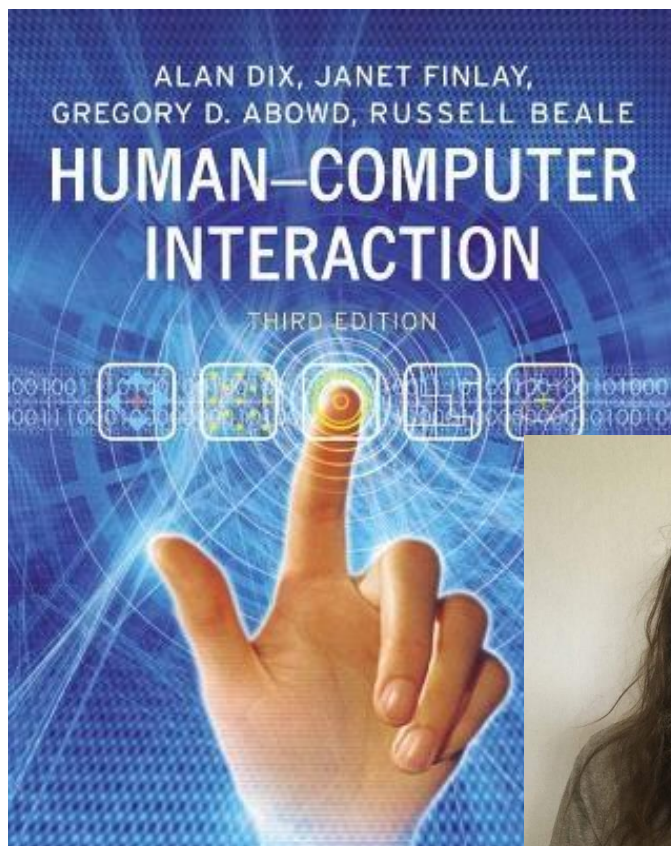


## Chapter 4:

### Principles to support Usability by Dix et al.

#### Overview

- 1 Usability 101 (by Jakob Nielsen)
- 2 Design Rules
- 3 Principle 1: Learnability
- 4 Principle 2: Flexibility
- 5 Principle 3: Robustness



## Usability 101 by Jakob Nielsen

Quality attribute.

Usability is a quality attribute that assesses how easy user interfaces are to use. The word "usability" also refers to methods for improving ease-of-use during the design process.

Usability has **five quality components**:

LEAMES

### Learnability

How easy is it for users to accomplish basic tasks the first time they encounter the

### Efficiency

Once users have learned the design, how quickly can they perform tasks?

### Memorability

When users return to the design after a period of not using it, how easily can they reestablish proficiency?

### Errors

How many errors do users make, how severe are these errors, and how easily can they recover from the errors?

### Satisfaction

How pleasant is it to use the design?

pleasant.

Leave if inconvenient.

On the Web, usability is a necessary condition for survival. If a website is difficult to use, people leave. If the homepage fails to clearly state what a company offers and what users can do on the site, people leave. If users get lost on a website, they leave. If a website's information is hard to read or doesn't answer users' key questions, they leave. Note a pattern here?

Users do not spend much time over reading a website manual or trying to figure out an interface (unless it is obligatory). If there are plenty of alternatives available, leaving is the first line of defence when users encounter a difficulty.

There are several evaluation methods for getting users' feedback to improve usability. Some are based on evaluation by UX experts, but probably the most common is usability testing with users, i.e., the actual end users carry out typical tasks with a complete product or a prototype. Together with a usability test, other methods can be used to collect complementary data. Those are, for example, questionnaires, interviews and focus group discussions.

Actual users  
complete or prototype.  
Usability testing.

## Types of Design Rules

There is a terminology to describe the different types of Design rules.

### Principles:

Abstract design rules

### Golden rules and heuristics:

More concrete than principles

### Standards:

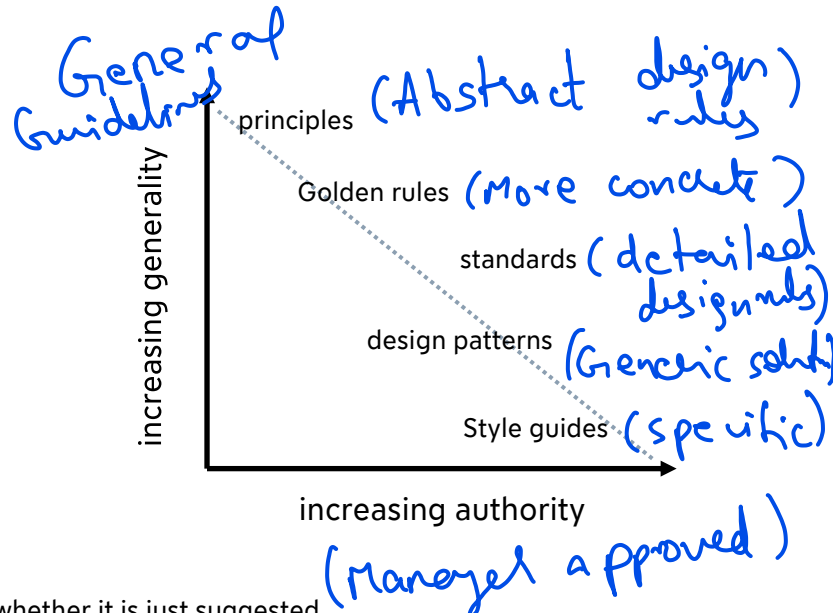
(Very) detailed design rules

### Design patterns:

Generic solution for a specific problem

### Style guides:

Provided for devices, operating systems,  
widget libraries



**Authority:** whether a rule must be followed or whether it is just suggested

**Generality:** applied to many design situations or focused on specific application situation



For an example of a style guide, visit: <https://design.google>

A style guide helps to ensure a continuous product experience. It means that no matter how, when or where a customer experiences a brand or a product, they are experiencing the same underlying traits.

It's this consistency across every touchpoint that helps to create an association with a brand or a product. The usage experiences feels 'complete' and consistent and helps building habits with the product.

consistent experience (underlying)  
wherever you go

## Principle 1: Learnability



Learnability: the ease with which new users can begin effective interaction and achieve maximal performance.

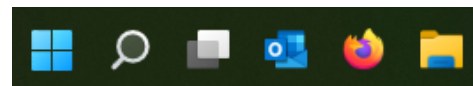
Learnability captures how well the user can start using the new system and which prior knowledge is required for this.

Therefore, several aspects of learnability need to be considered, which include:

### Predictability

Determining effect of future actions based on past interaction history and the visibility of operations

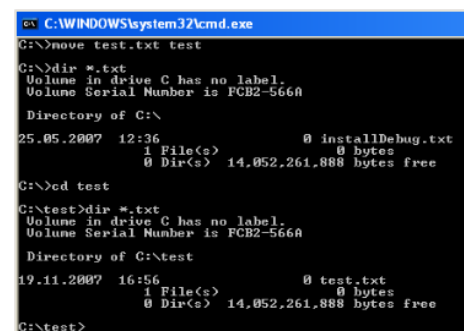
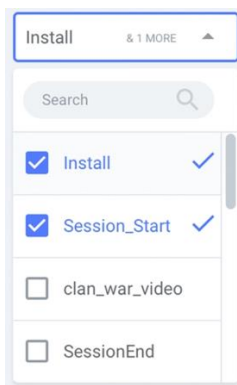
*future based on past interactions*



*past operations on current state.*

### Synthesizability

Ability of the user to assess the effect of past operations on the current state – this means that the user should see the changes of an operation given through immediate vs. eventual feedback



## Familiarity

To which extent can the user apply prior knowledge to new system –  
remember: affordance (guessability).

## Generalizability

Can specific interaction knowledge be extended to new situations



Image from the movie Star Trek IV:  
The Voyage Home



## Consistency

Likeness in input/output behavior arising from similar situations or task objectives

Gesture  
Zoom

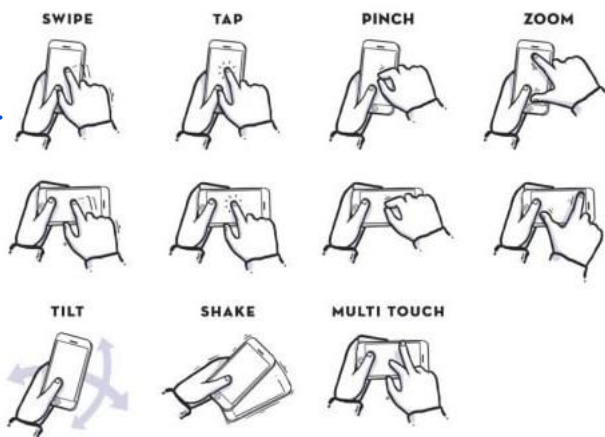


Image source: [Julian Burford](#)

## Excuse: The power of gestures

Gestures allow direct changes to UI elements using touch and help users perform tasks rapidly and intuitively. Through the ubiquity of mobile smartphones, some gestures have become common synonyms for a specific action (e.g., zoom in through touching the surface with two fingers and moving them apart.)

This previous knowledge can be used in new applications and there are common guidelines from big software companies how to implement these gestures.

E.g.:

[Google Gesture Guide](#)

[Microsoft Gesture Guidelines](#)

[Apple Gesture Guidelines](#)

[Android Gesture Guidelines](#)



## Principle 2: Flexibility → Multiplicity.



Flexibility: the multiplicity of ways the user and system exchange information.

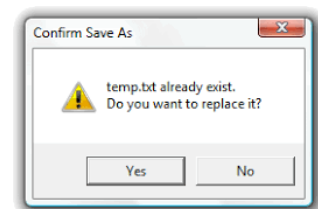
The flexibility of the interaction with a system is determined by several components, which will be introduced in this section.

### Dialogue initiative

The dialogue initiative includes the freedom from system-imposed constraints on input dialog. There are two types of dialogue initiatives, which are **user preemptiveness** (the user initiates a dialog) and **systems preemptiveness** (the system initiates dialog)



User initiates dialog.



System preemptiveness

System initiates dialog

### Multithreading

Describes the ability of system to support user interaction for several tasks at a time. Two types of Multithreading in UX design are **concurrent multimodality** and **interleaving multimodality**.

#### Concurrent multimodality:

Same time  
different  
task?

- Multi-modal dialog
- Editing text and beep (incoming mail) at the same time

#### Interleaving multimodality:

Permits temporal overlap between separate tasks, dialog is restricted to a single task

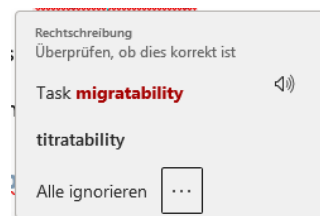
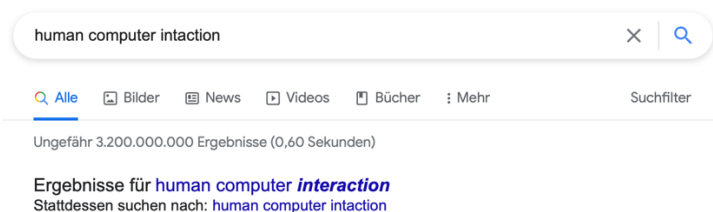
- Window system, window = task
- Modal dialogs
- Interaction with just one window at a given time

One thing at a time

# Task migrability.

## Task migrability

Some responsibilities for a given task can be passed from a user to the system. e.g., spell check in a word processing program



## Substitutivity

A system needs to allow equivalent values of input and output, that can be substituted for each other. → Representation of multiplicity

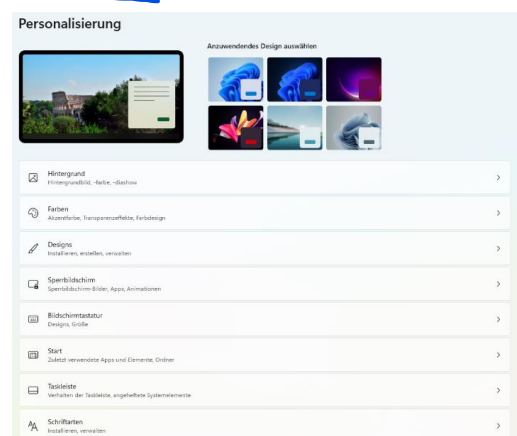
e.g.: different currencies, cm or inch

## Customizability

The user interface needs to be modifiable by the user (adaptability) or the system (adaptivity). Both terms describe "how" an intelligent mechanism used to describe the "how" an intelligent mechanism can achieve the goal of tailoring a UI to a specific user, e.g., through combinations of components and attributes

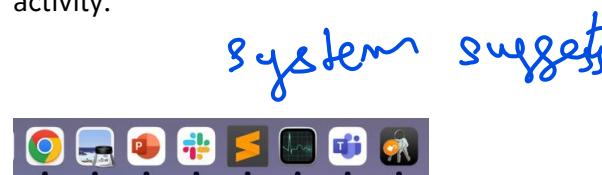
## User ← Adaptability

users' ability to adjust the form of input and output. → The user is actively and continuously involved in the adoption process of the UI



## Adaptivity → System.

automatic customization of the user interface by the system. → The system collects user information based on his or her activity.



User involved.

System suggests

## Principle 3: Robustness

level of support



**Robustness:** the level of support provided to the user in determining successful achievement and assessment of goal-directed behaviour.

look inside

**Observability** Ability of the user to evaluate the internal state of the system from its perceivable representation

evaluate internal state from perceived representation



A system is considered "observable" if the current state can be estimated by only using information from outputs - in a visual interface, this must be displayed information that is accessible for the user.

state estimate from o/p's

**Recoverability** Ability of the user to correct a recognized error:

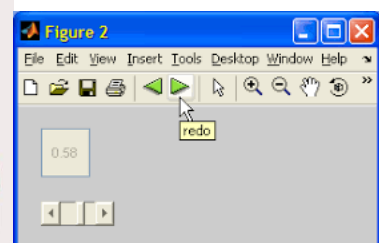
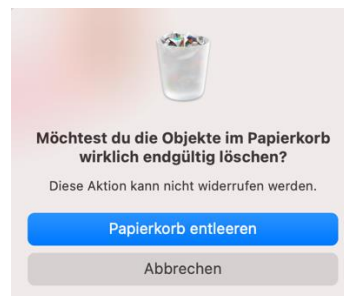
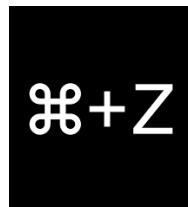
correct error.

Reachability (states): forward (redo) / backward (undo) recovery

The effort for a given task should be adequate to the importance or consequences of it: e.g., more effort or steps should be necessary to deleting a file then just to move them.

effort adequate to importance or consequences.

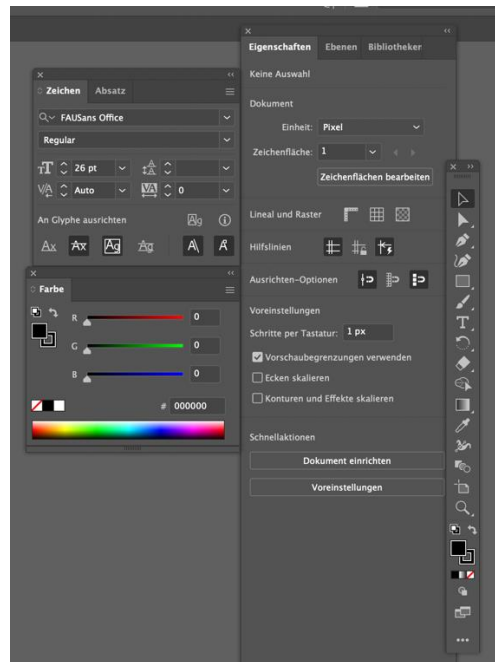
delete > move file.





## Task Conformance

Degree to which system services support all tasks of a user.



However, one should keep in mind, that by adding more functionalities to a interface, this will increase complexity and the ease of use. Thus, the balance between supporting tasks but not overloading users should be kept.

all tasks

more functions  
> More complex  
overload.

## Responsiveness

Describes how the user perceives the rate of communication with the system. The preferred perception should be short and contain instant responses.

short +  
instant  
response.



rate of communication

Letterboxing: Please wait.  
This may take a while.

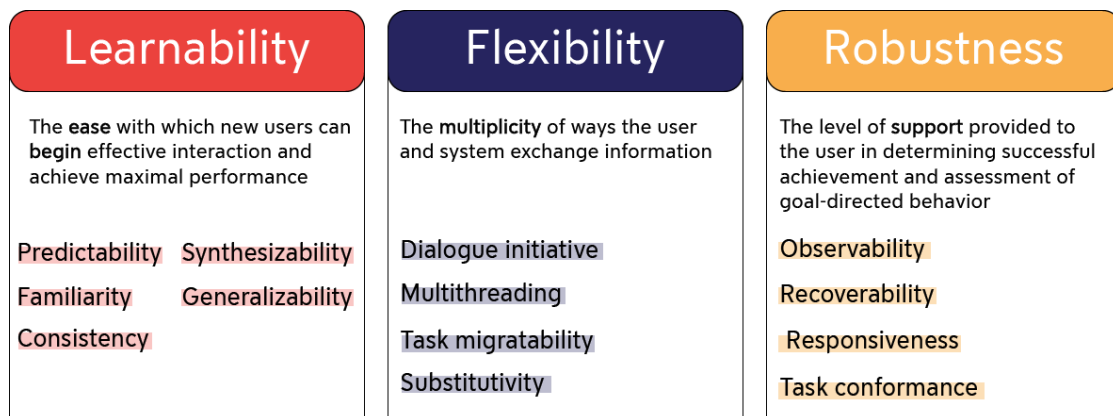


What happens if a system crashes and does not react anymore?  
Which consequences does this have on the UX/UI?

## Summary

Poor design  $\Rightarrow$  time waste + Hindrance

Poor design criteria are responsible for wasting computer users time and are a hindrance to effective interaction with human centred systems. It is important that before any design of an interface is attempted an in-depth analysis of task and user needs must be undertaken. Therefore, Alan Dix has proposed a taxonomy of three design principles which help to guide developers in the design process of user-friendly systems. The three principles comprise **Learnability**, **Flexibility**, and **Robustness** with respective sub-categories.



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