IdanCE!
Design and Development of an iPhone Application

May (Mei) Liu
May 3, 2010

Advised by Michael Fischer
Submitted to Yale University
Computer Science Senior Project
* Thank you to my advisor, Dr. Michael Fischer, for being there for me every step of the way. Thank you for leading me in the right direction and for asking me the right questions to help me turn an initial interest in software development into a fully functional iPhone application. Thank you for always being available to meet with me and helping me to advance my interest in computer science and research. Thank you also to Ms. Jennifer Wester for providing the content for this application and helping me explore the world of Ice Dancing. I have learned so much about the sport and am very grateful for all the time you took to explain every aspect to me.
Abstract

In this project, I develop a domain-specific iPhone application for ice skating spectators. I tackle this from both a design and development perspective in order to explore all components of the software development cycle. Working with a current professional ice skater, I design and develop a spectator application for customers who watch the sport of Ice Dancing. This application, IdanCE!, allows users to gain a better understanding of the sport and provides detailed information about the scoring methods used in the discipline, positions held by the skaters, and moves incorporated in the routines. The deliverables of this project include a design document that discusses the use cases for the program and a working prototype of the application. Using object-oriented programming skills, I developed modularized code that allows for easy extension and reusability. Furthermore, while I produced a full-functioning application, there are many opportunities for future development as additional use cases were not implemented.
Table of Contents

1. Introduction .................................................................................................................. 5

2. Design Perspective ......................................................................................................... 5
   2.1 Research on Existing iPhone Applications ............................................................. 6
       2.1.1 Ice Skating Domain ......................................................................................... 6
       2.1.2 Table of Content Implementations ................................................................. 6
   2.2 Specifications and Use Cases .................................................................................... 7
       2.2.1 Ice Dancing Features ...................................................................................... 7
       2.2.2 Application Use Cases .................................................................................. 8
   2.3 Discussion of Design Decisions ................................................................................. 8

3. Development Perspective ............................................................................................... 9
   3.1 Overview of iPhone Development Kit .................................................................... 9
   3.2 Application Development Layers .......................................................................... 9
       3.2.1 Prototype v1 ................................................................................................ 9
       3.2.2 Prototype v2 ................................................................................................10
       3.2.3 Prototype v3 ................................................................................................10
   3.3 Discussion of Development Process ..................................................................... 11
       3.3.1 Technical Structure and Organization ......................................................... 11
       3.3.2 Future Directions ......................................................................................... 11

4. Conclusion ..................................................................................................................... 12

Appendix
   A.1 Project Proposal – January 31, 2010 .................................................................... 13
   A.2 Overview of Relevant iPhone Applications – February 15, 2010 ......................... 15
   A.3 Preliminary Specifications – February 22, 2010 .................................................. 20
   A.4 Design Document – March 8, 2010 ...................................................................... 22
   A.5 Application Prototype v1 – April 5, 2010 ............................................................ 29
   A.6 Application Prototype v2 – April 19, 2010 ........................................................... 32
   A.7 Application Prototype v3 – April 26, 2010 ........................................................... 35
1 Introduction

Since its inception in 2007, the iPhone has gained incredible popularity and exponentially more users each year. This smartphone draws its customer base from students to professionals, from athletes to academics. In addition to its touch screen technology, 3G capability, and sleek physical appearance, the iPhone allows customers to add applications that offer specialized services for each user. These unique characteristics of the iPhone allow it to attract users across all age groups and professions and provide a perfect platform for creative software development.

In this project, I develop a domain-specific iPhone application for ice skating spectators. I tackle this from both a design and development perspective as software development is both conceptual and technical. The developer must not only understand the customers’ needs, but also be able to build robust and extensible code. This project explores all components of a software development cycle. From the design perspective, I conducted extensive research on existing iPhone applications to determine what has worked and what has not. I used this research to contribute to the design decisions I made for my own application. Furthermore, drawing from conversations with a current professional ice dancer, I outlined multiple use cases for the application and was able to test my design and user interface decisions with the clientele itself. From the development perspective, I became familiar with the iPhone OS and its SDK (Software Development Kit) platform. I then utilized tools from the SDK to develop a software prototype of the application of interest.

The IdanCE! application, developed in this project, provides a robust summary of the sport of Ice Dancing for spectators who wish to learn more about the sport. With detailed information about the scoring methods used in the discipline, positions held by the skaters, and moves incorporated in the routines, IdanCE! allows any person to gain a better understanding of Ice Dancing. In addition to simple text descriptions, this application also provides images, and in future versions, videos, of each of the positions and moves. The target audience for this application is any spectator who views the sport of Ice Dancing.

The paper proceeds as follows: in Section 2, I discuss this project from a design perspective, reviewing the research that was done, the use cases that were developed, and the design decisions that were made. In Section 3, I discuss this project from a development perspective, describing the iPhone development kit, the various application development layers, and future directions for the application. Finally, Section 4 concludes.

2 Design Perspective

Every application begins with a design. From the design perspective, I conducted extensive research on existing iPhone applications to determine what has worked and what has not. This research contributed to the design decisions I made for the IdanCE! application. After researching current applications, I proceeded to engage in conversations with Jennifer Wester, a professional ice skater, to determine the specifications of the application. Working together, we outlined the various aspects of Ice Dancing that we hoped to capture in the application and determined what the different use cases would be. By putting ourselves in the shoes of the user, we created a variety of experiential situations and developed a design document for the application. This section provides further details on the research conducted and design decisions made.
2.1 Research on Existing iPhone Applications

In designing the IdanCE! application, I began with some research on existing iPhone applications in order to gain a better understanding of the platform. In this research, I hoped to determine what has worked in the past and what has not by examining user feedback on existing applications. The research is split into applications that fall into two distinct categories: those related to the ice skating domain and those that implement a table of contents. Due to the nature of the desired application, I found it important to not only examine the ice skating domain, but also think about how to best organize the information we hoped to present. The following sections detail the research that was done.

2.1.1 Ice Skating Domain

First, I looked at existing applications for ice skating to see what is already available to customers in this field. From there, I concluded the goal of my specific application and why it is offering something that is not already available. By identifying the niche audience and target uses for my application, I can tailor my design and development to those purposes.

Currently, “SportsVideo” allows customers to watch videos of ice skating and chat live with ice skaters to gain advice and tips on the sport. Meanwhile, “Figure It” allows experienced ice skaters to build their own training programs and track personal progress over time. “Ice Skating Quiz” is simply a series of fun facts about the sport that users may use to test their knowledge and “Ice Skater” is a game where you can simulate yourself as a skater. Finally, “Figure Skating” provides a dictionary of terms that are used in the sport, but does not provide images or videos to accompany these definitions. As of January 2010, these five applications were the only ones related to figure skating available at the iTunes store.1

Taking each of these applications into account, I decided to focus my application on spectators of the sport – people who are watching an Ice Dancing routine. Besides simply providing a definition of the different components of the sport, as is done in “Figure Skating,” my application will show images and in later development cycles, videos as well. Therefore, users of my application will be able to match what they see on the ice with a particular screen in the application that provides further information. Later, I refer to each of these screens as “information pages,” that detail a particular element, move, position, etc. To begin, I intended to focus solely on Ice Dancing rather than other ice skating disciplines (Men’s, Women’s and Pairs), but this idea of a “spectator application” could easily be extended to those disciplines as well.

2.1.2 Table of Contents Implementations

Next, I look at different design ideas and patterns that have been used in iPhone applications. Although my application will consist primarily of “information pages” that provide details on elements, moves, levels, scoring methods and features, I will need to determine the best way to organize those pages into a coherent structure. Therefore, I look at a variety of applications that use different types of Table of Content designs, discuss the benefits and drawbacks of each and offer a suggestion for my application.

---

1 Appendix A.2 provides more details about each of the applications that were reviewed.
“Seafood Guide” is the most basic example in which everything is listed on one page and organized alphabetically. For my purposes, this doesn’t seem appropriate since each element in an Ice Dance routine can easily be categorized into various subgroups. Both “Grocery iQ” and “Fromage” organize pages into subgroups and provide headers in their table of contents with small icons or pictures attached. For my purposes, this seems appropriate, but perhaps not ideal. The images are too small to recognize and the list would still be extremely long. Meanwhile, both of these applications have a menu at the bottom of the screen and the buttons allow the user to jump to other features of the application. While I will not be providing any other features such as a list of coupons or favorite cheeses, I could potentially borrow this type of menu as an additional layer of my table of contents.

Finally, “Eventful” seems to provide the best organization I was able to find. In addition to a menu at the bottom of the page, this application also provides a menu at the top of the page and a listing of entries in the page. This provides, essentially, three layers of organization, which could be very helpful given the variety of pages I will include in IdanCE+. For example, I could use the bottom menu to jump between the Home page, the Scoring pages, the Moves pages and the Positions pages. For each of those pages, I could provide an additional menu at the top of the page if necessary. If not necessary, I can simply list the entries on the page as is done in “Grocery iQ” and “Fromage.” Before selecting which design to use, I must first consider the user specifications of my application.

### 2.2 Specifications and Use Cases

#### 2.2.1 Ice Dancing Features

Before beginning development, I sat down with Jennifer Wester, a professional ice dancer, to detail all the components of the sport we hoped to include in the application. This complex sport has many different layers and while there is a lot this application aimed to cover, not everything was completed.

Essentially, we wanted to include three categories of information pages: scoring methods, skater positions and dance moves. Scoring methods are different protocols used to score an Ice Dancing routine. In this application, we hoped to cover the two primary methods: the World Ranking System and the ISU Judging System. Skater positions are holds or poses that the skaters execute on the ice. There are a total of seven different types of positions and we planned to include both a textual description and generic image for each. Dance moves, include all the different elements that can be performed as part of an Ice Dancing routing. Within moves, there are five sub-categories: lifts, spins, step sequences, twizzles and other special moves. Furthermore, not only does each sub-category have many different types, but they also have different levels and special features. While we had originally hoped to include information on types, levels and features, using an additional level of organization as in the “Eventful” application, due to time constraints, we were only able to create pages that described the types of moves. In future development, we hope to include the guidelines that determine which level the move is and the features that may be exhibited within a move execution. In the original specifications, we had also planned to include both images and video footage of each element, but were unable to fully implement all the media in this prototype.

---

2 Appendix A.2 provides more detailed information on each of these applications, including screen shots of the programs and user feedback on their functionality.

3 Appendix A.3 details the original specifications that were identified.
2.2.2 Application Use Cases

As part of the design process, it is important to think about how an application will be used by its clientele. For example, what will the user hope to learn or want to do? What steps must she follow in order to gain that information or accomplish that task? Are these steps made clear by the design of the application? To answer these questions, we consider different use cases and experiential situations that might play out during the use of the application. The design document details the most important use cases that we hoped to fulfill in this application. 4

To begin, we hope the user will be able to learn about specific scoring methods and why a particular routine received the score that it did. This is use case #1. In this case, the user may simply follow the application’s menu at the bottom of the screen and select the “Scoring” tab. This will lead the user to the set of information pages that detail the different scoring methods. If time allows, these scoring method pages could also contain links to information pages on how individual moves or elements are scored.

In use case #2, we imagine a spectator of the sport who may observe a particular hold or position performed by the skaters and want to know what it is called or what the primary features are. In this case, the user would select the “Positions” tab at the bottom of the screen, which leads them to a table that lists each of the seven positions along with small images of each. We hope the user will be able to identify the position based on these images or their names and therefore select the correct entry in the table. Once selected, an information page will load that contains a larger image of the position along with more details in text form.

Finally, the last use case, use case #3, allows the spectator to examine details of a particular dance move in the routine. Let’s say, as an example, that the user would like to learn about a lift, one particular category of moves. There are many aspects of the lift that a spectator may want to learn about. For example, there is the type of lift, defined by the path that the lifting partner follows on the ice, the level of the lift, dependent on the difficulty of the lift, and the features of the lift, displayed by each of the partners. However, once the user selects the “Moves” tab at the bottom of the screen, she will be able to specify which type of move and what aspect of the move she wants to learn more about. Here is where the additional layer of organization, as is used in “Eventful,” becomes useful. A menu at the top of the screen will allow the user to select between move types (use case #3a), features (use case #3b), and levels (use case #3c).

2.3 Discussion of Design Decisions

While the specifications and use cases were detailed at the beginning of this project, an important attribute of a successful developer is one who knows how to be flexible. As development began and prototypes were created, there were various decisions that had to be made to change the original design of the application. For example, instead of adding an additional menu to the top of the scoring methods home page, we decided to simply include two buttons. This allows the home page of the scoring methods tab to provide a short introduction to the two methods and give the user the chance to select one of the two.

In addition, due to time constraints, we were unable to implement details on the levels and features of each of the moves. However, we did include the different categories of moves. Since

---

4 Appendix A.4 shows the design document that was developed for this project and contains diagrams to demonstrate the use cases discussed here.
additional layers of organization were not needed, we decided to forego the additional menu bar at the top of the screen and simply include the four tab bars at the bottom of the screen. With the moves tab, we were able to divide up the table into sections based on move type, and since we only included descriptions of the moves, there was no need for additional layers of organization.

Despite changes to the original design, the final version of the application still allows users to find answers in each of the use cases detailed in the design document. While information on levels and features for each move category are not included, they can easily be added in the next layer of development as the current code allows for that extensibility and the current design document already details the design specifications.

3 Development Perspective

3.1 Overview of iPhone Development Kit

iPhone applications can be developed with the iPhone Development Kit, which is written in Objective C. To develop applications for iPhone OS, you need a Mac OS X computer running the Xcode tools. Xcode is Apple’s suite of development tools that provide support for project management, code editing, building executables, source-level debugging, source-code repository management, performance tuning, and much more. At the center of this suite is the Xcode application itself, which provides the basic source-code development environment. Xcode is an integrated development environment (IDE) that provides all of the tools you need to create and manage your iPhone projects and source files, build your code into an executable, and run and debug your code either in iPhone simulator or on a device. In this project, the first step from the development perspective was becoming familiar with both Objective C and the Xcode IDE.

3.2 Application Development Layers

To allow for modular organization of the code, I decided to pursue development in a series of “layers.” In each layer, I produce a functioning prototype that exhibits some of the characteristics of the originally planned application.

3.2.1 Prototype v1

In the first layer of development, I focus on first setting up the menu at the bottom of the screen and then creating the first two tabs of the application: the home page and the scoring methods page. To create the menu at the bottom of the screen that appears as “tabs,” I extend the TabBarController class in my IdanCEAppDelegate.m and IdanCEAppDelegate.h files. The TabBarController allows you to specify how many tabs you would like to create on the bottom of the screen and which views will be loaded when the user selects these tabs. Therefore, I created four tabs: “Home,” “Scoring,” “Positions,” and “Moves.”

On the home page, I simply provide an introduction to what Ice Dancing is and what this particular application provides. Initially, this was simply created with a UITextView that displayed the text for this introduction. However, in a later prototype, I added the IdanCE logo, an image designed by Jennifer Wester, to the top of the page. This page is the page that appears when the user first launches the application and each time the user selects the “Home” tab at the bottom of the screen.
For the scoring methods, I created three independent pages. Each of these contains either a
UITextView or UIImageView (displaying either text or an image) and one or more UIButton. The
UITextView of the scoring methods home page simply introduces the two methods and displays the
two UIButton that allow the user to select which one she would like to learn more about. Once the
user proceeds to either the World Ranking System or ISU Judging System page, a new page appears
that describes each these methods, independently. In addition, a back button appears at the top of the
screen to allow the user to return to the scoring methods home page. In this prototype, the WRS page
contained a UITextView and the back button, while the IJS page contained an UIImageView and the
back button. This image displayed a table which is used for the program components aspect of the ISU
Judging System. However, in a later prototype, I decided to revert back to a UITextView as it was able
to provide more detailed information on the scoring method. Nonetheless, the UIImageView is still
initialized in the code and may be used in future development cycles. Furthermore, it would be nice to
embed images along with text to provide a fuller description of the scoring method. Another alternative
I considered was to include small images as buttons that would lead to an UIImageView with the
enlarged image. However, due to time constraints, we decided to not pursue this and focus on the other
two tabs of the application first. Hopefully, in future versions of this application, a combination of text
and images could be used to detail the scoring methods more clearly. 5

3.2.2 Prototype v2

After completing the first two tabs, I focused on the third tab for the second layer of
development. This tab provides information on individual skater positions. Since there are multiple
positions, I decided to use a TableView to display the different positions in an organized manner.
Initially I planned to include both an image and the name of the position as part of the table entries.
However, due to the size and dimensions of the images provided, I was unable to incorporate them into
smaller icons. Instead, I used an image of small a purple square as a placeholder. In future
development cycles, these squares can be replaced by a similarly-sized icon to represent each position.

When the user selects an entry in this table, the application will load a new information page
that displays both an image and text for that particular position. Since the image is a crucial part of this
information page, I allowed the text to be scrollable while the image stays fixed. Therefore, as the user
is reading through the text description, the image will always appear on the screen. However, due to
the size of the iPhone screen and the dimensions of the images provided, each vertical image is slightly
stretched. Nonetheless, there is no loss of information since each image still clearly displays the figures
of each partner and the position which they are holding. 6

3.2.3 Prototype v3

In the final layer of development, I completed the last tab of this application, the Moves. Due to
time constraints, I was not able to incorporate levels and features of each sub-category of move, but
was able to present details of each type of move in the four different sub-categories.

This tab is organized much like the Positions tab and utilizes a TableView as well. However,
because there are four distinct sub-categories of moves, I decided to organize the TableView into four
sections, each with a header. Each section contains a different number of entries based on how many

5 Appendix A.5 provides detailed screen shots of the home page and scoring methods pages.
6 Appendix A.6 provides detailed screen shots of the positions table and each individual information page for the seven
types of positions.
types fall into that sub-category. Both the number of sections and number of entries per section may be initialized in the TableView set-up.

Just as with the Positions page, when the user selects an entry in this table, the application will load a new information page containing details of that move. However, unlike the information pages on positions, the information pages on moves do not currently contain any images. In future development cycles, it would be nice to not only include images of these moves, but perhaps also short video clips of skaters performing the move.  

### 3.3 Discussion of Development Process

#### 3.3.1 Technical Structure and Organization

The overarching structure of this application is based on a TabBarController with four “tabs.” Each tab is then controlled by either a TextViewController (for the home page and scoring methods page) or a TableViewController (for the positions page and moves page). This organization allows for a modularized structure of the application and will make future development easy. Additional tabs may be added to the TabBarController as long as the tab is controlled by its own view controller.

In addition to view controllers, each of the information pages is an instance of the TextController class, which is composed of specific views. With the Moves pages, there is simply one UITextView contained in the page. However, with the Positions pages (which display images alongside the text descriptions), there is both an UIImageView and UITextView. These views can be initialized to particular parameters, colors, fonts, and orientations. Because of this object-oriented and modularized organization, extensibility is easy. Programmers may simply initialize additional “information pages” for additional moves, positions, levels or features, using the TextController class.

#### 3.3.2 Future Directions

The future opportunities for this project are limitless. As the original proposal was not completely implemented, the incomplete use cases may be added to this application. That is to say, additional information regarding the different characteristics that define levels in moves and the special features that may be added to moves could be added. While information pages exist for each of the types of moves, additional buttons or menus could be added on top of the current structure to allow for a more robust description for each move.

Due to limitations in both time and technical ability, this application simply contains images and text. However, if the developer became more familiar with the iPhone Development Kit, it would be possible to add short video clips into the application as well. While these clips may not be that important for the scoring methods or positions tabs, a short clip of a step sequence, for example, could provide significantly more information for the user.

Furthermore, as this application is specific to Ice Dancing, one discipline of competitive figure skating, other similar applications for the other disciplines (Men’s, Women’s, Pairs) could also be developed. The concept for this application is both novel and useful. Many people watch the sport of ice skating but do not understand the details of the moves and positions performed by skaters. Therefore, spectator apps, such as the one developed here, could provide a valuable resource for this clientele.

---

7 Appendix A.7 provides detailed screen shots of the moves table and each information page for the individual moves.
4 Conclusion

In this project, I produced a detailed design document for an iPhone application that spectators of Ice Dancing may use. In addition, a software prototype was developed that sets the foundation for future development of this application. In the process, not only did I learn about the different aspects of developing software for a particular user base, but I also became familiar with the iPhone Development Kit and learned the unique characteristics of Objective-C programming. Specifically, I was able to employ multi-layer view control, create UIButtonns to load new views, implement a TableView with multiple sections, and display both UITextViewes and UIImageViews on the same screen.

Furthermore, this project has taught me that while design decisions are important to make at the beginning of a software development project, what is more important is to allow flexibility without losing sight of the original goals. As development obstacles are faced, design decisions will have to change. However, it is important to keep both extensibility and reusability in mind whenever these design decisions are altered. The close connection and co-dependence of design and development was crucial to this project as both perspectives are fundamentally important to the development of successful software.
A.1  Project Proposal

Overview:

Since its inception in 2007, the iPhone has gained incredible popularity and exponentially more users each year. This smartphone draws its customer base from students to professionals, from athletes to academics. In addition to its touch screen technology, 3G capability, and sleek physical appearance, the applications that customers may add to their iPhones offer specialized services for each user. This unique characteristic of the iPhone allows it to attract users across all age groups and professions.

In this project, I hope to develop a domain-specific iPhone application for ice skaters. I plan to tackle this from both a design and development perspective. As discussed in the CPSC 427 course last fall, software development is both conceptual and technical. The developer must not only understand the customers’ needs, but also be able to build robust and extensible code. I hope that this project will allow me to experience all components of a software development cycle.

From the design perspective, I plan to do extensive research on existing iPhone applications to determine what has worked and what has not. I hope that this research will contribute to design decisions I make for my own application. Furthermore, through interviews and conversations with current ice skaters, I hope to outline many use cases for the application and be able to test my design and user interface decisions with the customers. By allowing them to “try out” the product, I will be able to determine which aspects satisfy the customers’ needs and which aspects need improvement. The result will be presented in the form of a design document which details different use cases and experiential situations of the customers.

From the development perspective, I plan to become familiar with the iPhone OS and its SDK development platform. I hope to then utilize the tools from the SDK to develop a software prototype of the application of interest. In addition, by understanding what the SDK is capable of doing, I can work with some customers to alter aspects that need improvement and specify aspects that the iPhone SDK does not currently support. The result will be presented in the form of a software prototype that hopefully has basic functionality with the ability to be extended in the future.

By the end of this project, I hope to produce a working prototype of a useful application for ice skaters. The specific application is yet to be determined as it will depend on further conversations with the skaters and further investigation of the capabilities of the iPhone SDK. In addition to the software prototype, I plan to provide a detailed design document and final report.

Timeline:

By Monday, February 22: [3 weeks]
- Finish initial research of other iPhone applications
- Collect thoughts and further specifications from Jennifer Wester (professional skater)
- Complete draft of design document with use cases and scenarios
- Get accustomed with the iPhone SDK platform for development
By Monday, March 8: [2 weeks]
- Develop preliminary prototype of application (with basic functionality, subset of the final product)
- Discuss issues and obstacles with Jennifer Wester and alter specifications
- Finalize design document with additional cases

Monday, March 8 – Monday, March 22: Spring Break

By Monday, April 5: [2 weeks]
- Develop initial prototype of application (with full functionality)
- Begin drafting final report with discussion of issues and obstacles faced from design and development perspectives

By Monday, April 19: [2 weeks]
- Test initial prototype with Jennifer Wester, collect feedback, and make necessary changes to software
- Continue drafting final report and include results of customer testing

By Monday, May 3: [2 weeks]
- Test final prototype for functionality in use cases from design document
- Complete all deliverables: final report, design document and software prototype

**Deliverables:**

1. Final report: discussing the project from both a design and technical perspective, detailing the development process, and commenting on obstacles that were faced.

2. Design document: detailing different use cases and experiential situations of the customers who will use this application.

3. Software prototype: demonstrating the different capabilities of the software and commenting on potential for future development.
Overview of Relevant iPhone Applications

When designing new software, it is important to look closely at what has been done before. Not only do designers want to avoid repeating something that has already been developed, but they would also like to ensure they are providing the best possible design for their customers. By doing extensive research on past successes and failures, the software designer can answer the following questions:

1. What will my program do that has not been done before? What niche target audience will my program attract?
2. How can my program’s design optimize user-friendliness? How can I ensure customers do not struggle with learning to use my program?

In this document, I provide a detailed overview of existing iPhone applications that are relevant to the one I am attempting to create. I first look at existing applications for ice skating to see what apps are already available to customers in this field. From there, I conclude the goal of my specific program and why it is offering something that is not already available. By identifying the niche audience and target uses of this application, I can tailor my design and development to those purposes.

Next, I look at different design ideas and patterns that have been used in iPhone applications. Although my application will consist primarily of information pages that provide details on elements, moves, levels, scoring methods and features, I will need to determine the best way to organize those pages into a coherent design structure. Therefore, I look at a variety of applications that use different types of Table of Content designs, discuss the benefits and drawbacks of each and offer a suggestion for my application.

Existing Applications for Ice Skating

SportsVideo: Ice Skating
- Video collection of everything ice skating
- Primary features:
  - Over 25 videos formatted to fit your iPhone/iPod Touch
  - Live user chat in a moderated discussion panel for sharing thoughts and comments on ice skating tips and trivia
- Videos include:
  - How to find the right size skates and how to tie your laces
  - Basic guidelines for posture, foot movement and steps
  - Instructional demos on how to do a lutz, axel, salchow and other jumps
- Released in December 2009
- Target audience: beginner skaters looking for instructional videos and live feedback as they learn to skate
- Feedback: all positive so far
**Figure It**
- Training aid for experienced figure skaters (singles only with pair and dance versions to come out in the near future)
- Primary features:
  - Build individual short and long programs based on your level
  - Track your personal progress over time as you train
  - Simulate your score using the International Judging System (IJS)
  - Provide element by element statistics
- Released in January 2010
- Target audience: experienced singles skaters looking for a way to keep track of their training
- Feedback: does not explain the IJS scoring system to you, only useful for experienced skaters, great tool for coaches to prepare for competitions, easy to create your own programs, most useful in keeping track of your personal progress

**Ice Skating Quiz**
- Fun quiz for skating fans to test their knowledge of the sport
- Primary features:
  - 25 easy questions worth 1 point each
  - 25 hard questions worth 3 points each
  - 3 lives before a game-over
- Released in December 2008
- Target audience: skating fans who just want to play a fun game
- Feedback: fun game to play if you are a figure skater and know some basic trivia, once you go through all the questions the game is useless

**IceSkater**
- Simulate yourself as a figure skater on ice
- Primary features:
  - Change the face of the skater to match yourself or another photo
  - Select different jumps for the skater to do
  - Move the skater around the ice as part of the program
  - Play internal or external music
- Released in December 2009
- Target audience: anyone with an interest in skating
- Feedback: very negative, does not work properly and has minimal features, very boring
Figure Skating
- Figure skating glossary with the names and meanings of basic figure skating terms
- Primary features:
  o Search using keyword
  o Search database in alphabetical order
  o Descriptions of all figure skating terms
  o Glossary/Dictionary based layout
- Released in January 2010
- Target audience: both experienced skaters and skating fans who want to look up the definition of a figure skating term
- Feedback: none available yet

As of January 2010, these 5 applications were the only ones related to figure skating available at the iTunes app store. In summary, here is the list of audiences that these existing applications serve:
- Beginner skaters looking for instructional videos and live feedback as they learn to skate
- Experienced singles skaters looking for a way to keep track of their training
- Skating fans who just want to play a fun game
- Anyone with an interest in skating
- Experienced skaters and skating fans who want to look up the definition of a skating term

Meanwhile, the application I hope to create will serve an audience that does not fall into any of the aforementioned categories. Instead, I will be targeting pure spectators and fans of the sport who are looking for a glossary or reference guide to the sport. More specifically, I hope to design an application that is like the combination of “Figure Skating” and “SportsVideo: Ice Skating” such that users can not only look up definitions of moves and elements, but also see videos and photos.

My application, to be called “Ice Dance,” will allow the average person to learn slightly more about the sport as they are watching a routine. Furthermore, I hope to allow the user to identify elements both by name (i.e. Level 3 Serpentine Lift) and image (i.e. photo of a Reverse Killian position). I will begin by focusing on the Ice Dance discipline, but if successful, this application could be extended to include other skating disciplines such as Ladies, Mens and Pairs.

Design Ideas for a Table of Contents

Seafood Guide
- Makes recommendations on sustainable seafood choices at restaurants and local grocery stores
- Primary features:
  o Regional guides that highlight the best choices in each area
  o Sushi guide lists fish by Japanese and common market names
- Released January 2010
- Feedback: Side alphabet makes it easy to jump to desired name
- Table of contents: Just a listing of each of the fish, allows sorting by alphabet and rating
**Grocery iQ**
- Helps you create and store shopping lists by scanning the barcode of a product or using the predictive search feature
- Primary features:
  - Database of millions of items to build lists from
  - Barcode scanning for adding items to your list
  - List sharing with other Grocery iQ users
  - Create store-specific lists, favorite lists, lists sorted by aisle
  - Include product details with notes on size, price, quantity, etc
- Released December 2009
- Feedback: very user friendly, the barcode scanning feature is especially useful, too many ads in the most recent release
- Table of Contents: sorted in categories (the gray bars), each product has a brief description with arrow to proceed to product detail, small icon for each product could contain picture

**Fromage**
- Pocket guide to cheeses made throughout the world
- Primary features:
  - Each entry includes photos, flavor descriptions and suggested choices for complementary wine
  - Over 650 cheeses with entries
  - Search by cheese name, region, milk type, or texture
- Released July 2009
- Feedback: search by name list was too long and would have to do too much finger scrolling, perhaps include a vertical letter index to speed finding if possible, otherwise very user-friendly with extensive database of cheeses
- Table of Contents: sorted into categories (blue bars), each cheese contains picture and location in table of contents, no arrow needed to proceed to product detail

**Eventful**
- Allows you to find local events, see what’s happening at your favorite venues and know which performers are coming soon
- Primary features:
  - Database of events, venue schedules and tour dates for over 130,000 performers
  - Locates events closest to your current location
- Released August 2008
- Feedback: Easy to use menus but trouble with search feature
- Table of Contents: Selection at top of screen between events, performers, venues and users; selection at bottom of screen for other features
As seen in the examples above, there are a variety of ways for organizing a collection of “information pages.” The “Seafood Guide” is the most basic example in which everything is listed on one page and organized alphabetically. For my purposes, this doesn’t seem appropriate since each element in an Ice Dance routine can easily be categorized into various subgroups.

Both “Grocery iQ” and “Fromage” organize pages into subgroups and provide headers in their table of contents with small icons or pictures attached. For my purposes, this seems appropriate, but not ideal. The images are too small to recognize and the list would still be extremely long. Meanwhile, both of these applications have a menu at the bottom of the screen and the buttons allow the user to jump to other features of the application. While I will not be providing any other features such as a list of coupons or favorite cheeses, I could potentially borrow this type of menu as an additional layer of my table of contents.

Finally, the “Eventful” application seems to provide the best organization I was able to find. In addition to a menu at the bottom of the page, this application also provides a menu at the top of the page and a listing of entries in the page. This provides, essentially, three layers of organization, which could be very helpful given the variety of pages I will include in “Ice Dance.” For example, I could use the bottom menu to jump between the Home page, the Scoring pages, the Moves pages and the Positions pages. For each of those pages, I could provide an additional menu at the top of the page if necessary. If not necessary, I can simply list the entries on the page as is done in “Grocery iQ” and “Fromage.”

In conclusion, there are a variety of ways that a table of contents can be organized, especially given a large collection of pages. Here, I have considered a few different design structures provided by existing iPhone applications, although none of them are in the realm of figure skating. It seems that most apps organize their table of contents using a menu on the bottom of the screen which allows the user to jump directly to a different category of pages. However, some applications, such as “Eventful,” provide an additional menu at the top of the screen as well. These added layers of organization will be important to my application as the elements in Ice Dance are categorized by type, level and features.
A.3 Preliminary Specifications

**SCORING**

(*explanation for each type of scoring method*)

ISU Judging System (IJS)  World Ranking System (WRS)

**POSITIONS**

(*photos for each position*)

Killian
Hand-in-hand
Foxtrot
Waltz Position
Tango
Reverse Killian
Reverse Foxtrot

**LIFTS**

(*photos for the types of lifts, photos for the position and grip features, videos for takeoff features*)

<table>
<thead>
<tr>
<th>Types of Lifts</th>
<th>Levels of Lifts</th>
<th>Features for Lifts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curve Lift</td>
<td>Level 1 Lift</td>
<td>Position of the lifting partner</td>
</tr>
<tr>
<td>Straight Line Lift</td>
<td>Level 2 Lift</td>
<td>Position of the lifted partner</td>
</tr>
<tr>
<td>Serpentine Lift</td>
<td>Level 3 Lift</td>
<td>Grip of the male</td>
</tr>
<tr>
<td>Rotational Lift</td>
<td>Level 4 Lift</td>
<td>Takeoff: on one foot, from another position, on two feet</td>
</tr>
<tr>
<td>Reverse Rotational Lift</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spinning Lift</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stationary Lift</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SPINS**

(*photos for the types of spins, photos for the entry and position features, video for time feature*)

<table>
<thead>
<tr>
<th>Types of Spins</th>
<th>Levels of Spins</th>
<th>Features for Spins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spin</td>
<td>Level 1 Spin</td>
<td>Entry</td>
</tr>
<tr>
<td>Combo Spin (one partner changes feet, both partners change feet)</td>
<td>Level 2 Spin</td>
<td>Position of the male</td>
</tr>
<tr>
<td></td>
<td>Level 3 Spin</td>
<td>Position of the female</td>
</tr>
<tr>
<td></td>
<td>Level 4 Spin</td>
<td>Time: hold for two revolutions</td>
</tr>
</tbody>
</table>
TWIZZLES

(photos for the types of twizzles, photos for the position feature, videos for timing and moving features)

<table>
<thead>
<tr>
<th>Types of Twizzles</th>
<th>Levels of Twizzles</th>
<th>Features for Twizzles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Twizzle (single) ⁸</td>
<td>Level 1 Twizzle Sequence</td>
<td>Timing: hold a feature for two revolutions</td>
</tr>
<tr>
<td>Twizzle Sequence: two or more twizzles ⁹</td>
<td>Level 2 Twizzle Sequence</td>
<td>Position</td>
</tr>
<tr>
<td></td>
<td>Level 3 Twizzle Sequence</td>
<td>Moving features: constant movement of arms, constant rise and fall in your knees</td>
</tr>
<tr>
<td></td>
<td>Level 4 Twizzle Sequence</td>
<td></td>
</tr>
</tbody>
</table>

FOOTWORK

(photos for the types of footwork, photos for each of the feature categories)

<table>
<thead>
<tr>
<th>Types of Footwork</th>
<th>Levels of Footwork</th>
<th>Features for Footwork</th>
</tr>
</thead>
<tbody>
<tr>
<td>Circular</td>
<td>Level 1</td>
<td>One-Foot Section</td>
</tr>
<tr>
<td>Straightline</td>
<td>Level 2</td>
<td>Highlights</td>
</tr>
<tr>
<td>Midline</td>
<td>Level 3</td>
<td>Positions</td>
</tr>
<tr>
<td>Midline Non-Touching</td>
<td>Level 4</td>
<td>7 Basic Steps</td>
</tr>
<tr>
<td>Diagonal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Serpentine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-Shaped</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OTHER MOVES

(photo for hydroblading move, videos for swing rolls and cross rolls)

<table>
<thead>
<tr>
<th>OTHER MOVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydroblading</td>
</tr>
<tr>
<td>Swing Rolls</td>
</tr>
<tr>
<td>Cross Rolls</td>
</tr>
</tbody>
</table>

---

⁸ A twizzle is the ice dance variation of a loop. Skaters move very fast and are intentionally traveling by making a series of little loops. The blade never turns backward although the skater will physically turn around.

⁹ Usually between two and seven rotations.
A.4 Design Document

IdanCE is an application built for the iPhone that targets spectators of figure skating. Using this app, audience members and fans across the world will be able to understand the moves, elements, techniques, and scoring methods of Ice Dance programs. In some ways, this program is like an encyclopedia for the sport of Ice Dance that allows a layman to learn all about the sport and become an expert within minutes. To illustrate the functionality of this application, I examine a variety of use cases in detail. In addition to detailing the basic features of each case, I also comment on additional features that may be added if time allows.

1. The spectator would like to learn about how the scoring system works for this sport.
2. The spectator observes a position that the ice skaters are holding on the ice and would like to look up the details.
3. The spectator observes a lift that the ice skaters perform and would like to learn about the lift.
   a. The spectator observes the path that the skates made on the ice and would like to learn about that specific type of lift.
   b. The spectator observes the details of the lift and would like to learn about the particular features that were displayed.
   c. The spectator observes a lift and would like to learn about the different levels of difficulty for such lifts.

This is the welcome page to the application. When the user opens the application, this is the first page she will come to.

From here, I will proceed through each of the four use cases detailed above.
**Use Case #1:**
The spectator would like to learn about how the scoring system works for this sport.

First, the user must select the “Scoring” tab on the bottom of the screen.

When that tab is selected, the user will come to a page on the World Ranking System (WRS). This page will have detailed information about this scoring system and how it works.

If the user would like to learn about the International Judging System (IJS), the user may select the tab at the top of the screen and will come to the following screen:

Additional features:
- The IJS screen may have links that allow the user to jump directly to individual information pages about each of the individual elements that detail how scoring works.

... Include tables, formulas and charts.
Use Case #2:
The spectator observes a position that the ice skaters are holding on the ice and would like to look up the details.

First, the user must select the “Positions” tab on the bottom of the screen.

When the tab is selected, a menu will appear on the screen the shows a list of all possible positions including the name, a picture, and a short description of the position.

Furthermore, the user may select a particular position and when the user clicks on that rectangle, a new screen will appear that discusses, more specifically, the position. For example, if the user selects “Reverse Killian,” the following screen would appear.

This information page would also include one extra button (back), which allows the user to return to the menu of Positions.

Additional features:
- The information pages could contain links to the original “Scoring” pages.
- The information pages could also include a video of a pair holding that position and discussing the different ways in which this position could be used.
Use Case #3:
The spectator observes a lift that the ice skaters perform and would like to learn about the lift.

First, the user must select the “Moves” tab at the bottom of the screen.

When the tab is selected, a menu will appear that allows the user to select a category of moves. A brief description may describe the differences between the categories.

The user may then select a category and proceed to the home page for that category. For example, in this case, the user is looking for information on a specific type of lift. Here is the screen that will appear when the user touches the “Lifts” button:

The homepage of the “Lifts” category will simply provide an overview of what a lift is, how many different types, levels and features there are and how those three are related. There may also be a picture on this page.

To learn the details of a specific type, level or feature of the lift, the user would have to select a button from the top of the screen. The following three sub-use cases detail the screens the user would see upon looking for this information.
Use Case #3a:
The spectator observes the path that the skates made on the ice and would like to learn about that specific type of lift.

Once the user selects the “Types” button at the top of the previous screen, this screen appears. It is much like the menu that appears for the different positions. It simply contains a diagram of the path that the lift must take to be considered that type of lift along with the name and a brief description.

The user may then touch any of these boxes to proceed to an information page with a much more detailed description of that particular type of move. For example, if the user selects the Curve Lift, the following screen will appear:

This information page would also include one extra button (back), which allows the user to return to the menu of Types of Lifts.

Additional features:
- The information pages could contain links to the original “Scoring” pages.
- The information pages could also include a video of a pair performing a lift along this particular path, although it is not really necessary since the diagram should be sufficient.
Use Case #3b:
The spectator observes the details of the lift and would like to learn about the particular features that were displayed.

When the “Features” tab is selected, a menu will appear that allows the user to select a category of features. A brief description may describe the differences between the categories.

Once the user selects a category, the following screen will appear, which allows the user to select a particular feature to learn more about.

After the user selects a particular feature by clicking on the menu, an information page will appear like the one shown to the left here.
Use case #3c:
The spectator observes a lift and would like to learn about the different levels of difficulty for such lifts.

<table>
<thead>
<tr>
<th>Overview</th>
<th>Types</th>
<th>Levels</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td># Features</td>
<td>Other Comments</td>
</tr>
<tr>
<td>Level 1:</td>
<td></td>
<td></td>
<td>▲</td>
</tr>
<tr>
<td>Level 2:</td>
<td></td>
<td></td>
<td>▲</td>
</tr>
<tr>
<td>Level 3:</td>
<td></td>
<td></td>
<td>▲</td>
</tr>
<tr>
<td>Level 4:</td>
<td></td>
<td></td>
<td>▲</td>
</tr>
</tbody>
</table>

When the user selects the “Levels” menu, a screen with a table like the one shown here will appear. The table will display the number of features that are required for each level as well as some brief comments. In addition, each level will have an arrow button that allows the user to touch and proceed to a screen with more details about that particular level. For example, if the user would like to see what is required of the most basic level (Level 1 Lift), the application would take the user to the following screen:

Additional features:
- The Level One Lift information page could also contain links to the other levels so that the user does not have to go back to the menu page.
- The information page could also contain links to the overview of scoring pages so that the user may jump directly to that information.

[description goes here, including scoring methods, etc]
A.5 Application Prototype v1

Prior to beginning the application development process, I gained a basic understanding of the iPhone development kit, XCode, and the iPhone simulator. Using that knowledge, I created a TabController class to represent each of the four “tabs” at the bottom of the page. These tabs will represent unique use cases as defined in the design document. This provides the basic framework for the IdanCE application.

For the first layer of development, I successfully implemented the “Home” and “Scoring” tabs. The “Home” tab is simply the welcome page that appears when the application is launched by the user. It contains a simple text view that provides a quick introduction into the ice dancing discipline and brief overview of the functionality of this application. The “Scoring” tab overviews the two types of scoring methods that may be used for Ice Dancing and displays two buttons in which the user may select for further information. When the user does select these buttons, they are taken to new information pages that detail each scoring method.

Home Page [left]
This page appears when the user first launches the application. It contains a simple Text View that provides a quick description of the sport of ice dancing and brief overview of what the application provides.

In the next level of development, I hope to add an image or logo to the top of the page so that this offers a more exciting welcome to users.
Scoring Methods Page [right]
This page appears when the user selects the “Scoring” tab at the bottom of the view. It introduces the two types of scoring methods used in the sport and provides two buttons for the user to click if interested in learning more about each scoring method.

World Ranking System Page [left]
This page appears when the user selects the “World Ranking System” button from the Scoring Methods Page. It provides further details about the World Ranking System in a simple Text View. In addition, a Back button at the top left corner allows users to return to the Scoring Methods Page.

In the next level of development, I hope to add an image of the current World Rankings to give users a more complete description.
**ISU Judging System Page [right]**

This page appears when the user selects the “ISU Judging System” button from the Scoring Methods Page. It provides further details about the ISU Judging System through a table that details the different Program Components. In addition, a Back button at the top left corner allows users to return to the Scoring Methods Page.

In the next level of development, I hope to add text alongside the current image to give users a more robust description.
A.6 Application Prototype v2

In the second layer of development, I worked on the Positions tab. This tab, when selected, displays a table that lists each of the seven positions in Ice Dancing. Each table cell is also a button that, when clicked, will lead the user to an information page.

These information pages for each position provide both an image and some text which describes the position. Each information page also provides a back button that allows the user to return to the table view that lists each of the Positions. Depending on the dimensions of the image, it is either placed above or beside the text. Furthermore, each text area is scroll-able and can be read through while the image remains stationary.

Positions Menu [left]

This page appears when the user selects the Positions tab at the bottom of the screen. The table provides links to individual information pages for each of the Positions.

In the next level of development, I hope to replace each of the individual purple boxes with images of the positions themselves. Currently the image is only displayed on the information pages, but not on the Positions menu.
Position Information Pages [right + below]
The images on the next two pages display the seven information pages I created for each of the Positions. As you can see, these pages include both an image and some text describing the position. While the image is stationary, if the user touches the text, she can scroll through to read the entire description.
In the Tango hold, the man and the lady are face to face however, in contrast to the Waltz hold, the tango position is intentionally aligned off of square. The woman should remain in the pocket of the man’s right arm; therefore staggering the shoulder alignment from the square alignment of waltz. The hand placements of the tango hold are similar to the Waltz hold otherwise.

The waltz, like other ballroom dances, is danced in what is known as ‘closed hold’. A closed hold is defined as any hold that closes the partner in what would appear to be a complete circle, as opposed to those holds where partners are linearly related. Waltz hold is composed of one partner facing the other and the lady having her left hand on the front of the man’s chest.

The reverse Killian hold is the same as the Killian hold with the exception that the lady is on the man’s left and thus the man’s left hand is placed on the lady’s left hip, right arms extended horizontally, creating a ‘reverse’ hold of the classical Killian.

Like other reverse holds, Reverse Foxtrot is like Foxtrot in all ways except for the fact that the lady is on the reverse side of the man than traditional Foxtrot and therefore the opposite arms are used to execute the hold.
A.7 Application Prototype v3

In the final layer of development, I worked on the Moves tab. This tab, when selected, displays a table that lists each of the different categories of moves and which types belong to each category. Each table cell is also a button that, when clicked, will lead the user to an information page. These information pages are similar to those created for the positions, but do not contain photos due to time limitations of the development process. In the next implementation of this application, both photos and videos may be added to these pages.

In addition to the Moves tab, I made some minor changes to the Home and Scoring tabs. On the Home page, I added a logo, developed by Jennifer Wester. In addition, on the Scoring pages, I changed the IJS information page to include simply text as it was able to provide a more robust summary of the scoring method. In the next implementation, however, hopefully photos may be added to this page to provide a more complete picture of how the method works.

Moves Menu [left + below]
This page appears when the user selects the Moves tab at the bottom of the screen. The table provides links to individual information pages for each of the Moves. Furthermore, the table divides the moves based on categories (Lifts, Spins, Step Sequences and Twizzles), which form headers within the table.

In the next level of development, I hope to replace each of the individual purple boxes with images of the moves themselves, but since no images were created due to time limitations, this was not possible for this prototype.
**Move Information Pages**

The information pages for each of the moves are very straightforward. Each one simply contains a title, a description and a back button that allows the user to return to the Moves menu. Each information page is captured in an image below.

**Lifts [below]**

There are seven different types of lifts: Combination, Curve, Reverse Rotational, Rotational, Serpentine, Stationary, and Straight Line. In addition to the types of lifts, a page providing the definition of a lift was also created.
Spins [right]
There are only two types of spins: a single spin and a combination spin.

Step Sequences [right + below]
There are four different types of step sequences: Circular, Diagonal, Midline and Serpentine. In addition to the types of step sequences, a page providing a definition of what a step sequence is was also created.
Twizzles [left]
There are only two types of twizzles: a single twizzle and a twizzle sequence. These information pages are unique and different from all other move information pages. In these, I include images in a format that is similar to the information pages of the Position Information Pages from the Application Prototype v2.

Home Page [right]
In addition to working on the individual Moves pages, I also made one update to the Home Page. Thanks to Jennifer Wester’s design of the IdanCE logo, I was able to include this on the welcome page as the first thing that users see.