

# DESIGNING THE USER AND SYSTEM INTERFACES

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## Lecture 8

1.11.2014, Saturday

# Outline of This Lecture

- User and System Interfaces
- Understanding the User Interface
- User-Interface Design Concepts
- The Transition from Analysis to User-Interface Design
- User-Interface Design
- Identifying System Interfaces
- Designing System Inputs
- Designing System Outputs

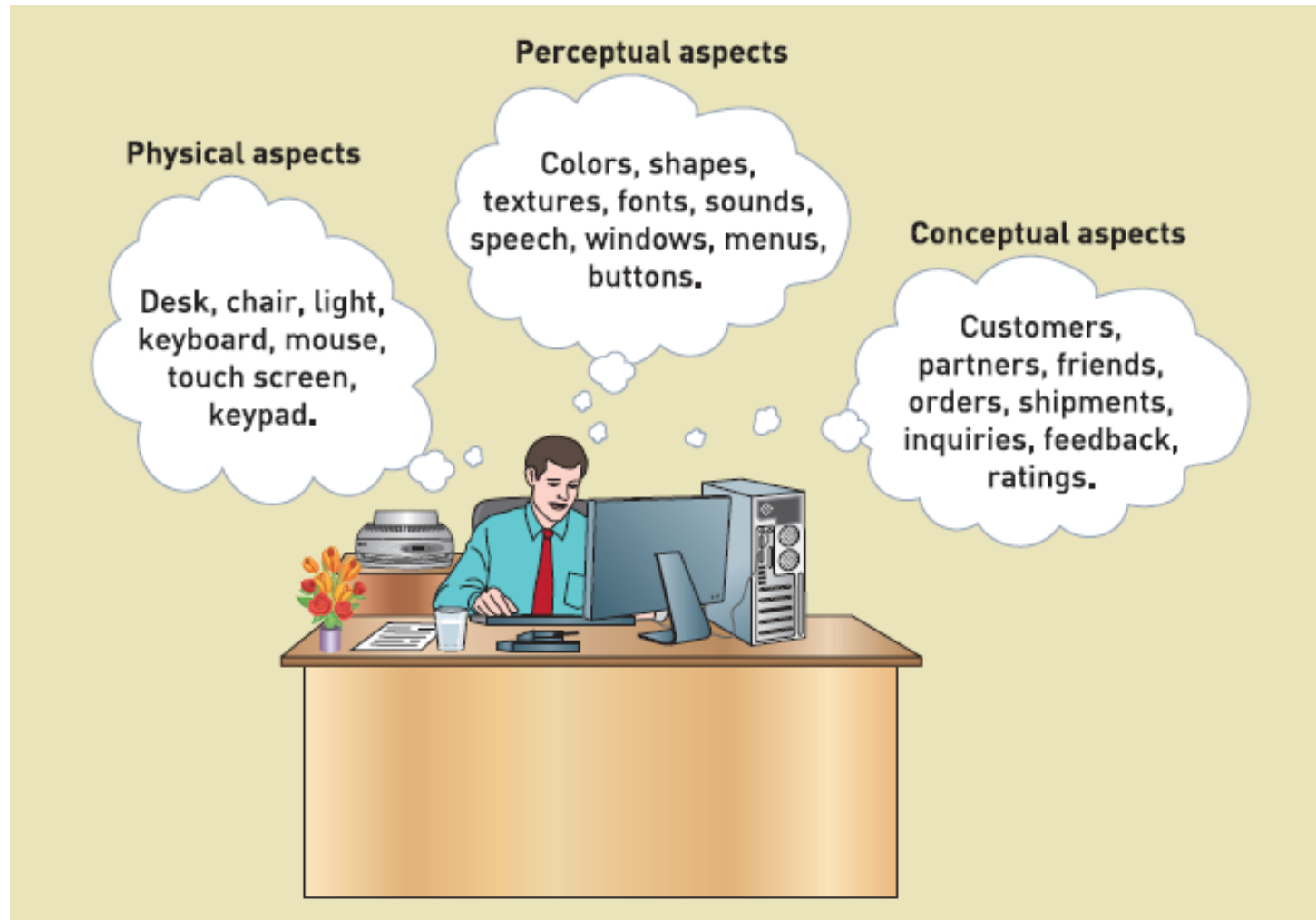
# User Interfaces and System Interfaces

- User Interface – inputs and outputs that directly involve a human user/actor
  - A dialog goes on between actor and system
- System Interface – the inputs and outputs that require minimal human intervention
  - Inputs captured automatically
  - Outputs direct to other systems
  - Printed and distributed outputs (statements, reports)

# User Centered Design

- Design techniques that embody the view that the user interface is the system to the user
- Dates back to the 1980s (more for Mac)
- Principles of User Centered Design
  - Focus early on users and their work
  - Evaluate designs to ensure usability
  - Use iterative development
- Note that contemporary A&D finally incorporates these principles

# Three Components of the User Interface



# Metaphors of Human Computer Interaction

- **Direct manipulation metaphor**
  - metaphor in which objects on a display are manipulated to look like physical objects (pictures) or graphic symbols that represent them (icons)
- **Desktop metaphor**
  - metaphor in which the visual display is organized into distinct regions, with a large empty workspace in the middle and a collection of tool icons around the perimeter
- **Document metaphor**
  - metaphor in which data is visually represented as paper pages or forms
- **Dialog metaphor**
  - metaphor in which user and computer accomplish a task by engaging in a conversation or dialog via text, voice, or tools such as labeled buttons

# Metaphor Details

Metaphor	Description	Example
Direct manipulation	Manipulating objects on a display that look like physical objects (pictures) or that represent them (icons)	The user drags a folder icon to an image of a recycle bin or trash can to delete a collection of files.
Desktop	Organizing visual display into distinct regions, with a large empty workspace in the middle and a collection of tool icons around the perimeter	At computer startup, a Windows user sees a desktop, with icons for a clock, calendar, notepad, inbox and sticky notes (the computer interface version of a physical Post-It note).
Document	Visually representing the data in files as paper pages or forms. These pages can be linked together by references (hyperlinks)	The user fills in a form field for a product he or she owns, and the manufacturer's Web site finds and displays the product's manual as an Adobe Acrobat file, which contains a hyper-linked table of contents and embedded links to related documents.
Dialog	The user and computer accomplishing a task by engaging in a conversation or dialog by using text, voice, or tools, such as labeled buttons	The user clicks a button labeled "troubleshoot" because the printer isn't working. The computer prints questions on the display, and the user responds by typing answers or selecting responses from a printed list.

# Direct Manipulation, Desktop, and Document Metaphors On One Screen

**CHAPTER 4**

**Sandia Medical Systems Real-Time Glucose Monitoring System**

Figure xxx shows a first-cut class diagram for Sandia Medical Devices' Real-Time Glucose Monitoring (RTGM.) system.

```

classDiagram
    class Physician {
        id
        lastName
        firstName
    }
    class Patient {
        id
        medicalRecordNumber
        physician
        birthDate
        gender
        race
        height
        weight
    }
    class MonitoringDevice {
        serialNumber
        manufacturer
        dateOfManufacture
        firmwareVersion
    }
    Physician "1..1" -- "0..*" Patient
    MonitoringDevice "1..1" -- "0..*" Patient
  
```

**CHAPTER 5**

Figure xxx. First-cut class diagram for the RTGM system

After consulting with system stakeholders, the following potential changes to the diagram are being considered:

- Include additional medical personnel (nurses and physicians' assistants, at minimum)
- Include alerts sent by the system to medical personnel and messages sent by medical personnel to the patient

Modify the diagram to incorporate the changes under consideration. Incorporate generalization, specialization, and inheritance into the diagram to minimize attribute overlap among classes. Are a set of abstract and concrete classes needed to represent variations among cell phones? Why or why not?

**CHAPTER 5**

Page: 4 of 5 Words: 1,066

Create answer key for Chapter 4 RTGM exercise



# Dialog Metaphor



# User Interface Design Concepts

- Human-Computer Interaction (HCI)
  - A field of study concerned with the efficiency and effectiveness of user interaction with computer systems, human-oriented input and output technology, and psychological aspects of user interfaces
- Visibility and Affordance
  - To be usable, a control must be visible to the user and its appearance should suggest its functionality
    - Media player controls, buttons, scroll bars

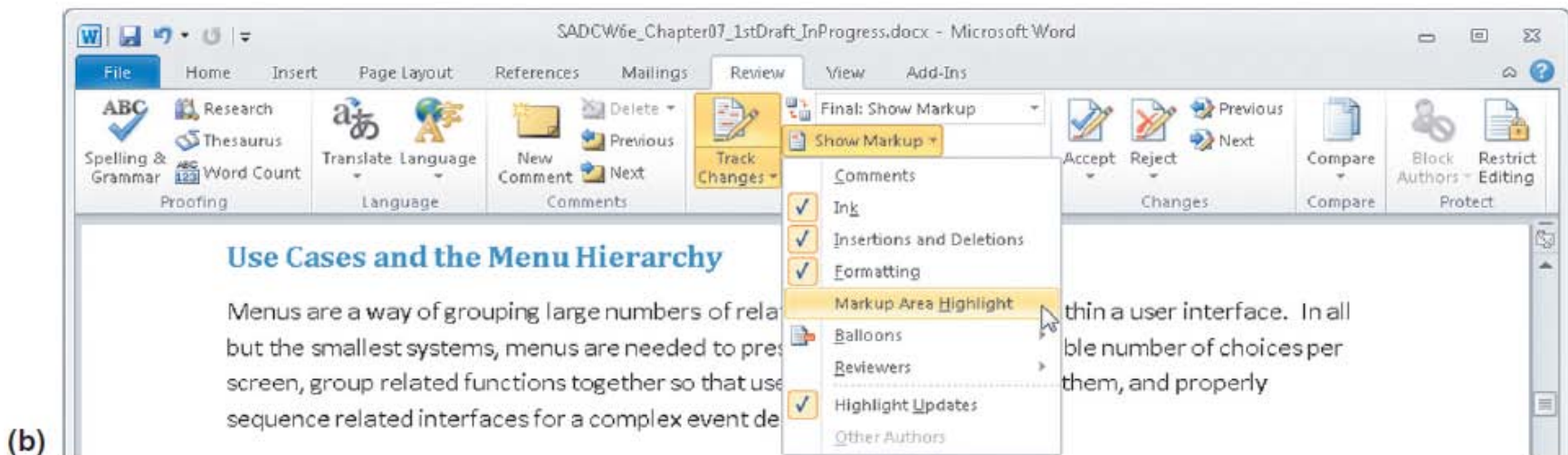
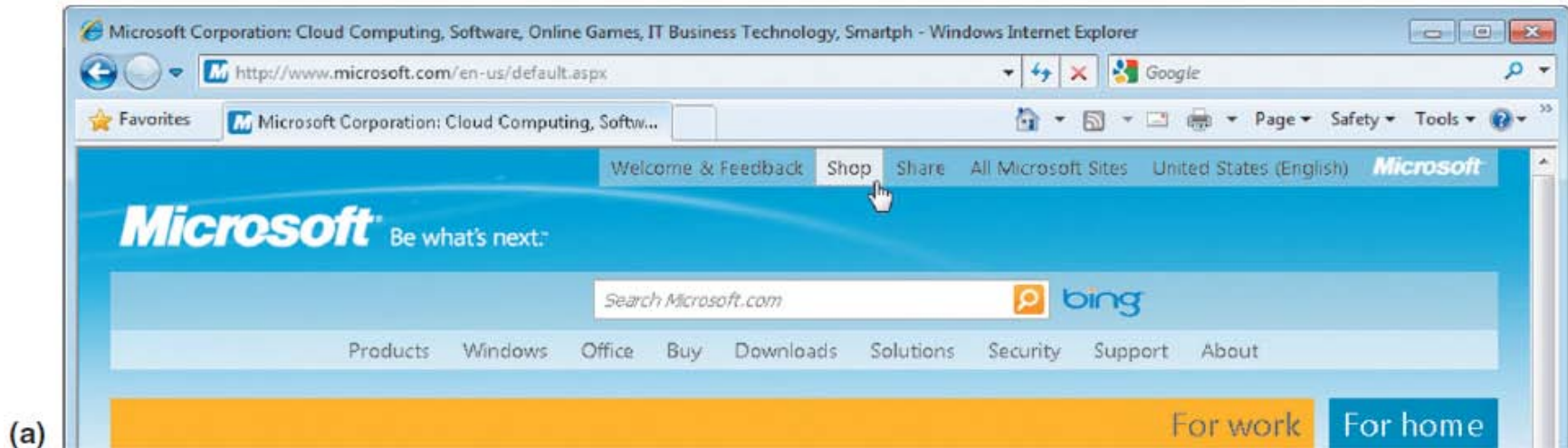
# User Interface Design Guidelines

- Design for Consistency
- Provide Shortcuts
- Provide Feedback
- Dialogs Should Yield Closure
- Error Handling that Provides Guidance
- Easy Reversal of Actions
- Reduce Short Term Memory Load

# Use Cases and the Menu Hierarchy

- We design use case by use case
- Menus are a typical way to organize access to use case functionality
- Different types of users might have different menus
- Useful to design an overall menu hierarchy and then subsets for different users
- Once the hierarchy is established, menus can be implemented in a variety of ways

# Two Different Menu Styles



# Some RMO Use Cases

Grouped by Actor and Subsystem

Subsystem	Use Case	Users/Actors
Sales	Search for item	Customer, customer service representative, store sales representative
Sales	View product comments and ratings	Customer, customer service representative, store sales representative
Sales	View accessory combinations	Customer, customer service representative, store sales representative
Sales	Fill shopping cart	Customer
Sales	Empty shopping cart	Customer
Sales	Check out shopping cart	Customer
Sales	Fill reserve cart	Customer
Sales	Empty reserve cart	Customer
Sales	Convert reserve cart	Customer
Sales	Create phone sale	Customer service representative
Sales	Create store sale	Store sales representative
Order fulfillment	Ship items	Shipping
Order fulfillment	Manage shippers	Shipping
Order fulfillment	Create backorder	Shipping
Order fulfillment	Create item return	Shipping, customer
Order fulfillment	Look up order status	Shipping, customer, management
Order fulfillment	Track shipment	Shipping, customer, marketing
Order fulfillment	Rate and comment on product	Customer
Order fulfillment	Provide suggestion	Customer

# RMO Use Cases

## Grouped into First Cut Menu Hierarchy

Menu Description	Menu Choices (Use Cases)	Intended User(s)
Shopping cart functions (primary or reserve)	<ul style="list-style-type: none"> <li>■ Search for item</li> <li>■ View product comments and ratings</li> <li>■ View accessory combinations</li> <li>■ Switch carts (primary to reserve or vice versa)</li> <li>■ Fill shopping cart</li> <li>■ Empty shopping cart</li> <li>■ Check out shopping cart</li> </ul>	Customer
Sale creation	<ul style="list-style-type: none"> <li>■ Search for item</li> <li>■ View product comments and ratings</li> <li>■ View accessory combinations</li> <li>■ Create sale</li> </ul>	Customer service and store sales representatives
Order shipment	<ul style="list-style-type: none"> <li>■ Ship items</li> <li>■ Manage shippers</li> <li>■ Create backorder</li> <li>■ Create item return</li> <li>■ Look up order status</li> <li>■ Track shipment</li> </ul>	Customer service and store sales representatives
Customer order control	<ul style="list-style-type: none"> <li>■ Look up order status</li> <li>■ Track shipment</li> <li>■ Create item return</li> <li>■ Rate and comment on product</li> <li>■ Provide suggestion</li> </ul>	Customer

# Dialog Design

- For each use case, think of the natural flow of a dialog between user and computer
  - Based on the flow of activities in use case description and/or the system sequence diagram
  - Use natural language to emphasize feedback to user
  - Create a storyboard of the dialog, showing the sequence of sketches of the screen each step of the dialog. (storyboarding)
  - Review the storyboard with users



# From Dialog to Storyboard (part 1)

## Use case *Check out shopping cart*

SYSTEM: What would you like to do?

USER: I'd like to check out.

SYSTEM: Okay. What is your e-mail address or account number?

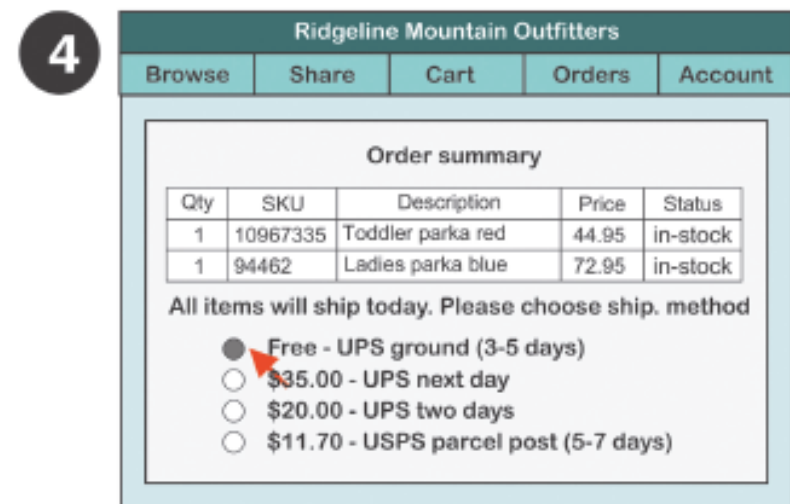
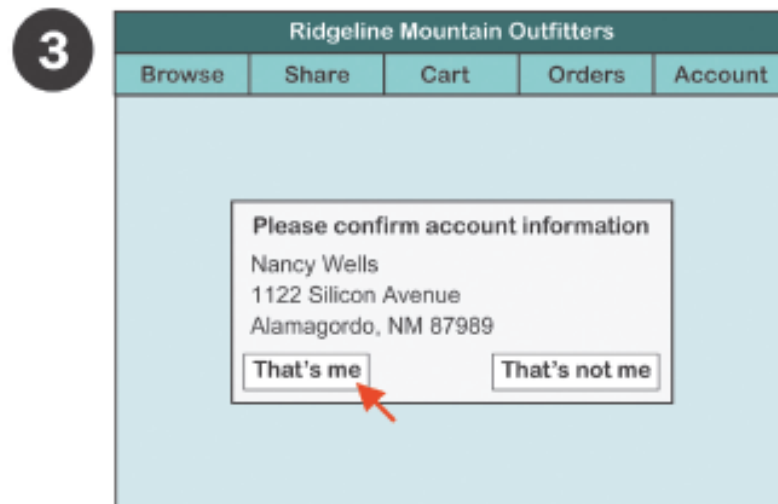
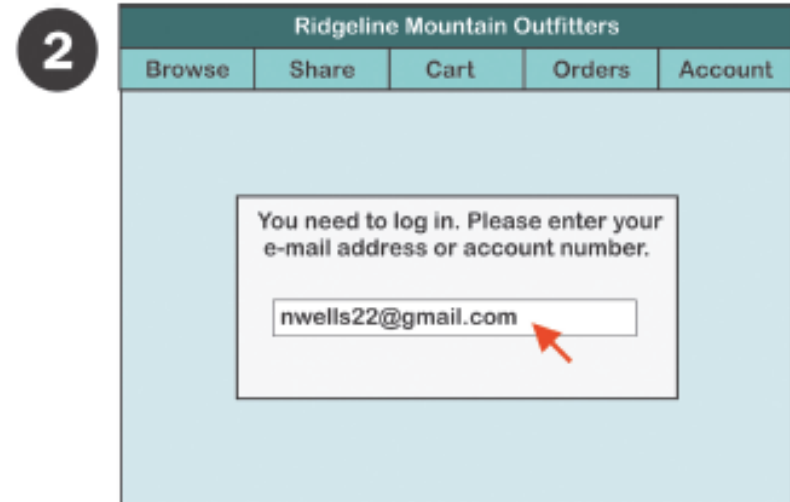
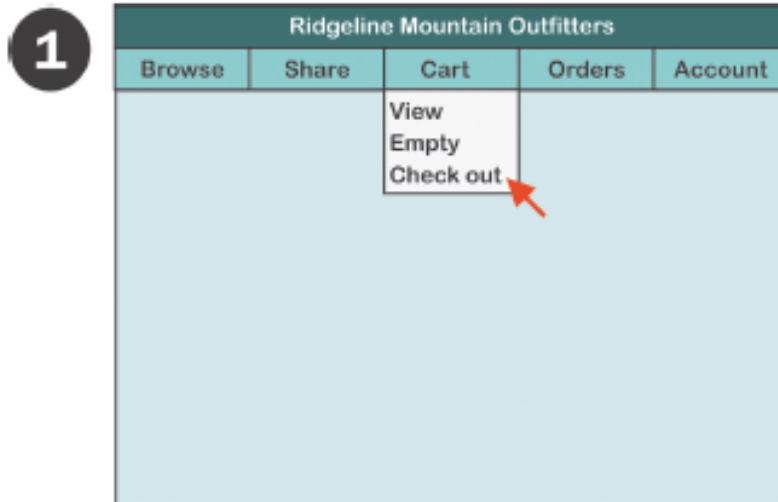
USER: My e-mail address is nwells22@gmail.com.

SYSTEM: Fine. You are Nancy Wells at 1122 Silicon Avenue. Correct?

USER: Yes.

SYSTEM: All items in your cart are in stock and can be shipped today. Because your order subtotal is over \$100, you qualify for free UPS ground shipping (3–5 days). Other shipping options include next day (\$35.00), two day (\$20.00), and USPS parcel post (\$11.70, 5–7 days). How would you like your items to be shipped?

# From Dialog to Storyboard (part 1)



## From Dialog to Storyboard (part 2)

USER: Free UPS ground shipping.

SYSTEM: We have a shipping address on file for you (1122 Silicon Avenue). Do you want your order shipped to that address?

USER: No.

SYSTEM: To what address would you like the order shipped?

USER: John Wells, 1612 Jefferson Street NE, Albuquerque, NM 87123.

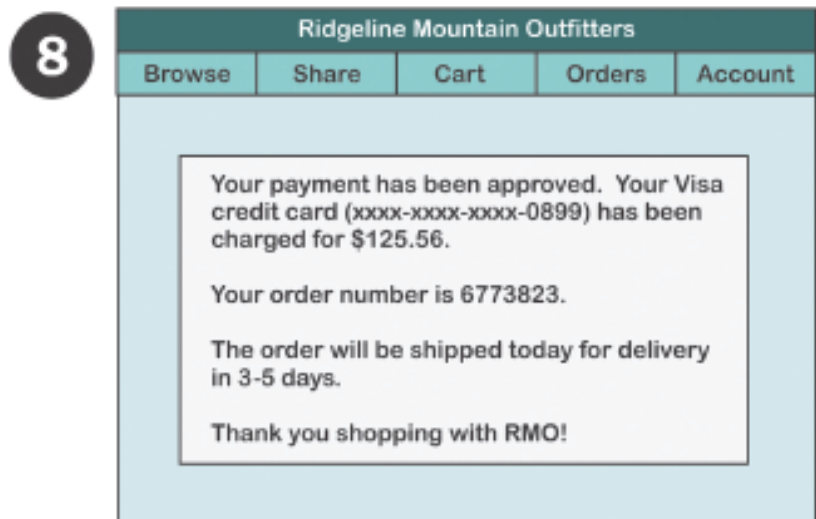
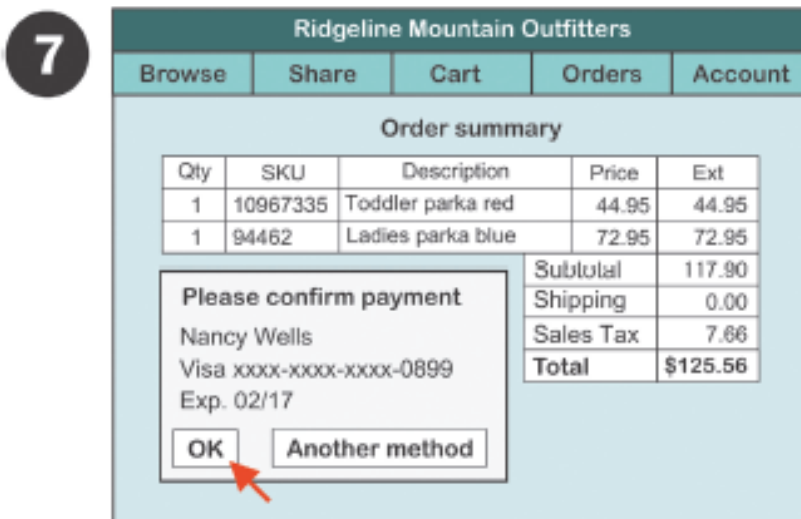
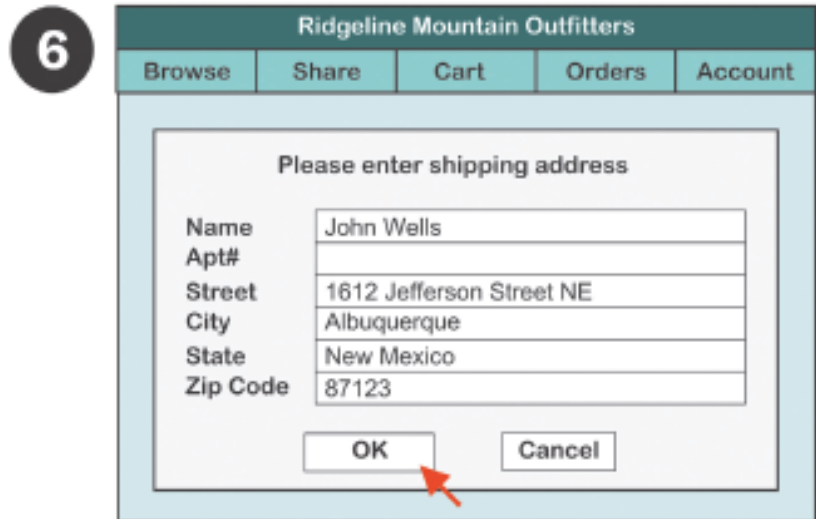
SYSTEM: Okay, the total charge is \$125.56 (\$117.90 item subtotal plus \$7.66 sales tax). Shall I charge that amount to your credit card on file (a Visa with an account number ending in 0899)?

USER: Yes.

SYSTEM: Your payment has been approved, and your order is being prepared for shipment. A confirmation e-mail has been sent to you, and another will be sent with a shipment tracking number when the order is shipped later today. Can I help you with anything else?

USER: No.

# From Dialog to Storyboard (part 2)



# Guidelines for Windows and Forms

- Interface Layout and Formatting
  - Consistency, labels and headings, distribution and order, fonts and colors
- Data Entry
  - Text box, list box, combo box, radio buttons, check boxes
- Navigation and Support Controls
  - Minimize, maximize, close, scroll bars, resize

# RMO Windows Form

RMO Customer Support System - Product Detail



**RIDGELINE MOUNTAIN  
OUTFITTERS**


**Product Information**

Product ID:

Size:

Color:

**Product Picture**



◀ ▶ Next/Previous Picture

**Product Description**

Toddlers medium-weight parka. Fleece lined. Hood with velcro closure. Elastic sleeve openings with glove/mitten hooks. One interior and two exterior pockets with velcro closures. Machine wash and dry. Nylon/polyester shell. Cotton lining.

Regular Price:

Sale Price:

**Search Criteria**

Key Words:

Catalog:

Gender:

Product Type:

Price Min:

Price Max:

**Inventory**

ID:

In Stock:

On Order:

Due Date:

Matches:

Next/Previous: ◀ ▶

# Guidelines for Web Browser User Interfaces

- Consistency
  - Cascading Style Sheets (CSS) – Web page encoding standard that enables a Web site designer to specify parts of a page that will always look the same and parts that will vary by task or audience
- Performance Considerations
  - Sensitive to network connection, amount of information transmitted, type of information transmitted
- Pictures, Video, and Sound
  - Powerful, but compatibility issues arise
- Users with Disabilities
  - Assistive technologies -- software (such as text-to-speech and voice-recognition utilities) that adapts user interfaces to the special needs of persons with disabilities



# RMO Example

## Using CSS for Consistency

www.rmo.biz - / - Windows Internet Explorer  
 http://www.rmo.biz/

Welcome to RMO.biz (Log In or Register) 0 Items **Checkout**


Search All Departments **FREE SHIPPING**  
 on orders of \$1.00 or more

Shop for Clothing Shop for Gear Wish List Store Locator My Account My Orders  
 Women's Apparel Men's Apparel Kids' Apparel Footwear Accessories Sale & Clearance

### Women's Nordic Ski Jacket

Comfort and Fashion on the Slopes

Our Nordic ski jacket combines fine tailoring with the performance features you need on the slopes including Thinsulate®, fold-away hood, two inside and two outside zippered pockets, Velcro® wrist adjusters



Size: Medium (10-12) Color: Purple

**Weekly Special \$104.95** [Add to Cart](#) [Fri](#)

www.rmo.biz - / - Windows Internet Explorer  
 http://www.rmo.biz/

Welcome to RMO.biz (Log In or Register) 0 Items **Checkout**

Search All Departments **FREE SHIPPING**  
 on orders of \$1.00 or more

Account Information Shipping Information Payment Information **Order Confirmation**

#### Product Summary

Description	Size	Color	Price	Quantity	Total
Ladies parka	Medium (10-12)	Blue	\$72.95	1	\$72.95
Toddler parka	Medium	Red	\$44.95	1	\$44.95

#### Billing Summary

Customer	Nancy Wells	<a href="#">Change</a>
Billing address	1122 Silicon Avenue 87989	<a href="#">Change</a>
Delivery address	1612 Jefferson Street NE 87123	<a href="#">Change</a>
Payment type	Visa, xxxx-xxxx-xxxx-0089	<a href="#">Change</a>
Delivery method	UPS - Ground (3-5 days)	<a href="#">Change</a>

#### Order Summary

Subtotal	\$117.90
Shipping	\$0.00
Sales Tax	\$7.66
Credits	\$0.00
<b>Order Total</b>	<b>\$125.56</b>

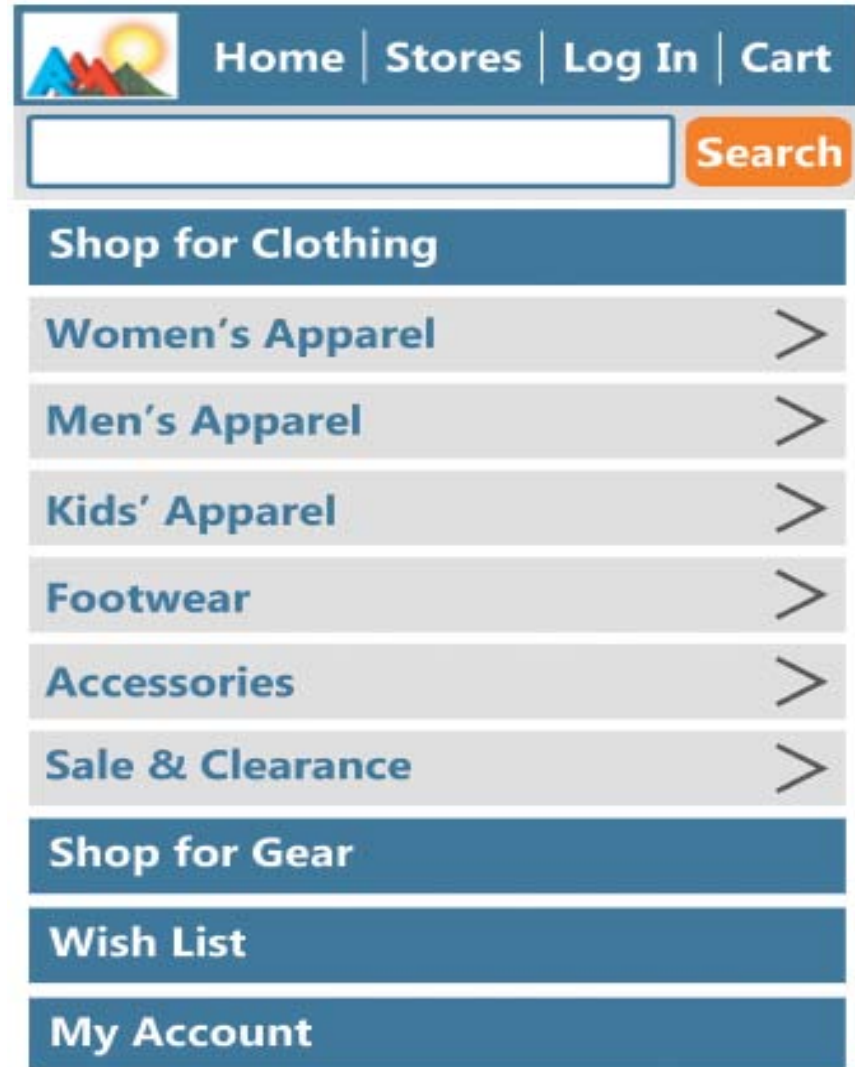
Click Accept to confirm and process your order -----> [Accept](#)



# Guidelines for Handheld Devices

- **Challenges**

- Small screen size, small keyboards and touch screens, limited network capacity, app design guidelines and toolkits

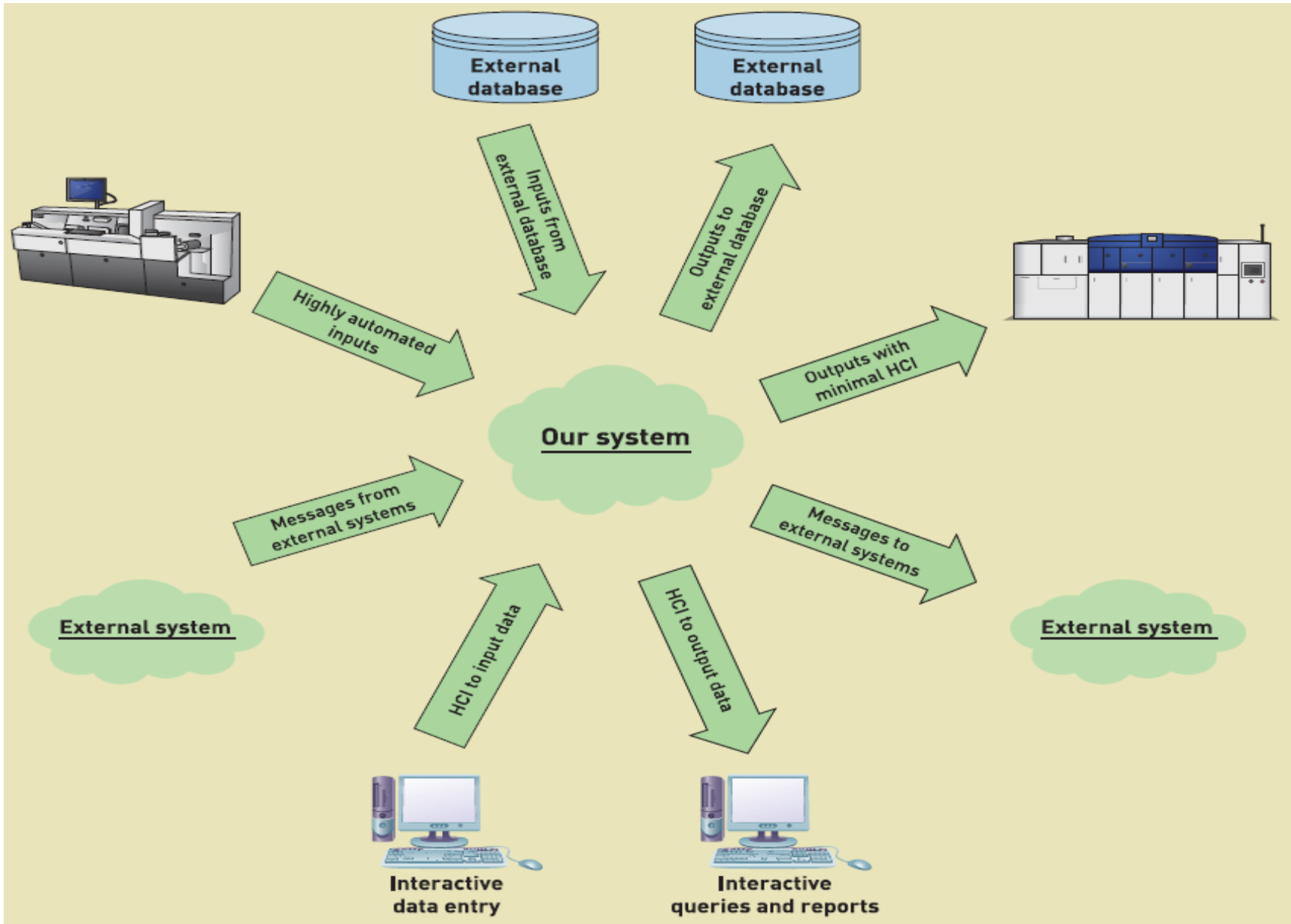


# Identifying System Interfaces

## Inputs/outputs with minimal human intervention

- Inputs from and outputs to other systems
  - These are direct interfaces with other information systems, normally formatted as network messages.
- Highly automated inputs and outputs
  - These are captured by devices (such as scanners) or generated by persons who start a process that proceeds without further human intervention.
- Inputs and outputs to external databases
  - These can supply input to or accept output from a system.

# Identifying System Interfaces



# XML for System Interfaces

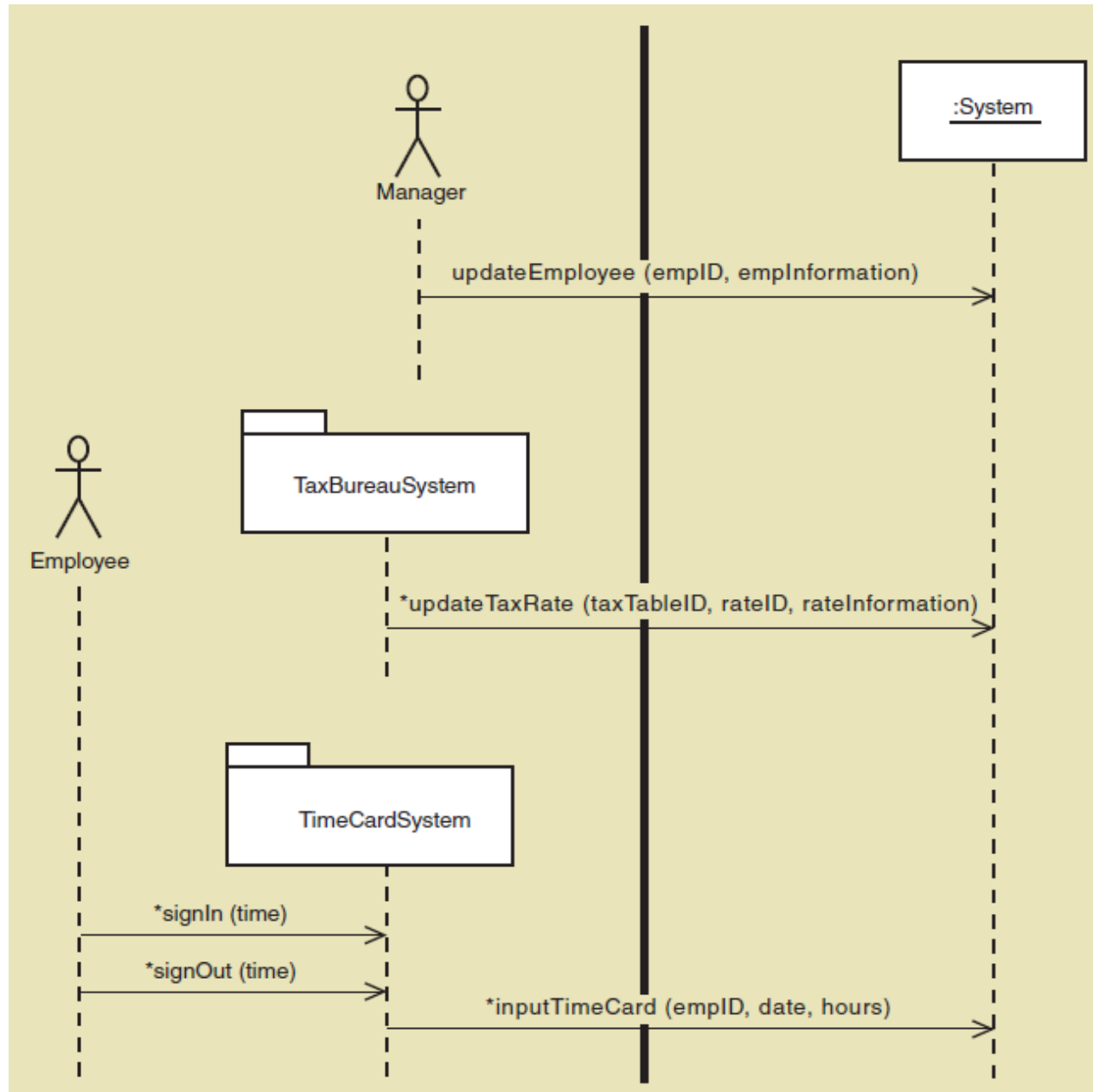
- Extensible Markup Language (XML) -- extension of HTML that embeds self-defining data structures within textual messages
  - XML tags -- character sequences (such as <name> and </name>) that define the beginning, end, and meaning of the text that appears between them

```
<customer record>
  <accountNumber>RMO10989</accountNumber>
  <name>William Jones</name>
  <billingAddress>
    <street>120 Roundabout Road</street>
    <city>Los Angeles</city>
    <state>CA</state>
    <zip>98115</zip></billingAddress>
  <shippingAddress>
    <street>120 Roundabout Road</street>
    <city>Los Angeles</city>
    <state>CA</state>
    <zip>98115</zip></shippingAddress>
  <dayPhone>215.767.2334</dayPhone>
  <nightPhone>215.899.8763</nightPhone>
</customer record>
```

# System Inputs

- Primary Objective is Error Free Input
  - Use electronic devices wherever possible
  - Avoid human involvement as much as possible
  - If information is already available in electronic form, use it instead of re-entering information
  - Validate and correct information at time and location entered
- Device Examples
  - Magnetic card strip readers, bar code readers, optical character recognition, radio frequency ID tags (RFID), touch screen, electronic pens, digitizers, speech recognition

- Defining System Inputs Details
  - Sequence Diagram
  - Details for messages



# System Outputs


- Detailed reports -- reports that contain specific information on business transactions
- Summary reports -- reports that summarize detail or recap periodic activity
- Exception reports -- reports that provide details or summary information about transactions or operating results that fall outside a predefined normal range of values
- Executive reports -- reports used by high level managers to assess overall organizational health and performance

# System Outputs

- Internal outputs -- reports or other outputs produced for use within the organization
  - Types of internal reports apply here
- External outputs -- reports or other outputs produced for use by people outside the organization
  - Statements, notices, stockholder reports
  - Higher quality, color, reflect image of organization
- Turnaround documents -- external outputs that includes one or more parts intended to be returned with new data or information
  - Bills



# External Output Example



## Ridgeline Mountain Outfitters—Shopping Cart Order

---

**Customer Name:** Fred Westing  
**Customer Number:** 6747222

---

**Shipping Address:**

936 N Swivel Street  
Hillville, Ohio 59222

**Order Number:** 4673064  
**Today's Date:** May 18, 2013

---

**Billing Address:**

936 N Swivel Street  
Hillville, Ohio 59222

Qty	Product ID	Description	Size	Color	Price	Extended Price	
1	458238WL	Jordan Men's Jumpman Team J	12	White/ Light Blue	\$119.99	\$119.99	
1	347827OP	Woolrich Men's Backpacker Shirt	XL	Oatmeal Plaid	\$41.99	\$41.99	
2	8759425SH	Nike D.R.I. – Fit Shirt	M	Black	\$30.00	\$60.00	
1	5858642OR	Puma Hiking Shorts	L	Tan	\$15.00	\$15.00	
						Subtotal	\$236.98
						Shipping	\$8.50
						Tax	\$11.25
						Total	\$256.73

**Shipping Information:**

**Shipping Method:** Normal 7–10 day

**Shipping Company:** UPS

**Tracking Number:** To be sent via email

**Email Address:** FredW253@aol.com

**Payment Information:**

American Express  MasterCard  VISA  Discover

**Account Number**

X	X	X	X	–	X	X	X	X	–	X	X	X	X	–	5	7	8	4
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

**MO YR**

**Expiration Date** 05 / 15

Thank you for your order. It is a pleasure to serve you.  
Check back next week for new weekly specials!!

# Internal Output Example

Detailed control  
break report

## Ridgeline Mountain Outfitters — Products and Items



ID	Season	Category	Supplier	Unit Price	Special Price	Discontinued
RMO12587	Spring/Fall	Mens C	8201	\$39.00	\$34.95	No

### Description Outdoor Nylon Jacket with Lining

Size	Color	Style	Units in Stock	Reorder Level	Units on Order
Small	Blue		691	150	
	Green		723	150	
	Red		569	150	
	Yellow		827	150	
Medium	Blue		722	150	
	Green		756	150	
	Red		698	150	
	Yellow		590	150	
Large	Blue		1289	150	
	Green		1455	150	
	Red		1329	150	
	Yellow		1370	150	
Xlarge	Blue		1498	150	
	Green		1248	150	
	Red		1266	150	
	Yellow		1322	150	

ID	Season	Category	Supplier	Unit Price	Special Price	Discontinued
RMO28497	All	Footwe	7993	\$49.95	\$44.89	No

### Description Hiking Walkers with Patterned Tread Durable Uppers

Size	Color	Style	Units in Stock	Reorder Level	Units on Order
7	Brown		389	100	
	Tan		422	100	
8	Brown		597	100	
	Tan		521	100	
9	Brown		633	100	
	Tan		654	100	
10	Brown		836	100	
	Tan		954	100	
11	Brown		862	100	
	Tan		792	100	
12	Brown		754	100	
	Tan		788	100	
13	Brown		830	100	
	Tan		921	100	

# Drill Down Online Report

## Summary and Detailed

<b>Monthly Sales Summary</b>						
Year	2013	Month	January			
Category	Season Code	Web Sales	Telephone Sales	Mail Sales	Total Sales	
Footwear	All	\$ 289,323	\$ 1,347,878	\$ 540,883	\$ 2,178,084	
Men's Clothing	Spring	\$ 1,768,454	\$ 2,879,243	\$ 437,874	\$ 4,691,484	
	Summer	213,938	387,121	123,590	724,649	
	Fall	142,823	129,873	112,234	384,930	
	Winter	2,980,489	6,453,896	675,290	10,109,675	
	All	4,839,729	10,847,368	1,349,234	16,996,331	
Totals				\$ 1,698,222	\$ 23,391,023	
Women's Clothing	Spring				965,610	
	Summer					
	Fall					
	Winter					
	All					
Totals						

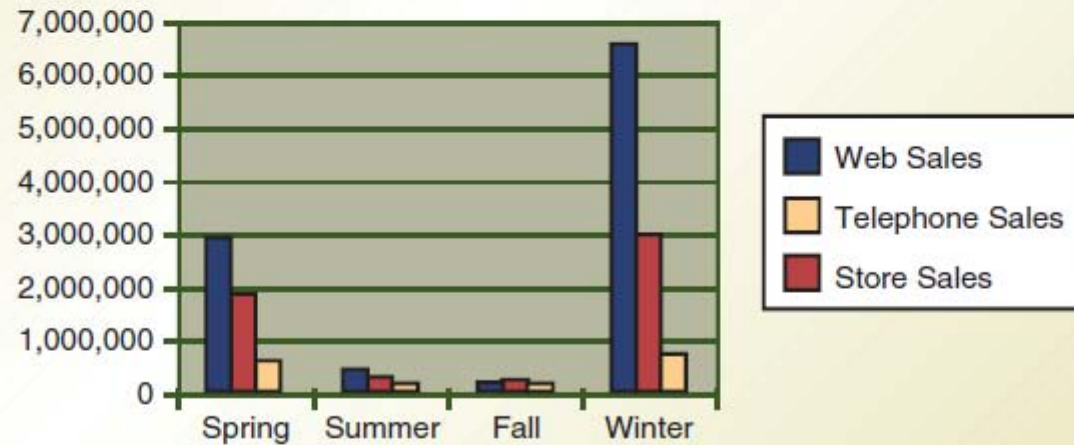
<b>Monthly Sales Detail</b>							
Year	2013	Month	January	Category	Men's Clothing	Season	Winter
Product ID	Product Description		Web Sales	Telephone Sales	Mail Sales	Total Sales	
RMO12987	Winter Parka		\$ 1,490,245	\$ 3,226,948	\$ 337,640	\$ 5,054,833	
RMO13788	Fur-Lined Gloves		149,022	322,695	33,765	505,482	
RMO23788	Wool Sweater		596,097	1,290,775	135,058	2,021,930	
RMO12980	Long Underwear		298,050	645,339	68,556	1,003,005	
RMO32998	Fleece-Lined Jacket		447,075	1,258,079	100,271	1,805,425	
Total			\$ 2,980,489	\$ 6,743,836	\$ 675,290	\$ 10,394,615	

# Graphical Outputs

### Men's Clothing Sales - January 2013



### Men's Clothing Sales by Season - January 2013



# Summary

- There are two types of interfaces – user interfaces and system interfaces
- User interfaces involve direct user interaction with the system. System interfaces require minimal or no user interaction
- The design of the user interface has a long history as human computer interaction (HCI) and relies on user-centered design, which focuses early on users, evaluates designs to ensure usability, and uses iterative development
- Metaphors are used to think about the nature of the user interface, and they include direct manipulation, desktop, document, and dialog metaphors.

# Summary (continued)

- Key user interface concepts include affordance and visibility for controls
- Other key principles include consistency, shortcuts, feedback, dialog closure, error handling, reversal of actions, and reducing short term memory loads
- Use cases are organized into one or more menu hierarchies to arrange functionality for users
- Dialogs and storyboards are used to design the interaction for each use case based on use case flow of activates and system sequence diagrams
- Guidelines are available for designing for Windows, Web browsers, and Handheld devices

## Summary (continued)

- System interfaces include inputs and outputs to other systems, highly automated inputs and outputs, and inputs and outputs to external databases.
- Designing system inputs involves identifying devices and mechanisms, identifying inputs and the data content, and determining the controls necessary
- Designing system outputs includes designing detailed reports, summary report, exception reports, and executive reports
- Outputs are also classified as internal, external, or turnaround
- Electronic reports and other outputs can include drill down, graphics, and multimedia