CHAPTER 10: HUMAN-COMPUTER INTERACTION LAYER DESIGN

Previously, Alec had the development team focusing on developing the analysis models of the problem domain. In the previous chapter's installment, Alec had split part of the team and had assigned them to work on the data management layer and to develop its design. In this installment, we follow the development team members that have been assigned to the human–computer interaction layer. Based on what Margaret has learned about mobile computing, social media, and globalization, she really wants to be able to deploy across multiple platforms in such a way that CD Selections will be able to reach a global market. However, Alec isn't quite sure that trying to deploy over multiple incompatible platforms is a good idea.

To begin with, the team reviewed the functional models for the CD Selections Internet Sales System. The use case diagram showed that there were three different high-level use cases in (see Figures 4-A and 4-D): Maintain CD Information, Place Order, and Maintain CD Marketing Information. There are also six additional use cases, Search/Browse CDs, Checkout, Create New Customer, Place In Store Hold, Place Special Order, and Fill Mail Order, associated with the Place Order use case.

Based on the perceived complexity of developing the current system without the deployment on multiple incompatible platforms, Alec was able to convince Margaret that even though he agreed with her as to the importance of both mobile and social computing platforms, that it would be better if they delayed the design and deployment for those platforms until a later version of the system is developed. Furthermore, given that the current system's focus was more about bringing in more customers to the bricks and mortar stores, they also agreed to delay the internationalization of the web site until a later version.

To keep the complexity of the current example under control, in this section, we focus only on the Place Order, Browse/Search CDs, and Checkout use cases.

Use Scenario Development

The first step in the interface design process was to develop the key use scenarios for the Internet Sales System. Since Alec assigned the human computer interaction layer design to himself, he began by examining the essential use cases (see Figures 4-B through 4-G) and thinking about the types of users and how they would interact with the system. To begin with, Alec identified two use scenarios: the browsing shopper and the hurry-up shopper (see Figure 10-A).[7] Alec also thought of several other use scenarios for the Web site in general, but omitted them since they were not relevant to the Internet sales portion. Likewise, he thought of several use scenarios that did not lead to sales (e.g., fans looking for information about their favorite artists and albums), and omitted them as well.

Interface Structure Design

Next, Alec created a window navigation diagram (WND) for the Web system. He began with the Place Order, Browse/Search CDs, and Checkout essential use cases to ensure that

[7] Of course, it may be necessary to modify the original essential use cases in light of these new subtypes of customer. Furthermore, the structural and behavioral models may have to be modified. Remember that object-oriented systems analysis and design is incremental and iterative, as such, additional requirements can be uncovered at any time.

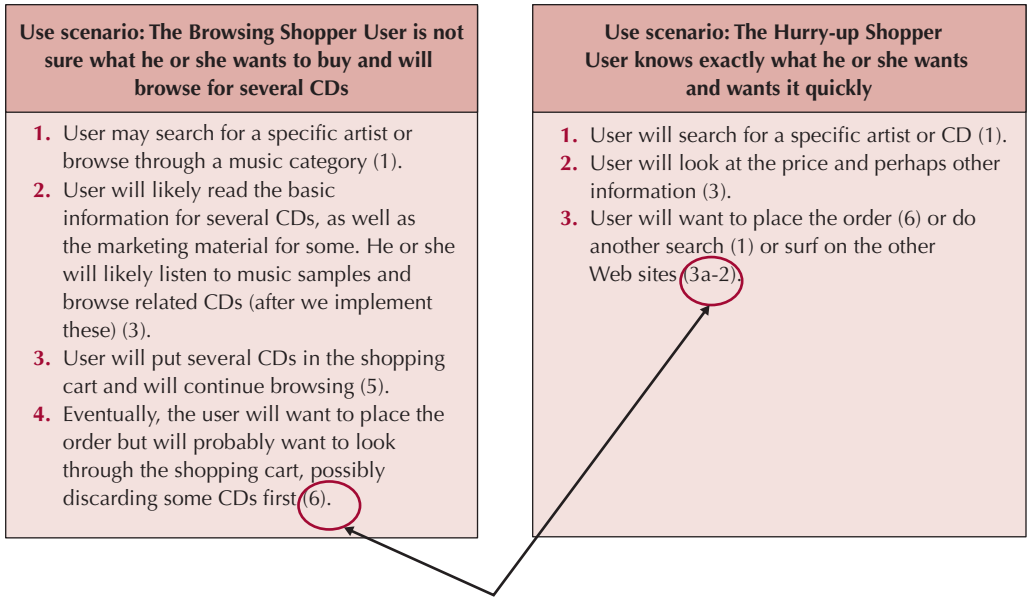

FIGURE 10-A Use Scenarios for the Browsing and Hurry-Up Customers

all functionality defined for the system was included in the WND. Figure 10-B shows the WND for the Web portion of the Internet Sales System. The system will start with a home page that contains the main menu for the sales system. Based on the essential use cases, Alec identified four basic operations that he felt made sense to support on the main menu: search the CD catalog, search by music category, review the contents of the shopping cart, and to actually place the order. Each of these was modeled as a hyperlink on the home page.

Alec then decided to model the full search option as a pop-up search menu that allowed the customer to choose to search the CD catalog based on artist, title, or composer. He further decided that a textbox would be required to allow the customer to type in the name of the artist, title, or composer depending on the type of search requested. Finally, he chose to use a button to submit the request to the system. After the "submit" button is pressed, the system produces a report that was composed of hyperlinks to the individual information on each CD. A CD report containing the basic information is generated by clicking on the hyperlink associated with the CD. On the basic report, Alec added buttons for choosing to find out additional information on the CD and to add the CD to the shopping cart. If the "Detail" Button is pressed, a detailed report containing the marketing information on the CD is produced. Finally, Alec decided to include a button on this report to add the CD to the shopping cart.

The second basic operation supported on the home page was to allow the user to search the CD catalog by category of music. Like the previous operation, Alec chose to model the category search with a pop up search menu. In this case, once the customer chose the category, the system would produce the report with the hyperlinks to the individual information on each CD. From that point on, the navigation would be identical to the previous searches.

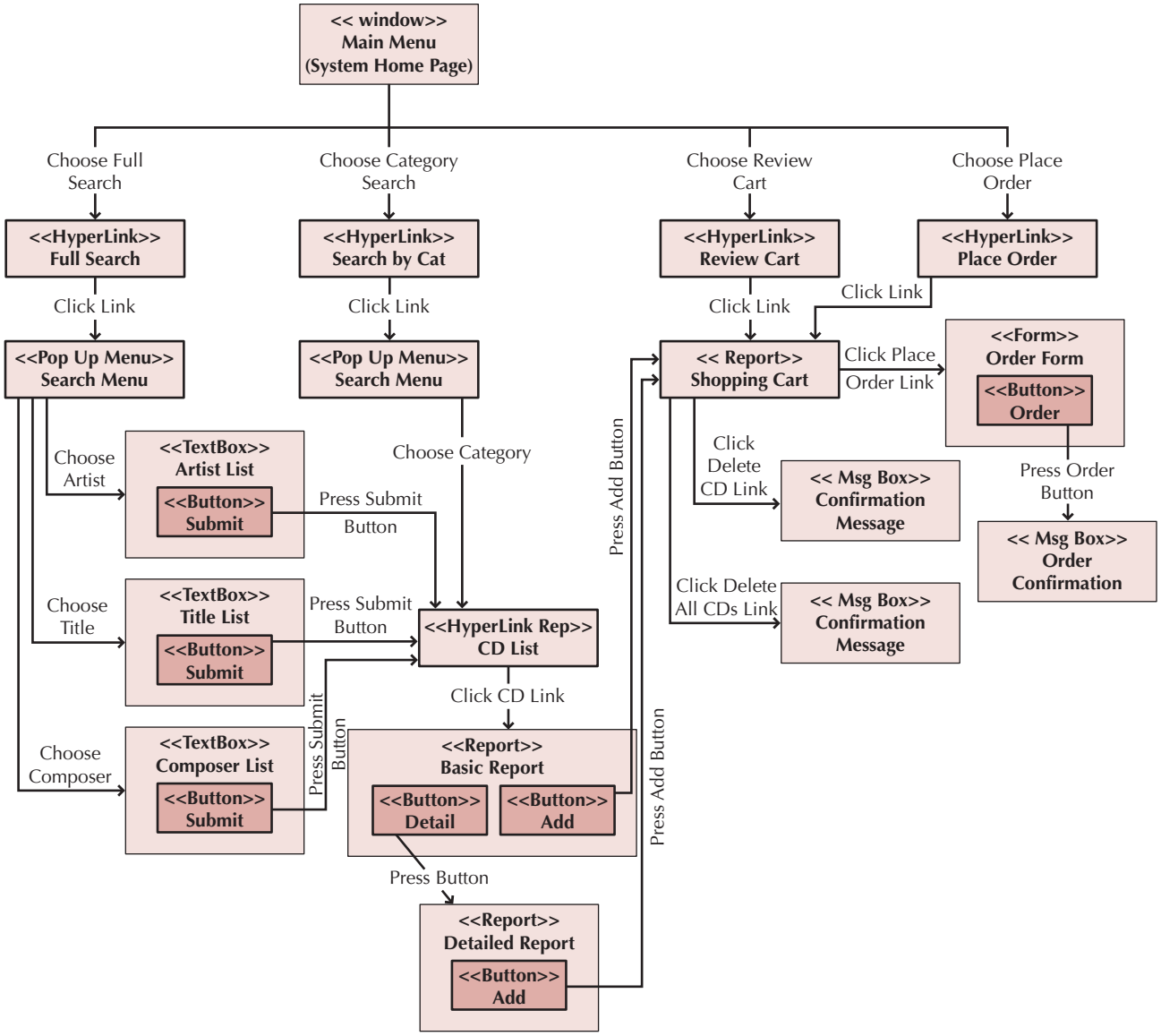

FIGURE 10-B CD-Selections Initial WND for the Web portion of the Internet Sales System

The third operation supported was to review the contents of the shopping cart. In this case, Alec decided to model the shopping cart as a report that contained three types of hyperlinks; one for removing an individual CD from the shopping cart, one for removing all CDs from the shopping cart, and one for placing the order. The removal hyperlinks would remove the individual CD (or all of the CDs) from the shopping cart if the user would confirm the operation. The place order link would send the customer to an order form. Once the customer filled out the order form, the customer would press the order button. The system would then respond with an order confirmation message box.

The fourth operation supported on the home page was to allow the customer to place an order directly. Upon review, Alec decided that the place order and review cart operations were essentially identical. As such, he decided to force the user to have the Place Order and Review Shopping Cart operations go through the same process.

Alec also envisioned that by using frames, the user would be able to return to the home page from any screen. Documenting these would give the WND too many lines, so Alec simply put a note describing it with the WND.

The Revised WND

Alec then examined the use scenarios to see how well the initial WND enabled different types of users to work through the system. He started with the Browsing Shopping use scenario and followed it through the WND, imagining what would appear on each screen and pretending to navigate through the system. He found the WND to work well, but he noticed a couple of minor issues related to the shopping cart. First, he decided that it would make sense to allow the customer to retrieve the information related to the CDs contained in the shopping cart. As such, he changed the stereotype of the user interface component from Report to HyperLink Rep and added a hyperlink from the Shopping Cart to the Basic Report created by the different search requests. Second, he noticed that the Shopping Cart was using hyperlinks to link to the Removal and Place Order processes. However, in all the other elements of the WND, he was using buttons to model the equivalent ideas. As such, he decided to change the Shopping Cart component to model these connections as buttons. Of course, this forced him to modify the transitions as well.

Alec next explored the Hurry-up Shopper use scenario. In this case, the WND did not work as well. Moving from the home page, to the search page, to the list of matching CDs, to the CD page with price and other information takes three mouse clicks. This falls within the three clicks rule, but for someone in a hurry, this may be too many. Alec decided to add a "quick-search" option to the home page that would enable the user to enter one search criteria (e.g., just artist name or title, rather than a more detailed search as would be possible on the search page) that would with one click take the user to the one CD that matched the criteria or to a list of CDs if there were more than one. This would enable an impatient user to get to the CD of interest in one or two clicks.

Once the CD is displayed on the screen, the Hurry-up Shopper use scenario would suggest that the user would immediately purchase the CD, do a new search, or abandon the Web site and surf elsewhere. This suggested two important changes. First, there had to be an easy way to go to the place order screen. As the WND stands (see Figure 10-B), the user must add the item to the shopping cart and then click on the link on the HTML frame to get to the place order screen. While the ability of users to notice the place order link in the frame would await the interface evaluation stage, Alec suspected, based on past experience, that a significant number of users would not see it. Therefore, he decided to add a buttons to the Basic Report screen and the Detailed Report screen called "Buy" (See Figure 10-C).

Second, since the Hurry-up Shopper might want to search for another CD instead of buying the CD, Alec decided to include the quick-search item from the home page on the frame. This would make all searches immediately available from anywhere in the system. This would mean that all functionality on the home page would now be carried on the frame. Alec updated the note on the bottom attached to the WND to reflect the change.

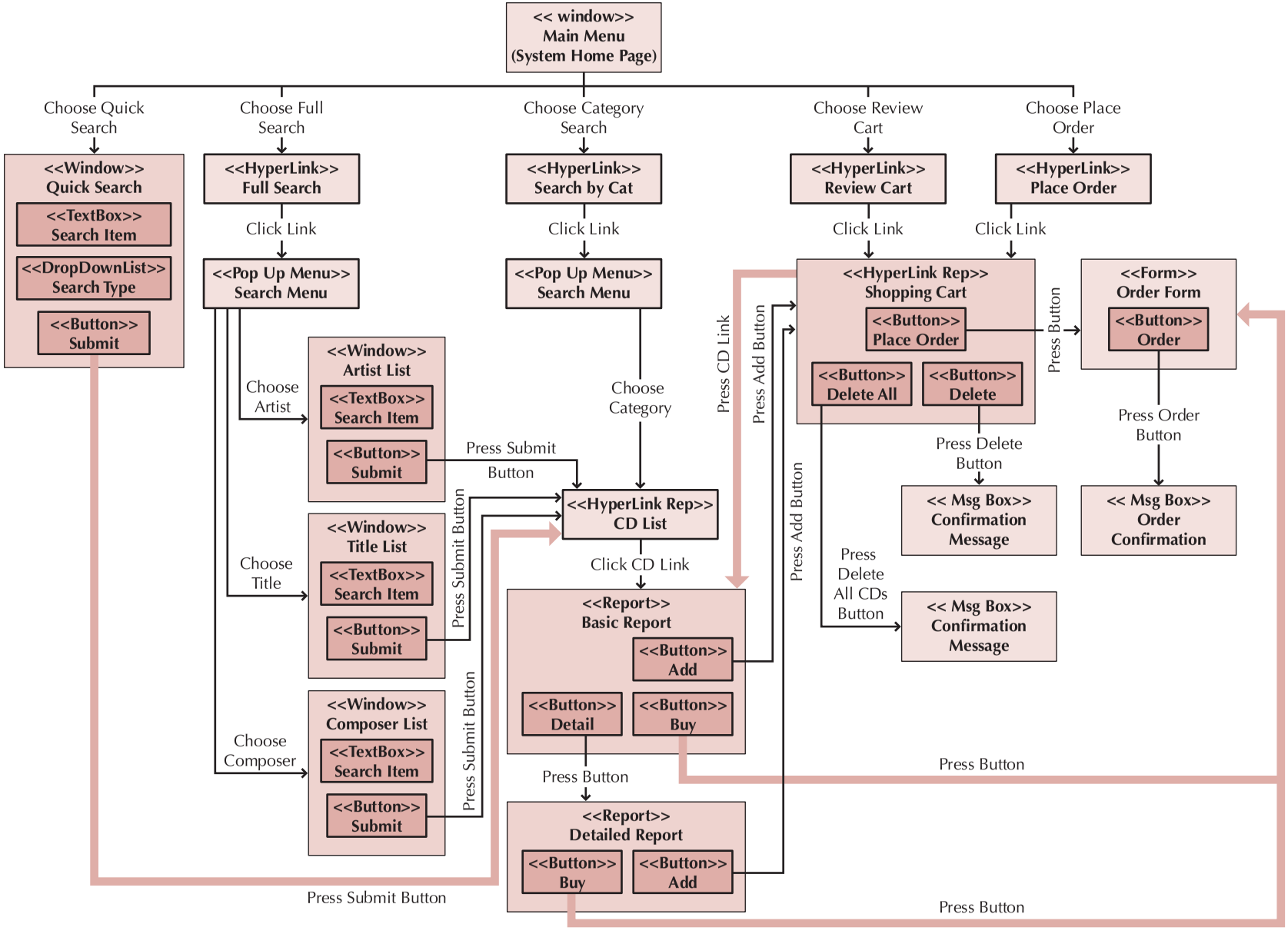

FIGURE 10-C CD-Selections revised WND for the Web portion of the Internet Sales System (changes are highlighted)

Finally, upon review of the WND, Alec decided to remodel the Artist List, Title List, and Composer Lists as window stereotypes instead of textbox stereotypes. He then added a Search Item textbox to each of these elements. Figure 10-C shows the revised WND for the Web portion of the Place Order use case. All changes are highlighted.

Interface Standards Design

Once the WND was complete, Alec moved on to develop the interface standards for the system. The interface metaphor was straightforward: a CD Selections music store. The key interface objects and actions were equally straightforward, as was the use of the CD Selections logo icon (see Figure 10-D).

Interface Template Design

For the interface template, Alec decided on a simple, clean design that had a modern background pattern, with the CD-Selections logo in the upper-left corner. The template had two navigation areas: one menu across the top for navigation within the entire Web site (e.g., overall Web site home page, store locations) and one menu down the left edge for navigation within the Internet sales system. The left edge menu contained the links to the top-level operations (see WND in Figure 10-C), as well as the "quick search" option. The center area of the screen is used for displaying forms and reports when the appropriate operation is chosen (see Figure 10-E).

At this point, Alec decided to seek some quick feedback on the interface structure and standards before investing time in prototyping the interface designs. Therefore, he met with Margaret Mooney, the project sponsor, and Chris Campbell, the consultant, to discuss the emerging design. Making changes at this point would be much simpler than after doing the prototype. Margaret and Chris had a few suggestions, so after the meeting Alec made the changes and moved into the design prototyping step.

Design Prototyping

Alec decided to develop a hypertext mark-up language (HTML) prototype of the system. The Internet sales system was new territory for CD Selections and a strategic investment in

Interface Metaphor: A CD Selections Music Store

Interface Objects

- **CD:** All items, whether CD, tape, or DVD, unless it is important to distinguish among them
- **Artist:** Person or group who records the CD
- **Title:** Title or name of CD
- **Composer:** Person or group who wrote the music for the CD (primarily used for classical music)
- **Music Category:** Type of music. Current categories include: Rock, Jazz, Classical, Country, Alternative, Soundtracks, Rap, Folk, Gospel.
- **CD List:** List of CD(s) that match the specified criteria
- **Shopping Cart:** Place to store CDs until they are requested

Interface Actions

- **Search for:** Display a CD list that matches specified criteria
- **Browse:** Display a CD list sorted in order by some criteria
- **Order:** Authorize special order or place hold

Interface Icons

- **CD Selections Logo:** Will be used on all screens

FIGURE 10-D
CD Selections
Interface Standards

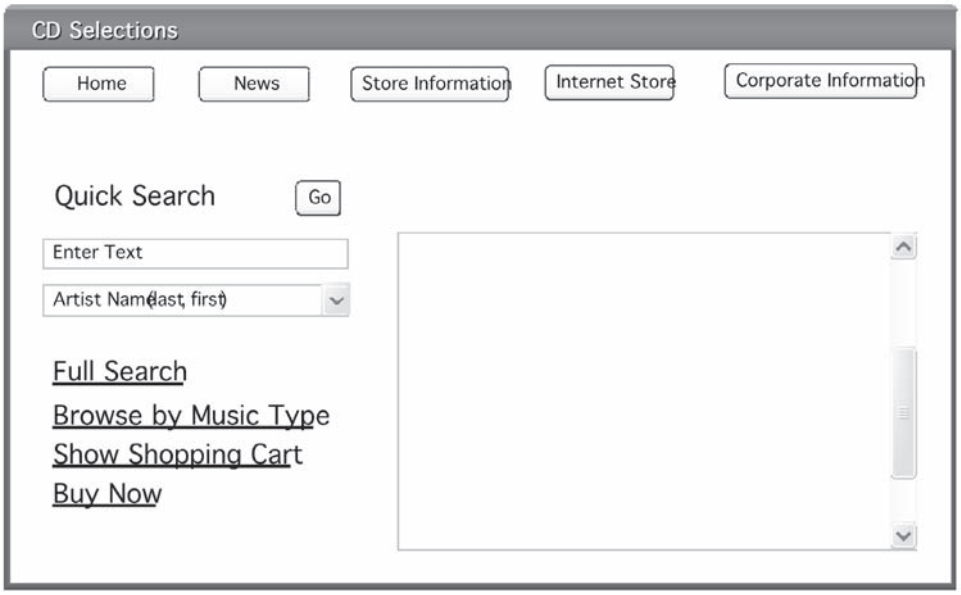

FIGURE 10-E CD Selections Interface Template for the Web Portion of the Internet Sales System

a new business model, so it was important to make sure that no key issues were overlooked. The HTML prototype would provide the most detailed information and enable interactive evaluation of the interface.

In designing the prototype, Alec started with the home screen and gradually worked his way through all the screens. The process was very iterative and he made many changes to the screens as he worked. Once he had an initial prototype designed, he posted it on CD Selections intranet and solicited comments from several friends with lots of Web experience. He revised it based on the comments he received. Figure 10-F presents some screens from the prototype.

Interface Evaluation

The next step was interface evaluation. Alec decided on a two-phase evaluation. The first evaluation was to be an interactive evaluation conducted by Margaret, her marketing managers, selected staff members, selected store managers, and Chris. They worked hands-on with the prototype and identified several ways to improve it. Alec modified the HTML prototype to reflect the changes suggested by the group and asked Margaret and Chris to review it again.

The second evaluation was another interactive evaluation, this time by a series of two focus groups of potential customers—one with little Internet experience, the other with extensive Internet experience. Once again, several minor changes were identified. Alec again modified the HTML prototype and asked Margaret and Chris to review it again. Once they were satisfied, the interface design was complete.

Navigation Design Documentation

The last step that Alec completed was to document the navigation design through the use of real use cases. To accomplish this, Alec gathered together the essential use case (see Figure 4-G), the use scenarios (see Figure 10-A), the window navigation diagram

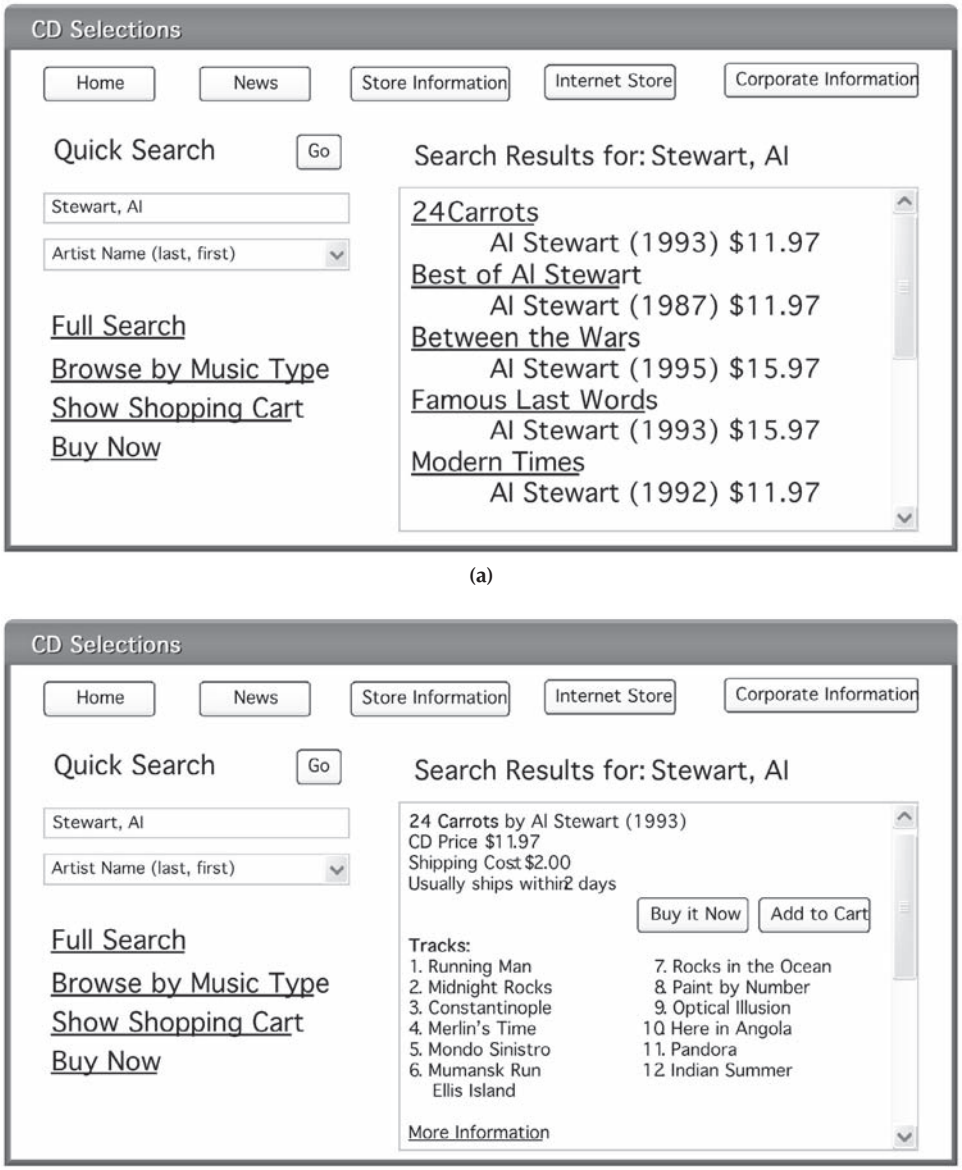

FIGURE 10-F
Sample Interfaces from the CD Selections Design Prototype

(see Figure 10-C), and the user interface prototype (see Figures 10-E and 10-F). First, he copied the contents of the essential use case to the real use case. He changed the type from detail, essential to detail, real and the primary actor was specialized to browsing customer instead of simply customer. Second, he wrote the specific set of steps and responses that described the interaction between the browsing customer and system. Figure 10-G shows a partial listing of the steps in the Normal Flow of Events and SubFlows sections of the real use case. Last, he repeated the steps for the hurry-up customer. Based on the detailed, real use cases, Alec realized that changes really needed to be cascaded back to the use case diagram and the detailed, essential use case descriptions. Again, this is typical of the iterative and incremental nature of object-oriented system development.

Use-Case Name: Place Order	ID: 15	Importance Level: High
Primary Actor: The Browsing Customer	Use-Case Type: Detail, Real	

Stakeholders and Interests: Customer Wants to search web site to purchase CD
EM Manager Wants to maximize Customer satisfaction.

Brief Description: This use case describes how customers can search the web site and place orders.

Trigger: Customer visits web site

Type: External

Relationships:
- Association:
- Include: Checkout, Browse/Search CDs
- Extend:
- Generalization:

Normal Flow of Events:
1. The Customer visits the Web site.
2. The System displays the Home Page
   - If the Customer wants to do a Full Search, execute S-1: Full Search
   - If the Customer wants to Browse by Music Type, execute S-2: Browse by Music Type
   - If the Customer wants to see any Special Deals, execute S-3: Special Deals
   - If the Customer wants to see the contents of the Shopping Cart, execute S-4: Shopping Cart
   - If the Customer wants to Buy Now, execute S-5: Buy Now
3. The Customer leaves the site.

SubFlows:

S-1: Full Search
1. The Customer clicks the Full Search hyperlink
2. The System displays the search type pop-up menu
   - If the Customer chooses an Artist search, execute S-1a: Artist List
   - If the Customer chooses an Title search, execute S-1a: Title List
   - If the Customer chooses an Composer search, execute S-1a: composer List

S-1a: Artist List
1. The System displays the Artist List window in the Center Area of the Home Page.
2. The Customer enters the Artist Name into the Search Item text box.
3. The Customer presses the Submit button.
4. The System executes S-2a: CD List.

S-2a: CD List
1. The System displays the CD List hyperlink report.
2. The Customer chooses a CD to review by clicking the CD link.
3. The System executes s-2b: Display Basic Report
4. Iterate over steps 2 and 3.

Alternate/Exceptional Flows:

FIGURE 10-G The Browsing Customer Real Use Case (Partial Listing Only)