SYDE 543 Course Notes

Cognitive Ergonomics

Paolo Torres

**University of Waterloo**

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# Why Cognitive Ergonomics?

## What is Cognitive Ergonomics?

* Cognitive ergonomics is the field of study that focuses on how well the use of a product matches the cognitive capabilities of users
* Mainly focuses on work activities which have an emphasized cognitive component, are in safety-critical environments, and are in a complex, changeable environment
* Domain: Environment where the system operates, presents constraints and opportunities
* Operates with two underlying theories: a theory about domain and about human cognition

## The Descriptive Model of Human Information Processing

* Short Term Sensory Store (STSS): Events first processed by sight, sound, touch, etc.
* Perception: Determining meaning of events, long term memory of events
* Response Selection: A decision made based on either perception or working memory

Diagram

Description automatically generated

## Kind vs. Wicked Learning Environment

* Kind learning environments have next steps and goals that are clear, have rules that are clear and never change, get feedback that is quick and accurate (golf, chess, etc.)
* Wicked learning environments have next steps and goals that may not be clear, have rules that may change, may or may not get feedback
* The work world is a wicked environment, where hyper specialization can backfire
* In a wicked world, we need people who generalize first then specialize later on
* We need both frogs and birds, frogs to see the details up close, and birds to integrate the knowledge together, to succeed in a wicked world

# Signal Detection Theory and UI/UX (Part 1)

## Signal-to-Noise Ratio

### Definitions

* Signal: Information that is relevant and useful to us
* Noise: Information that is irrelevant to our current need
* Signal-to-Noise Ratio: Ratio of relevant to irrelevant information in an interface

### Example

Graphical user interface

Description automatically generated

* If booking a flight, “Book Travel” is a signal, but everything else is noise
* UI elements may serve functions other than simple communication or task efficiency
* Aim for a reasonable signal-to-noise ratio rather than excluding all “irrelevant” parts

### Increasing Signal-to-Noise Ratio

* Pay attention to your content and have a strong visual hierarchy
* Start with a clear content strategy to help prioritize the information to convey
* Examples: Ensure every piece of text has some importance, avoid redundancy, separate paragraphs, bold keywords, use bullet points, etc.

### Visual Hierarchy

* Reflects the relative importance of different elements on the interface (highly relevant, high visual weight)
* Examples: Making font large and bold, changing colour on action, adding an icon, etc.

### Dynamic Noise

* What counts as noise can change from moment to moment, as the user’s task changes
* Example: Navigation on a website, where the navigation UI is noise while the user is focused on the page content, but becomes the signal once the user is done

### Heuristics

* Aesthetic and minimalist design (remove unnecessary elements from the user interface)

## Signal Detection Theory (SDT)

### Neural Activity

Diagram

Description automatically generated

### Hit, Miss, False Alarm, Correct Rejection

* Hit: Positive response when there is a signal
* Miss: Negative response when there is a signal
* False Alarm: Positive response when there is no signal
* Correct Rejection: Negative response when there is no signal

|  |  |  |
| --- | --- | --- |
|  | Signal + noise | Noise |
| Thinks phone ringing | Hit | False alarm |
| Thinks phone not ringing | Miss | Correct rejection |

### Perceptual Sensitivity ()

* How different the signal is from the noise
* Larger : Signal more distinguishable from noise, more hits and correct rejections
* Smaller : Signal less distinguishable from noise, more misses and false alarms

### Decision Criteria ()

* The degree at which the perceiver is biased to detect or not detect
* Conservative (large) : Minimal detection, more misses and correct rejections
* Liberal (small) : Maximal detection, more hits and false alarms

## Receiver Operating Characteristic (ROC) Curve

### ROC Curve

Chart

Description automatically generated

### Relationship Between ROC Curve and

* The steeper the curve, the higher the

### ROC Curve Axes

* : probability of a hit