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Next Generation Business Application Interfaces:

Lessons from Video Games

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Foreword

IBIT Reports are sourced, reviewed, and produced by the editorial staff. The editor and editor-in-chief consult on topics and identify new sources of reports. The editor typically works with authors who are interested in writing reports and provides feedback on initial drafts. Completed reports are first screened by the editor-in-chief and then sent out for review by two members of the editorial board. Final reports are then professionally produced and made available to IBIT members.

This IBIT Report *Next Generation Business Application Interfaces* examines video games to find lessons that can be applied to business applications. The video game industry generates significant revenue and is a major driver of technological innovation. Games process large amounts of information, facilitate group collaboration, and are products people enjoy using. Aren't these characteristics we would love main stream business applications to have? To achieve that goal the report analyzes video games across a variety of categories, examines their design structures, and then suggests how business applications may be more like them.

Bruce Fadem
Editor-in-Chief
January 5, 2012

Introduction

The U.S. video game industry generated \$18.6 billion in 2010¹. This is almost double the \$10.4 billion generated by U.S. movie ticket sales in 2010². This surprising statistic reinforces the powerful influence that video games have in popular culture. Gaming is an essential part of consumer electronics.

Video games have become a major driver of technological innovation. Some of the most powerful computers are video game consoles, such as the Playstation 3 and the Xbox 360. Changes in the ways in which we interact with technology are also driven by gaming, such as the motion-sensing Wii Remote and Xbox 360's Kinect and Playstation Move. Video games have also led the way in group collaboration, often achieving a level of sophistication in virtual collaboration not often seen within companies. Notably games, such as the Call of Duty series and World of Warcraft, allow users to play together over the Internet, communicating in real-time.³ The attention these games demand is incredible - in its first week, Halo: Reach accounted for 5,901 person-years of online game play.⁴

From a usability perspective, users of business applications are faced with many of the same issues as those that face video gamers. Both are working toward a goal, and often both have to deal with an overwhelming amount of information in order to achieve it. Further, the information they need is often stored in a variety of formats, as both structured and unstructured data. Consolidating these data so that they can be easily and correctly interpreted is critical to achieving success for both gamers and business users.

The next generation of corporate employees and

their managers, having grown up using iPhones and Playstations, will have a different set of expectations regarding software usability. This includes interfaces with a greater visual sophistication and interactivity. Developing applications that operate in a way consistent with those expectations will become critical to maintain relevance.

So far, however, few innovations in gaming application interfaces have made inroads into mainstream business applications. Still, games are increasingly used as training tools^{5,6}, and the goal-oriented, reward-based environment in games are starting to be applied to business applications.⁷ Nevertheless, these examples are still relatively rare, and they do not directly address how the user interacts with the software at a fundamental level. Most business applications employ the basic, form-based paradigm that has been around since the 1980s. This can be seen in everything from Enterprise Resource Planning systems like SAP, to popular web-based applications like Salesforce.com.

In order for businesses to make good decisions, they must be able to understand an increasingly rich information environment. The rise of "big data" and advanced analytics requires managers to navigate and make sense of large data sets. These managers must also be able to interact with multiple aspects of their environment at once, enabling them to better understand complex relationships and process flows.

Video game designers have solved many of these problems. Games require many pieces of information to be conveyed to the user at the same time in multiple formats, delivered effectively without interrupting the game's flow. Games also facilitate complex interactions combining data entry and extraction in real-time. This report details the analysis of 29 video games, with the purpose of developing a set of best practices that can be applied to the design of business applications.

1 <http://www.thestreet.com/story/10974455/video-game-industry-sales-fall-in-2010.html>

2 <http://www.the-numbers.com/market/2010.php>

3 <http://online.wsj.com/article/SB10001424052970203418804576040103609214400.html>

4 <http://www.bungie.net/News/content.aspx?type=topnews&cid=28805>

5 <http://online.wsj.com/article/SB10001424052702303912104575164573823418844.html>

6 http://www.businessweek.com/magazine/content/06_13/b3977062.htm

7 <http://tech.fortune.cnn.com/2010/09/03/the-game-based-economy/>

Methodology

We analyzed 29 console video games across a variety of categories including strategy, puzzle-solving, role playing, sports, and first-person shooters (see Table 1). Most of the games were based on the Xbox 360 platform; five were on the Playstation Portable (PSP). The games were selected for their diversity. For example, *Braid* and *Word Puzzle* differ in both game play and their visual interface. *Braid* is a “platform”¹ game that depends upon manipulating objects in order to achieve objectives, while *Word Puzzle* is based on a traditional pen-and-paper word search. This diversity allowed us to see very different implementations of common game elements across multiple genres.

The “players” played each game and recorded the ways in which information was visually communicated to the player. We also watched game

1 The term “platform” refers to a type of game whose play involves running and jumping from one platform to another, usually in order to reach a goal or solve a puzzle.

play videos, such as those that accompany product reviews on sites like ign.com and GameSpot.com. We recorded each “artifact” (visual component), the purpose it served in the game, and the specific information it was designed to convey. Photographs of certain elements were taken during game play as further documentation.² This summary analysis was used to create aggregate statistics across the entire collection. The aggregate statistics are presented as tables throughout this report.

The games were grouped into categories reflective of the classifications in the popular gaming press (such as GameSpot.com). However, some categories were merged to create a simple set of groups for comparison. For example, *Karaoke Revolution* was merged into a “Puzzle and Music” category since it has broadly similar play to a puzzle-type game.

2 The screenshots throughout this report are from various gaming web sites (citations are provided). The photographs taken as part of the analysis were adequate for documentation purposes but not at a quality level sufficient for printing.

Table 1. Games Analyzed for this Report

Category	Game Titles (Platform)
Strategy	Halo 3 (XBox 360) Command and Conquer 3 (XBox 360) Battlestations (XBox 360)
Puzzle and Music	Braid (XBox 360) Tetris (XBox 360) Word Puzzle (XBox 360) Super Puzzle Fighter (XBox 360) Karaoke Revolution Presents: American Idol Encore (XBox 360)
Role playing	Crisis Core: Final Fantasy VII (PSP) X-MEN Legends II: Rise of Apocalypse (XBox 360) Fallout 3 (XBox 360)
3-D Fighting	Street Fighter IV (XBox 360) Soul Caliber 4 (XBox 360) Dragon Ball Z: Shin Budokai (PSP) Street Fighter Alpha Max 3 (PSP) Tekken Dark Resurrection (PSP)
Sports and Racing	Madden 09 (PSP) NHL 09 (XBox 360) Tiger Woods Golf 08 (XBox 360) Burnout: Revenge (XBox 360) Fight Night (XBox 360)
Tactical Shooting	Ghost Recon Advanced Warfighter (XBox 360) Portal (XBox 360) Gears of War 2 (XBox 360)
First-Person Shooter	Call of Duty 4 (XBox 360) Far Cry 2 (XBox 360)
Action-Adventure	Ninja Gaiden 2 (XBox 360) Grand Theft Auto IV (XBox 360) Devil May Cry 4 (XBox 360)

Why look to video games?

Video games look and feel much different from productivity software, but they share basic similarities – both are goal-oriented and process large amounts of information. That’s why they can give us new ways of looking at the design of business applications:

- 1) Game players achieve goals in a non-linear way.** Business applications implement business processes in a linear, ordered way. Games often allow for performing tasks in any order – the goal is achieved whenever all the tasks are completed. Many workers execute processes in the same non-linear way, but the software maintains a structured flow, creating a disconnect between how people actually work and how the application is used. Games illustrate new ways to think about process flow.
- 2) Games are highly visual.** Most interaction with

games takes place on a single screen. This means complex, fast changing, and large volumes of task and goal-relevant information must be communicated to the user instantly. This forces game developers to represent information in an efficient, non-textual way. Business application designers have just as much information to convey, but the dominant paradigm remains multi-form data entry and multi-page reporting. Applying new visual techniques can greatly increase worker efficiency.

- 3) Games are entertainment products, not productivity tools.** Gaming is designed to be a hedonic experience. A business application has the utilitarian goal of contributing to their users’ productivity instead of simply being “fun.” The entertainment focus of games results in products people want to use for the interaction itself, a goal from which business applications could benefit. Creating business applications that are truly fun to use will increase attention to detail and effort expended when performing tasks.

Five common visual artifacts in games

Highlights

- Video games excel at the efficient communication of information to the user.
- Common visual elements include contextual navigation tools, goal indicators, menus, information overlays, and avatars.
- In games, conveying information is a balance between commanding attention and remaining unobtrusive.

The video game designer has a unique data visualization challenge. Business application developers have the luxury of allowing the user multiple input and report screens with which to interact. However, video games must be able to convey multiple pieces of information to the user on what is essentially a single display serving as the data entry form and the report. The interface must not interrupt the flow of game play, and therefore users are often fed multiple visual cues simultaneously in order to aid their deci-

sion process within the game.

We found that this is the underlying characteristic in the five prominent elements employed by the games we studied (see Figure 1). At least half the games employed one or more of the following visual artifacts: Contextual Navigation Tools, Goal Indicators, Menus, Information Overlays, and Avatars. This section will explore each one, and provide examples of how they are used (for a summary of the analysis see Table 2).

Table 2. Games and Visual Artifacts					
	Contextual Navigation Tools	Goal Indicators	Information Overlays	Menus	Avatars
Strategy					
Halo 3 (XBox 360)	√	√	√	√	
Command and Conquer 3 (XBox 360)	√	√	√	√	
Battlestations (XBox 360)	√	√	√	√	√
Puzzle and Music					
Braid (XBox 360)			√	√	√
Tetris (XBox 360)	√		√	√	
Word Puzzle (XBox 360)	√	√	√	√	
Super Puzzle Fighter (XBox 360)	√	√	√	√	√
Karaoke Revolution Presents: American Idol Encore (XBox 360)	√	√	√	√	√
Role Playing					
Crisis Core: Final Fantasy VII (PSP)		√	√	√	√
X-MEN Legends II: Rise of Apocalypse (XBox 360)	√	√	√	√	√
Fallout 3 (XBox 360)	√	√	√	√	√
3-D Fighting					
Street Fighter IV (XBox 360)		√	√	√	√
Soul Caliber 4 (XBox 360)	√	√	√	√	√
Dragon Ball Z: Budokai Tenkaichi 3 (PSP)		√	√	√	√
Street Fighter Alpha Max 3 (PSP)		√	√	√	√
Tekken Dark Resurrection (PSP)		√	√	√	√
Sports and Racing					
Madden 09 (PSP)	√		√	√	
NHL 09 (XBox 360)			√	√	
Tiger Woods Golf 08 (XBox 360)	√		√	√	√
Burnout: Revenge (XBox 360)	√	√	√	√	√
Fight Night (XBox 360)			√	√	√
Tactical Shooting					
Ghost Recon Advanced Warfighter (XBox 360)	√	√	√	√	√
Portal (XBox 360)	√		√	√	
Gears of War 2 (XBox 360)	√	√	√	√	√
First-Person Shooter					
Call of Duty 4 (XBox 360)	√	√	√	√	
Far Cry 2 (XBox 360)	√	√	√	√	
Action-Adventure					
Ninja Gaiden 2 (XBox 360)	√	√	√	√	√
Grand Theft Auto IV (XBox 360)	√	√	√	√	√
Devil May Cry 4 (XBox 360)	√	√	√	√	√

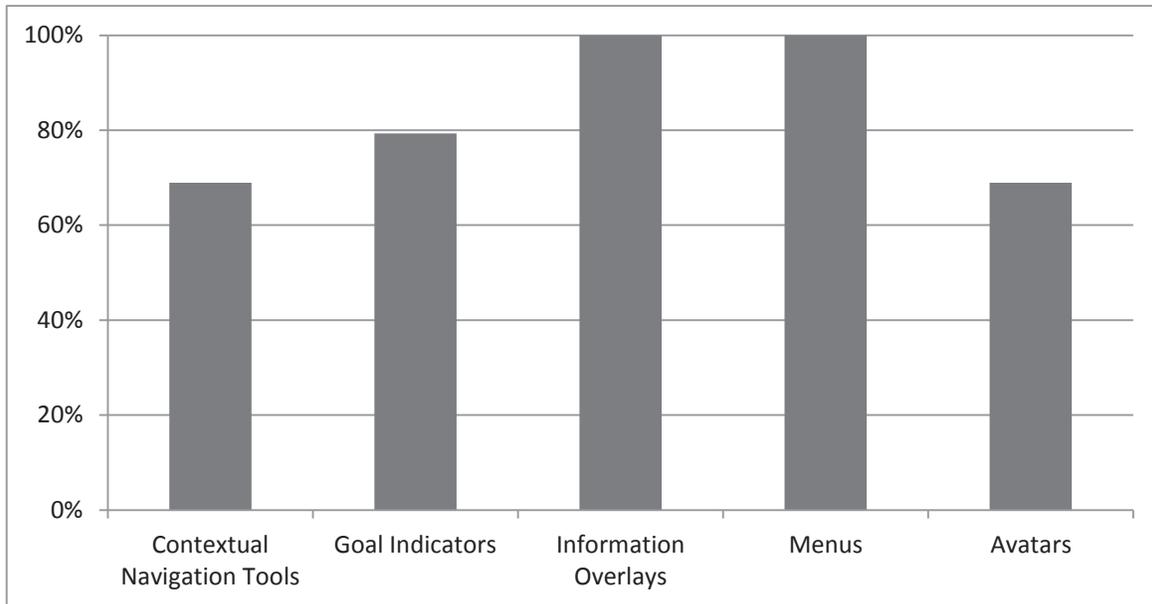


Figure 1. Common Visual Artifacts in Video Games

Contextual Navigation Tools: Games often involve movement of objects within a virtual space. Navigation tools help gamers orient themselves within the game space and make decisions about what to do next. These navigation aids can take very different forms. *Grand Theft Auto 4* implements a very straightforward implementation through embedding a map in the bottom left corner of the screen (see Figure 2). The map (highlighted in Figure 2) shows the area around the driver's current location. By combining that information with the view of the immediate area, the user can understand where they have just been

and how to get to the next location (i.e., how quickly the next turn will be reached).

Command and Conquer 3 also provides contextual navigation through a map. The player commands an army that can be active across a playing field much too large to fit on a single screen. The map (see Figure 2) shows a much wider view, highlighting the area currently in focus. This enables the player to see what's happening beyond the immediate view and directs her focus to other areas of the campaign in need of attention.



Figure 2: Navigation Tools in *Grand Theft Auto 4*¹ and *Command and Conquer 3*²

1 Image from <http://reviews.teamxbox.com/xbox-360/1307/Tetris-Evolution/p1/>

2 Image from <http://pc.ign.com/dor/objects/823989/command-conquer-3-tiberium-wars/images/command-conquer-3-tiberium-wars-20070329084847141.html>

Goal Indicators: This provides a mechanism for gamers to monitor their condition during the play. Their implementation is commonly undertaken as a horizontal or vertical bar that is filled to a certain level depending on status. These bars can be used for tracking progress towards an accomplishment (achievement as a goal) or for understanding when a player is in danger of losing the game (avoidance as a goal).

The goal indicator used in *Street Fighter 4* is a

status bar indicating the player's health (see Figure 3). When the bar is low, the player's health is depleted and is close to losing the round. In *Karaoke Revolution*, the bar is used to indicate success – the better the player performs the more the status bar is filled, with the goal being to reach and maintain a full status bar. *Word Puzzle* uses a status bar to indicate time remaining, providing a simpler visual cue than a clock counting down to zero.



Figure 3: Status bars in (from top) *Street Fighter 4*¹, *Karaoke Revolution*², and *Word Puzzle*³.

1 Image from http://media.xbox360.ign.com/media/142/14211549/imgs_2.html

2 Image from http://media.xbox360.ign.com/media/142/14267038/imgs_1.html

3 Image from <http://screenshots.teamxbox.com/screen/67801/Word-Puzzle/>

Information Overlays: The most common way to relay status to the player is through on-screen textual or numeric messages during gameplay.

However, the messages have to be brief as to not distract the player from the game. They are implemented as a “heads-up display” (HUD) superimposed over the game image, usually at the edges of the screen. Some of the messages are contextual and appear when they are relevant to events happening in the game.

Racing games, such as *Burnout Revenge*, often

employ a HUD (see Figure 4). The current lap, the player’s position in the race, the speed, and the overall rating are displayed throughout game play to indicate different aspects of the player’s status. In *Far Cry 2*, as new features of the game are unlocked, an overlay message appears for a few seconds at the top-center the screen. By appearing only temporarily, the message gets the player’s

attention without cluttering the display or interrupting the game.

Because of the complexity in navigating a menu, they often interrupt regular game play.

attention without cluttering the display or interrupting the game.



Figure 4: Information Overlays in (from top) *Burnout Revenge*¹ and *Far Cry 2*².

1 Image from <http://www.gamespot.com/xbox360/driving/burnoutrevenge/images/0/12/>

2 Image from <http://xbox360.ign.com/dor/objects/14226061/far-cry-2/images/far-cry-2-20081021021411531.html>

Menus: In every game we studied, there were interactions too complex to be handled exclusively by simple non-textual visual elements. These situations include manipulating complex game settings or navigating lists that can't practically be represented graphically. Therefore, menus are usually implemented as a list of options. Because of the complexity in navigating a menu, they often interrupt regular game play.

For example, *NHL 09*'s "Be a Pro" mode where the user creates a customized hockey player for play

throughout the game (see Figure 5). The player configuration requires allocating a fixed amount of points to a long list of attributes with textual descriptions like "passing" and "slap shot accuracy." Player status menus in *Fallout 3* are much different in appearance than *NHL 09*. The "Stats" screen shows the damage to different parts of the player's body (represented through an avatar and conveyed through textual messages and status bars). Players can choose which body part they want to heal by highlighting it.



Figure 5: Menus in (from top) *NHL 09*¹ and *Fallout 3*²

1 Image from <http://xbox360.ign.com/dor/objects/14230950/nhl-09/images/nhl-09-20080820013835479.html>

2 Image from <http://www.gamespot.com/xbox360/rpg/fallout3/images/0/86/>

Avatars: An avatar is the graphical representation of the user, used to orient the user within the game.¹ We consider something to be an avatar if it uniquely identifies a player. For example, in *Braid* the player is represented by a two-dimensional cartoon image (see Figure 6). In *Battlestations: Midway*, when the player is flying the fighter plane, they are represented by the image of the plane.

In *Street Fighter 4* and *Karaoke Revolution*, the user manipulates an image of the player's avatar to

perform the tasks in the game. *Fallout 3* uses a generic image of the player to show their injuries. In some of these games, such as *Battlestations: Midway* and *Grand Theft Auto 4*, the player can choose between an avatar view and a first-person view. However, information is often embedded within the avatar. For example, while driving a car in *Grand Theft Auto 4* and *Burnout Revenge*, as the car becomes damaged its representation changes on screen.

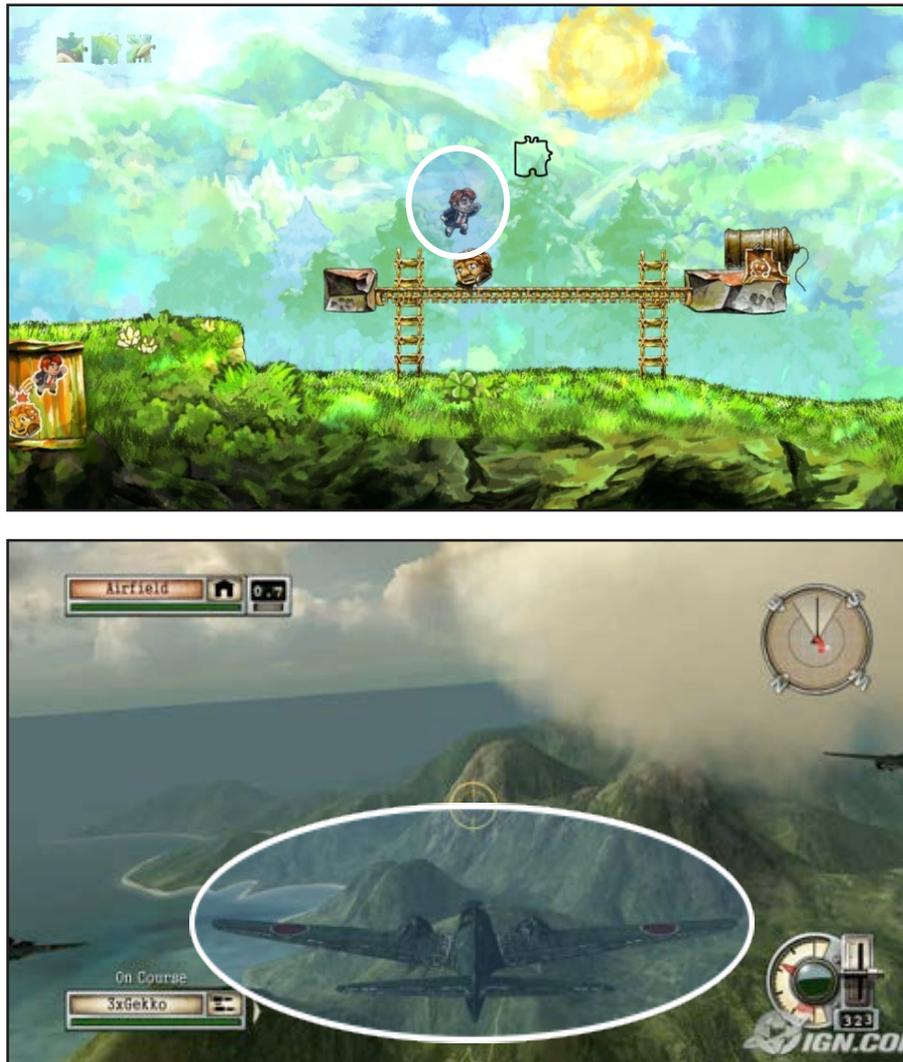


Figure 6: Avatars in (from top) *Braid*² and *Battlestations: Midway*³

1 [http://en.wikipedia.org/wiki/Avatar_\(computing\)](http://en.wikipedia.org/wiki/Avatar_(computing))

2 Image from <http://screenshots.teamxbox.com/screen-hires/77904/Braid/>

3 Image from <http://xbox360.ign.com/dor/objects/824256/battlestations-midway/images/battlestations-midway-20070226011151870.html>

Guidelines for application interface design

Highlights

- Games support several functions in common with business applications, such as goal setting, history management, real-time feedback, task facilitation, resource management, and providing context
- Guidelines that encourage support of these core functions can inform better application interface design
- Much of the innovation in this area lies in consumer-facing applications

The visual artifacts described in the previous section support six major gaming functions: goal setting, history management, real-time feedback, guidance and help, resource management, and providing context. Business applications often require support for these functions, even though their implementation might be quite different. In this section, we present a set of design propositions (summarized in Table 3) for each of these six functions. We also describe examples of how they have been implemented in the

games we've analyzed.

For each function, we also demonstrate how these concepts can be extended to business-oriented applications through a commercially-available example. Many of the examples in this section are found in consumer-facing web sites, such as those of online retailers. We found that much of the innovation around interface design is taking place in this space, and offer excellent examples for application developers as a whole.

Table 3. Gaming Functions and Design Guidelines

Function	Guideline
Goal Setting	Provide mechanisms for measuring and communicating achievement.
History Management	Enable users to retrace their steps to recall what they've done.
Real-time Feedback	Maintain constant feedback regarding a user's status to keep them focused on the current task.
Task Facilitation	Keep focus on task completion by minimizing the need for the user to look up the mechanics of task performance.
Resource Management	Communicate availability of assets required to perform a task, and urgency associated with those assets becoming depleted.
Providing Context	Orient the user within the application, showing related functions and information to aid navigation.

Goal Setting: Many games are task-oriented and involve performing complex, multi-step functions. The player is trying to accomplish a specific task in order to progress. Within a virtual space, navigation tools and maps can serve this function, such as *Grand Theft Auto 4*'s highlighting of the route to the player's destination. In *Karaoke Revolution*, a "full" status bar indicates the best achievable level of performance (see Figure 3). Burnout Revenge displays uses information overlays to indicate the current status (i.e., "Awesome," as depicted in Figure 4).

We see an example of goal setting in the personal finance application *Mint.com* (see Figure 7). Users define financial goals, linked to their account informa-

tion. Goal indicators, in the form of status bars, are used to show how close the user is to achieving their goal. There is also a numeric representation, but the graphical representation instantly relays the information and motivates the users to progress. The personal productivity iPhone app *Epic Win* turns a user's real-world task list into a role-playing game. The users, represented by medieval-themed avatars, advance through the game as they complete their tasks. Their progress is displayed on a map and shared with their friends. There are no tangible rewards for advancement, but the opportunities for social comparison are intended to motivate the users to complete their tasks on the list.

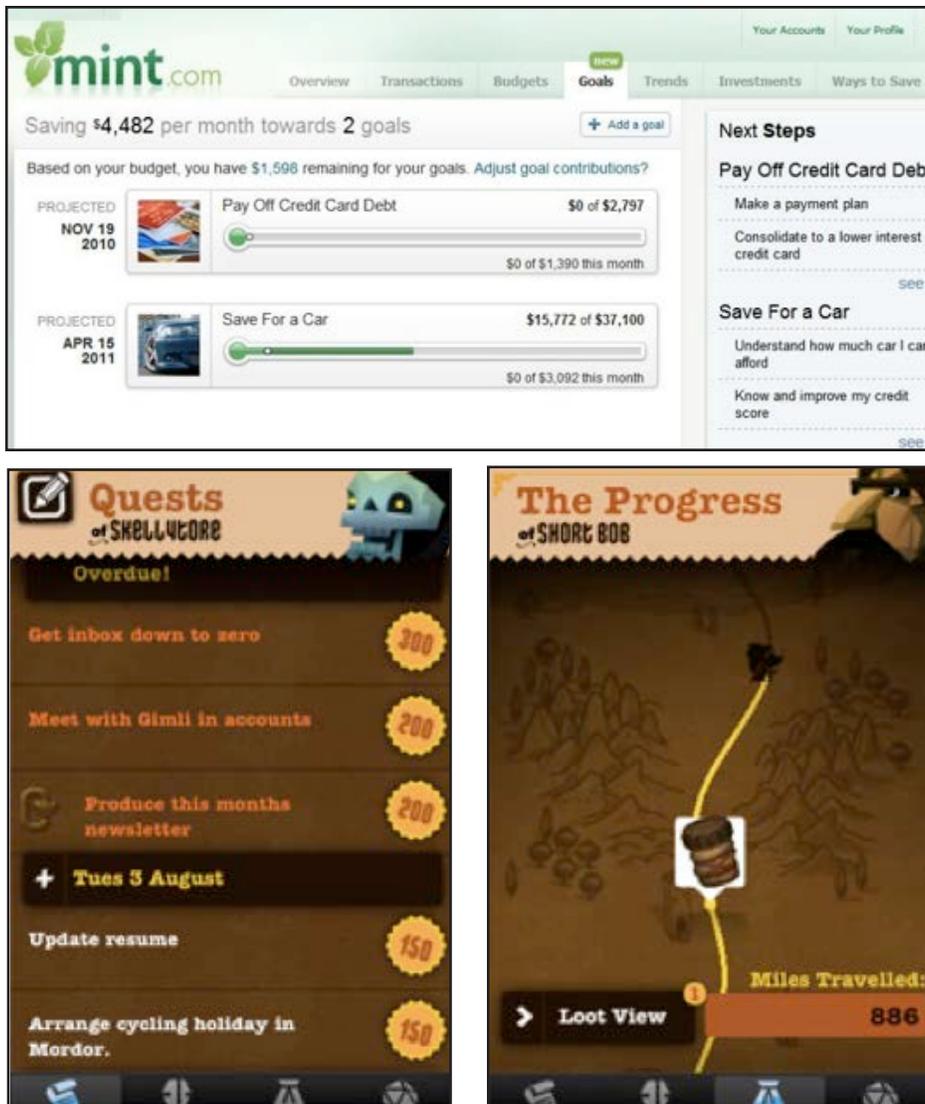


Figure 7: Goal setting in (from top) *Mint.com* and *Epic Win*¹

1 Images from <http://www.rexbox.co.uk/epicwin/media.html>

History Management: In task-based games, it is important for a player to be able to retrace their steps, either to understand how they reached their current status, or to revisit and make changes to the process. Complex sets of operations take place that often must be described using text, either through information overlays or menus. For example, *Madden 09* uses both, allowing the player to review a list of past plays made during the game.

Amazon.com keeps track of customers' browsing history for their current session and uses that infor-

mation to suggest other products that the customers may like. These are implemented by a menu of items, displayed as an ordered list, on a "Browsing History" page (see Figure 8). The site also conveys suggestions based on this history throughout the site. For example, the screen space directly below the main promotional item on the front page is devoted to the customer's browsing history. While these messages don't appear on top of the display, they do appear in a way to supplement the information in the customers' preferences.

Your Amazon.com™ > Your Browsing History
(Click here to [sign in](#).)

Narrow by Category
All Categories (4)
Electronics (2)
Camera & Photo (1)
Books (1)

Manage Your Browsing History
Delete all items
Click here to [turn off your browsing history](#).
Need more help? Visit the [Help](#) area.

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- SanDisk 2 GB Class 2 SD Flash Memory Card SDSDB-2048-A11**
by SanDisk (June 23, 2004)
Platform: Not Machine Specific
★☆☆☆ (5) (483)
List Price: \$27.99
Price: \$2.93
64 used & new from \$2.93 [\[Delete this item\]](#)
- Nikon D3100 14.2MP Digital SLR Camera with 18-55mm f/3.5-5.6 AF-S DX VR Nikkor Zoom Lens**
by Nikon (August 17, 2010)
★☆☆☆ (3) (12)
List Price: \$699.00
Price: \$649.95
14 used & new from \$649.95 [\[Delete this item\]](#)
- Apple iPod touch 32 GB (4th Generation) NEWEST MODEL**
by Apple (September 1, 2010)
★☆☆☆ (3) (223)
List Price: \$299.00
Price: \$288.54
31 used & new from \$279.99 [\[Delete this item\]](#)
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★☆☆☆ (3) (223)
List Price: \$27.99
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- Premium Black Soft Gel Silicone Skin... Lux** \$29.99 **\$0.01**

[View or edit your browsing history](#)

Figure 8: History management in Amazon.com

Real-Time Feedback: An important component of gaming is to convey a player's current status without negatively impacting task performance. We've seen several uses of game artifacts to convey real-time information. Goal indicators are a common visual mechanism to convey the time remaining in a round, such as we've seen in puzzle games like *Tetris* and *Word Puzzle*. Information overlays are also useful in conveying time remaining, such as in sports games like *Madden 09* and *NHL 09*.

We've seen several uses of game artifacts to convey real-time information.

The site Groupon.com uses an animated countdown clock under a "Buy!" button to indicate when the deal expires (see Figure 9). Time is the key factor in Groupon's business model, so time conveys both a sense of urgency and the terms of the deal. The travel service Expedia.com uses a countdown of a different kind; the site displays a message to indicate when a fare has limited availability. This allows the consumer to make judgments about the urgency of the purchase.



Figure 9: Real-Time Feedback in (from top) *Groupon.com* and *Expedia.com*

Task Facilitation: Games excel in communicating supplemental information that conveys task-related guidance without interrupting play. Maps are an integral part of providing guidance in games where contextual navigation is important, as in *Far Cry 2* (see Figure 4) and *Grand Theft Auto 4*. Help is also commonly conveyed during game play through information overlays, as we've seen in *Far Cry 2* when new capabilities are available to the player. Help is also commonly provided in games through the menu system, where the user can bring up a type of infor-

mation overlays with a diagram mapping game functions to the controller, as in *Halo 3* (see Figure 10).

The help function in Microsoft Office 2010 uses information overlays extensively. When a user runs their mouse over a button in the Office Ribbon, a “tooltip” containing a brief explanation of the function that button performs appears on the screen. The tip disappears when the mouse is moved. This allows the user to learn what the function does without interrupting their workflow.

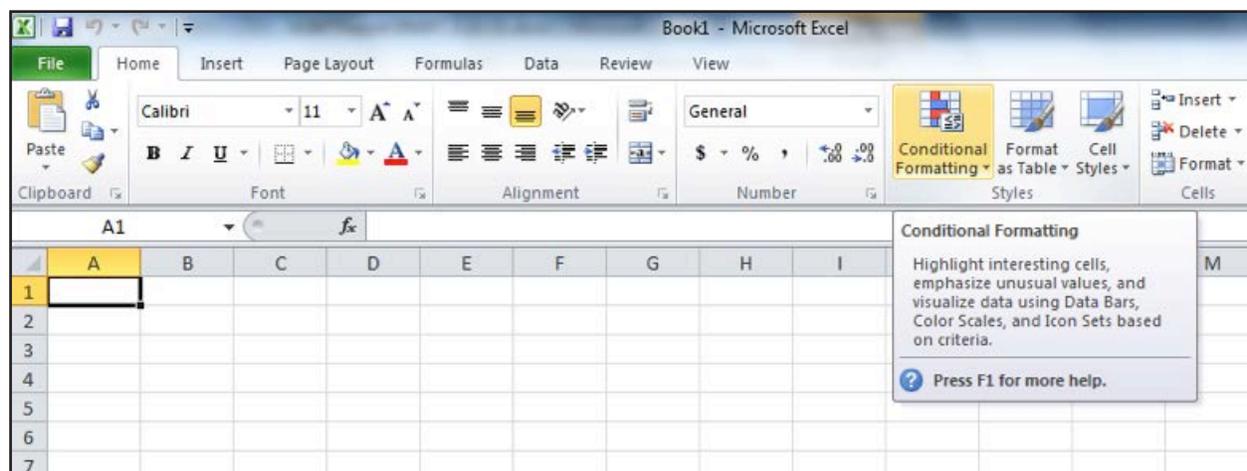


Figure 10: Task Facilitation in (from top) *Halo 3*¹ and *Microsoft Excel*

1 Images from <http://www.kotaku.com.au/2010/05/getting-started-with-the-halo-reach-beta/>

Resource Management: The monitoring, allocation, and use of assets are important components of game play. *Far Cry 2* uses maps to show the location of “safe houses” and weapons depots that contain the player’s supplies. Goal indicators and information overlays messages are frequently used together to show the level of ammunition a player has left, such as in the game in *Gears of War 2* (see Figure 11). We’ve seen menus used to allocate resources to configure custom players in *NHL 09*, and avatars used to convey the condition of the player (a resource) in

games like *Grand Theft Auto 4* and *Fallout 3*.

American Airlines uses maps of an airplane to enable passengers to select their preferred seat. The map shows which seats are already taken, and which seats are available for an additional fee. Because the map is laid out according to the configuration of each plane, the display also provides contextual information; customers can weigh their individual preferences to select a seat instead of inputting a complex set of conflicting parameters (for example, an aisle seat not over the wing but not too close to the back of the plane).

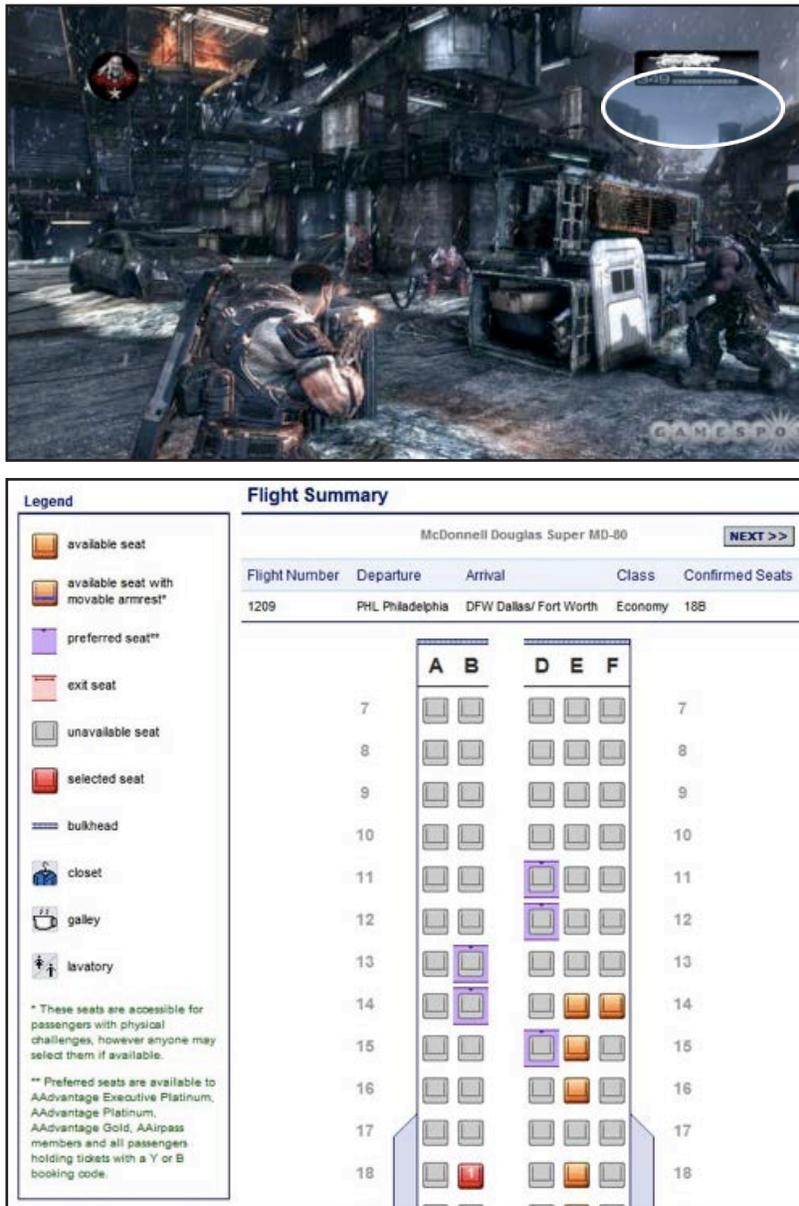


Figure 11: Resource management in
(from top) *Gears of War 2*¹ and *AA.com*

1 Images from <http://www.gamespot.com/xbox360/action/gearsofwar2/images/0/13/>

Providing Context: A common aspect of video games is that the player is required to complete tasks within a virtual space. The complexity of the game space can vary widely, requiring different levels of context to be conveyed to the player. Maps are an obvious way to relay context because they are a simple visual metaphor for the player’s position. Information overlays can also provide context, such as the numerical display of position in the race in *Burnout Revenge* (see Figure 4). Avatars are also useful in orienting players in the game, showing where they are in relationship to the other elements with which they interact - we’ve seen this in many of the third-person games in this analysis, including *Braid*, *Gears of War 2*, and *Battlestations*.

Context is an important component of web site navigation. The New York Stock Exchange’s web site uses a multi-level menu to create a navigation map as a sidebar (see Figure 12). By looking at the left side of the screen, we can see that the user is viewing the “Market Data Technology” page, but also that this is part of “Trading Solutions” category, which itself is a part of “Technologies.” This makes it easier for the user to navigate to other, related parts of the site without getting lost.

Another example of using maps to provide context is SAP’s Solution Composer. This tool produces process maps of a business’ key functions, organized around the concept of the value chain. A user can

“drill-down” to view the specific operations related to each function, and then can drill-down again to see additional detail (as well as the SAP products which can support that function). The value chain provides the high-level context, displayed across different views. The use of the value chain to provide context helps make the Solution Composer an effective sales tool for SAP as well as a planning tool for other businesses.

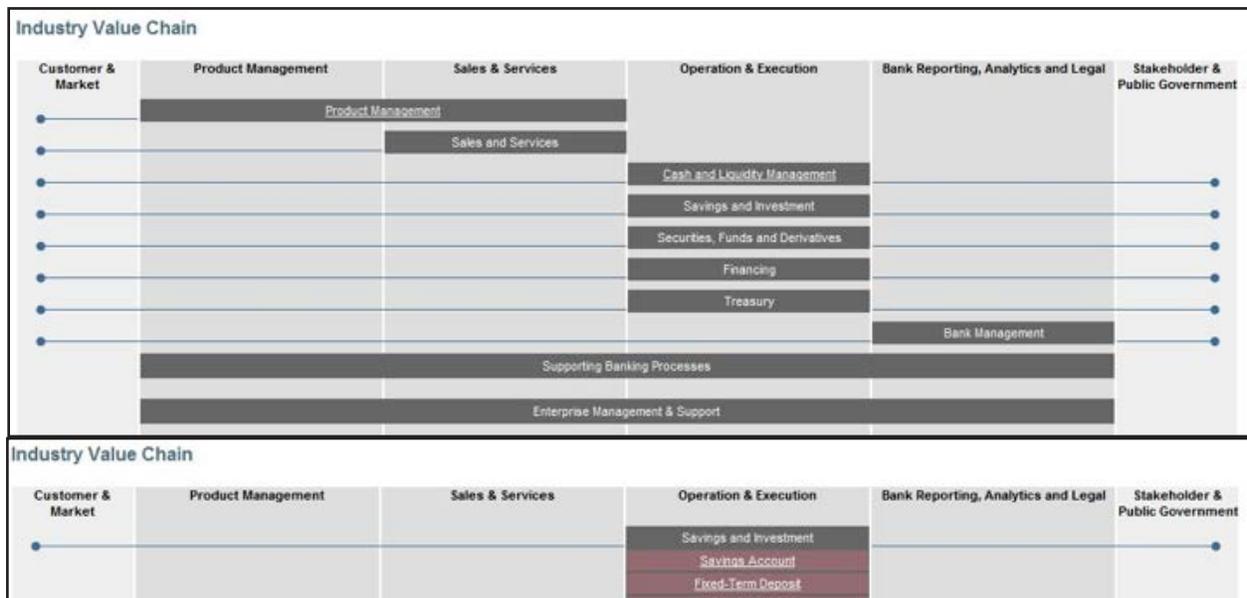


Figure 12: Providing context in (from top) *NYSE.com* and *SAP Business Maps*¹

1 Sample maps are viewable at <http://solutioncomposer.sap.com>, as well as a software tool which allows people to create their own maps.

The Challenges

While there are opportunities to apply these guidelines in many different business applications, this might not always be practical. There are several important differences between business applications and games that may make it difficult to create a more game-like interface for your application:

1) Many business applications tend to be data-entry intensive. Many of the visual artifacts described in this report involve relaying application output to the user. Input mainly consists of manipulating objects within the game space. This is very different from entering a lot of data into a form. There may not be an analogous way of doing this within a game-like interface, at least without fundamentally rethinking the application.

2) Video games are designed to run on powerful, standardized graphics hardware. Video game consoles like the Xbox and Playstation are closed hardware ecosystems with little room for customization. This is in sharp contrast to Windows-based desktops and laptops bought by most businesses. Not only do they tend to have less powerful graph-

ics capabilities, but their hardware varies widely among manufacturers. This makes it difficult to build software that implements a highly graphically-intensive user interaction because developers simply don't know the capabilities of the system on which the software will run.

3) Highly interactive experiences are difficult to deliver over a web-based platform. The web is the emerging delivery system for applications, and significant progress has been made in making the web a more interactive experience. However, browser-based applications are still limited. Google Maps and Facebook push the limits of what can be done in a browser, but real-time notification still lags behind "native" platform-based applications.

Developers need to be aware of the limitations of their platform and the requirements of their applications when applying the techniques in this report. Developers should also be aware of tomorrow's technologies. The emerging HTML5 standard promises to deliver increased capabilities to web sites, and new motion-based input technologies like Microsoft Kinect will lead us to rethink about how we interact with software.

Applying the Lessons: A Prototype Imaging System

In order to further demonstrate how these techniques can be applied, we created a prototype that improves upon the interface for a patient imaging system. Working with Temple University Hospital, we looked at the existing interface for a Picture Archiving and Communication System (see Figure 13 for an example) and looked for ways to simplify the display and improve interactions by using some of the lessons learned in this report. For the prototype, we focused specifically on the navigation among images for a single patient. Some of the issues with the existing interface include an overly complex display, complexity in navigating among images, and difficulty in finding the correct button to perform a function.

Several of the concepts discussed in this report are reflected in the prototype (see Figure 14). For example, the image of the body, on the left side of the display, provides a mechanism for contextual navigation. The smaller images across the top are part of the highlighted area of the body at the left.

Mechanisms for real-time feedback and task facilitation are also provided. Instead of additional notes placed over (and obscuring) the image in the existing system, the prototype highlights areas of the image to which a note is attached. Placing the mouse over the highlighted region on the main image automatically reveals an information overlay containing the text of the note, along with a status bar (i.e., goal indicator) indicating its level of importance. The result is an interface which reduces clutter and places less of a burden on the user to remember application functions.

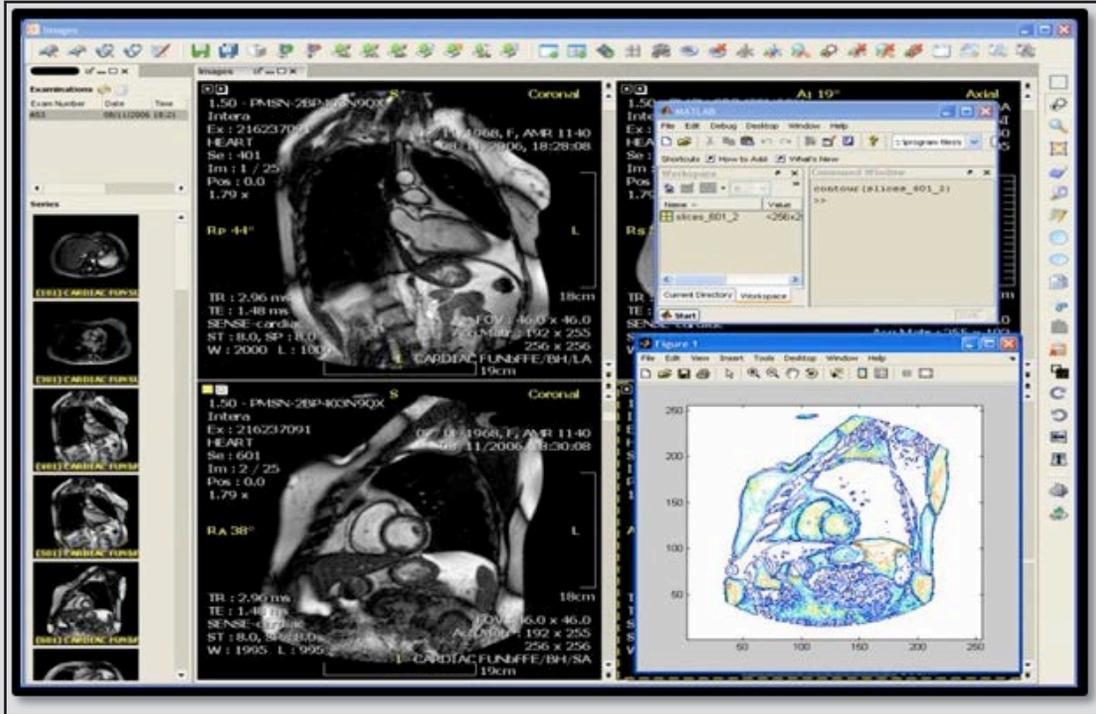


Figure 13: A Sample Screenshot of an existing PACS System

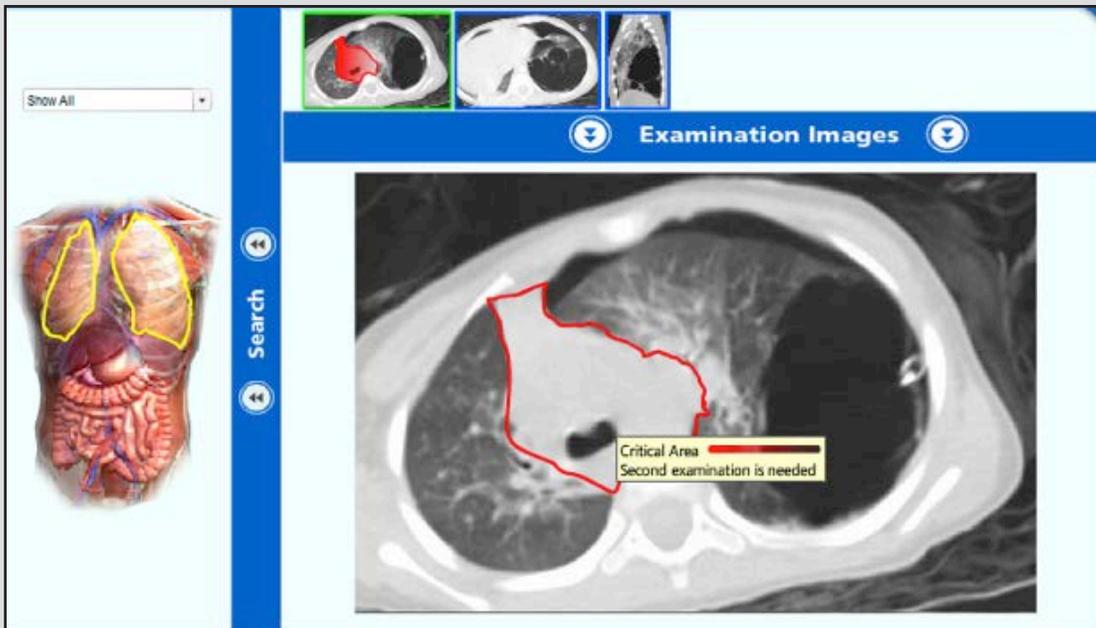


Figure 14: The Prototype System Focusing on Image Navigation

Final Recommendations

The ability to create engaging user experiences is important to the success of an application. Video games are primarily about engaging the user in a way that is both enjoyable and facilitates completing the task at hand. These should also be the goals for user-centric business applications, and therefore a careful examination of video games can also inform and improve the design of those applications. In order to generate thinking about gaming-inspired approaches to the design of business application interfaces, this report outlines a set of artifacts and functions. To encourage new ideas, we provided examples of successful implementations from both gaming and consumer-facing business applications.

For business application developers we make the following recommendations to put these ideas into action (see callout):

Keep the focus on goals:

The motivational power of monitoring and registering accomplishment is under-employed in business applications. A well-designed interface can be a motivational tool for users. Using visual cues, such as a status bar that shows how close the user is to achieving a goal, or displaying a message to confirm the completion of a task, can help keep the user on track by instilling a sense of urgency during the task and accomplishment upon its completion. Business applications, similar to video games, are process-focused and task-oriented. Applications such as Mint.com and Epic Win use these techniques to enable users to set their own goals, while Groupon uses a time-based countdown to convey a sense of urgency regarding a purchase.

Context is critical: Like games, business applications are becoming increasingly complex and sophisticated. This makes it much easier for users to lose track of where they are within the process they are trying to complete. Video games have largely solved this problem by providing mechanisms for relay-

ing context; a game like “Grand Theft Auto” would be virtually impossible to play without the map displayed in the corner of the screen. This is even more important for business applications, which are not inherently engaging. Something as simple as an online retailer relaying the current step in the ordering process can be very effective. These context cues indicate how long the entire process is likely to take and how much work there is left for the user to do before the task is completed.

Use non-textual cues: Communicating information graphically can be much more efficient, and can allow for multiple messages to be relayed to the user at the same time. The five visual elements we discussed in this report are often represented with little or no text. They can be used in combination with one another in order to send the user many pieces of information on a single display. The visual elements are implemented to enhance productivity through greater user engagement, instead of one at the expense of the other. We’ve seen examples of this such as Expedia augmenting a menu of fares with an information overlay notification indicating that there are limited seats at a given price. However, there are untapped opportunities for applications to bring visual elements now used almost exclusively in dashboards into other parts of the application, such as data entry, in order to increase speed and accuracy.

Maintain the application’s flow: Many games take a “sandbox” approach where the user can complete tasks in any order, as long as the ultimate goal is reached. Traditional business applications still follow a linear process of user interaction, where one step must be completed for the next to begin. In addition, exceptions are also often “modal,” requiring problems to be cleared before moving to the next step. A better approach to task facilitation is the use of visual elements such as information overlays that direct the user’s attention without slowing them down. This allows people to interact with the application in a way that is optimal for them. One example of this are the dynamic password validators on sites like Twitter, which immediately convey the strength of a new password as the users type it instead of requiring the user to “submit” the password for approval by the application.

Lessons Learned
<ul style="list-style-type: none">• Keep the focus on goals• Context is critical• Use non-textual cues• Maintain the application’s flow

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