Human Computer Interaction: Introduction

Prof. Andrew D. Bagdanov

Dipartimento di Ingegneria dell'Informazione
Università degli Studi di Firenze
andrew.bagdanov AT unifi.it

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Outline

Interaction design

HCI as design discipline

Three "use" words

- Useful: the artefacts and interventions should be functional and “do things”.
- Usable: they should be easy to “do things”, they should do the right thing and be enjoyable (user experience).
- Used: they should be attractive, available and accessible, and acceptable to organization/community.

Design context (recent HCI history)

- 1980s: first conferences and journals appeared; importance due to rise of personal computer; designed for work: *one user, one machine.*
- 1990s: many people, geographically remote; still one user; local networks; still designed for work: one user, one machine (and one machine, one user).
- Now: domestic use; global networks; ubiquitous devices.

Ubiquity of technology

- How many computers do you have?
- How many do you have *with you right now?*

Ubiquity and the importance of HCI

Daily life

- Computers permeate every aspect of our daily lives.
- Even when not "using" a computer, our life is affected in some way by computing.
- ATMs, ticket vending machines, drink/food dispensing machines, etc.
- HCI is an important factor when designing any (and all) of these because it affects our daily quality of life.

Accessibility

- HCI is key to building systems accessible to people with disabilities.
- A core philosophy of HCI is to provide safe, usable, and efficient systems to everyone
- Any system properly designed with HCI user-centered techniques and principles will also be maximally accessible to those with disabilities.

Ubiquity and the importance of HCI

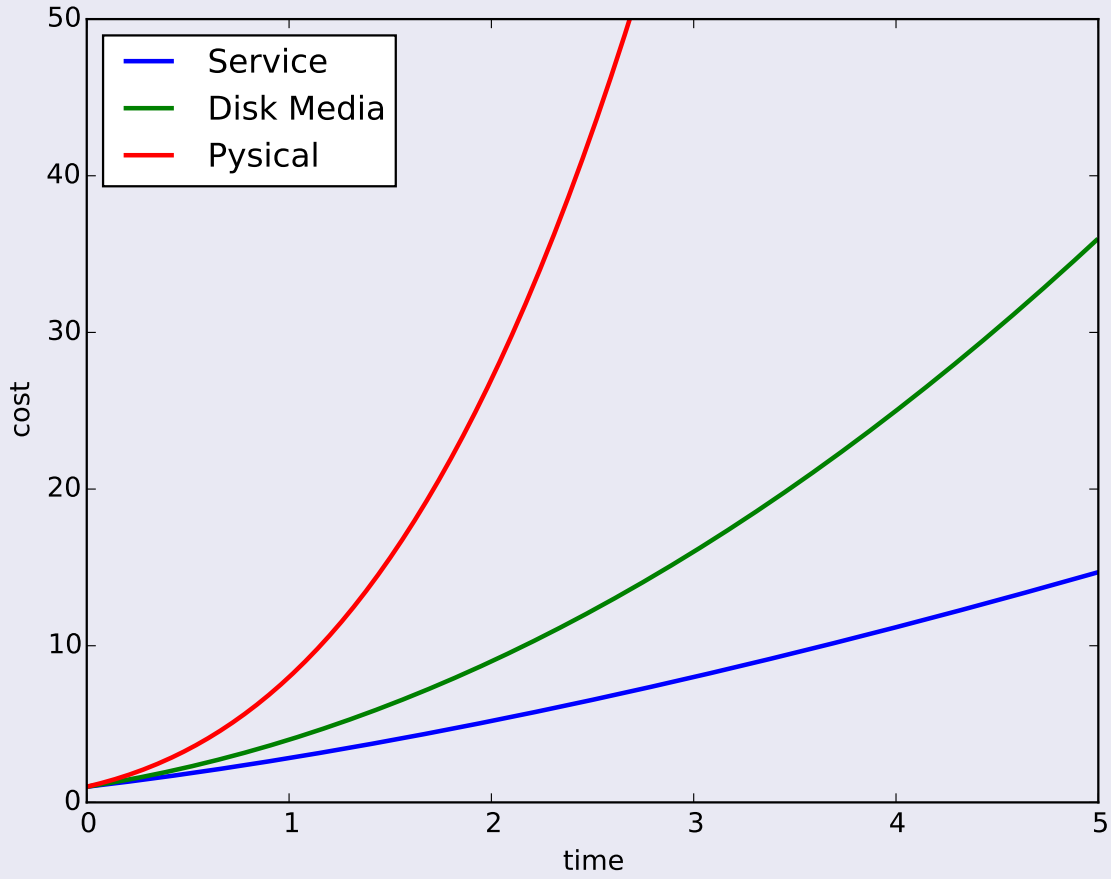
Untrained users

- Today, the vast (vast) majority of users are decidedly non-expert computer users.
- Contrast this with the early days of computers (even 20 years ago).
- Users expect to understand the main functionality of an average program within a few minutes.
- Interfaces *must* be effective, obvious, easy to use, and most importantly they must not require training.

The real cost of neglecting HCI

Software success

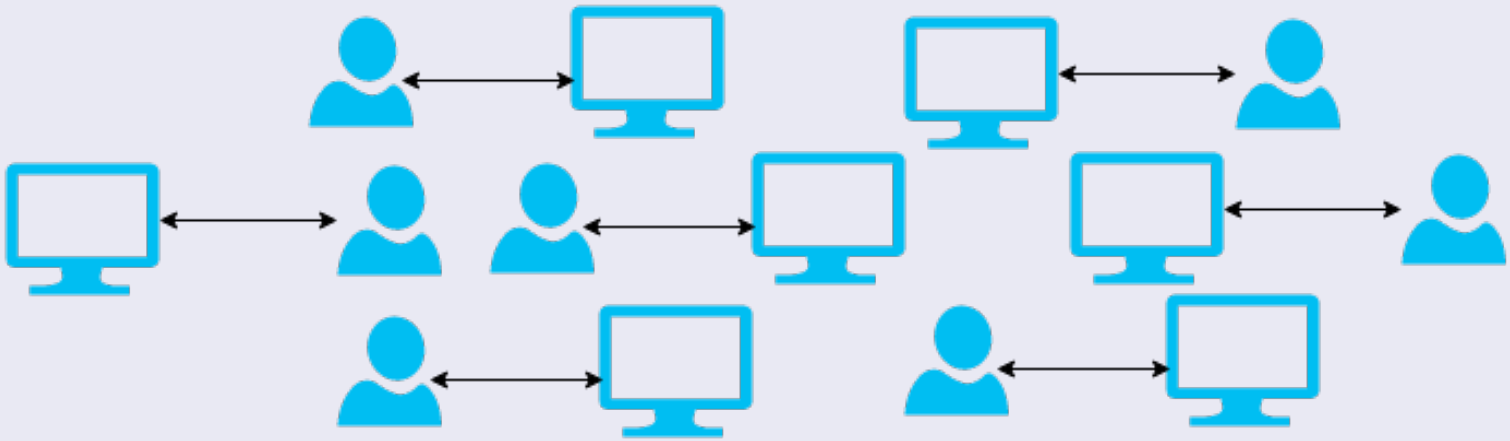
- HCI principles are not only important for the end user, but also for software development companies.



So what?

20 years ago

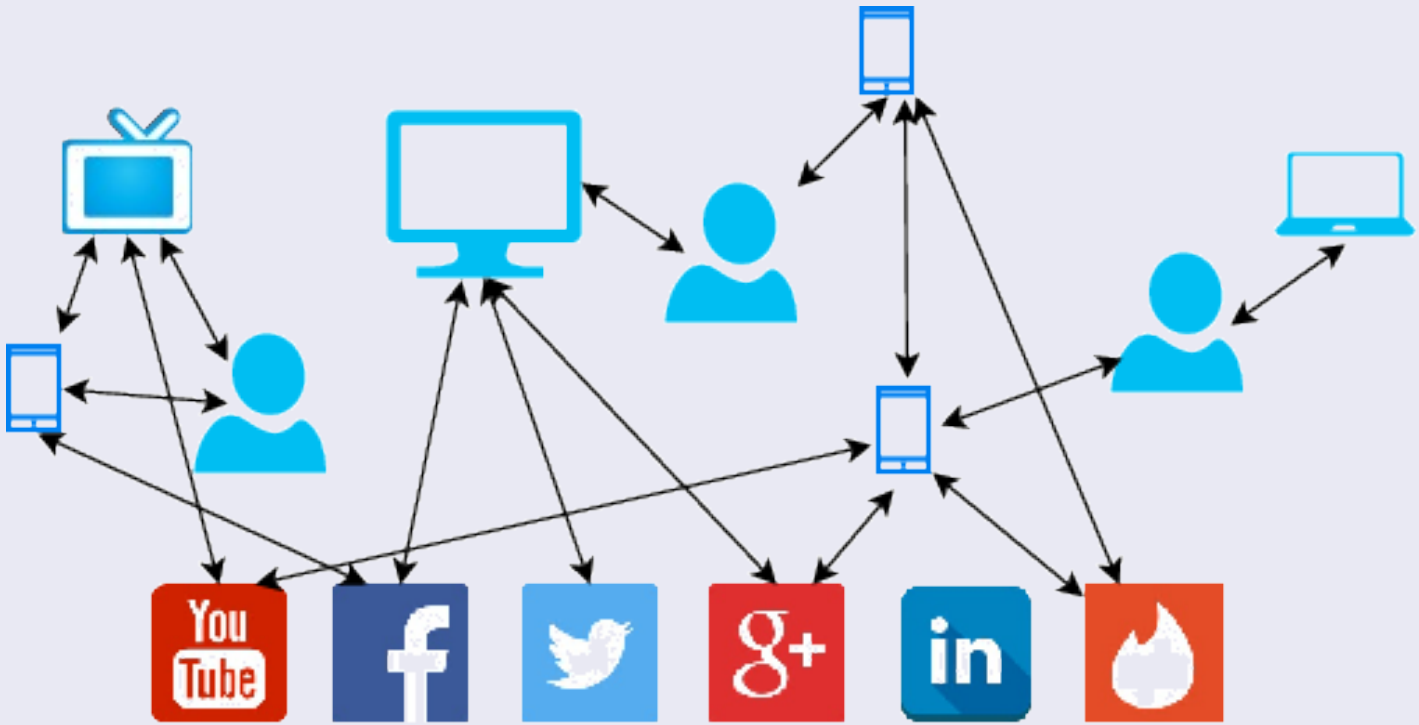
- Dialog: single user $\rightarrow$ single computer
- Very much work and task oriented.
- Traditional HCI: tasks, goals, work work work.
- Users trained to use a handful of programs.
- Elements of these programs optimized for efficiency.



So what?

Today

- Dialog: with the world.
- Much less computer/artefact/user divide.
- Wearable: no computer/user divide.
- Social platforms become mediators of interaction.



So what?

- We can (and should) ask ourselves why we should care about HCI (much less study it).
- The previous discussion should have shed some light on this.
- Technology is ubiquitous and we need to interface constantly with computers of all sorts.
- Studying and improving HCI thus has a pervasive affect on nearly every aspect of our lives.
- But, there is another reason – one perhaps even more important – related to how we take design for granted.
- More specifically, how bad design has come to pervade our lives.
- And how we have come to accept bad design as a norm.

Discoverability and the "Norman Door"

- Don Norman (a legendary figure in the HCI and design fields) popularized the concept of the *Norman Door*.
- These types of objects can be used to explore and understand design in everyday life.
- Question: How do you know how to use a door?

Five key principals

- Affordances: we understand what actions or properties a door (in the sense of Platonic ideal) affords the user. It allows passing through, it separates one area from another, etc.
- Signifiers: there are elements of the object's design that signify how to use it. A door has a handle indicating it should be pulled, a flat plate indicating it should be pushed, etc.
- Constraints: there may be physical constraints that indicate how a door must be used. There can also be cultural, logical, or semantic constraints.
- Mappings and feedback: there must be a direct mapping between an object's controls and their affect on the world.
- Conceptual model: perhaps the most important, we all of a mental model of what a door is and how to operate one.

So, again...

- How can should we *discover* the operating principles of this door?

The psychology of everyday actions

- We use the metaphor of everyday things because computers and technology have become *everyday things*.
- We will see in subsequent lectures that these questions touch on some deep themes in psychology and cognitive science.
- Understanding the intention of users, and supplying appropriate feedback when things go wrong (or go right) is essential.
- To do this we need to understand and model the user.
- But, one might ask, isn't modeling humans a dehumanizing act that we should avoid?

Human error

- Well, let's think about that...
- How many times have you read an article about an investigation into an industrial or airplane crash that concluded the problem was "human error"?
- Isn't it kind of strange that problems get written off like this? As *human error?*
- I mean, when a bridge collapses due to harmonic oscillations[1], do we write it off as "harmonic error", or "concrete error"?
- No, we say it was a design error.

[1] https://www.youtube.com/watch?v=j-zczJXSxnw

Human error, you say?

- The most infamous nuclear accident in the United States occurred at Three-mile Island in 1979.
- It was a classic "meltdown" in which the reactor core was destroyed and radioactive gas and water were vented into the environment.
- Cause? Human error.

Human error, you say?

Analyzing human error

- Don Norman was part of the commission investigating the Three-mile Island failure.
- There were indeed a host of human errors that combined to lead up to the accident.
- However, most of these were due to confusing controls, confusing alarms, and confusing feedback from the controls of the reactor plant.

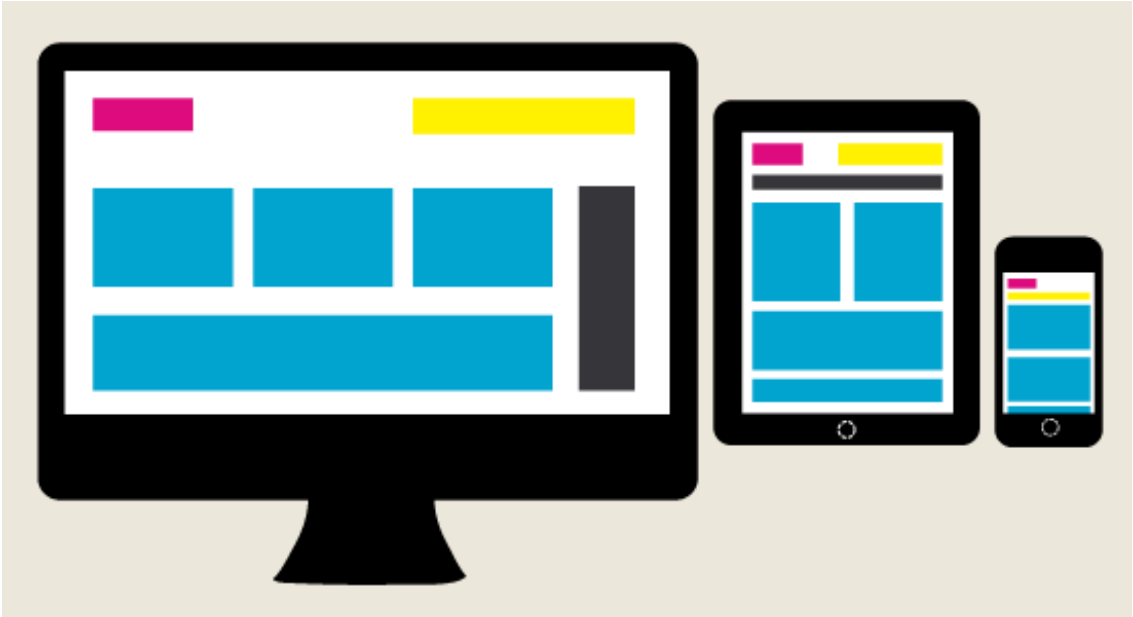
Towards an engineering discipline

- Concrete fails, so we design with that in mind.
- Humans make errors, why can't we design with that in mind?
- It is essential to model humans and their errors and how to prevent them (through proper signifiers, feedback, and mapping).
- When human error is a think of the past, humans will actually get a much better deal in the bargain.

The long game

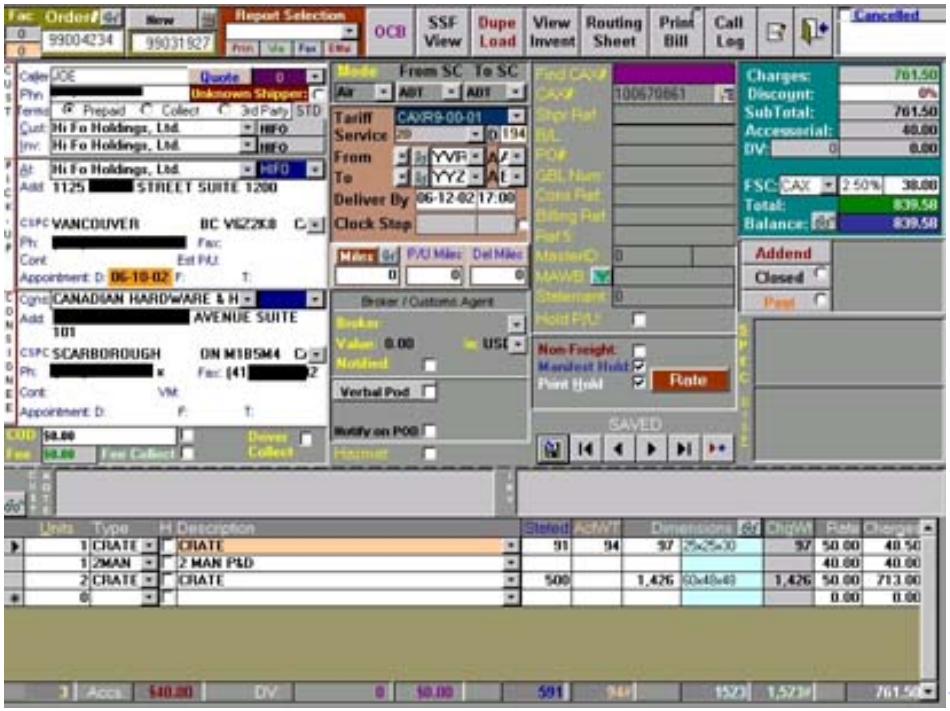
What's at stake?

- Good HCIs are a pleasure to use.
- I don't think that's an exaggeration: good user interfaces actually give pleasure to the user through their use.
- We all (I hope) have had the pleasure of using something designed extremely well, that feeling when everything just works right and even boring tasks give pleasure.



What's at stake

- Bad HCIs, on the other hand, create frustration and anger in the user.
- They conflict with our conceptual model of what we are using, and they provide inadequate or confusing feedback.
- We take them for granted (especially anyone working in a public administration, like this university).
- We should not take this for granted, and we should not put up with bad HCI design.



What's at stake

- Of course, it's not just frustration and mild annoyance at stake.
- Think about all of the HCIs used every day in whose hands lives are being placed.
- We cannot afford to take design of HCI lightly, we must relegate "human error" to the past with a modern theory of design.

What's in it for me?

- Anyone who looks at my CV might well wonder what on earth HCI has to do with my expertise.
- I am an expert in computer vision and machine learning, these are the things I do.
- Well, as it turns out HCI has recently been revolutionized by advances in computer vision.

Only one problem...

- The Kinect also promised to revolutionize Human Computer Interfaces.
- The *gestural* interface would allow people to interact with computers without the need for physical input/output devices.
- Only one problem: it wasn't very natural.

Only one problem...

- One significant problem was that gestural interfaces never knew when a user intended to interact with it.
- It could only either blindly react to anyone moving in its field of view, or not react to anything.
- We needed to detect intention to interact.

The way forward

- In order for interfaces to be more natural, they must adapt and respond to multiple styles of user interaction.
- In the case of gestural interfaces, this means adapting to individuals appearance and patterns of motions.
- This is a complex vision and a complex learning problem.
- Also, there has been a recent revolution in the AI and machine learning communities (called *deep learning*, you have probably heard something about it).
- This will (eventually) revolutionize HCI as well, enabling types of personalization that were never before possible.
- This is my angle: I am interested in understanding the role vision and learning can play in building better human computer interfaces that adapt to user behavior.

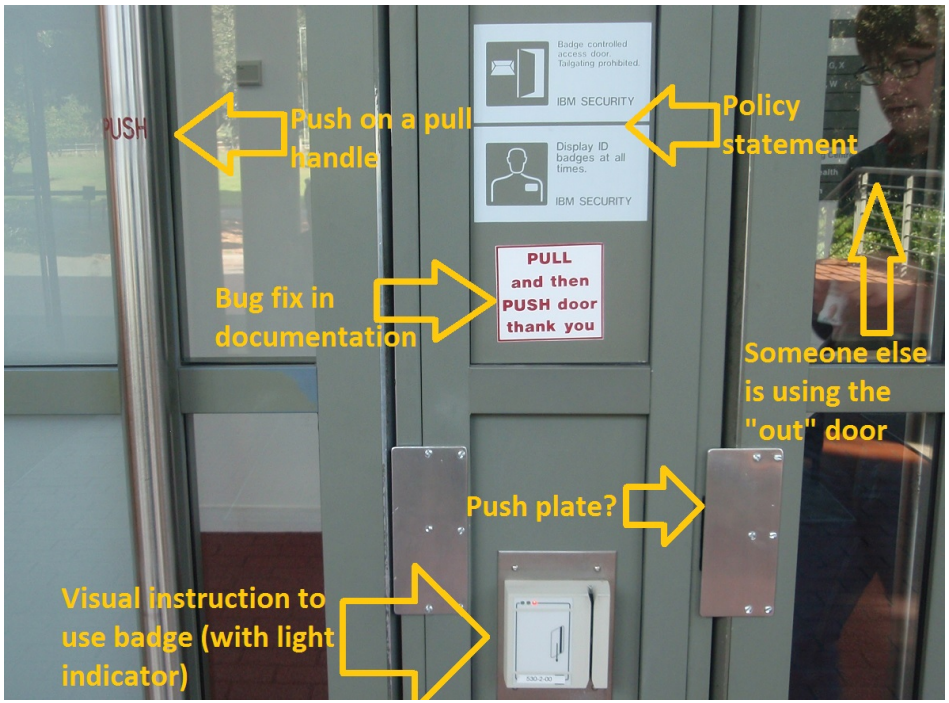
Design in the age of complexity

A motivating example

- Let's say that I were to be transported instantly from this lecture hall into the cockpit of a commercial airliner.
- Let's also imagine that the plane is (for some reason) also in flight at the time.
- I feel safe saying that I would have absolutely no idea how to do anything useful with any of the controls.

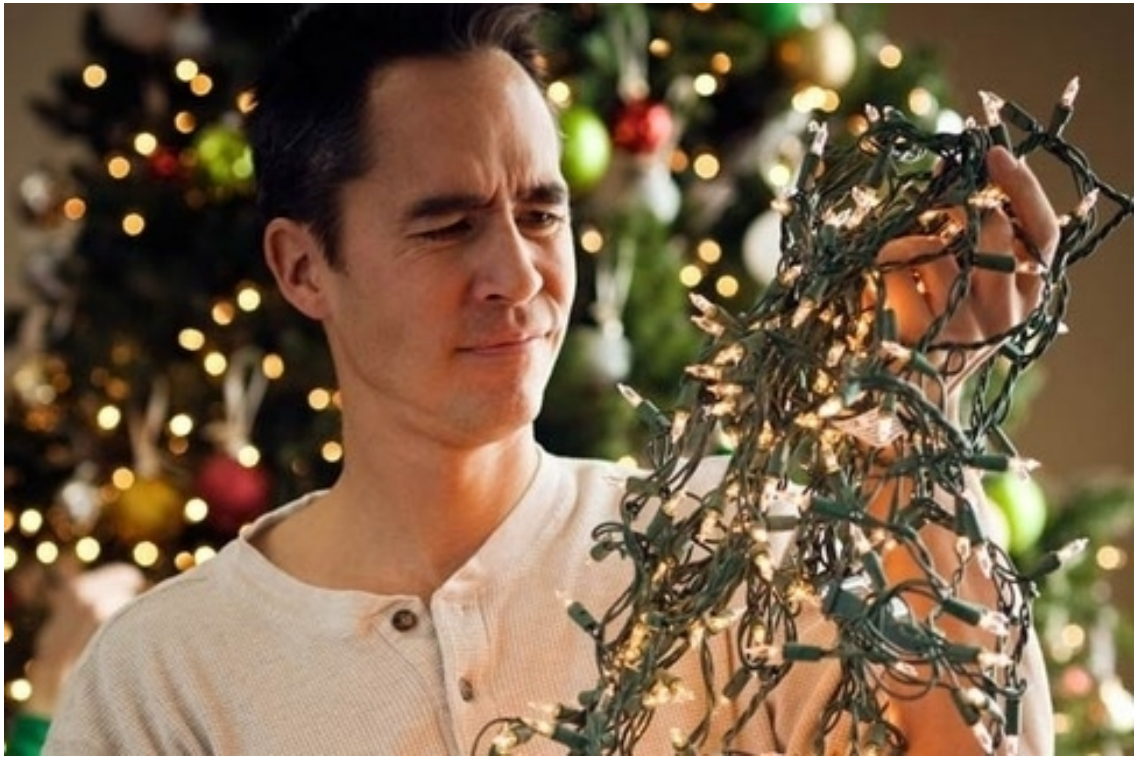
Back to reality

- OK, the 747 cockpit is an exaggerated example.
- However, how many times can you remember being in a situation where you just couldn't figure out how to work something simple?
- Our canonical example is, of course, the Norman Door.
- Sometimes even with experimentation you can't figure out how to make the damn door do what you want.



More objects designed to frustrate

- These were the bane of my father's existence.



More objects designed to frustrate

- This design is unhappily common in the UK.

More objects designed to frustrate

- Nothing makes me feel more enfeebled and in need of adult supervision that this type of failure.

More objects designed to frustrate

- I have lived in four countries and traveled extensively: not one of these is easy to use.

More objects designed to frustrate

- And hand dryers too.

Getting to the point

- Why on earth does this happen?
- How can it be that object as common as doors can confound us so much?
- We commented before that the way we know how to use things had to do with affordances and signifiers.
- (Well, also with mappings and conceptual models, but we will talk about those later.)
- In the next lecture we will talk about how affordances and signifiers conspire to give us cues about how to use objects.
- We will also talk about how feedback is then interpreted to create an iterative process by which we discover the correct way to use objects.
- We will begin with an analysis of the root causes: the complexity of modern devices and in relative infancy of human-centered design as an engineering discipline.

Homework

Homework

Exercise 1b.1: Norman doors

Over the next week, try to be more observant than usual when roaming around Santa Marta. Try to observe (and photograph) objects which fail to signify well (or those that do signify well).

Exercise 1b.2: Your experience of user experience

We all have experiences using objects and products and systems that are more pleasurable than others. Think hard and carefully about tour experiences and describe a genuinely pleasurable user experience you have known.