Usability of intelligent systems

Case example: search engines

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Curious AI

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Usability of The Hammer

3,000,000 years ago

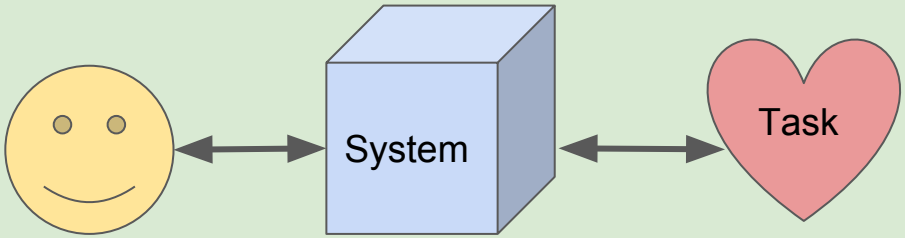
30,000 years ago

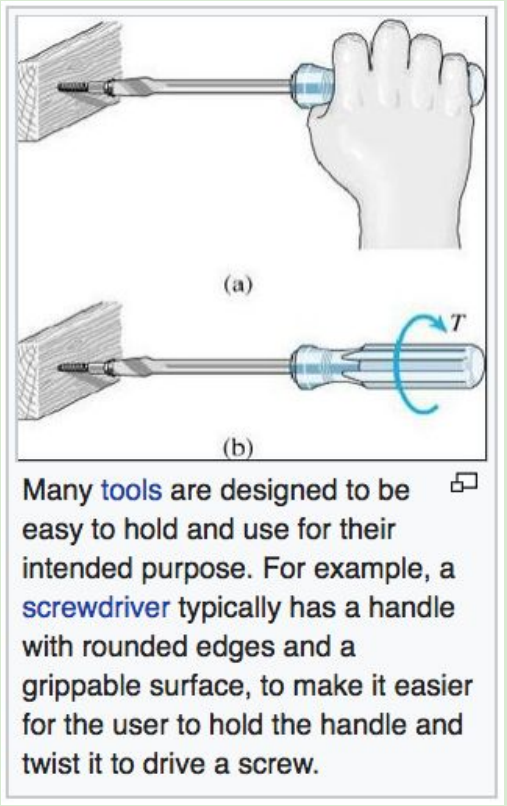
now

Usability

A system is usable for a task if it is easy for the user to complete the task with the help of the system

- We need to consider who is the user
- What is the system
- What is the task





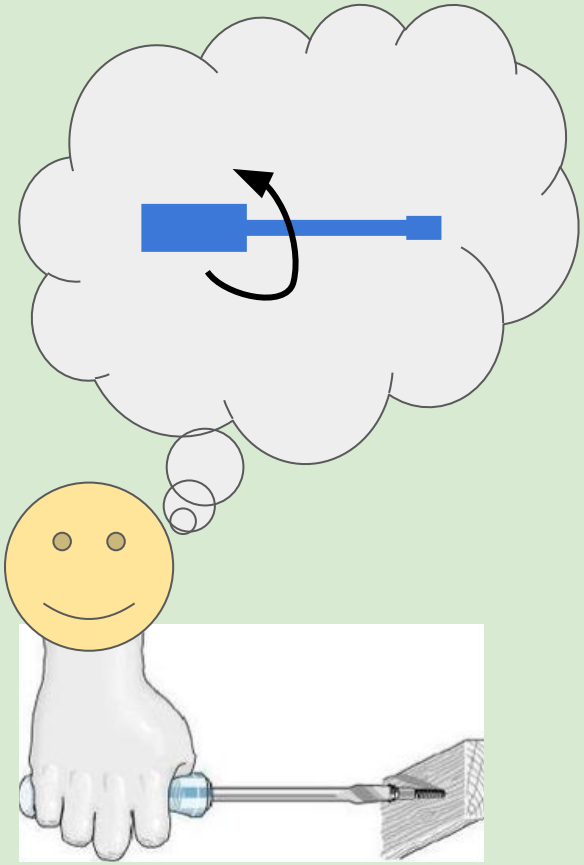
Many tools are designed to be easy to hold and use for their intended purpose. For example, a screwdriver typically has a handle with rounded edges and a grippable surface, to make it easier for the user to hold the handle and twist it to drive a screw.

Mental models

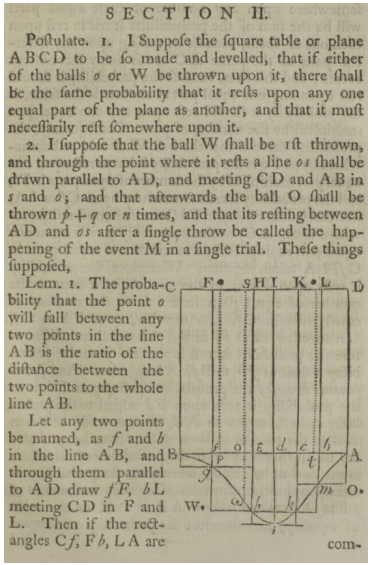
Mental model is the user's internal representation of the used system

- Allows the user to mentally simulate behavior of system
- Thus, allows selection of suitable actions
- (= model-predictive control)

=> In order to be usable, the system's behavior and the user's mental model must be aligned



Usability of Statistical Models



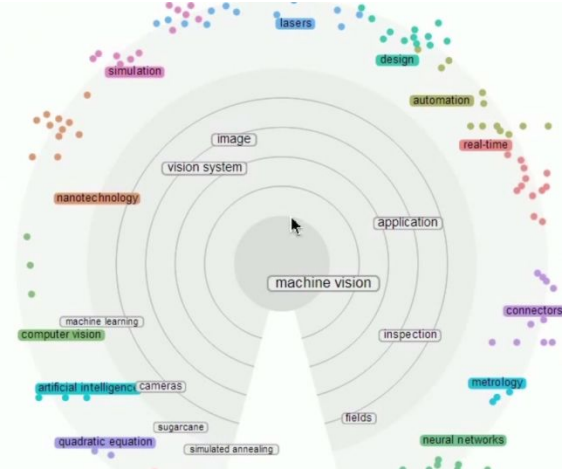
SECTION II.

Poſtulate. 1. I Suppoſe the ſquare table or plane ABCD to be ſo made and levelled, that if either of the balls *o* or W be thrown upon it, there ſhall be the ſame probability that it reſts upon any one equal part of the plane as another, and that it muſt neceſſarily reſt ſomewhere upon it.

2. I ſuppoſe that the ball W ſhall be 1ſt thrown, and through the point where it reſts a line *os* ſhall be drawn parallel to AD, and meeting CD and AB in *s* and *o*; and that afterwards the ball O ſhall be thrown $p+q$ or n times, and that its reſting between AD and *os* after a ſingle throw be called the happening of the event M in a ſingle trial. Theſe things ſuppoſed,

Lem. 1. The probability that the point *o* will fall between any two points in the line AB is the ratio of the diſtance between the two points to the whole line AB.

Let any two points be named, as *f* and *b* in the line AB, and through them parallel to AD draw *fF*, *bL* meeting CD in F and L. Then if the rectangles C*f*, F*b*, LA are com-



300 years ago

30 years ago

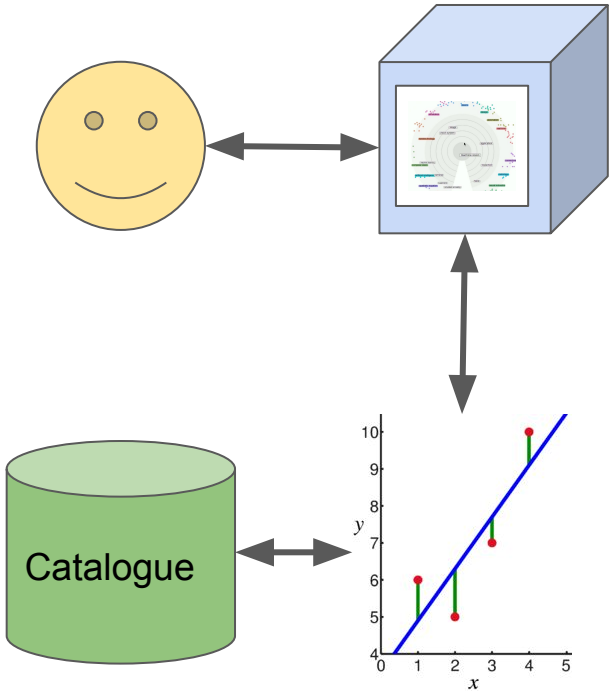
future?

Usability of a Recommender System

Task: Find interesting items from a vast catalogue

How:

- Construct a model of the user's interests based on user input
- Rank catalogue using model, display top results to user
- If user is not satisfied, allow her to give further input
- Repeat until convergence

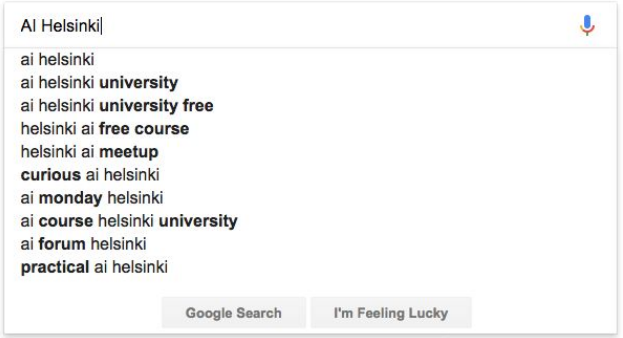


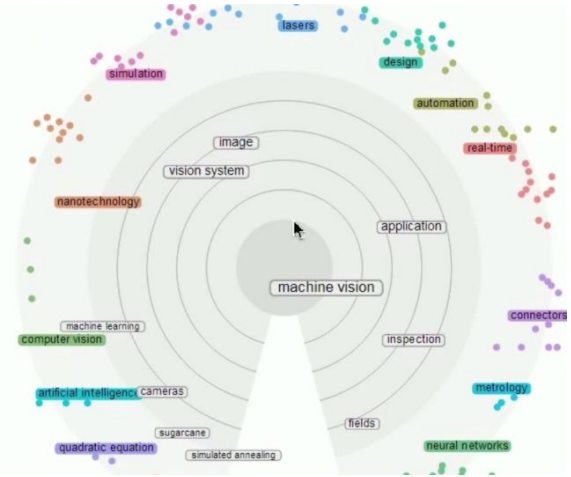
Usability of a Recommender System

"If user is not satisfied, allow her to give further input"

"A system is usable for a task if it is easy for the user to complete the task with the help of the system"

- What kind of input can the user give?
- How is the input given?
- How can the user know what input will improve the results?





Usability of a Recommender System

What kind of input can the user give?

=> What are the input variables of the recommender model?

Search keywords
Relevance feedback
….

How is the input given?

=> How is the UI implemented?

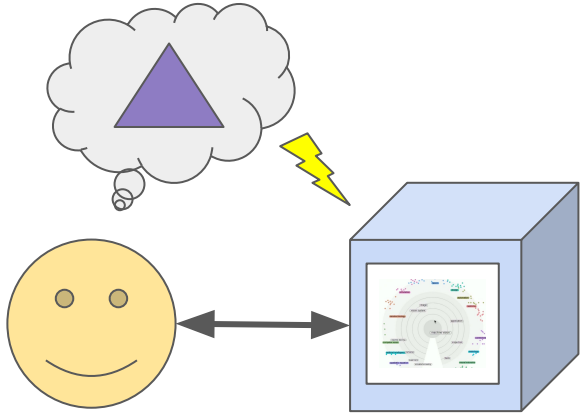
Keyword box
Feedback on model/results
….

How can the user know what input will improve the results?

=> How to make the system behavior match the mental model of the user

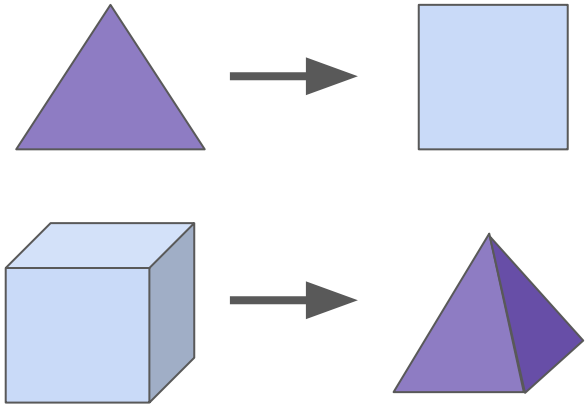
???

How to make the system match the mental model?



Two options:

- Change the mental model
  - Make it easier for the user to calibrate her mental model
- Change the system behavior
  - Make the system behave ‘more intuitively’

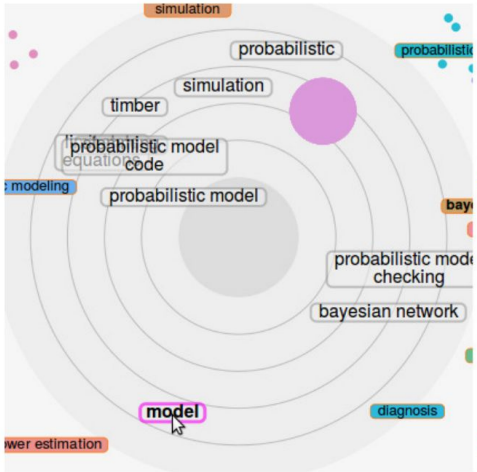


Allowing user to calibrate her mental model

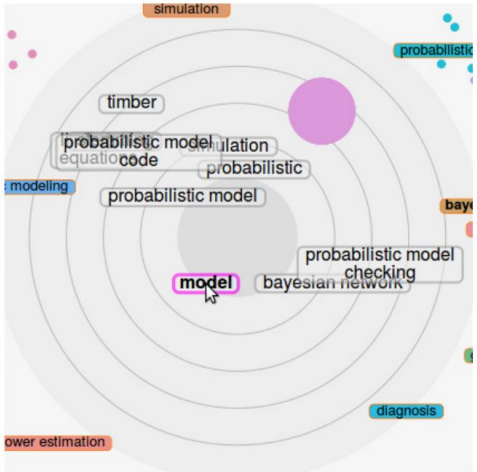
One solution:

Visualize the predicted effects of user actions

- Improves predictability of user actions
- Facilitates calibration of mental model



Low relevance feedback?



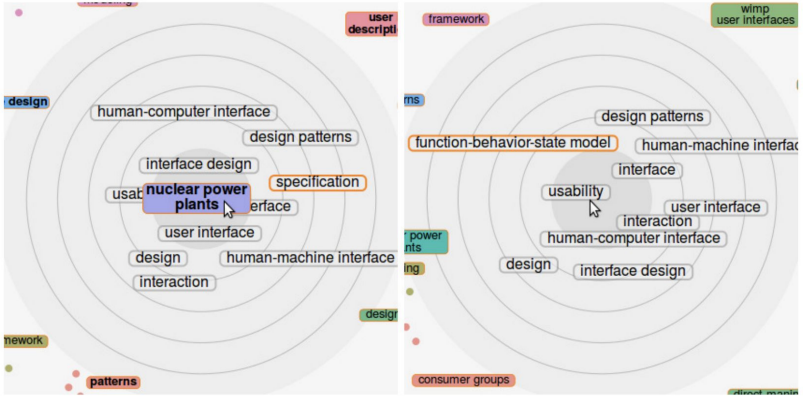
High relevance feedback?

Antti Kangasrääsiö, Dorota Głowacka, and Samuel Kaski. **Improving Controllability and Predictability of Interactive Recommendation Interfaces for Exploratory Search,** Intelligent User Interfaces 2015

Make the system behave ‘more intuitively’

One solution:
Interpret user feedback as requirements for next user model state

- Not just: “add this observation to training set”
- But instead: “find out what observations should be added to the training set for the system to behave like I want”



Not like this: user wants to make a certain feature relevant, but resulting user model state does not reflect this

Antti Kangasrääsiö, Dorota Głowacka, and Samuel Kaski. **Improving Controllability and Predictability of Interactive Recommendation Interfaces for Exploratory Search,** Intelligent User Interfaces 2015

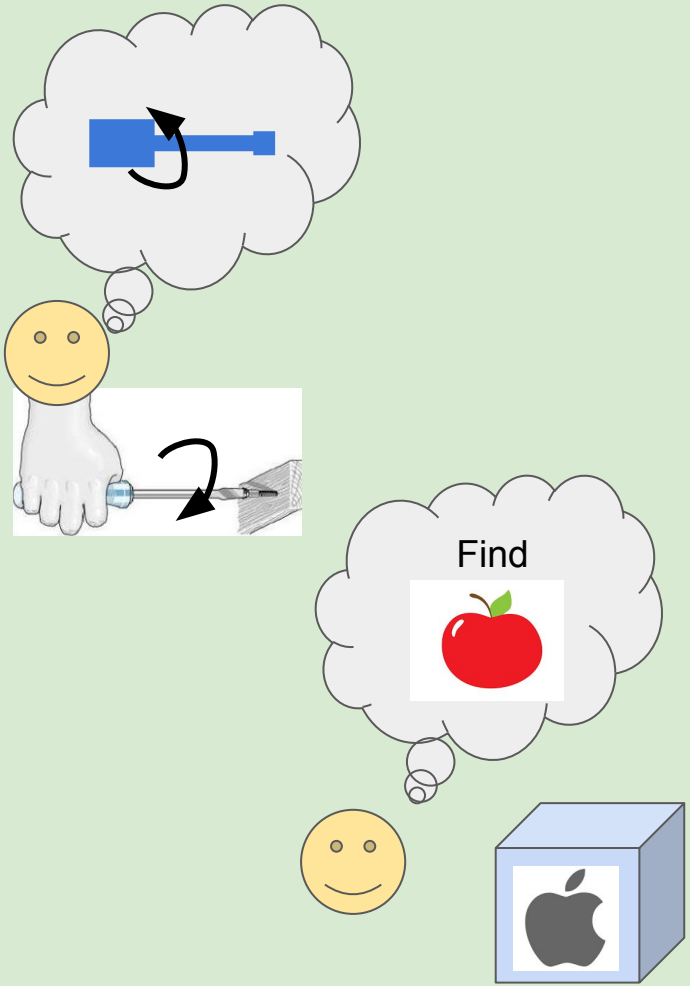
User errors

Users make various kinds of errors

- Unintentional errors
  - “Oops!”
- Mistaken actions
  - “I thought that would do something else”

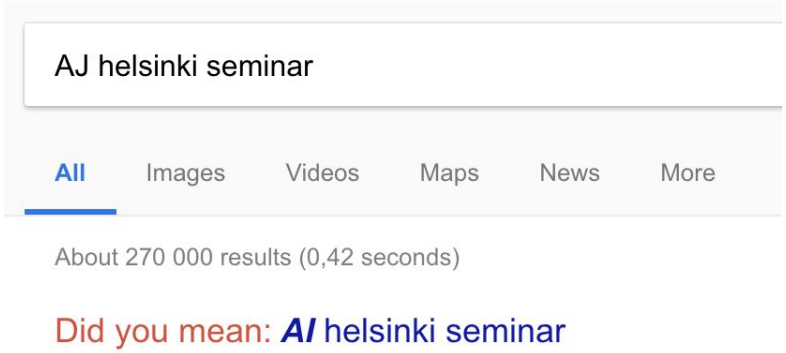
In order to quickly recover from errors, users need feedback

- Example: automatic spell-chekcing
  - “Oh, i made a typo?”
  - “Oh, the word is not spelled like that?”

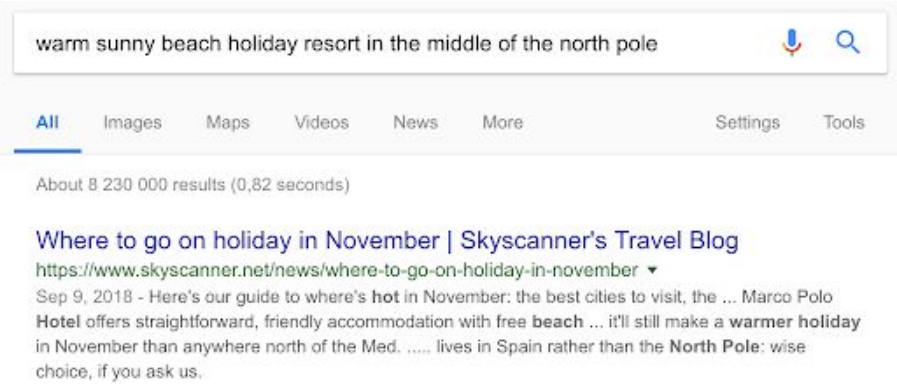


Error detection in one-shot search

Spell-checking like behavior can be used to detect and highlight typos



However, there is no feedback on queries that do not make sense

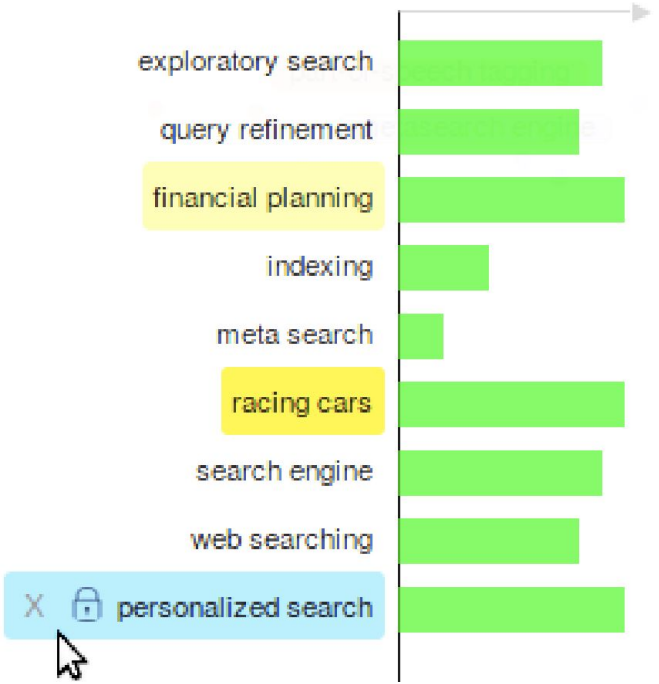


Error detection in iterative query refinement

When user refines the search query by giving relevance feedback, the final model is a function of the *entire training data set*

User's search interest may change over time and there might be errors in the feedback user gives

Solution: Visualize the user's feedback history and highlight outliers



Antti Kangasrääsiö, Yi Chen, Dorota Glowacka, and Samuel Kaski. **Interactive Modeling of Concept Drift and Errors in Relevance Feedback,** User Modeling, Adaptation and Personalization, 2016

Demo