order to do so.

Given the limited sample size of this study, the authors would recommend more user research to discover whether the existing values in the literature do meet the needs of the widest population, in particular those who are older and disabled. A second final year ergonomics project is now underway to suggest an optimum ratio between the size of buttons and the space between them to reduce error when using household appliances and to support the aesthetics of the product's design. The results of this study will be available in May 2012, following acceptance of the student's thesis by Loughborough University.

For more detail see Baverstock (2011) and Nicolle, Clift, Maguire, and Baverstock (not yet published but under review with the journal *Applied Ergonomics*).

3. Handles and catches

The ANEC R&T project suggested the following values for a hook grip or recessed handle (which you might find on a typical detergent tray for a dishwasher or washing machine):

To give the 95th percentile ample space to use a hook grip or recessed handle the recommended dimensions were:

51 mm deep, with a 51 mm lip,
89 mm wide



This handle design does not require knuckle width but only adequate finger clearance for all four fingers; however, it was suggested that the width should be increased. Even though most users will not need 89 mm, there was value in increasing the width to accommodate the 95th percentile adult knuckle width of 93 mm (Humanscale) and the 65-80 year old male 95th percentile knuckle width of 90 mm (Older Adultdata).

**Therefore, the revised recommended values are:
51 mm deep, with a 51 mm lip,
93 mm wide**

4. Font size and contrast

The earlier recommendations on font size made in the ANEC R&T project report were based on a considered view of the literature and our own research activities. Following further research, the recommended **x-height** of the font has been converted to **font point size** since it is more precise to consider the ratio between stroke width and height of the letter. Point size is also considered easier to apply by designers. The revised recommendations also take account of font type – the recommended values refer to the use of Arial font, but if a different font type is used, stroke width conversion tables are provided to ensure you include at least the same number of people in your design.

The earlier recommendation was, for example, as follows:

If 70% contrast is used and size of font is 4.7 mm x-height, research suggests that approximately 90% of people over the age of 65 would be able to read it at 1 metre (provided the lighting is at least 150 lx – Guidelines for artificial lighting in the kitchen are 250-500 lx).

Using the description of viewing distances (Figure 1) and data from Figure 2 on the number of people included as a result of the design option, an example of the revised recommendation is as follows:

If 70% contrast is used and size of font is 30 point, research suggests that approximately 90% of people over the age of 65 would be able to read the text in-house at night at a distance of 1 metre. In-house at night refers to the lighting level experienced at night in a house with the lights on (approximately 150 lx). During the daytime it is much brighter in a house due to the level of natural daylight entering through the windows, so this would be the worst case scenario.

The inclusion percentages displayed in Figure 2 apply only to UPPER and lower case Arial font. If a different font type is used, stroke width conversion guidance and tables are provided (see Figures 3 and 4) to ensure you include at least the same number of people in your design.

The following extracts from the Context Calculator, developed by Loughborough Design School as part of the i-design3 project, are based on a representative sample of 38 older adults ranging from 65-87 years old (mean age=74 yrs). A journal paper is now in preparation, and more detailed information will be provided on request (Elton and Nicolle, in preparation). The full tool will be made available on the Inclusive Design Toolkit at <http://www.inclusivedesigntoolkit.com/>

The screenshot shows a web interface with three tabs: 'Welcome', 'Understand more', and 'Design options'. The 'Design options' tab is active. Below the tabs is an information box with an 'i' icon and the text: 'You have clicked on the information button. This page will provide you with information regarding the viewing distances you can select from in this tool.' Below this is a large rounded rectangle containing three items, each with an icon of a person viewing an object and a line indicating the distance:

- 1 metre:** This is the closest distance older adults' (+60 years) eyes can focus without wearing glasses. Use this viewing distance for the design of all handheld products, household appliances, walk-up and use products and services .
- 2 metres:** Products/objects viewed at this distance may be similar to those viewed at 3 metres. Think about the layout of the environment, where it will be located, are there any physical constraints, will it be positioned at a height etc.
- 3 metres:** Products/objects that may be viewed at this distance include displays, way finding signs, bus and train timetable displays etc. Always think about where your product/object will be positioned before selecting the viewing distance.

At the bottom left of the rounded rectangle is a button labeled '< Back'.

Figure 1: Viewing distances

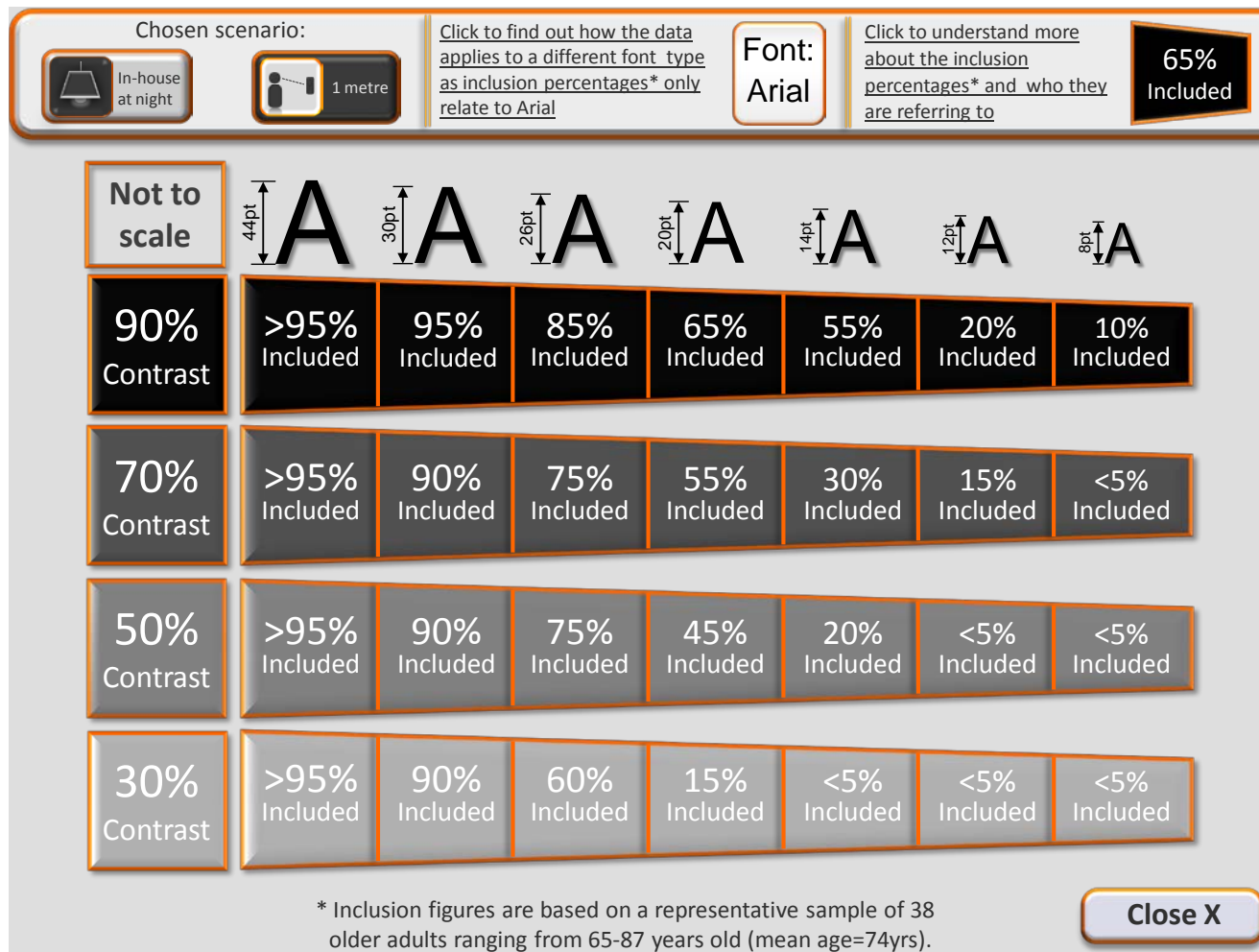
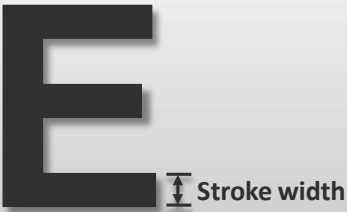


Figure 2: Recommended Font size In-house at night at 1 metre


Welcome Understand more **Design options**

Please read the guidance on this page if you wish to use a font other than Arial. Then view the stroke width tables to help determine what pt size your chosen font should be.

When using a font other than Arial you must ensure the letter stroke width of your chosen font matches the stroke width of the Arial font detailed in the chart. This will ensure the same percentage of people are included. Stroke width refers to the thickness of the stroke of a letter:



Matching the font size (pt) is not reliable because letter size and stroke width vary greatly between different typefaces at any given size (pt). All of the letter E's below are 72pt; however, there is a big difference in the letter height and stroke width of these letters.




Avoid using script (handwriting) typefaces. The legibility of Serif and Sans Serif typefaces are deemed equal at various viewing distances.

< Back View stroke width tables


Figure 3: Stroke width conversion guidance

Welcome
Understand more
Design options


Identify the Arial font size that gave you the desired level of inclusion. Then find out what pt size (of your chosen font) will give you the same stroke width*.



Arial pt size	Stroke width
44pt	1.16mm
30pt	0.94mm
26pt	0.74mm
20pt	0.58mm
14pt	0.46mm
12pt	0.36mm
8pt	0.29mm
6pt	0.24mm



Arial pt size	Stroke width
88pt	2.36mm
70pt	1.88mm
56pt	1.48mm
44pt	1.16mm
30pt	0.92mm
26pt	0.72mm
20pt	0.58mm
16pt	0.48mm



Arial pt size	Stroke width
132pt	3.54mm
106pt	2.82mm
84pt	2.22mm
66pt	1.74mm
52pt	1.38mm
40pt	1.08mm
28pt	0.87mm
26pt	0.72mm

< Back

*Note: stroke width can be determined by cropping a letter to the width of a stroke using a graphics software package and then selecting image size from the menu.

Figure 4: Stroke width conversion tables

5. References

Baverstock, S (2011) Discovering the requirements for European household appliances for ease of use by older and disabled people. BSc project report, Submitted in part-fulfilment of the requirements of the examination for the B.Sc. (Honours) in Ergonomics.

Elton, E and Nicolle C (in preparation). Reducing exclusion with products in everyday environments: The effects of everyday ambient illumination on older adult's near visual acuity

Nicolle, C., Maguire, M.C. and Clift, L. (2011). Requirements needed in European household appliance performance standards to improve ease of use by older and disabled people. [ANEC R&T Project 2010; ANEC-ML-2010-0044]

Nicolle, C., Clift, L, Maguire, MC and Baverstock, S (under review). Improving ease of use of kitchen appliances by older people and people with disabilities: a study of requirements for European performance standards