Designing for People

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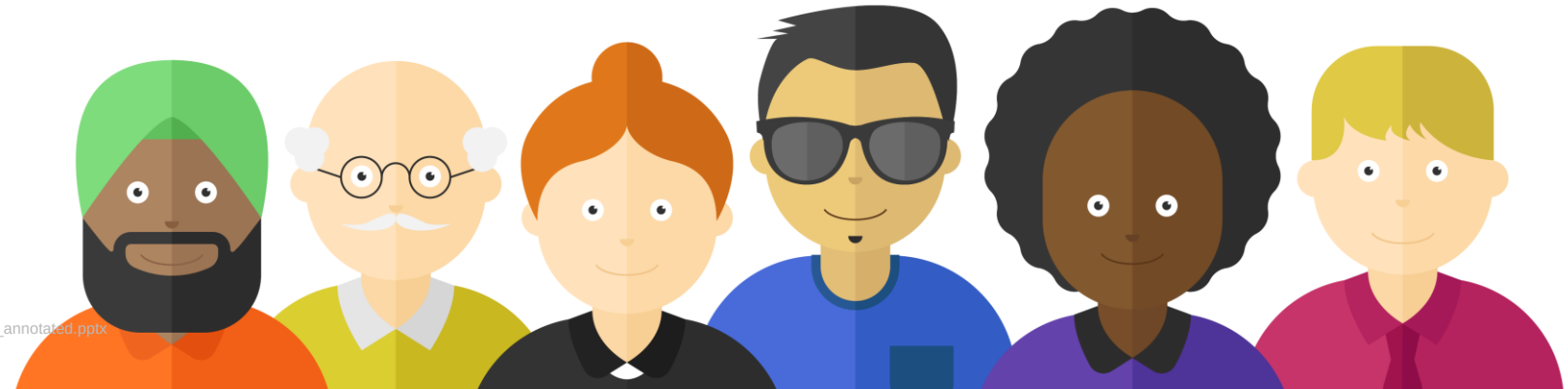
This presentation was delivered as a keynote address to the Equity in Transportation conference in Christchurch New Zealand (via video link).

This is an annotated version of the slide deck shared.



Delivering Journeys

A very quick introduction to the company I work for a design consultancy called DCA, we are a team of about 150 people.

And within transport we work across, trains, planes, and automobiles.

This is a picture of the intercity express train that we worked on for Hitachi, here in the UK.


We also work in aircraft interiors…

As well as working on the next generation of cockpit designs

We work in automotive supporting some of world's leading car brands

More recently, we have been working across a number of projects addressing self driving cars.

DCA

Through to autonomous shuttles to address the last mile challenge.

We also work across bus and coach.


财富
FORTUNE
CHINA
FIGARO

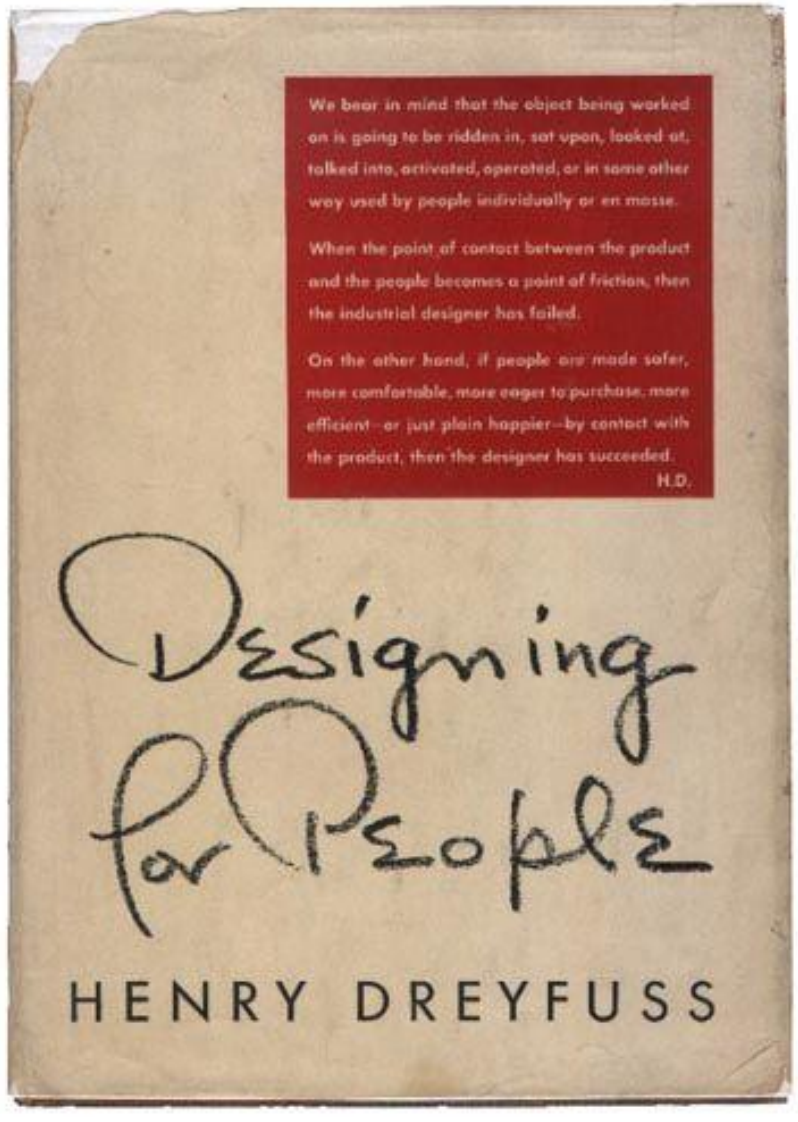
As well as cruise ship interiors.

Along side transport we work across medical devices, consumer, and industrial products.

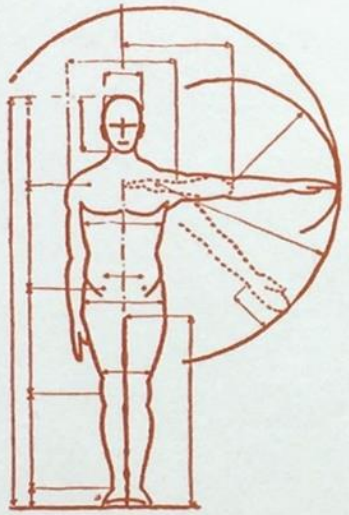
It doesn't matter if we are designing a train or a toothbrush, the one thing that unites the things that we design is that we are designing for people.

The idea of designing for people is, of course, not new.

This is one of favourite books, from one of my design heroes, an industrial designer called Henry Dreyfuss.



DESIGNING FOR PEOPLE



Dreyfuss wrote it back in 1955.

I love the passage in the front of the book…

This still remains a powerful idea 60 years later.

The idea that it is not the person using the product that has failed when things are not working quite right, but the designer or the product itself.

We bear in mind that the object being worked on is going to be ridden in, sat upon, looked at, talked into, activated, operated, or in some other way used by people individually or en masse.

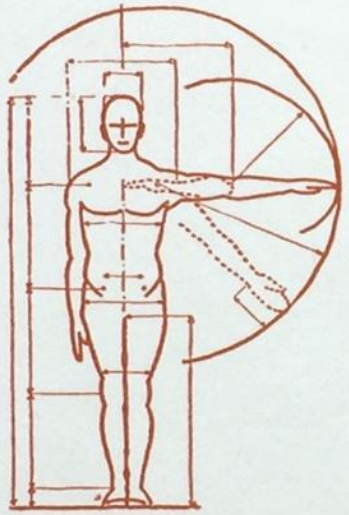
When the point of contact between the product and the people becomes a point of friction, then the industrial designer has failed.

On the other hand if people are made safer, more comfortable, more eager to purchase, more efficient—or just plain happier—by contact with the product, then the designer has succeeded.

Simon and Schuster, New York, 1955

by HENRY DREYFUSS

DESIGNING FOR PEOPLE



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or service

Simon and Schuster, New York, 1955

by HENRY DREYFUSS

But, the thing that I really love about this quote is that Dreyfuss goes on to talk about how designers can have a very positive impact, by making things safer, more comfortable, more efficient and people just plain happier from contact with the product or indeed the service.

60 or 70 years ago, around the time that Dreyfuss was writing that book, the idea of inclusive design didn't exist as a term.

What's more, there was also a view that for many products that one-size may fit all, and by designing for an 'average man' is good enough.

We instinctively know that for things like clothes we need a range of sizes and shapes, so it's surprising that that same logic doesn't always transfer to other products and services.

One size fits all?

Image credit: https://www.chartingyourfinancialfuture.com/investing/when-one-size-fits-all-falls-short/

But how many people are average?

The first military cockpits were designed around an average pilot. In the USA a model was developed in the 1930s and used for most of the USAF aircraft.

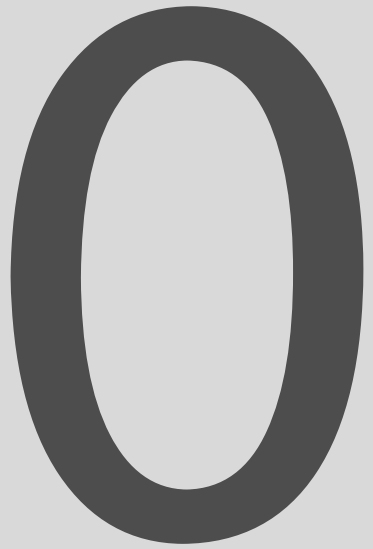
Fast forward to 1950 (around the time of Dreyfuss' book) and the US air force thought that it was about time that they updated their model. So they hired someone to measure over 4000 of their pilots and develop a new average pilot…

If we assume that the average is within the middle 30% of the range of values for each dimension.

How many of the 4,063 pilots were average on all 10 measurements?

1. Stature
2. Chest circumference
3. Sleeve length
4. Crouch height
5. Torso circumference
6. Hip circumference
7. Neck circumference
8. Waist circumference
9. Thigh circumference
10. Crotch length

Image credit: https://www.airspacemag.com/history-of-flight/the-59ers-180960072/
Further reading https://www.thestar.com/news/insight/2016/01/16/when-us-air-force-discovered-the-flaw-of-averages.html

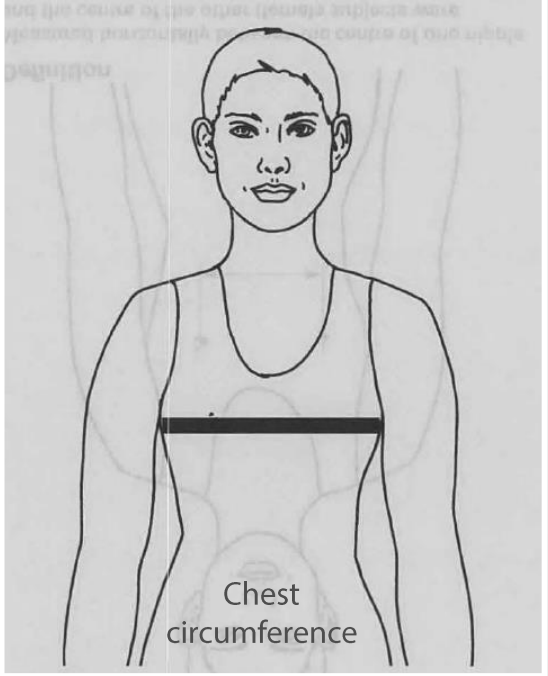


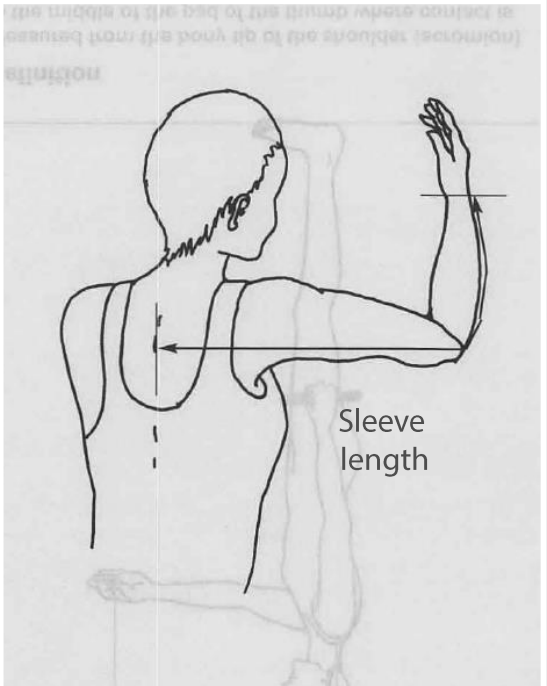
The flaw of averages!

Based on three measurements – less than 3.5% were average…

There was no such thing as an average pilot!

(and that was only men ♂)





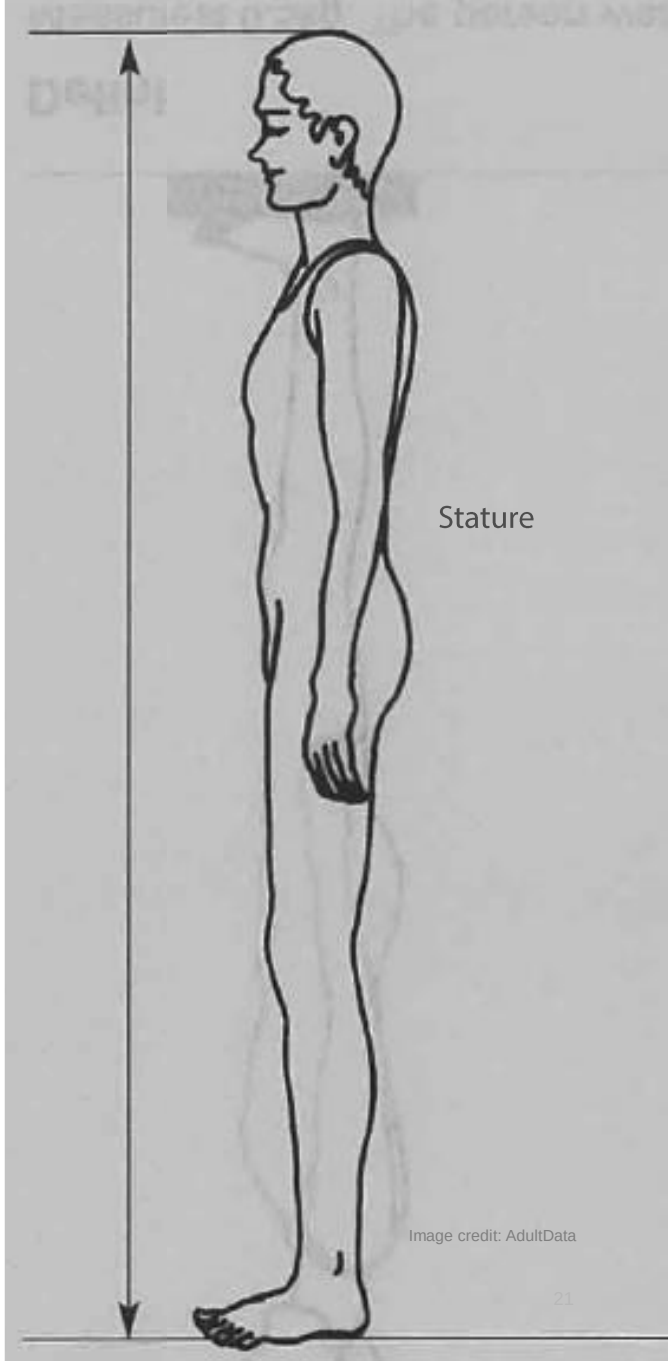


Image credit: AdultData

So when it comes to aircraft cockpit layout, it's clear that one size does not fit all. And that adjustment is needed for the pilot to be able to reach and see all of the controls and be able to see out the windshield.

Image credit: https://www.clubrowcreations.co.uk/promotional-products-dont-fit-all/

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But this isn't just a problem of the past, nor is just a problem of fit.

In most industries, driver crash tests are still conducted with a 50th percentile male mannequin (based on US and European population).

So if you are fortunate enough to be male and 175cm tall then you can be comforted by the idea that over the last 50 years cars have been optimised for your safety.

But if you are not, then you might be at greater risk of injury in the event of a crash…

Image credit: https://www.auto123.com/en/multimedia/news/volvo-cars-crash-test-laboratory-10th-birthday/55142/

A world designed around the average man

And its not just cars. Our world has been largely designed around an average man.

Police stab vests are designed around the shape of a male torso.

Bags of cement or potatoes are sized based on male lifting capabilities

Standard bricks are based on the size of a man's hand.

Office temperatures set based on a male metabolic rate (5° too cold for women).

And the space allocated for toilets doesn't tend to account for the fact that women need more space – they need more cubicles as urinals are not used, on average they take 2.3x as long per visit, and on average make more frequent trips.

https://www.theguardian.com/lifeandstyle/2019/feb/23/truth-world-built-for-men-car-crashes

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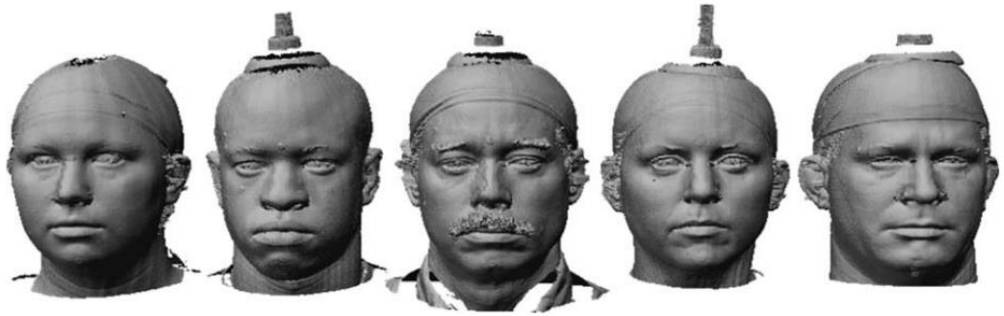
And its not just about tall and short and gender, but also variance in features that may be linked to ethnicity.

A lot of products are designed around a European face – what happens if you nose is a different shape?



Ziqing Zhuang, Stacey Benson & Dennis Viscusi (2010) Digital 3-D headforms with facial features representative of the current US workforce, Ergonomics,53:5, 661-671, DOI: 10.1080/00140130903581656

We have designed a number of products in this space recently and the good news is that human diversity things is now being explicitly considered.

But it hasn't always been the case…

Image credit: DCA

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Size

So, inclusive design is about size

Image credit: https://www.theodysseyonline.com/9-perks-of-being-tall-person

Size

Shape

And it's also about shape…

And we are changing shapes perhaps faster than ever.

Many products are now being designed for masses of 350kg, it also has significant implications for things like seat sizes.

Image credit: Fatboyslim

But it's not just about size and shape, physical capabilities have historically had a significant impact on the way we design physical spaces.

Image credit: BBC

Size

Shape

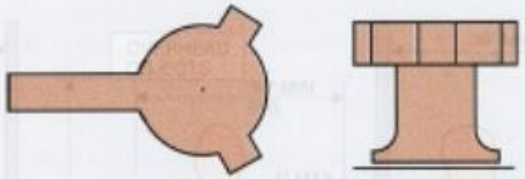
Capabilities

From a physical perspective, there is lots of information available in the form of anthropometric datasets.

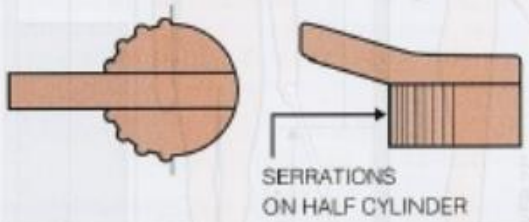
Image credit: DCA

FOR ARTHRITIS

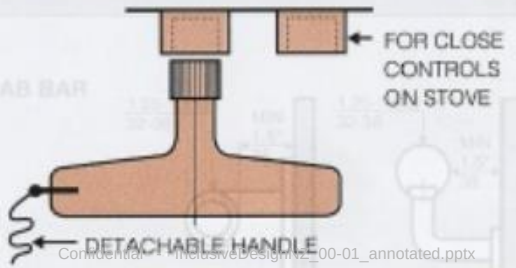
FOR PARKINSON'S DISEASE OR MULTIPLE SCHLEROSIS

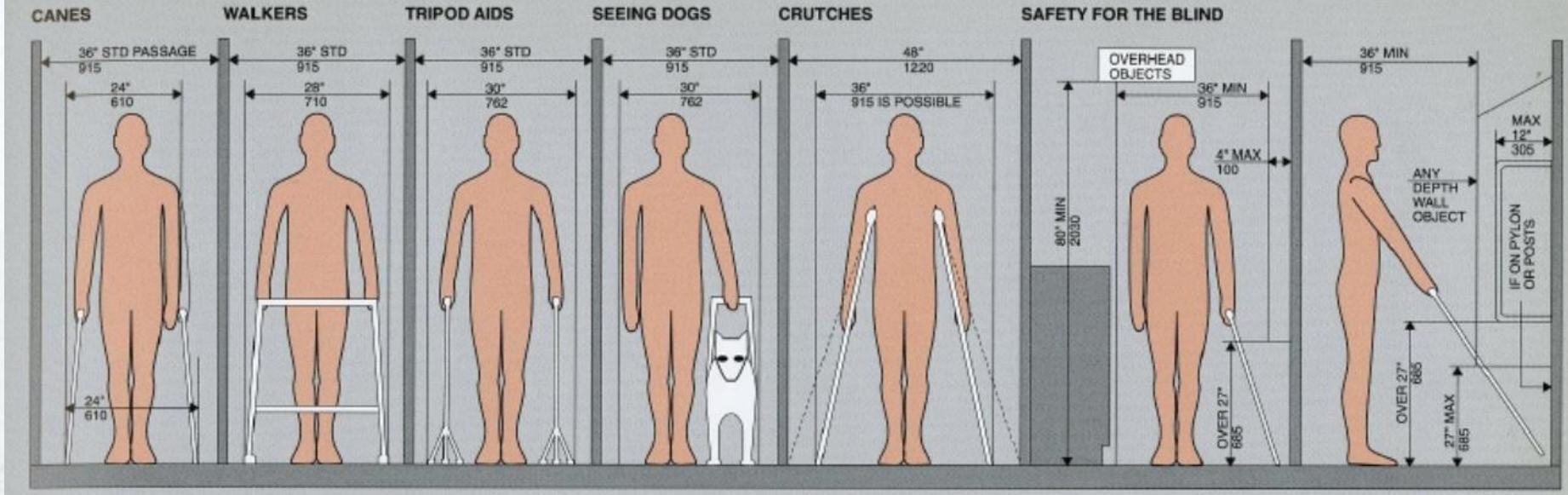


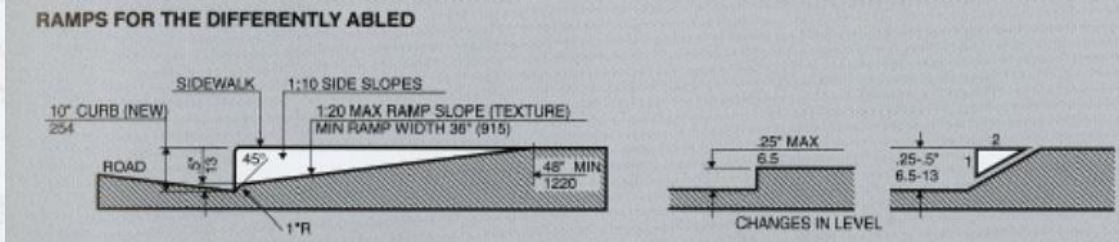
FOR PHYSICAL WEAKNESS POLIOMYELITIS OR MUSCULAR DYSTROPHY

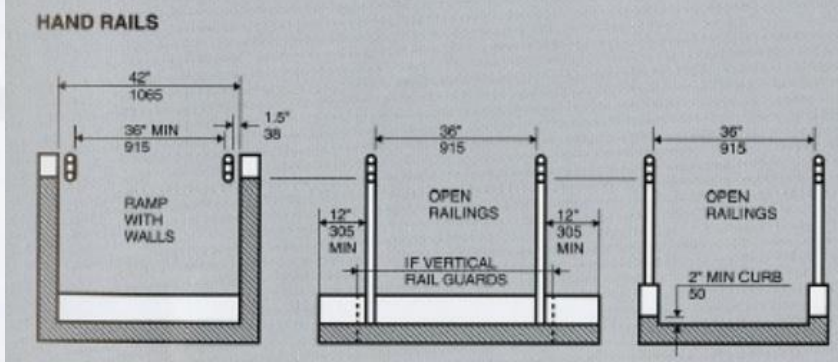


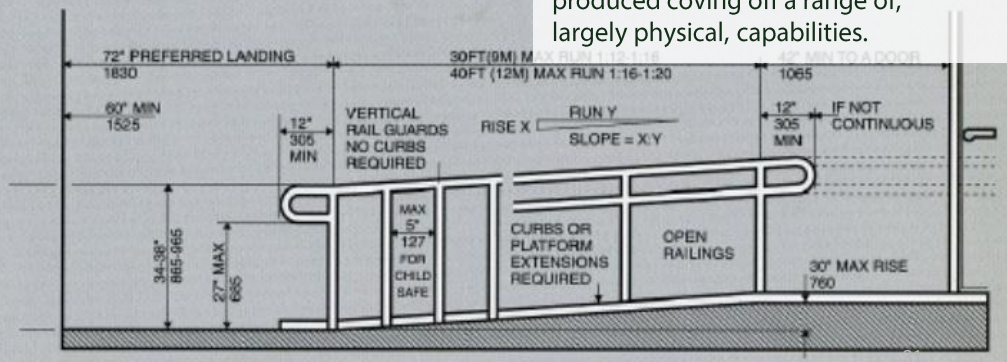
FOR ARTHRITIS OR PHYSICAL WEAKNESS

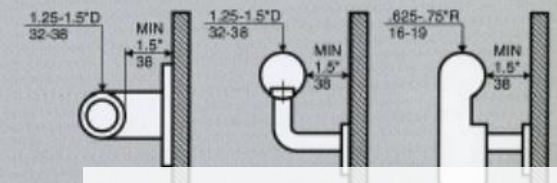












Datasets have also been produced coving off a range of, largely physical, capabilities.

Image credit: Measure of man and woman

But our capabilities are not fixed, as we age our capabilities change.

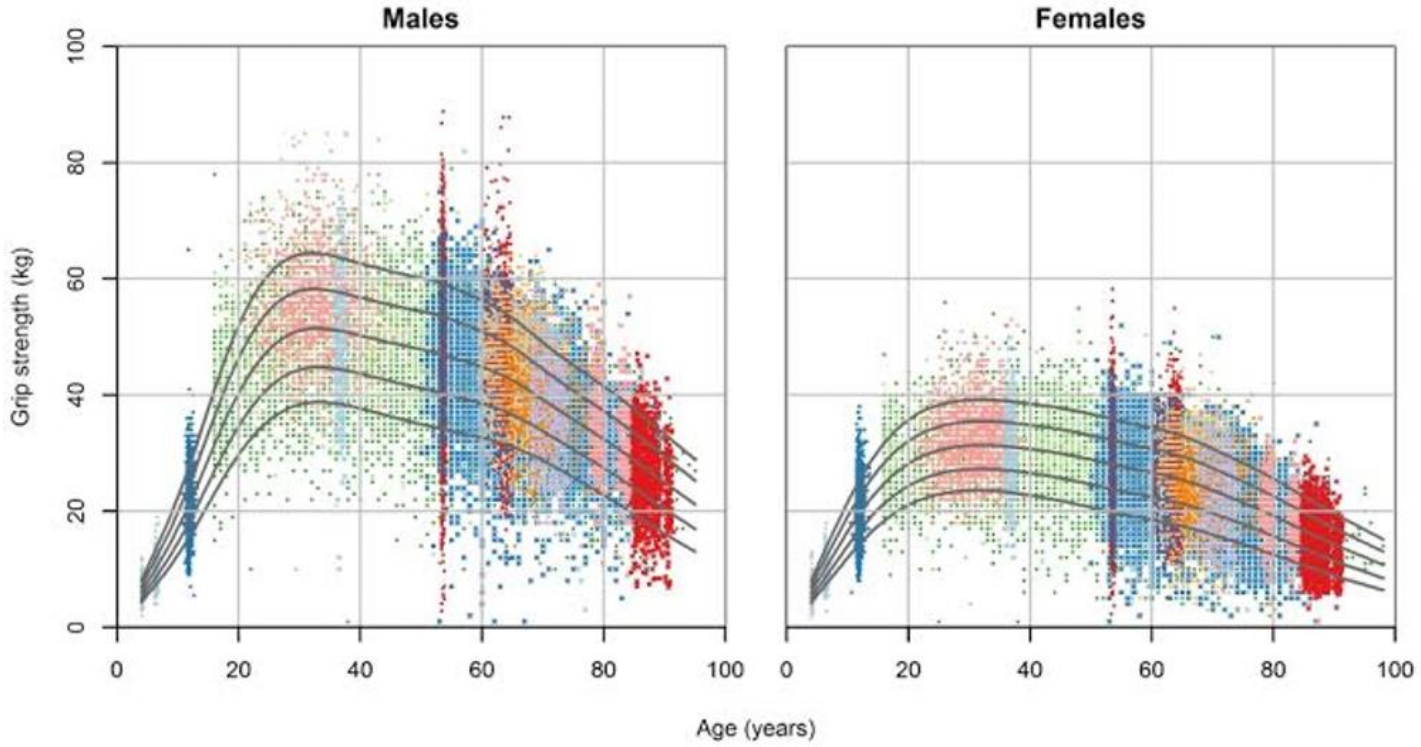
As we approach old age, we tend to shrink and also lose our strength.

However, we are increasingly remaining in work for much longer. As such, the role of inclusive design is becoming more important.

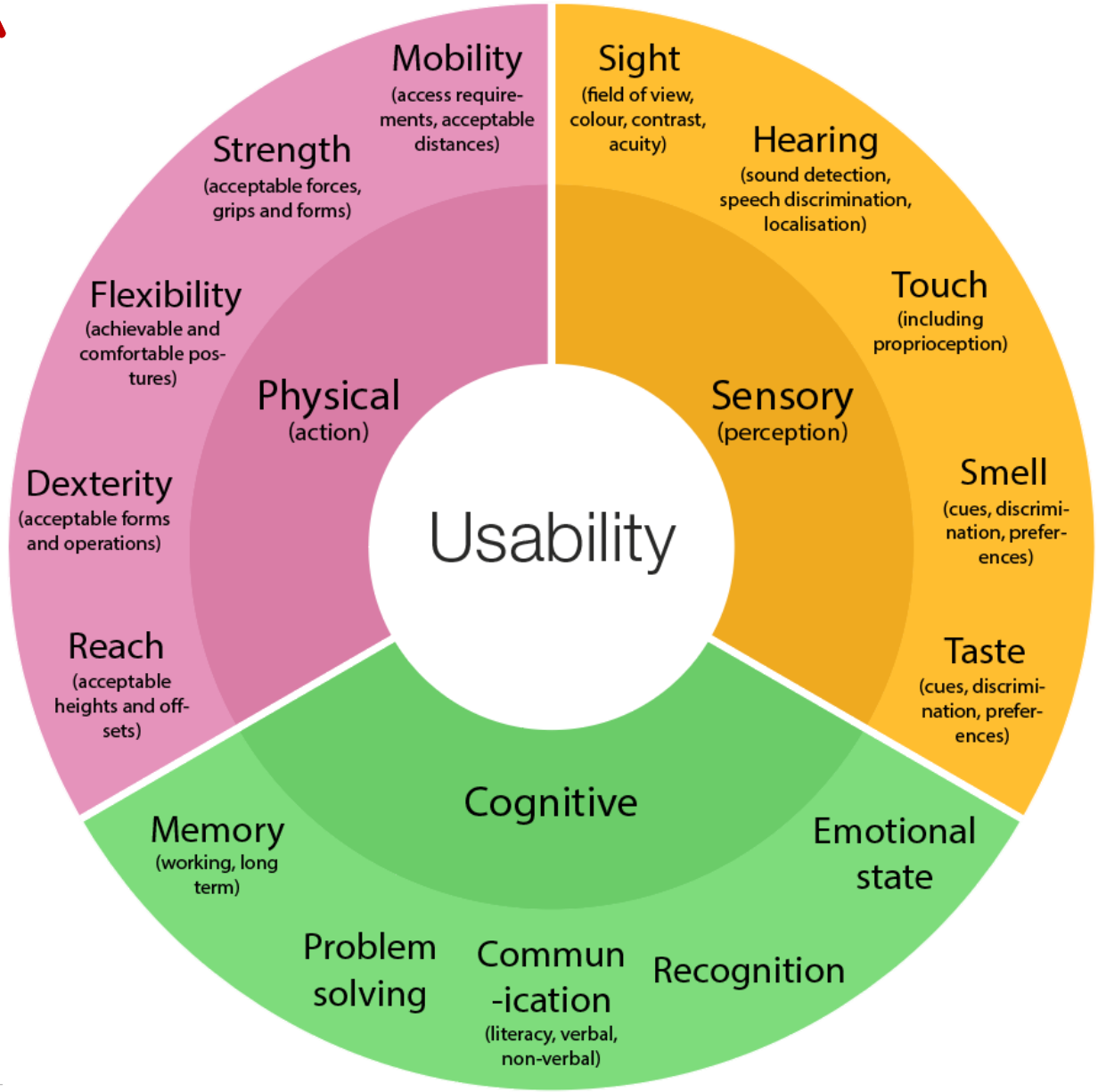
Image credit: http://www.cumbriachamberofcommerce.co.uk/why-your-business-needs-older-workers-2/

In terms of strength it really is down hill from 40, in fact more like mid 30s.

And we can see similar trends for many of our sensory capabilities too like eye sight and hearing.



http://theconversation.com/what-your-hand-grip-says-about-your-strength-through-life-35063



So it's not just about size and strength.

The diagram on the left is a useful prompt we use when considering capabilities, it breaks them down in terms of whether they are sensory, cognitive, or physical.

Physical capabilities are the kinds of things that we might naturally think about when we think about inclusive design. They cover off size, strength, mobility, dexterity.

Sensory capabilities also change between us both on the capabilities that we are born with and those the deteriorate over time or perhaps more suddenly – sight, hearing touch smell and taste.

Our cognitive abilities also differ between us and they also change as we age or as a result of events in our lives, perhaps some form of trauma.

Confidential -

As we have seen from the examples so far, there are a number of aspects that will shape our range of capabilities.

Our size and shape, our gender, ethnicity, education levels, poverty, languages, cultures and customs, our diets and our age

These all have the potential to impact our ability to interact with the products and services around us.

In the UK those from the wealthiest socioeconomic groups are, on average, 30mm taller than those from the poorest groups.

This trend is common across most counties that it has been measured in.

Only one country (with data) bucks the trend.

Any guesses?

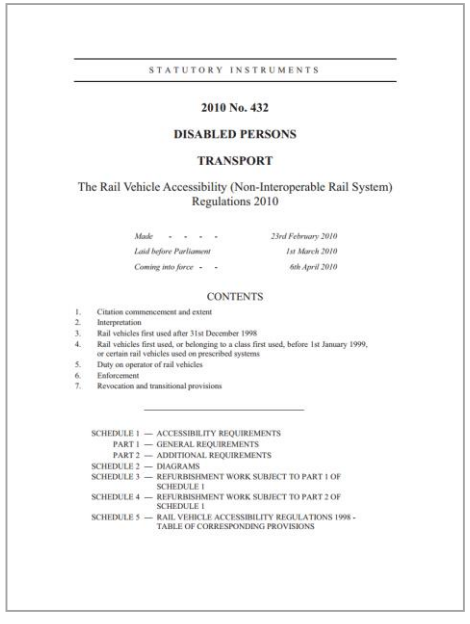
Why bother?

(or why should companies invest in inclusive design?)

The motivations for inclusive design can be crudely divided into the carrot the stick.

Image credit: Shutterstock

Regulations



STATUTORY INSTRUMENTS

2010 No. 432

DISABLED PERSONS

TRANSPORT

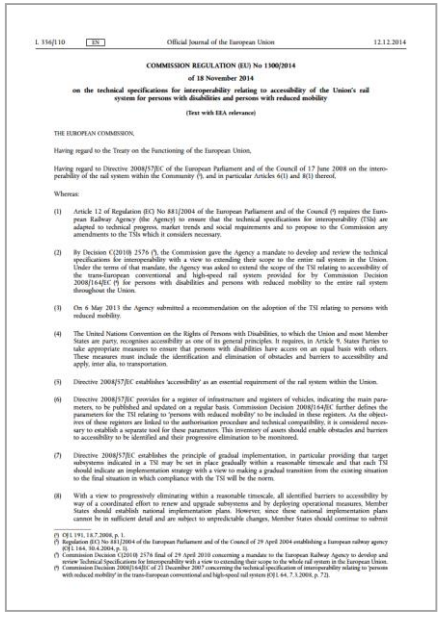
The Rail Vehicle Accessibility (Non-Interoperable Rail System) Regulations 2010

Made - - - - 23rd February 2010
Laid before Parliament 1st March 2010
Coming into force - - 6th April 2010

CONTENTS

1. Citation commencement and extent
2. Interpretation
3. Rail vehicles first used after 31st December 1998
4. Rail vehicles first used, or belonging to a class first used, before 1st January 1999, or certain rail vehicles used on prescribed systems
5. Duty on operator of rail vehicles
6. Enforcement
7. Revocation and transitional provisions

SCHEDULE 1 — ACCESSIBILITY REQUIREMENTS
PART 1 — GENERAL REQUIREMENTS
PART 2 — ADDITIONAL REQUIREMENTS
SCHEDULE 2 — DIAGRAMS
SCHEDULE 3 — REFURBISHMENT WORK SUBJECT TO PART 1 OF SCHEDULE 1
SCHEDULE 4 — REFURBISHMENT WORK SUBJECT TO PART 2 OF SCHEDULE 1
SCHEDULE 5 — RAIL VEHICLE ACCESSIBILITY REGULATIONS 1998 - TABLE OF CORRESPONDING PROVISIONS



L 336/110 EN Official Journal of the European Union 12.12.2014

COMMISSION REGULATION (EU) No 1300/2014

of 18 November 2014

on the technical specifications for interoperability relating to accessibility of the Union's rail system for persons with disabilities and persons with reduced mobility

(Text with EEA relevance)

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community (1), and in particular Articles 6(1) and 8(1) thereof,

Whereas:

(1) Article 12 of Regulation (EC) No 881/2004 of the European Parliament and of the Council (2) requires the European Railway Agency (the Agency) to ensure that the technical specifications for interoperability (TSIs) are adapted to technical progress, market trends and social requirements and to propose to the Commission any amendments to the TSIs which it considers necessary.

(2) By Decision C(2010) 2576 (3), the Commission gave the Agency a mandate to develop and review the technical specifications for interoperability with a view to extending their scope to the entire rail system in the Union. Under the terms of that mandate, the Agency was asked to extend the scope of the TSI relating to accessibility of the trans-European conventional and high-speed rail system provided for by Commission Decision 2008/164/EC (4) for persons with disabilities and persons with reduced mobility to the entire rail system throughout the Union.

(3) On 6 May 2013 the Agency submitted a recommendation on the adoption of the TSI relating to persons with reduced mobility.

(4) The United Nations Convention on the Rights of Persons with Disabilities, to which the Union and most Member States are party, recognises accessibility as one of its general principles. It requires, in Article 9, States Parties to take appropriate measures to ensure that persons with disabilities have access on an equal basis with others. These measures must include the identification and elimination of obstacles and barriers to accessibility and apply, inter alia, to transportation.

(5) Directive 2008/57/EC establishes 'accessibility' as an essential requirement of the rail system within the Union.

(6) Directive 2008/57/EC provides for a register of infrastructure and registers of vehicles, indicating the main parameters, to be published and updated on a regular basis. Commission Decision 2008/164/EC further defines the parameters for the TSI relating to 'persons with reduced mobility' to be included in these registers. As the objectives of these registers are linked to the authorisation procedure and technical compatibility, it is considered necessary to establish a separate tool for these parameters. This inventory of assets should enable obstacles and barriers to accessibility to be identified and their progressive elimination to be monitored.

(7) Directive 2008/57/EC establishes the principle of gradual implementation, in particular providing that target subsystems indicated in a TSI may be set in place gradually within a reasonable timescale and that each TSI should indicate an implementation strategy with a view to making a gradual transition from the existing situation to the final situation in which compliance with the TSI will be the norm.

(8) With a view to progressively eliminating within a reasonable timescale, all identified barriers to accessibility by way of a coordinated effort to renew and upgrade subsystems and by deploying operational measures, Member States should establish national implementation plans. However, since these national implementation plans cannot be in sufficient detail and are subject to unpredictable changes, Member States should continue to submit

(1) OJ L 191, 18.7.2008, p. 1.
(2) Regulation (EC) No 881/2004 of the European Parliament and of the Council of 29 April 2004 establishing a European railway agency (OJ L 164, 30.4.2004, p. 1).
(3) Commission Decision C(2010) 2576 final of 29 April 2010 concerning a mandate to the European Railway Agency to develop and review Technical Specifications for Interoperability with a view to extending their scope to the whole rail system in the European Union.
(4) Commission Decision 2008/164/EC of 21 December 2007 concerning the technical specification of interoperability relating to 'persons with reduced mobility' in the trans-European conventional and high-speed rail system (OJ L 64, 7.3.2008, p. 72).

ONLINE VERSION

HM Government

The Building Regulations 2010

Access to and use of buildings

M

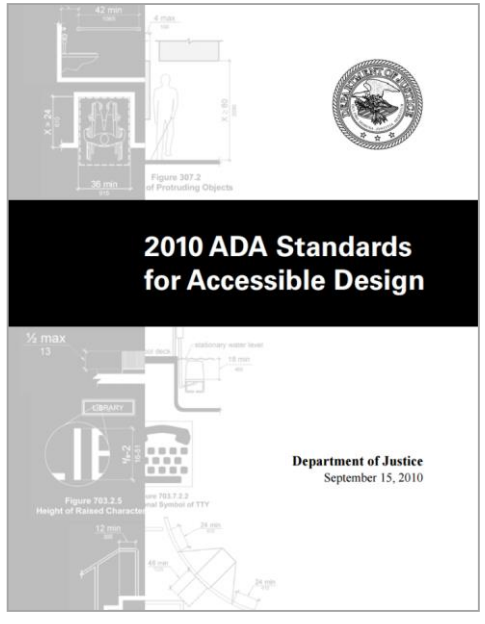
APPROVED DOCUMENT

Volume 1: Dwellings

M4(1) Category 1: Visitable dwellings
M4(2) Category 2: Accessible and adaptable dwellings
M4(3) Category 3: Wheelchair user dwellings

2015 edition incorporating 2016 amendments – for use in England*

ONLINE VERSION



2010 ADA Standards for Accessible Design

Department of Justice
September 15, 2010

The stick, the very big stick, in some markets is regulations (and essential standards).

In many countries, accessibility rights have been written into law – meaning that non-compliance is a complete barrier to entry.

This means that buildings, and public transport systems need to demonstrate that they meet minimum standards largely around their physical space.

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In many cases, these regulations are quite prescriptive.

Let's take the PRM TSI (the technical standard for persons with reduced mobility) as an example. This standard applies to the design of the majority of trains across Europe.

It is designed to ensure that rail transport is accessible to as many people as possible.

It mandates clear specifications for the train such as handholds between 800mm and 1200mm from the floor.

If the train doesn't comply with this standard, the train can't go into service – so as a train manufacturer, you have to take it seriously.

Image credit: DCA

That's the stick, but the giant carrot is quite simply more customers for product and services.

What's more, in most markets, older customers hold a disproportionate amount of wealth.

Image credit:http://www.telegraph.co.uk/news/picture-galleries/pictures-of-the-day/11091402/Pictures-of-the-day-12-September-2014.html?frame=3036610

The purple pound – the annual disposable income of disable people is estimated to be one trillion dollars globally.

$1tn

Image credit: Barclays

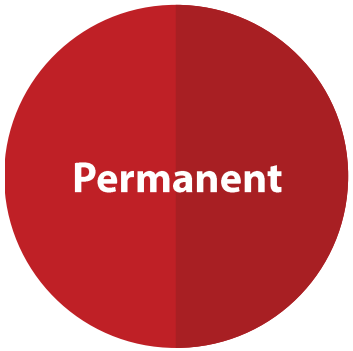
In addition, there are some clear trends in a number of sectors that are creating new markets.

For example, in healthcare there is a trend towards allowing more patients to self manage their treatments.

For this to be viable, products need to be easier to use and more inclusive.

In other words, more inclusive products create new categories and even shift category expectations.

Types of exclusion



But it is important not to think about inclusive design as something that is simply for disabled people. People are often excluded from using services for a number of reasons.

Some exclusions will be permanent or persistent, they will always be there – perhaps being deaf or blind from birth

Others will be temporary – we may break our arm, injure our backs, or spend a week in a country where we don't speak the language.

Others will be situational, we may be carrying a small child, driving a car, in a loud room or a quiet space.

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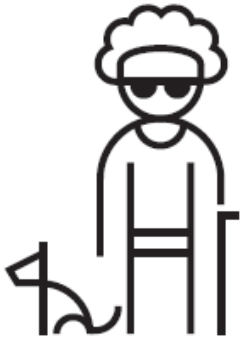
	Permanent	Temporary	Situational
Touch	 One arm	 Arm injury	 New parent
See	 Blind	 Cataract	 Distracted driver

	Permanent	Temporary	Situational
Hear	 Deaf	 Ear infection	 Bartender
Speak	 Non-verbal	 Laryngitis	 Heavy accent

Inclusive
A Microsoft Design Toolkit

As such one of the main motivators for inclusive design is that, in many cases, designs for permanent disabilities also tend to help situational ones. So a good design for a niche market often means a good design for all.

There are great examples of inclusive design all around us.

The dropped curb is just one of them. It helps wheelchair users but it also helps anyone with a wheels make the transition between the road and the pavement, those with prams, cyclists, scooters, those pushing trolleys, anyone with wheels.

The tactile features also help those that are visually impaired, and also those that simply are not paying attention…

Image credit: http://www.ims.penpoo.com/index.php?showtopic=39943

Perhaps looking at a smart phone

Road signs are another great example, as they do not rely on being able to speak or read the local language.

Image credit: https://urbandistro.com/smartphone-zombies-pictures.html

Subtitles are another good example of inclusive design.

They work well for those who have a hearing impairment, but they also work for those who speak a different language, or those trying to learn one

They also work for those who choose not to have sound in given situation – perhaps watching a short video clip on a train or an open plan office.

Image credit: Netflix


DCA
Permanent
Deaf
Temporary
Ear infection
Situational
In an open plan office, in another country
لذا قُلت بدون تفاصيل لن أوقع
Star Trek Into Darkness
Image credit: Netflix
1:25 / 8:38

Traffic lights are also great because they are not reliant on colour vision.
The location of the light also tells you what to do: top-stop, bottom-go

It is never a good idea to differentiate two signals on only one difference. As a rough heuristic the more attributes that are different the less likely that they will be confused.

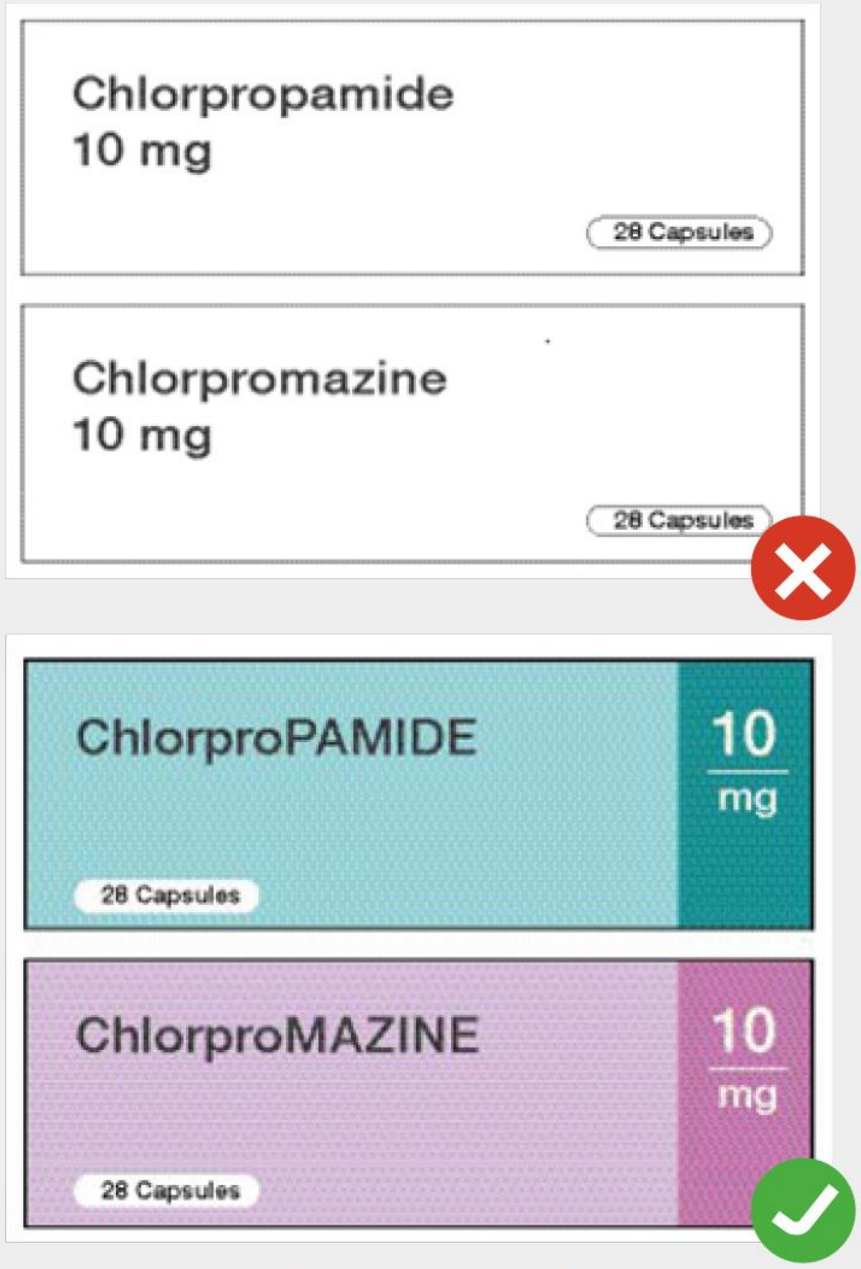
Colour
Location
Shape
Size

It also makes them much easier to describe in instructions.

DCA

There are many example where this has had some really negative consequences.

Some relative simple design changes can make a huge difference to ease of use but, perhaps more critically, also to safety.



Source: National Patient Safety Agency (2007)

And no talk on inclusive design would be complete without a slide with OXO good grips products on it.

Designed for people with limited dexterity, but in most cases just better to use.

Image credit: OXO

Testing with real users and iteration is often a critical part of the design process.

Image credit: Beautiful user – Ellen Lupton 2015

On a more cognitive level, Ikea instructions are a great example of inclusive design.

Printed without words, using only simple illustrations, accessible to speakers of any language, and almost any literacy and skill level.

This of course has massive advantages for Ikea. They don't have the hassle of expensive translations, printing multiple copies or having multiple product SKUs.

But they also make the whole product use journey much better.

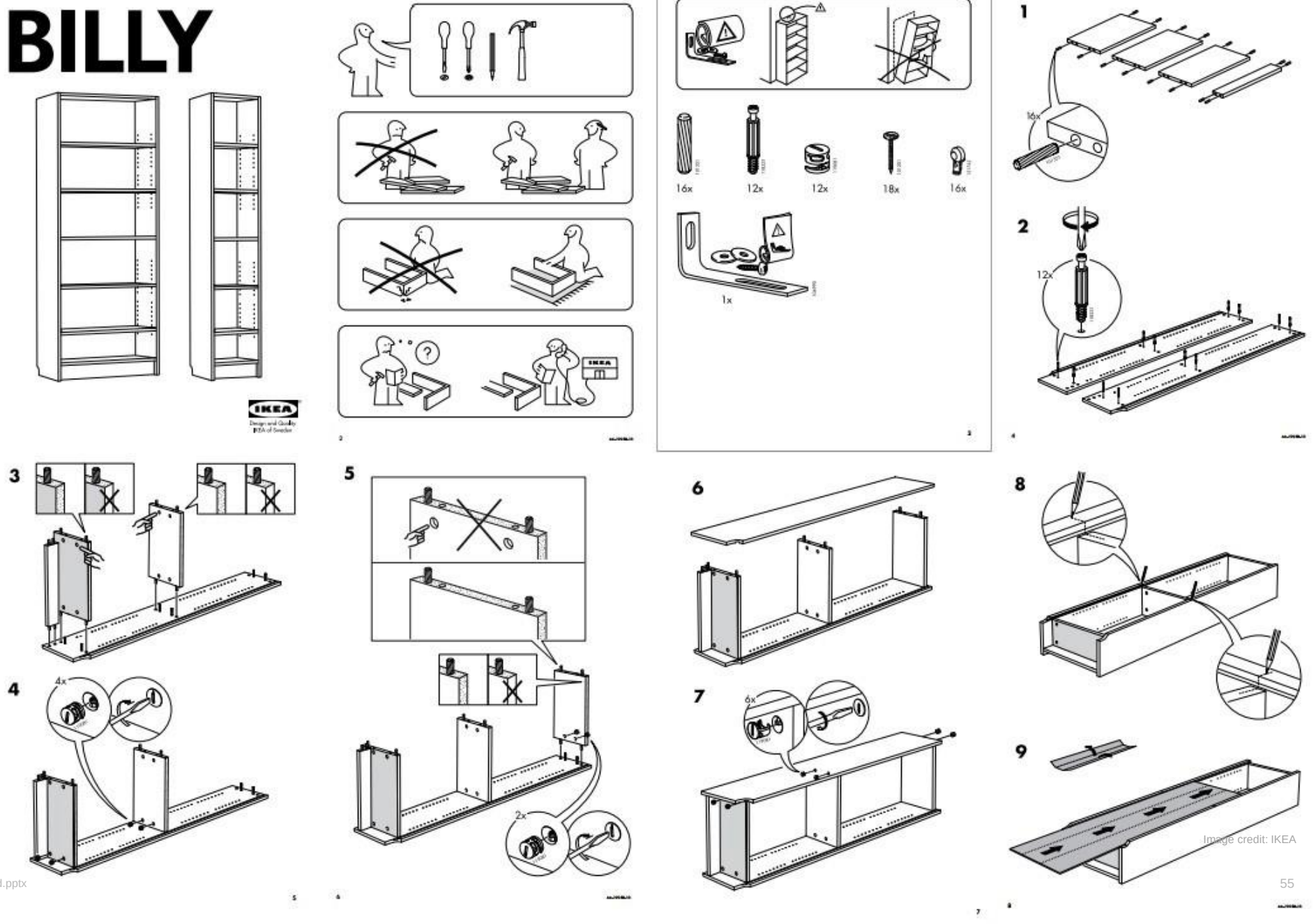
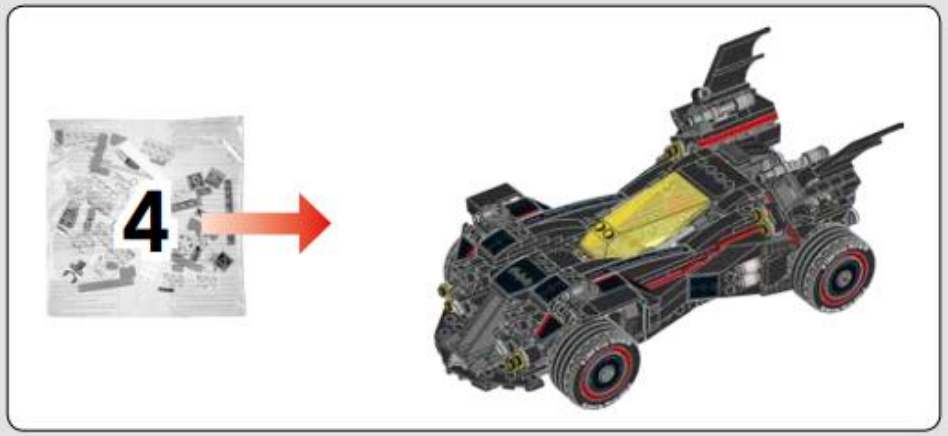


Image credit: IKEA



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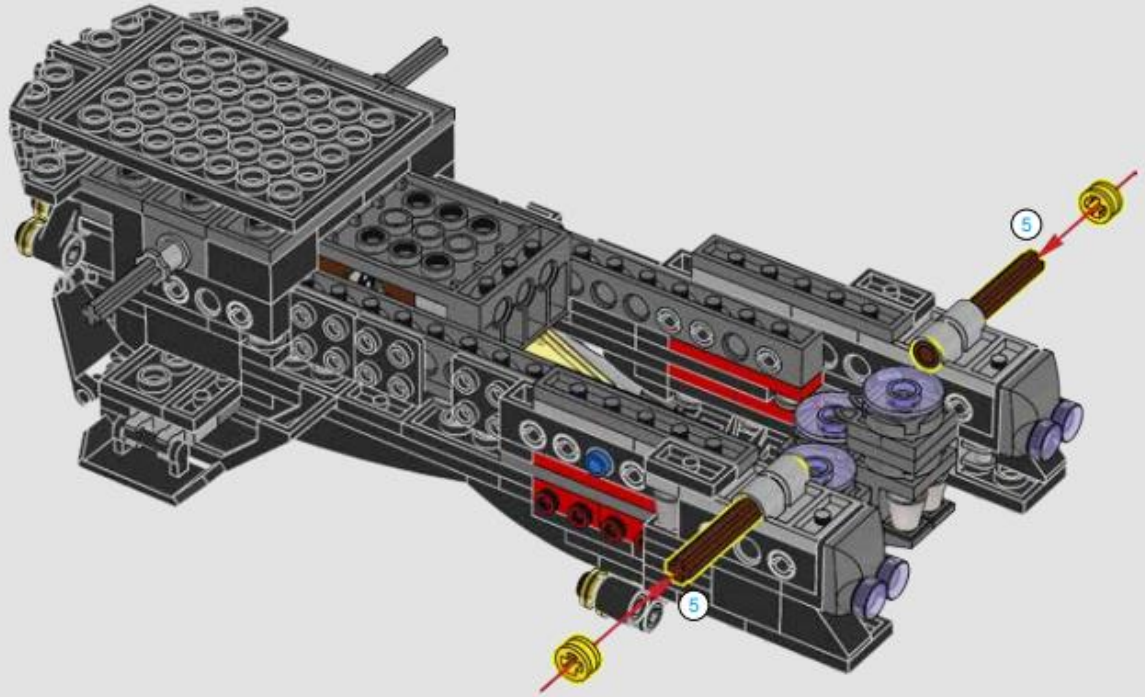


Lego have also been doing the same thing for years.

Making their products accessible to almost any age and language.

Image credit: Lego

Apple and Google are both great at building in accessibility features into the operating systems.

These kind of features are used by many people, not just those with a registered disability.

Upsize the text in apps.

When you activate Larger Dynamic Type on iPhone, iPad or Apple Watch, the text inside apps like Mail, Messages and Settings is converted to a larger, easier-to-read size.

DCA

Features like video calling have transformed the way deaf people communicate.

But they also create very engaging experiences, I realised the true value of video calling when talking to my two young children – the video was far more engaging for them than a voice only call.

Likewise, a flashing phone may really help if you are deaf, but it also helps if you have loud music playing or you have left your phone on silent.

Catch every sign, gesture and facial expression with FaceTime.

With high-quality video and a fast frame rate, FaceTime is a great way for people who use sign language to communicate easily. And because Mac, iPhone, iPad and iPod touch all come equipped with FaceTime, you can talk to iOS and macOS users across the street or across the globe.

See your phone ring with LED Flash.

Don't miss an incoming FaceTime call, text message, email or notification. Just set the LED light on your iPhone camera to flash. Instead of getting an audio alert, you'll see a blinking light from the rear flash.

Why bother?

(what is the business case?)

Image credit: Shutterstock

Compliance

A larger customer base

Improved product experience & satisfaction

Reduced returns and servicing

Brand reputation

Feel good factor with staff

Image credit: Shutterstock

So as I hope is clear, we are very strong advocates for inclusive design.

It's fundamental to our philosophy towards design and something we are incredibly passionate about.

To us inclusive design is simply good design.

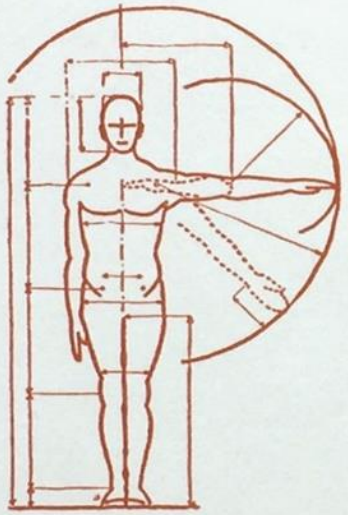
Inclusive design = Good design

That said, good design is more than just inclusive design…

Good design > Inclusive design

DCA

DESIGNING



In the book we discussed earlier, Dreyfuss is talking about a much broader, and richer, definition of what it means to design for people.

Something that's measureable and testable.

Safety comfort, efficiency, happiness

Simon and Schuster, New York, 1955

FOR PEOPLE

We bear in mind that the object being worked on is going to be ridden in, sat upon, looked at, talked into, activated, operated, or in some other way used by people individually or en masse.

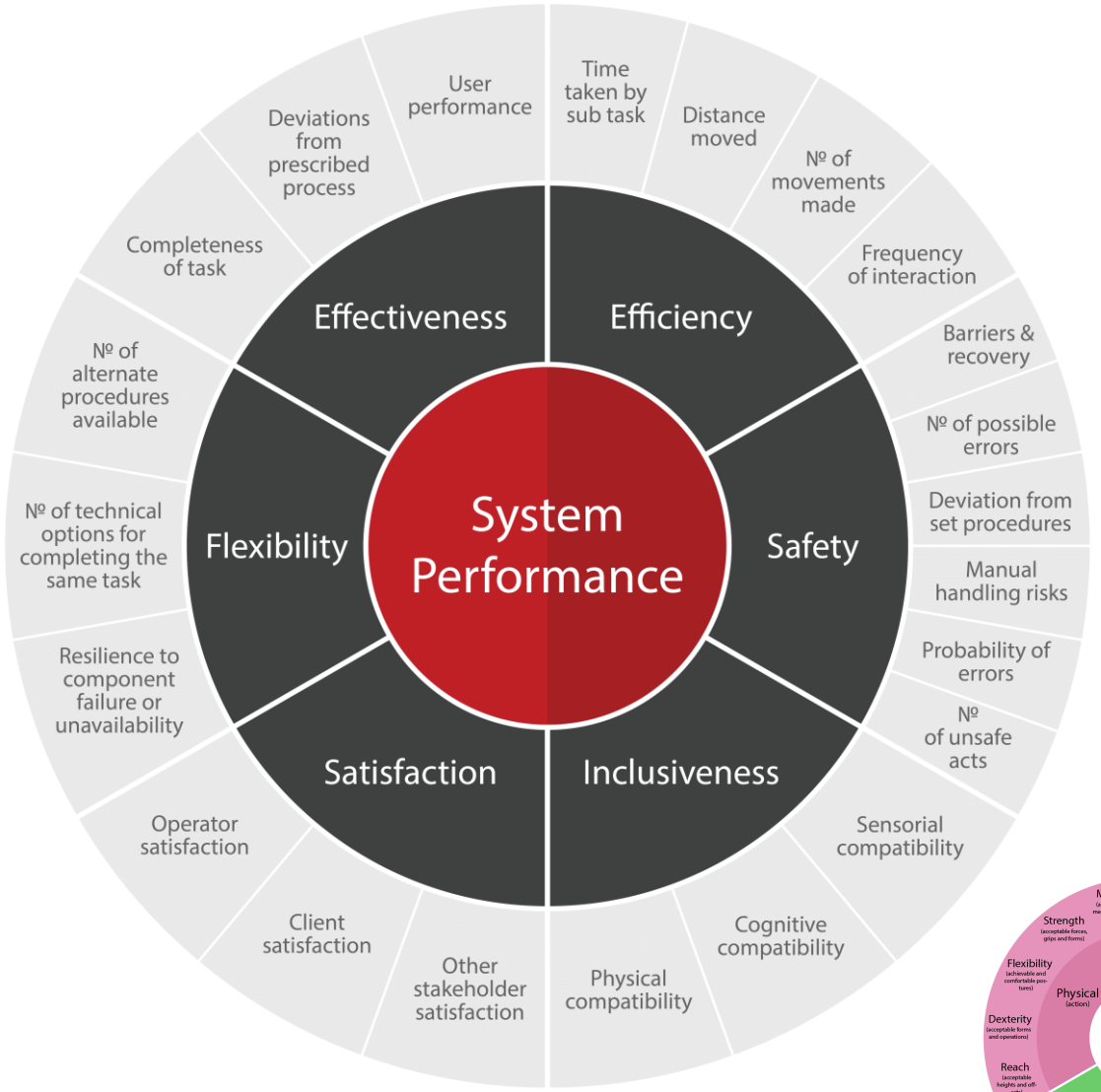
When the point of contact between the product and the people becomes a point of friction, then the industrial designer has failed.

On the other hand if people are made safer, more comfortable, more eager to purchase, more efficient—or just plain happier—by contact with the product, then the designer has succeeded.

or service

by HENRY DREYFUSS

DCA



And as a tool we use something very similar today to define what's important in a project.

Inclusiveness is a central tenet of this, but it sits along side safety, efficiency, effectiveness, flexibility and satisfaction.

In reality they tend to work together. Greater inclusiveness often leads to greater flexibility and greater satisfaction.

But sometimes they are in conflict and must be balanced against each other.

And this balancing act is very important to understand – as, if it is found to be in conflict, it can be easily undermined.

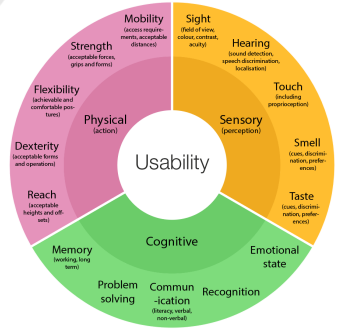


Image credit: DCA

Case study

I want to talk a little bit about fire extinguishers – hopefully it's a good example because it's quite easy to explain, but it also covers a range of accessibility issues.

Our focus for this project was on the top component – the tank itself was out of scope

And our brief was to redesign this component to remove cost – shifting from a metal component to a glass filled polymer.

We took this opportunity to also create a more inclusive, better user experience.

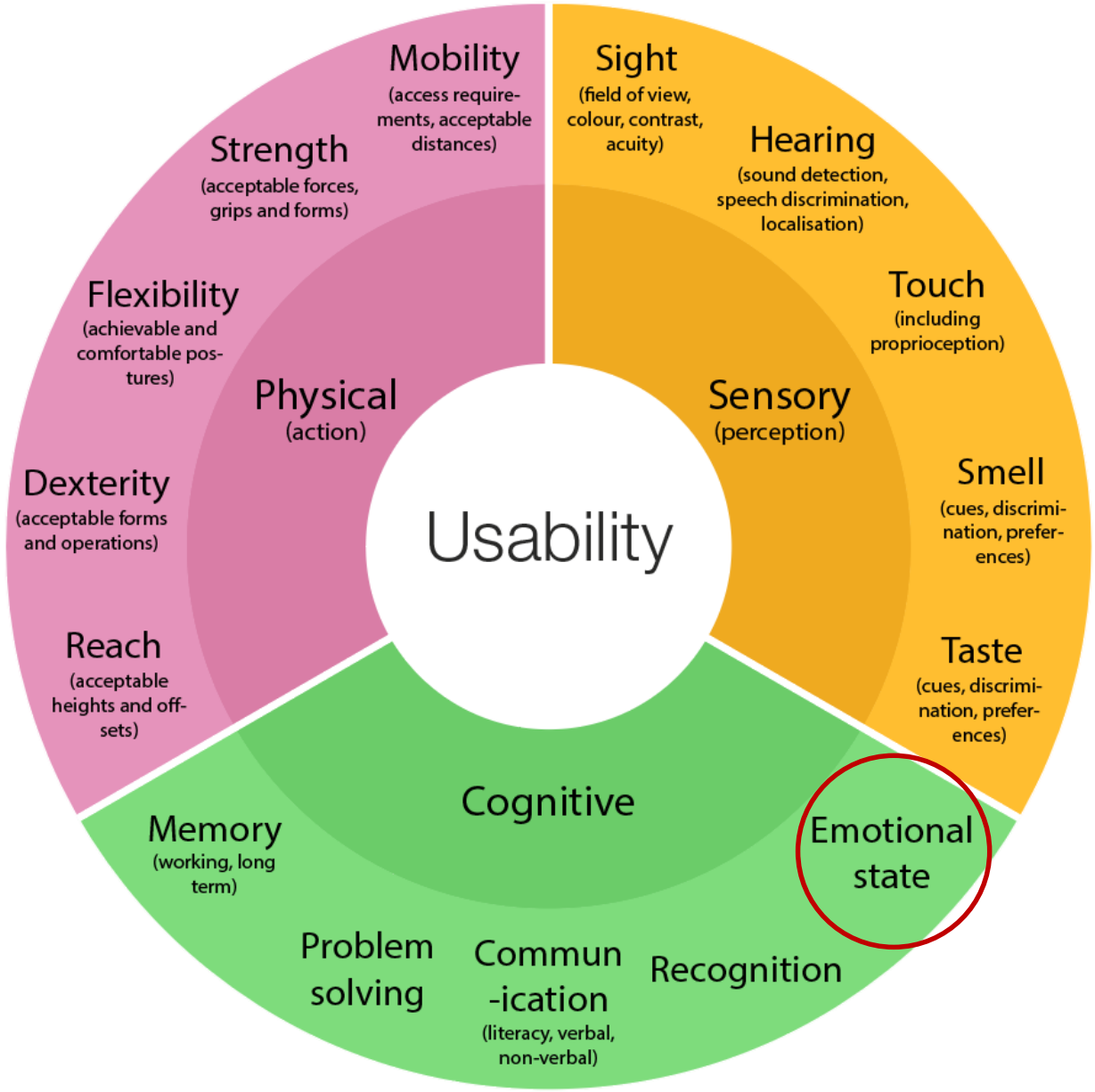
The very first thing we did was watch people using the product.

We were particularly interested in how people behaved in a high pressure environment. So we literally put them in the spot light! We lit a controlled fire and we had lots of people watching them and photographing them as they tackle the fire.

We then studied the videos and observed some important themes.

Image credit: DCA

We can also assess the demand that each task, or part of this dialogue, is placing on the person at a sensory cognitive and physical level



Cognitive

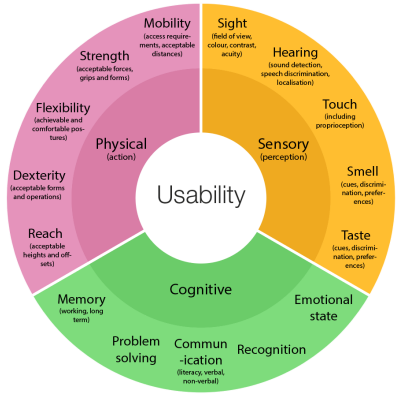
- People forget to pull out the pins
- When they do remember they are often squeezing the handle making it harder to remove the pin

Sensory

- The pins don't really stand out

Physical

- Fire extinguishers are designed in favour or right handed people (pick up with right hand, pull pin out with left)
- The handles are not that comfortable to grip
- The pins are hard to get your fingers in when in a hurry



Sensory

- Easier to visually identify the pin.

Cognitive

- Clearer than the ‘pin’ needs to be removed.
- Possible to remove the pin when squeezing.

Physical

- Handle designed to work just as well regardless of which hand the extinguisher is held in. This means it works for left handed people, but also those with a weaker arm or just people who pick it up in a different way.
- Handle more comfortable to grip.
- Hole in the ‘pin’ much bigger – easier & faster to use.

Image credit: DCA

We also made it much easier to spot a used fire extinguisher

Image credit: DCA

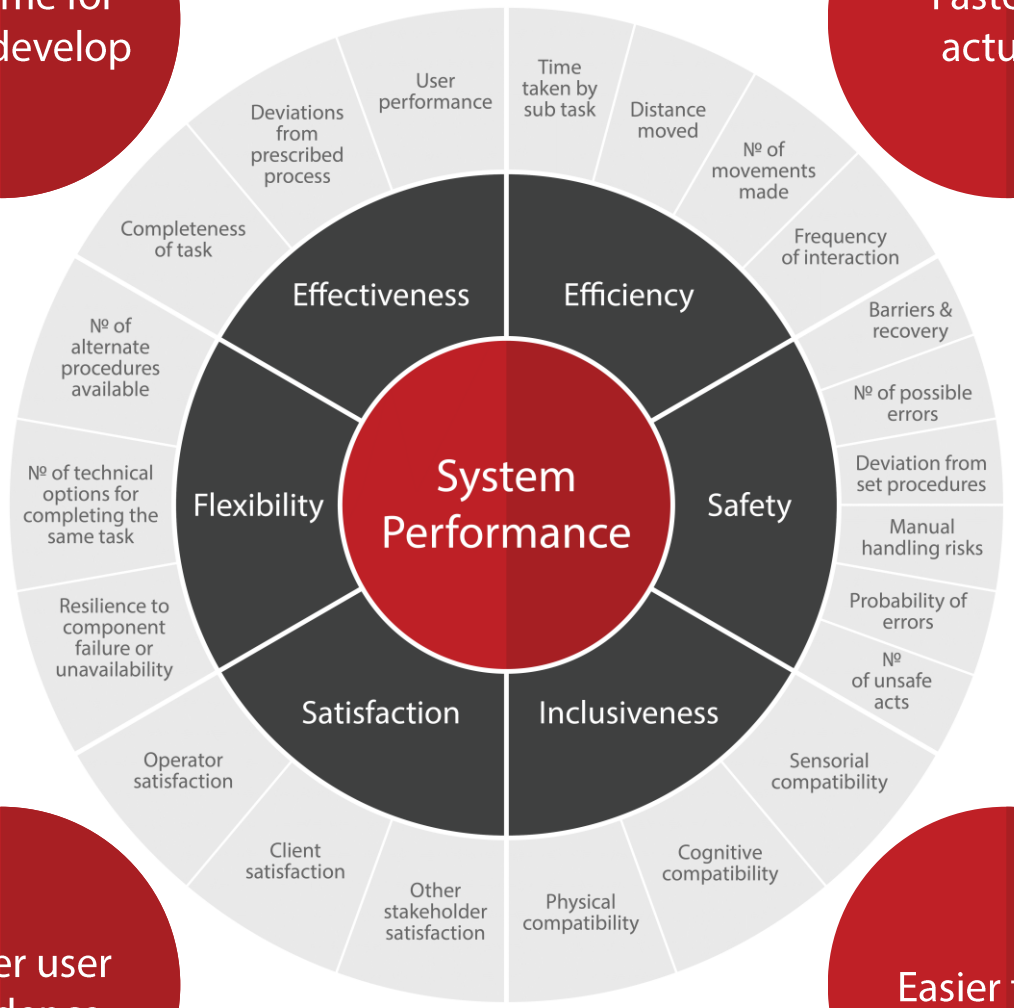
FX extinguishers are 30% faster to prime and deploy than traditional extinguisher designs.

Image credit: DCA

DCA

Less time for fire to develop

Faster to actuate



Can be used in either hand

Easier to identify unsafe extinguishers (used or in need of service)

Greater user confidence

Easier to use

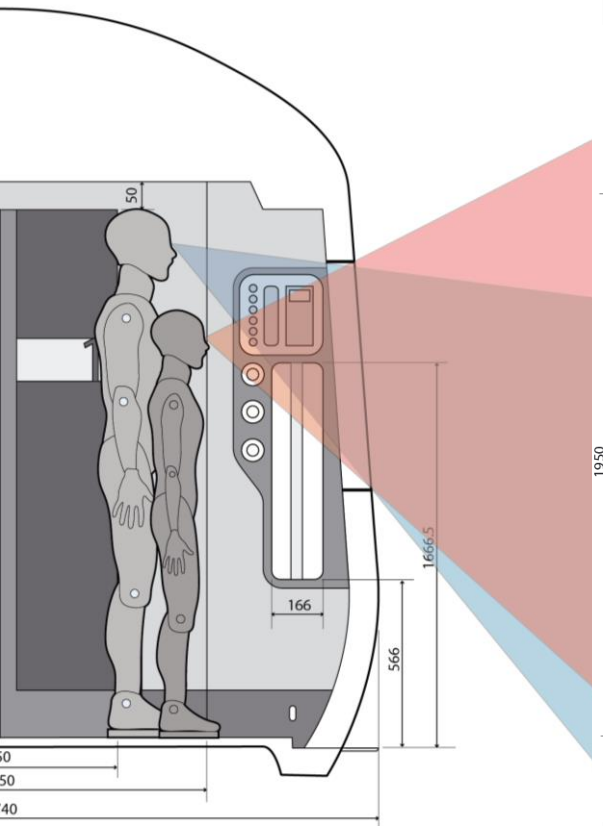
Image credit: DCA

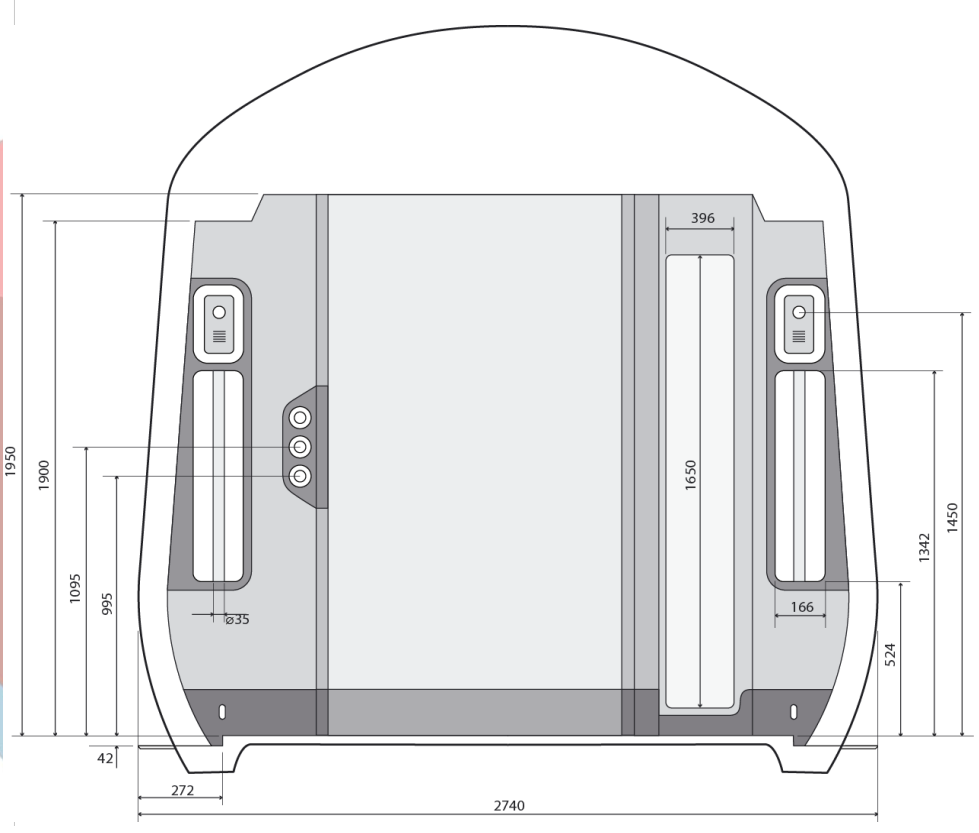
Image credit: https://www.yorkpress.co.uk/news/14354559.new-faster-virgin-trains-will-cut-london-to-edinburgh-journey-to-four-hours/

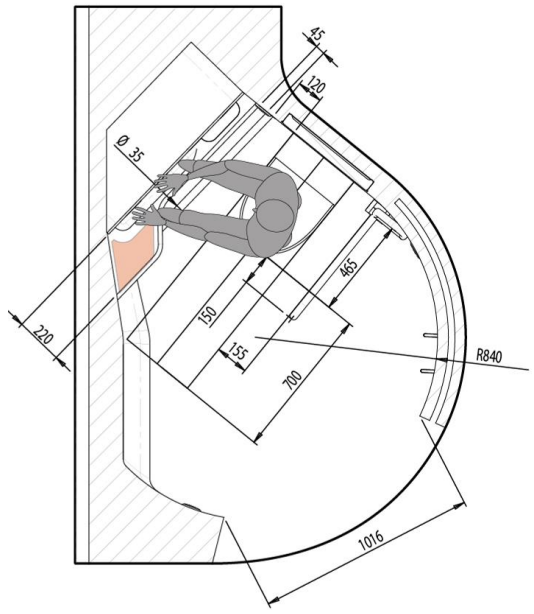
The design of the next generation of high speed rail for the UK is another example.

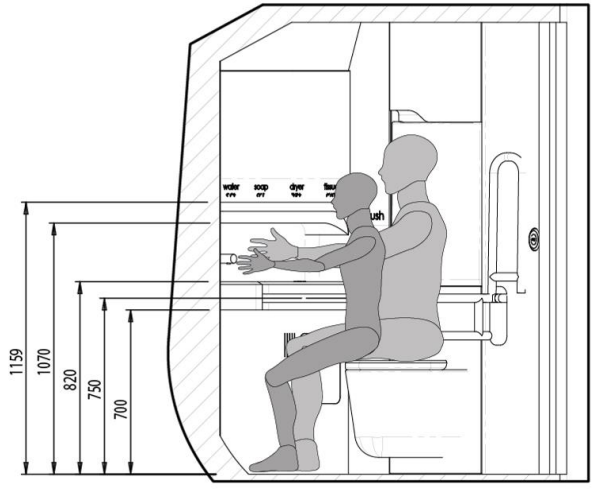
As we discussed earlier, trains are an interesting example because they are dominated by the stick. If the train is not compliant with accessibility standards, it doesn't make it onto the network.

So the first stage of the process is understanding those regulations and standards and designing in light of them.









But in many ways, the regulations can be subjective and there is no substitute for physically exploring the design.

As part of an empathic design approach, we experience the design as a wheelchair user, we explored getting on board, moving to the toilet, transferring from the chair to the toilet seat.

Image credit: DCA

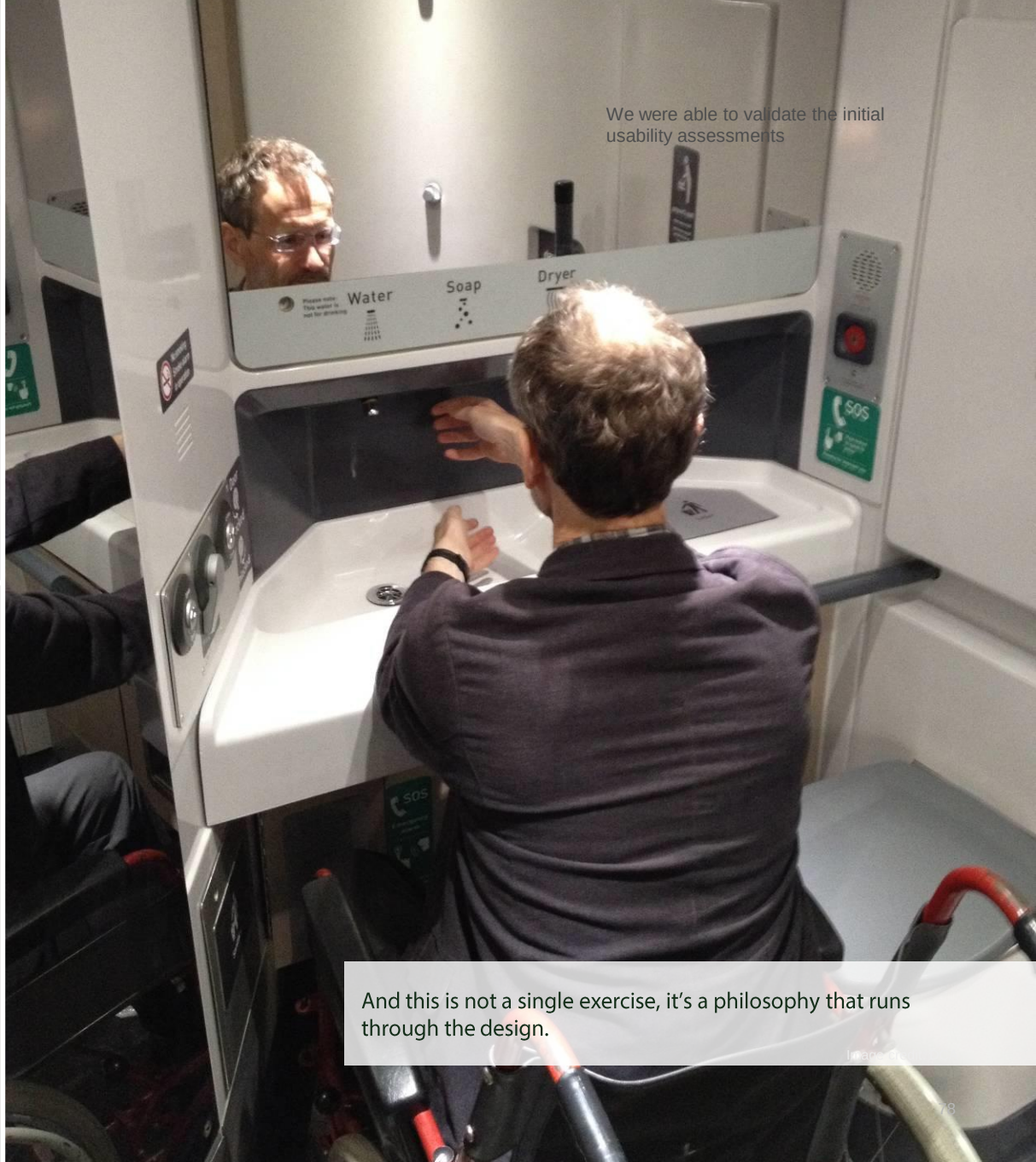
DCA

But empathic design is no substitute for talking to people with real world experience.

These people often have different coping mechanisms, life-hacks that we can only guess at.

We tested an early design with a wide range of users, wheel chair users, those with different visual capabilities, buggy users, and those with luggage.

Image credit: DCA



We were able to validate the initial usability assessments

And this is not a single exercise, it's a philosophy that runs through the design.

Checking on things like actuation forces.

Image credit: DCA

Image credit: DCA

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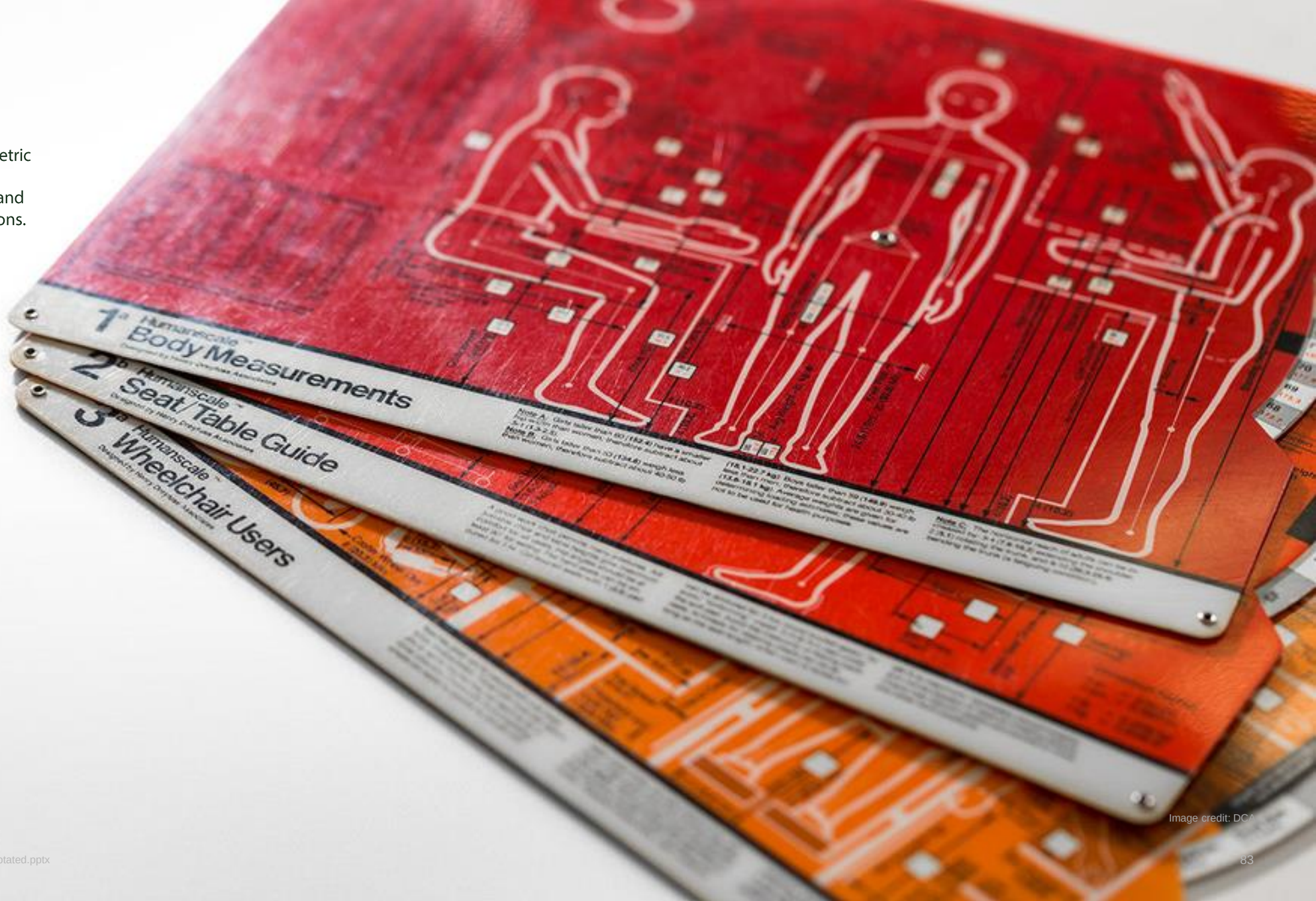
User-Centered Product Design Award

Image credit: DCA

Tools

image credit: DCA

There are different anthropometric data sets that can be used to describe the variability in size and strength for different populations.



Humanscale
Reprints - https://humanscalemanual.com/

Image credit: DCA

C

DCA

Common

'normal' colour vision

There are free smartphone apps and desk based tools that can be used to simulate different capabilities in colour vision.

P

Protanope

A reduced sensitivity to red light
1% of males

D

Deuteranope

A reduced sensitivity to green light

T

Tritanope

A reduced sensitivity to blue light
(extremely rare)

Colour vision simulator app

http://www.colourblindawareness.org/colour-blindness/types-of-colour-blindness/

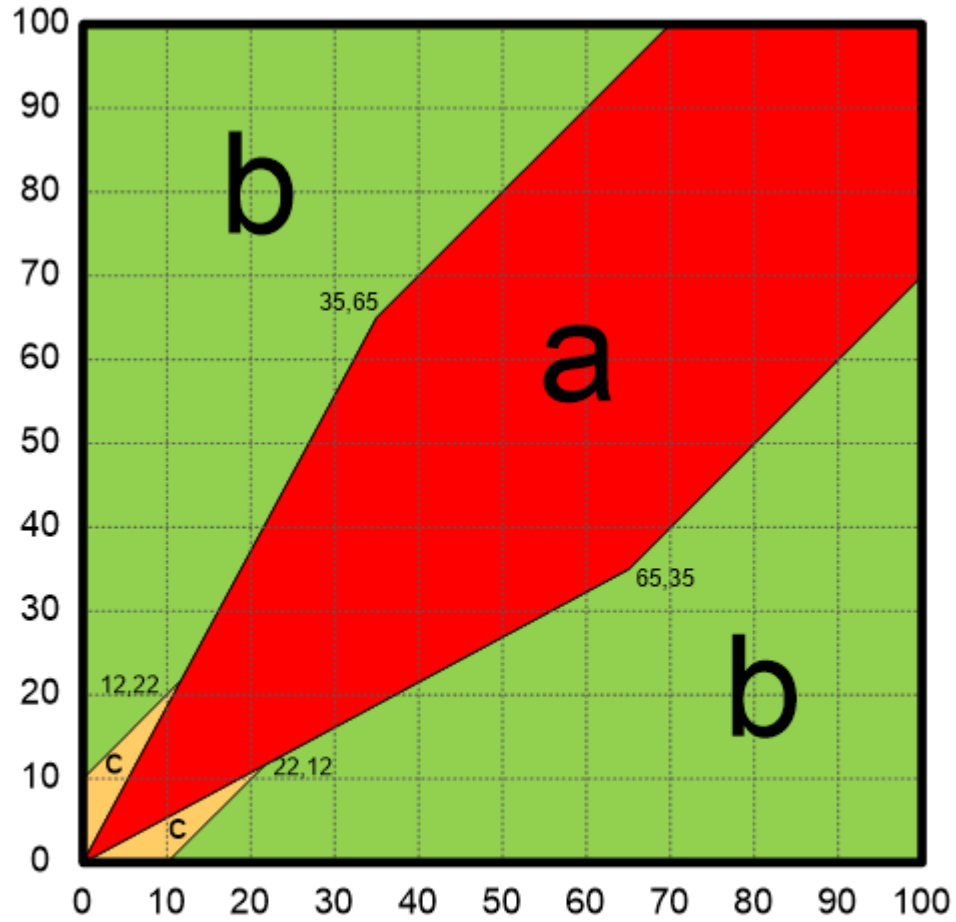
One useful tool for ensuring contrast is to ensure a good separation between light reflectance values or LRVs.

An LRV can be tested my shining a light on a given colour and material and measuring how much comes back.

White approaches 100

Black approaches 0

Monochromatic



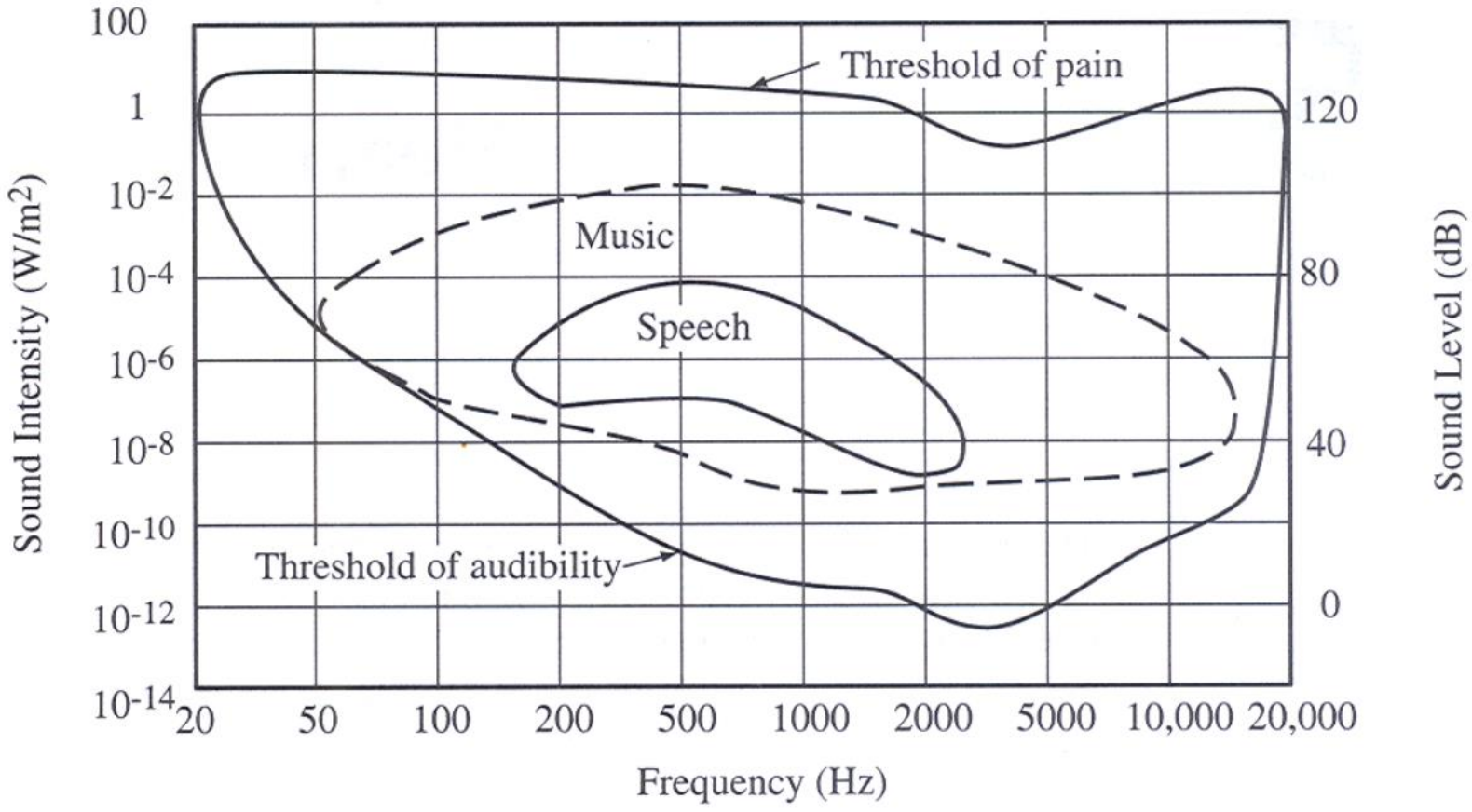
Key

'a'	LRV values that intersect in this area do not achieve an acceptable contrast level
'b'	LRV values that intersect in this area achieve an acceptable contrast level
'c'	LRV values that intersect in this area achieve an acceptable contrast level ONLY if the material being assessed is a flooring material

Reproduced from BS EN 16584-1 p26

The range of humans hearing is different for different people. As we age, the frequency band tends to narrow.

The Range of Human Hearing: Sound Intensity, Sound Intensity Level *vs.* Frequency:

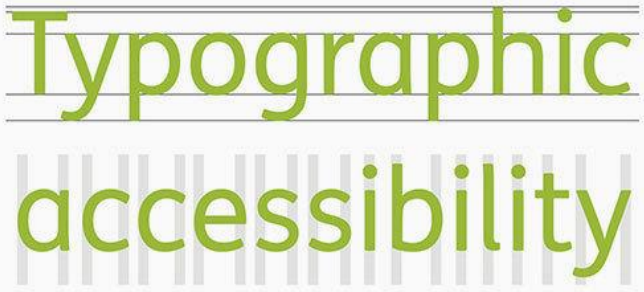


Errede, 2002. The Human Ear: Hearing, Sound Intensity and Loudness Levels. UIUC Physics 406 Acoustical Physics of Music. University of Illinois.

Fontsmith

The choice of type face can have a big impact on how legible the text is. This can have a marked impact on reading speed and strain.

Careful consideration of letter forms can also reduce confusion assisting those that are new to reading, or those with difficulty.



Ascenders which extend higher than the cap height help to emphasise word patterns

A large x-height enhances legibility by creating more space for lowercase letterforms

A lower junction on the 'r' helps to differentiate the 'rn' from the 'm'

Emphasised dot size on the 'i' and 'j' accentuates recognition

Differentiation of often confused letterforms improve readability

Open counters enhance legibility by reducing fill in at smaller sizes

Open terminals prevent shapes from appearing closed increasing clarity

Balanced spacing allows us to read in saccades (rapid eye movement) effectively

A Stem weight 17-20% of the x-height maximises legibility

Many fonts mirror the 'b' to create the 'p' and 'd' which can be confusing

Extended tails promote clearer letter shapes and character recognition

A tail of the 'Q' that follows through helps to distinguish from the 'O'

W3C provides great guidance and tools on internet accessibility.

W3C® Web Accessibility Initiative WAI

- Perceivable information and user interface
  - Text alternatives for non-text content
  - Captions and other alternatives for multimedia
  - Content can be presented in different ways
  - Content is easier to see and hear
- Operable user interface and navigation
  - Functionality is available from a keyboard
  - Users have enough time to read and use the content
  - Content does not cause seizures
  - Users can easily navigate, find content, and determine where they are
- Understandable information and user interface
  - Text is readable and understandable
  - Content appears and operates in predictable ways
  - Users are helped to avoid and correct mistakes
- Robust content and reliable interpretation
  - Content is compatible with current and future user tools

Further reading: https://www.w3.org/standards/webdesign/accessibility

References

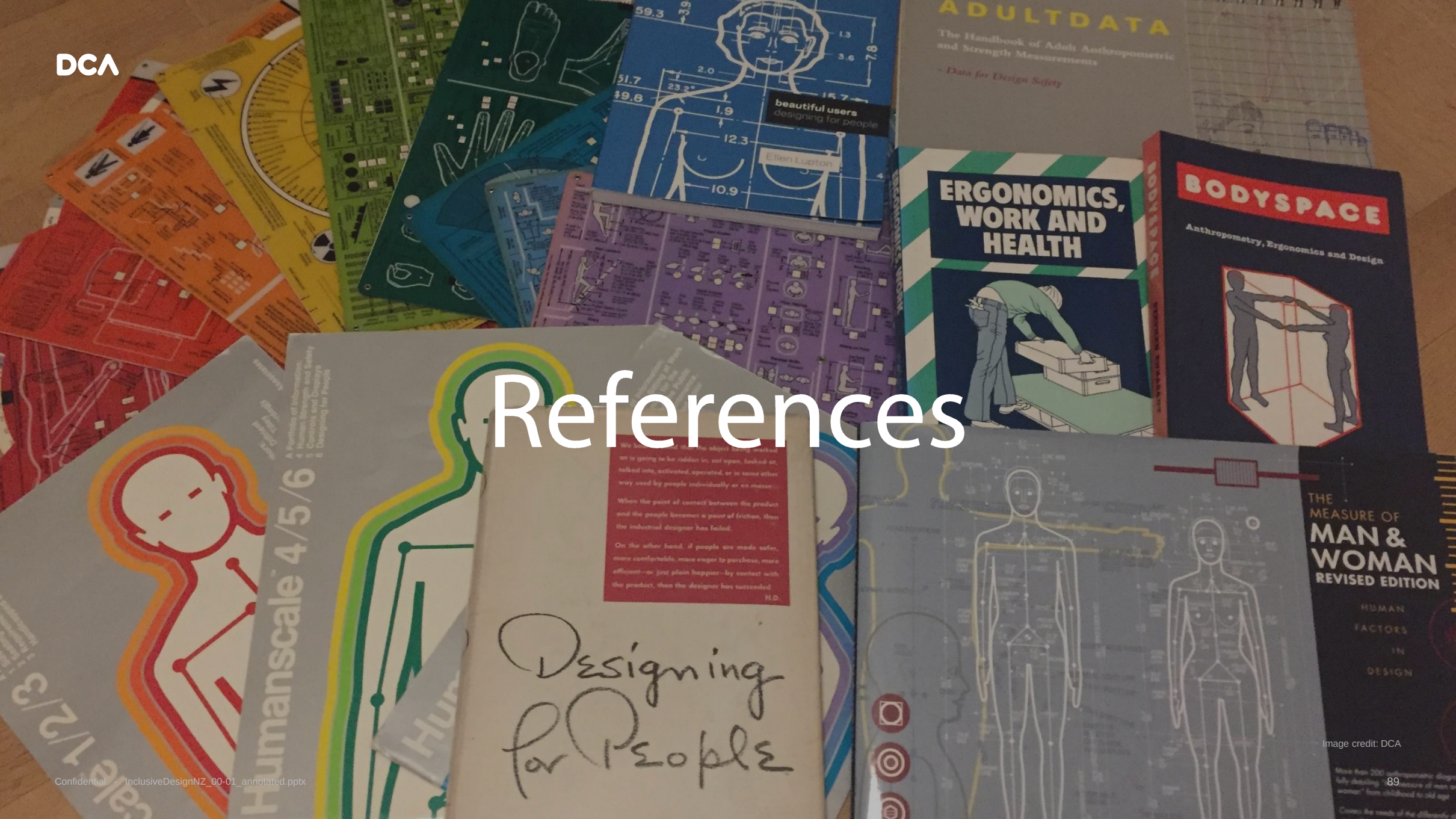


Image credit: DCA

Anthropometric data sets

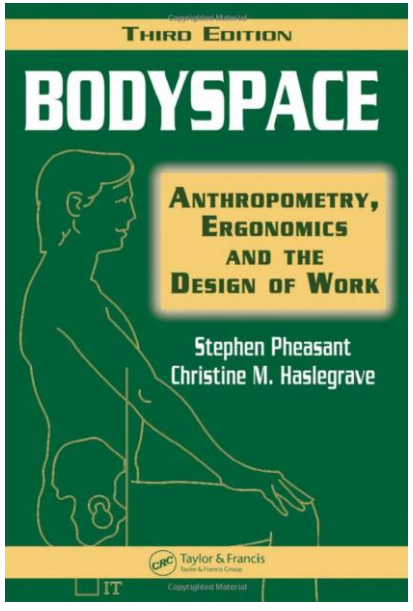
There are a number of anthropometric data sets available that describe different populations. The majority of these focus of the size and shape of individuals, but some also include strength data.

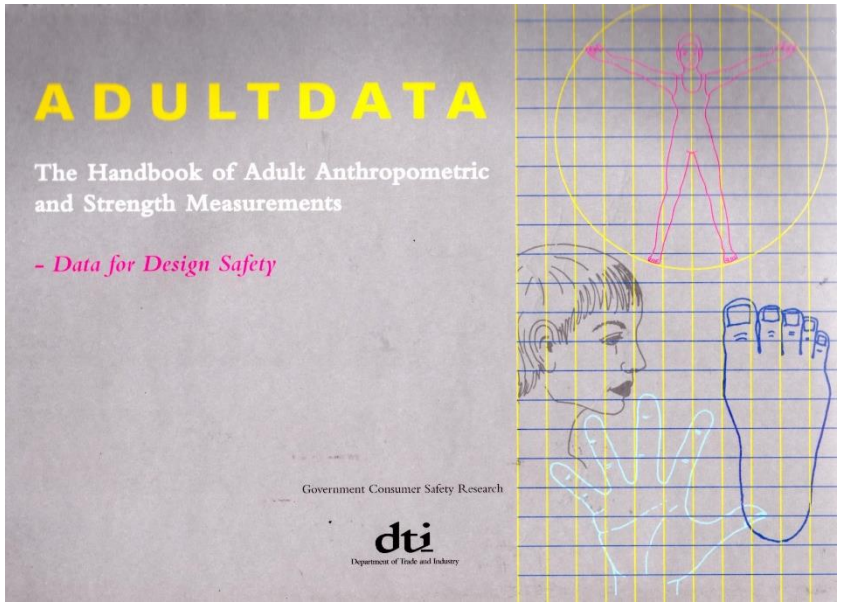
There are a number of potential pitfalls to be aware of when using this data such as:

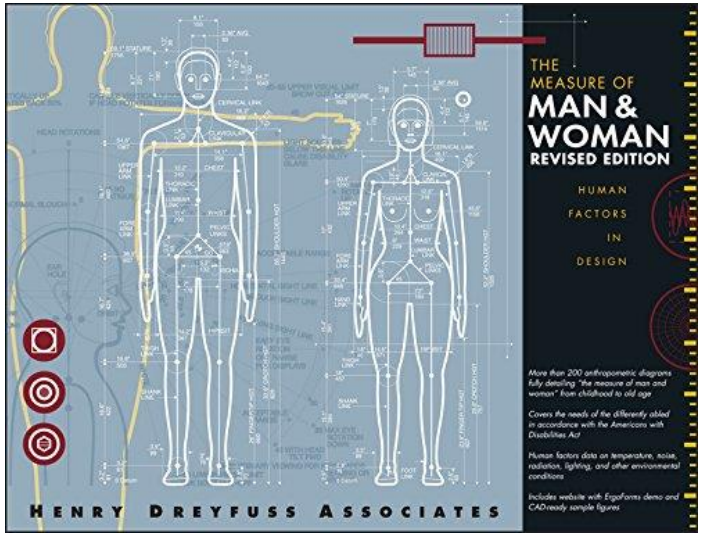
- The population sampled (was it really representative)
- The age of the data (people typically get taller and heavier with every generation)
- Is the correct measurement being used

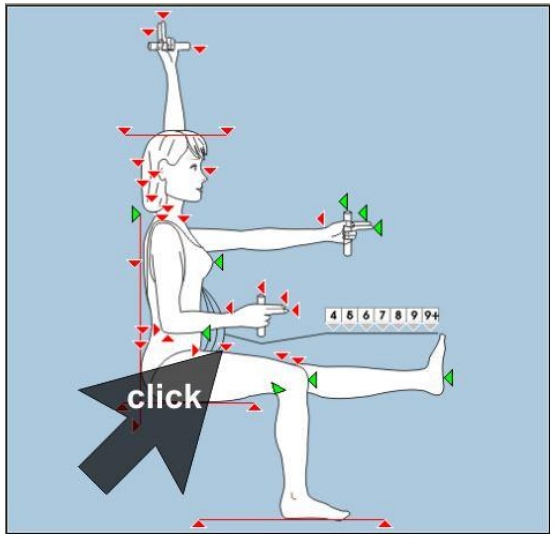
As such, the data should be used with caution and validated with testing – never the less, it serves as a very efficient starting point for a design. Key resources include:

- AdultData – this was a report produced in the UK it covers a wide range of measurements pulling data together for different populations.
- PeopleSize – a digital version of AdultData with some updates.
- Bodyspace – a great text book from Stephen Pheasant – includes anthropometric data sets for the most commonly used measurements.
- The measure of man and woman – a book from Henry Dreyfuss Associates with more of a design focus. Based on the American population.





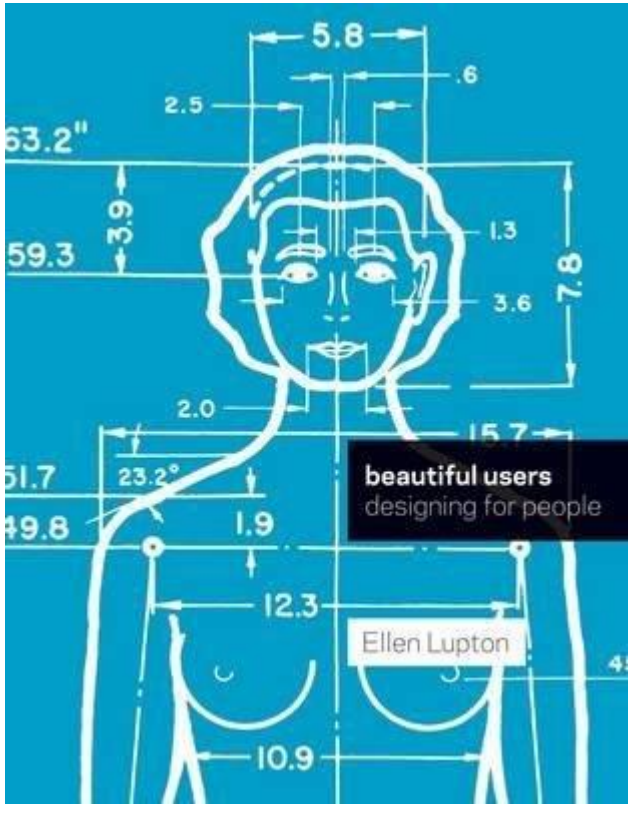


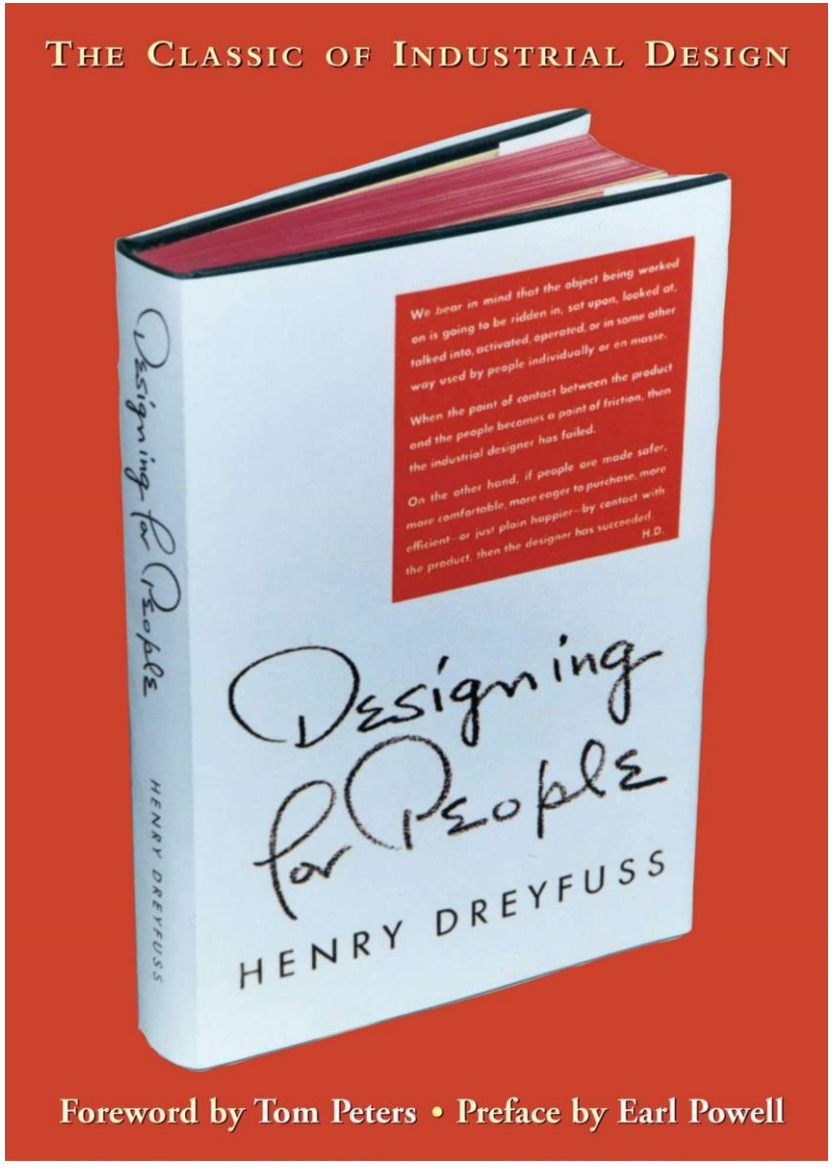


Easier reading on design for people

Designing for people – a reprint of a great text from Henry Dreyfuss (1955)

Beautiful users – a more recent book (2014) with a quirky twist on designing for people – PDF version available online for free (posted by the author)





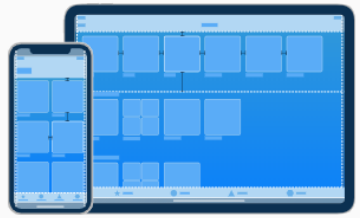
DCA

Inclusive design guides

Human Interface Guidelines

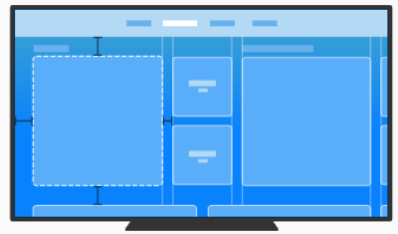
Get in-depth information and UI resources for designing great apps that integrate seamlessly with Apple platforms.

macOS ›



iOS ›

watchOS ›



tvOS ›

Image credit: Apple

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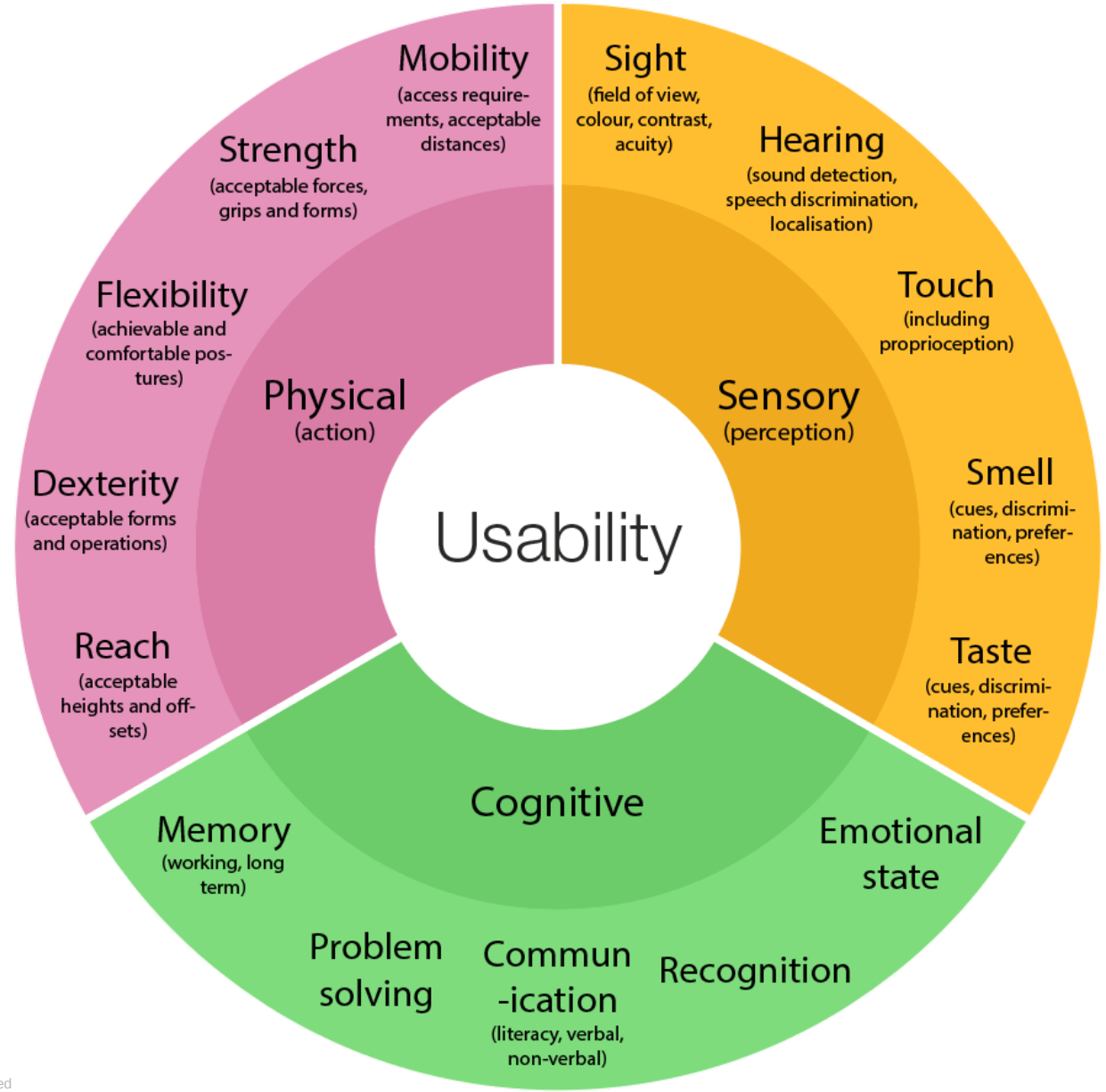
To summarise then,

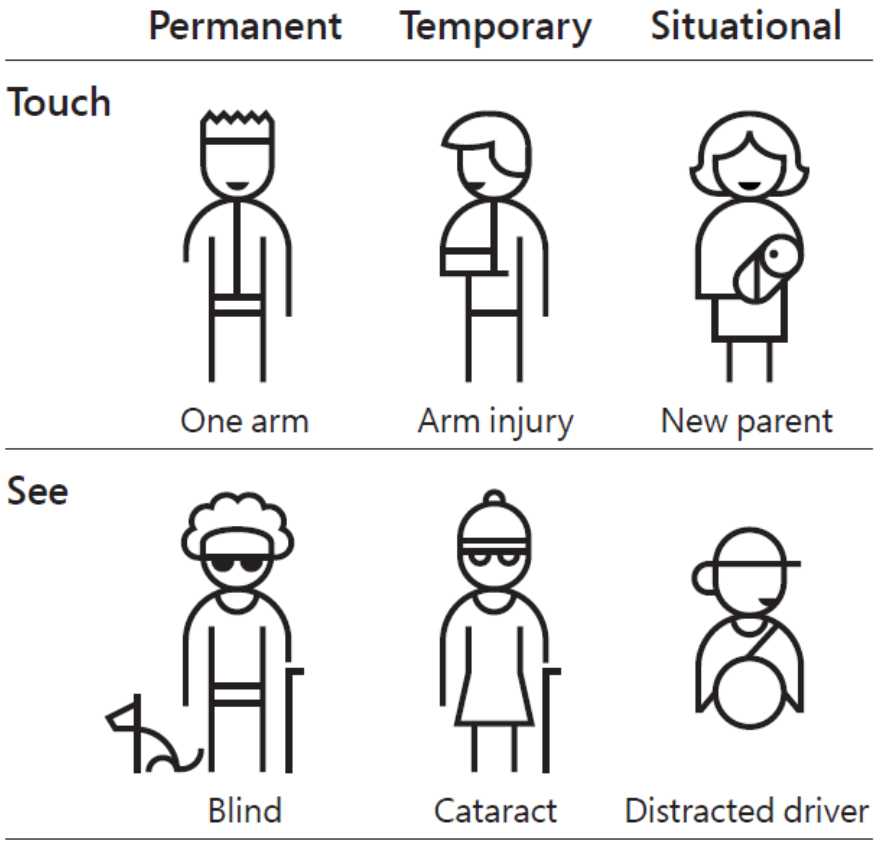
Inclusive design is a lot more than just size and shape, it's about all of these things

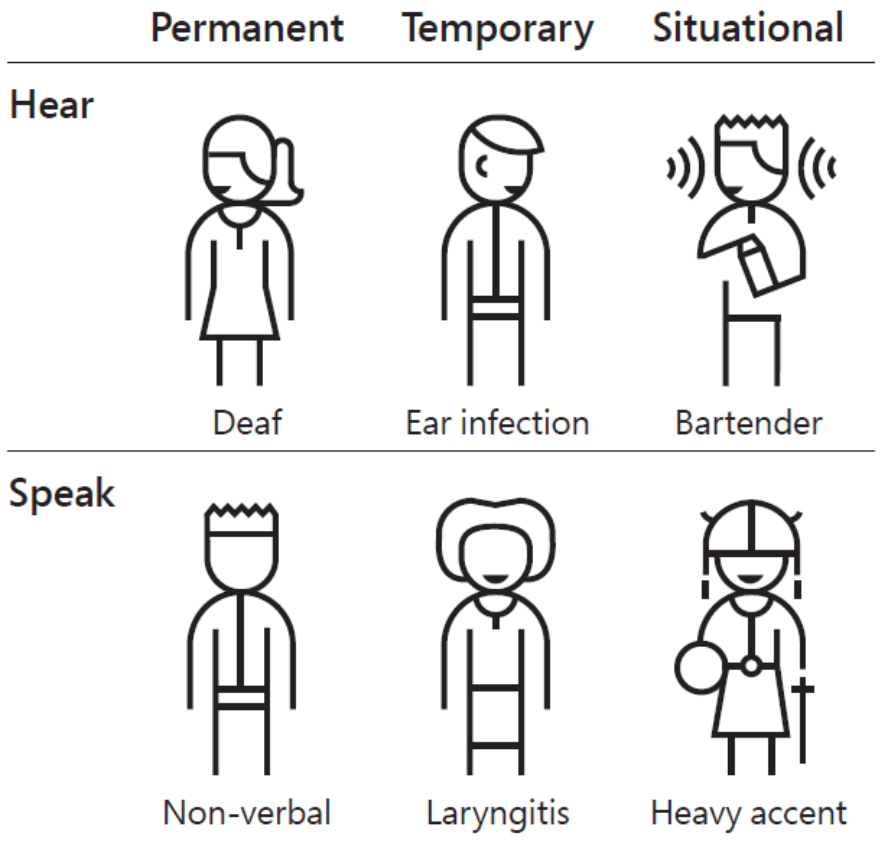
It's about designing for diverse range of capabilities at a sensory, cognitive and physical level



It is also not just about binary states of these things, either being able to see or not.

We need to think about capabilities in terms of permanent, temporary and situational skills





Inclusive
A Microsoft Design Toolkit

Inclusive design is a great thing to do from an ethical perspective,

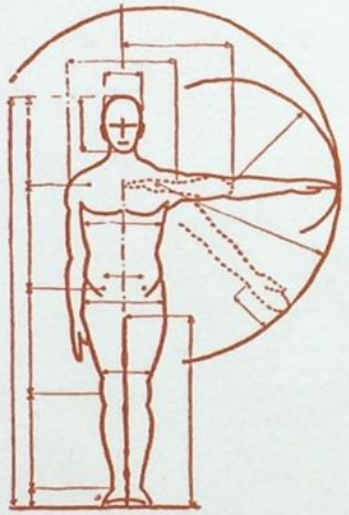
But it's also critical to manage the really big challenges that we are facing, an aging population, a healthcare system in crisis

Image credit: http://www.cumbriachamberofcommerce.co.uk/why-your-business-needs-older-workers-2/

Ultimately, it's about doing what Dreyfuss was trying to do back in 1955.

It's about removing those points of friction

DESIGNING FOR PEOPLE



We bear in mind that the object being worked on is going to be ridden in, sat upon, looked at, talked into, activated, operated, or in some other way used by people individually or en masse.

When the point of contact between the product and the people becomes a point of friction, then the industrial designer has failed.

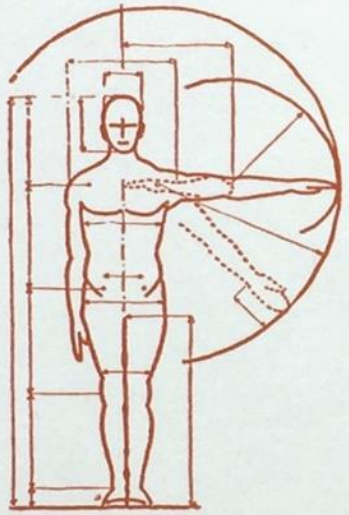
On the other hand if people are made safer, more comfortable, more eager to purchase, more efficient—or just plain happier—by contact with the product, then the designer has succeeded.

Simon and Schuster, New York, 1955

by HENRY DREYFUSS

So that we can make people safer, more comfortable, more efficient and plain happier.

DESIGNING FOR PEOPLE



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or service

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