



User Interfaces

EECS 346I – Sections A & B
Fall 2021

Resource Pack: Humans (Users) II
Getting Started, Thinking about Human Behaviour

© **Melanie Baljko**

Intellectual Property Notice

This presentation is protected by Canadian and international copyright laws. Reproduction and distribution of the presentation without the written permission of the copyright holder is prohibited.

These course materials are designed for use as part of the EECS3461 course at York University and are the intellectual property of the instructor unless otherwise stated. Third party copyrighted materials (such as book chapters, journal articles, music, videos, etc) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law.

Copying this material for distribution (e.g., uploading material to a commercial third-party website) may lead to a charge of misconduct under York's Code of Student Rights and Responsibilities and the Senate Policy on Academic Honesty and/or legal consequences for violation of copyright law if copyright law has been violated.

© Melanie Baljko, 2021

Dependencies

This resource pack assumes that you are already familiar with:

- R-Humans-I
- R-Design-V (and all previous)
- R-Interaction-II (and all previous)

Inquiry

1. Why is this resource pack called R-Humans-II and not R-Users-II? What is meant by *user*?
2. Why do people (users) do the things they do? Are people (users) rational?
3. What is Choice Architecture? What is Nudge Theory?

1. Why is this resource pack called R-Humans-II and not R-Users-II? What is meant by *user*?

‘User’ as an ‘Objective Fact’

- We have been using a simple characterization up until this point
 - *use* refers to whether a technology is *used* by a person or not
- this makes a *user* to be the person who is using the technology
- in this way of thinking, the user is seen in terms of *objective fact*
 - an *objective fact* is sometimes called a ‘natural’ fact
 - a *phenomenon* (see R-Knowledge-I)
 - something that can be observed
 - empirically verifiable

What is a Discursive Construct?

- many things come to have meaning with all of the power and reality of objective facts, but they are not objective facts
 - example: Santa Claus
- how do these things come into existence? how do they acquire their meaning?
- one process is through the collective act of language, by referring to and discussing the thing
- this process is called *discursive construction*

Users as Discursive Constructs

- In this discipline, the construct of the *user* gets employed in the following ways
 - users as **an object of scientific study** (particularly ergonomics and cognitive psychology)
 - users as **an entity to be modelled** (in order to understand and predict user behaviours)
- the discursive construction of users in the discipline of Human Computer Interaction has evolved over time (Cooper and Bowers, 1995)
- “users are seen in terms of the characteristic picture of the user as a person sitting in front of a computer, sitting within arm’s reach” (Carroll 2003)

Users: further discursive construction...

- A further discursive construction of 'user' emerged (Cooper and Bowers, 1995):
- users as a construct in political discourses: **users are a constituency in need of empowerment**

Users: a constituency in need of empowerment

- this construct is strongly tied to humanist values of progress and empowerment
- this construct is tied to a rhetoric that praises technological development for its power to transform society

Users: a constituency in need of empowerment

- this construct is connected to warnings that when users' needs are not taken into account, users will be left angry, scared, frustrated, etc
- *“However, our awareness of the problems and a desire to do well are not sufficient. Designers, managers, and programmers must be willing to step forward and fight for the user. ... Victory will come to people who take a disciplined, iterative, and empirical approach to the study of human performance in the use of interactive systems... In this way, each designer has the responsibility of making the world a little bit warmer, wiser, safer, and more compassionate” (Schneiderman, 1987: v-vi)*

2. Why do people (users) do the things they do? Are people (users) rational?

Why do people (users) do the things they do?

- one of the enduring questions of many areas of scholarship.... let's take a stab at it

Users: Rational or not?

- do people do the things they do as a result of a rational thought process?
 - in other words, they are 'rational economic agents'
 - suggests that the thought process is a conscious one, that explicit decision making (deliberation) is involved
- do people do use heuristics?
 - a heuristic is a "rule of thumb"
 - are they even aware of when they are using heuristics?

Goals vs Activities and Tasks

- recall the hierarchy:
 - motivations → goals → activities → tasks → operations
- the hierarchy suggests that humans are logical and rational
- the hierarchy suggests that there is a conscious thought process and explicit decision making and deliberation
- the hierarchy suggests that humans are **rational agents**

Rational Choice Theory

- a sociological perspective that focuses on individual behaviour
- rationality is widely used as an assumption of behaviour in individuals
- “understand[ing] individual actors ... as acting, or more likely interacting, in a manner such that they can be deemed to be doing the best they can for themselves, given their objectives, resources, and circumstances, as they seem them” (p. 223, Abell 1998)
- aggregate social behaviors results from the behaviors of individual actors, each of whom is making their individual decisions

Evidence for Rational or not?

- sociologists (along with others) argue that humans are social agents and do not continuously calculate according to explicit rational and economic criteria
- our thinking must contend with:
 - huge amounts of information (only some of which needs to be remembered)
 - information that is incomplete or ambiguous
 - time pressures (having to decide quickly)
- to tackle this, humans often use cognitive heuristics

Cognitive Heuristics

- a cognitive heuristic is a mental shortcut; it is a 'rule of thumb' that works well in some scenarios and works not too well in other scenarios
 - when the heuristic works well → evidence of goodness
 - when the heuristic doesn't work well → leads to errors
- a heuristic will, by definition, result in errors in at least some scenarios
 - if the heuristic works optimally in all scenarios, then it is no longer a heuristic!
- a heuristic, by definition, is considered to not be 'rational' because it does not always produce the best outcome, given the current goals, available resources, and circumstance
- a heuristic is a kind of strategy to tackle problem solving and decision-making quickly, without having to continually consider huge amounts of information and to adjudicate among huge numbers of options

Cognitive Bias

- a cognitive heuristic will, by definition, result in errors in at least some scenarios
 - these scenarios tend to follow patterns
 - thus, cognitive heuristics lead to systematic errors
- **cognitive biases** refer to systematic mistakes that derive from limits that are inherent in our capacity to process information [Shiraev et al, 2016]
- cognitive biases derive from cognitive heuristics
- we can't always perceive our own cognitive biases; even when confronted with them, we may even reject their existence (denial)

Illustration

- ...and here we are going to watch the videos
- Design to nudge and change behaviour: Silke Krukow at TEDxCopenhagen, TEDx, [16:53]
<https://www.youtube.com/watch?v=EsUzI9lZMak>
- Nudge, the Animation: Helping people make better choices, Rotman School of Management [2:54]
<https://www.youtube.com/watch?v=jsy1E3ckxIM>
- reminder: stop/restart recording

Mental models: some basics

- Craik (1943) described mental models as:
 - internal constructions of some aspect of the external world
 - constructions that are manipulated somehow (processing)
 - predictions and inferences can be made as a result of this processing
- Johnson-Laird (1983) and others
 - the processing of mental models involves both unconscious and conscious processes
 - the processing of mental models involves 'fleshing out' the mental model
 - the processing of mental models involves 'running' the mental model
 - the processing of mental models involves activation of images and analogies

Heuristics and Cognitive Biases

- a heuristic is a mental shortcut, a kind of strategy to tackle problem solving and decision-making
- cognitive biases derive from mental heuristics
- heuristics operate on and employ mental models, thus heuristics and mental models are connected

Mental Models: In Sum

- a mental model is a representation that someone has 'in their mind'
- a mental model is an internal construction
- the representation says something about how something works
- a person can describe their own mental models, at least for some of them
- a person may not be consciously aware of their mental models
- cognitive biases are examples of mental models
- a mental model can be "run" (gets employed in a thought process)
- there is plenty of evidence that people have mental models

Rational Agents vs Bounded Rational Agents

- the acknowledgement that rationality may be bounded
 - by the cognitive limitations of the mind
 - by the time available to make decisions
 - by the tractability of the decision problem

The Belief-Desire-Intention (BDI) Model

- The BDI model is based on Bratman's work called "Intention, Plans, and Practical Reason"
- Bratman is a philosopher, working on the philosophy of action
- The BDI model holds that humans are bounded rational agents; it holds that humans are rational agents and will generate behaviours in accordance with logic-based planning
- while not hugely influential in psychology, the BDI model became massively influential in software and in Artificial Intelligence
 - it is well established as a software architecture for artificial agents

Beliefs, Desires, and Intentions

- cognitive agents live in the world and, in this world, **exogenous** events take place
 - exogenous events are external to the agent, as opposed to endogenous events (which are internal to the agent)
 - these events can have an impact on the agent's mental states, such as updating a belief or impacting a goal
- cognitive agents have three types of attitudes (mental states): beliefs, desires, and intentions
 - beliefs are informational mental states
 - desires are motivational mental states, goals get derived from the desires
 - intentions are mental states that take a stance of committing towards goals (desires) in future action
- planning is the process of deriving the sequence of actions that should be performed to achieve one or more intentions

Validity of BDI?

- BDI is a classic model in AI, with many software implementations
- BDI accounts for some human behaviours, but is often criticized for the following reasons:
 - why these attitudes (beliefs, desires, and intentions) and not some other set? these are not enough/too many
 - how does learning take place?
 - what about human behaviour that is not rational?

Heuristics

- a heuristic is a mental shortcut, a kind of strategy to tackle problem solving and decision-making
- our brains are overwhelmed
 - bombarded with huge amounts of information (only some of which needs to be remembered)
 - bombarded with information that is incomplete or ambiguous
 - having to decide quickly
- heuristics allow people to function without having to constantly consider huge amounts of information and to weight huge number of options
- a heuristics is a rule of thumb, that works well in some but not all scenarios
- a heuristic, by definition, is considered irrational (as is, not mathematically rational, not in the derogatory sense)
- a heuristic will, by definition, result in systematic errors

Cognitive Bias and Logical Fallacies

- **cognitive biases** refer to systematic mistakes that derive from limits that are inherent in our capacity to process information [Shiraev et al, 2016]
- cognitive biases derive from mental heuristics
- we can't always perceive our own cognitive biases
- even when confronted with them, we may even reject their existence (denial)
- a **logical fallacy** is an error in a logical argument
- thus, a logical fallacy is not the same thing as a cognitive bias

Types of Cognitive Biases

- there is a large number of cognitive biases
- I will show you a visualization of 118 different cognitive biases
- a summary of 12 key cognitive biases is provided here
- then we will watch a video

“Cognitive Bias Codex”

- a visualization of 188 cognitive biases, categorized under the headings:
 - we need to act fast
 - not enough meaning
 - too much information
 - what should we remember

<https://www.visualcapitalist.com/every-single-cognitive-bias/>

Illustration

- and here we are going to watch the video
- “12 Cognitive Biases Explained” [10:08]
https://www.youtube.com/watch?v=wEwGBIr_RIw
- reminder: stop/restart recording

Cognitive Biases (a sampling)

- Anchoring Effect: The tendency of individuals to overly rely on an initial piece of information—the ‘anchor’—in future decisions.
- Availability Bias: The tendency of individuals to overestimate the importance of the information that is available to them
- Bandwagon Effect: The tendency of individuals to value something more because others seem to value it.

Cognitive Biases (a sampling)

- Choice Supportive Bias: The tendency of individuals to retroactively ascribe positive attributes to a choice one has made and/or to demote the alternatives that they did not choose
- Confirmation Bias: the tendency of individuals to search for, interpret, favor, and recall information in a way that confirms or supports one's prior beliefs or values
- Ostrich Bias: The tendency of individuals to avoid information that they perceive as potentially unpleasant

Cognitive Biases (a sampling)

- Framing Effect : The tendency of individuals to reach different decisions from the same information depending on how it is presented.
- Scarcity Bias: The tendency of individuals to place a higher value on things that are scarce.
- Sunk Cost Fallacy: The tendency of individuals to continue an action if they have invested resources into it, even if that action might make them worse off.

Cognitive Biases (a sampling)

- Outcome Bias: The tendency of individuals to evaluate the quality of a decision making on the basis of the outcome as opposed to the quality of the decision making process itself.
- Survivorship Bias: The tendency of individuals to judge things on the basis on visible information and to overlook information that is not visible
- Blind Spot Bias: The tendency of individuals to recognize the impact of bias on the judgment of others, while failing to see the impact of bias on one's own judgement

1. What is Choice Architecture? What is Nudge Theory?

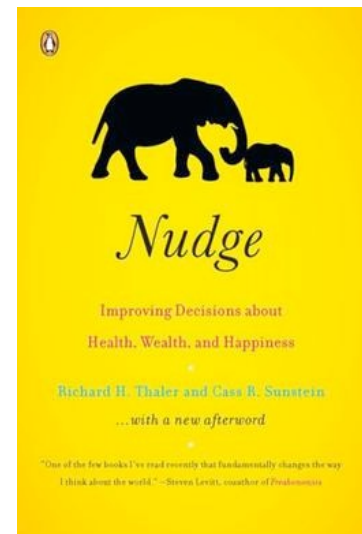
Theories of Decision Making

two theories have been described:

1. Rational Theory: **making a choice** involves weighing up the costs and benefits of different courses of action (e.g. von Neumann and Morgenstern, 1944)
 2. Heuristics: **making a choice** involves application of heuristics (Gigerenzer et al, 1999)
 - a heuristic is a "rules of thumb"
- there is plenty of empirical evidence that people use heuristics, making snap judgments and do not make use of all information

Nudge Theory

- Thaler and Sunstein are critical of the idea "that each of us thinks and chooses unfailingly well, and thus fits within the textbook picture of human beings offered by economists"
- idea of "choice architecture" : the design of the way in which choices can be presented to consumers
- idea of nudge: that positive reinforcement and indirect suggestions are the way to influence the behavior and decision making of groups or individuals



Resources

(links also found on eClass)

- Ly, Kim and Mazar, Nina and Zhao, Min and Soman, Dilip, **A Practitioner's Guide to Nudging** (March 15, 2013). Rotman School of Management Working Paper No. 2609347, Available at SSRN:
<https://ssrn.com/abstract=2609347> or
<http://dx.doi.org/10.2139/ssrn.2609347>
- Design to nudge and change behaviour: Silke Krukow at TEDxCopenhagen, TEDx, [16:53]
<https://www.youtube.com/watch?v=EsUzI9lZMak>
- Nudge, the Animation: Helping people make better choices, Rotman School of Management [2:54]
<https://www.youtube.com/watch?v=jsy1E3ckxIM>