

**IDENTIFYING NEW AND OBSOLETE USABILITY HEURISTICS
FOR WEB-BASED BUSINESS SOFTWARE**

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With the emergence of advanced software development technologies, web sites have become increasingly dynamic and provide greater functionality. One class of business software that has seen an increased focus on web-based implementations are customer relationship management (CRM) systems. As the complexity and functionality of these web-based applications increase, usability engineering also becomes more important. Heuristic evaluations are a way to perform a usability analysis without the necessity of involving actual users. Rather, experts in the field of human-computer interaction and usability evaluate a system's user interface based on a set of defined principles (i.e. heuristics).

While there is some research investigating usability heuristics for web sites and web applications, these heuristics are of a general nature and do not focus on CRM systems. On the other hand, it has been recommended that general heuristics be complemented by heuristics specific to the domain they are to be applied to, since general heuristics are likely to miss domain-specific problems. This thesis investigates the relevance of existing heuristics to today's web-based CRM systems, as well as the potential need for new, specific heuristics.

To answer this question, a two-phased, mixed approach combining qualitative and quantitative methods was employed. First, usability experts were asked to review ex-

isting heuristics. Second, users of CRM systems evaluated this new list for validation.

The results show that there is a need for domain-specific heuristics for web-based CRM systems. In addition, it was shown that general heuristics and heuristics developed for similar classes of applications are rated as more applicable than heuristics developed for very different classes of applications.

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Chapter 1

Introduction

With the emergence of advanced software development technologies, web sites have become increasingly dynamic and provide greater functionality. It is now possible to create sophisticated applications for the web, which are close, if not equal, to traditional desktop applications in terms of complexity and functionality.

Current research shows that web applications are also increasingly moving into the workplace, replacing previously desktop-based business applications such as enterprise resource planning systems, customer relationship management systems (e.g. Microsoft Dynamics CRM and Oracle CRM On Demand), and customizable information storage and retrieval systems (e.g. force.com and ZOHO tools) (Band et al., 2010a). In 2011 alone, the global market for web-based Software-as-a-Service (SaaS) products was worth \$12.1 and grew 20.7% compared to the previous year (Symplified, 2011). These web-based applications offer a number of features, putting them on par with desktop applications, sometimes even exceeding the functionalities of their traditional counterparts.

One class of business software that has seen an increased focus on web-based implementations are customer relationship management (CRM) systems. Band et al. (2010a), for example, found that CRM technology buyers now consider web-based

solutions their first choice, before even considering a traditional solution. CRM systems are the foundations for the customer relationship management strategy within a business, which aims to create and maintain lasting, lucrative relationships with customers (Ling and Yen, 2001). Modern customer relationship management addresses challenges such as the need for market segmentation and targeted advertising (Brown, 2000).

CRM systems are “information systems aimed at enabling organisations to realise a customer focus” (Bull, 2003, p. 592). CRM systems are used to execute marketing strategies and offer a number of benefits over traditional mass-media marketing. These benefits include reduced costs, increased traceability of advertising campaign effectiveness, easier identification of high-value and low-value customers, as well as a way to target specific customer segments (Brown, 2000, p. 8).

Traditionally, these CRM applications were desktop-based and installed on client computers. Recently though, many of them have become available as web-based versions which run in a web browser and don’t require any additional software to be installed. The applications are used to increase a business’s productivity and are integrated in employees’ work flows and processes. Usage is often mandatory and dictated by upper-level management.

As the complexity and functionality of these web-based applications increase, usability engineering also becomes more important. *Usability* is a measurable characteristic of user interfaces that shows how easy to learn and use an interface is (Mayhew, 1999). Users are impatient and often give up quickly when they experience problems (Najjar, 2011; Nielsen, 2000). Therefore, good usability can lead to decreased frustration and increased employee satisfaction, even in mandatory usage situations (Hsieh et al., ms). In addition, it is important for CRM system vendors to provide a good user experience in order to attract and retain customers, since customers generally have a variety of providers to choose from and can decide whether they like one

before they commit to purchasing it (Hasan et al., 2009; Nielsen, 2000).

There are many different ways to improve usability. Some methods include the observation of users, other methods are based on an assessment of certain properties of a system, and a third group uses usability experts to evaluate a system based on a set of defined usability heuristics.

Heuristic evaluations are a way to perform a usability analysis without the necessity of involving actual users. Rather, experts in the field of human-computer interaction and usability evaluate a system's user interface based on a set of defined principles (i.e. heuristics). This method is relatively cheap and allows for the swift identification of major and minor usability problems, without having to locate and recruit users (Nielsen, 1993). Previous research has shown that heuristic evaluations are a suitable technique for assessing web applications (Nielsen, 2000; Sharp et al., 2007; Ssemugabi and de Villiers, 2010).

1.1 Research Problem

There are a number of established and tested usability heuristics which have been developed for desktop applications or software in general (e.g. Leavitt and Shneiderman, 2006; Molich and Nielsen, 1990; Nielsen, 1994b; Pierotti, 1995, see section 2.3).

Web applications, however, have a number of limitations and likewise advantages that differentiate them from traditional desktop applications. Limitations include differences in the implementation of web browsers resulting in differently rendered interfaces, a lack of platform- and browser-independent keyboard short-cuts, and varying network speeds affecting load time and performance. Examples of benefits are the ability to collaborate with other users in real-time, as well as an easy method of managing updates and distributing new functionality.

While there is some research investigating usability heuristics for web sites and

web applications (e.g. De Jong and Van Der Geest, 2000; Krug, 2006; Leavitt and Shneiderman, 2006; Najjar, 2011), these heuristics are of a general nature and do not focus on CRM systems. Rusu et al. (2011), on the other hand, recommend that general heuristics be complemented by heuristics specific to the domain they are to be applied to, since general heuristics are likely to miss domain-specific problems. Other researchers have also come to this conclusion and developed specific usability heuristics for specific applications based on general heuristics (e.g. Zhang and Walji, 2011). While there are heuristics and guidelines available for web sites, they are not geared toward web-based CRM systems and their characteristics, which will be explained later on.

In addition, usability heuristics can become obsolete over time as user interfaces change and new interface components emerge and others disappear. With the evolution of user interface paradigms from command-line interfaces over monochrome, text-based terminals to window-based graphical user interfaces, the interface components used in each vary considerably (Sharp et al., 2007, p. 220ff). Therefore, usability heuristics developed for a specific interface type or interface element may become obsolete when the corresponding element is superseded by a newer technology.

In consequence, this thesis will be guided by the following research questions:

- a. What usability heuristics are relevant to web-based CRM systems?
- b. Which heuristics are irrelevant?
- c. Are there new heuristics that need to be added?

1.2 Importance

The value of performing a heuristic evaluation lies in being able to quickly and cheaply identify major and minor usability problems. Rather than having to recruit users for

a usability test, usability experts can evaluate a system by means of a set of heuristics to identify usability issues and improve the user interface.

While the benefits of good and usable interfaces are largely intangible and unquantifiable, research has shown that reducing the number of usability problems improves employee productivity (Marcus, 2005, p. 17) and job satisfaction (Preece et al., 1998, p. 19), reduces the need for user support, and decreases the need for user training (Karat, 1990; Marcus, 2005).

Although it has been argued that good usability is not important in mandatory usage situations like those common for business software, Hsieh et al. (ms) show that user satisfaction with a system has a positive impact on employee service quality and, in turn, on customer satisfaction.

Since usability issues of CRM software are evident and well-covered in academia and industry (e.g. Band et al., 2008; Fjermestad and Romano, 2003), it is important to improve on usability in order to avoid the pitfalls described by Hsieh et al. (ms). One way to achieve better usability is to perform evaluations of the software based on a set of relevant and applicable heuristics.

While there are general heuristics to increase usability and user satisfaction for desktop and web applications, they are not specific to web-based business applications and their characteristics. This means that when they are used in an evaluation of such a system, important domain-specific usability issues may be missed (Rusu et al., 2011).

1.2.1 Characteristics of Web-Based Business Software

Some of the characteristics that differentiate web-based business software from general web applications are a greater focus on reliable data storage and retrieval, a large amount of interaction between the user and the system, as well as a need for efficient and fast expert navigation.

These web-based business applications are used within organizations on a daily basis and are a critical part of the business workflow. They support core business activities such as customer relationship management or supply chain management. As such, they are integral to the health of the business. In order to fulfill their functions, they often are integrated with other applications internal and external to an organization.

There is a lack of research investigating heuristics specific to the domain of web-based business software and its characteristics. Due to this lack of heuristics, important usability issues may be missed when these systems are evaluated, leading to less-than-optimal user interfaces and thus decreased user satisfaction.

1.3 Contributions

The results of this thesis add to the existing body of usability heuristics and provide a set of heuristics tailored to the expanding class of web-based business software. This thesis closes a gap in usability heuristics for web-based business software.

For practitioners, the benefits are two-fold. On one hand, a better understanding of the heuristics relevant to web-based business software will allow for the selection of systems with greater usability, which can lead to benefits such as increased productivity and customer satisfaction within the organization. On the other hand, it will allow vendors to evaluate their own products and improve them in order to gain a competitive advantage through improved usability.

1.4 Organization of this Thesis

This thesis is divided into five chapters. Chapter 2 discusses existing research about the usability heuristics, provides background information on customer relationship management, and presents existing theories related to usability and its importance.

The research method followed in this thesis is described in chapter 3. This chapter includes descriptions of the research question and research design, as well as participant selection. Chapter 4 presents the findings of the study. The thesis is concluded by chapter 5, which discusses and analyzes the findings, and describes the limitations of the study as well as future research directions.

Chapter 2

Literature Review

In the first section of this chapter, theories relevant to this thesis will be discussed. These theories explain constructs such as information systems success and task-technology fit. These are pertinent to emphasizing the importance of good usability and informing the theoretical aspect of this thesis.

The second section will address existing research in the area of customer relationship management systems with special emphasis on known usability issues and leading products in the industry.

The third section of this chapter will give an overview of research in the area of usability heuristics and the most important and relevant works. As stated previously, a number of studies (e.g. Leavitt and Shneiderman, 2006; Molich and Nielsen, 1990; Weiss, 1994) have addressed the need for usability heuristics for desktop and web-based applications in general, as well as specific classes of web applications such as e-learning and e-commerce sites.

2.1 Theories

While conducting the literature review, no theories pertinent to developing heuristics for specific types of applications or for evaluating existing heuristics in terms of

their applicability to a type of applications were found. There are, however, theories which explain the role of usability in the greater context of information systems and organizations.

The following two theories explain the performance impacts information systems have on individuals or organizations. Both recognize the importance of usability as a characteristic of the system in determining performance outcomes. Accordingly, they postulate that good system usability will contribute to increased individual and, in consequence, organizational performance. Therefore, managers should be interested in choosing a CRM system with good usability and vendors should be interested in providing a product with good usability in order to reap the benefits of highly user-friendly software.

2.1.1 Information Systems Success Model

The information systems success model (DeLone and McLean, 1992, 2003, 2004) defines six categories for measuring the success of information systems: system quality, information quality, use, user satisfaction, individual impact, and organizational impact. A second literature review (DeLone and McLean, 2003) led to the authors' suggestion of adding *service quality* to the list of system characteristics, and merging *individual impact* and *organizational impact* into a single construct named *net benefits*, resulting in the model shown in figure 2.1.

According to the revised model, *information quality* (e.g. ease of understanding and completeness), *system quality* (measured in metrics such as ease of use and ease of learning, usefulness, and convenience of access) and *service quality* (e.g. reliability, responsiveness, and being up-to-date) influence *user satisfaction* (e.g. enjoyment and overall satisfaction) and *intention to use*, which is related to *use* (e.g. amount of use and voluntariness of use), which in turn also influence each other. Use and user satisfaction also influence *net benefits*, consisting of *individual impact* (e.g. decision

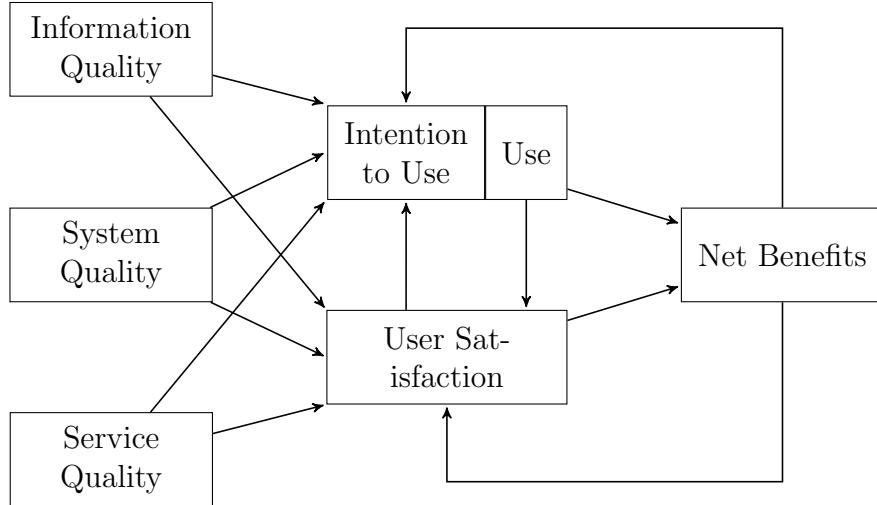


Figure 2.1: Updated D&M IS Success Model (DeLone and McLean, 2003)

effectiveness, job performance), which subsequently influences *organizational impact* (e.g. cost reductions, increased profits).

Several studies investigated the significance of the various relationships among constructs in the model. Seddon and Kiew (1996) confirmed that there are significant relationships between system quality and user satisfaction, and information quality and user satisfaction. This finding means that improved information quality (which contains ease of understanding of the outputs of the system) and system quality (containing ease of use, ease of learning, and convenience of access) can lead to increased user satisfaction. Usability is a component of both of these independent variables, and thus plays a role in the relationship with user satisfaction.

Teo and Wong (1998) and Wixom and Watson (2001) found that there is a significant relationship between system quality and individual impact, which means that a higher-quality system can lead to positive individual impact. Since usability is a component of system quality, it can be argued that using heuristics to increase a system's usability will lead to increased job performance and decision quality.

In addition, Teo and Wong (1998) and Wixom and Watson (2001) found that there is a significant relationship between information quality and individual impact

(a component of *net benefits* in the revised model), which means that increased understandability and usefulness of a system's output can lead to increased decision quality and job effectiveness (DeLone and McLean, 2003).

Overall, the model shows that usability plays an important role in information systems success, as it is a component of system quality and, to a lesser extent, of information quality and service quality. These three constructs influence user satisfaction and intention to use, which is coupled to use, and finally net benefits to the organization in which the information system is used. This network of relationships underlines the importance of good usability to ensure the success of an information system and, in continuation, the need for better tools for usability engineering.

2.1.2 Task-Technology Fit

Another popular theory in this area is the task-technology fit model (Goodhue, 1995), in which *technologies* are defined as “tools used by individuals in carrying out their tasks” (Goodhue, 1995, p. 1828) and *tasks* are defined as “actions carried out by individuals in turning inputs into outputs” (Goodhue, 1995, p. 1828). Consequently, *task-technology fit* is defined as “the extent that technology functionality matches task requirements and individual abilities” (Goodhue, 1995, p. 1829). This theory is relevant, since usability is an important aspect of *technology characteristics*.

Goodhue and Thompson (1995) extend the task-technology fit model with the technology-to-performance chain, in order to include the influence of usage in explaining an individual's job performance. Figure 2.2 shows the extended task-technology fit model.

The combined model suggests that a good fit between technology, task, and the individual's characteristics, together with actual usage, will lead to improved job performance. In addition, different users are theorized to rate the same technology differently due to variances in their task needs and abilities. This means that when

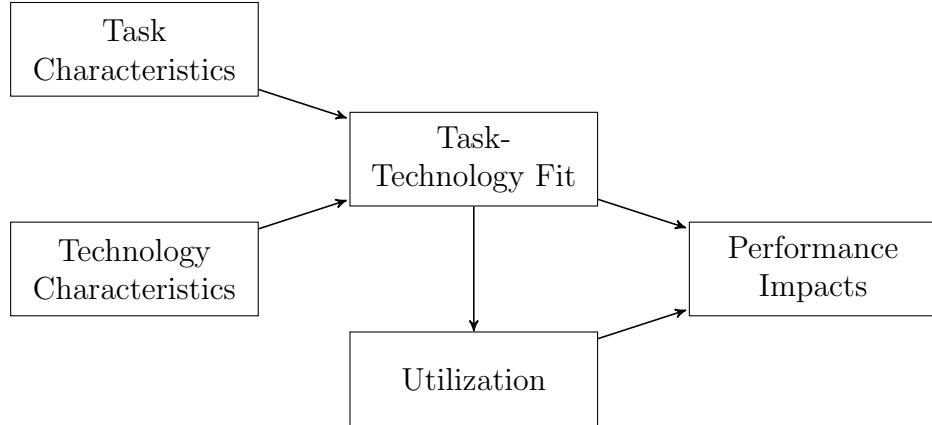


Figure 2.2: Task-technology fit with technology-to-performance chain (Goodhue and Thompson, 1995)

evaluating the usability of a system, it is important to factor in characteristics of the different tasks that users need to complete using a system, in order to ensure an actual increase in work performance (Goodhue, 2006).

According to the model, users will rate a technology system better if it fits the task characteristics. Since usability is an important component of a technology's characteristics, increased usability of a technology will, subject to other factors, lead to performance improvements. If the methods and tools used for usability engineering (e.g. heuristic evaluations) can be advanced, a technology's characteristics and fit to the task can be improved.

2.2 Customer Relationship Management

As alluded to previously, customer relationship management is the “process of acquiring, retaining and growing profitable customers” (Brown, 2000, p. 8). In today’s competitive marketplace, mass-advertising is often not an effective way to build lucrative relationships with customers, and thus customer relationship management becomes increasingly important in creating purposeful and tailored advertising strategies to reach customers (Brown, 2000; McKenzie, 2001). The ultimate goals of CRM are to

“win mind share, increase wallet share, and reduce churn” (McKenzie, 2001).

Many companies employ computer-based systems of some form or other in an effort to realize the potential benefits of customer relationship management and to execute marketing strategies. While some systems are rudimentary, there is a large offering of specialized software for this purpose.

Most dedicated CRM systems can be grouped into one of three categories (Band et al., 2010a). Enterprise CRM systems specialize in large-scale installations for companies with more than 1,000 employees, often spread across different countries. These systems are the most full-featured. Mid-market CRM systems cater to smaller companies with less than 1,000 employees and usually offer limited functionality for a cheaper price. Often, these solutions are hosted by the vendor and licensed in a software-as-a-service model. Finally, there are specialty tools, which offer a narrow band of specialized functionality, such as analytics and data management, or functionality for a specific industry such as pharmaceuticals or telecommunications (Band et al., 2010a).

2.2.1 Business Need, Advantages, and Problems

The business need for this type of software is increasing and driven by a commoditization of many products and a fragmentation of the marketplace and customers. This changing business environment necessitates a detailed marketing strategy with an emphasis on tailored advertising and utilization of different communication channels (Brown, 2000).

CRM systems support an organization in typical marketing activities by providing the functionality mentioned as follows (Band et al., 2010c; Chaffey, 2011).

- Customer selection (identify types of customers to target, segment customers)
 - customer business intelligence

- customer data management
- Customer acquisition (perform marketing activities to form relationships with new customers)
 - sales force automation
 - revenue and pricing management
 - order management
- Customer retention (perform marketing activities to maintain relationships with customers)
 - electronic bill presentment and payment
 - interactive voice response
 - contact center infrastructure
 - customer service and support
- Customer extension (increase depth or range of products a customer purchases from the company)
 - sales force automation
 - customer service management

More recently, many CRM suites have added capabilities for social media integration, support for mobile devices, and hosted software-as-a-service options. Social media integration allows CRM users to directly interact with their customers and prospects through the various social networks. Some CRM suites also allow employees within a company to network with each other and use social media-like features within the CRM system to share important information. Support for mobile devices such as smartphones and tablets is becoming increasingly important, since many salespeople want to be able to access the CRM system from their devices while on the road. Most major CRM vendors now also offer software-as-a-service solutions, which means that the vendor hosts the system and typically charges a per-use fee for access to it.

There are many reasons for the adoption of CRM systems and a corresponding strategy. Costs may be reduced by employing targeted advertising models through

which specific lucrative customer groups and individuals can be identified, campaigns can be tracked and assessed based on their effectiveness, and the importance of the price of a product can be reduced by providing superior customer service (Brown, 2000). In addition, recent research has shown that it is important to diversify marketing efforts as much as possible, since long-term customers are not necessarily more loyal than new customers, as they may still buy from a competitor who can offer better value (Chaffey, 2011, p. 451).

Band et al. (2010a) identified the top customer relationship management goals of both business-to-business (B2B) and business-to-consumer (B2C) oriented companies. The top three benefits B2B companies seek to realize through CRM systems are attracting new customers (66%), retaining existing customers and improving loyalty (63%), and selling more products/services to existing customers (50%) (Band et al., 2010a). The top three CRM goals of B2C companies are retaining existing customers and improving loyalty (72%), improving the customer experience (62%), and attracting new customers (45%) (Band et al., 2010a).

Despite the compelling promises made about CRM systems, implementations of these systems are complex and therefore often troubled. Due to failed implementations, expected benefits are often not realized. Among the reasons for failing CRM implementations are a lack of shared understanding between different parts of the company, a lack of clear program scope, fragmented and fractional implementations, and a lack of a clear strategy for utilizing the CRM system (Brown, 2000; McKenzie, 2001).

Many failed CRM system implementations have been attributed to a lack of good usability and user experience, which resulted in employee user dissatisfaction with and resistance to change toward the new system. Kemp (2001) found that a lack of alignment between users' workflow and the application's design, as well as poorly designed user interfaces, lead to many CRM implementation failures. Ebner (2003)

reported usability as being a frequent source of “trouble” in CRM implementations. Recently though, an improvement in the usability of many CRM systems has been noted, which shows that there is an interest in resolving the problem Band et al. (2010a,b).

2.2.2 Examples of CRM Software

Band et al. (2010a,b) identified several CRM solutions as leaders in the market for large and/or midsized companies. All of these leading solutions are either fully web-based or have at least an alternative web-based user interface. Table 2.1 gives an overview of these solutions. Band et al. (2010a,b) also assigned a rating for each product’s usability on a scale of one through five, but it is unclear how these ratings were developed and on what they are based.

Table 2.1: Leaders in the CRM market as identified by Band et al. (2010a) and Band et al. (2010b)

Solution	Large Companies	Midsize Companies	Usability
Microsoft Dynamics CRM	✓	✓	4.93
salesforce.com	✓	✓	4.87
Oracle CRM On Demand	✓	✓	4.54
SAP CRM	✓	✓	4.37
Oracle Siebel CRM	✓		4.33
SAP Business All-in-One		✓	4.22
CDC Software Pivotal	✓	✓	4.13
RightNow CX	✓	✓	3.94
SugarCRM Sugar Professional		✓	3.90

While these industry rankings and ratings are a useful tool to identify strong players and innovators, market positions can change quickly, as was recently exemplified when IBM, formerly Oracle Siebel CRM’s largest customer, switched to SugarCRM, a relative new-comer and outsider due to its open source approach (Jones, 2012).

Section 3.4.2.1 contains an overview of the three CRM systems selected as examples for the study.

2.3 Usability Heuristics

There are a number of different usability engineering techniques, some more expensive and complex than others. Traditional user testing, for example, calls for the inclusion of a representative sample of end users and expensive equipment to capture the user's action. Discount usability engineering techniques (Nielsen, 1993) on the other hand are cheap, quick, and easy to perform, thus more likely to be used. Naturally, there are trade-offs that come with these benefits. First and foremost, some aspects of usability and problems may be missed when discount techniques are used. These techniques include user observation, scenarios, thinking aloud, and heuristic evaluations (Nielsen, 1993). It is recommended to combine these techniques to identify the largest possible number of usability problems.

User observation is an important and basic method for usability engineering in which users are asked to perform everyday tasks using an interface in their normal work environment. The researcher observes the user without interfering and takes notes about any problems the user encounters (Nielsen, 1993).

Scenarios use extremely simplified user interface prototypes for predefined tasks to allow users to interact with the design for a system before it is fully developed and identify usability problems. This method is very simple and allows for the review of prototypes at every iteration (Nielsen, 1993).

Thinking aloud is a technique in which one user at a time is asked to complete a set of tasks while “thinking aloud” and narrating their thought process. This method allows the researcher to gain insight into the reasoning behind a user’s actions and clearly identify problematic user interface elements (Nielsen, 1993). It is also possible

to record the user's actions on the screen as well as their commentary for further analysis.

Heuristic evaluations are a way to identify usability problems without the involvement of users. With this technique, usability experts are asked to evaluate a system based on a list of heuristics to identify usability problems that violate them (Nielsen, 1993). Usability problems are also often rated with regard to their severity. Many sets of heuristics have been developed for various purposes and at various levels of detail. A selection of these is presented in subsection 2.3.1 below.

2.3.1 Heuristics in the Literature

After an extensive literature review and examination of the findings, two classification schemes for usability heuristics emerged. First, heuristics can be classified by specificity, second they can be classified by granularity.

In terms of specificity, there are two broad groups—heuristics that were developed for any kind of user interface or all computer user interfaces, and heuristics focused on a particular application area such as e-commerce. Typically, the more general heuristics provide quite specific instructions and low-level guidelines for user interface design (e.g. icon design and layout of data entry fields). The specialized heuristics are higher-level and more concerned with workflows, task support, and industry-specific functionality (e.g. ability to personalize screens).

With regard to granularity, some researchers have developed specific checklists suitable for evaluating a user interface, while others only provide a set of general principles. Some research falls in between, offering intermediate granularity. As will be explained in section 3.3, the level of detail of the heuristics is relevant due to the nature of the empirical study of this thesis. Table 2.2 gives an overview over the heuristics research that is reviewed in this study.

Table 2.2: Heuristics research reviewed in this study; heuristics marked with a * were used as materials for the empirical study

Study		Application Area	Granularity
Molich and Nielsen (1990) etc.	*	Any kind of user interface	Principles
Norman (2002)		Any kind of user interface	Principles
Perlman (1997)		Computers	Principles
Weiss (1994)		Computers	Checklist
Pierotti (1995)		Computers	Checklist
Leavitt and Shneiderman (2006)		Web	Checklist
Zhang and Walji (2011)		Electronic health records	Principles
Petre et al. (2006)		E-commerce	Intermediate
Ardito et al. (2006)	*	E-learning	Intermediate
Oztekin et al. (2010)		E-learning	Intermediate
Singh and Wesson (2009)	*	ERP systems	Intermediate

.1 Classification by Granularity

Overall, there are three distinct levels of granularity that heuristics fall into.

Principles These heuristics are broadly-formulated and apply to a large number of different user interfaces and application areas. There are usually 15 or less heuristics in a set and each heuristic consists of a name and a short description. Due to the general nature of these heuristics, usability expertise is needed in order to apply them correctly and identify usability problems. They are sometimes used as the basis for developing more detailed heuristics or as categories for detailed heuristics. An example of a heuristic in this category would be “*Visibility of system status*: The system should always keep the users informed about what is going on, through appropriate feedback within reasonable time” (Nielsen, 1994b).

Intermediate Heuristics in this category generally apply to a specific type of user interface or application area (e.g. e-commerce applications) and focus on special characteristics of the application area. Since these heuristics are more detailed, there are typically between 30 and 60 items in a set. They are more specific than general prin-

ciples, but less specific than checklists. An example for a heuristic in this category is “Does the course offer multiple opportunities for interaction and communication among students, to instructor, and to content?” (Oztekin et al., 2010).

Checklist These heuristics are very detailed and low-level. They are generally used for broad application areas such as computer user interfaces in general or web user interfaces. These heuristics are most suited for a step-by-step evaluation of a user interface and often provide a rating scale for that purpose. Generally, there are more than 100 items in a set of heuristics of this type. Due to the fact that they are more detailed and specific than the other types of heuristics, they can also be used by non-usability experts to evaluate a system, but they may often seem intimidating in light of the sheer number of heuristics in a set. An example would be “When using data entry fields, specify the desired measurement units with the field labels rather than requiring users to enter them” (Leavitt and Shneiderman, 2006).

.2 Classification by Specificity

There are two levels of specificity with regard to application areas that heuristics can be categorized into. First, there are heuristics which are applicable to a broad spectrum of user interfaces (e.g. computer user interfaces in general). Second, there are heuristics which have been developed with a specific class of applications in mind (e.g. e-learning systems).

General Heuristics The heuristics in this section were developed for broad categories of user interfaces such as computer interfaces in general or web-based interfaces. They typically fall either into the category of principles or checklists.

One of the earliest and best-established sets of heuristics was originally developed by Molich and Nielsen (1990) and later refined by Nielsen (1994a,b). The set consists of ten general, broadly-formulated usability principles, which are applicable

to most graphical user interfaces. The authors do not provide specific checklists for the evaluation of systems, but short definitions of the heuristics. Other researchers (e.g. Lavery et al., 1996; Perlman, 1997) have developed alternative descriptions and general evaluation questions for these heuristics.

Norman (2002, p. 52) identified four “principles of good design”, *visibility* [of system status], *a good conceptual model*, *good mappings*, and *feedback*. These heuristics are general in nature and apply to not only computer user interfaces, but any kind of “thing” a person might interact with, be it physical or virtual. As such, these concepts are very broadly-formulated and while the author does explain them in detail, there are no concrete guidelines for a heuristic evaluation.

Perlman (1997) based his list of thirteen general principles on the heuristics developed by Nielsen (1993) and Norman (2002). Perlman took all ten of Nielsen’s heuristics and rephrased some of them. They were supplemented with two heuristics from Norman (2002). Perlman also added two new heuristics (*provide maps and a trail* and *show the user what is (not) possible*). In addition, Perlman added short explanations for each heuristic, which differ from the existing explanations provided by the original authors of the respective heuristics.

Weiss (1994) developed sets of heuristics and evaluation checklists for four aspects of user interfaces (presentation, conversation, navigation, and explanation). The checklists are focused on traditional desktop-based computer systems (i.e. not web-based) and address both hardware and software usability. Due to the time period during which they were developed, the heuristics are mostly based on early “green screen” and terminal interfaces. There is a total of 285 guidelines in 20 checklists grouped into four categories. In addition to the checklists themselves, instructions for evaluating systems and selecting relevant user interface components to evaluate are provided. During an evaluation, items on the checklists are rated as fulfilled, not fulfilled, or not available. Sets of heuristics can be mixed and matched based on the

specific deficiencies of the system that is to be evaluated. Weiss (1994) also provides a survey instrument for measuring user satisfaction.

Pierotti (1995) created a checklist based on the items developed by Weiss (1994). The original items remained unchanged, but were regrouped into the categories identified by Nielsen (1994b). Pierotti also added three new categories (*skills, pleasurable and respectful interaction with the user*, and *privacy*) to accommodate all of Weiss's heuristics. In addition, two new items were added to the privacy category.

Leavitt and Shneiderman (2006) provide an extensive list of 209 usability guidelines specific to web sites and web applications. The guidelines are categorized into 17 groups. The list is based on a review of the relevant literature and each item in it is rated in terms of strength of evidence and relative importance. While focused on web-based interfaces, the heuristics are still quite general in nature and not specific to the characteristics of business software.

Specific Heuristics The research in this group addresses a specific and relatively narrow field of applications or users. The heuristics are generally on a higher, less detailed level than those discussed in the previous section. These heuristics typically are of intermediate granularity, thus being neither very specific nor general.

Numerous studies have investigated heuristics for specific types of applications and systems. Petre et al. (2006), for example, developed a set of heuristics for e-commerce based on a list of obstacles encountered by online shoppers as they used different online stores.

E-learning has also been a popular area for the development of heuristics. Ardito et al. (2006) developed 64 heuristics in this area. They are grouped into two broad groups: platform guidelines and module guidelines. Within these groups, there are four categories of heuristics. Oztekin et al. (2010) developed a total of 36 heuristics in twelve categories loosely based on Nielsen's heuristics. In addition, Freire et al.

(2012) provide a review of recent research on e-learning usability heuristics.

Zhang and Walji (2011) developed heuristics for the area of electronic health records. These were based on the heuristics developed by Nielsen (1993) as well as the “eight golden rules” by Shneiderman (1998). There are a total of fourteen heuristics, which are very broadly-formulated. Finally, enterprise resource planning (ERP) systems were the focus of the research by Singh and Wesson (2009).

Usability heuristics have also been developed with specific types of users in mind. These include elderly users (e.g. AARP, 2004; Redish and Chisnel, 2004) and visually impaired users (e.g. Harper et al., 2003).

2.4 What We Know

This section contained a review of the literature on theoretical frameworks relating to usability engineering, CRM systems, and usability heuristics. There has not been much research with regard to theoretical frameworks for usability engineering or heuristic evaluations in particular. There do exist frameworks which contain usability as a part of some of their constructs and two popular examples of these were presented.

With regard to CRM systems, we know what they are used for in organizations, who uses them, which solutions are widely used, and that implementations of CRM systems are often problematic. We do not know, which usability problems are commonly found in CRM systems and there is no set of heuristics specific to them.

Finally, there is a wealth of usability heuristics, which can be categorized according to two schemes. First, there is a spectrum of heuristics, with general heuristics on one side and domain-specific heuristics on the other. Second, there are three distinct levels of granularity, principles, checklists, and intermediate heuristics. Previous research has shown that both general and domain-specific heuristics are necessary

to adequately evaluate a software system for usability problems. Yet, there are no heuristics specific to web-based CRM systems. There is also no framework for the development of specific heuristics.

Chapter 3

Methodology

This chapter contains a description of the research methodology used in this thesis. The methodology is built on existing, proven research methods, which were modified and expanded upon to answer the research question central to this thesis.

This study is guided by the following research questions:

- a. What usability heuristics are relevant to web-based CRM systems?
- b. Which heuristics are irrelevant?
- c. Are there new heuristics that need to be added?

In order to identify new and obsolete usability heuristics specific to the domain of web-based customer relationship management systems, a qualitative design with three steps is employed. A collaborative group session with usability experts is held, followed by a validation through CRM users, after which the results of the two phases are analyzed and compared to existing heuristics.

First, background information about existing methods used in this study is provided. Second, the CRM systems and usability heuristics selected as input materials for the study are discussed. Third, the method for identifying eligible participants is detailed. Fourth, the research design including the structure of the group session

is explained. Last, the types of data collected in this study and their sources are detailed.

3.1 Background of Methods

The protocol used for the group session is based on two existing fields of research: focus group studies and collaboration science. These areas and their applicability to this thesis are explained below.

3.1.1 Collaboration Science

The goal of the focus group session with the usability experts was to identify as many new and obsolete usability heuristics for web-based CRM software as possible. To achieve this goal, the session was structured using an approach based on collaboration science and the use of thinkLets (Briggs et al., 2001). This method has proven to build consensus more quickly, reduce session duration, and improve the quality of the end product (de Vreede and Briggs, 2005).

While the study is not a collaborative effort (in the strict sense of stakeholders working together to reach a mutually beneficial goal they can commit to), the techniques developed for collaboration science are still helpful in improving the outcome of this undertaking, because the participants are asked to work together and eventually come to a consensus about the list of heuristics for web-based CRM systems.

ThinkLets are “the smallest unit of intellectual capital required to create one repeatable, predictable pattern of collaboration among people working toward a goal” (Briggs et al., 2003). ThinkLets allow for the successful collaboration of groups without the need for a highly-trained facilitator by defining reusable process for collaboration in detail (de Vreede and Briggs, 2005).

In this study, a group support system (GroupSystems ThinkTankTM) is used to

facilitate the session and instantiate the thinkLet patterns into a collaboration protocol. The first pattern of collaboration used in the group session is a voting activity, in which the participants vote on the heuristics presented to them. The second pattern of collaboration is a brainstorming activity, in which the participants develop ideas for new heuristics. An in-depth description of the structure of the group session is provided in section 3.4.3.

3.1.2 Focus Group Studies

Focus group studies have an unclear background and stem from several different research fields such as marketing research, organizational research, and community development (Barbour, 2008, p. 18). For this reason, this method has different meanings to different people and is quite flexible. Typically though, focus groups are more or less structured interviews of small groups of people led by a moderator or facilitator, who guides the participants' discussion around a specific topic (Barbour, 2008; Morgan, 1998). Focus group studies have become increasingly popular over the last two decades and are now used in research fields other than those they were used for initially (Morgan, 1998).

Rather than providing generalizable answers to questions, focus groups can provide insightful data about how opinions are formed and modified through group interaction as well as an in-depth understanding of the participants' opinions and perspectives (Barbour, 2008; Edmunds, 1999). Focus groups have the advantage of not putting participants "on the spot" if they can't answer a question (Barbour, 2008) and the group interactions allow for the exchange of ideas and opinions between participants.

Due to the "mixed parentage" (Barbour, 2008) of focus groups, many variations exist. A focus group typically consists of seven to ten participants, although "mini focus groups" with less participants and bigger groups with more participants have been employed as well (Edmunds, 1999; Marshall and Rossman, 1999). Other variants

exist, in which the focus groups sessions are performed over the phone or Internet (Edmunds, 1999). The participants are selected based on shared characteristics considered desirable for the study, such as expertise in a certain area (Marshall and Rossman, 1999). The moderator should be trained and experienced in guiding and stimulating group discussions without influencing the participants.

The focus group method was chosen for the last part of the collaborative group session, wherein the participants were asked to discuss the results and their impressions of the activities completed prior to the focus group session. Table 3.1 shows the appropriateness of the focus group method to this study based on the strengths of the method as identified by Marshall and Rossman (1999), Edmunds (1999), and Morgan (1998).

Table 3.1: Appropriateness of the focus group method to this study (wording of strengths taken from Marshall and Rossman, 1999)

Strength of Focus Groups	Application to Study
Fosters face-to-face interaction with participants	Direct interaction between participants can facilitate and accelerate consensus-building
Facilitates immediate follow-up for clarification	Participants can answer questions by the researcher immediately and thus improve data analysis
Provides for flexibility in formulating hypotheses	Study is exploratory and changes to the research questions are likely
Facilitates analysis, validity checks, and triangulation	Results of focus group activity are analyzed in conjunction with quantitative data gathered in the first two activities of the group sessions
Facilitates cooperation	To achieve the ultimate goal of a single, agreed-upon list of heuristics, the participants need to cooperate and come to a consensus

Edmunds (1999, p. 99ff) explores the advantages and disadvantages of moderating

focus groups yourself, which was the case for this study. The biggest advantages are reduced costs by forgoing the need to hire a trained professional from an outside source to moderate and analyze the focus group. In addition, an inside moderator usually also has a better understanding of the area being studied. On the other hand, an inside moderator is often biased and may impart this bias on the participants, knowingly or not. In addition, an untrained moderator can prevent the true results from emerging and thus defeats the purpose of conducting the study (Edmunds, 1999).

3.2 Participant Selection

Both of the two phases involved five to six participants. Nielsen (1993, p. 156) recommends including five to six evaluators in a heuristic evaluation, since a group of this size is expected to find about 75% of usability problems. Beyond this point, the number of additional problems found per evaluator decreases rapidly (Nielsen, 1993). For the purposes of this thesis, it is reasonable to assume that a group of participants of this size can also be expected to identify a large part of heuristics relevant to an application area, although a larger sample size may be required to increase the thoroughness. This limitation will also be discussed in section 5.4.

For the first phase, usability experts from both academia and industry were asked to participate. A minimum of three years of experience in designing and/or developing user interfaces and usability was required. Usability experts with experience in using or evaluating web-based CRM software were preferred. The second phase included actual users, who use web-based CRM software in their daily job routines. The participants were required to have at least one year of experience in working with a web-based CRM system, since they should be able to identify usability problems and other characteristics of this type of software that may affect the development of heuristics.

Usability experts were recruited through personal contacts. CRM users were recruited through personal contacts as well as snowball sampling, in which the recruited usability experts were asked to identify and invite CRM users in their organization.

3.3 Research Design

Figure 3.1 provides an overview of the research design, which consists of four activities based on the development of three sets of heuristics. First, a literature review was conducted. During the literature review, important and relevant usability heuristics were researched and collected. These heuristics served as the basis for the subsequent steps and were eventually used in the final analysis.

Second, a focus group session with usability experts was used to identify heuristics specific to web-based CRM systems. The experts used their judgement to select still-relevant heuristics from the lists identified as part of the literature review, and supplemented them with new heuristics as suitable to cover the characteristics of web-based CRM software.

Third, a validation phase with actual users of a web-based CRM system was completed. This step aimed to increase the internal validity of the results by including the perspectives of users. The participants in this step were given the list of heuristics created in the first phase and were asked to rate the heuristics based on their perceived applicability. After the rating, the participants were asked to identify missing heuristics.

Fourth, the results of the two phases were analyzed to identify the points on which the usability experts and the CRM users agree and on which they disagree. The resulting set of proposed heuristics for web-based CRM systems was then compared to the heuristics used as the initial input for the first focus group. In comparing this new set of heuristics to existing heuristics identified in the literature review, it can

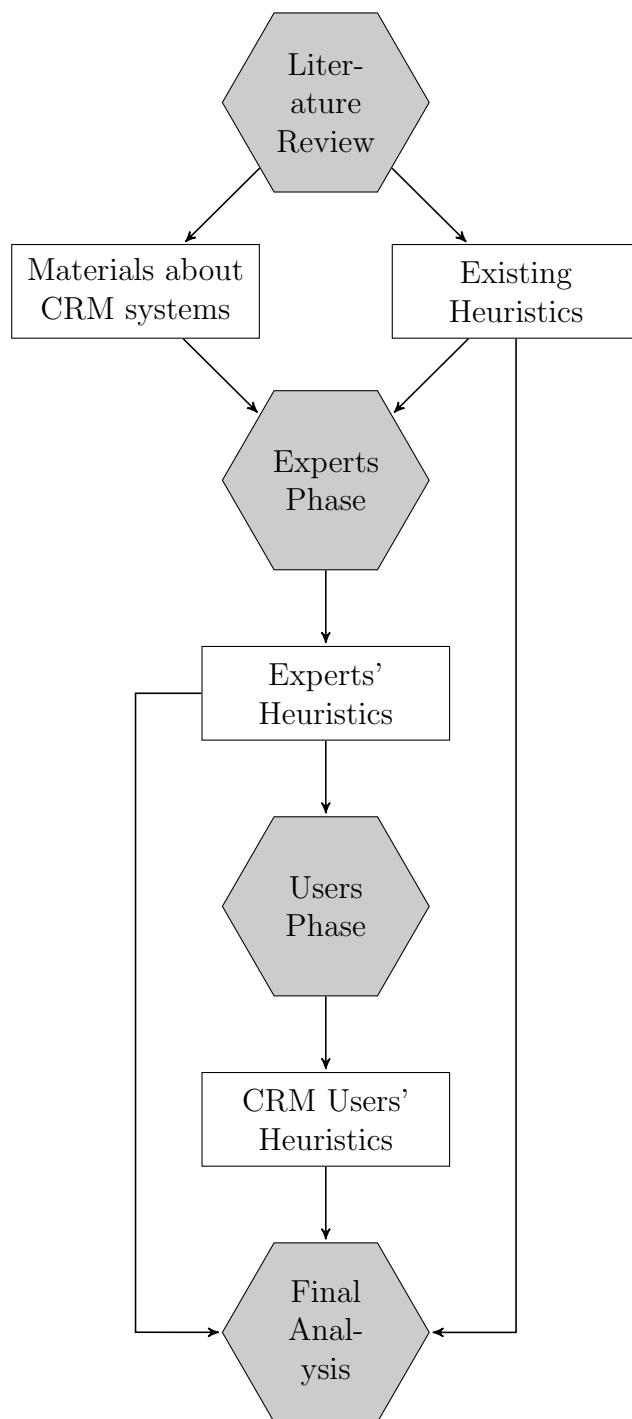


Figure 3.1: Research design

then be determined which heuristics have become irrelevant for this class of software, and which new ones need to be added to heuristic evaluations in order to reduce the likelihood of missing problems and to cover as much of the system to be evaluated as possible.

An important consideration is the level of detail at which heuristics are to be evaluated. Some existing sets are high-level and only provide few principles (e.g. Molich and Nielsen, 1990), others are detailed and consist of hundreds of items (e.g. Leavitt and Shneiderman, 2006). For this study, a middle ground was sought by aiming for around fifty to sixty items in the final list. The items were intended to be more specific than stating a general principle like “consistency”, but less specific than, for example, stating that “each save button is in the same location”. A heuristic at the right level might be “buttons are always in the same location”.

3.3.1 Pilot

A pilot study was conducted to help ensure the actual focus group sessions will run smoothly. The goal of the trial run was to uncover potential weaknesses or problems with the procedures so they could be rectified before the actual sessions. The data resulting from the trial run were not used for this study, as the trial’s purpose was only to test procedures.

A group of fourteen undergraduate students participated in the trial run. The trial run was performed as a part of the final exam for a user interface design course at the University of Nebraska at Omaha.

For this reason, a number of modifications to the protocol used in the actual sessions had to be made. First, due to the limited amount of time available for the pilot, the students were asked to evaluate only one specific system instead of a class of systems. In addition, an abbreviated list of 26 heuristics was used as the basis for the evaluation. Second, the students were not sufficiently trained to develop

new heuristics for the system, so they were only asked to evaluate existing heuristics given to them with regard to applicability. Third, the students were also asked to identify usability problems based on the heuristics supplied to them to satisfy the requirements for the final exam of the class they were taking.

The students were asked to evaluate a student information system familiar to them on the basis of heuristics supplied to them (a modified version of the set developed by Oztekin et al., 2010, see appendix B). The students also received a short list of usage scenarios to aid them in purposefully interacting with the system (also in appendix B). Since some of the heuristics were not directly applicable to the system in question, the students were also asked to state whether they believe the heuristics to be appropriate.

After the evaluation phase, the students were asked to discuss the identified usability problems to create a unified list. They were asked to name the usability problems they saw most often in the list they created during the previous activity. The moderator then inserted the problems every student agreed on into a single list in preparation for the final activity. As a last step, the participants rated the usability problems in the list by severity on a three-point scale of “high”, “medium”, and “low”.

During the trial run, no significant problems with the protocol were encountered. The participants were able to understand the instructions and use the group support system easily. Overall, the students also understood the heuristics and were able to evaluate them with regard to their applicability to the student information system used for this pilot.

The duration of the trial run was limited to one hour, because it was only a part of a exam. This amount of time was far too short to complete the entire protocol. Only 26 heuristics were used and it took most students 45 minutes to comment on each of them. A time frame of one hour for the evaluation component should have

provided sufficient time. The subsequent discussion was ended after 15 minutes due to the time constraints mentioned previously. A longer period would have allowed for a more complete discussion. In consequence, a period of three hours was estimated to be necessary to complete the full protocol with the two focus groups.

3.4 Research Study

3.4.1 Pre-Tasking

In preparation for the study, the usability experts were asked to review pre-task material. This is an important step for increasing the level of detail the participants were able to produce, as well as getting them in the right mindset by providing context (Cooper and Schindler, 2011, p. 164).

In order for the participants of the first phase to be able to prepare, the list of existing heuristics from the literature review was provided to them prior to the session for their review. The participants were asked to examine the existing heuristics and start thinking about whether they might be relevant to web-based CRM systems. In addition, screen shots of exemplary systems were sent to the participants to provide visual context and stimuli for developing new heuristics specific to the class of systems at hand.

3.4.2 Materials

.1 CRM Systems

Based on their leading role in the markets for both large and midsized companies, as well as their wide adoption and availability of documentation, Microsoft Dynamics CRM and salesforce.com were selected as examples of web-based CRM software for this thesis' focus group sessions, which are explained in detail in chapter 3. In addi-

tion, SugarCRM Sugar Professional was selected, even though it is less present in the enterprise market, because it has the lowest usability rating of the nine leaders and is the only open-source product among them.

Microsoft Dynamics CRM Microsoft Dynamics CRM claims to power business productivity through its cloud-based offering. The product can be accessed through a web browser or through a Microsoft Outlook add-in. The software is similar to many of the other Microsoft products in terms of functionality and usability, which makes it familiar to many users (Band et al., 2010a). Microsoft Dynamics CRM has the second-strongest presence in the market for enterprise CRM systems, ranking right after Oracle Siebel CRM (Band et al., 2010a). Example screen shots of the system are available in appendix section A.1.

salesforce.com Transforming companies into “social enterprises” is the goal of salesforce.com, which they aim to achieve through a strong focus on social media integration and enabling of organization-internal collaboration. The solution is fully web-based and available in a subscription-based software-as-a-service (SaaS) pricing and delivery model, which makes it attractive for organizations not wanting to spend time and money creating an on-premises infrastructure for this purpose. Salesforce.com has the fourth-largest presence in the market for enterprise CRM solutions (Band et al., 2010a), and is actually the leader in terms of market presence for mid-sized companies (Band et al., 2010b). Example screen shots are available in appendix section A.2.

SugarCRM Sugar Professional As the largest open-source system in the market, SugarCRM is in a special position, since it offers a free edition of its product. Besides the free edition, there are various paid editions with differing levels of service. Paid editions are also available in a hosted delivery model, but all versions can be installed

on premises. Due to the open-source status, there is an active developer and support community. Example screen shots are available in appendix section A.3.

.2 Usability Heuristics

The ten heuristics developed by Nielsen (1994b, p. 30) were selected as the basis for the materials for the empirical study, since they are established and well-known general principles.

Two medium-grain sets of heuristics were selected to investigate whether these are considered more or less applicable to the class of systems targeted by this study. One of them was developed for ERP systems, which is a class of systems fairly similar to CRM systems; the other was developed for e-learning systems, which have a quite different set of users and purpose.

The heuristics by Ardito et al. (2006) were chosen to represent the heuristics for systems dissimilar to CRM systems. Finally, the heuristics by Singh and Wesson (2009) were selected, because ERP systems are similar to CRM systems in terms of users and purpose.

No heuristics at the checklist level were included, because there are too many per set and they are not application-specific. Nielsen's heuristics were included to represent the general heuristics instead.

3.4.3 Session Structure

The two phases followed two similar structures. Both sessions involved five to six participants and consisted of a quantitative rating activity followed by a qualitative discussion activity.

The differences lie in the input materials, the nature of the qualitative activity, as well as the participants. For the usability expert session, the background materials included a list of existing usability heuristics identified in the literature review. For

the CRM user session on the other hand, the materials consisted only of the list of heuristics created by the usability experts in the first session.

Another difference is that the first phase was based on a focus group session, during which all participants collaborated. During the second phase, the participants did not collaborate, but completed the rating and discussion activities individually through an online questionnaire and a phone interview with the researcher respectively.

Figure 3.2 shows the structure of the usability expert session and figure 3.3 shows the structure of the CRM user session.

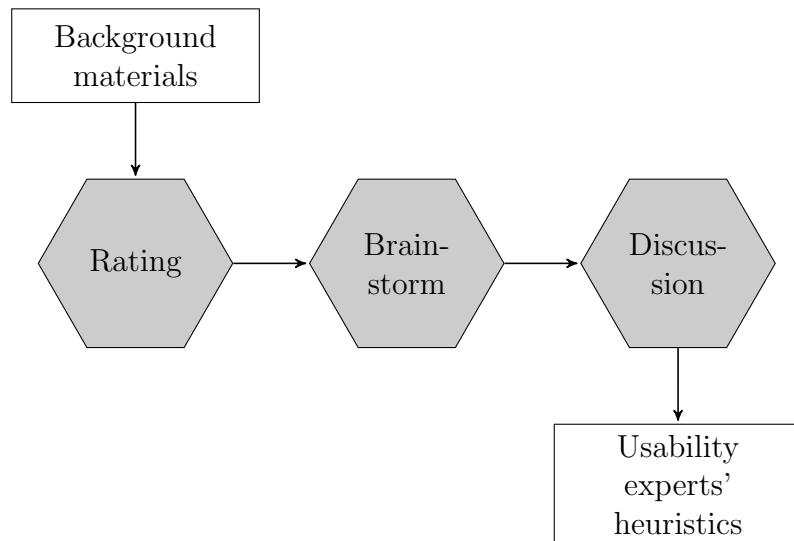


Figure 3.2: Structure of the collaborative session with usability experts

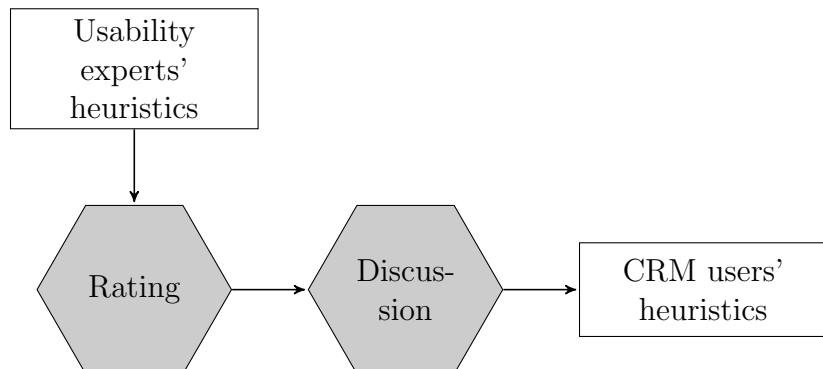


Figure 3.3: Structure of the validation phase with CRM users

.1 First Phase: Usability Experts

First, the participants were asked to review the list of heuristics provided to them in the group support system (see appendix D) and to assign two ratings to each heuristic. The first rating allowed the participants to specify how applicable each of the provided heuristics is to web-based CRM systems in their opinion. This rating was assigned on a five-point numeric scale. The second rating allowed the participants to indicate whether they think any modifications were necessary in order to make a heuristic more applicable (e.g. whether wording needed to be changed).

After the first activity, a brainstorming session followed. The participants were asked to re-evaluate the heuristics which received the highest rating for “need for rewording” in the previous phase. The participants reworded heuristics were possible and discarded the others. Finally, the participants discussed any ideas for heuristics they thought needed to be added to account for web-based CRM systems as extensively as possible. The group support system also allowed for participants to interact and comment on each others’ ideas in addition to the verbal discussion.

.2 Second Phase: CRM Users

First, the participants of this phase were asked to review the list of heuristics developed by the usability experts and assign a rating to each. This rating allowed the participants to specify how applicable they think each heuristic is to web-based CRM systems. The rating was assigned on a five-point numeric scale with an additional option of “don’t know” for cases in which a participant may not understand a heuristic. The questionnaire with the heuristics was made available to the participants in a web-based survey tool.

The researcher then called each participant to administer a follow-up interview. In order to refresh the participants’ memory of the usability heuristics, the first questions were “What do you like about your CRM system?” and “What don’t you like about

your CRM system?”. The participants were then asked to give their overall impression of the applicability of the heuristics they saw in the questionnaire and to identify any areas they felt were not addressed properly by the heuristics. Finally, the participants were asked about the heuristics which were added by the usability experts in order to place a special emphasis on validating their legitimacy.

This phase was conducted with individual interviews as opposed to the focus group approach utilized in the first phase. The main reason for this difference was that the participants in the second phase were less willing to make the bigger time commitment required by the group set-up. Robinson (1993) found that there is no significant difference in the number and quality of responses obtained through group versus individual interviews. Therefore the change in protocol was not felt to be a problem in answering the research question.

3.5 Data Sources and Analysis

During the study, both quantitative and qualitative data were collected. Quantitative data was collected during the first activity of the two phases, wherein the participants' votes on the applicability of the presented usability heuristics were collected. For the group session, this means data about the participants' opinions of the applicability of existing usability heuristics to the specific context of web-based CRM systems. For the second phase, the votes captured the participants' agreement with the results from the first group session, as the participants' votes indicate their opinions of the applicability of the heuristics developed in the first group session to web-based CRM systems.

Qualitative data was collected during the later activities of each phase. During these activities, the participants provided comments and opinions about the usability heuristics presented to them. During the first phase, the participants engaged in a

group discussion about the reviewed heuristics, their need for rewording, as well as any areas missing from the heuristics. During the second phase, the participants engaged in one-on-one phone interviews with the researcher to discuss their overall impression of the heuristics, any missing areas, as well as a targeted discussion of the heuristics newly added by the usability experts.

3.5.1 Analysis of Quantitative Data

Due to the small number of participants in the study, the options for statistical analysis of the data are limited. For the quantitative data collected in the rating activity, descriptive statistics such as means and variance were used to determine overall scores for each heuristic. The heuristics were then sorted based on their applicability score and divided into two groups. The analysis performed on the data is available in sections 4.1.2 and 4.2.2.

3.5.2 Analysis of Qualitative Data

Focus group analysis can be challenging and deserves special attention. It is important to note that focus group analysis already starts during the session itself. Krueger (1998) recommends a systematic approach to focus group analysis consisting of six steps, which were followed while analyzing the data in this study. First, the questions for the participants should be ordered in a way that maximizes insight by allowing for enough time for the participants to order their thoughts and exchange opinions with the other participants. Only then should the actual topical questions be asked. During the focus group, comments should be electronically recorded. In addition, notes should be taken by an assistant moderator, since the main moderator is not likely to have enough time to take thorough notes. At the end of the focus group, it is important to get participant verification, by letting every participant summarize their main points or reading the moderators' notes to the participants and ensuring

they agree to them.

Immediately after the focus group, the moderator and other participating personnel should debrief and talk about any important points or quotes they remember. This debriefing should also be recorded electronically for later reference. During the main analysis process, labels should be attached to main ideas or phenomena. These labels or codes are then used as the basis for further analysis such as identifying counts of codes and combinations in which they occur. The final step recommended by Krueger (1998) comes after the analysis: preliminary and final reports should be shared with participants and stakeholders.

Chapter 4

Results

This chapter presents the results of this thesis based on the two parts of the study. First, the results of the session with usability experts are presented. Second, the results of the session with CRM users are presented. Both of these sections consist of a description of the participants and an overview and analysis of the outcomes. Finally, a comparative analysis is conducted to investigate the commonalities and differences between the results of the first and second phases. Finally, a unified list of usability heuristics for web-based CRM systems is created.

4.1 Phase One

The first session was administered on June 28th, 2012, and took 2.5 hours. During the first segment, which lasted approximately one hour, participants were briefed and then rated existing heuristics presented to them in the group support system. After a break, the participants engaged in a group discussion during which they were asked to reword those heuristics which were identified to be in need of rewording to be more applicable to web-based CRM systems. Finally, the participants were asked to develop new heuristics specific to web-based CRM systems in a group discussion. The two discussions in the second part of the session took one hour.

4.1.1 Participants

Five usability experts participated in the first session. Table 4.1 gives an overview of the participants' experience relevant to this study. All participants had at least four years of experience evaluating, designing, or developing user interfaces, and at least 2.5 years of professional experience in the usability field. Although one participant only had 2.5 years of professional experience in the usability field, he completed a Master's degree in human-computer interaction and had research experience in the field. The mean number of years of professional experience was 9.7, while the mean number of years evaluating, designing, or developing user interfaces was 11.4.

The participants' experience with CRM systems was much less extensive. Two out of the five participants had no experience using a CRM system, with the mean being 1.2 years of experience. Only two people had any experience evaluating, designing, or developing CRM systems (three years and 0.1 years of experience respectively).

Table 4.1: Years of experience with usability and CRM systems of the participants of the first session

Years of Experience...	Participant				
	A	B	C	D	E
working in the usability field	6	10	15	15	2.5
evaluating, designing, or developing user interfaces	6	17	15	15	4
using a CRM system	0	3	1	2	0
evaluating, designing, or developing CRM systems	0	3	0	0	0.1

4.1.2 Evaluation of Existing Heuristics

The first activity of the session consisted of a rating of the existing heuristics based on their applicability to web-based CRM systems and their need for rewording to become more applicable. The ratings for applicability were performed on a five-point scale ranging from “not applicable” (1) to “highly applicable” (5). The ratings for

the need for rewording were performed on a dichotomous scale (“no” (0) and “yes” (1)). Responses to all heuristics on both scales were mandatory.

In total, 84 existing heuristics were used during the first activity of the first session. Ten were taken from Nielsen (1994b), 35 from Singh and Wesson (2009), and 39 from Ardito et al. (2006). Table 4.2 shows selected descriptive statistics for the heuristics based on their source. Overall, the general heuristics developed by Nielsen (1994b) etc. were rated as the most applicable with the least need for rewording. The heuristics specific to ERP systems developed by Singh and Wesson (2009) were rated as slightly less applicable than the first set, with a higher need for rephrasing. Finally, the e-learning heuristics developed by Ardito et al. (2006) received the lowest overall scores with regard to applicability and the highest scores with regard to their need for rewording.

Table 4.2: Overall applicability and need for rewording by heuristics source; *applicability* was measured on a five-point scale (1-5), *need for rewording* was measured on a binary scale (0, 1)

Source	Applicability			Need for Rewording		
	Mean	Min.	Max.	Mean	Min.	Max.
Nielsen (1994b)	4.100	3.8	4.6	0.040	0.0	0.4
Singh and Wesson (2009)	3.709	1.4	4.6	0.246	0.0	0.8
Ardito et al. (2006)	2.708	1.4	4.6	0.303	0.0	0.8

Figure 4.1 provides an overview of the number of heuristics with a given rating of applicability as well as a cumulative count of heuristics based on their applicability rating. There is no clear natural grouping of heuristics (i.e. a clear cut-off or separation between highly applicable heuristics and less applicable heuristics), but there are two somewhat distinct groups (heuristics rated 2.6 or below and heuristics rated 3 and above). The lower group comprises 21 heuristics (25%), the upper group 56 heuristics (66.67%). Seven heuristics (8.33%) received a rating of 2.8, which lies between these groups.

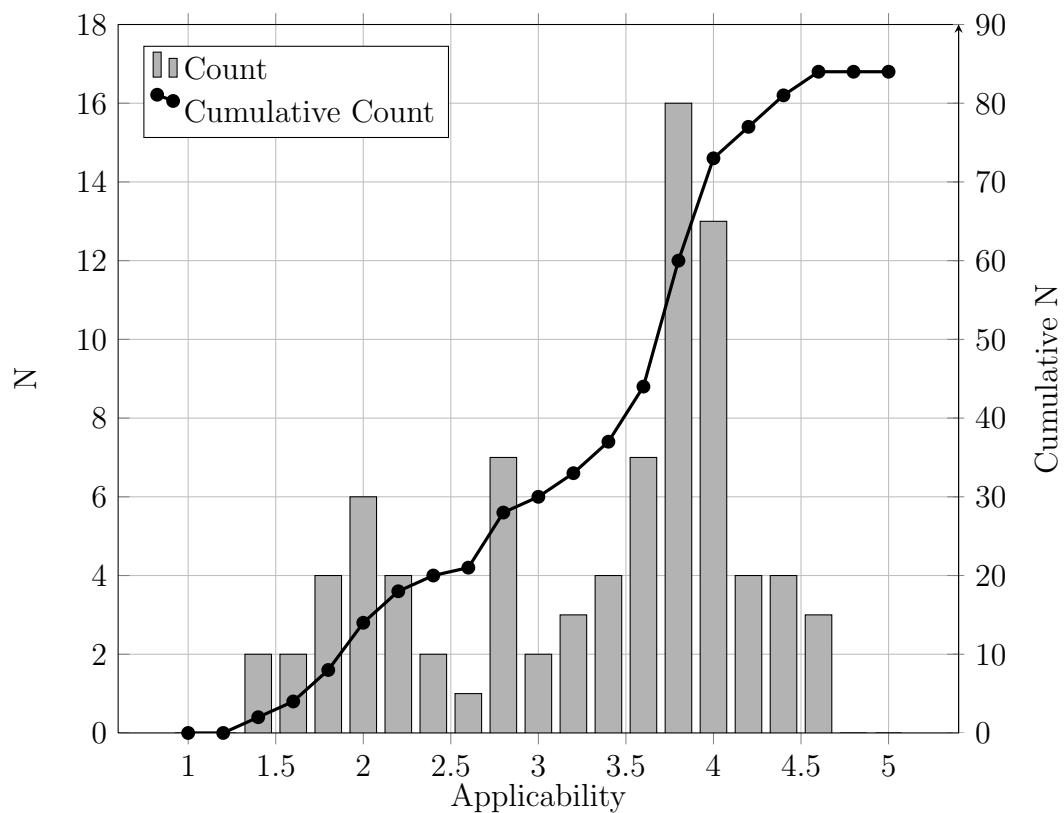


Figure 4.1: Count and cumulative count of heuristics based on applicability rating by usability experts

Figure 4.2 shows the percentage of heuristics achieving a given applicability rating by source. Clearly, Nielsen's heuristics performed well, as they all achieved a rating of 3.8 or more. The ratings for the heuristics developed by Singh and Wesson (2009) are more dispersed, but with the exception of one outlier, achieved ratings of 2.8 or more. The e-learning heuristics developed by Ardito et al. (2006) were rated least applicable to web-based CRM systems on average, but were also the most dispersed.

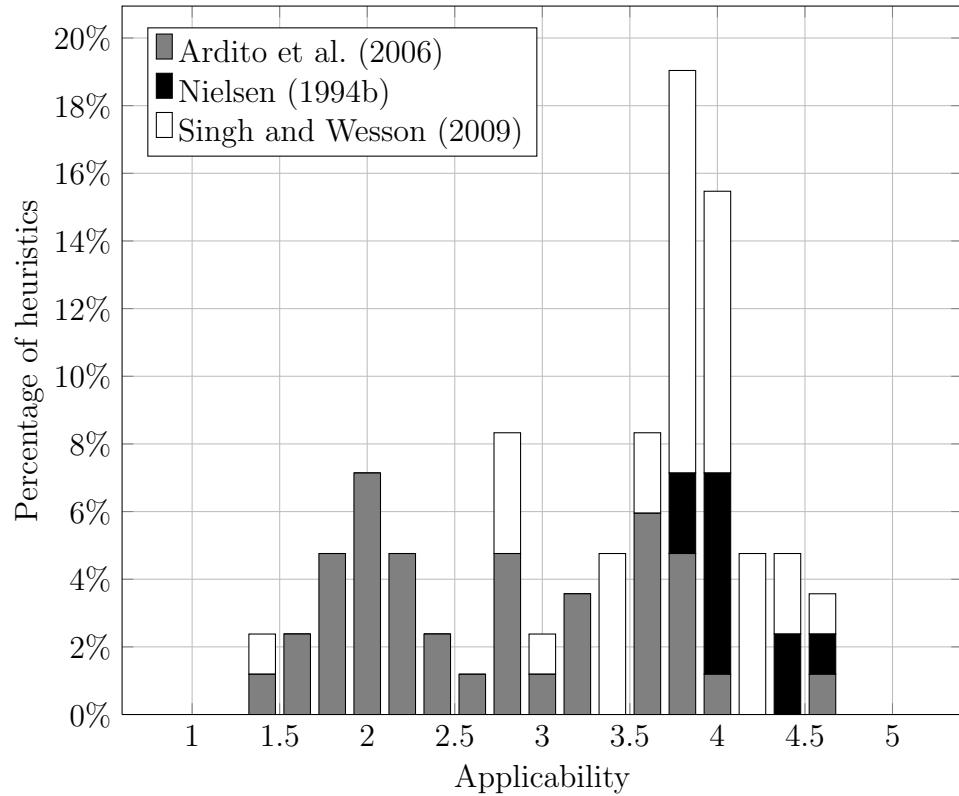


Figure 4.2: Percent of all heuristics with a given rating of applicability by source

If an applicability rating of 3 is chosen as a cut-off for selecting heuristics deemed applicable to web-based CRM systems, a total of 56 heuristics are included and 28 excluded. Of the included heuristics, 15 were developed by Ardito et al. (2006), 10 were developed by Nielsen (1994b), and 31 were developed by Singh and Wesson (2009). Table 4.3 shows the number of heuristics included from each source given an applicability rating cut-off of 3.

A detailed table with the mean and standard deviation for each heuristic's appli-

Table 4.3: Heuristics above and below cut-off by source

Source	N	N \geq 3	N < 3	%N \geq 3
Ardito et al. (2006)	39	15	24	38.64
Nielsen (1994b)	10	10	0	100.00
Singh and Wesson (2009)	35	31	4	88.57
Total	84	56	28	66.67

cability to CRM systems and need for rewording is available in appendix section G.1.

4.1.3 Development of New Heuristics

The first step in developing new heuristics for web-based CRM systems was an evaluation of the heuristics with a rated need for rewording of 0.5 or more (i.e. more than half of the participants indicated that the heuristic needed to be reworded). All heuristics with a rating for “need for rewording” of 0.5 or greater were included in this activity, regardless of their applicability rating. There were a total of 13 heuristics in this category. Of the 13 heuristics, only four received a rating of applicability of three or greater. Heuristics with a low applicability rating were included, because it was anticipated their applicability could be improved through rewording.

None of the heuristics developed by Nielsen (1994b) received a rating of 0.5 or greater, but six of the heuristics developed by Singh and Wesson (2009) and seven of the heuristics developed by Ardito et al. (2006) were in need of rewording.

The participants engaged in a group discussion focused on identifying specific problems with the heuristics in need of rewording, and establishing alternative heuristics on their basis. During the discussion, the participants identified different themes of problems with the heuristics. Table 4.4 gives an overview over these themes and how often they occurred. Some heuristics were associated with more than one theme.

Table 4.4: Problems identified with heuristics in need of rewording; A = number of heuristics per problem theme developed by Ardito et al. (2006), S = number of heuristics per problem theme developed by Singh and Wesson (2009)

Problem Theme	A	S	Total	Reworded
Difficult to understand	4	2	6	3
Domain-specific wording	5	0	5	3
Too vague and general	0	3	3	1
Not a real heuristic	1	1	2	1
Subjective	0	2	2	1
Incomplete	0	1	1	1
Multiple meanings	0	1	1	0

The two most common themes were “difficult to understand” and “domain-specific

wording”. Of the six heuristics which were difficult to understand, two came from Singh and Wesson (2009) and four came from Ardito et al. (2006). All five of the heuristics with domain-specific wording that needed to be changed were developed by Ardito et al. (2006).

The participants were able to modify these heuristics in eight cases to create new heuristics which are more relevant to web-based CRM systems. Table 4.4 also shows how many of the heuristics with a certain problem theme were reworded by the participants.

There were two heuristics which received an applicability rating of three or greater, but which the usability experts were unable to reword. The first heuristic is “Functionality to search for information that is available”. The second heuristic is “The visual layout is well designed”. Both of them were developed by Singh and Wesson (2009) and the usability experts commented that they were too vague and general to be useful. In addition, the second heuristic was classified as “subjective”.

Table 4.5 shows a comparison between the old heuristics and the new versions. Note that in one case, the participants created two new heuristics to replace one old one, for a total of nine new heuristics.

In total, 63 of the existing heuristics are included and 22 are dropped. Table 4.6 gives an overview over the criteria for inclusion of existing heuristics as well as the number of heuristics in each group. Inclusion in the usability experts’ list is based on the heuristic’s rating of applicability as well as their need for rewording. All heuristics which scored an applicability rating of three or greater are included. Heuristics with an applicability rating of less than three were only included, if they received a rating of 0.5 for their need to be reworded and the participants were able to reword them.

Of the 13 heuristics rated to be in need of rewording, four received an applicability rating of three or greater and are included in the usability experts’ list of heuristics for web-based CRM systems (two of these were also reworded and the new version

Table 4.5: Old and new heuristics developed in first session; A = heuristic developed by Ardito et al. (2006), S = heuristic developed by Singh and Wesson (2009)

Old Heuristic	Source	New Heuristic
Clearly visualize course structure	A	Clearly visualize user workflow Clearly visualize employee performance
Provide adaptation of the graphical aspect to the context of use	A	The system is customizable at the user level
Highlight cross-references by state and course maps to facilitate topic links	A	Highlight cross-references between different types of data (e.g. customer issues, sales support, and marketing campaigns)
Insert easy to use platform tools	A	The system conforms to platform conventions
Provide communication mechanisms to both students and lecturers	A	The system's communication mechanisms match the needs of the users
There is a correlation between the searched item and the required information	S	The results returned by a search are relevant to the information required by the user
The output is easy to understand and interpret, whether the output is structured	S	The output style fits the type of data being displayed
The system is intimidating and complex to learn and use	S	The system reduces intimidation and complexity by providing positive feedback and reinforcement, a clear path to execution, and a terminology that matches the users' language

Table 4.6: Decision matrix for inclusion or exclusion of existing heuristics; Y = heuristic is included, N = heuristic is not included; numbers in parentheses represent the number of heuristics fulfilling the criteria; * one heuristic in this category was reworded and split into two new heuristics

		Needs Rewording	
		< 0.5	> 0.5
		Reworded	Not Reworded
Applicability	≥ 3	Y (52)	Y (2)
	< 3	N (19)	Y (6 + 1*)

is included in the list). In addition, seven reworded heuristics are added to the list. These heuristics are based on existing heuristics which received an applicability rating of less than three, but have been reworded to reflect the characteristics of web-based CRM systems. Three heuristics received an applicability rating of less than three and the participants were not able to improve them by rewording, which means they are not included. Table 4.7 shows the heuristics that were excluded as well as their source and category.

When examining the sources of the heuristics which were dropped, it becomes quite evident, that some categories are much more prominent in the list than others. Table 4.8 shows the percentage of heuristics dropped from each original category. There were three categories from which more than one third of the heuristics were dropped. These categories are *hypermediality* (71.4%), *user activity* (64.3%), and *application proactivity* (40%). All three of these categories stem from the set of e-learning heuristics developed by Ardito et al. (2006). These heuristics use domain-specific wording or make reference to domain-specific user interface elements (such as assessment tests and learning paths).

The second and last step in developing new heuristics was an open group discussion in which the participants were asked to identify heuristics which have not been addressed by the heuristics they saw in the previous activity. During this discussion, the participants developed five new heuristics:

- The system provides appropriate filters to organize data
- The system allows for tailoring of the interface to an individual's workflow
- The system displays appropriate information depending on the task at hand
- The system has a dashboard which shows the current status at a quick glance
- Help and documentation are immersed in the system, non-obtrusive, and ubiquitous

Table 4.7: Heuristics excluded based on criteria mentioned previously

Heuristic	Source	Category
The capability of the system to support customization for the user at a transaction level	S	Customization
The system supports alternative navigation metaphors	S	Navigation
The system supports guidance-type information	S	Navigation
Insert assessment tests in various forms	A	Application Proactivity
Automatically update students' progress tracking	A	Application Proactivity
Insert learning domain tools	A	Application Proactivity
Allow different repository modes for lecturers and students	A	Application Proactivity
Provide support for the preparation of the multimedia material	A	Hypermediality
Maximize personalized access to learning contents	A	Hypermediality
Allow repository access to both lecturer and student	A	Hypermediality
Create contextualized bookmarks	A	Hypermediality
Enable off-line use of platform maintaining tools and learning context	A	Hypermediality
Provide the possibility to personalize interface graphics	A	Presentation
Enable to define a clear learning path	A	User Activity
Allow to define alternative learning paths	A	User Activity
Provide support for assessment test	A	User Activity
Manage reports about attendance and usage of a course	A	User Activity
Allow use of learning tools even when not scheduled	A	User Activity
Allow the possibility to personalize the learning path	A	User Activity
Provide mechanisms to integrate the didactic material	A	User Activity
Allow the possibility to create standard-compliant documents and tests (AICC, IMS, SCORM)	A	User Activity
Provide authoring tools to facilitate documents updating and assessment tests editing	A	User Activity

Table 4.8: Categories from which heuristics were dropped with percentage of heuristics dropped

Category	Source	Original #	# Dropped	% Dropped
Customization	S	6	1	16.7
Navigation	S	10	2	20.0
Application Proactivity	A	10	4	40.0
Hypermediality	A	7	5	71.4
Presentation	A	8	1	12.5
User Activity	A	14	9	64.3

With these five new heuristics, the final experts' list of heuristics for web-based CRM systems consists of 68 heuristics. 56 of the original heuristics were included, because they received an applicability rating of three or greater. Of these, two were reworded by the usability experts to become more applicable or clear. In addition, the reworded versions of six heuristics which received an applicability rating of less than three were included (note that one of the heuristics was reworded to result in two separate heuristics for a total of seven). Finally, five new heuristics developed by the usability experts were added. Figure 4.3 shows the composition of this list.

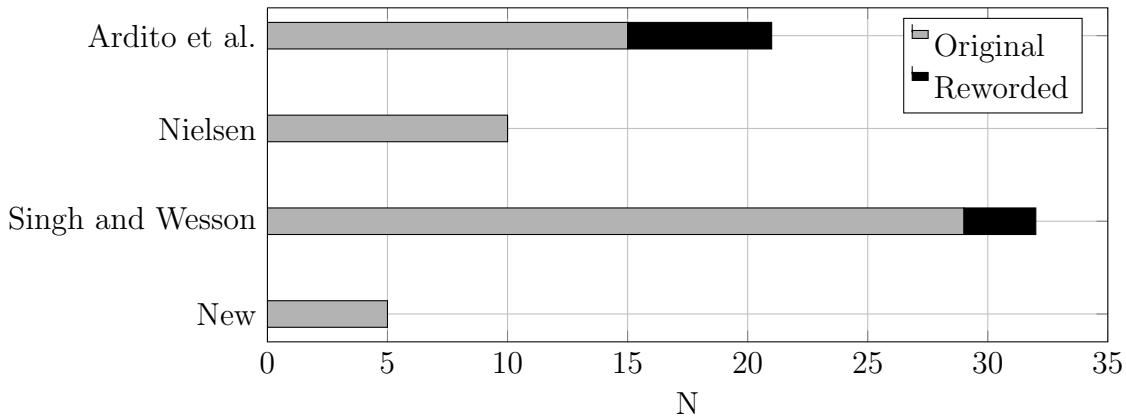


Figure 4.3: Sources of heuristics in usability experts' list

4.2 Phase Two

The second phase was administered between July 11th, 2012 and July 30th, 2012. The participants were asked to fill out an online questionnaire by rating the applicability of each of the heuristics from the first phase. The questionnaire also contained some background questions. After the participants filled out the questionnaire, the researcher called them to conduct a follow-up interview.

4.2.1 Participants

A total of six CRM users participated in this phase, although one of them could not be reached for the follow-up interview. All participants had at least two years of experience using a web-based CRM system. The mean number of years of experience was 5.67. With the exception of one participant, all use a CRM system daily. The other participant uses one two to three times per week. All but one of the participants had been using a web-based CRM system for the entirety of their years of experience with any CRM system. Table 4.9 gives an overview of the participants' experience.

Table 4.9: Years of experience with CRM systems of the participants of the second phase

Years of Experience...	Participant					
	F	G	H	I	J	K
using a CRM system	3	5	16	6	10	2
using a web-based CRM system	3	5	8	6	10	2

Four of the participants used salesforce.com as their CRM system, one used a system called Bullhorn. The system the sixth participant used could not be determined.

4.2.2 Evaluation of Usability Experts' Heuristics

The first activity in this phase, similarly to the first activity in the previous phase, consisted of a rating of the heuristics developed in the first phase based on their applicability to web-based CRM systems. The ratings were performed on a five-point scale ranging from “not applicable” (1) to “highly applicable” (5). There was an additional option of “don’t know” for cases in which the participant was unable to understand the heuristic.

On average, it took the participants close to 52 minutes to complete the questionnaire. It should be noted that four of the participants took less than 45 minutes to complete the questionnaire, while it took the two others more than one hour.

A total of 68 heuristics was rated in this activity. Ten were taken from Nielsen (1994b), 32 from Singh and Wesson (2009), 21 from Ardito et al. (2006), and five were newly developed during the previous phase. Table 4.10 shows selected descriptive statistics for the heuristics based on their source. Overall, the ratings of applicability were very similar and very high across all sources of heuristics. Appendix section G.2 contains the detailed results of the rating activity.

Table 4.10: Overall applicability by heuristics source during second phase

Source	N	% Missing	Applicability			
			Mean	Min.	Max.	St. Dev.
Ardito et al. (2006)	21	14.29	4.03	2	5	0.849
Nielsen (1994b)	10	10.00	4.08	1	5	0.614
Singh and Wesson (2009)	32	4.69	4.33	2	5	0.699
New	5	3.33	4.03	2	5	0.650

One exception is a heuristic which consistently received very low ratings by every participant. The heuristic is “Users often choose system functions by mistake and will need a clearly marked ‘emergency exit’ to leave the unwanted state without having to go through an extended dialogue. Support and undo and redo.” by Nielsen (1994b).

The mean rating for this heuristic was 1.83 with a standard deviation of 0.687. This is very surprising, as the usability experts rated this heuristic much higher, at 4.6 with a standard deviation of 0.894. Thus, this heuristic was one of the three which received the highest rating of applicability by the usability experts. This is by far the biggest distance between the ratings assigned by usability experts and CRM users for any one heuristic. Since the heuristic did receive very high ratings by the usability experts, it will remain in the list of accepted heuristics, until a measurement error can be eliminated as the reason for this discrepancy.

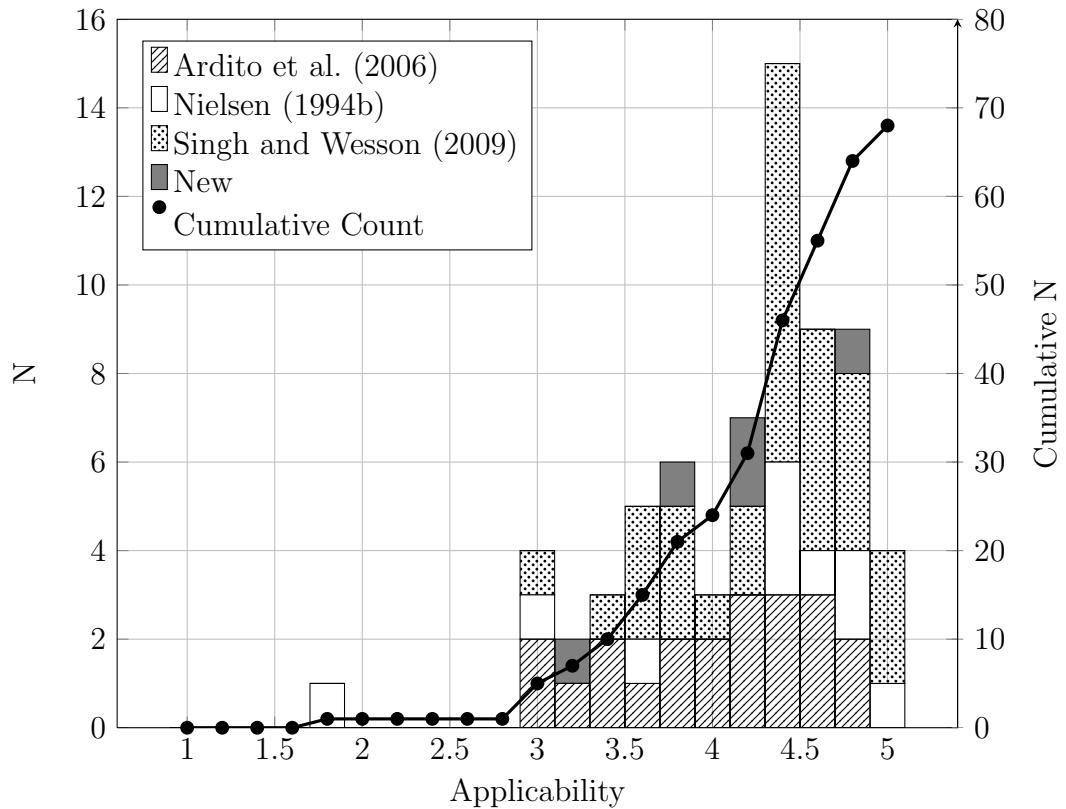


Figure 4.4: Count and cumulative count of heuristics based on applicability rating by CRM users

As adumbrated previously, the heuristics received much more uniform ratings in this phase than in the previous phase. When removing the outlier discussed in the previous paragraph, the lowest mean rating received by any heuristic in this phase is 3.0, which indicates relatively good applicability and the heuristics receiving this

rating would have been included in the list of accepted heuristics in the previous phase. Figure 4.4 shows the number of heuristics with a given rating of applicability as well as the cumulative count.

Another interesting figure is the percentage of abstentions for each group of heuristics. Ardito et al. (2006) received the highest number of missing votes, followed by Nielsen (1994b). Table 4.10 shows the number of votes missing by source. The percentage represents the total number of votes missing. For Ardito et al. (2006), the maximum number of votes that could have been cast is 21 heuristics times six participants ($21 * 6 = 126$). Of these, 18 votes have not been cast, leading to an abstention rate of 14.29%. One likely interpretation of these figures is that the participants did not feel comfortable making a decision about the heuristics because they either were unable to understand the heuristic or because they did not feel they have enough experience to make a judgment. This could mean that the participants found the heuristics by Ardito et al. (2006) much harder to understand than the heuristics developed by the usability experts in the previous phase of the study. This problem was also present in phase one, where the participants stated that the most common problem with the heuristics was that they were difficult to understand.

4.2.3 Oral Comments

During this phase, five follow-up phone interviews were conducted with the participants. One participant could not be reached despite numerous attempts. Although the researcher attempted to perform the phone interviews shortly after the participants completed the questionnaire, this was not always possible. Only in two cases could the participants be reached within 24 hours of them completing the questionnaire. The other three participants were interviewed between six and sixteen days after their completing the questionnaire. The interviews consisted of three parts corresponding to the three subsections below.

.1 Introductory Questions

The first two questions asked in the interview were focused on the CRM systems the participants use to create some context and get them to open up and become comfortable sharing their opinion. These questions were “What do you like most about your CRM system?” and “What do you like least about your CRM system?”.

The participants were fairly open in discussing these topics and all had something positive and negative to say about their CRM systems without needing to reflect for a long period of time. Overall usability of the CRM systems was the most commonly named positive and negative aspect. Some of the participants found their respective CRM system very easy to use and user-friendly, while others thought theirs was difficult to use and required “a lot of clicking around” to complete a task. The participants who use salesforce.com reported that they liked their CRM system better than the participants who used another system.

Another common theme was the advantage of web-based systems to be available from anywhere, even mobile devices. One participant pointed out that she can access the system when working from home on her own computer and another participant said he loved the fact that he can look up information on the go from his smartphone. The participants also pointed out that they like the fact that their CRM system synchronizes across different communication tools such as e-mail clients. This was particularly important to one participant, whose company requires her to log all oral communications and store all written communications in their CRM system. Another participant mentioned that the information she has about her clients is synchronized between her CRM system and her e-mail client, so she can have access to that information from both systems.

Information overload was mentioned as a negative aspect of CRM systems as experienced by the users. One participant said he sometimes felt overwhelmed by the amount of information in the system and the speed at which it gets created, even

though the system does provide categorization and filtering of the information.

.2 Overall Impression

This section of the interview served to discuss the participants' overall impression of the heuristics as well as their opinion of whether any heuristics were missing or areas of CRM systems that had not been covered. The questions asked in this part of the interview were "What was your overall impression of the heuristics you saw in the questionnaire?" and "Do you think there is anything that is important to CRM systems that was not covered by the heuristics?".

The participants' overall impressions of the heuristics were good. They said that most of the heuristics seemed applicable and made sense to them. Some of the participants did point out that a number of the heuristics were "wordy" and difficult for them to understand, but that they selected the corresponding option on the questionnaire in those cases. Another participant stated that he was unable to judge some of the heuristics since he only had experience using the CRM system as opposed to administering it. This was especially true for heuristics related to customization, as this is often done by an administrator.

When asked whether they thought anything was missing, none of the participants identified an area. This question may have been problematic and not effective in uncovering missing heuristics, since humans are typically bad at identifying things that are missing when asked outright. Another explanation might be that most of the participants were satisfied with their CRM systems for the most part and therefore weren't able to identify potential usability problems, since they don't encounter them.

The participants did mention aspects of CRM systems they liked or disliked but which were not included in the heuristics. These aspects are *access from mobile devices for traveling salespeople* and *synchronization of data across communication tools* (e.g. contact information is automatically transferred to the e-mail client and

communications with a contact are available from within the CRM system). Based on these two aspects, two new heuristics are added:

- The system is accessible and usable from mobile devices.
- The system allows for synchronization of its information with outside communication tools.

.3 Focused Evaluation of New Heuristics

Finally, special emphasis was placed on discussing the five heuristics which were developed in the first phase to create an extra layer of validation. In this section of the interview, the five newly created heuristics were read to the participants one by one and they were asked if they thought each particular heuristic was important for web-based CRM systems.

There was overall agreement among all participants that all heuristics are important to web-based CRM systems. Only in one case, one participant stated he didn't think the heuristic "Help and documentation are immersed in the system, non-obtrusive, and ubiquitous" was important, because he usually contacts his company's technical support team when he has a question about the CRM system, instead of consulting the system documentation.

4.3 Comparative Analysis

4.3.1 Evaluation of Existing Heuristics

As part of the final analysis, the ratings assigned by the usability experts and the CRM users were compared. Overall, the ratings for most heuristics were higher as assigned by CRM users than by usability experts. On average, the increase amounted to 0.55 points. The heuristics which were reworded by the usability experts received

a much higher rating than the original heuristics. On average, the ratings for the reworded heuristics increased by 1.92 points as compared to the original heuristics. Table 4.11 shows the difference in ratings between phases by source.

Table 4.11: Comparison of rating differences between phases by source

Source	Usability Experts	CRM Users	Difference
Ardito et al. (2006)	3.19	4.03	0.84
Nielsen (1994b)	4.10	4.08	-0.02
Singh and Wesson (2009)	3.79	4.33	0.54
New	—	4.03	—

Of the five heuristics whose rating decreased the most between the two phases, the average decrease was 1.3 points. Three of these heuristics were developed by Nielsen (1994b). Table 4.12 gives an overview of these five heuristics. The five heuristics which experience the largest increase in ratings are shown in table 4.13. All of these heuristics are reworded versions of the original heuristics. Table 4.14 shows the five heuristics which received the highest increase in ratings when excluding the reworded heuristics.

Table 4.12: Heuristics whose applicability rating decreased by 0.8 points or more during phase two

Heuristic	Source	Difference
Users often choose system functions by mistake and will need a clearly marked ‘emergency exit’ to leave the unwanted state without having to go through an extended dialogue. Support and undo and redo.	N	-2.77
The ability of the UI to be configured without affecting the underlying business logic of the system	S	-1.4
Accelerators – unseen by the novice user – may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.	N	-0.8
Introduce mechanism to highlight errors and cues to avoid errors	A	-0.8
Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.	N	-0.8

Table 4.13: Heuristics with the largest rating increase

Heuristic	Source	Difference
Clearly visualize employee performance	A	2.83
Highlight cross-references between different types of data (e.g. customer issues, sales support, and marketing campaigns)	A	2.63
Clearly visualize user workflow	A	2.33
The system reduces intimidation and complexity by providing positive feedback and reinforcement, a clear path to execution, and a terminology that matches the users’ language	S	2.27
The system’s communication mechanisms match the needs of the users	A	2.17

Table 4.14: Heuristics with the largest rating increase excluding reworded heuristics

Heuristic	Source	Difference
Functionality to search for information that is available	S	1.6
The output provided provides clear visibility into the various other departments	S	1.5
Clearly visualize progress tracking	A	1.4
Maximize adaptation of technology to the context of use	A	1.33
The system improves user productivity	S	1.07

4.3.2 Creation of New Heuristics

During phase one, five new heuristics were created and then accepted by the participants in phase two.

1. The system provides appropriate filters to organize data
2. The system allows for tailoring of the interface to an individual's workflow
3. The system displays appropriate information depending on the task at hand
4. The system has a dashboard which shows the current status at a quick glance
5. Help and documentation are immersed in the system, non-obtrusive, and ubiquitous

During phase two, two new heuristics were added.

6. The system is accessible and usable from mobile devices
7. The system allows for synchronization of its information with outside communication tools

To create a unified list of heuristics in appropriate categories, these seven heuristics can be added to the categories created by Singh and Wesson (2009). Heuristics 1, 3, 4, and 7 can be sorted into the category *task support*, 2 can be added to *customization*, 6 belongs to *presentation*, and 5 belongs to *learnability*.

The ten heuristics developed by Nielsen (1994b) can also be sorted into the categories developed by Singh and Wesson (2009) to create a single list of heuristics for web-based CRM systems. See table 4.15 for the categorization of the heuristics.

Table 4.15: Categorizing heuristics developed by Nielsen (1994b) into categories developed by Singh and Wesson (2009)

Heuristic	Category
Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.	Learnability
Even better than good error messages is a careful design which prevents a problem from occurring in the first place.	Navigation
Make object, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.	Navigation
Accelerators – unseen by the novice user – may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.	Navigation
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.	Presentation
Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.	Presentation
Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	Presentation
The system should speak the users' language with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.	Task Support
Users often choose system functions by mistake and will need a clearly marked “emergency exit” to leave the unwanted state without having to go through an extended dialogue. Support and undo and redo.	Task Support
Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.	Task Support

Most of the remaining heuristics by Ardito et al. (2006) can remain in their categories and are added to the final list of heuristics. Solely the two heuristics that were in the category *hypermediality* are added to the category *task support* instead, since it is a better fit for them. Finally, the list of heuristics for web-based CRM systems consists of the categories and heuristics displayed in table 4.17. There are a total of 70 heuristics in seven categories. Table 4.16 shows the composition of the final list.

Table 4.16: Composition of the final list of heuristics; N = Nielsen (1994b), S = Singh and Wesson (2009), A = Ardito et al. (2006)

Category	N	S	A	New	Total
Application Proactivity	0	0	6	0	6
Customization	0	5	0	1	6
Learnability	1	5	0	1	7
Navigation	3	8	0	0	11
Presentation	3	6	8	1	18
Task Support	3	8	2	4	17
User Activity	0	0	5	0	5
Total	10	32	21	7	70

Table 4.17: Final, unified list of heuristics for web-based CRM systems

Category	Heuristic	Source
Application Proactivity	Introduce mechanisms to prevent usage errors	A
Application Proactivity	Maximize adaptation of technology to the context of use	A
Application Proactivity	Provide mechanisms for teaching-through-errors	A
Application Proactivity	Provide mechanisms to manage user's profiles	A
Application Proactivity	Register the date of last modification of documents to facilitate updating	A
Application Proactivity	The system conforms to platform conventions	A
Customization	The ability of the system to be re-configured over a period of time	S

Category	Heuristic	Source
Customization	The ability of the UI to be configured without affecting the underlying business logic of the system	S
Customization	The alignment of the system to update existing business processes, and (or) to include new ones	S
Customization	The capability of the system to support user-level customization	S
Customization	The ease in which the system can be configured to a particular industry type	S
Customization	The system allows for tailoring of the interface to an individual's workflow	New
Learnability	A user can learn how to use the system without a long introduction	S
Learnability	Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.	N
Learnability	Help and documentation are immersed in the system, non-obtrusive, and ubiquitous	New
Learnability	It is easy to become skillful at using the system within a short amount of time	S
Learnability	The system reduces intimidation and complexity by providing positive feedback and reinforcement, a clear path to execution, and a terminology that matches the users' language	S
Learnability	The various functions of the system can be identified by exploration	S
Learnability	There is sufficient on-line help to support the learning process	S
Navigation	Accelerators – unseen by the novice user – may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.	N
Navigation	Even better than good error messages is a careful design which prevents a problem from occurring in the first place.	N
Navigation	Functionality can be found quickly and easily	S

Category	Heuristic	Source
Navigation	Functionality to search for information that is available	S
Navigation	Information can be easily accessed	S
Navigation	Make object, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.	N
Navigation	The results returned by a search are relevant to the information required by the user	S
Navigation	The system can guide the user through the correct sequence of transaction to complete a business process	S
Navigation	The system is capable of supporting the different interaction styles of the various users	S
Navigation	The UI supports efficient and accurate navigation of the system	S
Navigation	There is clarity in terms of the next sequence of transactions of steps	S
Presentation	Clearly and constantly indicate system state	A
Presentation	Clearly visualize employee performance	A
Presentation	Clearly visualize options and commands available	A
Presentation	Clearly visualize progress tracking	A
Presentation	Clearly visualize user workflow	A
Presentation	Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.	N
Presentation	Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	N
Presentation	Introduce mechanism to highlight errors and cues to avoid errors	A
Presentation	Maintain UCD [user-centered design] attributes for interface graphical aspects	A
Presentation	The information presented supports informed decision making	S
Presentation	The information provided by the system is timely, accurate, complete and understandable	S

Category	Heuristic	Source
Presentation	The output provided provides clear visibility into the various other departments	S
Presentation	The output style fits the type of data being displayed	S
Presentation	The system is accessible and usable from mobile devices	New
Presentation	The system is customizable at the user level	A
Presentation	The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.	N
Presentation	The UI [user interface] is intuitive	S
Presentation	The visual layout is well designed	S
Task Support	Highlight cross-references between different types of data (e.g. customer issues, sales support, and marketing campaigns)	A
Task Support	Supply different media channels for communication	A
Task Support	The information provided by the system is in real-time	S
Task Support	The responses from the system are quick and efficient	S
Task Support	The system allows for synchronization of its information with outside communication tools	New
Task Support	The system automates routine and redundant tasks	S
Task Support	The system displays appropriate information depending on the task at hand	New
Task Support	The system has a dashboard which provides a quick glance of the current status	New
Task Support	The system improves user productivity	S
Task Support	The system is easy to use	S
Task Support	The system provides appropriate filters to organize data	New
Task Support	The system should speak the users' language with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.	N
Task Support	The system supports efficient completion of tasks	S

Category	Heuristic	Source
Task Support	The system supports improved information flow between the various organizational departments	S
Task Support	The terminology used by the system is consistent with the terminology of the user	S
Task Support	Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support and undo and redo.	N
Task Support	Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.	N
User Activity	Insert mechanisms to make annotations	A
User Activity	Provide both synchronous and asynchronous communication tools	A
User Activity	Provide easy-to-use authoring tools	A
User Activity	Provide mechanisms for search by indexing, key or natural language	A
User Activity	The system's communication mechanisms match the needs of the users	A

Chapter 5

Discussion & Conclusion

The purpose of this study was to identify the usability heuristics relevant to web-based CRM systems. To investigate this problem, a two-phased study was conducted involving both usability experts and CRM users. While the previous chapter presented the results of the two phases as well as the comparative analysis, this chapter presents a discussion of the results and the findings gleaned from them, as well as their implications and the study's limitations.

5.1 Discussion

5.1.1 Applicability Based on Specificity

The results of the first phase showed a gradation in applicability of the heuristics based on their source. The most general set of heuristics (Nielsen, 1994b) received the highest ratings at 4.087, followed closely by the heuristics specifically developed for ERP systems (Singh and Wesson, 2009) at 4.086 points, while the heuristics for e-learning systems (Ardito et al., 2006) received the lowest ratings at 3.647 points. The reason for this may be that the general heuristics were not developed with a specific class of applications in mind. They were intentionally created to be applicable to a

wide array of user interfaces (Nielsen, 1994b, p. 28).

On the other hand, previous research has shown that some usability problems may be missed, if only general heuristics are used in an evaluation (e.g. Rusu et al., 2011), so it is necessary to create heuristics for specific applications to improve usability evaluations, even though they may not be widely applicable.

5.1.2 Applicability Based on Domain

The ERP heuristics were likely rated as more applicable than the e-learning heuristics, because ERP systems are more similar to CRM systems. In fact, many ERP systems contain CRM systems. They also support similar work flows and users, as opposed to e-learning systems, which have a different audience and goals. ERP and CRM systems are usually used to support and even automate business processes, while e-learning systems are used to support learning processes and education.

This finding shows that similar classes of applications share more of the same heuristics than applications used for very different purposes. This finding also supports previous research indicating that different heuristics are needed to appropriately cover different classes of applications (e.g. Rusu et al., 2011). In addition, the *Task-Technology Fit* model discussed in section 2.1.2 shows that task characteristics have a direct influence on task-technology fit. Two tasks with very different characteristics will likely also have a different technology fit, whereas tasks which share many characteristics and are more similar will have a similar fit to a technology.

5.1.3 Lack of Specificity of Usability Experts' New Heuristics

The five new heuristics developed by the usability experts in phase one are relatively general and do not use any domain-specific terminology. They appear to be applicable to a variety of systems that are used to store and access large volumes of information and support business processes.

The reason for this lack of specificity may be that most of the usability experts had very little experience with CRM systems. On average, the participants had only 1.2 years of experience using a CRM system. Nielsen (1992) found that in heuristic evaluations, evaluators who have expertise in both usability as well as the subject matter of the system being evaluated find 19 percentage points more usability problems than evaluators who do not have subject matter expertise. It is quite likely that the participants in this thesis study had difficulty developing heuristics that are more specific to CRM systems because they were not “double specialists”. This limitation is discussed in greater detail in section 5.4.

5.1.4 Differences in Ratings for Nielsen’s Heuristics

On average, the usability experts rated the heuristics developed by Nielsen (1994b) higher than the CRM users did. The average applicability rating assigned to Nielsen’s heuristics (4.10) by usability experts is 0.81 higher than the average rating for all heuristics (3.29). On the contrary, the average rating assigned to Nielsen’s heuristics (4.08) by CRM users is 0.10 points lower than the average rating for all heuristics (4.18). This means that the usability experts considered Nielsen’s heuristics more applicable and important than the CRM users did.

Based on observations made during the focus group discussion, it is likely that most of the usability experts recognized these heuristics and their importance in the field of usability research, while none of the CRM users did. Since the usability experts recognized Nielsen’s importance in the field, which became evident in the focus group discussion, they may have been biased to assigning a higher rating to his heuristics than they actually deserved.

It is also possible that the CRM users assigned lower ratings to Nielsen’s heuristics, because they are general in nature and the participants therefore thought they were less useful than the more specific heuristics.

5.1.5 Low Rating for *User Control and Freedom* Heuristic by CRM Users

One of Nielsen's heuristics ("Users often choose system functions by mistake and will need a clearly marked 'emergency exit' to leave the unwanted state without having to go through an extended dialogue. Support undo and redo.") received a particularly high rating by the usability experts, while the CRM users assigned the lowest rating by far to it.

One possible explanation is the previously mentioned bias of the usability experts to rate this heuristic highly, although it may not be very applicable in reality. This explanation seems possible, yet is unlikely, because there is such a big discrepancy between the two ratings.

Another explanation might be that the users took offense to the wording of the heuristic, thinking that they do not, in fact, make a lot of mistakes when using a system. It is also possible that the users had trouble understanding this particular heuristic, as they assigned higher ratings to other heuristics related to error avoidance and recovery ("Introduce mechanisms to prevent usage errors" received a rating of 4.6, "Introduce mechanisms to highlight errors and cues to avoid errors" received a rating of 3.0). Further research is necessary to investigate this discrepancy.

5.1.6 Answers to Research Questions

The first research question, "What are the usability heuristics relevant to web-based CRM systems?" was answered by the creation of the unified list in table 4.17. Existing heuristics were evaluated by two sets of participants and those with high ratings of applicability to web-based CRM systems were included in the final list. It contains heuristics from four sources: the heuristics created by Nielsen (1994b), Singh and Wesson (2009), and Ardito et al. (2006), as well as heuristics created by the

participants of the study.

The answer to the second research question, "Which heuristics are irrelevant?", shows that heuristics are irrelevant to a particular class of applications, if they contain domain-specific wording or references to user interface elements, which are not used in the class of applications at hand. More broadly-formulated, general heuristics are applicable to more classes of applications, but less helpful in identifying domain-specific usability problems.

The final research question, "Are there new heuristics that need to be added?", can be answered with a "yes". Seven new heuristics were created during the study and added to the body of heuristics for web-based CRM systems. It is expected that these heuristics are most relevant to web-based CRM systems and less relevant to other types of computer systems.

5.2 Contributions

This study was the first to investigate usability heuristics for web-based CRM systems as well as the effects of the involvement of users in the process of developing domain-specific usability heuristics. It was shown that there is a difference in the applicability of a set of heuristics based on the domain it is applied to. General heuristics remain largely applicable to specific domains, while the applicability of specific heuristics depends on the similarity of the domain they were developed for and the one they are used to evaluate.

The findings of this study demonstrate that users can be involved in the process of developing domain-specific heuristics and can add subject matter expertise, especially if the usability experts have no or only limited experience with the specific class of applications. It was shown that people unfamiliar with usability evaluations and heuristics are still able to understand them for the most part and can make valuable

contributions and judgments on their applicability to a domain they are familiar with.

5.3 Implications

5.3.1 For Research

The results of this study show that there is a need for developing domain-specific usability heuristics for the various classes of software in use. It will also be necessary to periodically evaluate existing heuristics to investigate whether they need to be adapted to account for emerging types of systems.

Since this study found that even people untrained in usability evaluations can understand heuristics and make contributions to the development of them, the question of whether usability experts are still necessary arises. Traditionally, usability experts both create usability heuristics and then use them to evaluate software and identify usability problems. Now that non-experts were successfully included in the development of new heuristics, it remains to be answered whether this holds true in general and usability experts do not have to play the main role in developing new heuristics, but can inform the process and support domain experts in the development. It is also possible that the non-experts could perform a heuristic evaluation by themselves and apply a set of defined heuristics correctly to identify usability problems.

There are also implications with regard to the two theories discussed in section 2.1. Some of the constructs contained in these models have relationships with the concepts and findings developed in this thesis.

.1 IS Success Model

The study performed in this thesis mostly relates to the independent variables in the IS Success Model, as these capture the quality of the system, information, and service, rather than the attitudes and behaviors which are captured by the dependent

variables. Usability heuristics are used to improve the quality of an information system, which will then influence the attitudes and behaviors.

System quality measures the desired characteristics of the information system itself (DeLone and McLean, 2004). Among these qualities are usability, availability, and reliability. *System flexibility* is also one of the characteristics included in *system quality* and was originally developed by Hamilton and Chervany (1981). In the final list of heuristics developed in the present study, there are thirteen items related to flexibility and customizability, which is a component of flexibility (see table 5.1).

These heuristics generally recommend that the system be flexible to allow for varying interaction modes across users as well as for customization of the system to different users, business processes, and industries. Since there is a total of 70 heuristics in the list, the percentage of heuristics relating to system flexibility is 18.6%. This finding reinforces the relationship between usability and system quality.

Information quality measures the quality of the information system's output (DeLone and McLean, 1992). This construct contains measures such as relevance, understandability, accuracy, and timeliness of the information provided by the system. There are nine items in the final list of heuristics developed in the present study relating to information quality (see table 5.2). The heuristics are concerned with clarity, relevance, usableness, and timeliness of the system's output. This shows that information quality is important for the usability of CRM systems.

Service quality is a construct focused on the support the information system and IS organization provides for end users and includes *tangibility*, *reliability*, *responsiveness*, *assurance*, and *empathy* (DeLone and McLean, 2003). With regard to this thesis, two instruments in this construct are of particular interest, *responsiveness* (promptness of service to users) and *assurance* (knowledge of IS employees to do their job

Table 5.1: Heuristics related to system flexibility with overall applicability ratings

Heuristic	Source	Applicability
Maximize adaptation of technology to the context of use	A	3.73
Provide mechanisms for search by indexing, key or natural language	A	3.93
Supply different media channels for communication	A	3.82
The system is customizable at the user level	A	3.00
The system's communication mechanisms match the needs of the users	A	3.18
Accelerators – unseen by the novice user – may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.	N	3.96
The system allows for tailoring of the interface to an individual's workflow	New	3.17
The system is accessible and usable from mobile devices	New	—
The ability of the system to be re-configured over a period of time	S	4.13
The ability of the UI to be configured without affecting the underlying business logic of the system	S	3.64
The capability of the system to support user-level customization	S	3.55
The ease in which the system can be configured to a particular industry type	S	3.89
The system is capable of supporting the different interaction styles of the various users	S	3.64

well). During the phone interviews performed with CRM users, one of the participants pointed out that help and documentation are not important to him, because he prefers to consult the IT department when he has a question about or problem with the CRM application instead of reading the help documentation. It seems reasonable to assume that this attitude is fairly common among end users and therefore, a responsive and knowledgeable IT help desk are important in ensuring the success of an information system.

This discovery shows that there is a relationship between service quality and us-

Table 5.2: Heuristics related to information quality with overall applicability ratings

Heuristic	Source	Applicability
Clearly visualize employee performance	A	3.55
The system displays appropriate information depending on the task at hand	New	4.17
The system has a dashboard which provides a quick glance of the current status	New	4.83
The system allows for synchronization of its information with outside communication tools	New	—
Information can be easily accessed	S	4.55
The information presented supports informed decision making	S	4.53
The information provided by the system is in real-time	S	4.18
The information provided by the system is timely, accurate, complete and understandable	S	4.73
The output provided provides clear visibility into the various other departments	S	3.82
The output style fits the type of data being displayed	S	4.15

ability, as increased service quality through a responsive and competent help desk can increase the ability of the end users to properly operate the system and therefore increase *user satisfaction* with the system. There is also an interesting implication when looking at the relationship in the opposite direction. A good help desk could effectively erase the need for good documentation of the system for some users, although others may still prefer to use the documentation instead of consulting the help desk.

.2 Task-Technology Fit

The results of the study performed for this thesis have implications for the three variables in the task-technology fit model developed by Goodhue (1995).

Task characteristics are the characteristics of the “actions carried out by individuals in turning inputs into outputs” (Goodhue, 1995). Tasks can be classified by

their variety and difficulty, interdependence, and routineness (Goodhue, 1995). The different tasks performed within CRM systems can be classified into different groups. Answering a customer's complaint call, for example, entails more variety and less interdependence, than creating a report about the sales performance of products across market segments. There are also differences in classification of tasks from different classes of systems. The characteristics of the tasks performed with an accounting system likely differ from those performed with a CRM system.

Technology characteristics are the characteristics of the “tools used by individuals in carrying out their tasks”. While an examination of the tools/systems themselves was not part of this study, previous research has examined CRM systems. Band et al. (2010a,b), for example, compared the functionality and usability of a variety of CRM systems and found a number of differences.

Task-technology fit is “the extent that technology functionality matches task requirements and individual abilities”. The findings of this thesis study show that the more similar the task characteristics are, the more applicable the heuristics are. This finding is in line with the idea that task-technology fit will be similar for tasks which share many characteristics when using the same technology.

5.3.2 For Practice

For practitioners, the findings of this study show that it is indeed important to use both general heuristics and heuristics specific to the class of system being evaluated, as other heuristics are not as applicable. If there is not a set of heuristics specific to the type of system being evaluated, it should be developed. Alternatively, it may be acceptable to use a set of heuristics for a similar type of applications, as this study shows that heuristics for similar types of applications are more applicable than heuristics for very different types of applications. In addition, the set of heuristics

developed in this study can be used for heuristic evaluations of web-based CRM systems.

Second, this study has shown that users of the software heuristics are being developed for can be involved in the process successfully. They can add a domain-specific perspective to the development of heuristics, especially when the usability experts do not have that experience. It remains to be answered whether usability experts are even still needed for heuristic evaluations, as it has been shown that users can understand them, although it has not been proven that they know how to apply the heuristics to identify usability problems. This implication could change the role of the usability expert to be someone who informs and guides the development of heuristics and their application.

5.4 Limitations

The biggest limitation of this study is its small sample size. Typically, it is recommended to repeat focus groups on a particular topic at least three or four times with different participants to ensure as many points as possible are covered (Edmunds, 1999; Morgan, 1998). Due to time constraints, this was not possible. Instead, the second phase of this study was used to achieve a degree of validity by engaging CRM users.

This means the results only have limited generalizability and thus external validity (Creswell, 1994, p. 158). In addition, reproducibility of the results may be limited due to the qualitative and exploratory nature of the study as well as the small sample size, which can lead to decreased reliability (Creswell, 1994, p. 159).

With regard to the participants themselves, there were two main limitations. First, the participants in phase one had expertise in usability engineering, but not in using or designing CRM systems (i.e. they were not “double experts”). This means that

they had a sub-optimal understanding of the characteristics of CRM systems and the tasks performed on them, which manifested itself during the creation of new heuristics, because their lack of domain-specific knowledge led to the development of less specific heuristics.

Second, the participants of the second study were difficult to recruit. Initially, the researcher planned to perform two focus group sessions (with the same protocol), but due to a lack of participants available at any single point in time, it became necessary to switch to the method described in this study.

This change brought with it another limitation. The participants were not briefed in person about the purpose of the study and their role in it. They merely received a written set of instructions and explanations. It is expected that some participants may not have read these instructions and explanations in full detail and thus did not understand their role in the study as fully as others.

Another limitation during this phase was that in many cases, more than a week passed between the point in time when participants filled out the questionnaire and when they could be reached for the follow-up interview. This means these participants did not have the questionnaire fresh on their minds. To mitigate this limitation, a few engagement questions were asked to refocus the participants on the topic and make them more comfortable expressing their opinion (see section 3.4.3). Yet, it would have been beneficial to interview all participants within 24 or 48 hours after they filled out the questionnaire.

5.5 Future Directions

Due to the limitations faced by this study outlined above, a future research direction is the validation of the results with a greater sample of usability experts and CRM users. This could be accomplished through a method similar to that used in this

thesis, e.g. through repeated collaborative sessions.

Alternatively, a quantitative methodology for the validation of the results could be developed to be able to capture the judgment of a greater number of participants and analyze the results using more advanced statistical methods. This new methodology could be similar to the questionnaire used in the second phase of this study.

Furthermore, the usefulness of the developed set of heuristics has not been researched. Future research could investigate the usefulness of the heuristics for user interface designers etc. seeking to perform a heuristic evaluation of a web-based CRM system.

It would also be interesting to investigate the discrepancy in ratings for the *user control and freedom* heuristic to find out why this heuristic was rated as highly applicable by usability experts and very inapplicable by CRM users.

Another interesting research area would be the success of involving of non-usability experts in the use of heuristics. While this study has shown that non-usability experts can understand heuristics and make valuable contributions in judging their applicability to a domain they are familiar with, it is unclear whether they would be able to apply them in an evaluation to identify usability problems. It would also be interesting to investigate whether heuristics can be successfully evaluated by non-usability experts alone, effectively removing the need for usability experts entirely.

Finally, a generalizable framework for developing usability heuristics for a specific class of applications should be developed, so that new heuristics can be developed more easily and reliably. This framework could be based on the method used in this study.

5.6 Conclusion

This thesis investigated usability heuristics and their applicability to web-based CRM systems. A literature review and research method were presented to address the questions:

- a. What usability heuristics are relevant to web-based CRM systems?
- b. Which heuristics are irrelevant?
- c. Are there new heuristics that need to be added?

A two-phased, mixed approach combining different qualitative and quantitative methods was employed to answer the research questions.

With regard to the first two research questions, general heuristics were found to be more applicable to this specific class of applications than heuristics developed for other classes of systems which are used for purposes that greatly differ from CRM systems. Heuristics for e-learning systems, for example, were shown to be much less applicable than the general heuristics developed by Nielsen (1994b).

As for the third research question, there were seven new heuristics, which were created specifically for web-based CRM systems. This shows that there is a need for domain-specific heuristics for web-based CRM systems.

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Appendix A

Screen Shots of Selected CRM Software

A.1 Microsoft Dynamics CRM

A.1.1 Sales Account Information

Microsoft Dynamics CRM

Bettina Lechner University of Nebraska Sign Out

File Accounts View Charts Add Customize

New Edit Delete Duplicate Detection

Records Workplace

4 My Work What's New Dashboards Activities Calendar Imports

Queues Articles Reports Announcements

4 Customers Accounts Contacts

Customize

Activate Deactivate Merge Add to Marketing Connect Assign E-mail Direct E-mail Duplicates

Send Direct Add to List E-mail

Collaborate

Follow Unfollow Share Copy a Link E-mail a Link

Run Start Workflow Dialog Import Data Report+ Data

Advanced Find

Export to Excel Filter Import Data Run Report+ Data

Get Started with Accounts An account is a company or corporation that you do business with.

1. Import → Import from Files → About Importing Overview Video

2. Use About Quick Campaigns → Detect Duplicates → About Sharing & Assigning

3. Modify & Manage → Create Custom Views → Set Up Duplicate Detection → Customize Accounts

Accounts: My Active Accounts

Account Name	Main Phone	Address 1: City	Primary Contact
A Store (sample)	555-0136	Renton	Adrian Dumitrascu (sample)
Advanced Components (sample)	555-0135	Dallas	Brain LaMee (sample)
Affordable Equipment (sample)	555-0162	Santa Cruz	Cat Francis (sample)
Basic Company (sample)	555-0174	Lynnwood	Cathan Cook (sample)
Best o' Things (sample)	555-0145	Los Angeles	Darren Parker (sample)
Blue Company (sample)	555-0131	Redmond	Forrest Chand (sample)
Designer Goods (sample)	555-0197	Redmond	Eva Corlett (sample)
Elemental Goods (sample)	555-0127	Missoula	Gabrielle Gamma (sample)
Grand Store (sample)	555-0135	Redmond	George Sullivan (sample)
Litware Inc. (sample)	555-0116	Phoenix	Marco Tanara (sample)
Magnificent Store (sample)	555-0135	Daly City	Patrick Steiner (sample)
Recreation Supplies (sample)	555-0171	Newport Beach	Susan Burk (sample)
Unusual Store (sample)	555-0178	Lebanon	Thomas Aven (sample)
Variety Store (sample)	555-0135	Port Orchard	Yvonne McKay (sample)

Workplace Sales Marketing Service Settings Resource Center

1 - 14 of 14 [0 selected]

All # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

◀ Page 1 ▶

Figure A.1: List of accounts, retrieved June 4, 2012

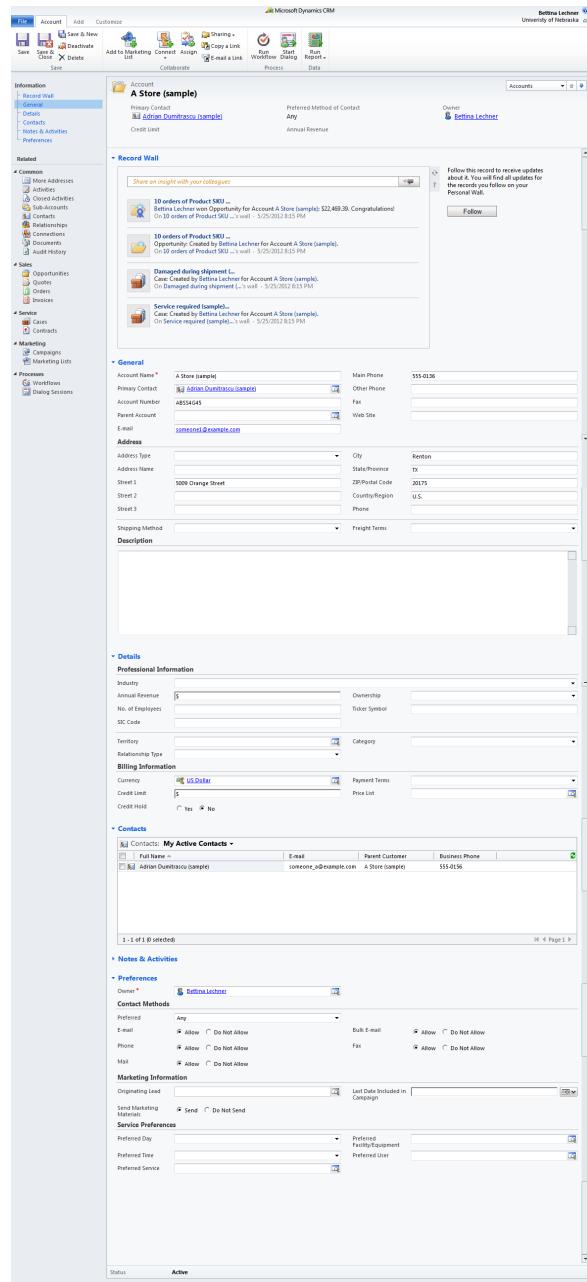


Figure A.2: Detail view of sales account, retrieved June 4, 2012

A.1.2 Contact Information

The screenshot shows the Microsoft Dynamics CRM interface. The top navigation bar includes 'File', 'Contacts' (selected), 'View', 'Charts', 'Add', 'Customize', 'Activate', 'Deactivate', 'Merge', 'Delete', 'New', 'Edit', 'Advanced Find', 'Export to Excel', 'Run Workflow Dialog', 'Start Process', 'Run Report', 'Import Data', 'Filter', 'Data', and 'Sign Out'. Below the navigation bar is a toolbar with icons for Share, Copy a Link, Connect, Assign, E-mail a Link, Collaborate, and a 'Get Started with Contacts' button.

The main content area displays a list of 'My Active Contacts' with columns for 'Full Name', 'E-mail', 'Business Phone', and 'Parent Customer'. The list includes entries such as:

Full Name	E-mail	Business Phone	Parent Customer
Adrian Dumitrescu (sample)	someone_a@example.com	555-0136	A Store (sample)
Brain Lahier (sample)	someone_b@example.com	555-0135	Advanced Components (sam
Cat Frands (sample)	someone_c@example.com	555-0178	Affordable Equipment (sam
Cathan Cook (sample)	someone_d@example.com	555-0138	Basic C Company (sample)
Darren Parker (sample)	someone_e@example.com	555-0136	Best o f Things (sample)
Eva Corets (sample)	someone_f@example.com	555-0138	Designer Goods (sample)
Forrest Chand (sample)	someone_g@example.com	555-0186	Blue Company (sample)
Gabrielle Cannata (sample)	someone_h@example.com	555-0168	Elemental Goods (sample)
George Sullivan (sample)	someone_i@example.com	555-0142	Grand Store (sample)
Marco Tanara (sample)	someone_j@example.com	555-0192	Litware Inc. (sample)
Patrick Steinke (sample)	someone_k@example.com	555-0154	Magnificent Store Sample (
Susan Burk (sample)	someone_l@example.com	555-0142	Recreation Supplies (sample)
Thomas Axen (sample)	someone_m@example.com	555-0180	Unusual Store (sample)
Yvonne McKay (sample)	someone_n@example.com	555-0136	Variety Store (sample)

At the bottom of the contact list, it says '1 - 14 of 14 (0 selected)'. The footer contains links for 'Workplace', 'Sales', 'Marketing', 'Service', 'Settings', and 'Resource Center'.

Figure A.3: List of contacts, retrieved June 4, 2012

Microsoft Dynamics CRM

Bettina Lechner University of Nebraska

Contact Brain LaMee (sample)

E-mail: someone_b@example.com Preferred Method of Contact: Any Owner: Bettina Lechner

Record Wall

Share an insight with your colleagues Follow this record to receive updates when it is modified and all updates for the records you follow on your Personal Wall.

General

Salutation: Brain Business Phone: 555-0123
First Name: Brain Home Phone:
Middle Name: Mobile Phone:
Last Name: LaMee (sample) Fax:
Job Title: Owner E-mail: someone_b@example.com
Parent Customer: Advanced Components (sample)

Address

Address Type: City: Issaquah
Address Name: State/Province: WA
Street 1: 5979 El Pueblo ZIP/Postal Code: 23382
Street 2: Country/Region: U.S.
Street 3: Phone:

Description

Details

Professional Information

Department: Role:
Manager: Assistant
Manager Phone: Assistant Phone:
Personal Information

Gender: Birthday: Anniversary:
Marital Status: Spouse/Partner Name:

Notes & Activities

Preferences

Owner: Bettina Lechner
Billing Information

Currency: US Dollar Payment Terms:
Credit Limit: \$ Credit Hold: Yes No
Price List:

Contact Methods

Preferred: Any
E-mail: Allow Do Not Allow Bulk E-mail: Allow Do Not Allow
Phone: Allow Do Not Allow Fax: Allow Do Not Allow
Mail: Allow Do Not Allow

Marketing Information

Originating Lead: Last Date Included in Campaign:
Send Marketing Materials: Send Do Not Send
Service Preferences

Preferred Day: Preferred Facility/Equipment:
Preferred Time: Morning Preferred User:
Preferred Service:

Status: Active

Figure A.4: Detail view of contact, retrieved June 4, 2012

A.1.3 Reports and Dashboards

The screenshot shows the Microsoft Dynamics CRM interface with the title bar "Microsoft Dynamics CRM". The top navigation bar includes "File", "Reports", "View", "Charts", "Customize", "Delete", "New", "Edit", "Run Report", "Edit Default Filter", "Actions", "Records", and "Workplace". The "Workplace" icon is highlighted.

The main area displays a grid titled "Available Reports" with the following columns: Name, Modified On, Report Type, and Description. The reports listed are:

Name	Modified On	Report Type	Description
Account Distribution	5/25/2012 8:15...	Reporting Serv...	Identify patterns in top revenue-generating accounts.
Account Overview	5/25/2012 8:15...	Reporting Serv...	View a one-page overview of an account.
Account Summary	5/25/2012 8:16...	Reporting Serv...	View a chronological summary of an account.
Activities	5/25/2012 8:16...	Reporting Serv...	Display a list of activities.
Campaign Activity Status	5/25/2012 8:15...	Reporting Serv...	Track campaign activities.
Duplicate Detection	5/25/2012 8:15...	Reporting Serv...	Compare two campaigns.
Imports	5/25/2012 8:15...	Reporting Serv...	Track the progress and status of imports.
Queues	5/25/2012 8:15...	Reporting Serv...	View the patterns in cases.
Reports	5/25/2012 8:16...	Reporting Serv...	View the progress and status of reports.
Announcements	5/25/2012 8:16...	Reporting Serv...	Compare how your sales team performs.
Competitor Win Loss	5/25/2012 8:16...	Reporting Serv...	Compare how your sales team performs.
Invoice	5/25/2012 8:16...	Reporting Serv...	View an invoice and its line items.
Invoice Status	5/25/2012 8:16...	Reporting Serv...	View your accounts receivable.
Accounts	5/25/2012 8:15...	Reporting Serv...	Compare your lead sources.
Contacts	5/25/2012 8:16...	Reporting Serv...	Identify accounts that have not been contacted.
Lead Source Effectiveness	5/25/2012 8:16...	Reporting Serv...	Identify leads that have not been converted.
Neglected Accounts	5/25/2012 8:15...	Reporting Serv...	View an order and its line items.
Neglected Cases	5/25/2012 8:15...	Reporting Serv...	View products that are used by an account.
Neglected Leads	5/25/2012 8:15...	Reporting Serv...	View products that are used by a contact.
Order	5/25/2012 8:16...	Reporting Serv...	View progress against goals.
Products By Account	5/25/2012 8:15...	Reporting Serv...	View a quote and its line items.
Products By Contact	5/25/2012 8:16...	Reporting Serv...	Understand past sales performance.
Progress against goals	5/25/2012 8:16...	Reporting Serv...	View anticipated potential sales.
Quote	5/25/2012 8:16...	Reporting Serv...	View the patterns in service activity.
Sales History	5/25/2012 8:16...	Reporting Serv...	Identify the most frequently used keywords.
Sales Pipeline	5/25/2012 8:15...	Reporting Serv...	View user contact and security roles.
Service Activity Volume	5/25/2012 8:15...	Reporting Serv...	
Top Knowledge Base Articles	5/25/2012 8:15...	Reporting Serv...	
User Summary	5/25/2012 8:15...	Reporting Serv...	

The bottom navigation bar includes "Workplace", "Sales", "Marketing", "Service", "Settings", and "Resource Center". A footer note indicates "1 - 25 of 25 (0 selected)".

Figure A.5: List of reports, retrieved June 4, 2012

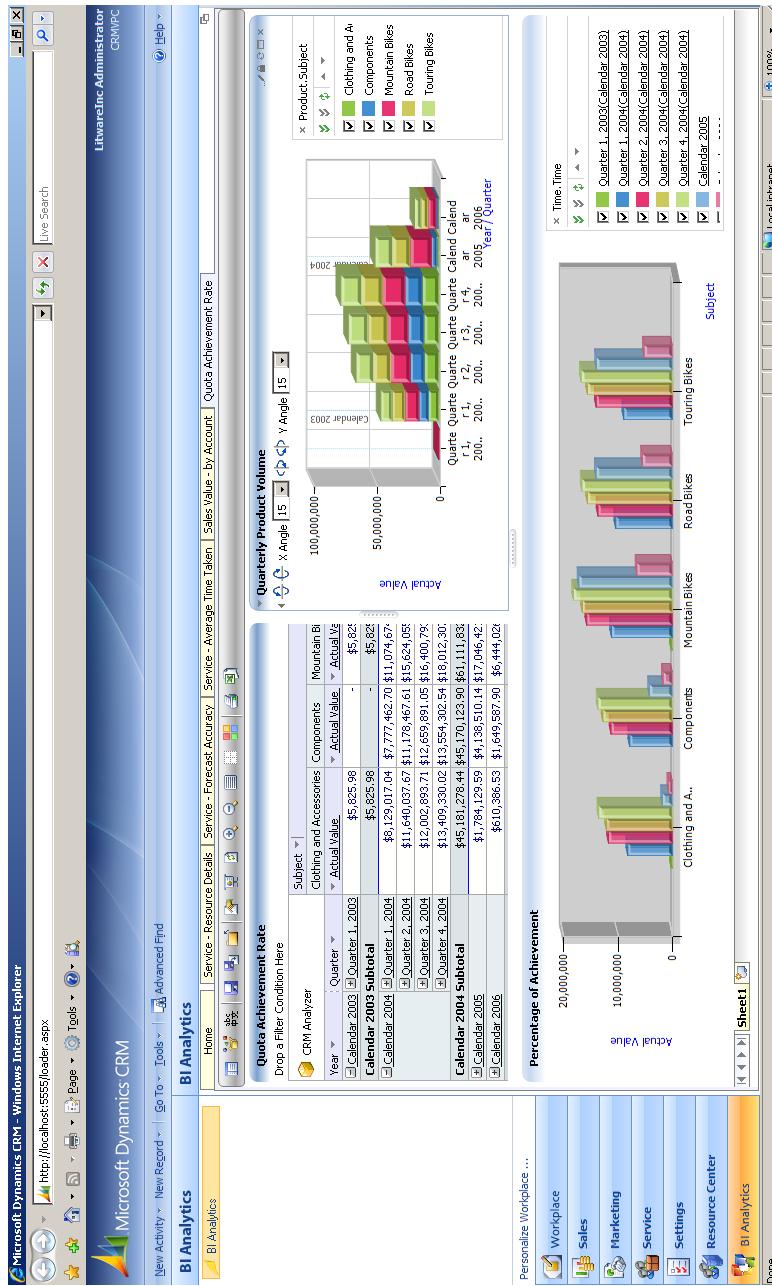


Figure A.6: Business intelligence dashboard, retrieved from http://www.liventerprise.com/tool/Microsoft_Dynamics_CRM/, May 16, 2012

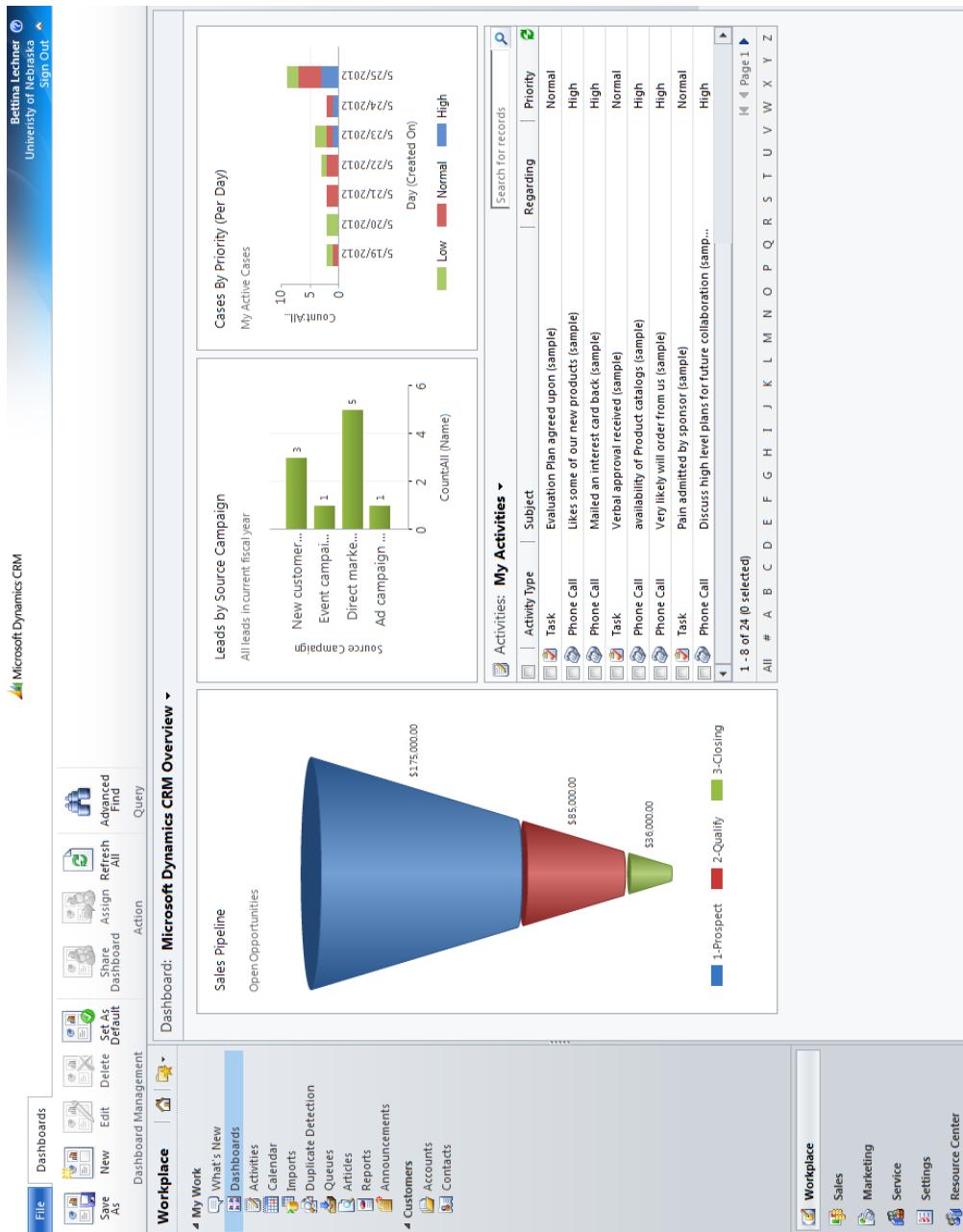


Figure A.7: Dashboard on home screen, retrieved June, 4, 2012

A.1.4 Customizability

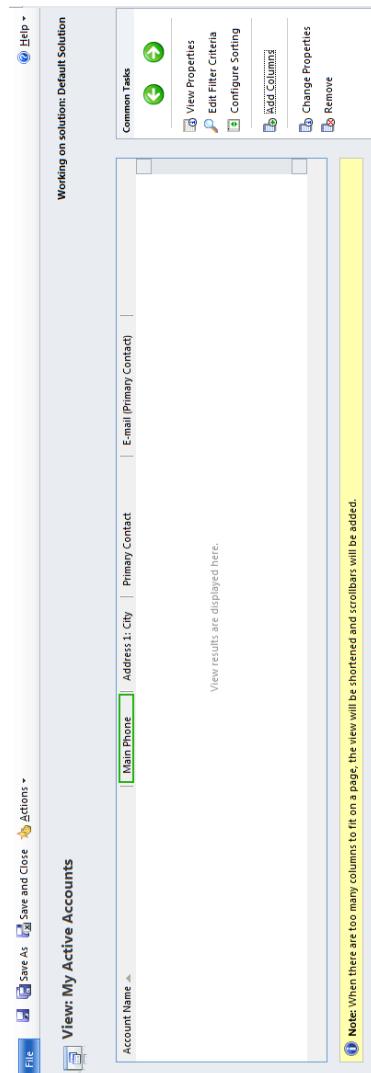


Figure A.8: Customize table with list of accounts, retrieved June 4, 2012

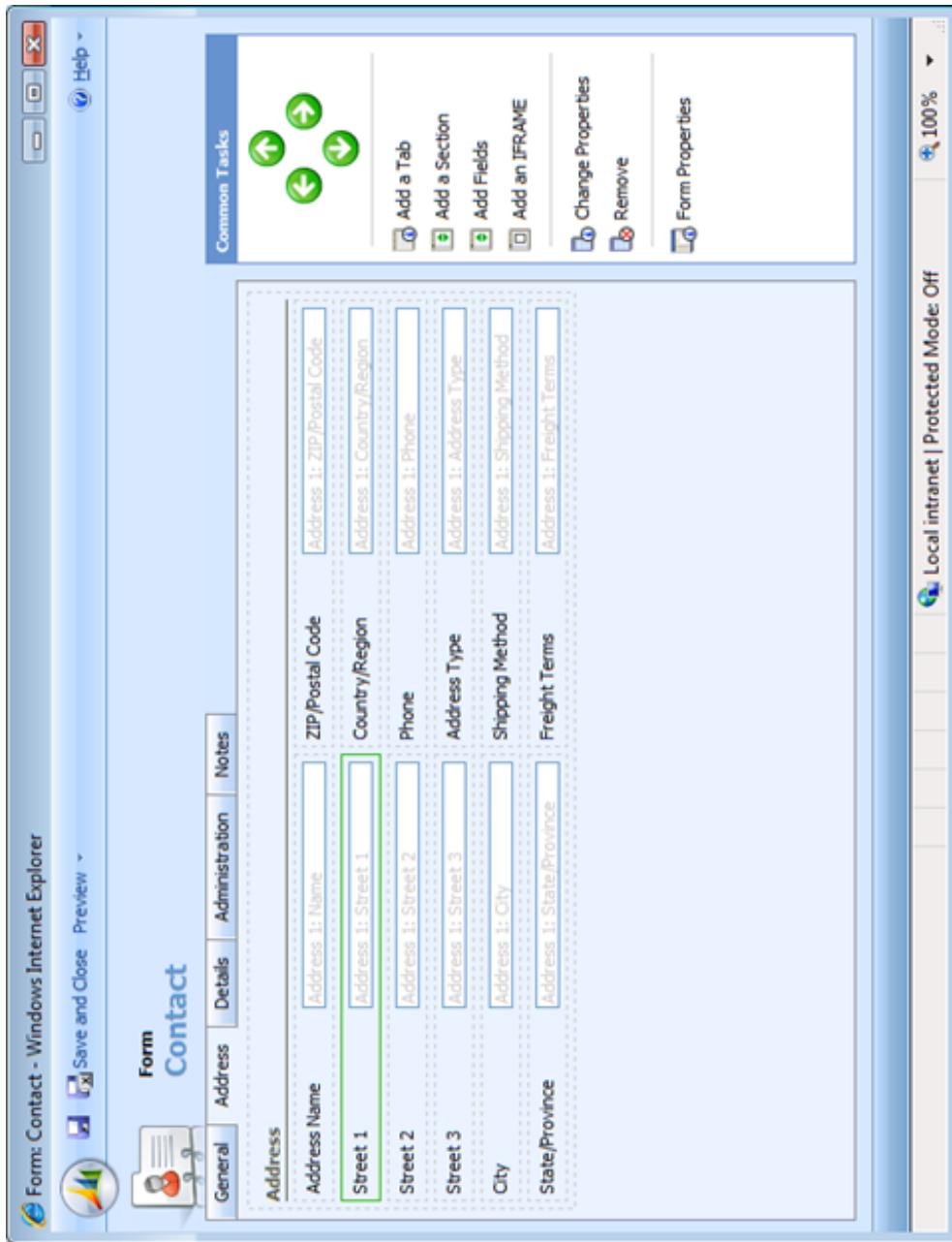


Figure A.9: Form for customizing contact information, retrieved from <http://blogs.msdn.com/b/dynamicscrmonline/archive/2009/01/20/tip-for-a-successful-import-using-the-import-wizard.aspx>, May 16, 2012



Figure A.10: Customizing workflow information, retrieved from <http://imageshack.us/f/97/leadworkflow.jpg/>, May 16, 2012

A.1.5 Navigation Shortcuts

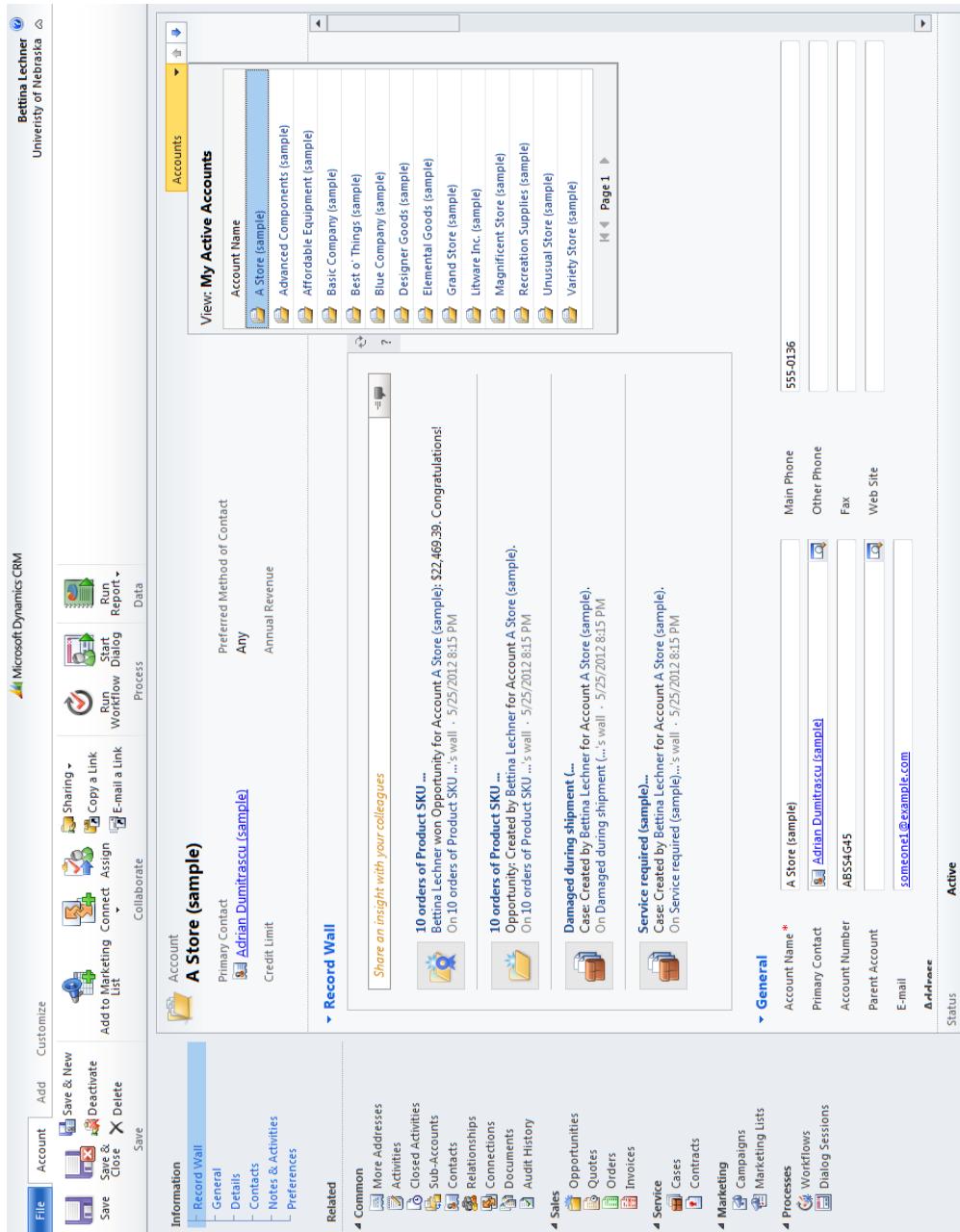


Figure A.11: Window with shortcuts to other accounts, retrieved June 4, 2012

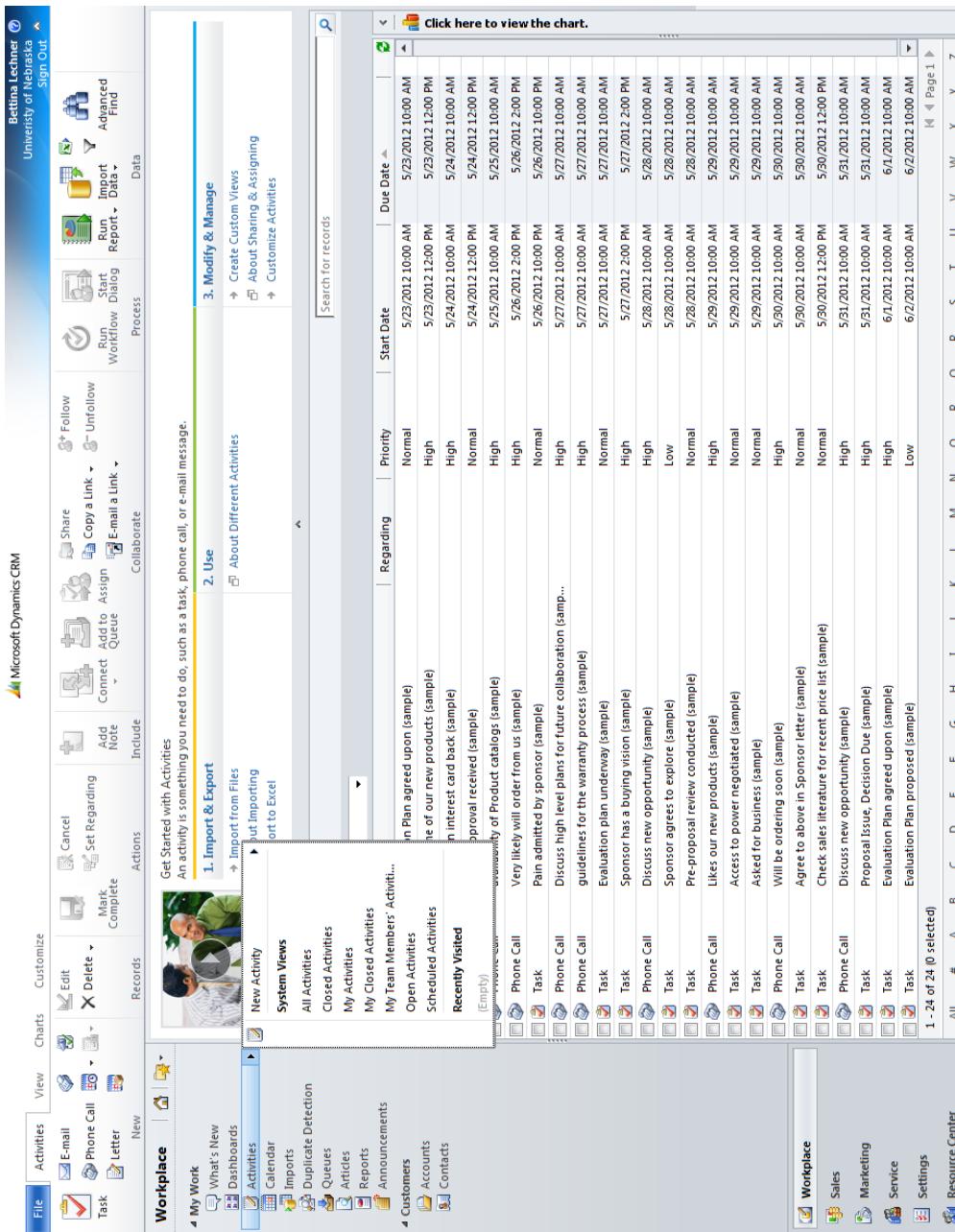


Figure A.12: Window with shortcuts for recent activities, retrieved June 4, 2012

A.1.6 Miscellaneous

The screenshot shows the Microsoft Dynamics CRM interface for a user named Bettina Lechner. The top navigation bar includes links for Sign Out, University of Nebraska, Advanced Find, Import Data, Run Report, Start Workflow, and Data.

The main area displays a list of recent activities under the heading "Activities: My Activities". The list is filtered to show "All" activities. The columns include Due Date, Activity Type, Subject, Regarding, Priority, Start Date, and Due Date. The activities listed are:

Due Date	Activity Type	Subject	Regarding	Priority	Start Date	Due Date
5/23/2012 10:00 AM	Task	Evaluation Plan agreed upon (sample)		Normal	5/23/2012 10:00 AM	5/23/2012 10:00 AM
5/23/2012 12:00 PM	Phone Call	Likes some of our new products (sample)	Mailed an interest card back (sample)	High	5/23/2012 12:00 PM	5/23/2012 12:00 PM
5/24/2012 10:00 AM	Phone Call	Mailed an interest card back (sample)	Verbal approval received (sample)	High	5/24/2012 10:00 AM	5/24/2012 10:00 AM
5/24/2012 12:00 PM	Task	Availability of Product Catalogs (sample)		Normal	5/24/2012 12:00 PM	5/24/2012 12:00 PM
5/25/2012 10:00 AM	Phone Call	Very likely will order from us (sample)	Pain admitted by sponsor (sample)	High	5/25/2012 10:00 AM	5/25/2012 10:00 AM
5/26/2012 2:00 PM	Phone Call	Pain admitted by sponsor (sample)	Discuss high level plans for future collaboration (sample...)	Normal	5/26/2012 2:00 PM	5/26/2012 2:00 PM
5/27/2012 10:00 AM	Phone Call	Guidelines for the warranty process (sample)	Evaluation plan underway (sample)	High	5/27/2012 10:00 AM	5/27/2012 10:00 AM
5/27/2012 10:00 AM	Task	Evaluation plan underway (sample)	Sponsor has a buying vision (sample)	Normal	5/27/2012 10:00 AM	5/27/2012 10:00 AM
5/27/2012 2:00 PM	Phone Call	Sponsor has a buying vision (sample)	Discuss new opportunity (sample)	High	5/27/2012 2:00 PM	5/27/2012 2:00 PM
5/28/2012 10:00 AM	Task	Discuss new opportunity (sample)	Sponsor agrees to explore (sample)	Low	5/28/2012 10:00 AM	5/28/2012 10:00 AM
5/28/2012 10:00 AM	Task	Sponsor agrees to explore (sample)	Pre-proposal review conducted (sample)	Normal	5/28/2012 10:00 AM	5/28/2012 10:00 AM
5/29/2012 10:00 AM	Phone Call	Likes our new products (sample)	Access to power negotiated (sample)	High	5/29/2012 10:00 AM	5/29/2012 10:00 AM
5/29/2012 10:00 AM	Task	Access to power negotiated (sample)	Asked for business (sample)	Normal	5/29/2012 10:00 AM	5/29/2012 10:00 AM
5/29/2012 10:00 AM	Phone Call	Will be ordering soon (sample)	Will be ordering soon (sample)	High	5/29/2012 10:00 AM	5/29/2012 10:00 AM
5/30/2012 10:00 AM	Task	Will be ordering soon (sample)	Agree to above in sponsor letter (sample)	Normal	5/30/2012 10:00 AM	5/30/2012 10:00 AM
5/30/2012 12:00 PM	Phone Call	Check sales literature for recent price list (sample)	Check sales literature for recent price list (sample)	Normal	5/30/2012 12:00 PM	5/30/2012 12:00 PM
5/31/2012 10:00 AM	Phone Call	Discuss new opportunity (sample)	Proposal issue: Decision Due (sample)	High	5/31/2012 10:00 AM	5/31/2012 10:00 AM
5/31/2012 10:00 AM	Task	Proposal issue: Decision Due (sample)	Evaluation Plan agreed upon (sample)	High	5/31/2012 10:00 AM	5/31/2012 10:00 AM
6/1/2012 10:00 AM	Task	Evaluation Plan agreed upon (sample)	Evaluation Plan proposed (sample)	Low	6/1/2012 10:00 AM	6/1/2012 10:00 AM
6/2/2012 10:00 AM	Task	Evaluation Plan proposed (sample)		Low	6/2/2012 10:00 AM	6/2/2012 10:00 AM

At the bottom, there are buttons for "1 - 24 of 24 (0 selected)" and "All # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z".

Figure A.13: List of recent activities, retrieved June 4, 2012

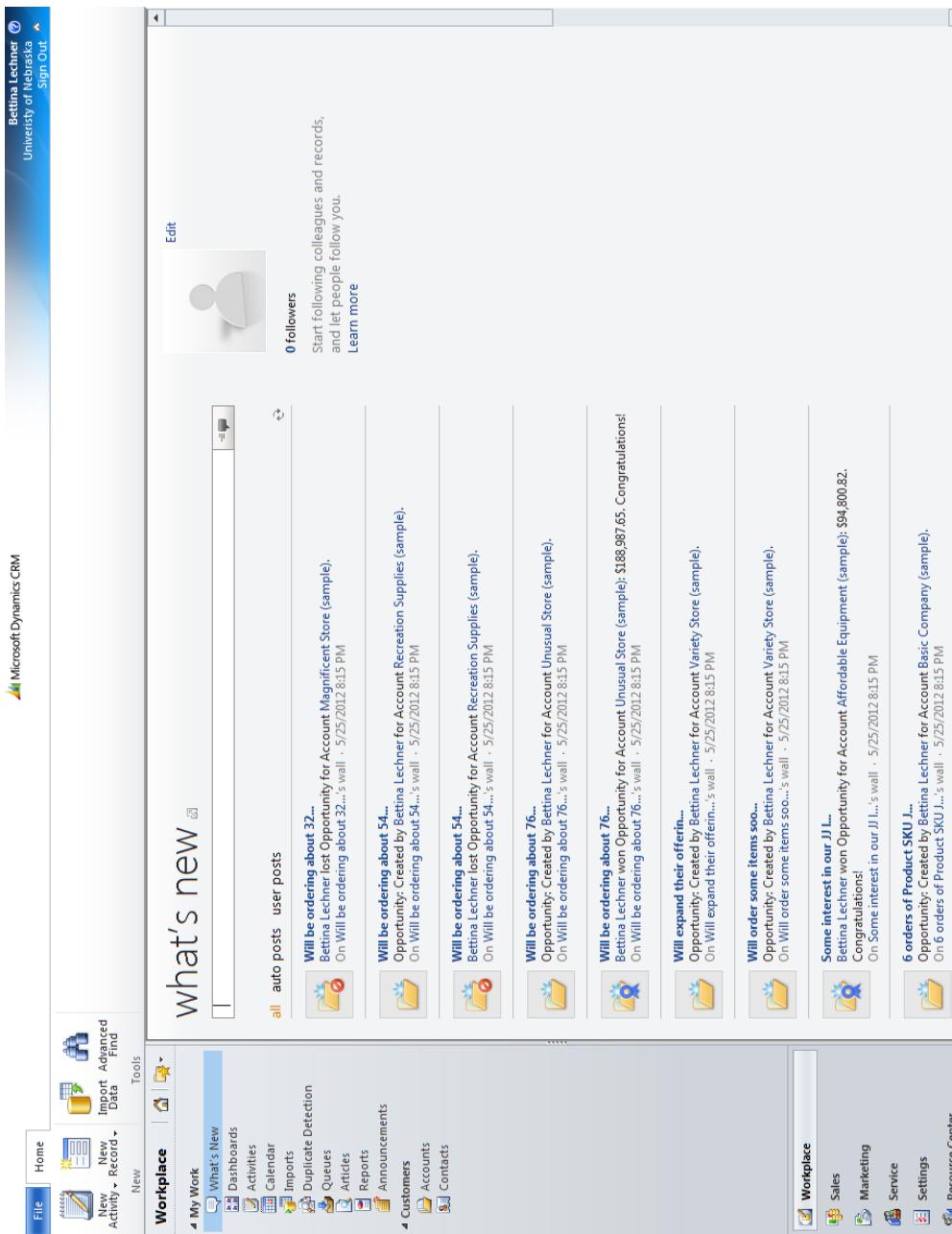


Figure A.14: “What’s new” screen with recent activities of persons one is subscribed to, retrieved June 4, 2012

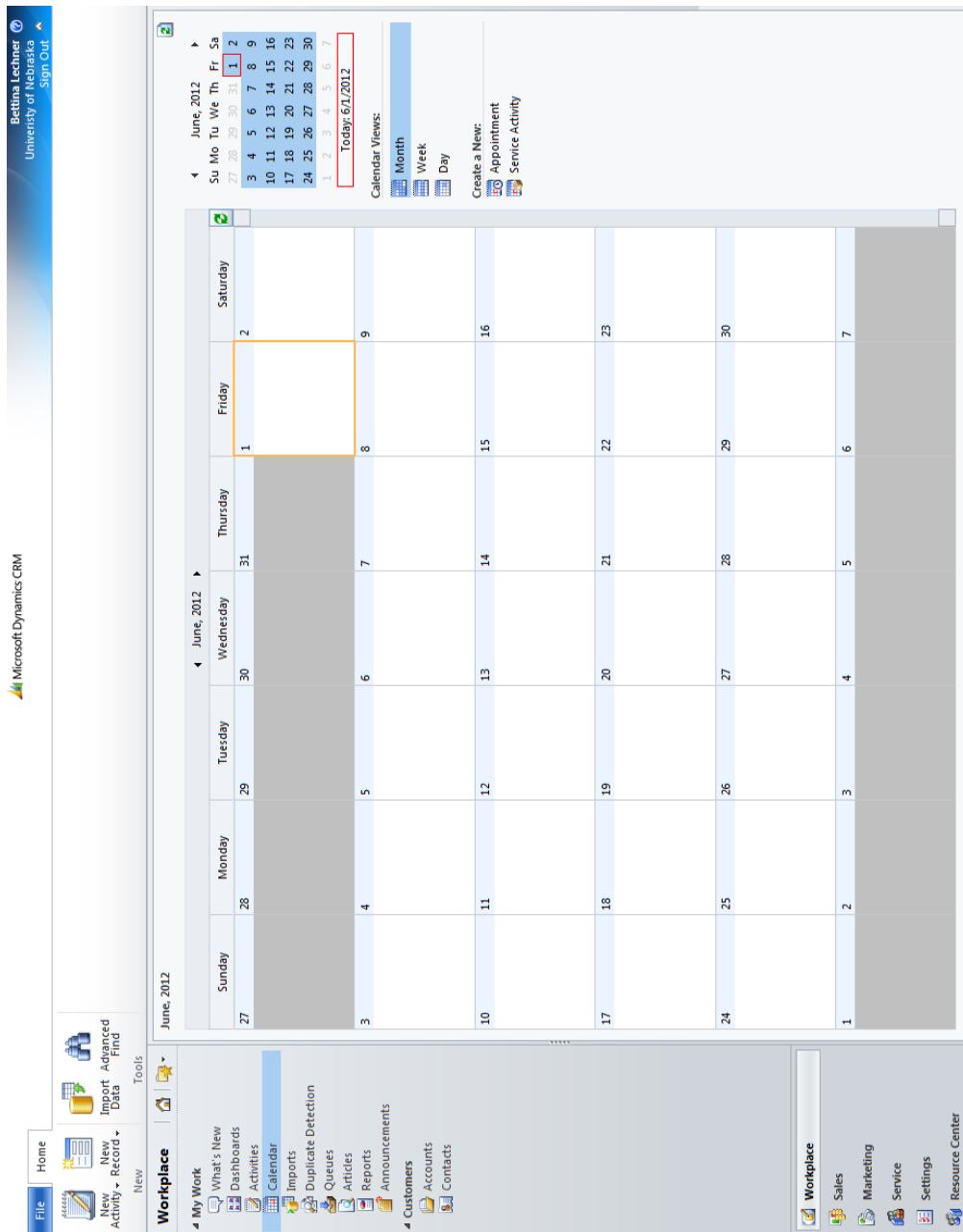


Figure A.15: Calendar, retrieved June 4, 2012

Microsoft Dynamics CRM

Bettina Lechner University of Nebraska Sign Out

File

- Imports
- Share
- Copy a Link
- E-mail a Link
- Collaborate
- Delete
- Assign
- Announcements
- Customers
- Accounts
- Contacts
- Queues
- Articles
- Reports
- Duplicate Detection

Records

Workplace

Get Started with Importing your customer and business information into Microsoft Dynamics CRM Online by importing it.

1. Get Data In

- Import from Files
- Import Data Maps
- Download a Data Import Template

2. Learn More

- About Importing
- About Data Maps

3. Monitor & Manage

- About Checking Import Status
- Manage Sample Data

Imports: My Imports

Import Name	Status Reason	Successes	Partial Failures	Errors	Total Proc...	Created On	Created By
Sample Data Goal	Completed	4	0	0	0	4	5/25/2012 8:15 ... Bettina Lechner
Sample Data Article	Completed	4	0	0	0	4	5/25/2012 8:15 ... Bettina Lechner
Sample Data Account	Completed	14	0	0	0	14	5/25/2012 8:15 ... Bettina Lechner
Sample Data Campaign	Completed	8	0	0	0	8	5/25/2012 8:15 ... Bettina Lechner
Sample Data Case	Completed	28	0	0	0	28	5/25/2012 8:15 ... Bettina Lechner
Sample Data Contact	Completed	14	0	0	0	14	5/25/2012 8:15 ... Bettina Lechner
Sample Data Lead	Completed	10	0	0	0	10	5/25/2012 8:15 ... Bettina Lechner
Sample Data Opportunity	Completed	15	0	0	0	15	5/25/2012 8:15 ... Bettina Lechner
Sample Data Phone Call	Completed	10	0	0	0	10	5/25/2012 8:15 ... Bettina Lechner
Sample Data Subject	Completed	2	0	0	0	2	5/25/2012 8:15 ... Bettina Lechner
Sample Data Task	Completed	14	0	0	0	14	5/25/2012 8:15 ... Bettina Lechner

Workplace

Sales

Marketing

Service

Settings

Resource Center

1 - 11 of 11 [0 selected]

All # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

[◀ Page 1 ▶]

Figure A.16: List of file import jobs, retrieved June 4, 2012

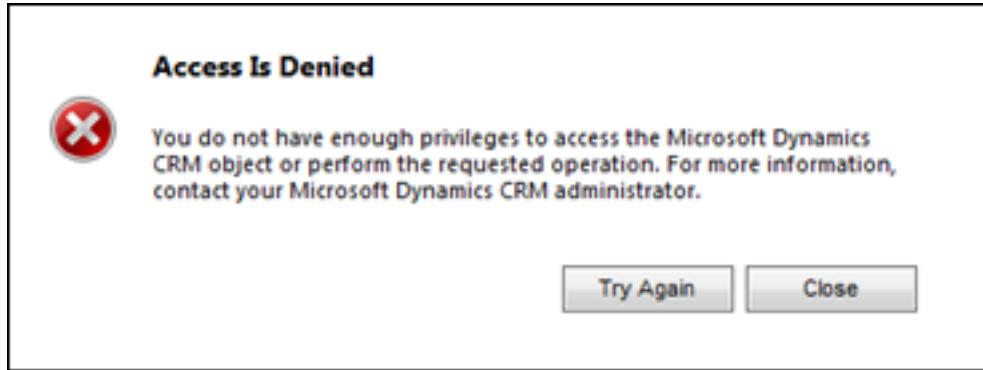


Figure A.17: Permissions error, retrieved from
<http://social.microsoft.com/Forums/en-US/crm/thread/ad41ccd0-ef3c-49aa-a7d6-de0c3cd66aca>, May 16, 2012

A.2 salesforce.com

A.2.1 Sales Account Information

The screenshot shows the Salesforce Home page with the Accounts tab selected. The top navigation bar includes links for 'Search', 'Subscribe Now!', '24 Days Remaining', 'Help & Training', and 'Sales'. The main content area displays a list of recent accounts:

Account Name	Billing City	Phone
Prince Family Paper	Calden	
Dunder Mifflin	Scranton	
Sabre	Tallahassee	
Q&R Technologies	Reno	

Below the account list are sections for 'Recent Items' (including a redial button for 'Cannot setup auto-dial numbers'), 'Tools' (with links like 'Import My Accounts & Contacts' and 'Transfer Accounts'), and 'Reports' (with links like 'Active Accounts' and 'Contact History Report'). A 'Recycle Bin' section is also visible.

Figure A.18: Overview screen of sales accounts, retrieved June 4, 2012

The screenshot shows the Salesforce interface for the 'Dunder Mifflin' account. At the top, there's a navigation bar with links for Home, Getting Started, Chatter, Profile, Groups, File, Leads, Accounts, Contacts, Data.com, Opportunities, Reports, and Dashboards. A sidebar on the left lists recent items such as 'Dunder Mifflin', 'Prince Family Paper', and 'Cannot set up auto-dial numbers'. The main content area displays the account detail for 'Dunder Mifflin' with sections for Account Detail, Additional Information, Address Information, System Information, Custom Links, Contacts, Open Activities, Activity History, Opportunities, Cases, Partners, and Notes & Attachments. The 'Contacts' section lists three employees: Erin Hannon, Angela Martin, and Michael Scott. The 'Open Activities' section shows a task for Michael Scott related to 'Call about missing product'. The 'Activity History' section shows a call made by Michael Scott on 5/29/2012. The 'Opportunities' section shows one opportunity for 'Delivery missing three phones'.

Figure A.19: Detail view of sales account, retrieved June 4, 2012

The screenshot shows the 'Account Edit' screen for the account 'Dunder Mifflin'. The top navigation bar includes 'Sales' and '24 Days Remaining'.

Account Information:

- Owner: Bettina Lechner
- Name: Dunder Mifflin
- Parent Account: Sabre

Additional Information:

- Type: Customer
- Industry: Other
- Description: Linda Feltz, 15% off TCO, phone systems, Roger Prince, Bettina Lechner, New TO, System

Billing Address:

- Street: 1725 Slough Road
- City: Scranton
- State/Province: PA
- Zip/Postal Code: 58754
- Country: Billing Country

Shipping Address:

- Street: [empty]
- City: [empty]
- State/Province: [empty]
- Zip/Postal Code: [empty]
- Country: Shipping Country

Buttons:

- Save, Save & New, Cancel

Help:

- Help for this page
- Required information

Recent Items:

- DunderMifflin
- Entice Family Paper
- Reddit button does nothing
- Cannot set up auto-dial numbers
- Charles Minor
- Linda Feltz
- Roger Prince
- 15% off TCO, phone systems
- Bettina Lechner
- New TO, System

Recycle Bin:

Figure A.20: Editing view of sales account, retrieved June 4, 2012

A.2.2 Contact Information

The screenshot shows the Salesforce Contacts overview screen. At the top, there's a navigation bar with links for Home, Getting Started, Chatter, Profile, Groups, Files, Leads, Accounts, Contacts, Data.com, Opportunities, Reports, Dashboards, and a plus sign for creating new items. A search bar is also present.

In the center, there's a main content area titled "Recent Contacts". It displays a table with columns for Name, Account Name, and Phone. The data includes:

Name	Account Name	Phone
Scott, Michael	Dunder Mifflin	(498) 654-6587
Minor, Charles	Global Media	(415) 555-1212
Prince, Linda	Prince Family Paper	
Prince, Roger	Prince Family Paper	(042) 555-4895
Hudson, Stanley	C&R Technology	(402) 695-9876
Hannan, Erin	Dunder Mifflin	(465) 645-6987
Martin, Angela	Dunder Mifflin	(798) 654-6654

Below the contacts table, there are sections for "Recent Viewed" (with a dropdown arrow), "Tools", and "Reports".

The "Tools" section contains links: Import My Accounts & Contacts, Sync to Outlook, Import My Organization's Accounts & Contacts, Mass Delete Contacts, Mass Email Contacts, Mass Stay-in-Touch, and Mass Add Contacts to Campaign.

The "Reports" section contains links: HTML Email Status Report, Partner Accounts, Mailing List, Contact History Report, Bounced Contacts, and Go to Reports ».

The "Recycle Bin" section has a "Quick Create" button and fields for First Name, Last Name, Account, Phone, and Email, along with a Save button.

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Figure A.21: Overview screen of contacts, retrieved June 4, 2012

The screenshot shows the Salesforce interface for viewing a contact record. The contact is Michael Scott, with the ID 00001003. The page includes sections for Contact Detail, Address Information, Additional Information, System Information, Open Activities, Activity History, Opportunities, Cases, Notes & Attachments, HTML Email Status, and Campaign History. The contact's details include his name, title (Branch Manager), and association with the Dunder Mifflin account. His address is listed as 1725 Slough Road, Scranton, PA 98754. The 'Open Activities' section shows a single task related to him.

Action	Subject	Related To	Task	Due Date	Status	Priority	Assigned To
Edit Del	Call about missing product	00001003		✓	Waiting on someone else	High	Bettina Lechner

Figure A.22: Detail view of contact, retrieved June 4, 2012

The screenshot shows the Salesforce Contact Edit interface for a contact named Michael Scott. The top navigation bar includes links for Home, Getting Started, Chatter, Profile, Groups, Files, Leads, Accounts, Contacts, Data.com, Opportunities, Reports, Dashboards, and a plus sign. A banner at the top right indicates "20 Days Remaining" and a "Subscribe Now!" button. The main content area is titled "Contact Edit" for Michael Scott. It displays a list of recent items on the left, including links to Michael Scott, Dunder Mifflin, Prince Family Paper, and other characters from the TV show. The contact details are organized into sections: "Contact Information", "Address Information", "Additional Information", and "Description Information". The "Contact Information" section shows Michael Scott as the contact owner, with first name "Michael", last name "Scott", account name "Dunder Mifflin", title "Branch Manager", phone "(498) 654-6587", mobile "", email "m.g.scott@dundermifflin.com", and reports to (empty). The "Address Information" section contains fields for mailing street ("1725 Slough Road"), mailing city ("Scranton"), mailing state/province ("PA"), mailing zip/postal code ("98754"), mailing country (empty), other street (empty), other city (empty), other state/province (empty), other zip/postal code (empty), and other country (empty). The "Additional Information" section includes fields for fax (empty), home phone (empty), other phone (empty), assistant ("Erin Hannon"), asst. phone (empty), lead source ("Trade Show"), birthdate ("3/15/1964"), and department (empty). The "Description Information" section has a large text area for a description, which is currently empty. At the bottom of the form are "Save", "Save & New", and "Cancel" buttons.

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Figure A.23: Editing view of contact, retrieved June 4, 2012

A.2.3 Sales Leads and Opportunities

The screenshot shows the Salesforce sales leads overview screen. At the top, there's a navigation bar with links for Home, Getting Started, Chatter, Profile, Groups, Files, Leads, Accounts, Contacts, Data.com, Opportunities, Reports, Dashboards, and a plus sign for creating new items. A "Sales" button is also present. On the left, there's a sidebar with "Recent Items" showing leads from "Michael Scott", "Dunder Mifflin", "Prince Family Paper", and others. Below this is a "Create New..." button. The main content area has several sections:

- Recent Leads:** A table showing two recent leads: "Smith, Bob" (Company: Advanced Micro, Phone: (987) 135-4657) and "Sinha, Raliy" (Company: Avaya, Phone: (402) 555-1234). Buttons for "New", "Edit", and "Create New View" are available.
- Reports:** A section with links for "Lead Lifetime", "Leads By Source", and "Bounced Leads". It also includes a "Go to Reports" link and a "Run Report" button.
- Tools:** A section with links for "Import Leads", "Mass Delete Leads", "Transfer Leads", "Mass Email Leads", and "Mass Add Leads to Campaign".
- Quick Create:** A form for creating new leads with fields for First Name, Last Name, Company, Phone, Email, and Campaign, along with a "Save" button.

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Figure A.24: Overview screen of sales leads, retrieved June 4, 2012

The screenshot shows the Salesforce 12 interface for viewing a lead record. The top navigation bar includes links for Home, Getting Started, Chatter, Profile, Groups, Files, Leads, Accounts, Contacts, Data.com, Opportunities, Reports, and Sales. The Leads tab is currently selected.

Lead Detail:

- Lead Owner:** Bettina Lechner [Change]
- Name:** Bob Smith
- Company:** Advanced Micro
- Title:** IT Manager
- Lead Status:** Open
- Phone:** (No phone number listed)
- Email:** (No email listed)
- Rating:** (No rating listed)

Address Information:

- Address: Omaha, NE 68106
- Website: (No website listed)

Additional Information:

- No. of Employees: 126
- Annual Revenue: \$4,684,796
- Description: (No description listed)
- Lead Source: Trade Show
- Industry: Telecommunications
- Created By: Bettina Lechner, 5/25/2012 3:33 PM
- Last Modified By: Bettina Lechner, 5/25/2012 3:33 PM

Custom Links:

- Google Search
- Google News
- Google Maps
- Hoovers Profile
- Send Gmail

Open Activities:

- New Task
- New Event
- New Meeting Request

Activity History:

- Log A Call
- Mail Merge
- Send An Email

HTML Email Status:

- Send An Email

Campaign History:

- Add to Campaign

At the bottom of the page, there are links for Privacy Statement, Security Statement, Terms of Use, and 508 Compliance.

Figure A.25: Detail view of sales lead, retrieved June 4, 2012

The screenshot shows the Salesforce Lead Edit page. At the top, there's a navigation bar with links like Home, Getting Started, Chatter, Profile, Groups, Files, Leads (which is highlighted in orange), Accounts, Contacts, Data.com, Opportunities, Reports, and a plus sign. On the far right of the top bar are links for '30 Days Remaining', 'Subscribe Now!', 'Bettina Lechner', 'Help & Training', and 'Sales'. Below the top bar, there's a search bar with 'Search All...' and a 'Search' button, along with 'Options...' and a gear icon.

The main content area is titled 'Lead Edit' and 'New Lead'. It has a 'Lead Edit' sub-header with 'Save', 'Save & New', and 'Cancel' buttons. A note indicates that 'Lead Status' is required information. The 'Lead Information' section contains fields for Lead Owner (Bettina Lechner), First Name (Rajiv), Last Name (Singh), Company (Avaya), Title (Head of Purchasing), Lead Status (Contacted), Phone, Email, and Rating (Warm). The 'Address Information' section includes fields for Street (1234 Main Street), City (Chicago), State/Province (IL), Zip/Postal Code, and Country. The 'Additional Information' section includes fields for No. of Employees (4687), Annual Revenue (6415356), Lead Source (External Referral), and Industry (Telecommunications). The 'Description Information' section has a large text area for Description. The 'Optional' section contains a checkbox for 'Assign using active assignment rule'. At the bottom of the form are 'Save', 'Save & New', and 'Cancel' buttons.

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Figure A.26: Editing view of sales lead, retrieved June 4, 2012

A.2.4 Reports and Dashboards

The screenshot shows the Salesforce Reports & Dashboards page. At the top, there is a navigation bar with links for Home, Chatter, Profile, Groups, Files, Accounts, Contacts, Cases, Solutions, Reports, Dashboards, Getting Started (social), and Call Center. A search bar and a 'Subscribe Now!' button are also present. The main content area is titled 'Reports & Dashboards' and contains sections for 'All Folders' and 'All Reports'.

All Folders:

Action	Name	Created By
Find a folder...	Sample Report: # of Accounts	Unfiled Public Rep... Lechner_Bettina
Find a folder...	Adoption Dashboard	Company Dashbo... Lechner_Bettina

All Reports:

Action	Name	Folder	Created By
Find reports and dashboards...	How many accounts are being added to Salesforce?		
Find a folder...	Adoption Dashboard		
Find a folder...	Sample Report: # of Accounts		

The sidebar on the left includes links for Home, Chatter, Profile, Groups, Files, Accounts, Contacts, Cases, Solutions, Reports, Dashboards, Getting Started (social), and Call Center. It also features a 'Search All...' bar, a 'Options...' button, and a 'New Report...' and 'New Dashboard...' button.

Figure A.27: Overview screen of available reports, retrieved June 4, 2012

Salesforce 12 Search All Options... 27 Days Remaining Select New! Bettina Lechner Help & Training Call Center Help for this Page

Home Chatter Profile Groups Files Accounts Contacts Cases Solutions Reports Dashboards Getting Started [leads] + ▾

Leads By Source

Report Generation Status: Complete

Report Options:

Summarize Information by: Subtotal By: Show Subtotal By: Lead Status ▾ Show Lead Status ▾ My Needs ▾ Date Field: Range Create Date: 12/01/2012 To: 5/26/2012 Time Frame: Range Date Field: Custom Create Date: 12/01/2012 To: 5/26/2012

Run Report ▾ Hide Details ▾ Customize ▾ Save As ▾ Printable View ▾ Export Details

Subscription	First Name	Last Name	Title	Company	Address	City	State/Province	Zip/Postal Code	Country	Phone	Email	Description	Status	Industry	Rating	Annual Revenue	Employees	Converted	Owner	Create Date	Last Modified
<input type="checkbox"/> Lead Source: Advertisment (1 record)	Mr.	Bob	Smith	Universal Technologies	Hartford	Connecticut	6103	United States	(555) 555-1212	info@salesforce.com	-	Open	Aerospace & Defense	-	\$28,212	155,000	<input type="checkbox"/>	Bettina Lechner	5/25/2012	5/25/2012	
<input type="checkbox"/> Lead Source: Employee Referral (2 records)	-	Sarah	Lehner	MediLife, Inc.	One Main Street	New York	100-10	United States	(555) 555-1212	info@salesforce.com	-	Contacted	Insurance	-	\$33,147	48,500	<input type="checkbox"/>	Bettina Lechner	5/25/2012	5/25/2012	
<input type="checkbox"/> Lead Source: External Referral (1 record)	-	John	Smith	BB&L Inc.	11 Elm Avenue	Hartford	Connecticut	6156	United States	(555) 555-1212	info@salesforce.com	-	Open	Insurance	-	\$19,379	28,000	<input type="checkbox"/>	Bettina Lechner	5/25/2012	5/25/2012
<input type="checkbox"/> Lead Source: Trade Show (1 record)	-	Erika	Purchasing	Alpha	1234 Main Street	Chicago	IL	-	(402) 555-1234	efinch@alpha.com	-	Contacted	Telecommunications	Warm	\$4,415,256	4,687	<input type="checkbox"/>	Bettina Lechner	5/25/2012	5/25/2012	
<input type="checkbox"/> Lead Source: Other (1 record)	Mr.	Bob	Smith	Advanced Micro	Advanced	Omaha	NE	68106	-	(877) 131-4557	bob.smith@ams.com	-	Open	Telecommunications	Cold	\$4,584,795	126	<input type="checkbox"/>	Bettina Lechner	5/25/2012	5/25/2012
Grand Totals (6 records)																					

Check rows to filter then drill down by: -None- ▾ Drill Down!

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Figure A.28: Sample report, retrieved June 4, 2012



Figure A.29: Business intelligence dashboard, retrieved from <http://thirdwaveconsulting.com/grants-management/>, May 16, 2012

The screenshot shows the Salesforce Home screen for user Bettina Lechner. At the top, there's a search bar with 'Search All...' and a 'Search' button. To the right are links for '30 Days Remaining', 'Subscribe Now!', 'Bettina Lechner', 'Help & Training', and 'Sales'. Below the header is a navigation bar with links: Home, Getting Started, Chatter, Profile, Groups, Files, Leads, Accounts, Contacts, Data.com, Opportunities, Reports, and a plus sign for more.

The main content area starts with a 'Recent Items' sidebar containing links to 'Bettina Lechner' and 'Geoff Minor'. Below that are 'Custom Links' and 'Messages and Alerts' sections, followed by a 'Recycle Bin' link.

The central workspace has a 'Chatter' feed. It shows a post from Bettina Lechner on May 25, 2012, about creating a group. A 'Chatter Expert' message follows, providing tips for using Chatter. There's also a 'Write a comment...' input field.

To the right of the workspace are 'Recommendations' and a 'Complete your profile' callout. Another callout for 'Geoff Minor' is shown, indicating he was recently viewed.

The bottom section features a 'Dashboard' summary with three cards: 'Users Logged In' (1 active user), '# Completed Activities' (Last 30 Days), and '# of Accounts' (Record Count over time).

Below the dashboard are 'My Tasks' (no open tasks) and a 'Calendar' for May 2012, showing no scheduled meetings or requests.

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Figure A.30: Home screen, retrieved June 4, 2012

A.2.5 Customizability

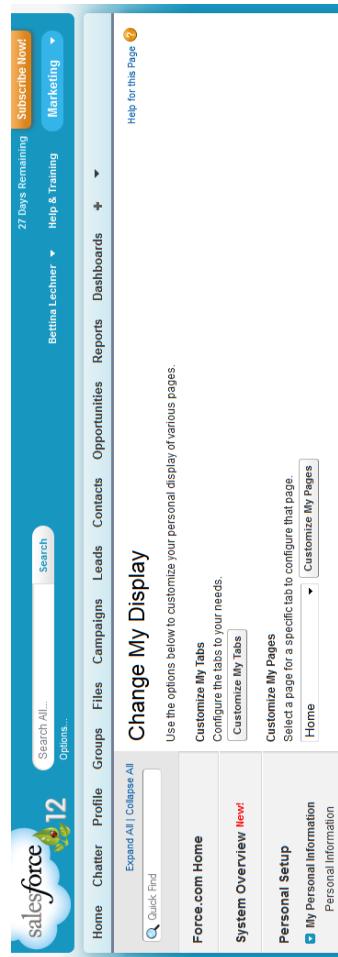


Figure A.31: Display customization, retrieved June 4, 2012

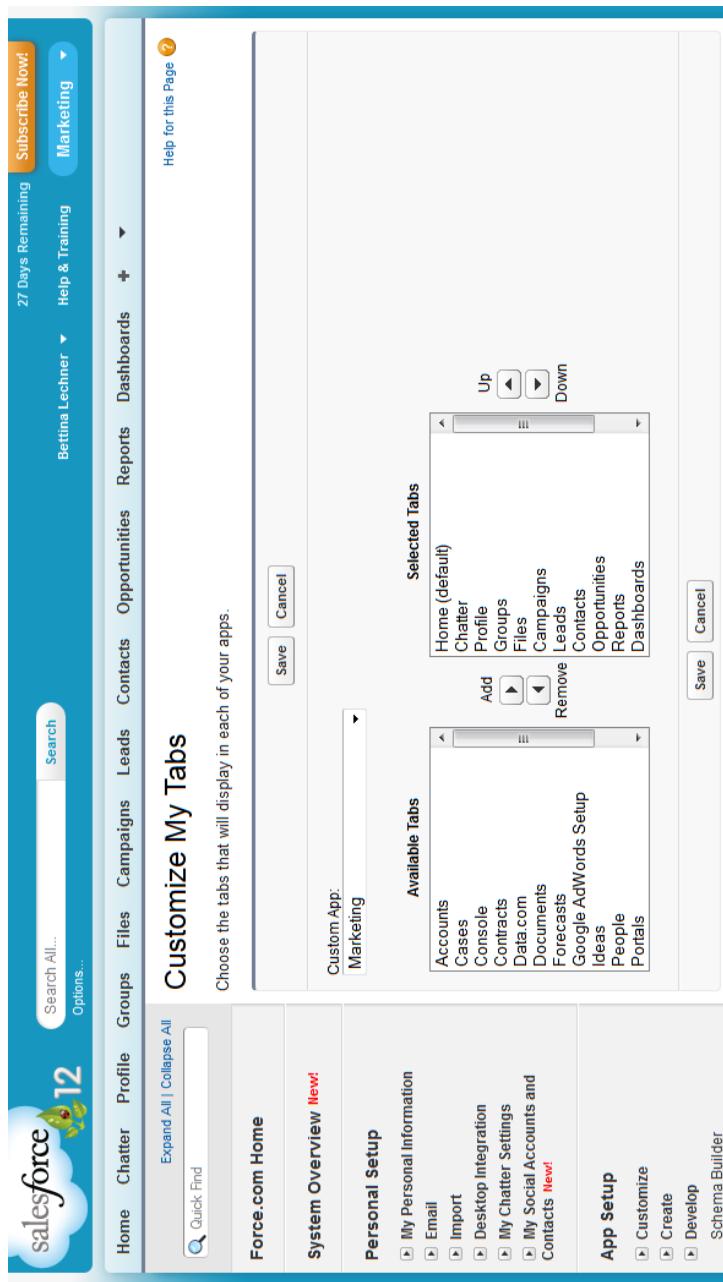


Figure A.32: Tab customization, retrieved June 4, 2012

The screenshot shows the Salesforce Contact screen customization interface. At the top, there's a navigation bar with links like Home, Getting Started, Chatter, Profile, Groups, Files, Leads, Accounts, Contacts, Data.com, Opportunities, Reports, and Dashboards. A sidebar on the left contains sections for Force.com Home, System Overview, Personal Setup (with sub-links for My Personal Information, Email, Import, Desktop Integration, My Chatter Settings, and My Social Accounts and Contacts), App Setup (with sub-links for Customize, Create, Develop, Schema Builder, Installed Packages, AppExchange Marketplace, and Critical Updates), and Administration Setup (with sub-links for Manage Users, Company Profile, Security Controls, Communication Templates, Translation Workbench, Data Management, Monitoring, Mobile Administration, Desktop Administration, Email Administration, and Google Apps). Below the sidebar, there's a 'Checkout' section with a 'Checkout Summary' link.

The main content area is titled 'Contact Layout' and shows a 'Fields' section with a 'Quick Find' field and a 'Layout Properties' button. It lists fields such as First Name, Last Name, Birthdate, Department, Email, Home Phone, Account Name, Contact Owner, Description, Fax, Last Modified By, Assistant, Created By, Do Not Call, Fax Opt Out, and Last Stay-in-Touch. Below this is a 'Contact Sample' section with tabs for 'Contact Detail' (containing standard buttons like Edit, Delete, Clone, Sharing, Request Update, View Self-Service, and various enable/disable buttons) and 'Custom Buttons'. The 'Contact Detail' tab also includes sections for Contact Information, Address Information, Additional Information, Description Information, System Information, Custom Links, Open Activities, Activity History, Opportunities, Cases, Notes & Attachments, and HTML Email Status. The 'Opportunities' section shows a table with columns for Opportunity Name, Stage, Amount, and Close Date. The 'Cases' section shows a table with columns for Case, Subject, Priority, Date/Time Opened, Status, and Owner. The 'Notes & Attachments' section notes that the list is not customizable. The 'HTML Email Status' section shows a table with columns for Subject, Date Sent, Date Opened, # Times Opened, and Last Opened. The 'Campaign History' section shows a table with columns for Campaign Name, Start Date, Type, Status, Responded, and Member Status Updated. At the bottom, there's a copyright notice: 'Copyright © 2000-2012 salesforce.com, inc. All rights reserved | Privacy Statement | Security Statement | Terms of Use | SOA Compliance'.

Figure A.33: Contact screen customization, retrieved June 4, 2012

A.2.6 Knowledge Management and Customer Service

The screenshot shows the Salesforce 12 customer service solution overview screen. At the top, there's a navigation bar with links for Home, Chatter, Profile, Groups, Files, Accounts, Contacts, Cases, Solutions, Reports, Dashboards, Getting Started (social), and Call Center. A search bar and a 'Subscribe Now!' button are also present. The main content area is divided into several sections:

- Solutions Home:** Features a lightbulb icon and a search bar for finding matching solutions. It includes a 'Create New...' button and a 'Recent Items' section.
- Solution Views:** Shows a list of recent views with options to Edit or Create New View.
- Recent Solutions:** Displays a table of recent solutions with columns for Solution Title, Solution Number, Status, and Author Alias. Two entries are shown:

Solution Title	Solution Number	Status	Author Alias
Redial button does nothing	00000001	Reviewed	ElTech
Cannot set up auto-dial numbers	00000002	Draft	ElTech
- Tools:** Includes a 'Mass Delete Solutions' option.
- Reports:** Contains links for 'Solution List' and 'Solution History Report'. A 'Go to Reports' link is also present.
- Recycle Bin:** Shows a single item: '15% off TOL phone systems'.

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Figure A.34: Overview screen of customer service problem solutions, retrieved June 4, 2012

The screenshot shows the Salesforce 12 interface with the following details:

- Header:** Recent Items, Search All..., Options..., 27 Days Remaining, Subscribe Now!, Call Center.
- Breadcrumbs:** Home > Solutions > Solution Detail.
- Solution Detail:**
 - Recent Items:** Redial button does nothing, Cannot setup auto-dial numbers.
 - Solution Detail:**

Solution Number	00000001	Visible in Self-Service Portal
Status	Reviewed	Visible in Public Knowledge Base
 - Detail Information:**
 - Solution Title:** Redial button does nothing
 - Solution Details:** Hang up phone, Unplug cable from phone, Wait 15 seconds, Plug cable back in, Redial should work again.
 - System Information:** Created By: Bettina Lechner, Last Modified By: Bettina Lechner, Date: 5/29/2012 8:40 AM.
- Cases:** No records to display.
- Solution History:**

Date	User	Action
5/29/2012 8:42 AM	Bettina Lechner	Changed Status from Draft to Reviewed.
		Changed Visible in Public Knowledge Base from false to true.
5/29/2012 8:40 AM	Bettina Lechner	Created.
- Attachments:** No records to display.
- Help & Training:** Always show me ▾ more records per related list, Back To Top.
- Page Footer:** Copyright © 2000-2012 salesforce.com, inc. All rights reserved. | Privacy Statement | Security Statement | Terms of Use | 508 Compliance.

Figure A.35: Detail view of customer service problem solution, retrieved June 4, 2012

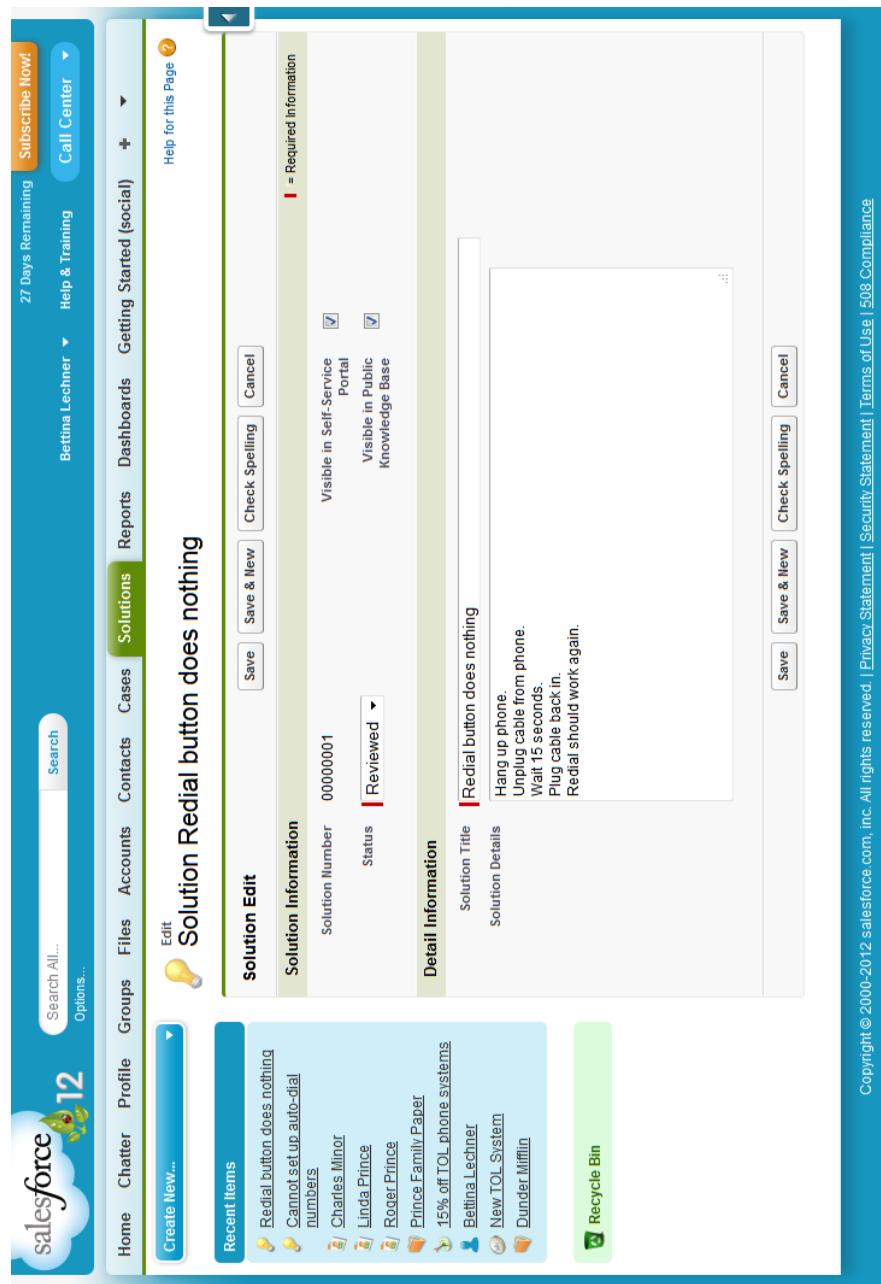


Figure A.36: Editing view of customer service problem solution, retrieved June 4, 2012

Task Edit

Task Information

- Assigned To: Bettina Lechner
- Subject: about missing product
- Due Date: 5/29/2012
- Comments: Called to let us know that we delivered too few phones

Additional Information

- Status: Completed
- Phone: (498) 654-6587
- Email: m.g.scott@dundermifflin.com
- Send Notification Email

Schedule follow up task

Task Information

- Assigned To: Bettina Lechner
- Subject: Call
- Due Date: 5/29/2012
- Comments:

Additional Information

- Status: Waiting on someone else
- Priority: High
- Send Notification Email

Reminder

- Reminder: 5/29/2012 8:00 AM

Save Cancel

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Figure A.37: Detail view of customer service call log, retrieved June 4, 2012

The screenshot shows the Salesforce interface for a Case record. The top navigation bar includes links for Home, Getting Started, Chatter, Profile, Groups, Files, Leads, Accounts, Contacts, Data.com, Opportunities, Reports, and Sales. The main content area displays the following details:

Case Detail

Case Information:

- Case Owner: Bettina Lechner [Change]
- Contact Phone: (498) 654-6587
- Case Number: 00001003
- Contact Email: m.g.scott@dundermifflin.com
- Contact Name: Michael Scott
- Account Name: Dunder Mifflin

Additional Information:

Status	New	Type	Problem
Case Origin	Phone	Case Reason	New problem
Priority	High		
Subject	Delivery missing three phones		
Description	The delivery we sent them was three phones short.		
Date/Time Opened	5/29/2012 7:27 AM	Date/Time Closed	

System Information:

Created By: Bettina Lechner, 5/29/2012 7:27 AM Last Modified By: Bettina Lechner, 5/29/2012 7:27 AM

Solutions: View Suggested Solutions or Find Solution

No Solutions Attached

Open Activities:

Action	Subject	Name	Task	Due Date	Status	Priority	Assigned To
Edit Del	Call	Michael Scott	✓		Waiting on someone else	High	Bettina Lechner

Activity History:

Action	Subject	Name	Task	Due Date	Assigned To	Last Modified Date/Time
Edit Del	Call about missing product	Michael Scott	✓	5/29/2012	Bettina Lechner	5/29/2012 7:29 AM

Case Comments: New

No records to display

Case History:

Date	User	Action
5/29/2012 7:27 AM	Bettina Lechner	Created.

Attachments: Attach File

No records to display

[Back To Top](#) Always show me ▾ more records per related list

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Figure A.38: Detail view of customer service case log, retrieved June 4, 2012

A.2.7 Social Media Features

The screenshot shows a Salesforce Chatter profile page for a user named Bettina Lechner. At the top, there's a navigation bar with links for Home, Getting Started, Chatter, Profile, Groups, Files, Leads, Accounts, Contacts, Data.com, Opportunities, Reports, and a Sales button. A search bar and a 'Subscribe Now!' button are also present.

The main content area displays Bettina Lechner's profile information, including her name, title (Moderator), and a large placeholder image for her profile picture. Below this, there's a section titled 'Chatter Contribution' showing she is an 'Active Influencer' with 1 comment received and 0 likes received. There's also a 'Contact' section listing her as a Researcher with an email address (blechner@unomaha.edu) and a phone number (402) 218-9648, along with US as her location.

On the right side, there are several modules: 'Add your photo' (with a camera icon), 'Share' (with a cloud icon), 'Followers' (listing 'No followers.'), 'Following' (listing 'Find people to follow'), 'Groups' (listing 'Show All (1)' with a group icon), 'Chatter Expert' (with a 'C' icon and a tip about getting started), and 'Files Owned' (listing 'No files have been added yet').

At the bottom, there's an 'About Me' section with a pencil icon and the text 'Enter information so people can learn more about you.'

Figure A.39: Personal profile, retrieved June 4, 2012

The screenshot shows the Salesforce news feed interface for a user named Monica Lawrence. The top navigation bar includes links for Monica Lawrence, Setup, Help, Logout, and Sales Cloud. The main content area displays a news item from Monica Lawrence:

Monica Lawrence I'll be in NYC all week, call my cell if you need to reach me.

Below this, there's a section titled "What are you working on?" with a "Share" button. A comment from Nick Watson follows:

Nick Watson Monica, would you mind meeting with John from Anaco Limited while you're out there? It would be great for someone to discuss the deal with him face to face.

Further down, another comment from Monica Lawrence is shown:

Monica Lawrence No problem, I'll keep you posted.

On the left side, there are search and filter options, including "Search All" and "Create New...". Below these are "Recent Items" and a list of recent users:

- Nick Watson
- AB Partners, Inc.
- Robert Fontana
- Data Mart
- Ryan Anderson
- Allied Technologies - 150K
- Steven Maher
- Kevin Wu
- Green Dot Media - 120K
- Laura Aisley

On the right side, there are several news items from other companies:

- SAP** 1:51 PM Delete Unfollow
- Optos Inc. - SAP** Your order has been shipped.
- Stratus Computers - Case 00001644** Case has been escalated to Critical

At the bottom, there are "Write a Comment" and "Recycle Bin" buttons.

Figure A.40: Company news feed, retrieved from <http://isolsoft.com/salesforce-software-review/>, May 16, 2012

The screenshot shows a Salesforce Chatter feed for a user named Anna Smith. At the top, there's a navigation bar with links for 'Customize Page', 'Edit Layout', 'Printable View', and 'Help for this Page'. Below the navigation, there's a header for Anna Smith, her profile picture, and a list of sharing icons (LinkedIn, Facebook, Twitter, YouTube). A 'Following' button is visible. The main feed area has a light blue header with a 'Write something...' input field and a 'Share' button. To the right, there are buttons for 'Followers' and 'Show All (1)'. A sorting dropdown menu is set to 'Post Date'. The feed contains two posts from Bettina Lechner:

- Bettina Lechner** just called to ask about our new product. She seemed pretty interested.
Today at 3:48 PM · Comment · Like
- Bettina Lechner** created this contact.
Today at 3:45 PM · Comment · Like

Figure A.41: “Chatter” feed for sales contact, retrieved June 4, 2012

A.3 SugarCRM

A.3.1 Sales Account Information

The screenshot shows the SugarCRM interface for managing sales accounts. At the top, there's a navigation bar with links for Accounts, Contacts, Opportunities, Reports, More, and a search bar. Below the navigation is a search form titled "Search Accounts" with fields for Name, Any Email, State, Type (with dropdown options like Analyst, Competitor, Customer, Integrator, Investor), Website, Any Address, Postal Code, Industry (with dropdown options like Apparel, Banking, Biotechnology, Chemicals, Communications), Any Phone, City, Country, and Assigned to (with a dropdown list of users: admin, chris, Hal, Jane, jason, jim). There are also buttons for "Save", "Update", and "Delete".

Below the search form is a "Layout Options" section where users can "Display Columns" or "Hide Columns" for the account list. The columns shown include Name, City, Billing Country, Phone, User, Email Address, Team, Type, Industry, Annual Revenue, Phone Fax, Billing Street, Billing State, and Billing Postal Code. The list is ordered by Name in ascending order.

The main area displays a table of accounts with the following data:

Name	City	Billing Country	Phone	User	Email Address	Team
Real Madrid	Madrid	Spain	+011 34 911 222 333	chris		East
Singapore Airlines	Singapore	Singapore	+011 65 1111 2222	chris		East
SugarCRM Inc.	Cupertino	United States	+14084546900	jim	crmmadesimple@gmail.com	Jim Brennan+
Tata	Mumbai	India	+011 91 22 1111 2222	chris		East
Vatten	Stockholm	Sweden	+011 46 8 111 22 33	chris		East

At the bottom, there are buttons for Print and Back to top, along with a copyright notice: "SUGARCRM. © 2012 SugarCRM Inc."

Figure A.42: Overview screen of sales accounts, retrieved July 12, 2012

The screenshot displays the SugarCRM application interface. At the top, a navigation bar includes links for Accounts, Contacts, Opportunities, Reports, More, and a search bar. Below the header, the main content area shows a detailed view of a sales account. The account information includes:

- Name:** SugarCRM Inc.
- Website:** www.sugarcrm.com
- Billing Address:** 1000 North Wolfe Road, Suite 2000, Santa Clara, CA 95051, United States
- Description:** SugarCRM is the world's leading provider of commercial open source customer relationship management (CRM) software for companies of all sizes. SugarCRM easily integrates with Microsoft Office and Google G Suite and is a more flexible, cost-effective alternative than proprietary enterprise systems. SugarCRM's open source nature allows companies to more easily customize and integrate customer relationship management (CRM) solutions to fit their needs. SugarCRM's open source nature also allows companies to maintain more positive relationships. SugarCRM offers several editions of its software, including the free edition, the open source edition, and appliance-based solutions to suit customer security, integrated and configuration needs.
- Office Phone:** +12094555555
- Fax:**
- Email Address:** cmnreddyakshi@gmail.com (Primary)

A sidebar on the right contains a news feed titled "SugarCRM Expands In Leadership Position" dated July 12, 2012, with a link to "View Details".

The main content area is divided into sections for Activities, Documents, Contacts, Opportunities, Quotes, Products, Campaigns, Commercials, Leads, Member Organizations, Cases, Documents, Bugs, and Projects. Each section has a "Create" button and a list of items with columns for Subject, Status, Contact, Date Modified, Date Created, Assigned User, and other relevant details. The "Activities" section lists multiple entries for "Delivery Status Notification (Failure)".

Figure A.43: Detail view of sales account, retrieved July 12, 2012

SugarCRM Inc.

Save | Cancel | View Change Log

Overview | More Information | Other

Name: * SugarCRM Inc.

Website: www.sugarcrm.com

Billing Address

Street:	10050 North Wolfe Road
City:	Cupertino
State:	California
Postal Code:	95014
Country:	United States

Shipping Address

Street:	10050 North Wolfe Road
City:	Cupertino
State:	California
Postal Code:	95014
Country:	United States

Copy address from left:

Type: Customer

Email Address: + crmmadesimple@gmail.com - Primary Opted Out Invalid

Description: SugarCRM is the world's leading provider of commercial open source customer relationship management (CRM) software for companies of all sizes. SugarCRM easily adapts to any business environment by offering a more flexible, cost-effective alternative than proprietary applications. SugarCRM's open source architecture allows companies to more easily customize and integrate customer-facing business processes in order to build and maintain more profitable relationships. SugarCRM offers several deployment options, including on-demand, on-site and appliance-based solutions to suit customers' security, integration and configuration needs.

dealsize: minnow

Save | Cancel | View Change Log

◀ Back to top

Figure A.44: Editing view of sales account, retrieved July 12, 2012

A.3.2 Contact Information

The screenshot shows the SugarCRM interface for managing contacts. At the top, there's a navigation bar with links for Accounts, Contacts, Opportunities, Reports, More, and a search bar. Below the navigation is a header titled "Search Contacts". The main area is a grid displaying 40 contacts out of a total of 83. The columns in the grid are: Name, Title, Account Name, Email, Office Phone, User, and Date Created. Each contact row includes a small thumbnail, a star icon, and a pencil icon for editing. The contacts listed include various names like Lucille La, Thurman Yoho, Maggie Mimms, etc., with their respective titles, companies, and contact details. At the bottom of the grid, there are buttons for "Delete" and "Print". The SugarCRM logo and copyright information are visible at the very bottom.

Name	Title	Account Name	Email	Office Phone	User	Date Created
Lucille La		Macy's, Inc.	the94@example.tv	(352) 057-4530	will	02-22-2010 17:41
Thurman Yoho	VP Sales	WellPoint Inc	support.info.kid@example.co.uk	(498) 350-6979	will	02-22-2010 17:41
Maggie Mimms	President	Apollo Construction Llc	section46@example.co.uk	(372) 397-6676	will	02-22-2010 17:41
Corina Lujan	IT Developer	Perkin Elmer, Inc.	beans.vegan.qa@example.us	(090) 443-1279	will	02-22-2010 17:41
Victor Saba	VP Operations	White Castle	qa.beans@example.name	(833) 292-3016	will	02-22-2010 17:41
Jerald Arenas	Director Sales	Perkin Elmer, Inc.	im.kid.kid@example.edu	(483) 011-7537	will	02-22-2010 17:41
Joel Zeledon	Mgr Operations	Harvard University	sugar.kid@example.com	(674) 897-5375	will	02-22-2010 17:41
Woodrow Roebuck	Director Sales	Harvard University	hr39@example.cn	(765) 718-2401	will	02-22-2010 17:41
Juliana Lafountain	Director Sales	Hewlett-Packard Company	the.qa@example.co.jp	(828) 459-3862	will	02-22-2010 17:41
Shelly Hoisington	President	Halliburton Company	the84@example.tw	(721) 949-4143	will	02-22-2010 17:41
Saul Burman	VP Operations	National Football League Inc.	vegan.vegan@example.biz	(927) 689-3001	will	02-22-2010 17:41
Ramon Deshotel	Director Sales	Harvard University	support.the@example.us	(450) 398-4871	will	02-22-2010 17:41
Rosalia Zebrowski	Director Sales	Harvard University	phone.the.vegan@example.cn	(267) 513-9888	will	02-22-2010 17:41
Yong Keele	IT Developer	ABC Inc.	im.sugar@example.co.uk	(721) 567-0286	chris	02-22-2010 17:41
Leonor Roberts	VP Operations	National Football League Inc.	the.qa.the@example.net	(703) 020-6052	chris	02-22-2010 17:41
Delbert Halley	Director Operations	Harvard University	sugar.beans@example.edu	(584) 900-7439	will	02-22-2010 17:41
Fernando Buzzell	VP Sales	Complete Holdings Ltd.	im24@example.co.uk	(584) 216-0753	chris	02-22-2010 17:41
Norberto Spooner	Director Operations	Bank of America Corporation	im.qa@example.de	(729) 096-4118	will	02-22-2010 17:41
Marcia Holder	Mgr Operations	Harvard University	hr.im@example.cn	(087) 002-9852	will	02-22-2010 17:41

Figure A.45: Overview screen of contacts, retrieved July 12, 2012

Figure A.46: Detail view of contact, retrieved July 12, 2012

Accounts Contacts Opportunities Reports More ▾ Search will ▾ + ▾

Jerald Arenas

First Name:	<input type="text" value="Jerald"/>	Office Phone:	<input type="text" value="(483) 011-7537"/>
Last Name: *	<input type="text" value="Arenas"/>	Mobile:	<input type="text" value="(206) 609-3849"/>
Title:	<input type="text" value="Director Sales"/>	Fax:	<input type="text"/>
Account Name:	<input type="text" value="Perkin Elmer, Inc."/>	Home:	<input type="text" value="(619) 485-2963"/>
Lead Source:	<input type="text" value="Cold Call"/>	Other Phone:	<input type="text"/>
campaign:	<input type="text"/>	Do Not Call:	<input type="checkbox"/>
Teams: *	<input type="text" value="East"/>	Assigned to:	<input type="text" value="will"/> <input type="button" value="X"/> <input type="button" value="↶"/> <input type="button" value="↷"/>
Primary			

◀ Back to top 

 © 2012 SugarCRM Inc.

Figure A.47: Editing view of contact, retrieved July 12, 2012

A.3.3 Sales Leads and Opportunities

The screenshot shows the SugarCRM interface for managing sales leads and opportunities. The top navigation bar includes links for Accounts, Contacts, Opportunities, Reports, More, Search, and a user icon. A search bar is present at the top right.

The main area is titled "Search Opportunities". It features several search criteria fields:

- Opportunity Name:** An input field with a clear button.
- Assigned to:** A dropdown menu showing users: Rick, salah, Sarah, SugarCRM Support, Support Group, and will. The entry "will" is currently selected.
- Expected Close Date:** A dropdown menu with options: Equals, >, <, >=, <=, and Between. The "Equals" option is selected.
- Sales Stage:** A dropdown menu showing stages: Prospecting, Qualification, Needs Analysis, Value Proposition, Id. Decision Makers, Perception Analysis, and Primary. The "Prospecting" stage is highlighted.
- Opportunity Amount:** A dropdown menu with options: Equals, >, <, >=, <=, Between, and Not Between. The "Equals" option is selected.
- Lead Source:** A dropdown menu showing sources: Cold Call, Existing Customer, Self Generated, Employee, Partner, and Other. The "Cold Call" source is listed.
- Teams:** A dropdown menu showing teams: Sales, Marketing, and Service. The "Sales" team is listed.
- My Favorites:** A section containing a checkbox and a link to "Layout Options".
- Layout Options:** Buttons for "Search", "Clear", "Basic Search", and "Saved Searches".
- Save:** A button to save the current search query.
- Modify current search:** Buttons for "Update" and "Delete".
- Navigation:** Buttons for "Delete", "Edit", and "View".
- Results:** A table listing one opportunity:

Name	Account Name	Sales Stage	Amount	Close	User	Date Created
Computer Room Remodel	Northern Trust Corporation	Prospecting	\$105,185.19	04-29-2012	will	04-02-2011 19:56
- Pagination:** Navigation arrows for page 1 of 1.
- Footer:** Links for "Print" and "Back to top".

Figure A.48: Overview screen of sales leads, retrieved July 12, 2012

Accounts Contacts Opportunities Reports More ▾ Search will + ▾

Computer Room Remodel

Edit (1 of 1)

Opportunity Name:	Computer Room Remodel	Account Name:	Northern Trust Corporation
Opportunity Amount: (USD \$):	185,185.19	Expected Close Date:	04-29-2012
Sales Stage:	Prospecting	Type:	
Probability (%):	10	Lead Source:	Other
Next Step:		Campaign:	
Description:			

Other

Assigned to:	will	Date Modified:	09-28-2011 11:26 by jason
Teams:	East	Date Created:	04-02-2011 19:56 by jim

All Sales Marketing Support Collaboration Other

Activities ▾

Subject	Status	Contact	Due Date	Assigned User
Win Plan Review	Planned		08-13-2011 13:00	jim

History ▾

Subject	Status	Contact	Date Modified	Date Created	Assigned User
Summer Marketing Effort: Our new summer product line!	Sent		04-02-2010 19:19	04-02-2010 19:19	Jane

Documents ▾

Name	File	Category	Source	Status	Publish Date

SUGARCRM. © 2012 SugarCRM Inc.

Contacts ▾

Name	Account Name	Role	Email	Office Phone
Grant Rupp	Northern Trust Corporation		section60@example.co.jp	(050) 255-8097

Quotes ▾

Subject	Account Name	Total Amount	Valid Until	Assigned User
tst	Northern Trust Corporation	\$38,320.50	05-19-2011	jim

Leads ▾

Name	Referred By	Lead Source	Office Phone	Email	Lead Source Description	Assigned User
Grant Rupp		Other	(312) 255-8097	section60@example.co.jp	chris	

Contracts ▾

Name	Account Name	Start	End	Status	Value
No Data					

Projects ▾

Name	Assigned To	Start Date	End Date
No Data			

Print Back to top

Figure A.49: Detail view of sales lead, retrieved July 12, 2012

The screenshot shows the SugarCRM interface for editing a sales lead. The top navigation bar includes links for Accounts, Contacts, Opportunities, Reports, More, and a search bar. A sidebar on the left has a 'Create' button. The main content area is divided into two tabs: 'Primary' and 'Other'. The 'Primary' tab contains fields for Account Name, Expected Close Date, Type, Lead Source, and Campaign. The 'Other' tab contains fields for Opportunity Name, US Dollars amount, Currency, Opportunity Amount, Sales Stage, Probability (%), Next Step, Description, Assigned to, and Teams. Buttons for Save, Cancel, and Print are located at the bottom of each tab.

Primary	
Account Name:	<input type="text"/>
Expected Close Date:	<input type="text"/>
Type:	<input type="text"/>
Lead Source:	<input type="text"/>
Campaign:	<input type="text"/>

Other	
Opportunity Name:	<input type="text"/>
US Dollars :	\$ <input type="text"/>
Currency:	<input type="text"/>
Opportunity Amount:	<input type="text"/>
Sales Stage:	<input checked="" type="checkbox"/> Prospecting
Probability (%):	10
Next Step:	<input type="text"/>
Description:	<input type="text"/>
Assigned to:	will <input type="text"/> <input type="button" value="X"/>
Teams:	<input type="text"/> Primary <input type="button" value="+"/> <input type="button" value="X"/> <input type="radio"/> East <input type="button" value="-"/>

Save Cancel Print Back to top

SUGARCRM. © 2012 SugarCRM Inc.

Figure A.50: Editing view of sales lead, retrieved July 12, 2012

A.3.4 Reports and Dashboards

The screenshot shows the SugarCRM Reports and Dashboards overview screen. At the top, there are search fields for 'Title', 'Module' (with options like Accounts, Bar Tracker, Calls, Campaign Log, Campaigns, and Cases), 'Report Type' (with options like Rows and Columns, Summation, Summation with details, and Matrix), and 'Assigned to' (a list of users including admin, chris, Hui, Jane, jason, and jim). Below these are sections for 'Team' (East, Global, Chris Oliver, Will Westin) and 'Layout Options' (Basic Search, Saved Searches). The main area displays a grid of 40 reports, each with a preview icon, report name, module, report type, user assigned, schedule, accessed on, and date created. The reports include: Cases by Assigned User, Closed Cases Report, Forecasted Revenue next 12 months, Expected Commissions, Commission Report, Contacts by Category, Meetings by Status, All Contacts by Industry, Quarterly Close Rate Report, Total Deals by Rep, Case by Type, Individual Pipeline Report, latest Calls, Open Cases by User by Priority, Leads by Status by Rep, Closed Lost Contacts, Matrix_Closed Won Opp by User by Lead source, Meetings by Team by User, and West Team Pipeline Report.

Report Name	Module	Report Type	User	Schedule	Accessed On	Date Created
Cases by Assigned User	Cases	Summation with details	jim	-- none --	07-14-2011 09:30	
Closed Cases Report	Cases	Matrix	jim	-- none --	05-24-2011 11:38	
Forecasted Revenue next 12 months	Opportunities	Summation with details	jim	-- none --	05-04-2011 10:14	11-30-2010 11:33
Expected Commissions	Opportunities	Summation with details	max	-- none --		11-30-2010 10:55
Commission Report	Opportunities	Summation with details	jim	-- none --	11-22-2010 14:52	11-22-2010 13:41
Contacts by Category	Contacts	Rows and Columns	jim	-- none --		11-12-2010 15:16
Meetings by Status	Meetings	Summation with details	jim	-- none --		11-04-2010 15:54
All Contacts by Industry	Contacts	Rows and Columns	jim	-- none --		11-02-2010 10:27
Quarterly Close Rate Report	Opportunities	Summation with details	jim	-- none --	10-08-2010 13:51	
Total Deals by Rep	Opportunities	Summation with details	jim	-- none --	09-14-2010 10:17	
Case by Type	Cases	Summation with details	jim	-- none --	08-19-2010 10:02	
Individual Pipeline Report	Opportunities	Summation with details	jim	-- none --	08-18-2010 13:27	
latest Calls	Calls	Summation with details	jim	-- none --	08-18-2010 13:10	
Open Cases by User by Priority	Cases	Summation with details	rachel	-- none --	07-07-2010 10:37	
Leads by Status by Rep	Leads	Summation with details	jason	-- none --	06-25-2010 14:35	
Closed Lost Contacts	Contacts	Rows and Columns	will	-- none --	07-07-2010 14:36	06-24-2010 08:10
Matrix_Closed Won Opp by User by Lead source	Opportunities	Matrix	admin	-- none --	10-27-2010 10:37	06-17-2010 16:05
Meetings by Team by User	Meetings	Summation with details	admin	-- none --		06-16-2010 10:54
West Team Pipeline Report	Opportunities	Summation with details	jason	-- none --		06-15-2010 15:08

Figure A.51: Overview screen of available reports, retrieved July 12, 2012

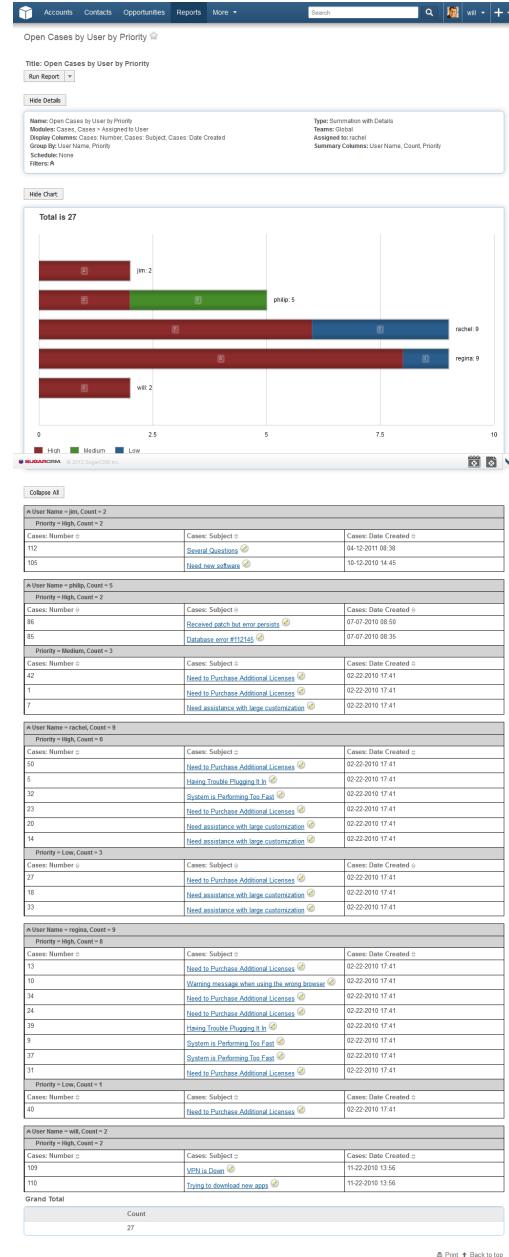


Figure A.52: Sample report, retrieved July 12, 2012

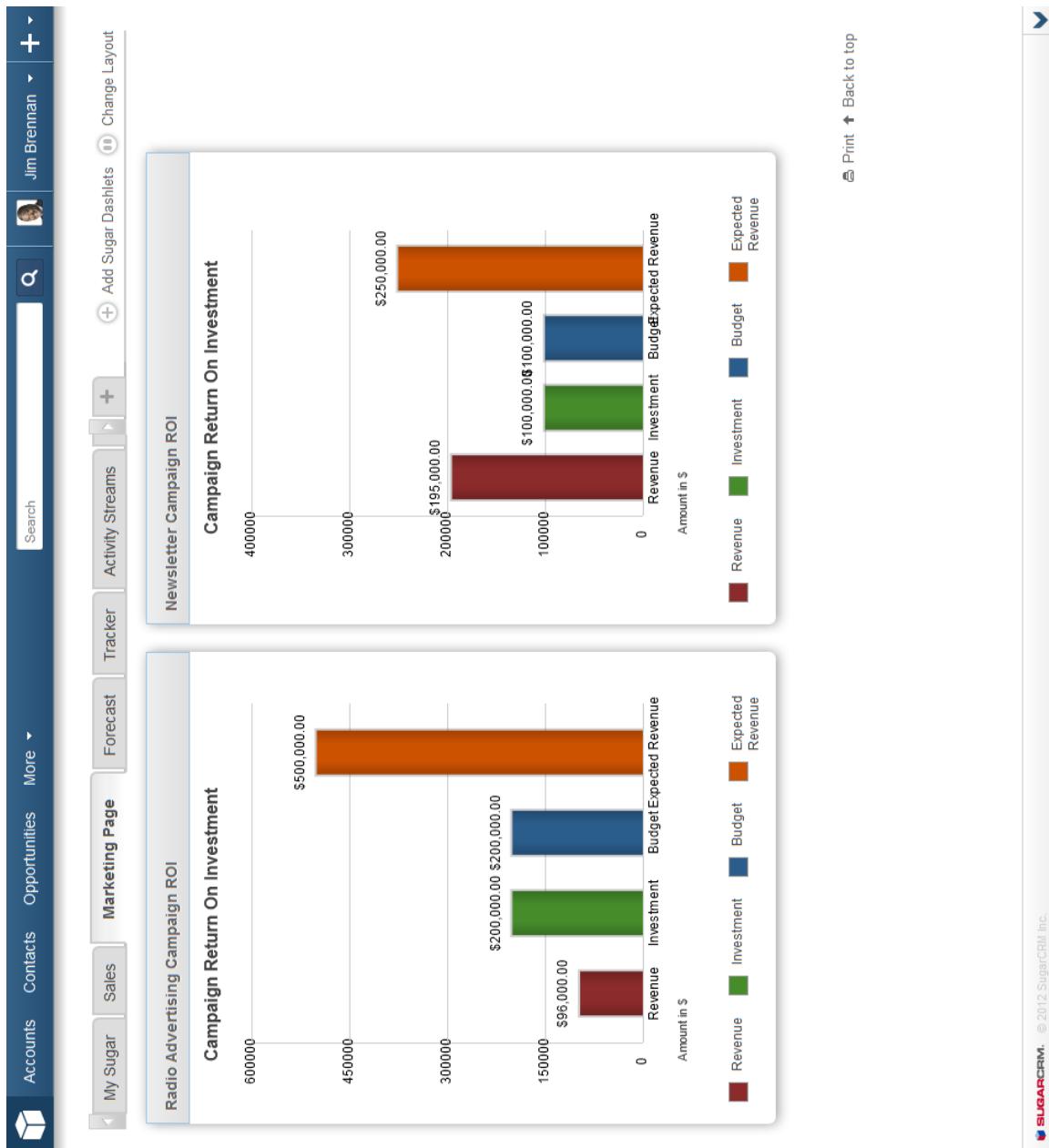


Figure A.53: Business intelligence dashboard, retrieved from <http://thirdwaveconsulting.com/grants-management/>, May 16, 2012

My Sugar Accounts Contacts Opportunities Reports Documents Cases Campaigns Knowledge Base More Search will +

My Pipeline Pipeline total is \$1,795K

Opportunity size in \$K

Prospecting Qualification Negotiation/Review Proposal/Price Quote Closed Won

My Calls (1 - 5 of 23)

Close	Subject	Related to	Start Date	Accept?	Status
Follow Up on Closed Deal	Fancy Yellow Electric Scooter		08-21-2011 12:45	✓ ?	Planned
Perkin Elmer Executive Meeting	Perkin Elmer - 250 enterprise		08-20-2011 11:30		
Talk to Jane about Schedule	Chevron - End User Training		08-16-2011 10:00		
Follow up with Carly	HP - 500 Pro		08-23-2011 14:00		

My Favorite Records (1 - 5 of 5)

Name	Module Name	Date Made Favorite
Macy's - 250 Pro	Opportunities	10-28-2010 12:35
Perkin Elmer - 250 enterprise	Opportunities	10-28-2010 12:35
Caterpillar Inc.	Accounts	10-28-2010 12:34
Apple Inc.	Accounts	10-28-2010 12:34
Apollo Construction Llc	Accounts	10-28-2010 12:34

My Twitter (1 - 15 of 0)

- Kara Swisher Today's Probably the Wrong Day for Yahoo to Launch a Big Animated Series From Tom Hanks [http://t.co/dzuU4X](#) 41 Seconds ago
- Robert Bacal Discover How to Bring Trust to the Cloud: Strong Authentication for SaaS Applications... [http://t.co/0d0hyA8](#) 41 Seconds ago
- Robert Bacal Transform Multi-Factor Authentication from Something You Have to Something You Already... [http://t.co/9xkOwNjV](#) 41 Seconds ago
- Robert Bacal Forget the Token Necklace! Discover How Identity Federation Can Simplify User Experience... [http://t.co/pn7GkTZ](#) 41 Seconds ago
- Robert Bacal How Enabling Supply Chain Visibility Can Improve the Bottom Line Supply Chain executives are... [http://t.co/wvGR5RA](#) 41 Seconds ago
- Robert Bacal Top 5 Reasons to Consider Object Data: The non-relational... [http://t.co/09DfLJ](#) 41 Seconds ago

My Activity Stream Post (0 - 0 of 0)

No Data

My Open Tasks (1 - 5 of 35)

Close	Subject	Related to	Priority	Status	Start Date	Due Date
call customer	aldo 10000		High	In Progress	08-25-2011 13:00	08-25-2011
Review	Haliburton		Not Started		09-16-2011	09-16-2011
Review Large Opportunity	500 Enterprise		High	Not Started	09-06-2011 15:15	09-08-2011
Review Large Opportunity	300 hours consulting services		High	Not Started	08-23-2011 10:30	08-23-2011
Review Large Opportunity	Bank of America Corporation		High	Not Started	08-14-2011 13:00	08-16-2011

My Leads (1 - 5 of 35)

Name	Title	Office Phone	Email Address
Robbie Persaud	IT Developer	(608) 031-9770	sugar.support@example.us
Danny Speicher	Director Operations	(184) 057-2280	support.dev@example.de
Laverne Leftwich	VP Operations	(083) 852-1874	qa13@example.net
Cornell Knuth	IT Developer	(229) 474-9942	sugar.sales@example.org
Rosa Yocom	VP Operations	(938) 238-8778	phone.sales@example.com

My Meetings (1 - 5 of 22)

Close	Subject	Related to	Start Date	Accept?
testing	Cloud.com		08-25-2011 13:00	✓ ?
Large Opportunity	Yellow Electric Scooters		08-22-2011 11:45	✓ ?
test meeting 123			08-21-2011 13:45	✓ ?
Large Opportunity	Yellow Electric Scooters		08-24-2011 12:45	✓ ?
review meeting	aldo 10000		08-09-2011 14:15	✓ ?

Print Back to top

Figure A.54: Home screen, retrieved July 12, 2012

A.3.5 Knowledge Management and Customer Service

The screenshot shows a SugarCRM interface for managing customer service problem solutions. At the top, there's a navigation bar with links for Accounts, Contacts, Knowledge Base, More, and a search bar. Below that is a secondary search bar with fields for Search, Advanced Search, Browse, and a dropdown for Search within: All.

The main content area displays a table of 12 records, each representing a problem solution. The columns are: Title (sorted by frequency), Frequency, Approver Name, Author, Product (sorted by date created), and Date Created. The records are:

Title	Frequency	Approver Name	Author	Product	Date Created
Re: Last Viewed on Internal	1	admin	jim		10/26/2010 15:30
Need Technical Assistance	2	rachel	jim		10/21/2010 15:49
Need to Purchase Additional Licenses	2	rachel	rachel		08/25/2010 14:38
Error message #231987 appears on log in	1	jim	rachel		08/25/2010 14:14
Need a new Computer	4	jim	jim		08/11/2010 09:49
System error 55032	11	rachel	jason		07/07/2010 08:17
System error 55045	6	rachel	jason		07/07/2010 08:17
Encountering System Error when trying to save to the network	12	rachel	jason		06/17/2010 14:44
Operating System returning error 47709	8	Jane	jason		06/17/2010 14:34
System is Performing Too Fast	4	jim	jason		06/17/2010 14:32
Warning message when using the wrong browser	8	rachel	jason		06/17/2010 14:31
Having Trouble Plugging It In	4	jason	jason		06/17/2010 14:31

At the bottom right, there are links for Print and Back to top. The SugarCRM logo is visible in the bottom right corner of the page.

Figure A.55: Overview screen of customer service problem solutions, retrieved July 12, 2012

Encountering System Error when trying to save to the network

[Edit](#)

Title:		Encountering System Error when trying to save to the network		Hide Details
Author:		Jason Lewis		
External Article? :		<input checked="" type="checkbox"/>		Status: Published
Team:		Global		Approver: Rachel Stevens
Publish Date:		08/28/2010		Revision: 1
Expiration Date:				
Date Created:		06/17/2010 14:44		
Body:		Case Number: 44 Subject: Encountering System Error when trying to save to the network Users are not allowed to save to the network as this is a secure system designed to only save to the main server		
Tags:		FAQs		
Attachments:				

[Print](#) [Back to top](#)

SUGARCRM © 2012 SugarCRM Inc.

Figure A.56: Detail view of customer service problem solution, retrieved July 12, 2012

Figure A.57: Editing view of customer service problem solution, retrieved July 12, 2012

Create

Accounts Contacts Opportunities Reports Calls More ▾ Search

Overview

Subject: *	Status: *
Start Date & Time: * 07-17-2012 15:15	Related to: Inbound Account
Duration: * 0:15 (hours/minutes)	Reminders: Popup 5 minutes prior Email
Description:	

Other

Assigned to: will	Teams: * Primary
	East

Scheduling

Tuesday July 17 2012

11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00
Will Westin								

Add Invitees

First Name: <input type="text"/>	Last Name: <input type="text"/>	Email: <input type="text"/>	Search <input type="text"/>
----------------------------------	---------------------------------	-----------------------------	-----------------------------

Create an invitee

As Contact As Lead

Buttons

Save **Cancel** **Save & Send Invites** **Close and Create New**

Figure A.58: Detail view of customer service call log, retrieved July 12, 2012

The screenshot shows a SugarCRM interface for a case titled "Several Questions".

Overview:

Case Number:	112	Priority:	High
Status:	New	Account Name:	Northern Trust Corporation
Type:			
Subject:	Several Questions		
Description:	Lots of vague details about this case. Just like you typically get from a customer on their first time thru the application.		
Resolution:			
Show in Portal:	<input type="checkbox"/>		
Products:			

Other:

Assigned to:	jim	Date Modified:	04-12-2011 08:38 by jim
Teams:	Global	Date Created:	04-12-2011 08:38 by jim

Activities: Create Task (0 - 0 of 0)

History: Create Note or Attachment (1 - 1 of 1)

Subject:	Status:	Contact:	Due Date:	Assigned User:	
blank -	Archived		04-12-2011 08:38	04-12-2011 08:38	jim

Documents: Create (0 - 0 of 0)

Contacts: Create (1 - 1 of 1)

Name:	Account Name:	Email:	Office Phone:
Grant Rupp	Northern Trust Corporation	section60@example.co.jp	(050) 255-8097

Bugs: Create (0 - 0 of 0)

Projects: Create (0 - 0 of 0)

[Print](#) [Back to top](#)

Figure A.59: Detail view of customer service case log, retrieved July 12, 2012

Appendix B

Materials used in Trial Run

B.1 Heuristics

These heuristics are based on Oztekin et al. (2010). They were modified to account for the characteristics of the system being evaluated in the trial run by eliminating some heuristics clearly not applicable to the system being evaluated in the trial run.

Table B.1: Heuristics used in trial run

Category	Guideline
Reducing redundancy	Are learning objects easily created and reused? Are items visible in multiple places and from multiple paths? Does modifying an action or activity require excessive “redoing” to make a single change?
Aesthetics	Are the screens pleasing to look at? Is there proper use of color or graphics that enhance navigation?
Completeness	Can you clearly understand all components and structure? Is the screen well organized, easy to navigate, and logical? Are meaningful labels and descriptive links used to support recognition?

Memorability	<p>Is there sufficient visibility so the user does not have to look for things and try to remember them?</p> <p>Is information presented in organized chunks to support learnability and memorability?</p> <p>Is cognitive load reduced by providing familiarity of items and action sequences?</p> <p>Is the user offered sufficient FAQ and human support to obtain necessary help?</p>
Consistency, functionality	<p>Does the interface provide adequate “back” button functionality to return to a previous screen?</p> <p>Do the activity, icon, button, label, and links provide clear purpose/intent that matches the tasks?</p> <p>Is consistent form and style used for various titles and headers?</p>
Accessibility	<p>Are alternative pathways to course content and activities available?</p> <p>Are accessibility issues addressed throughout the course?</p> <p>Are screen features adaptable to individual user preference?</p>
Interactivity, feedback, help	<p>Is the user provided with sufficient information to know where in the system he/she is?</p> <p>Does the course offer multiple opportunities for interaction and communication among students, to instructor, and to content?</p>
Flexibility	Is the speed of loading course page high enough?
Visibility	<p>Is the intended functionality clear for each option or selection?</p> <p>Are options (buttons/selections) logically grouped and labeled?</p>
Error prevention	<p>Can multiple but similar tasks be done easily?</p> <p>Can the user easily undo selections, actions, errors in arrangement or management of items?</p> <p>Do error or warning messages prevent possible errors from occurring?</p>

B.2 Instructions for Participants

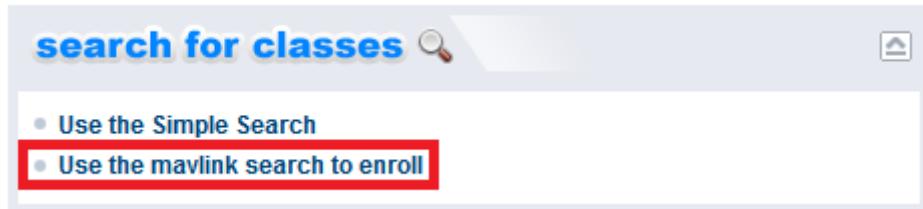
Setup

- URL: [removed]
- User Name: [removed]
- Session ID: [removed]
- Session Passkey: [removed]

Evaluation

Log into mavlink using your Student ID and password.

Click on “Search for classes” on the far left. Click on “Use the mavlink search to enroll”.



As you walk through the following tasks, take note of any usability problems you can identify using the heuristics supplied in ThinkTank. When you identify a usability problem, leave a comment with a short description of the problem on the corresponding heuristic in ThinkTank. Comment on every heuristic. If you can't identify any new problems that relate to a specific heuristic, please state that.

Task List

1. Search for all UNO classes offered in the Fall semester of 2012 in the area of Criminology & Criminal Justice, taught on Mondays and Wednesdays.

2. You changed your mind and want to take a class that is taught only on Tuesdays instead. You do not want to enroll in a class that is offered on days other than Tuesday (e.g. Tuesdays and Thursdays). All other criteria remain the same.
3. Search for all Fall 2012 classes taught by Jong-Hoon Youn.
4. Find out who taught “INTRO TO WEB DEVELOPMENT” during Spring 2011.

(The answers to these scenarios are not important. They are only intended to help you identify usability problems by interacting with MavLink.)

Appendix C

Institutional Review Board Application

Authorization from the Institutional Review Board (IRB) was sought prior to performing the study. The IRB approved the application on June 6, 2012.

C.1 Final Approval

June 6, 2012

Ann Fruhling, PhD
School of Interdisciplinary Informatics
UNO – Via Courier

IRB #: 236-12-EX

TITLE OF APPLICATION/PROTOCOL: Identifying new and obsolete usability heuristics for web-based business software

Dear Dr. Fruhling:

The Office of Regulatory Affairs (ORA) has reviewed your application for ***Educational, Behavioral, and Social Science Research*** on the above-titled research project. According to the information provided, this project is exempt under 45 CFR 46:101b, category 2. You are therefore authorized to begin the research.

It is understood this project will be conducted in full accordance with all applicable HRPP Policies. It is also understood that the ORA will be immediately notified of any proposed changes that may affect the exempt status of your research project.

Please be advised that this research has a maximum **approval period of 5 years** from the original date of approval and release. If this study continues beyond the five year approval period, the project must be resubmitted in order to maintain an active approval status.

Sincerely,



Gail Kotulak, CIP
IRB Administrator
Office of Regulatory Affairs (ORA)

gdk

C.2 Full Application

**EXEMPT EDUCATIONAL, BEHAVIORAL, AND SOCIAL SCIENCE RESEARCH
SECTION I**

1. Status:

New Submission

2. Title of Protocol:

Identifying new and obsolete usability heuristics for web-based business software

3. Responsible Personnel:

A. Principal Investigator (PI):

Fruhling, Ann - School of Interdisciplinary Informatics - 4025544968 - afruhling@unomaha.edu - degree: Ph.D. - address: - phone:

B. Secondary Investigator (SI):

Lechner, Bettina - ISQA - 4025546042 - blechner@unomaha.edu - degree: n/a - address: - phone:

C. Participating Personnel:

Petter, Stacie - Information Systems & Quantitative Analy - 4025542077 - spetter@unomaha.edu - alt #: -- - degree: Ph.D. - address: - phone:

Siy, Harvey - Computer Science - 4025542834 - hsiy@unomaha.edu - degree: Ph.D. - address: - phone:

D. Lead Coordinator:

E. Coordinator(s):

F. Data/Administrative Personnel:

G. Are you a student?

No

4. Funding Source:

Check all that apply and provide the source of the funding.

Other - Provide source: personal funding

5. Funding Agency Deadline for IRB Approval:

No

6. Study Sites

Provide the names and locations of all study sites where this research will be conducted under the oversight of the UNMC IRB or the Joint Pediatric IRB. Submit a letter from an authorized official at all external performance sites other than UNMC, TNMC, UNO or CH&MC granting permission to conduct the research at that site.

UNO Peter Kiewit Institute

7. Principal Investigator Assurance

The Principal Investigator understands and accepts the following obligations to protect the rights and welfare of research subjects in this study:

- I certify that I have carefully reviewed this application and all supporting documents. I have determined that the application is accurate, complete and ready for submission to the IRB.
- I recognize that as the PI it is my responsibility to ensure that this research and the actions of all research personnel involved in conducting the study will comply fully with the IRB-approved protocol and HRPP policies.
- I certify that all listed research personnel will be given a copy of the final IRB approved application and any other relevant study related documents in accordance with their defined responsibilities.
- I recognize that it is my responsibility to ensure that valid informed consent/assent has been obtained, as appropriate, from all research subjects or their legally authorized representative (LARs).
- All listed study personnel have completed the IRB required CITI Training.
- I will not initiate any change in protocol which may change the exempt status of this study without IRB approval.

- I will maintain all required research records on file and I recognize that the IRB is authorized to inspect these records.
- I will inform the Office of Regulatory Affairs (ORA) immediately of any research related problems which impact the subjects.
- I understand that IRB approval is valid for a maximum period of five years.

Fruhling, Ann - May 10 2012 3:02PM

SECTION II

PURPOSE OF THE STUDY AND BACKGROUND

1. Purpose of the Study

What are the specific scientific objectives of the research?

The aim of this study is to identify new and obsolete usability heuristics for web-based business software. To this end, existing usability heuristics for different types of systems will be evaluated with regard to their relevance to modern web-based business software. In addition, new heuristics will be developed as needed.

2. Background and Rationale

Describe the background of the study.

There are a number of established and tested usability heuristics which have been developed for desktop applications or software in general.

Web applications, however, have a number of limitations and likewise advantages that differentiate them from traditional desktop applications. Limitations include differences in the implementation of web browsers resulting in differently rendered interfaces, a lack of platform- and browser-independent keyboard short-cuts, and varying network speeds affecting load time and performance. Examples of benefits are the ability to collaborate with other users in real-time, as well as an easy method of managing updates and distributing new functionality.

While there is some research investigating usability heuristics for web sites and web applications, these heuristics are of general nature and do not focus on web-based business systems.

On the other hand, it has been recommended that general heuristics be complemented by heuristics specific to the domain they are to be applied to, since general heuristics are likely to miss domain-specific problems (Rusu, 2011). While there are heuristics and guidelines available for web sites, they are not geared toward web-based business systems.

CHARACTERISTICS OF THE SUBJECT POPULATION

3. Accrual

A. What is the number of subjects that must complete the study in order to achieve the scientific objectives of the research?

A total of 10 participants in two groups of 5 each is expected to be sufficient for

this study. One group will participate in a pilot study, the other two groups will participate in the actual study.

B. What is the statistical or other justification for the number of subjects needed to complete the study?

Nielsen (1993, p. 156) recommends including five to six evaluators in a heuristic evaluation, since a group of this size is expected to find about 75% of usability problems. It is reasonable to assume that a group of participants of this size can also be expected to identify a large part of heuristics relevant to an application area.

C. What is the maximum number of subjects that will be participating in this research study at all sites under the oversight of the UNMC IRB OR THE JOINT PEDIATRIC IRB and what is the justification for this number?

The maximum number of subjects in this study is 15, since no more subjects will be needed and recruited.

4. Gender of the Subjects

Are there any enrollment restrictions based on gender?

No

5. Age Range of the Subjects

A. What is the age range of the adult subjects?

The minimum age for subjects to participate in this study is 19, there is no upper limit.

B. What is the rationale for selecting this age range?

Subjects should be at least of majority, but any person older than that is eligible to participate, given they fulfill other criteria.

C. Will children (18 years of age or younger) be included in this research?

No

What is the justification for excluding children from this research?

Participants in this study must be usability experts in academia or industry, or have significant experience in using web-based business software. Children are not eligible.

6. Race and Ethnicity

Are there any subject enrollment restrictions based upon race or ethnic origin?

No

7. Inclusion Criteria

What are the specific inclusion criteria?

Participants will be recruited into two groups. The first group will consist of usability experts from academia or industry. The second group will consist of users of web-based business software with at least one year of experience with using such a system.

METHODS AND PROCEDURES

8. Description of Procedures

A. Describe the procedures, evaluations and/or tests that will be done.

Since the subjects will be assigned to one of two groups, two focus group studies will be held. Each subject will participate in one of the two focus group studies.

First, the participants will be asked to review a list of usability heuristics provided to them and assign a rating to each heuristic. This rating allows them to specify how applicable they think each of the heuristics is to web-based CRM systems.

Second, they will be asked to brainstorm any ideas for heuristics they think need to be added to account for web-based CRM systems.

Third, they will be asked to join a group discussion to discuss potential points of conflicting opinions about the heuristics. Their oral comments and the oral comments of the other participants will be recorded during this part of the study to allow for better analysis. The comments will only be recorded if all participants agree to be recorded.

Information about the participants' years of experience in the IT field will be collected to gauge their level of expertise. This information will be linked to the participants' responses during the study, but not to any personally identifying information.

B. Does the research involve review of identifiable private information, including information from public or other registries or databases?

No

9. Confidentiality

Where will the research data be stored during the study and how will it be secured?

The research data will be stored on the researchers' computers. No personally identifying information will be stored with the research results.

10. Privacy

How will you ensure that the privacy is protected during recruitment and in ongoing interactions with participants?

Only participants and investigators will be allowed to access these rooms during the time of the study. No personally identifying information will be stored with the research results.

RISK/BENEFIT ASSESSMENT

11. Potential Risks

Are there any potential risks associated with the research procedure, intervention, evaluation and/or test?

Yes

Describe.

There is a possible risk of a loss of confidentiality.

12. Potential Benefits to the Subject

Are there potential benefits to the subjects that may reasonably be expected from participation in the research?

Yes

Describe.

Usability experts may find the resulting set of usability heuristics valuable in their work as they develop or evaluate web-based business software for purchase. All participants will be sent a copy of the final report should they be interested in it.

13. Potential Benefits to Society

What are the anticipated benefits (i.e. value) to society that may reasonably be expected to result from this research?

The results of this study will add to the existing body of usability heuristics and provide a set of heuristics tailored to the expanding class of web-based business software.

For practitioners, gaining a better understanding of the heuristics relevant to web-based business software will allow for the creation or selection of systems with greater usability, which can lead to benefits such as increased productivity and customer satisfaction.

The study will close the gap in usability heuristics for web-based business software. In addition, the study will contribute to research by increasing our understanding of the emerging field of web-based business software and how heuristics apply to it.

FINANCIAL COMPENSATION

14. Compensation to the Subject for Participation

Will the subject receive any compensation for participation?

No

SUBJECT IDENTIFICATION, RECRUITMENT AND CONSENT/ASSENT

15. Method of Subject Identification and Recruitment

A. How will prospective subjects be identified (e.g., previous research participants, class rosters, databases)?

Usability experts will be identified through personal contacts of the researchers. Users of web-based business software will be identified through personal contacts of the researchers and the usability experts (snowball sampling).

B. Describe how the principal, secondary investigator, participating personnel have ethical access to the names of potential subjects or how these names will be obtained?

Participants will be identified through existing personal contacts.

C. How will prospective subjects be contacted for recruitment into the study?

The participants will be contacted through personal e-mail, phone calls, or personal communication.

16. Informed Consent

Will informed consent be obtained from prospective subjects?

Yes

A) Describe the process of informed consent.

Before the studies begin, a written narrative will be read to the participants detailing the research.

B) Indicate and submit the form(s) to be used for the research.

Written narrative of information to be orally conveyed to the subject

EXEMPTION CATEGORY

17. Exemption Category

A) Specify the exemption category [1-6] under which this protocol should be classified.

2

LITERATURE REVIEW

18. References

Provide a full listing of the key references cited in the background (Section II.3). The references should clearly support the stated purpose of the study.

Nielsen, J. (1993). *Usability Engineering*. Academic Press, San Diego, CA.

Rusu, C., Roncagliolo, S., Rusu, V., and Collazos, C. (2011). A methodology to establish usability heuristics. In *The Fourth International Conference on Advances in Computer-Human Interactions*, pages 59–62.

SECTION III

SUBMISSION DEADLINE

EXEMPT REVIEW: Applications that qualify for exempt review have no submission deadline and can be reviewed independent of the IRB meeting schedule. The ORA reserves the right to reclassify applications and/or refer those applications for either expedited review or full board review as appropriate. In some cases, investigators may be asked to resubmit the project using the IRB Application for Behavioral and Social Science Research.

Call the Office of Regulatory Affairs for assistance in determining if your study meets the requirements for exempt review.

SUBMISSION CHECKLIST

Check all that apply.

Subject recruitment material

Copy of all questionnaires, surveys, assessment tools, and other relevant materials

ADDITIONAL REVIEW REQUIREMENTS

Final IRB approval and release of studies is contingent upon approval by the following UNMC committees or departments. Check the appropriate boxes:

No Additional Reviews Required

Appendix D

Materials Used in First Focus Group

The following materials were used to provide context and information during the first focus group session, as well as before the session as pre-tasking material. Unless noted otherwise, the materials are provided in this chapter.

- Description of CRM systems and functionality
- Screen shots of CRM systems (see appendix A)
- Existing heuristics identified in literature review (see appendix F.1)
 - Heuristics developed by Nielsen (1994b)
 - Heuristics for ERP systems developed by Singh and Wesson (2009)
 - Heuristics for e-learning systems developed by Ardito et al. (2006)
- Online live demo of Microsoft Dynamics CRM and salesforce.com

D.1 Recruitment Material

Dear Participant:

My name is Bettina Lechner and I am a graduate student at the University of Nebraska at Omaha working on my Master's thesis under the advisement of Dr. Ann Fruhling. As part of my thesis, I am conducting a study investigating usability heuristics for customer relationship management (CRM) systems.

You are invited to participate in a focus group study with the aim of identifying new and obsolete usability heuristics for web-based customer relationship management systems. The study is planned to take place on Thursday, June 21st, 2012 at 4PM, at the Peter Kiewit Institute at the University of Nebraska at Omaha (1110 S. 67th St, Omaha, NE). The study will take about three hours of your time. Dinner will be provided.

There are a number of established and tested usability heuristics which have been developed for desktop applications or software in general. Web applications, however, have a number of limitations and likewise advantages that differentiate them from traditional desktop applications. While there is some research investigating usability heuristics for web sites and web applications, these heuristics are of general nature and do not focus on web-based CRM systems. It has been recommended that general heuristics be complemented by heuristics specific to the domain they are to be applied to, since general heuristics are likely to miss domain-specific problems.

The aim of this study is to identify new and obsolete usability heuristics for web-based CRM software. Should you decide to participate in this study, you would be asked to work in a small group with other usability experts to review and evaluate a set of usability heuristics provided to you, as well as to supplement those heuristics with new ones specific to web-based CRM software. Your risks are limited to a potential loss of confidentiality. You will receive a copy of the final report, if you are interested.

If you are interested in participating in this research or have any questions related to it, please reply to this e-mail or contact one of the persons listed below by Thursday,

June 14th, 2012.

Bettina Lechner: (402) 218-9887 or blechner@unomaha.edu

Dr. Ann Fruhling: (402) 554-4968 or afruhling@unomaha.edu

D.2 Background Questionnaire

The following questions were used to collect information about the participants' experience in fields relevant to the study. The answers were collected through paper forms and were linked to the participants' responses throughout the study by assigning a unique ID number to each participant.

How many years of experience do you have working in the usability _____ field?

How many years of experience do you have evaluating, designing, _____ or developing user interfaces?

How many years of experience do you have using a CRM system? _____

How many years of experience do you have evaluating, designing, _____ or developing CRM systems?

D.3 Description of CRM Systems

Customer relationship management (CRM) systems are used by many organizations to implement targeted marketing and advertising strategies and to build lucrative relationships with customers. To this end, these systems offer certain common functionalities (Band et al., 2010c; Chaffey, 2011):

- Customer selection (identify types of customers to target, segment customers):
customer business intelligence, customer data management
- Customer acquisition (perform marketing activities to form relationships with

new customers): sales force automation (leads management, approval workflows, quoting), revenue and pricing management, order management

- Customer retention (perform marketing activities to maintain relationships with customers): electronic bill presentment and payment, interactive voice response, contact center infrastructure, customer service and support
- Customer extension (increase depth or range of products a customer purchases from the company): sales force automation, customer service management

D.4 Instructions for Participants

D.4.1 Setup for Group Support System

- URL: [removed]
- User Name: [removed]
- Session ID: [removed]
- Session Passkey: [removed]

D.4.2 Tasks

Step 1

Please review the informational materials about CRM systems on your desk. These materials include a short description of CRM systems and typical functionality and screen shots of two different web-based CRM systems. In addition, there should be a browser window open on your computer. The browser is logged into two web-based CRM systems (Microsoft Dynamics CRM and salesforce.com) you can interact with to familiarize yourself with their functionality.

Step 2

Please review the list of heuristics on your desk. By design, some of these heuristics may be more applicable to web-based CRM systems than others. There may be some heuristics which seem like duplicates or are very similar to each other, but this is also intentional.

Log on to the group support system using the information provided above, where you will find the same list of usability heuristics. Please cast your vote with regard to how applicable you think each individual heuristic is to web-based CRM systems. You can also indicate whether you think any modifications to the original wording are necessary to account for CRM systems.

Step 3

Once you are done voting, please proceed to the brainstorming activity. Please enter any heuristics that you think are relevant to web-based CRM systems, but are not present in the list you reviewed during the previous activity. As other participants enter their ideas, you can comment on them.

Step 4

Participate in the group discussion led by the moderator.

Step 5

Fill out the short questionnaire about your professional background.

Appendix E

Materials Used in Second Focus Group

The following materials were used for the second phase of the study which included CRM users.

- Recruitment material
- List of usability heuristics developed by usability experts in first phase (see appendix section F.2)
- Background questionnaire

E.1 Recruitment Material

Dear Participant:

My name is Bettina Lechner and I am a graduate student at the University of Nebraska at Omaha working on my Master's thesis under the advisement of Dr. Ann Fruhling. As part of my thesis, I am conducting a study investigating usability heuristics for customer relationship management (CRM) systems.

You are invited to participate in a study with the aim of identifying new and obsolete usability heuristics for web-based customer relationship management systems. If you choose to participate, I will send you an online survey, which should take about 30 minutes to complete. After you complete the survey, I would give you a phone call to discuss any further ideas or opinions you might have.

Usability heuristics are general principles or best practices that help software developers improve the user-friendliness of the applications they develop. Usability heuristics are used to evaluate a user interface design and identify problems that can then be fixed. There are many different sets of usability heuristics that already exist, which are either very general or focused on specific types of applications.

The aim of this study is to identify new and obsolete usability heuristics for web-based CRM software. Your risks are limited to a potential loss of confidentiality. You will receive a copy of the final report, if you are interested.

If you are interested in participating in this research or have any questions related to it, please contact one of the persons listed below.

Bettina Lechner: (402) 218-9887 or blechner@unomaha.edu

Dr. Ann Fruhling: (402) 554-4968 or afruhling@unomaha.edu

E.2 Background Questionnaire

The following questions were used to collect information about the participants' experience in fields relevant to the study. The answers were collected through paper forms and were linked to the participants' responses throughout the study by assigning a unique ID number to each participant.

How many years of experience do you have using a CRM (customer _____ relationship management) system?

How many years of experience do you have using a web-based/
online CRM system (using an Internet browser such as Internet
Explorer or Mozilla Firefox to access the system)? _____

How often do you use the CRM system? _____

Appendix F

Lists of Heuristics Created

This section contains the three lists developed in the various phases of this study. Section F.1 consists of the heuristics selected in the literature review, which were presented to the usability experts for review. Section F.2 contains the heuristics developed by the usability experts during the first phase of the empirical study. This list was used as the basis for the second phase. Section F.3 consists of the heuristics developed by the CRM users during the second phase of the empirical study. Please note that although each heuristic is linked back to its source in the tables following, the participants did not receive this information. They were only presented the heuristics themselves.

F.1 List Based on Literature Review

Table F.1: List of heuristics developed during literature review; N = Nielsen (1994b), S = Singh and Wesson (2009), A = Ardito et al. (2006)

Heuristic	Source
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.	N

Heuristic	Source
The system should speak the users' language with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.	N
Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support and undo and redo.	N
Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.	N
Even better than good error messages is a careful design which prevents a problem from occurring in the first place.	N
Make object, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.	N
Accelerators – unseen by the novice user – may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.	N
Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.	N
Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	N
Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.	N
Information can be easily accessed	S
Functionality can be found quickly and easily	S
The system can guide the user through the correct sequence of transaction to complete a business process	S
The UI supports efficient and accurate navigation of the system	S
Functionality to search for information that is available	S

Heuristic	Source
There is a correlation between the searched item and the required information	S
The system is capable of supporting the different interaction styles of the various users	S
The system supports alternative navigation metaphors	S
The system supports guidance-type information	S
There is clarity in terms of the next sequence of transactions of steps	S
The visual layout is well designed	S
The information provided by the system is timely, accurate, complete and understandable	S
The output is easy to understand and interpret, whether the output is structured	S
The information presented supports informed decision making	S
The output provided provides clear visibility into the various other departments	S
The UI is intuitive	S
Maintain UCD [user-centered design] attributes for interface graphical aspects	A
Introduce mechanism to highlight errors and cues to avoid errors	A
Provide the possibility to personalize interface graphics	A
Clearly and constantly indicate system state	A
Clearly visualize progress tracking	A
Clearly visualize options and commands available	A
Clearly visualize course structure	A
Provide adaptation of the graphical aspect to the context of use	A
The terminology used by the system is consistent with the terminology of the user	S
The information provided by the system is in real-time	S
The responses from the system are quick and efficient	S
The system supports efficient completion of tasks	S
The system improves user productivity	S

Heuristic	Source
The system automates routine and redundant tasks	S
The system is easy to use	S
The system supports improved information flow between the various organizational departments	S
A user can learn how to use the system without a long introduction	S
The various functions of the system can be identified by exploration	S
There is sufficient on-line help to support the learning process	S
It is easy to become skillful at using the system within a short amount of time	S
The system is intimidating and complex to learn and use	S
The ease in which the system can be configured to a particular industry type	S
The capability of the system to support user-level customization	S
The capability of the system to support customization for the user at a transaction level	S
The alignment of the system to update existing business processes, and (or) to include new ones	S
The ability of the system to be re-configured over a period of time	S
The ability of the UI to be configured without affecting the underlying business logic of the system	S
Provide support for the preparation of the multimedia material	A
Highlight cross-references by state and course maps to facilitate topic links	A
Supply different media channels for communication	A
Maximize personalized access to learning contents	A
Allow repository access to both lecturer and student	A
Create contextualized bookmarks	A
Enable off-line use of platform maintaining tools and learning context	A
Insert assessment tests in various forms	A
Automatically update students' progress tracking	A
Insert learning domain tools	A

Heuristic	Source
Provide mechanisms to manage user's profiles	A
Introduce mechanisms to prevent usage errors	A
Provide mechanisms for teaching-through-errors	A
Allow different repository modes for lecturers and students	A
Insert easy to use platform tools	A
Maximize adaptation of technology to the context of use	A
Register the date of last modification of documents to facilitate updating	A
Provide easy-to-use authoring tools	A
Enable to define a clear learning path	A
Allow to define alternative learning paths	A
Provide support for assessment test	A
Manage reports about attendance and usage of a course	A
Allow use of learning tools even when not scheduled	A
Provide both synchronous and asynchronous communication tools	A
Provide communication mechanisms to both students and lecturers	A
Allow the possibility to personalize the learning path	A
Insert mechanisms to make annotations	A
Provide mechanisms to integrate the didactic material	A
Provide mechanisms for search by indexing, key or natural language	A
Allow the possibility to create standard-compliant documents and tests (AICC, IMS, SCORM)	A
Provide authoring tools to facilitate documents updating and assessment tests editing	A

F.2 List Developed by Usability Experts

Table F.2: List of heuristics developed during first phase; * heuristic is a reworded version of original; N = Nielsen (1994b), S = Singh and Wesson (2009), A = Arditò et al. (2006)

Heuristic	Source
Maximize adaptation of technology to the context of use	A
The system is customizable at the user level	A*
Insert mechanisms to make annotations	A
Clearly visualize user workflow	A*
Clearly visualize options and commands available	A
Clearly and constantly indicate system state	A
Clearly visualize progress tracking	A
Introduce mechanism to highlight errors and cues to avoid errors	A
Provide mechanisms to manage user's profiles	A
Provide mechanisms for search by indexing, key or natural language	A
The system's communication mechanisms match the needs of the users	A*
Maintain UCD [user-centered design] attributes for interface graphical aspects	A
Highlight cross-references between different types of data (e.g. customer issues, sales support, and marketing campaigns)	A*
Register the date of last modification of documents to facilitate updating	A
Provide easy-to-use authoring tools	A
Supply different media channels for communication	A
Introduce mechanisms to prevent usage errors	A
Provide both synchronous and asynchronous communication tools	A
The system conforms to platform conventions	A*
Provide mechanisms for teaching-through-errors	A
Clearly visualize employee performance	A*
Even better than good error messages is a careful design which prevents a problem from occurring in the first place.	N

Heuristic	Source
Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	N
Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.	N
Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.	N
Accelerators – unseen by the novice user – may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.	N
Make object, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.	N
Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.	N
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.	N
The system should speak the users' language with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.	N
Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support and undo and redo.	N
The system provides appropriate filters to organize data	New
The system has a dashboard which provides a quick glance of the current status	New
The system displays appropriate information depending on the task at hand	New
Help and documentation are immersed in the system, non-obtrusive, and ubiquitous	New
The system allows for tailoring of the interface to an individual's workflow	New

Heuristic	Source
The terminology used by the system is consistent with the terminology of the user	S
The various functions of the system can be identified by exploration	S
The system is capable of supporting the different interaction styles of the various users	S
Functionality can be found quickly and easily	S
The information provided by the system is in real-time	S
The ability of the system to be re-configured over a period of time	S
The output style fits the type of data being displayed	S*
The responses from the system are quick and efficient	S
The system is easy to use	S
The ease in which the system can be configured to a particular industry type	S
The system supports efficient completion of tasks	S
The system can guide the user through the correct sequence of transaction to complete a business process	S
The system reduces intimidation and complexity by providing positive feedback and reinforcement, a clear path to execution, and a terminology that matches the users' language	S*
The output provided provides clear visibility into the various other departments	S
The capability of the system to support user-level customization	S
The system automates routine and redundant tasks	S
The alignment of the system to update existing business processes, and (or) to include new ones	S
The results returned by a search are relevant to the information required by the user	S*
The ability of the UI to be configured without affecting the underlying business logic of the system	S
Information can be easily accessed	S
The system supports improved information flow between the various organizational departments	S

Heuristic	Source
There is clarity in terms of the next sequence of transactions of steps	S
It is easy to become skillful at using the system within a short amount of time	S
The UI supports efficient and accurate navigation of the system	S
The system improves user productivity	S
Functionality to search for information that is available	S
The information provided by the system is timely, accurate, complete and understandable	S
The information presented supports informed decision making	S
There is sufficient on-line help to support the learning process	S
The visual layout is well designed	S
The UI is intuitive	S
A user can learn how to use the system without a long introduction	S

F.3 List Validated by CRM Users

Table F.3: List of heuristics developed during second phase; * heuristic is a reworded version of original; N = Nielsen (1994b), S = Singh and Wesson (2009), A = Ardito et al. (2006), New = newly developed heuristic

Heuristic	Source
Clearly and constantly indicate system state	A
Clearly visualize employee performance	A*
Clearly visualize options and commands available	A
Clearly visualize progress tracking	A
Clearly visualize user workflow	A*
Highlight cross-references between different types of data (e.g. customer issues, sales support, and marketing campaigns)	A*
Insert mechanisms to make annotations	A
Introduce mechanism to highlight errors and cues to avoid errors	A

Heuristic	Source
Introduce mechanisms to prevent usage errors	A
Maintain UCD [user-centered design] attributes for interface graphical aspects	A
Maximize adaptation of technology to the context of use	A
Provide both synchronous and asynchronous communication tools	A
Provide easy-to-use authoring tools	A
Provide mechanisms for search by indexing, key or natural language	A
Provide mechanisms for teaching-through-errors	A
Provide mechanisms to manage user's profiles	A
Register the date of last modification of documents to facilitate updating	A
Supply different media channels for communication	A
The system conforms to platform conventions	A*
The system is customizable at the user level	A*
The system's communication mechanisms match the needs of the users	A*
Accelerators – unseen by the novice user – may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.	N
Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.	N
Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	N
Even better than good error messages is a careful design which prevents a problem from occurring in the first place.	N
Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.	N
Make object, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.	N

Heuristic	Source
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.	N
The system should speak the users' language with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.	N
Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.	N
Help and documentation are immersed in the system, non-obtrusive, and ubiquitous	New
The system allows for tailoring of the interface to an individual's workflow	New
The system displays appropriate information depending on the task at hand	New
The system has a dashboard which provides a quick glance of the current status	New
The system provides appropriate filters to organize data	New
A user can learn how to use the system without a long introduction	S
Functionality can be found quickly and easily	S
Functionality to search for information that is available	S
Information can be easily accessed	S
It is easy to become skillful at using the system within a short amount of time	S
The ability of the system to be re-configured over a period of time	S
The ability of the UI to be configured without affecting the underlying business logic of the system	S
The alignment of the system to update existing business processes, and (or) to include new ones	S
The capability of the system to support user-level customization	S
The ease in which the system can be configured to a particular industry type	S
The information presented supports informed decision making	S
The information provided by the system is in real-time	S

Heuristic	Source
The information provided by the system is timely, accurate, complete and understandable	S
The output provided provides clear visibility into the various other departments	S
The output style fits the type of data being displayed	S*
The responses from the system are quick and efficient	S
The results returned by a search are relevant to the information required by the user	S*
The system automates routine and redundant tasks	S
The system can guide the user through the correct sequence of transaction to complete a business process	S
The system improves user productivity	S
The system is capable of supporting the different interaction styles of the various users	S
The system is easy to use	S
The system reduces intimidation and complexity by providing positive feedback and reinforcement, a clear path to execution, and a terminology that matches the users' language	S*
The system supports efficient completion of tasks	S
The system supports improved information flow between the various organizational departments	S
The terminology used by the system is consistent with the terminology of the user	S
The UI [user interface] is intuitive	S
The UI supports efficient and accurate navigation of the system	S
The various functions of the system can be identified by exploration	S
The visual layout is well designed	S
There is clarity in terms of the next sequence of transactions of steps	S
There is sufficient on-line help to support the learning process	S

F.4 Final, Unified List of Heuristics

Table F.4: Final, unified list of heuristics for web-based CRM systems

Category	Heuristic	Source
Application Proactivity	Introduce mechanisms to prevent usage errors	A
Application Proactivity	Maximize adaptation of technology to the context of use	A
Application Proactivity	Provide mechanisms for teaching-through-errors	A
Application Proactivity	Provide mechanisms to manage user's profiles	A
Application Proactivity	Register the date of last modification of documents to facilitate updating	A
Application Proactivity	The system conforms to platform conventions	A
Customization	The ability of the system to be re-configured over a period of time	S
Customization	The ability of the UI to be configured without affecting the underlying business logic of the system	S
Customization	The alignment of the system to update existing business processes, and (or) to include new ones	S
Customization	The capability of the system to support user-level customization	S
Customization	The ease in which the system can be configured to a particular industry type	S
Customization	The system allows for tailoring of the interface to an individual's workflow	New
Learnability	A user can learn how to use the system without a long introduction	S
Learnability	Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.	N
Learnability	Help and documentation are immersed in the system, non-obtrusive, and ubiquitous	New
Learnability	It is easy to become skillful at using the system within a short amount of time	S

Category	Heuristic	Source
Learnability	The system reduces intimidation and complexity by providing positive feedback and reinforcement, a clear path to execution, and a terminology that matches the users' language	S
Learnability	The various functions of the system can be identified by exploration	S
Learnability	There is sufficient on-line help to support the learning process	S
Navigation	Accelerators – unseen by the novice user – may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.	N
Navigation	Even better than good error messages is a careful design which prevents a problem from occurring in the first place.	N
Navigation	Functionality can be found quickly and easily	S
Navigation	Functionality to search for information that is available	S
Navigation	Information can be easily accessed	S
Navigation	Make object, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.	N
Navigation	The results returned by a search are relevant to the information required by the user	S
Navigation	The system can guide the user through the correct sequence of transaction to complete a business process	S
Navigation	The system is capable of supporting the different interaction styles of the various users	S
Navigation	The UI supports efficient and accurate navigation of the system	S
Navigation	There is clarity in terms of the next sequence of transactions of steps	S
Presentation	Clearly and constantly indicate system state	A
Presentation	Clearly visualize employee performance	A
Presentation	Clearly visualize options and commands available	A
Presentation	Clearly visualize progress tracking	A

Category	Heuristic	Source
Presentation	Clearly visualize user workflow	A
Presentation	Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.	N
Presentation	Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	N
Presentation	Introduce mechanism to highlight errors and cues to avoid errors	A
Presentation	Maintain UCD [user-centered design] attributes for interface graphical aspects	A
Presentation	The information presented supports informed decision making	S
Presentation	The information provided by the system is timely, accurate, complete and understandable	S
Presentation	The output provided provides clear visibility into the various other departments	S
Presentation	The output style fits the type of data being displayed	S
Presentation	The system is accessible and usable from mobile devices	New
Presentation	The system is customizable at the user level	A
Presentation	The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.	N
Presentation	The UI [user interface] is intuitive	S
Presentation	The visual layout is well designed	S
Task Support	Highlight cross-references between different types of data (e.g. customer issues, sales support, and marketing campaigns)	A
Task Support	Supply different media channels for communication	A
Task Support	The information provided by the system is in real-time	S
Task Support	The responses from the system are quick and efficient	S
Task Support	The system allows for synchronization of its information with outside communication tools	New
Task Support	The system automates routine and redundant tasks	S

Category	Heuristic	Source
Task Support	The system displays appropriate information depending on the task at hand	New
Task Support	The system has a dashboard which provides a quick glance of the current status	New
Task Support	The system improves user productivity	S
Task Support	The system is easy to use	S
Task Support	The system provides appropriate filters to organize data	New
Task Support	The system should speak the users' language with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.	N
Task Support	The system supports efficient completion of tasks	S
Task Support	The system supports improved information flow between the various organizational departments	S
Task Support	The terminology used by the system is consistent with the terminology of the user	S
Task Support	Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support and undo and redo.	N
Task Support	Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.	N
User Activity	Insert mechanisms to make annotations	A
User Activity	Provide both synchronous and asynchronous communication tools	A
User Activity	Provide easy-to-use authoring tools	A
User Activity	Provide mechanisms for search by indexing, key or natural language	A
User Activity	The system's communication mechanisms match the needs of the users	A

Appendix G

Detailed Results

G.1 First Phase

Table G.1: Mean and standard deviation for each heuristic's rating of applicability to CRM systems and need for rewording

Heuristic	Applicability			Need for Rewording		
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.	3.8	0.837	0.0	0.000		
The system should speak the users' language with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.	4.0	0.707	0.0	0.000		
Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support and undo and redo.	4.6	0.894	0.0	0.000		
Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.	4.4	0.894	0.0	0.000		
Even better than good error messages is a careful design which prevents a problem from occurring in the first place.	4.0	1.000	0.0	0.000		
Make object, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.	4.0	0.707	0.0	0.000		
Accelerators—unseen by the novice user—may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.	4.4	0.894	0.0	0.000		

Heuristic	Applicability			Need for Rewording		
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.	3.8	0.837	0.4	0.548		
Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	4.0	0.707	0.0	0.000		
Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.	4.0	0.707	0.0	0.000		
Information can be easily accessed	4.0	1.000	0.4	0.548		
Functionality can be found quickly and easily	3.8	0.447	0.2	0.447		
The system can guide the user through the correct sequence of transaction to complete a business process	4.0	1.225	0.2	0.447		
The UI supports efficient and accurate navigation of the system	4.2	0.837	0.2	0.447		
Functionality to search for information that is available	3.4	1.140	0.6	0.548		
There is a correlation between the searched item and the required information	3.4	1.140	0.6	0.548		
The system is capable of supporting the different interaction styles of the various users	3.8	1.304	0.0	0.000		
The system supports alternative navigation metaphors	2.8	1.304	0.4	0.548		

Heuristic	Applicability			Need for Rewording		
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
The system supports guidance-type information	2.8	0.837	0.8	0.447		
There is clarity in terms of the next sequence of transactions of steps	3.8	1.304	0.2	0.447		
The visual layout is well designed	4.0	0.707	0.6	0.548		
The information provided by the system is timely, accurate, complete and understandable	4.4	0.894	0.4	0.548		
The output is easy to understand and interpret, whether the output is structured	3.6	0.548	0.8	0.447		
The information presented supports informed decision making	4.2	0.837	0.2	0.447		
The output provided provides clear visibility into the various other departments	3.0	1.414	0.4	0.548		
The UI is intuitive	3.8	0.447	0.4	0.548		
Maintain UCD [user-centered design] attributes for interface graphical aspects	4.0	0.707	0.4	0.548		
Introduce mechanism to highlight errors and cues to avoid errors	3.8	0.837	0.0	0.000		
Provide the possibility to personalize interface graphics	2.8	1.483	0.0	0.000		
Clearly and constantly indicate system state	3.8	0.837	0.0	0.000		
Clearly visualize progress tracking	3.2	1.304	0.2	0.447		
Clearly visualize options and commands available	3.8	0.447	0.2	0.447		
Clearly visualize course structure	2.0	0.707	0.8	0.447		

Heuristic	Applicability			Need for Rewording		
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Provide adaptation of the graphical aspect to the context of use	2.4	0.548	0.8	0.447		
The terminology used by the system is consistent with the terminology of the user	4.6	0.548	0.0	0.000		
The information provided by the system is in real-time	3.8	1.304	0.2	0.447		
The responses from the system are quick and efficient	4.0	0.707	0.0	0.000		
The system supports efficient completion of tasks	4.0	1.225	0.0	0.000		
The system improves user productivity	3.6	1.140	0.4	0.548		
The system automates routine and redundant tasks	4.2	0.837	0.0	0.000		
The system is easy to use	3.8	0.837	0.4	0.548		
The system supports improved information flow between the various organizational departments	3.8	1.304	0.0	0.000		
A user can learn how to use the system without a long introduction	4.0	0.707	0.0	0.000		
The various functions of the system can be identified by exploration	3.8	0.447	0.0	0.000		
There is sufficient on-line help to support the learning process	3.8	0.837	0.0	0.000		
It is easy to become skillful at using the system within a short amount of time	3.4	0.548	0.4	0.548		
The system is intimidating and complex to learn and use	1.4	0.894	0.6	0.548		
The ease in which the system can be configured to a particular industry type	4.0	0.000	0.2	0.447		

Heuristic	Applicability			Need for Rewording		
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
The capability of the system to support user-level customization	3.4	1.140	0.0	0.000	0.000	0.000
The capability of the system to support customization for the user at a transaction level	2.8	0.837	0.0	0.000	0.000	0.000
The alignment of the system to update existing business processes, and (or) to include new ones	4.2	0.447	0.0	0.000	0.000	0.000
The ability of the system to be re-configured over a period of time	3.8	1.095	0.0	0.000	0.000	0.000
The ability of the UI to be configured without affecting the underlying business logic of the system	4.4	0.548	0.0	0.000	0.000	0.000
Provide support for the preparation of the multimedia material	2.6	1.342	0.2	0.447	0.447	0.447
Highlight cross-references by state and course maps to facilitate topic links	2.2	0.837	0.6	0.548	0.548	0.548
Supply different media channels for communication	3.6	0.894	0.2	0.447	0.447	0.447
Maximize personalized access to learning contents	2.8	0.447	0.4	0.548	0.548	0.548
Allow repository access to both lecturer and student	2.0	1.732	0.4	0.548	0.548	0.548
Create contextualized bookmarks	2.8	1.643	0.4	0.548	0.548	0.548
Enable off-line use of platform maintaining tools and learning context	2.8	1.304	0.4	0.548	0.548	0.548
Insert assessment tests in various forms	1.4	0.548	0.0	0.000	0.000	0.000
Automatically update students' progress tracking	1.6	0.548	0.4	0.548	0.548	0.548
Insert learning domain tools	1.8	0.837	0.4	0.548	0.548	0.548

Heuristic	Applicability			Need for Rewording		
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Provide mechanisms to manage user's profiles	3.2	0.837	0.2	0.447	0.447	0.447
Introduce mechanisms to prevent usage errors	3.8	0.447	0.0	0.000	0.000	0.000
Provide mechanisms for teaching-through-errors	3.2	1.304	0.0	0.000	0.6	0.548
Allow different repository modes for lecturers and students	1.8	1.304	0.8	0.447	0.4	0.548
Insert easy to use platform tools	2.0	0.707	0.6	0.548	0.6	0.548
Maximize adaptation of technology to the context of use	3.0	1.000	0.4	0.548	0.4	0.548
Register the date of last modification of documents to facilitate updating	4.6	0.548	0.0	0.000	0.0	0.000
Provide easy-to-use authoring tools	3.6	1.140	0.2	0.447	0.2	0.447
Enable to define a clear learning path	2.2	0.837	0.4	0.548	0.4	0.548
Allow to define alternative learning paths	2.2	0.837	0.4	0.548	0.4	0.548
Provide support for assessment test	2.0	0.707	0.2	0.447	0.2	0.447
Manage reports about attendance and usage of a course	1.8	0.837	0.2	0.447	0.2	0.447
Allow use of learning tools even when not scheduled	2.2	1.095	0.2	0.447	0.2	0.447
Provide both synchronous and asynchronous communication tools	3.6	0.548	0.0	0.000	0.0	0.000
Provide communication mechanisms to both students and lecturers	2.0	0.707	0.6	0.548	0.6	0.548
Allow the possibility to personalize the learning path	2.0	0.707	0.4	0.548	0.4	0.548
Insert mechanisms to make annotations	3.6	1.517	0.2	0.447	0.2	0.447

Heuristic	Applicability			Need for Rewording		
	Mean	Std. Dev.	Mean	Mean	Std. Dev.	Std. Dev.
Provide mechanisms to integrate the didactic material	1.8	0.447	0.6	0.6	0.548	
Provide mechanisms for search by indexing, key or natural language	3.6	1.140	0.2	0.2	0.447	
Allow the possibility to create standard-compliant documents and tests (AICC, IMS, SCORM)	1.6	0.548	0.2	0.2	0.447	
Provide authoring tools to facilitate documents updating and assessment tests editing	2.4	1.140	0.2	0.2	0.447	

G.2 Second Phase

Table G.2: Mean and standard deviation for each heuristic's rating of applicability to CRM systems

Heuristic	Applicability		
	Mean	Std. Dev.	
Clearly and constantly indicate system state	3.80	1.166	
Clearly visualize employee performance	4.83	0.373	
Clearly visualize options and commands available	4.00	1.000	
Clearly visualize progress tracking	4.60	0.490	
Clearly visualize user workflow	4.33	0.943	
Highlight cross-references between different types of data (e.g. customer issues, sales support, and marketing campaigns)	4.83	0.373	
Insert mechanisms to make annotations	3.40	0.490	
Introduce mechanism to highlight errors and cues to avoid errors	3.00	0.632	
Introduce mechanisms to prevent usage errors	4.60	0.490	
Maintain UCD [user-centered design] attributes for interface graphical aspects	4.25	0.829	
Maximize adaptation of technology to the context of use	4.33	0.471	
Provide both synchronous and asynchronous communication tools	4.50	0.500	
Provide easy-to-use authoring tools	3.75	1.299	
Provide mechanisms for search by indexing, key or natural language	4.20	1.166	
Provide mechanisms for teaching-through-errors	3.00	1.265	

Heuristic	Applicability	
	Mean	Std. Dev.
Provide mechanisms to manage user's profiles	3.20	1.166
Register the date of last modification of documents to facilitate updating	4.60	0.490
Supply different media channels for communication	4.00	1.414
The system conforms to platform conventions	3.67	0.943
The system is customizable at the user level	3.50	1.258
The system's communication mechanisms match the needs of the users	4.17	1.067
Accelerators – unseen by the novice user – may often speed up the interaction for the expert user to such an extent that the system can cater to both inexperienced and experienced users.	3.60	1.020
Allow users to tailor frequent actions.		
Dialogues should not contain information which is irrelevant or rarely needed. Every extra unit of information in a dialogue competes with the relevant units of information and diminishes their relative visibility.	3.00	1.414
Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.	5.00	0.000
Even better than good error messages is a careful design which prevents a problem from occurring in the first place.	4.33	0.471
Even though it is better if the system can be used without documentation, it may be necessary to provide help and documentation. Any such information should be easy to search, focused on the user's task, list concrete steps to be carried out, and not be too large.	4.33	0.471

Heuristic	Applicability	Mean	Std. Dev.
Make object, actions, and options visible. The user should not have to remember information from one part of the dialogue to another. Instructions for use of the system should be visible or easily retrievable whenever appropriate.	4.67	0.471	
The system should always keep users informed about what is going on, through appropriate feedback within reasonable time.	4.40	0.800	
The system should speak the users' language with words, phrases, and concepts familiar to the user, rather than system-oriented terms. Follow real-world conventions, making information appear in a natural and logical order.	4.80	0.400	
Users often choose system functions by mistake and will need a clearly marked "emergency exit" to leave the unwanted state without having to go through an extended dialogue. Support and undo and redo.	1.83	0.687	
Users should not have to wonder whether different words, situations, or actions mean the same thing. Follow platform conventions.	4.80	0.400	
Help and documentation are immersed in the system, non-obtrusive, and ubiquitous	3.80	0.748	
The system allows for tailoring of the interface to an individual's workflow	3.17	1.067	
The system displays appropriate information depending on the task at hand	4.17	0.687	
The system has a dashboard which provides a quick glance of the current status	4.83	0.373	
The system provides appropriate filters to organize data	4.17	0.373	
A user can learn how to use the system without a long introduction	3.83	1.344	
Functionality can be found quickly and easily	4.17	1.213	

Heuristic	Applicability	Mean	Std. Dev.
Functionality to search for information that is available	5.00	0.000	
Information can be easily accessed	5.00	0.000	
It is easy to become skillful at using the system within a short amount of time	4.33	0.745	
The ability of the system to be re-configured over a period of time	4.40	0.490	
The ability of the UI to be configured without affecting the underlying business logic of the system	3.00	0.894	
The alignment of the system to update existing business processes, and (or) to include new ones	4.80	0.400	
The capability of the system to support user-level customization	3.67	1.247	
The ease in which the system can be configured to a particular industry type	3.80	0.980	
The information presented supports informed decision making	4.80	0.400	
The information provided by the system is in real-time	4.50	0.764	
The information provided is timely, accurate, complete and understandable	5.00	0.000	
The output provided provides clear visibility into the various other departments	4.50	0.500	
The output style fits the type of data being displayed	4.60	0.490	
The responses from the system are quick and efficient	4.83	0.373	
The results returned by a search are relevant to the information required by the user	4.67	0.471	
The system automates routine and redundant tasks	4.40	0.800	

Heuristic	Applicability	Mean	Std. Dev.
The system can guide the user through the correct sequence of transaction to complete a business process	3.67	1.247	
The system improves user productivity	4.67	0.745	
The system is capable of supporting the different interaction styles of the various users	3.50	1.258	
The system is easy to use	4.33	0.745	
The system reduces intimidation and complexity by providing positive feedback and reinforcement, a clear path to execution, and a terminology that matches the users' language	3.67	1.247	
The system supports efficient completion of tasks	4.67	0.471	
The system supports improved information flow between the various organizational departments	4.67	0.471	
The terminology used by the system is consistent with the terminology of the user	4.83	0.373	
The UI [user interface] is intuitive	4.33	1.106	
The UI supports efficient and accurate navigation of the system	4.50	0.764	
The various functions of the system can be identified by exploration	3.75	0.829	
The visual layout is well designed	4.00	0.816	
There is clarity in terms of the next sequence of transactions of steps	4.17	0.687	
There is sufficient on-line help to support the learning process	4.50	0.500	