



Digital Innovation
Development
for Entrepreneurs



COURSE
DETAILS

M	Th	Monday	Thursday
17-Jun-24	20-Jun-24	Course Introduction	Project - Contextual Design
24-Jun-24	27-Jun-24	Usability & Guidelines	teachers day (am)
1-Jul-24	4-Jul-24	Principles & Theories	Lab 1: Contextual Inquiry for Digital
8-Jul-24	11-Jul-24	Cognition - Perceptions	Lab 2: Contextual Design – modelling I
15-Jul-24	18-Jul-24	Cognition - Limitations	Lab 3: Contextual Design – modelling II
22-Jul-24	25-Jul-24	closed	Lab 4: Contextual Design – modelling III
29-Jul-24	1-Aug-24	closed	Cognition - Memory
5-Aug-24	8-Aug-24	Cognition - Learning	review
12-Aug-24	15-Aug-24		reading week
19-Aug-24	22-Aug-24		midterm exams



GOLDEN
RULES

1. Strive for consistency
2. Cater to universal usability
3. Offer informative feedback
4. Design dialogs to yield closure
5. Prevent errors
6. Permit easy reversal of actions
7. Support internal locus of control
8. Reduce short term memory load

The 8 Golden Rules of Interface Design





GOLDEN
RULES

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The 8 Golden Rules of Interface Design



Strive for Consistency

GOLDEN
RULES

consistent sequences of actions

identical terminology

consistent color, layout, fonts, etc.

exceptions

e.g. confirm delete, no password echo

limited & comprehensible



Cater for Universal Usability

GOLDEN
RULES

design for diverse use (plasticity) & diverse users (universal)

plasticity facilitates content transformation

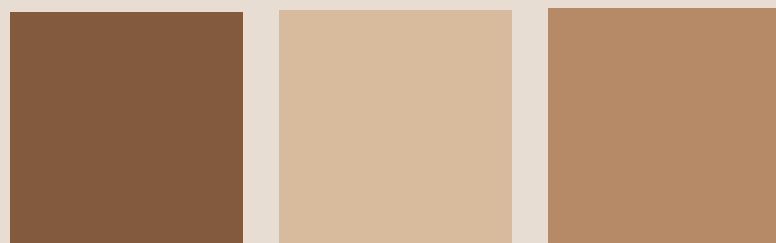
novice to expert

- explanations

- features for experts e.g. shortcuts

age ranges

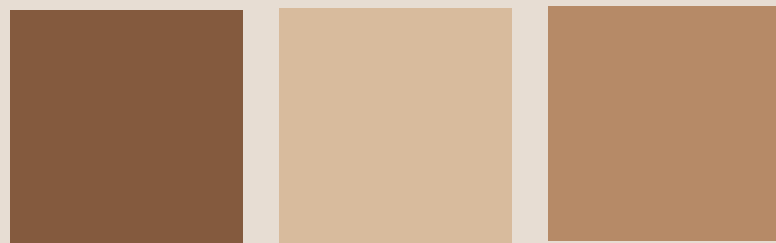
disabilities



Design dialogs to yield Closure

GOLDEN
RULES

beginning, middle , end (closure)
e.g. confirmation page



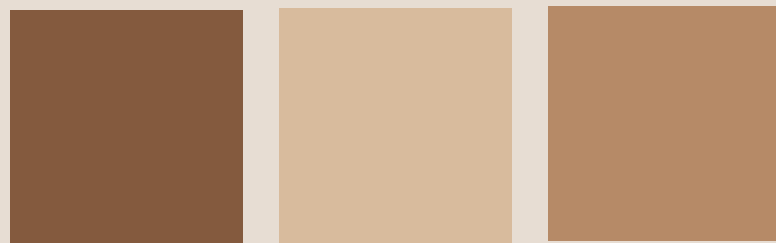
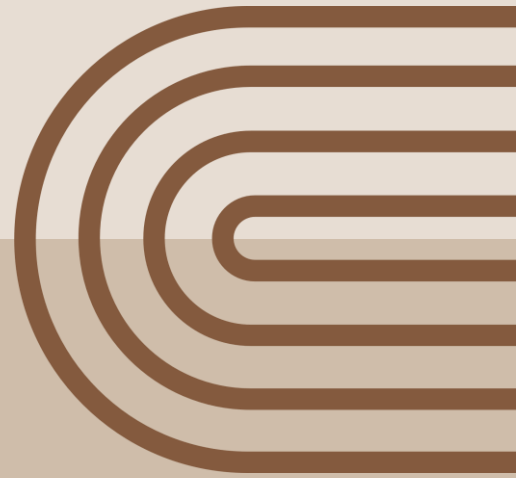
⊕ Offer informative feedback

GOLDEN
RULES

action – feedback

usual action – modest feedback

rare action – substantial feedback



Prevent Errors

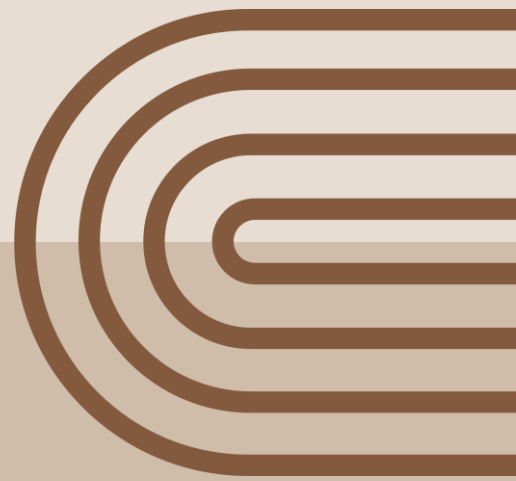
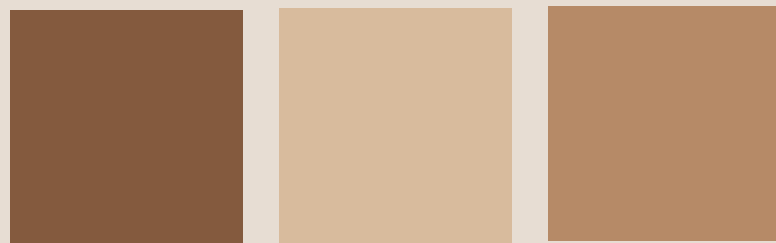
GOLDEN
RULES

prevent users making (serious) errors

validation

grey out unavailable options

selection rather than freestyle typing



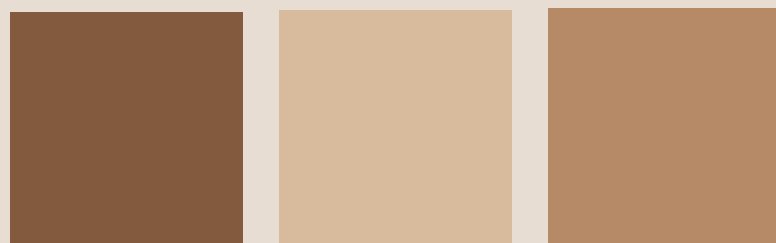
Permit *easy* reversal of actions

GOLDEN
RULES

easy recovery

reversible actions

options of reversing a single or a group of actions



Support Internal Locus of Control

GOLDEN
RULES

user is in control

'in charge' feeling

no surprises

dislikes:

tedious data-entry sequences

difficulty in obtaining necessary information

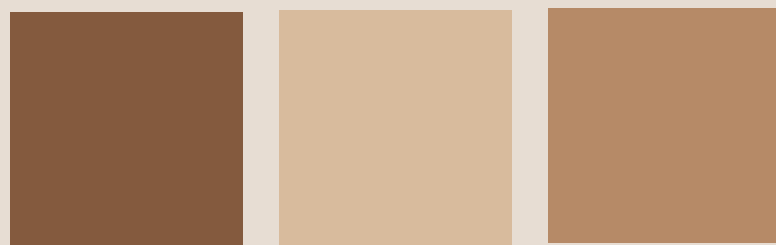
inability to produce their desired result



Reduce short term memory load

GOLDEN
RULES

users have short-term memory limits
use 5 items (+/- 1)



Interactive Design

USER
DESIGN

feedback & response

Providing *clear and timely feedback* to users in response to their actions

affordance

Designing elements that *suggest their functionality* or how they can be interacted with

consistency

Maintaining consistent patterns and behaviours across the interface to reduce cognitive load and enhance learnability

tools & techniques

Prototyping tools, user *flow diagrams*

Norman's four principles of design



Visibility

users should know, just by looking at an interface, what their options are and how to access them



Feedback

provide clear responses to user actions to let them know whether or not their action was successful



Affordance

is the link between how things look and how they're used



Mapping

the controls for something will closely resemble their effect e.g. vertical scroll bar



Affordance

Affordance refers to the properties of an object that suggest how it can be used

A door handle affords pulling & a button affords pressing

Affordance guides users on how to interact with the interface

Scroll bars in a web browser affords scrolling

Phone icons afford tapping

Trash bin – drag items to delete them

Text fields – indicate where users enter data



Feedback

Feedback is the response from the system to the user's actions

Clicking a button changes its color to show it has been pressed

feedback types: visual, auditory, haptic

visual - highlight a selected menu item

auditory – a sound when a time period is finished, with a

haptic – a vibration when a time period is finished

- confirms actions
- prevents errors
- enhances user confidence

Examples: progress bars, error messages



Consistency

CONSISTENCY

Consistent user interface goal

Definition is elusive - multiple levels sometimes in conflict

Sometimes advantageous to be inconsistent

Consistent

delete/insert character
delete/insert word
delete/insert line
delete/insert paragraph

Inconsistent A

delete/insert character
remove/bring word
destroy/create line
kill/birth paragraph

Inconsistent B

delete/insert character
remove/insert word
delete/insert line
delete/insert paragraph



Inconsistency

SLOWER

Inconsistent elements

slow users by 5-10 %

Inconsistent terminology

slow users by 20-25 %

CONSISTENCY



Norman's seven stages of action

1. Forming the goal
2. Forming the intention
3. Specifying the action
4. Executing the action
5. Perceiving the system state
6. Interpreting the system state
7. Evaluating the outcome

STAGES OF
ACTION

Stages of
Action
Model

Interface model

Foley and Van Dam four-level approach

Conceptual level

Semantic level

Syntactic level

Lexical level

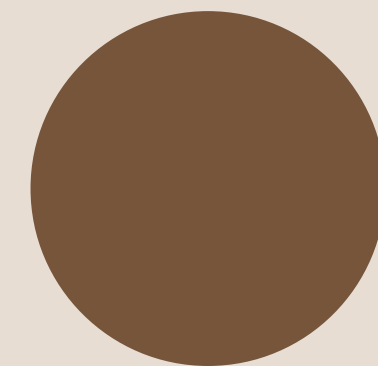
DESIGN BY
LEVEL

Conceptual level

user's mental model
e.g. drawing program that operates on objects

Semantic level

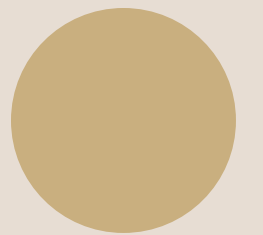
the meanings conveyed by the user's input & computer's output
e.g. delete object, undo



Learning

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



Interface model

Foley and Van Dam four-level approach

Conceptual level

Semantic level

Syntactic level

Lexical level

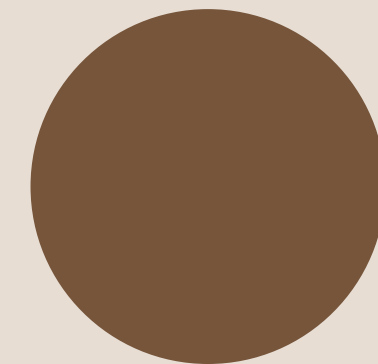
DESIGN BY
LEVEL

Syntactic level

how actions are assembled to instruct the computer to perform a task
e.g. drag an object to the trash can & confirmation dialog box

Lexical level

device mechanisms
e.g. mouse double-click within 0.2 seconds

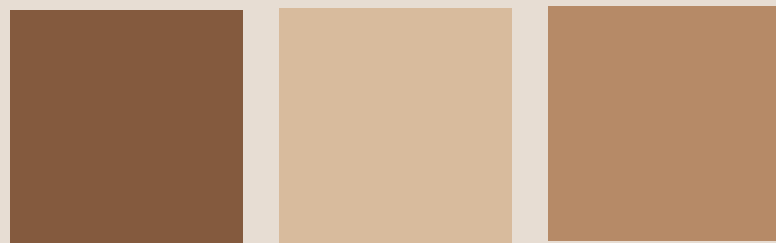


Gestalt Principles of Visual Perceptions

PERCEPTIONS

For presentation purposes the most important principles are:

- Proximity
- Similarity
- Continuity
- Closure
- Symmetry
- Figure / ground
- Common face



Proximity

Objects near each other appear grouped
Figure 2.1 stars are horizontal or vertically grouped
Design objects together
To reduce visual clutter group without boxes or borders



FIGURE 2.1

Proximity: Items that are closer appear grouped. Left: rows, Right: columns.

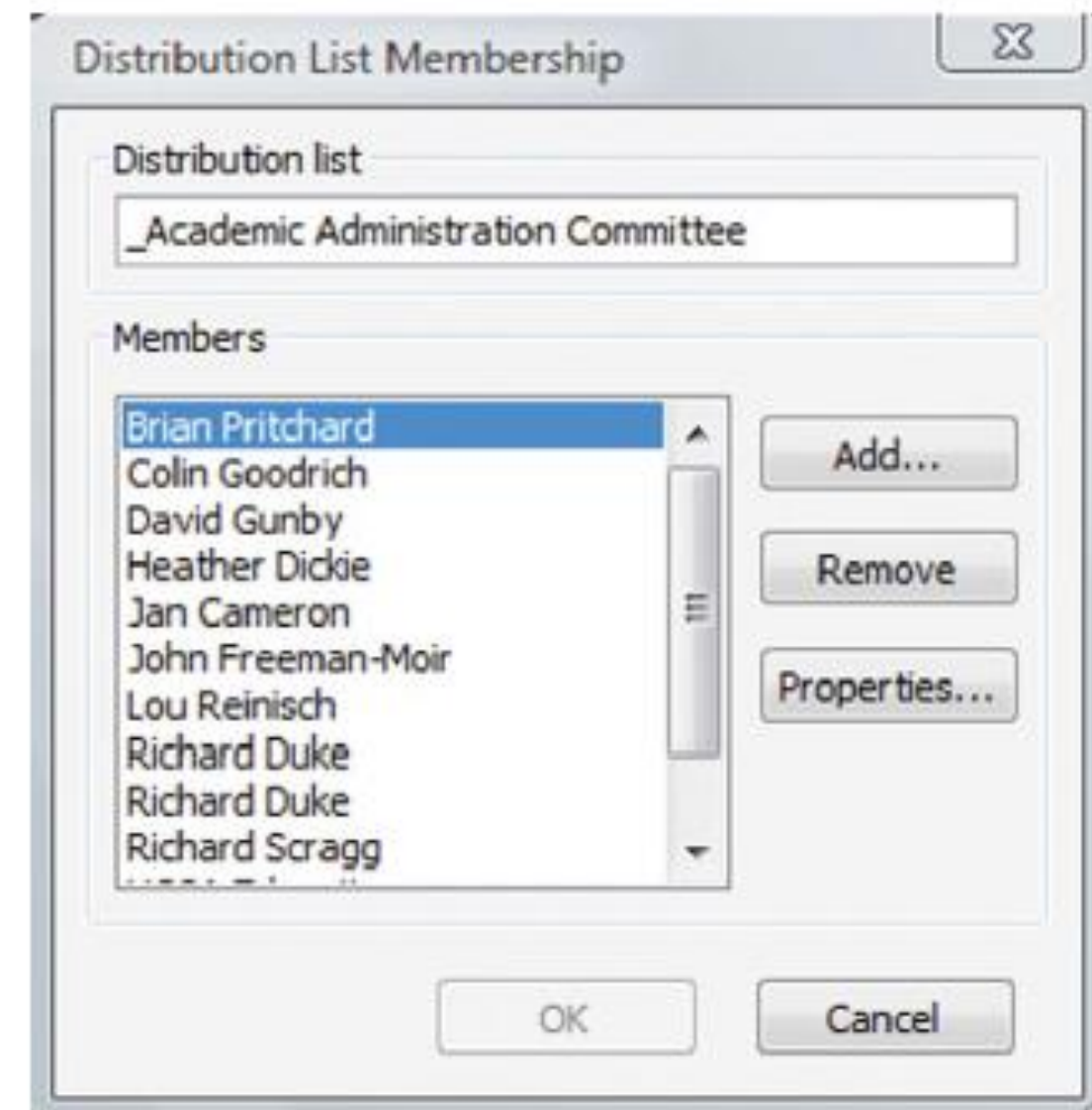


FIGURE 2.2

In Outlook's Distribution List Membership dialog box, list buttons are in a group box, separate from the window-control buttons.



Similarity

PERCEPTIONS

Objects that appear similar also appear grouped.



FIGURE 2.5

Similarity: Items appear grouped if they look more similar to each other than to other objects.

Similarity: Items appear grouped if they look more similar to each other than to other objects.
FIGURE 2.5

Continuity

- We tend to resolve ambiguity
- Fill in missing data
- Perceive whole objects
- Assume continuous forms

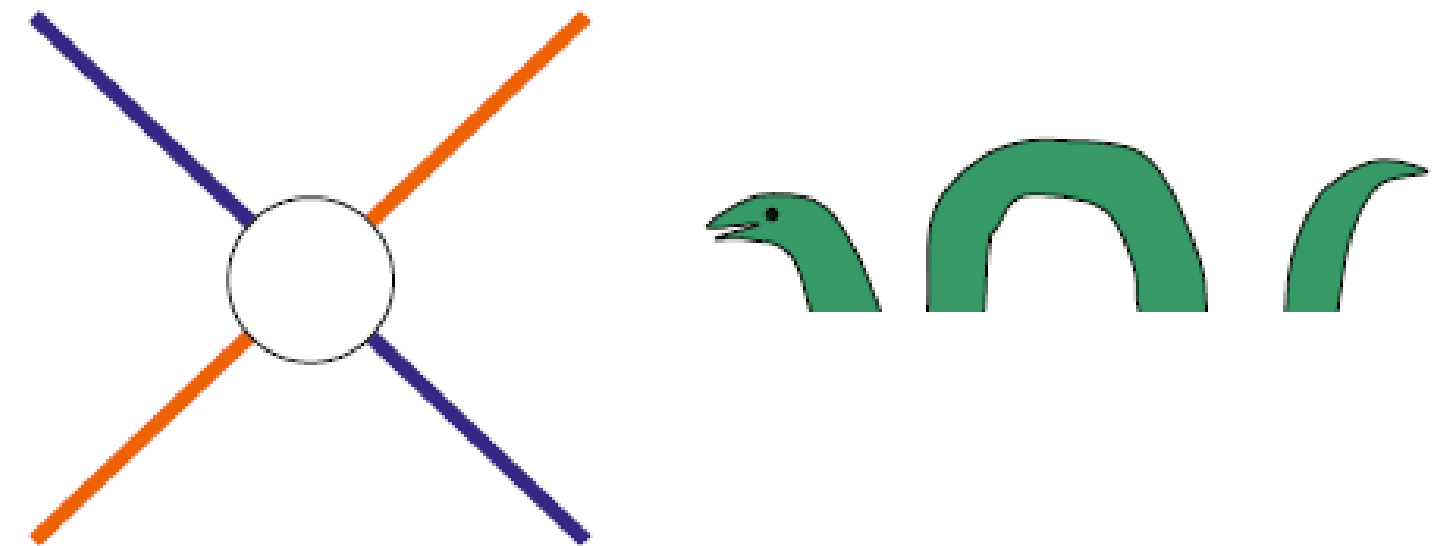


FIGURE 2.8

Continuity: Human vision is biased to see continuous forms, even adding missing data if necessary.

necessary:

Continuity: Human vision is biased to see continuous forms, even adding missing data if

FIGURE 2.8

Continuity

PERCEPTIONS

We fill in missing data

Slide controls: we see continuous lines rather than 2 lines separated by an object

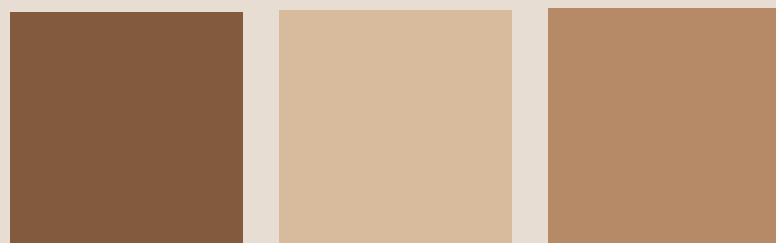


FIGURE 2.9

The IBM company logo uses the Continuity principle to form letters from disconnected patches.

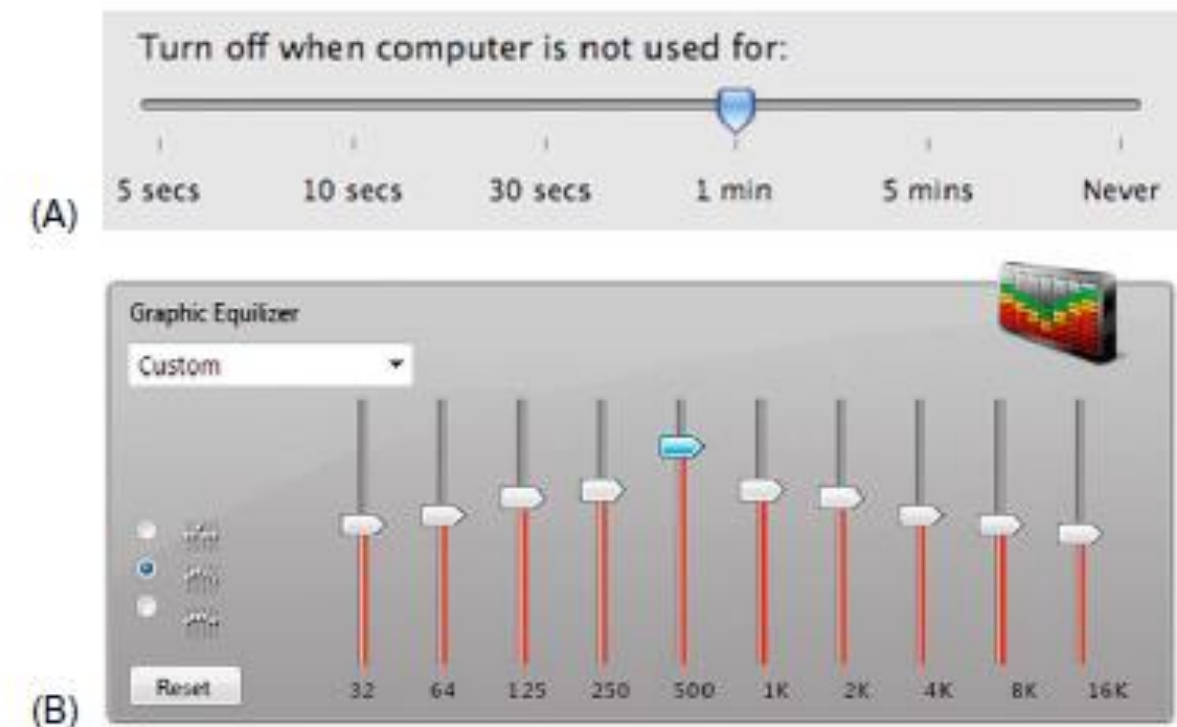


FIGURE 2.10

Continuity: We see a slider as a single slot with a handle somewhere on it, not as two slots separated by a handle. (A) Mac OS, (B) ComponentOne.

Closure

PERCEPTIONS

Similarly to continuity
we close open figures



FIGURE 2.12

Icons depicting stacks of objects exhibit the Closure principle: partially visible objects are perceived as whole.

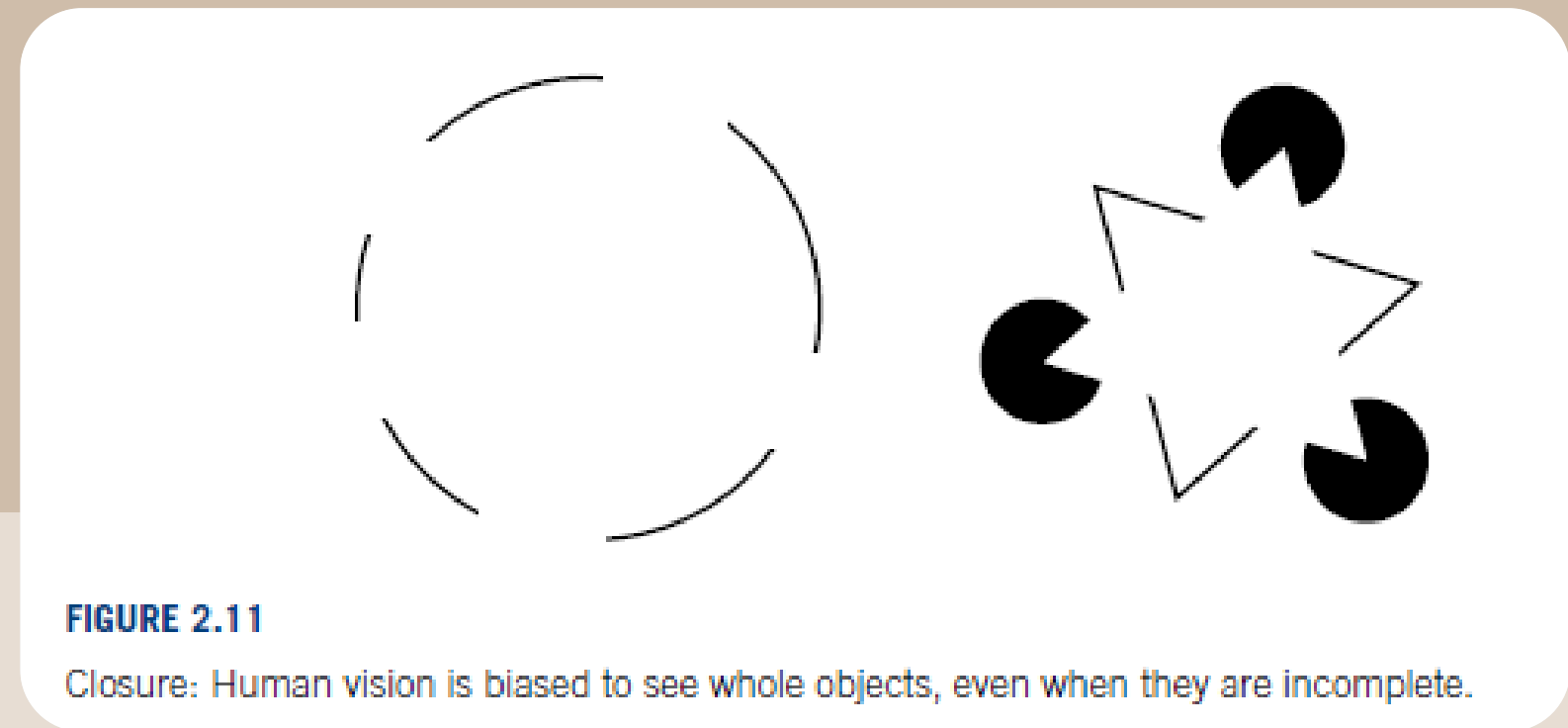


FIGURE 2.11

Closure: Human vision is biased to see whole objects, even when they are incomplete.

Closure: Human vision is biased to see whole objects, even when they are incomplete.

FIGURE 2.11

Symmetry

We see objects – figure 2.13 as two overlapping diamonds

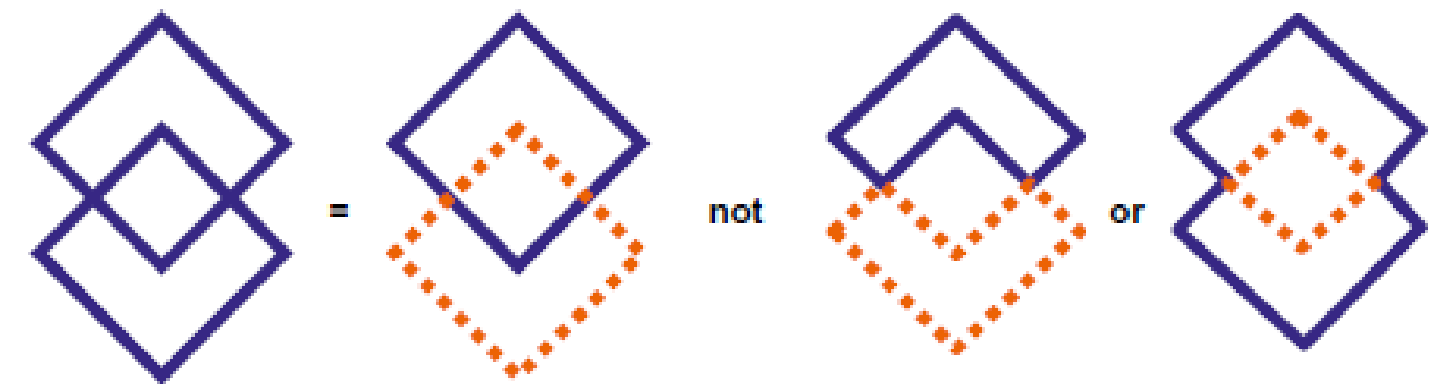


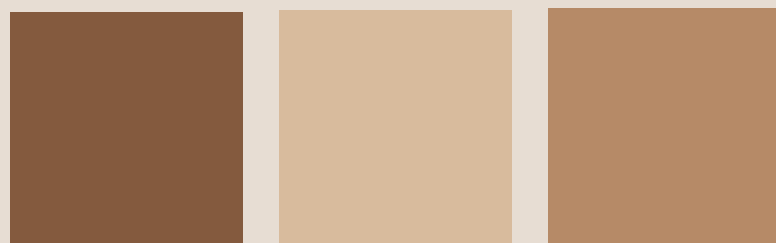
FIGURE 2.13

Symmetry: The human visual system tries to resolve complex scenes into combinations of simple, symmetrical shapes.

symmetrical shapes

Symmetry: The human visual system tries to resolve complex scenes into combinations of simple

FIGURE 2.13



Symmetry

PERCEPTIONS

We can exploit this trait in design
3D on a 2D display

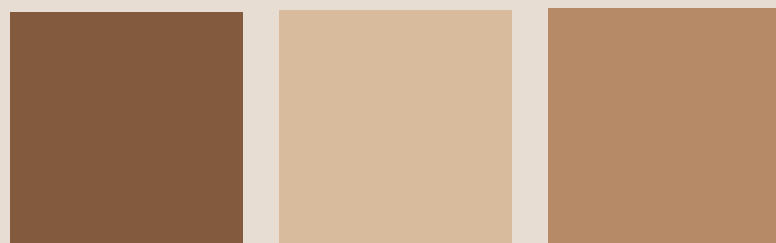


FIGURE 2.14

The cover of the book *Coherence in Thought and Action* (Thagard, 2002) uses the Symmetry, Closure, and Continuity principles to depict a cube.

Closure and Continuity principles to depict a cube.
the cover of the book coherence in thought and action (thagard, 2002) uses the symmetry,

Figure / Ground

PERCEPTIONS

We separate into foreground and background

Foreground is primary attention

Small triangle first

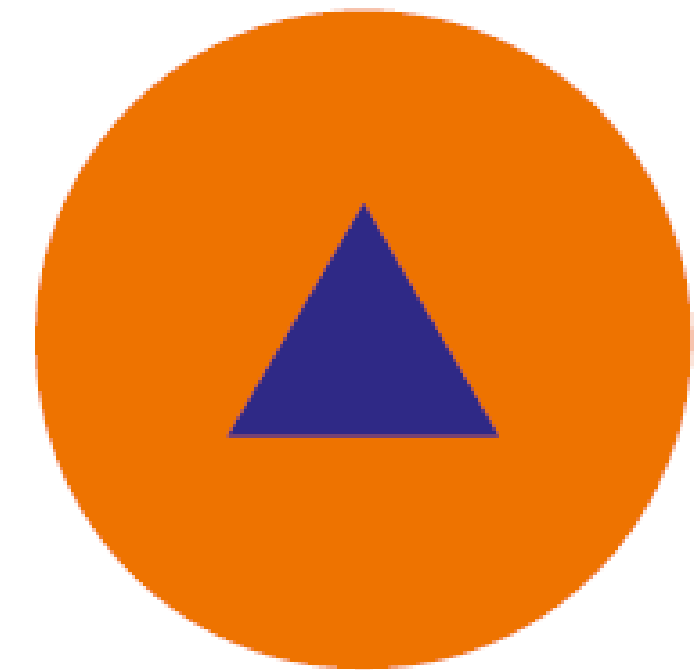


FIGURE 2.16

Figure/Ground: When objects overlap, we see the smaller as figure on ground.

Figure/Ground: When objects overlap, we see the smaller as figure on ground.

FIGURE 2.16



Figure / Ground

PERCEPTIONS

We separate into foreground and background

Black or white foreground?



FIGURE 2.17

M. C. Escher exploited figure/ground ambiguity in his art.

M. C. Escher exploited figure/ground ambiguity in his art.

FIGURE 2.17



Common Face

PERCEPTIONS

We perceive objects that are moving together as grouped or related

Working together not individually

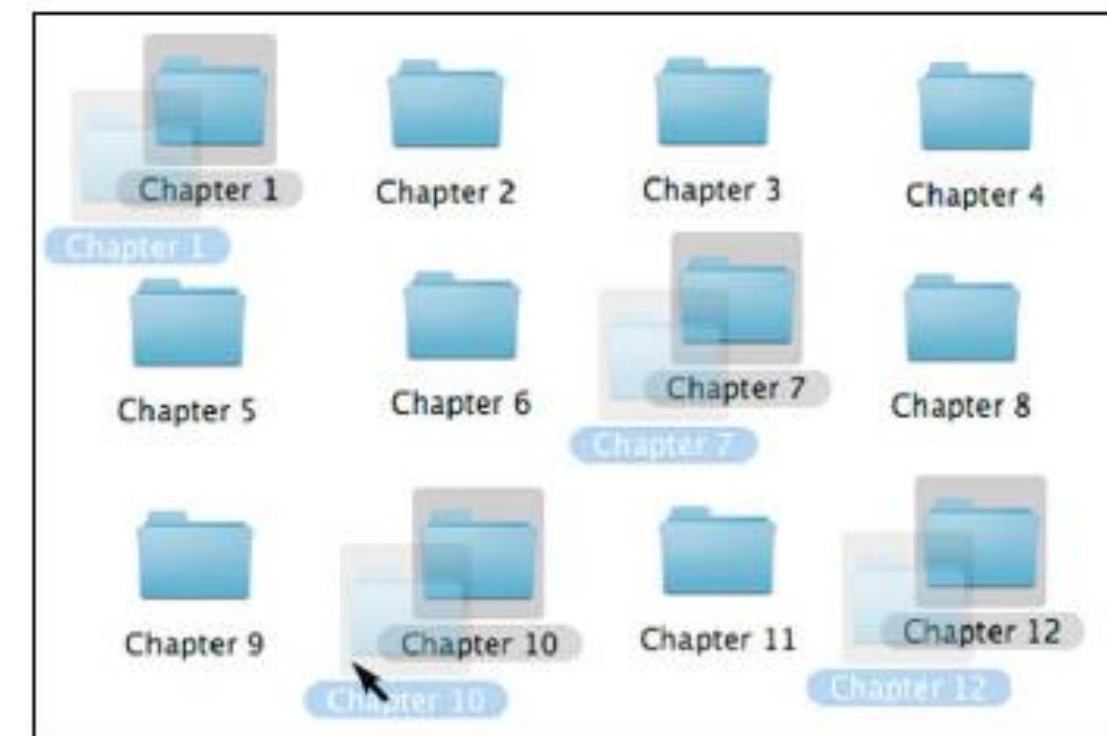


FIGURE 2.23

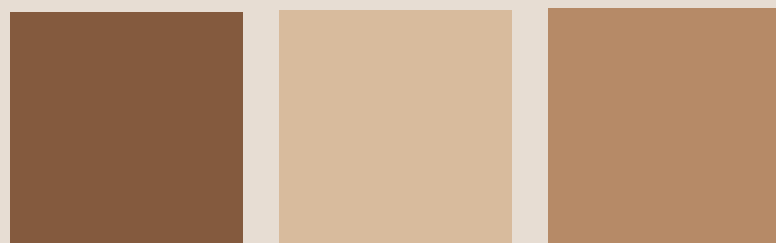
Similarity and Common Fate: When users drag folders that they have selected, common highlighting and motion make the selected folders appear grouped.

Perceptions

PERCEPTIONS

A design can be checked by checking each principle

Proximity
Similarity
Continuity
Closure
Symmetry
Figure / ground
Common face

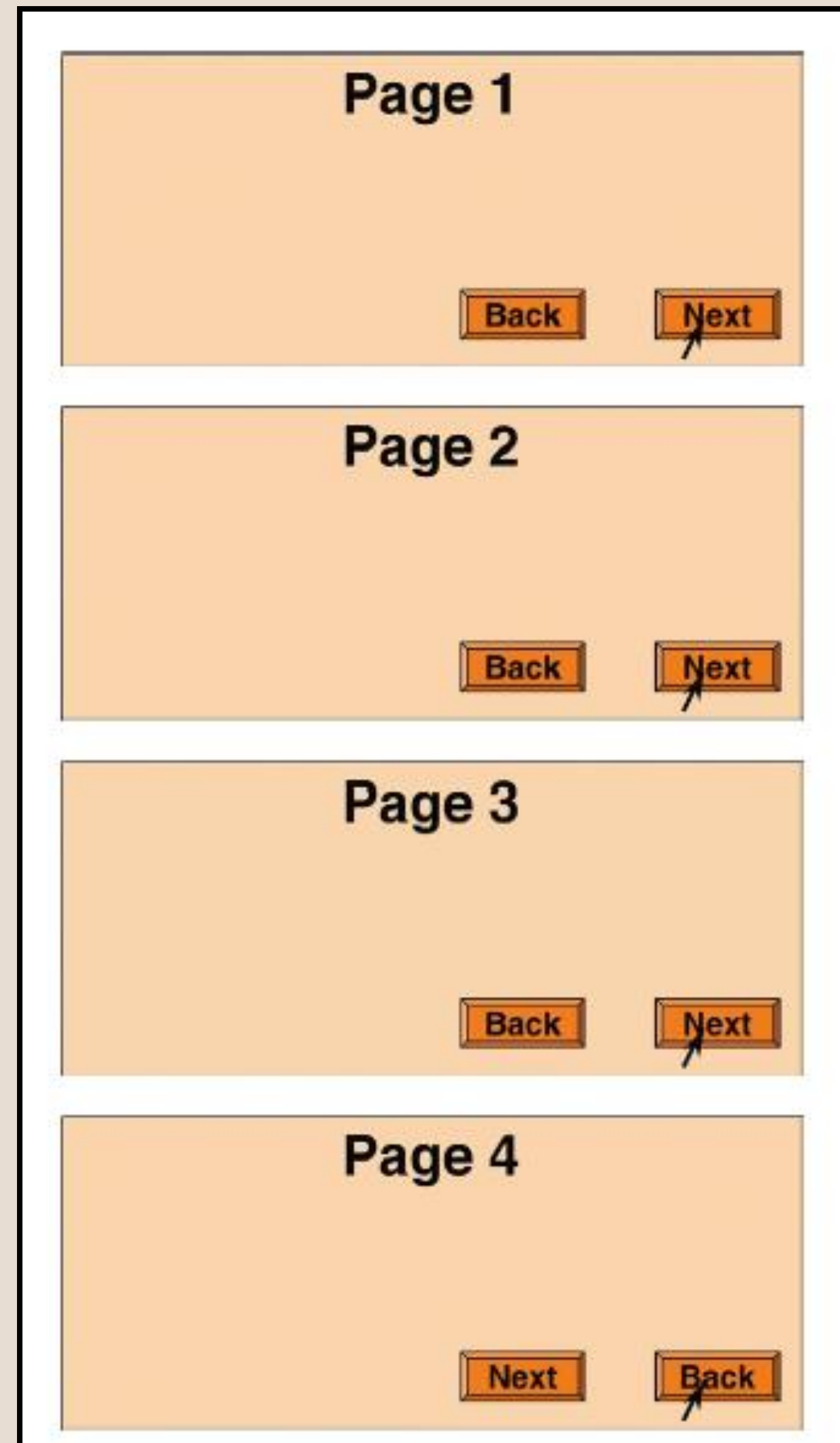


Perceptions – bias by experience

Users select items without looking at them carefully

Example of a design guideline:

place controls consistently



Unstructured:

You are booked on United flight 237, which departs from Auckland at 14:30 on Tuesday 15 Oct and arrives at San Francisco at 11:40 on Tuesday 15 Oct.

Structured:

Flight: United 237, Auckland → San Francisco
Depart: 14:30 Tue 15 Oct
Arrive: 11:40 Tue 15 Oct

FIGURE 3.1

Structured presentation of airline reservation information is easier to scan and understand.

Structured presentation of airline reservation information is easier to scan and understand.

FIGURE 3.1

we seek and use visual structure

Perceiving structure helps us make sense of objects and events quickly

So when information is presented in a structured way it is easier to scan and understand



visual hierarchy

PERCEPTIONS

Create a Clear Visual Hierarchy

Organize and prioritize the contents of a page by using size, prominence, and content relationships. Let's look at these relationships more closely.

The more important a headline is, the larger its font size should be. Big bold headlines help to grab the user's attention as they scan the Web page. The more important the headline or content, the higher up the page it should be placed. The most important or popular content should always be positioned prominently near the top of the page, so users can view it without having to scroll too far. Group similar content types by displaying the content in a similar visual style, or in a clearly defined area.

Create a Clear Visual Hierarchy

Organize and prioritize the contents of a page by using size, prominence, and content relationships.

Let's look at these relationships more closely:

- **Size.** The more important a headline is, the larger its font size should be. Big bold headlines help to grab the user's attention as they scan the Web page.
- **Prominence.** The more important the headline or content, the higher up the page it should be placed. The most important or popular content should always be positioned prominently near the top of the page, so users can view it without having to scroll too far.
- **Content Relationships.** Group similar content types by displaying the content in a similar visual style, or in a clearly defined area.

FIGURE 3.11

Find the advice about prominence in each of these displays. Prose text format (left) makes people read everything. Visual hierarchy (right) lets people ignore information irrelevant to their goals.



design implications



FIGURE 6.6

This error message for faulty login is missed by some users even though it is not far from "Login" button.

RETURNING CUSTOMER LOGIN

Login ID not found.

Login ID:

fooo

Password:

Remember my Login ID for faster logins.

LOGIN

Error messages

need to be in the fovea – where the user is looking

mark the error

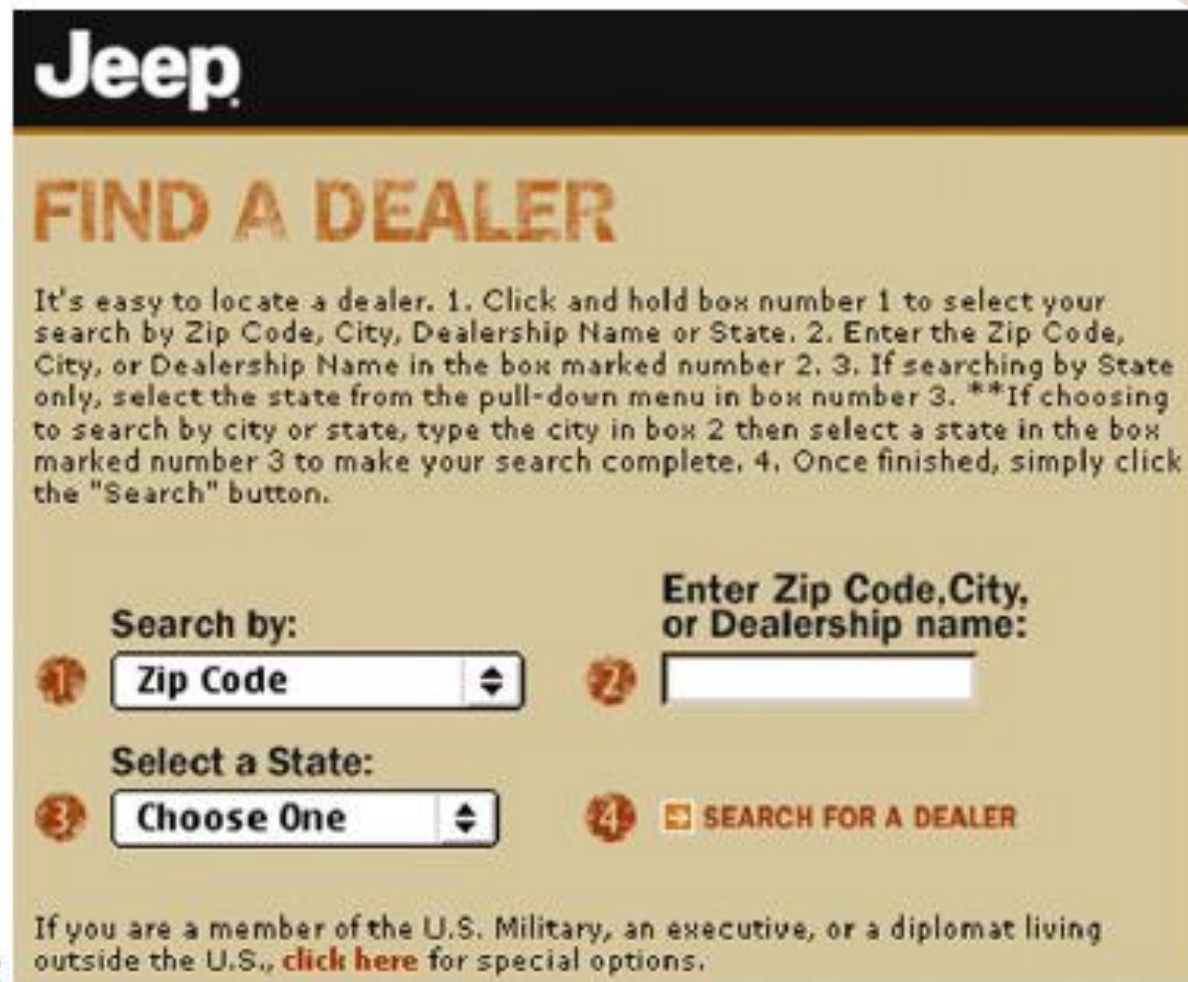
if the error message is in the periphery it wont be noticed

the user just sees an empty field

red is used for errors



unnecessary reading



Jeep

FIND A DEALER

It's easy to locate a dealer. 1. Click and hold box number 1 to select your search by Zip Code, City, Dealership Name or State. 2. Enter the Zip Code, City, or Dealership Name in the box marked number 2. 3. If searching by State only, select the state from the pull-down menu in box number 3. **If choosing to search by city or state, type the city in box 2 then select a state in the box marked number 3 to make your search complete. 4. Once finished, simply click the "Search" button.

Search by:
1 Zip Code

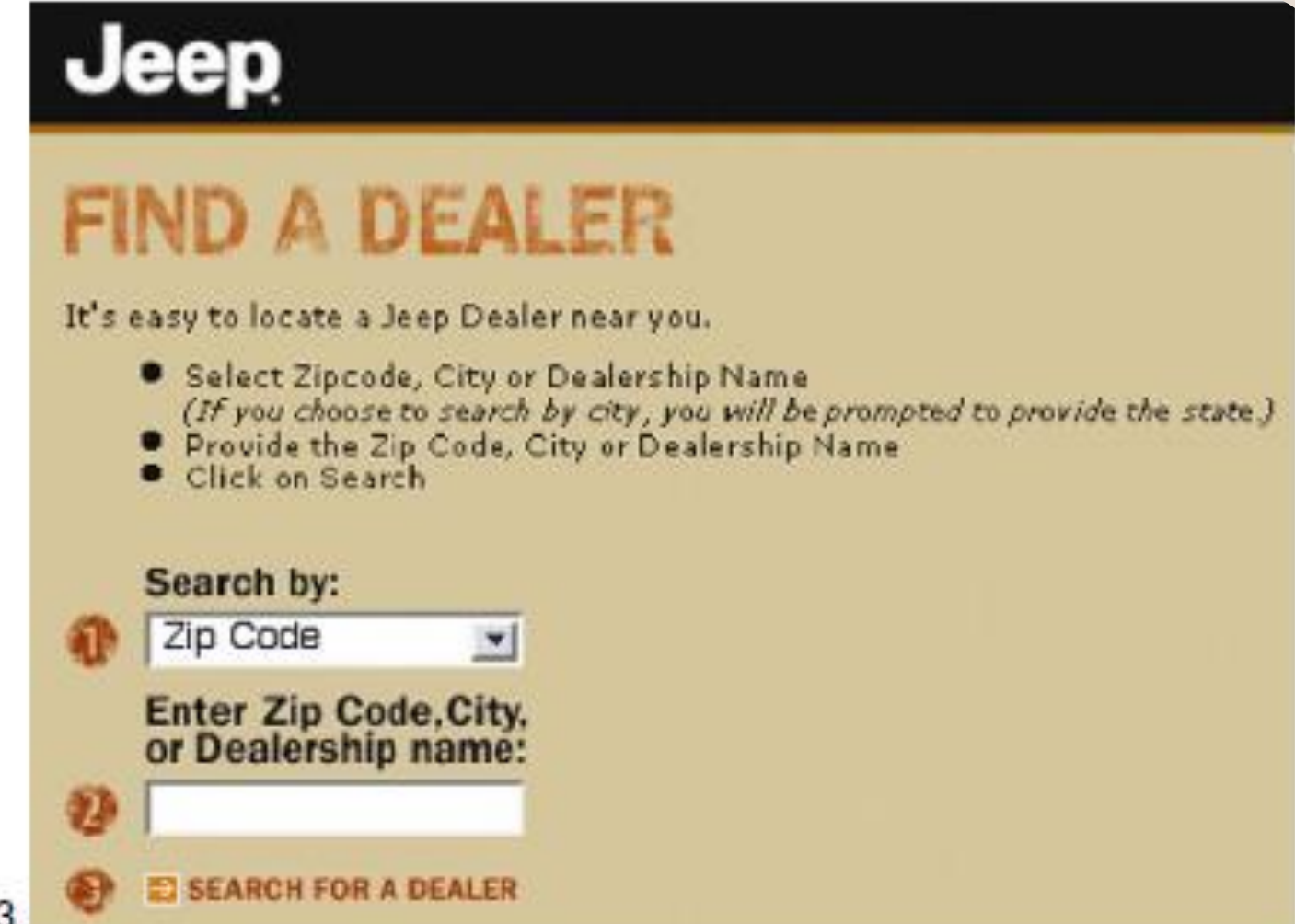
Select a State:
3 Choose One

Enter Zip Code, City, or Dealership name:
2

4 SEARCH FOR A DEALER

If you are a member of the U.S. Military, an executive, or a diplomat living outside the U.S., [click here](#) for special options.

2002



Jeep

FIND A DEALER

It's easy to locate a Jeep Dealer near you.

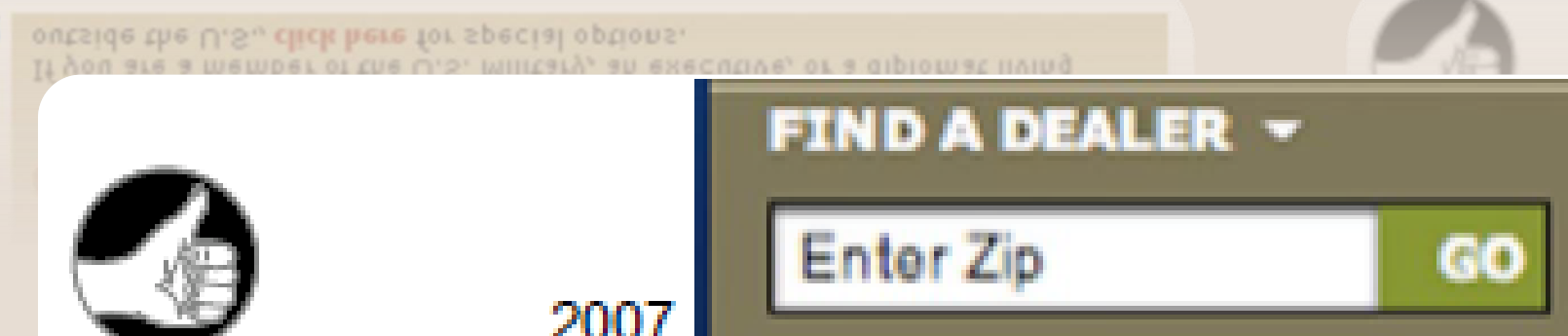
- Select Zipcode, City or Dealership Name
(If you choose to search by city, you will be prompted to provide the state.)
- Provide the Zip Code, City or Dealership Name
- Click on Search

Search by:
1 Zip Code

Enter Zip Code, City, or Dealership name:
2

3 SEARCH FOR A DEALER

2003



Jeep

FIND A DEALER

Enter Zip

GO

2007

FIGURE 4.17

Between 2002 and 2007, Jeep.com drastically reduced the reading required by "Find a Dealer."

Short-term Memory

MEMORY

Short-term memory is not a store.

It is a combination of phenomena arising from perception and attention – awareness.

Short-term Memory

MEMORY

Characteristics

Focus of our attention

What we are conscious of at any given moment

Two important characteristics of short-term memory

1. Low capacity
2. Volatile

Short-term Memory

MEMORY

Change Blindness

- A person pretends to be a tourist and asks for directions
- A person tries to help
- Whilst looking at a map they are distracted
- The experimenter changes hat, hair colour, even gender,
- but the helper does not notice – their focus is on the map

Design Implications

MEMORY

People need assistance to help remember

- Augment memory

- Don't burden memory

Examples:

- PIN / passwords – complex or too long

- rememberable date – what date?

Results in:

- passwords written on post-its & stuck to the PC

- Simple passwords – easy to crack

- Customer support recovering passwords

Design Implications

MEMORY

Consistency

more consistency = less memory burden

Design A is easiest to learn

Design B will take more time to learn

Design C will result in more errors over a long period of time

Table 7.1 Which UI Design will be Easiest to Learn and Remember? Which One will be Hardest?

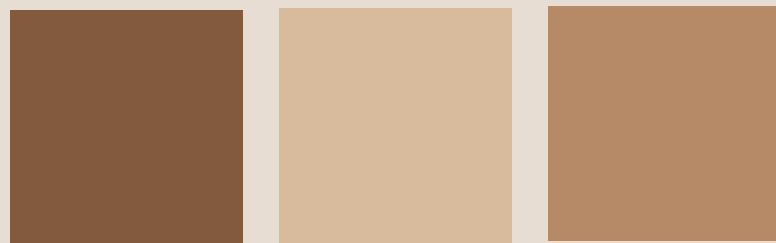
Object	Document Editor Keyboard Shortcuts: Alternative Designs					
	Design A		Design B		Design C	
	Cut	Paste	Cut	Paste	Cut	Paste
Text	CNTRL-X	CNTRL-V	CNTRL-X	CNTRL-V	CNTRL-X	CNTRL-V
Sketch	CNTRL-X	CNTRL-V	CNTRL-C	CNTRL-P	CNTRL-X	CNTRL-V
Table	CNTRL-X	CNTRL-V	CNTRL-Z	CNTRL-Y	CNTRL-X	CNTRL-V
Image	CNTRL-X	CNTRL-V	CNTRL-M	CNTRL-N	CNTRL-X	CNTRL-V
Video	CNTRL-X	CNTRL-V	CNTRL-Q	CNTRL-R	CNTRL-E	CNTRL-R

Attention

ATTENTION

Important patterns include:

1. We focus on our goals not our tools
2. We use external aids to keep track of what we are doing
3. We follow an information 'scent' towards our goal
4. We prefer familiar paths
5. Goal, execute, evaluate
6. We forget to cleanup



Design Implications

ATTENTION

goal

Provide clear paths for the goals the software is intended for, including the initial steps.

execute

Design objects and actions on the task. Provide a scent to guide the user without taking them away from their goal.

evaluate

Provide feedback and allow users to go back to achieve their goal.



Long-term Memory

MEMORY

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.

The more a pattern is reactivated the stronger it becomes resulting in it being easier to reactivate
Corresponding perception becomes easier to recognize and recall.

Recognition & Recall

RECOGNITION & RECALL

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.



Recognition & Recall

RECOGNITION
& RECALL

Recognition is easy

- We assess situations quickly
- Ancestors needed to know if an animal was potential food or a threat immediately
- We recognize faces very quickly
- We don't recognize faces quickly
- The same face perceived again reactivates the same pattern, only easier than before
- This is *recognition*



Recognition & Recall

RECOGNITION
& RECALL

Recall is hard

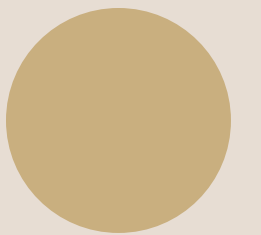
- Recall is when old patterns are reactivated without perceptual input
- We have developed without the immediate necessity for recall but the ability of recall
- We use aids to help us with recall such as
 - Notes for speeches
 - Diaries for dates
 - Address books
 - Calendars for appointments



Implications for UI design

Graphical User Interfaces (GUI)

- The ease of recognition verses the difficulty in recall is seen in GUI design
- The GUI is based on two well-known UI design rules:
 1. **See & choose is easier than recall & type**
 2. Use pictures where possible to convey function



Recognition & Recall

RECOGNITION
& RECALL

See and choose

- Show users their options
- Allow them to choose
- Not require the user to recall what they want
- Recognition rather than recall is one of the widely used heuristics for UI evaluation
- Recall and type can be used such as search boxes



Learning

LEARNING

Krug 2006

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

Learning

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

LEARNING

Consistent vocabulary – we learn faster if

- task-focused
- familiar
- consistent



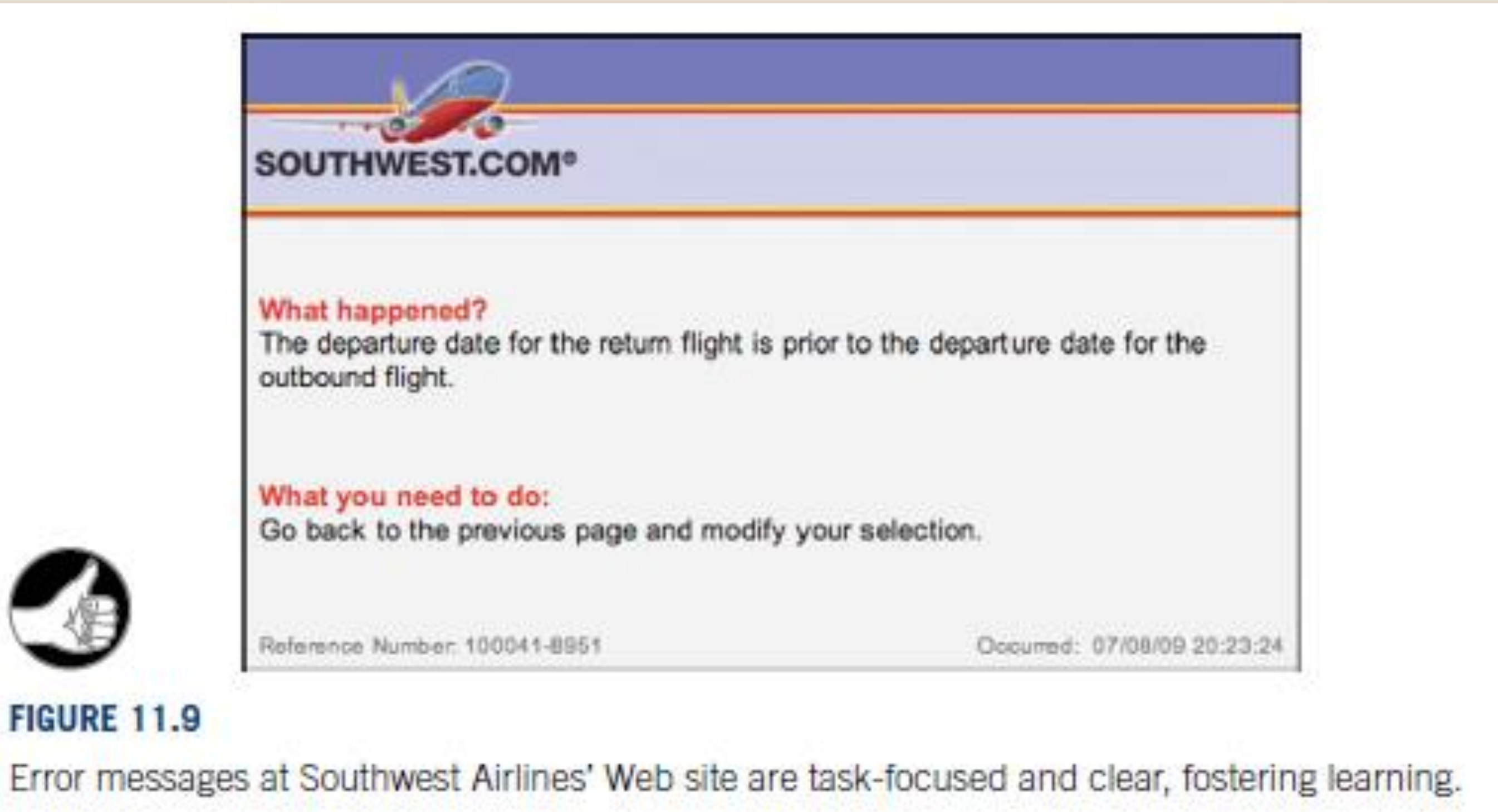


FIGURE 11.9

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

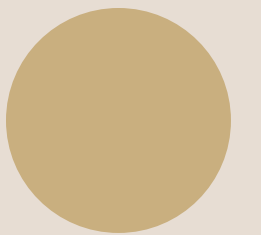


Learning

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)



Time

TIME

Most important factor in determining user satisfaction

responsiveness

four decades research has found

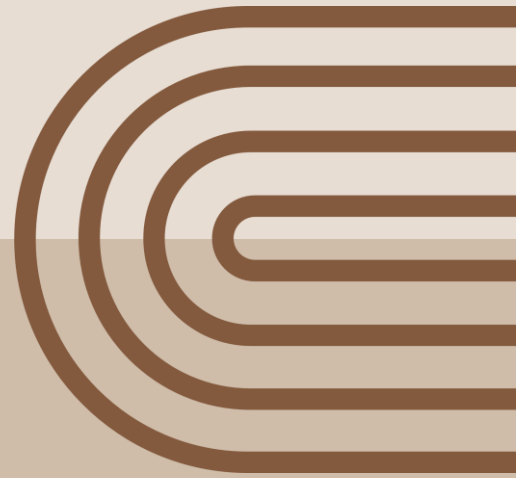
an interactive system's responsiveness –

it's ability to keep up with the user

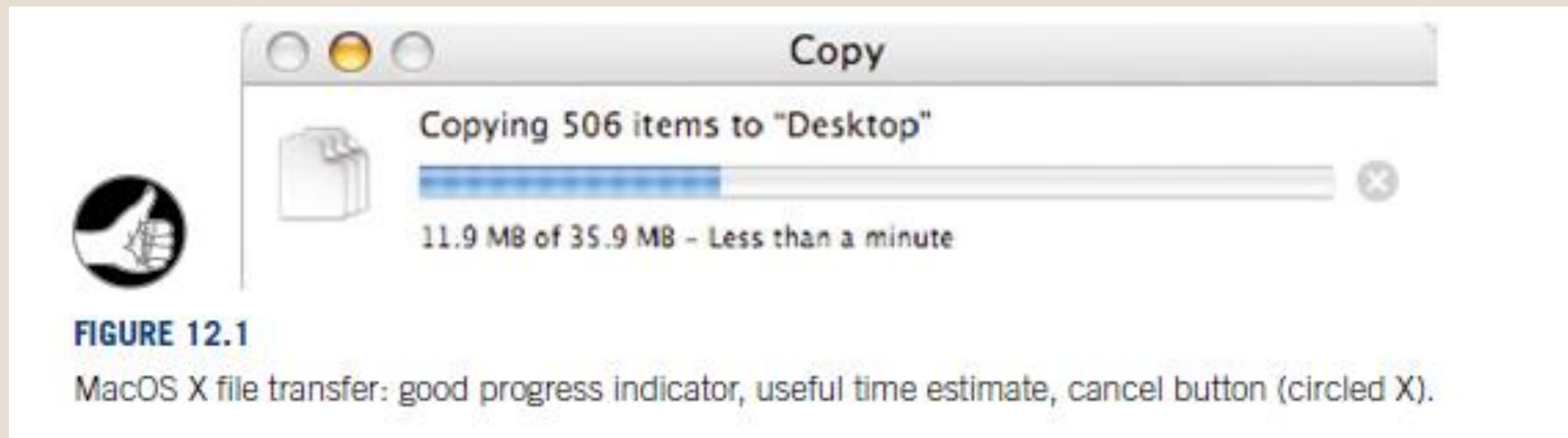
keep informed about its status

and not wait unexpectedly

is the **most** important factor in determining the user satisfaction



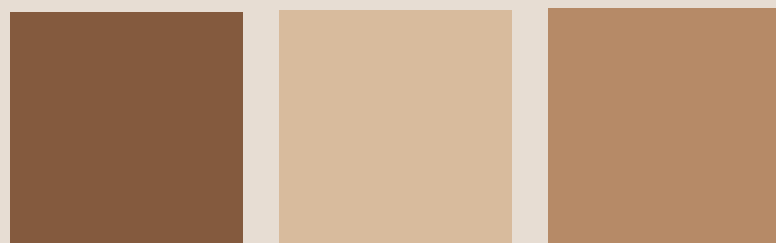
Time



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



KNOW YOUR
USERS

 novice

 knowledgeable

 expert

time to learn

how long does it take to learn relevant tasks?

speed of performance

how long does it take to perform relevant benchmarks?

rate of errors by users

how many & what kind of errors are made during benchmark tasks?

retention over time

frequency of use and ease of learning help make for better user retention

subjective satisfaction

allow for user feedback via interviews, comments & satisfaction scales

USABILITY
GOALS



Evaluation