

User Centered Design for Audit and Feedback

Mark Chignell
Department of Mechanical & Industrial Engineering
University of Toronto

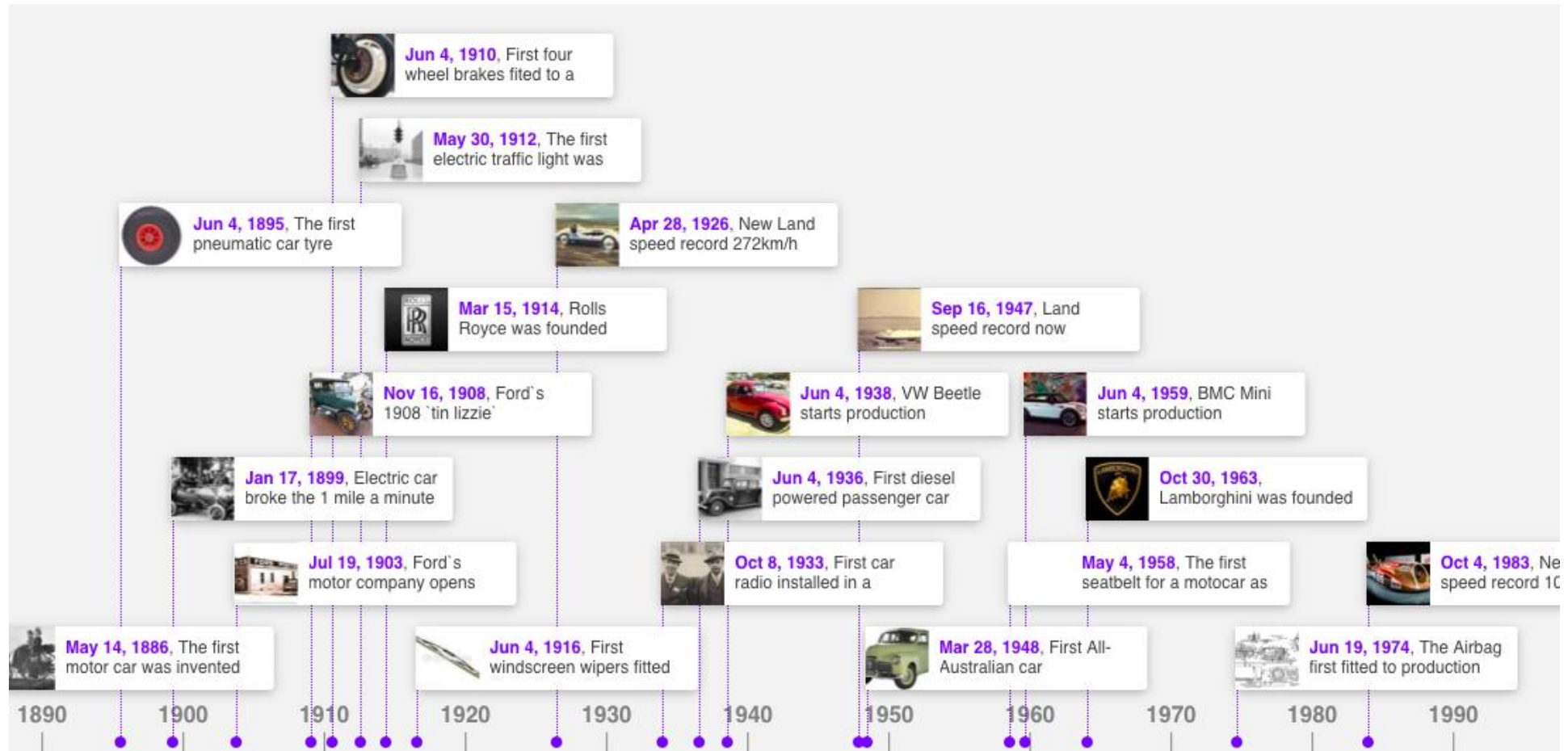
Why do we need User-Centered Design (UCD)?

- Otherwise, when an intervention fails we don't know we don't know the cause
 - Bad idea? (e.g., removing removing plaque in the brain may be treating effet rather than cause)
 - Bad context of use? (e.g., intervention only works prior to the onset of symptoms)
 - Bad design/implementation? (e.g., insufficient feedback/safeguard in the interface for ensuring correct dosage)

Unusable Interventions -> Bad Results



Design is Iterative



It took over 70 years for Seatbelts to become a standard part of cars

- American car manufacturers Nash (in 1949) and Ford (in 1955) offered seat belts as options, while Swedish Saab first introduced seat belts as standard in **1958**

RCT with suboptimal design



VS.



Cars are no good. They break down too much, and scare the horses on the street

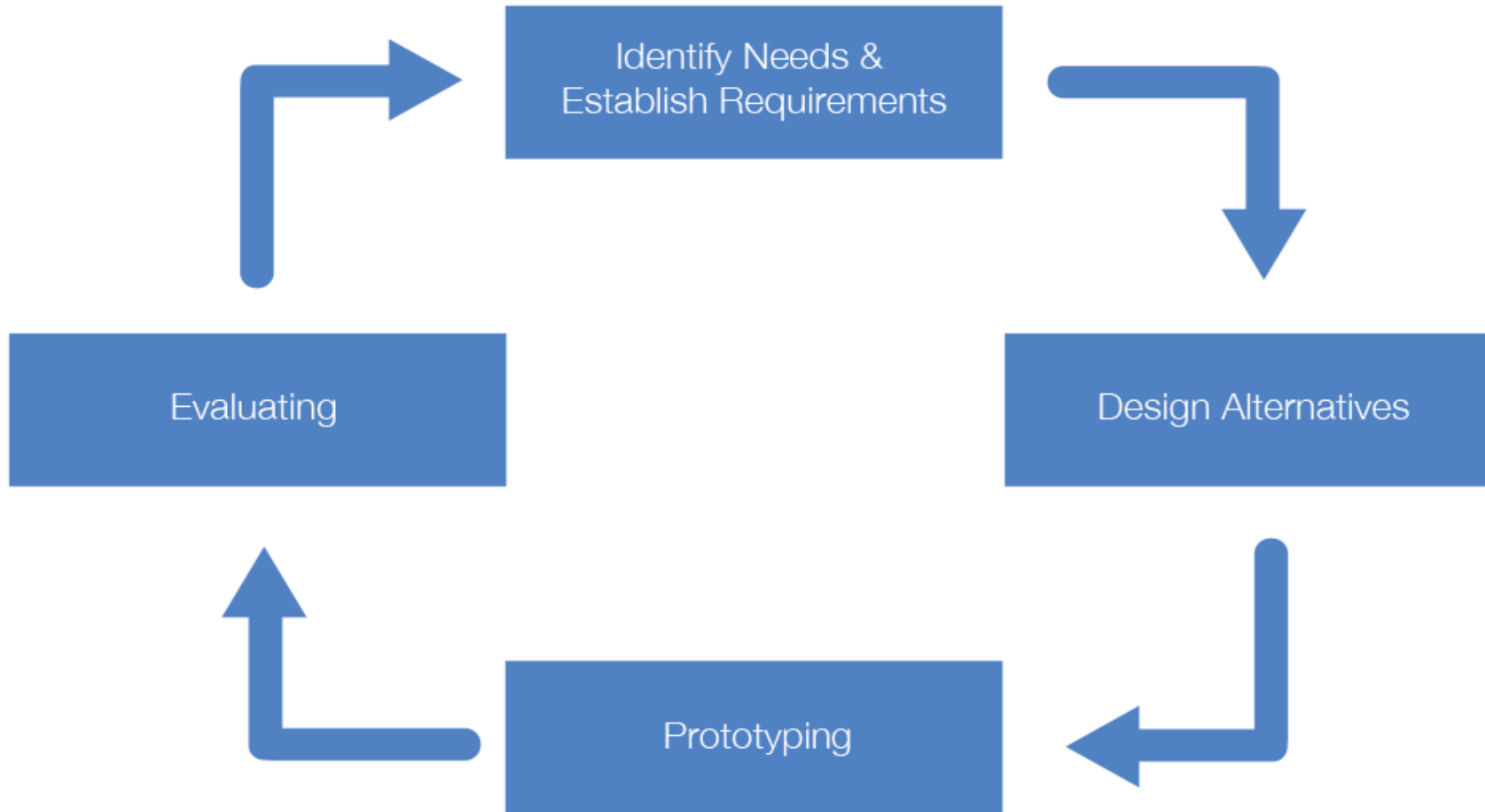
What went Wrong?

- The intervention wasn't optimized prior to running the trial

How do we optimize an intervention?

- We carry out iterative design and we keep making it better until it is “as good as it can be” (given the time and budget available) and easy to use.
 - Iterative design is used by Human factors and user interface design specialists
 - Iterative design is part of the kaizen (continual improvement) method used in lean six sigma
- We strive to use continuous improvement routinely in hospitals these days, so why not require it for research interventions?

Iterative Design Process

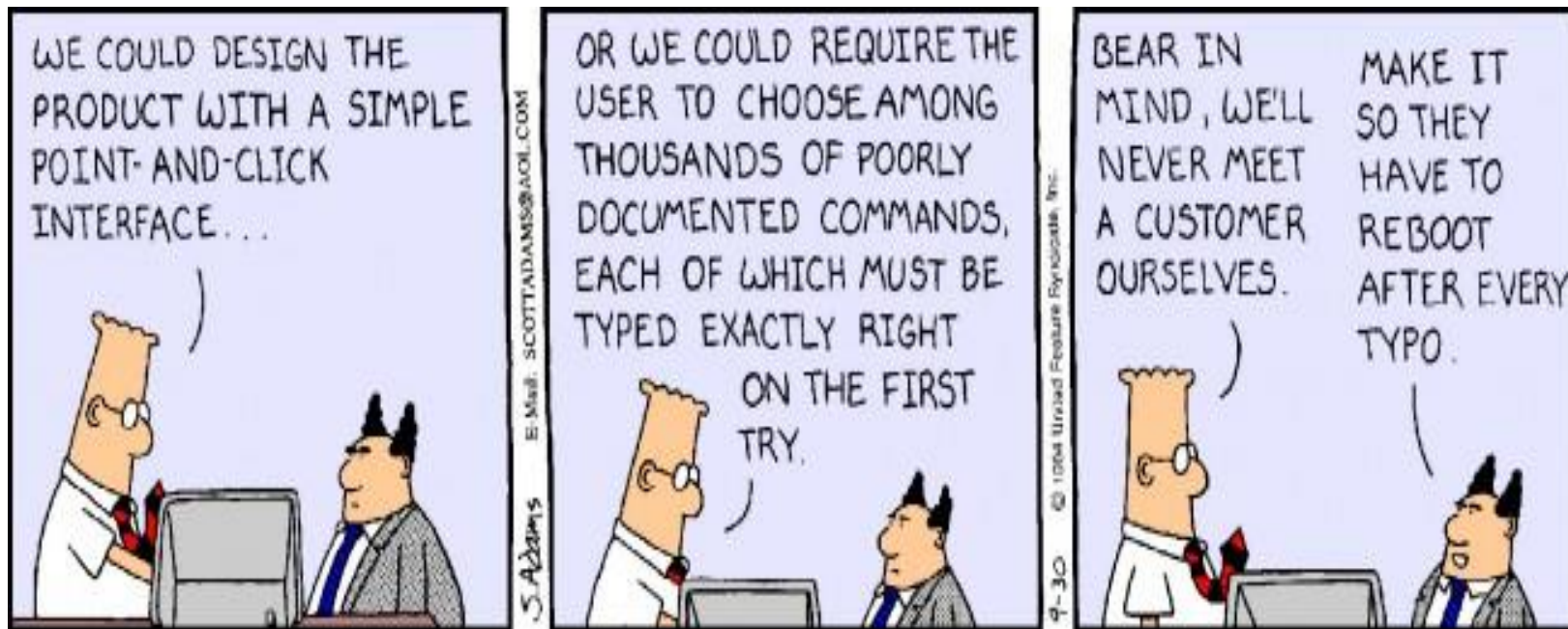


Human Factors: Tools of the Trade

- Guidelines and Heuristics
 - E.g., use a knob of a particular size requirement a particular amount of force to turn
- Requirements Analysis
 - Find out what people (and the situations) require
- Preliminary Design
 - Design something based on general principles, relevant science, requirements
- Iterative Design
 - Prototype, test (user testing), refine

Goals of Interaction Design

- Develop usable products
 - Usability means easy to learn, effective to use and provide an enjoyable experience
- Involve users in the design process



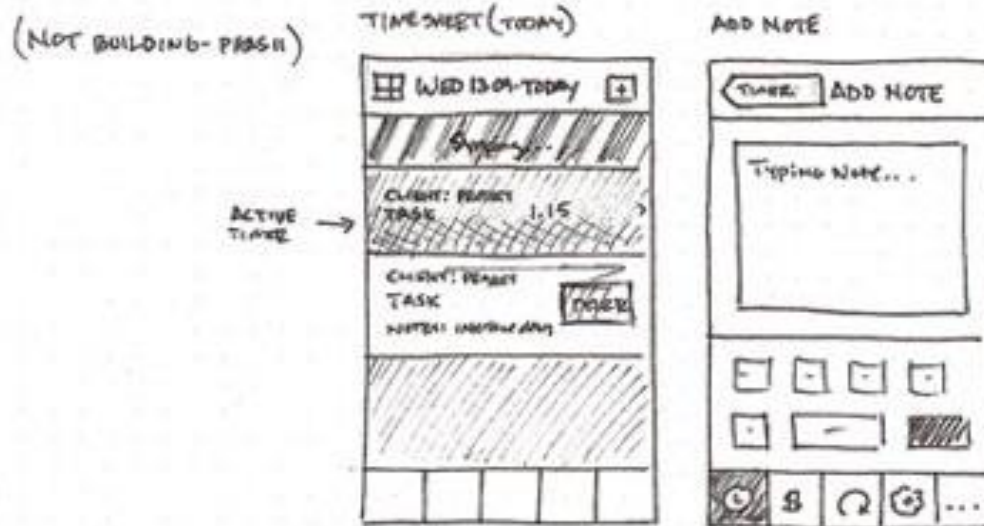
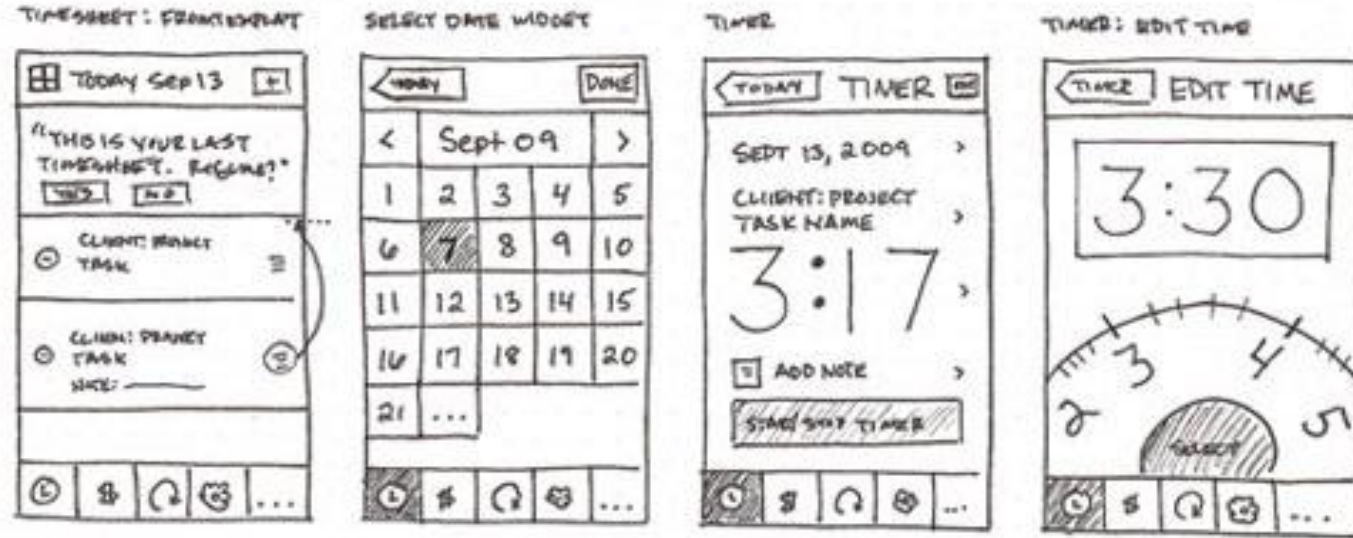
Usability Goals

- **Effectiveness:** how good a product is at doing what it is supposed to do
- **Efficiency:** the way a product supports users in carrying out their tasks
- **Safety:** involves protecting the user from dangerous conditions and undesirable situations

Usability Goals

- **Utility:** the extent to which the product provides the right kind of functionality so that users can do what they need or want to do
- **Learnability:** how easy a system is to learn to use
- **Memorability:** how easy a product is to remember how to use, once learned

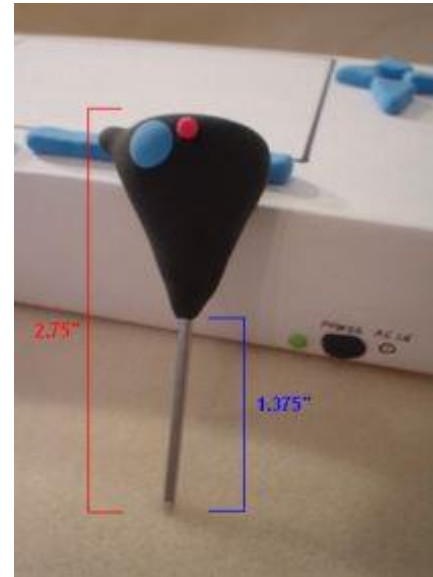
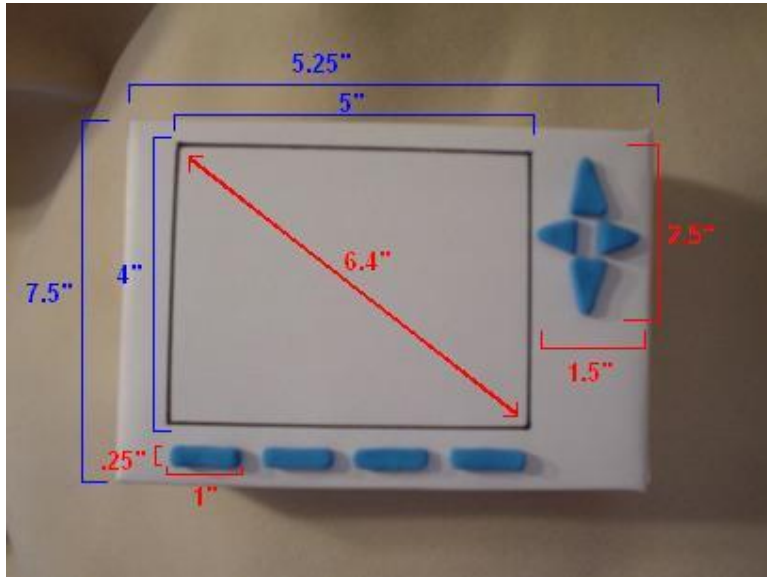
Paper Prototypes



Generating Prototypes from Use Cases

- One way to produce a paper-based prototype is to generate one from a use case output from the requirements activity
- For each step in the use case, the prototype will need to have an interaction component to deal with it
- By stepping through the use case, it is possible to build up a paper-based prototype to cover the required behaviour

Physical Prototypes



Efficient Evaluation with Heuristics

- Visibility of system status
- Match between system and real world
- User control and freedom
- Consistency and standards
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Aesthetic and minimalist design
- Help users recognize, diagnose, and recover from errors
- Help and documentation

Recommendation

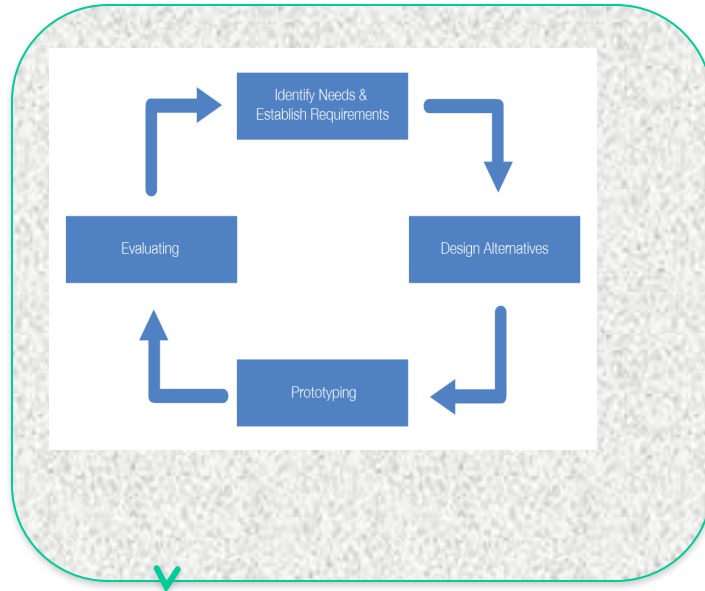
- AF guidelines and requirements – good
- Experimental evaluations of alternative interventions and AF methods – good
- But.....
- High quality comparisons of interventions (against each other, or against controls) requires optimization of each intervention
 - so that we are measuring the intervention construct
 - and NOT extraneous factors like usability

Summary: Science and Design

- Healthcare can never be based on a pure science model
- Healthcare is a complex socio-technical process with many factors (multi-variate)
- Interventions have to be optimized so that differences we observe are not due to extraneous variables
- Randomization does not protect us from the effects of poor design

Revised Process

– Iterative Design



Intervention

RCT

