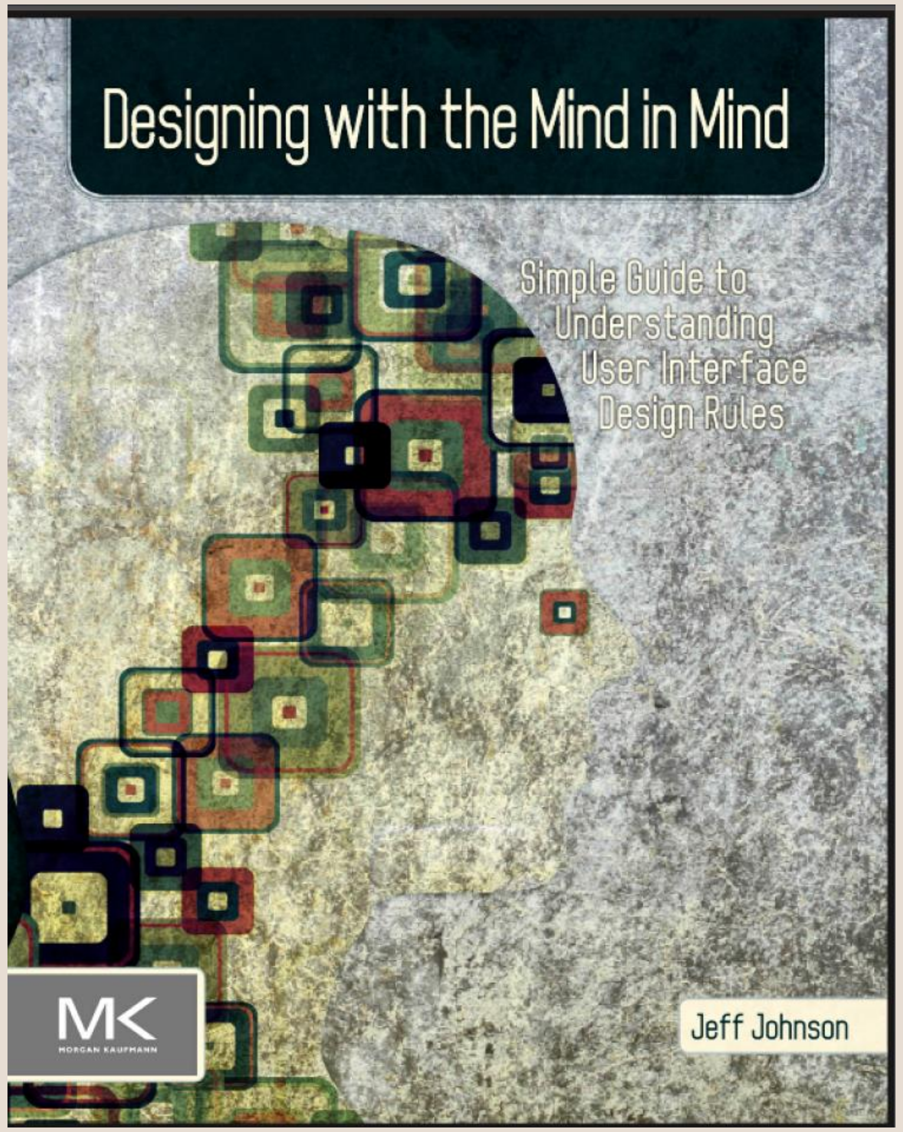
Learning

LIMITATIONS

Source

This lesson's material and images are from the following book:



Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules
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Learning from Experience

1

We perceive what we expect

Perception

We have three brains

1. the old brain
2. the midbrain
3. the new brain

Perception

the old brain

- mainly the brain stem
- around since the first fish evolved
- classifies everything as :
  - edible
  - dangerous
  - sexy
- regulates the body’s automatic functions
  - breathing, digestion, reflexive movement

Learning

the midbrain

- above the old brain
- below the cortex
- evolved between the old and new brain
- controls emotions

Learning

the new brain

- the cerebral cortex
- controls intentional activity e.g. planning
- only a few mammals have a sizable new brain
  - elephants
  - dolphins / porpoises
  - whales
  - monkeys / apes

Learning

Learning from experience

- we learn quickly & easily from experience
- but not perfectly!
- have bias towards our experiences (or close relatives / friends) over what we read or hear
  - e.g. bad experience with a type of car
- don't always learn from our mistakes
- people over generalize
  - e.g. not all crows are black

Learning

Learning from experience

animals without an old brain can't learn from experience

need a cortex to learn from others

- aware of learning (large new brain)
- articulate what we have learnt (just humans?)

Learning

Performing learned actions

- if we repeat something many times it becomes almost automatic
  - riding a bike
  - brushing your teeth
  - deleting a text
- called “routine, well-learned behavior”

Learning

Performing learned actions

- learning to drive
- every actions requires conscious attention
- exceeds our attention capacity
- so we practice
- actions become automatic

Learning

Performing learned actions

- check our emails – it becomes automatic
- we use a different device, OS, application
- now it requires conscious thought
- takes more time
- is more prone to error

Learning

Problems are hard

- people can deal with new situations
- we are not reliant on instinct or well-practiced behaviours
- the large new brain allows us to deal with problems at short notice
- but this uses controlled processing
- requires focused attention
- constant monitoring
- slow, strains memory and requires conscious mental effort

Learning

Problems are hard

- we evolved between 200,000 and 50,000 years ago
- numeric calculations have existed since about 3-4,000 B.C
- so our brain has evolved before calculations existed
- 1 or 2 step calculations are OK
- multiple steps can overload our short-term memory
- see examples

- John's cat is not black and likes milk. Sue's cat is not brown and doesn't like milk. Sam's cat is not white and doesn't like milk. Mary's cat is not yellow and likes milk. Someone found a cat that is yellow and likes milk. Whose cat is it?[4] *(The negations create more chunks of information than most people's short-term memory can hold at once.)*

- A farmer has cows and chickens—30 animals total. The animals have a total of 74 legs. How many of each animal does the farmer have? *(Requires translation to two equations and then solving using algebra.)*

- A Zen master blindfolded three of his students. He told them that he would paint either a red dot or a blue dot on each one's forehead. In fact, he painted red dots on all three foreheads. Then he said "In a minute I will remove your blindfolds. When I do, look at each other and if you see at least one red dot, raise your hand. Then guess which color your own dot is." Then he removed the blindfolds. The three students looked at each other, then all three raised a hand. After a minute, one of the students said "My dot is red." How did she know? *(Requires reasoning by contradiction, a specialized method taught in logic and mathematics.)*

Learning

Problems are hard

1. John
2. 7 cows, 23 chickens
3. if blue dot then other students colour must be red (see red + blue) to be two red (see red + own dot), but delay, so not blue dot

Learning

UI design implications

don't impose technical problems

- is ID the same as username?
- total price – before or after discount?
- incompatible plugin – what do I do?
- change the page number – how?
- align icons horizontally - uncheck it
  - will it now be vertical or not aligned?

Learning

Krug 2006

"Interactive systems should minimize the amount of attention the users must devote to operating them."

Learning

Some design advice

1. prominently indicate system states & user’s progress to their goal
2. guide users toward their goals
    - information scent
3. tell users explicitly and exactly what they need to know
4. don’t make users diagnose system problems

Learning

Some design advice

1. minimize the number and complexity of settings
2. let people use perception rather than calculation
    - use of graphical representations
    - snap-to grids
    - scroll bars (e.g. go to page *n*)
3. make the system familiar
4. let the computer do the maths

Factors that Effect Learning

2

We perceive what we expect

Learning

Recognition

- New perceptions similar to the original ones reactivate the same patterns of neurons.

Recall

- If no similar perception exists, stimulation from activity in other parts of the brain can also reactivate a pattern. This awareness results in recall.

Learning

Factors that affect learning

- we learn faster when the:
  - operation is task-focused, simple and consistent
  - vocabulary is task-focused, simple and consistent
  - risk is low

Learning

Factors that affect learning

- when using a tool we translate the task into operations provided by the tool (goal -> operation)
- user expends mental effort
- attention is not on the task but on the tool
- if the tool does what the user wants (small gulf of execution),
- the tool becomes automatic
  - e.g. call a friend name ->address book->dial
  - or speed dial

Learning

Factors that affect learning

- to design systems that provide operations that match user's goals & tasks designers must understand the user's goals and tasks. But how?

1. perform a task analysis
2. design a task-focused conceptual model
   object/actions analysis
3. design a UI based strictly on the task analysis & conceptual model

Learning

Task analysis

- answer questions by observing people doing the tasks
- next step is to design the conceptual model for the tool
    - focus on the user's tasks and goals
    - what are the concepts people need to know to use it
    - easier to learn the tool
- now you can design the UI

Learning

Conceptual model

- objects / actions analysis
- what are the conceptual objects?
- what actions can be performed on these objects?
    - attributes (settings)
    - relationships (between objects)

Learning

Conceptual model

if it is not in the objects / actions analysis
users should not know about it

Learning

Conceptual Model	Not in the conceptual model
Writing a cheque	Click button
Voiding a cheque	Load database
Deposits	Edit table
Withdraws	Flush buttons
Balancing accounts	Switch modes

Learning

Objects	Attributes
cheques	payee, number, amount, amount text, date
accounts	owner, balance
transactions	amount, date

simple
least objects (required functionality)
concepts add complexity

Learning

Consistency

- strongly affects how quickly users progress from:
  - controlled , consciously monitored, slow operation, to
  - automatic, unmonitored, faster operation
- more predictable = more consistent
  - conceptual level consistency (model)
  - keystroke consistency
    - mapping between the conceptual objects and
    - the physical movements required to execute them

Learning

Keystroke Consistency

- "muscle memory" (motor habits)
- standardizing physical actions for the same types
- example editing text
    - opening docs, following links, scrolling, etc.
- designs follow look-and-feel standards
- built into design tools
- exist for software, wed design, etc.
- stick to keystroke consistency
    - be innovative at the conceptual level

Learning

Consistent vocabulary – we learn faster if

- task-focused
- familiar
- consistent

Learning

Consistency – task-focused

- concepts are task-focused
- concept names are task-focused

FIGURE 11.5

iCasualties.org uses language that is not task-focused ("database") in its instructions.

Learning

Consistency – familiar

- no geak-speak
- example (for teachers):
  - category = subject
  - subcategory = unit

FIGURE 11.8
Error message in Windows Media Player uses a familiar term (“current state”) in an unfamiliar way.

FIGURE 11.7
Error message at Continental.com uses “geek speak” (computer jargon).

LEARNING

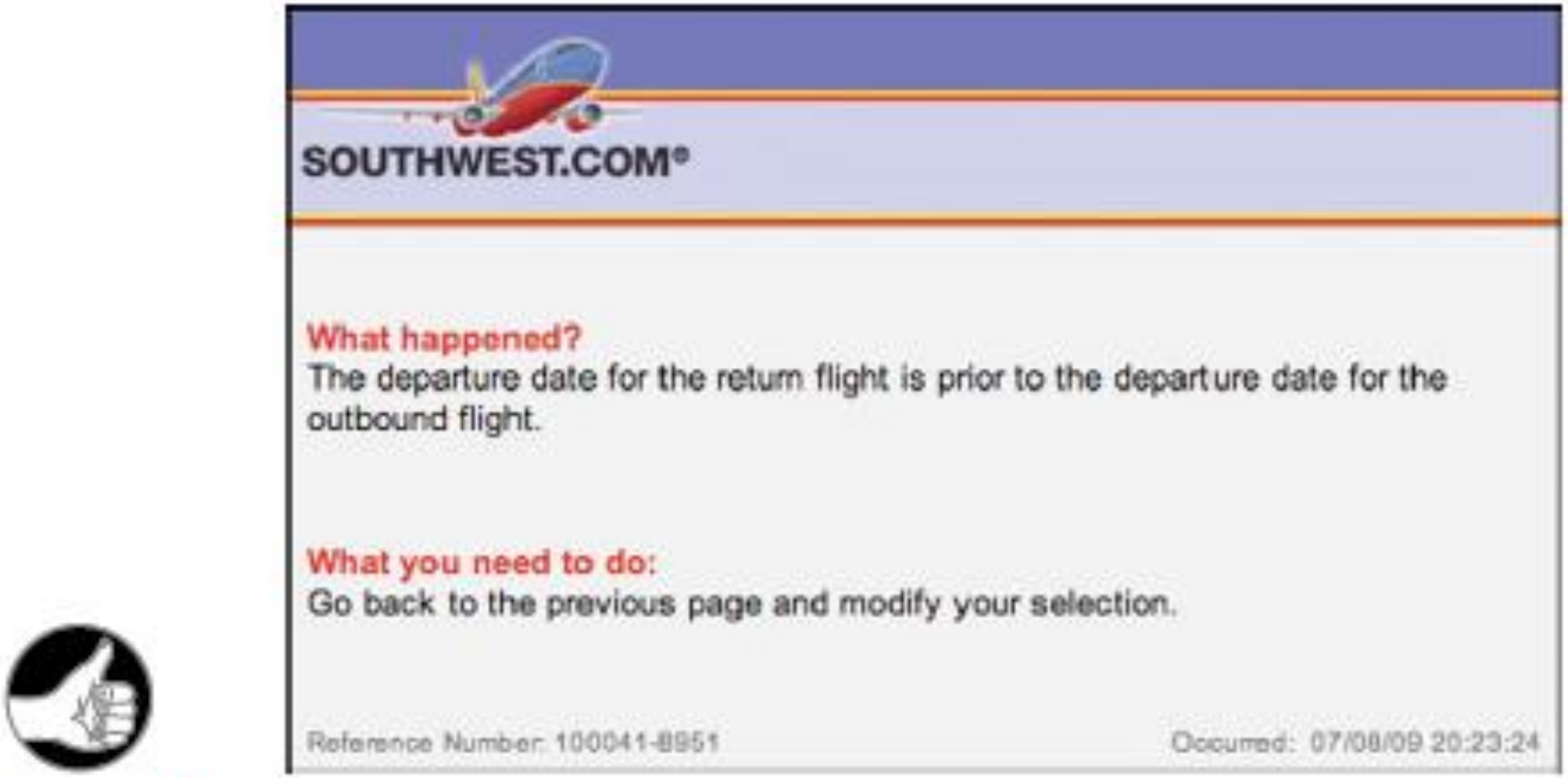

FIGURE 11.9

Error messages at Southwest Airlines' Web site are task-focused and clear, fostering learning.

Learning

Consistent

- same name = same thing, different name = different thing
- search ≠ query
- so don't
  - use a different term for the same concept
  - use the same term for a different concept (overloading)

Learning

Consistent

- a good conceptual model will help with vocabulary
- product lexicon
- map terms with concepts
- terms come from the task not your implementation
- GUI design has ‘reserve words’
- use for consistency in design, documentation, etc.

Learning

Low risk

- people often don’t know about system functionality
- because they have never tried it
- systems with easy-to-make mistakes deter exploration
- if users fear making mistakes learning is hampered
- user-friendly systems foster learning
- “low risk”

Learning

Low risk

- prevent errors
- no invalid commands
- make errors easy to detect and correct

Learning

we learn to use systems faster when

- an operation is task-focused, simple and consistent
- vocabulary is task-focused, simple and consistent
- risk is low

Time

2

We perceive what we expect

Time

For presentation purposes the most important principles are:

Proximity
Similarity
Continuity
Closure
Symmetry
Figure / ground
Common face

Time

Most important factor in determining user satisfaction

- responsiveness
- four decades research has found
- an interactive system's responsiveness –
- it's ability to keep up with the user
- keep informed about its status
- and not wait unexpectedly
- is the most important factor in determining the user satisfaction

Time

Responsiveness

- keep a user informed even when a request can’t be fulfilled
- feedback
- what the user has done
- what is happening
- current status
- base the feedback on human cognitive deadlines

Time

Responsiveness

- Let you know immediately that your input was received
- Provide some indication of how long operations will take (see Fig. 12.1)
- Free you to do other things while waiting
- Manage queued events intelligently
- Perform housekeeping and low-priority tasks in the background
- Anticipate your most common requests

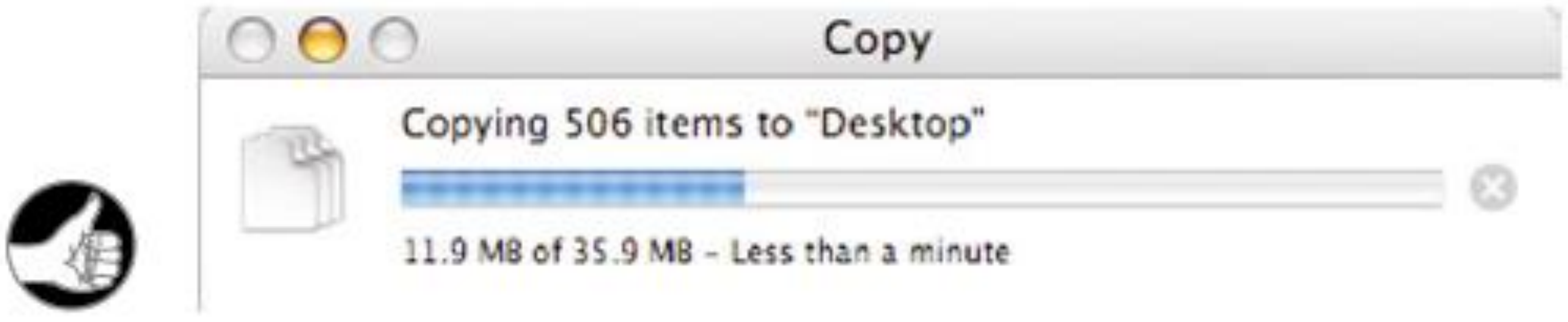

FIGURE 12.1
MacOS X file transfer: good progress indicator, useful time estimate, cancel button (circled X).

Time

Poor responsiveness

- Delayed feedback for button presses, scrollbar movement, or object manipulations
- Time-consuming operations that block other activity and cannot be aborted (see Fig. 12.2)
- Providing no clue how long lengthy operations will take (see Fig. 12.2)
- Jerky, hard-to-follow animations
- Ignoring user input while performing "housekeeping" tasks users did not request

FIGURE 12.2
MacOS X: No progress bar (just a busy bar) and no cancel. (A) MacOS X, (B) iMovie.

Time

Responsiveness

our systems and brain have durations and deadlines

Perceptual and Cognitive Functions	Duration
Shortest gap of silence that we can detect in a sound	1 millisecond (0.001 second)
Minimum time between spikes in auditory neurons, the fastest neurons in the brain	milliseconds (0.002 second)
Shortest time a visual stimulus can be shown and still affect us (perhaps unconsciously)	5 milliseconds (0.005 second)
Minimum noticeable lag in ink as someone draws with a stylus	10 milliseconds (0.01 second)
Maximum interval for auditory fusion of successive sound pulses into a pitched tone	20 milliseconds (0.02 second)
Maximum interval for visual fusion of successive images	50 milliseconds (0.05 second)
Speed of flinch reflex (involuntary motor response to possible danger)	80 milliseconds (0.08 second)
Time lag between a visual event and our full perception of it (or perceptual cycle time)	100 milliseconds (0.1 second)
Duration of *saccade* (involuntary eye movement), during which vision is suppressed	100 milliseconds (0.1 second)
Maximum interval between events for perception that one event caused another event	140 milliseconds (0.14 second)
Time required for a skilled reader's brain to comprehend a printed word	150 milliseconds (0.15 second)

Time

Responsiveness

our systems and brain have durations and deadlines

Time to *subitize* (determine the number of) up to four to five items in our visual field	200 milliseconds (0.2 second; 50 milliseconds/item)
Editorial "window" for events that reach consciousness	200 milliseconds (0.2 second)
Time to identify (i.e., name) a visually presented object	250 milliseconds (0.25 second)
Time required to mentally count *each* item in a scene when there are *more than four items*	300 milliseconds (0.3 second)
Attentional "blink" (inattentiveness to other input) following recognition of an object	500 milliseconds (0.5 second)
Visual-motor reaction time (intentional response to unexpected event)	700 milliseconds (0.7 second)
Maximum duration of silent gap between turns in person-to-person conversation	About 1 second
Duration of unbroken attention to a single task ("unit task")	6–30 second
Time to make critical decisions in emergency situations, e.g., medical triage	1–5 minutes
Duration of important purchase decision, e.g., buying a car	1–10 days
Time to choose a lifetime career	20 years

Time

Responsiveness

so we have deadlines

failure to acknowledge an action will result in the repetition of the action

- Acknowledge user actions instantly, even if returning the answer will take time; preserve users' perception of cause and effect
- Let users know when the software is busy and when it isn't
- Free users to do other things while waiting for a function to finish
- Animate movement smoothly and clearly
- Allow users to abort (cancel) lengthy operations they don't want
- Allow users to judge how much time lengthy operations will take
- Do its best to let users set their own work pace

Table 12.1 The Time Deadlines for Human Computer Interaction

Deadline	Perceptual and Cognitive Functions	Deadlines for Interactive System Design
0.001 second	• Minimum detectable silent audio gap	• Maximum tolerable delay or drop-out time for audio feedback (e.g., tones, "earcons," music)
0.01 second	• Preconscious perception • Shortest noticeable pen-ink lag	• Inducing unconscious familiarity of images or symbols • Generating tones of various pitches • Electronic ink maximum lag time
0.1 second	• Subitizing 1–4 items • Involuntary eye movement (saccade) • Flinch reflex • Perception of cause-effect • Perceptual-motor feedback • Visual fusion • Object identification • Editorial window of consciousness • The perceptual "moment"	• Assume users can "count" 1–4 screen items in ~100 milliseconds, but more than four take 300 milliseconds/item • Feedback for successful hand-eye coordination, e.g., pointer movement, object movement or resizing, scrolling, drawing with mouse • Feedback for click on button or link • Displaying "busy" indicators • Allowable overlap between speech utterances • Maximum interval between animation frames
1 second	• Max conversational gaps • Visual-motor reaction time for unexpected events • Attentional "blink"	• Displaying progress indicators for long operations • Finishing user-requested operations, e.g., open window • Finishing unrequested operations, e.g., auto-save • Time after info presentation that can be used for other computation, e.g., to make inactive objects active • Required wait time after presenting important info before presenting more
10 seconds	• Unbroken concentration on a task • Unit task: one part of a larger task	• Completing one step of a multistep task, e.g., one edit in a text editor • Completing user input to an operation • Completing one step in a wizard (multipage dialog box)
100 seconds	• Critical decision in emergency situation	• Assure that all info required for decision is provided or can be found within this time

Conclusion

use busy indicators
use progress indicators
delays between tasks is less bothersome than delays within tasks
display important information first
fake feedback until the goal can be reached
work ahead (load before use)
process user input according to priority
can reduce quality to improve time
provide timely feedback even on the web

References

Johnson J. (2010) *Designing with the Mind in Mind: Simple Guide to Understanding User Interface Design Rules.* Morgan Kaufmann, San Francisco

Krug S. (2006) *Don't make me think: A Common Sense Approach to Web Usability*, 2nd Edition, New Riders, Berkeley, California, USA

Thank You!

any questions?