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**Creating a usable web-based calendar
and reminder service; an investigation
of internal and external information
management**

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BIRTHDAYHERO

*Creating a usable web-based calendar and reminder service;
an investigation of internal and external information management*

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Abstract

The thesis explores how a web-based calendar and reminder service called BirthdayHero could help users improve how well they remember birthdays, anniversaries and other important events. A primary goal is to use the design process to better understand the relationship between internal and external information management. Internal information management is what we do when we use our memory to store and manage information. External information management is the use of physical or digital artifacts, like calendars or journals.

To understand user needs, interviews have been conducted with potential users. The interviews uncovered that people use many different tools to manage birthdays and events. Not all of their needs are met with the tools they are currently using. Almost all participants would have liked to get SMS text message reminders for important events. The strengths and weaknesses of using e-mail and SMS messages as reminders are discussed. The thesis argues that SMS reminders are the best choice for reminding users of events, because they are immediately received and are likely to be read.

The thesis is structured around four central research questions.

The first research question concerns the development of a usable web-based calendar and reminder service. Working prototypes of the calendar interface have been designed and tested for usability. The tests found that the prototypes are to some extent usable and satisfy user needs, but that there is still room for improvement.

Second, the differences between internal and external information management are explored. This is done to outline the strengths and weaknesses of relying on our memory to remember important dates, versus relying on calendars, organizers or other physical artifacts.

Third, the contrasts between appliance and general purpose services are discussed. The thesis argues that BirthdayHero could fulfill an unmet user need as a backup service. It can ensure that users can't forget important events, while keeping the complexity of the service to a minimum. This entails that the service will be an appliance service, focusing on doing one thing, and doing it well.

Finally, the thesis presents a method of improving how well users memorize dates, based on a learning technique called spaced repetition. Through a prototype design, it explores how the service could improve how well users remember events even without reminders.

Preface

This thesis was written to achieve a master's degree in "IT- språk, logikk og psykologi" (IT – language, logic and psychology) at the University of Oslo, 2010.

I would like to thank my counselor, Jo Herstad, at the Department of Informatics for great advice on both writing and theory. I would also like to thank all those who have played a part in making this thesis happen, and especially friends and family for their support.

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1. Introduction

The last century has witnessed an explosive growth in tools of human communication. With the advent of cell phones and the internet we can reach almost anyone on the planet within seconds. With this technology also came opportunities to maintain social relationships with friends and family both locally and globally. We can even find new friends who share our interests, but who may very well live on other continents. Although our social networks may have grown in size, our innate ability to efficiently store and recall information about our social contacts has not advanced considerably. This thesis will investigate how a proposed web-based service called BirthdayHero could help people remember more of the important events in their lives. Specifically, the thesis explores how a usable web-based calendar coupled with e-mail and SMS text message reminders could help users remember birthdays, anniversaries and other important events. It will examine methods of internal and external information management, and whether a combination of these methods could help make our lives a little easier. The thesis also explores how the BirthdayHero service could be designed to improve how well we remember birthdays and other events even without receiving reminders.

1.1 Background

A basic goal of Human-Computer Interaction (HCI) is to improve the interactions between users and computers by making computers more usable and receptive to the user's needs. To discover what these needs are, interaction designers must develop an understanding of what problems the user faces, and how technology could help solve those problems. A common problem in our daily lives is information overload – having too much information to process and remember. The BirthdayHero service aims to alleviate information overload by letting users transition from internal to external information management. We often struggle with remembering arbitrary information like dates for long periods of time. Some of the work of organizing, managing and reminding us of important events could be delegated to a computer, leaving us free to worry about other things.

Another relevant field is that of Personal Information Management (PIM). Many PIM tools have been developed to help us organize our lives. These include task managers, calendars and organizers. A PIM tool's purpose is to facilitate the recording, tracking, and

management of certain types of personal information. (Jones & Teevan, 2007) Many of these tools are increasingly becoming digital, making the field of PIM in some ways intertwine with HCI. Creating a PIM tool to be used on digital devices requires an understanding of the interactions between man and machine.

The evolution of computer interfaces has been from *recall* to *recognition*. Early operating systems presented the user with a command prompt which relied on the user *recalling* the appropriate commands to type in. These interfaces were cumbersome, especially for novice users, because they relied too heavily on the user's memory. With more computing power came the introduction of graphical user interfaces (GUI) in the 1980s. These advances made systems and services more intuitive, because the user only needed to *recognize* icons on the screen to perform actions that would previously have required the user to memorize commands. The service I propose in this thesis can be seen as a contribution to both the study of Personal Information Management and HCI. BirthdayHero takes advantage of recognition to remind users of events they might otherwise forget. It also incorporates knowledge from the field of psychology to introduce a new method of improving its users' memory recall performance.

1.2 Memory and birthdays

Memory involves recalling information we have stored to enable us to act appropriately in various situations. Without memory, we would be unable to function. It allows us to recognize someone's face, remember that person's name, when we met them last, and so on. We can't remember everything we receive from our senses, however, as it would overload our brains. We filter information, attempting to store only what we need to remember. This filtering process is not without problems. Often we forget the things we need to remember, like birthdays and credit card PIN-codes. Other times we remember things we never really wanted to remember, like old songs playing endlessly in our minds.

A modern human being must memorize many types of arbitrary data. Phone numbers, street-addresses, e-mail addresses and birthdays, among others. Many low- and high-tech devices exist to help us organize and store this data. While some people use massive programs like Microsoft Outlook to manage their contacts and appointments, others rely on wall-mounted calendars and hand-scribbled Post-it notes. To keep in touch with friends and

family, many use Facebook or other social networks. Dates are but one of many pieces of data that we must remember, but forgetting birthdays and anniversaries can have social consequences, and therefore warrant further study.

1.3 Motivation

My own inability to efficiently remember birthdays made me want to investigate how we could use modern technology to prevent us from forgetting birthdays and other events. Another goal has been to get a deeper understanding of how people manage, remember and forget birthdays.

The central idea behind BirthdayHero, to send users reminders of upcoming birthdays, could be implanted in a million different ways. As an interaction designer, my goal is not to just make something that works, but to make something that is pleasurable to use. The idea of a reminder service is worth nothing without an excellent implementation. As Thomas Edison said, genius is “1 percent inspiration, 99% perspiration”. (Edison)

I find the challenges of creating this service to be intriguing because they embody knowledge from many diverse fields. To understand how our memory functions, we must look to the cognitive sciences. To find out what the effects of forgetting a birthday are, we must study social psychology. To create usable web interfaces requires knowledge about interaction design, graphic design and usability. Building a working prototype, in turn, requires programming skills.

This thesis is by no means a total exploration of all aspects and issues associated with managing birthdays and getting reminders. It should be viewed as a presentation of one potential solution to a problem. Designing and creating a usable implementation of a web-based calendar and reminder service forms the core of the thesis. Whether or not my vision for how this service should work is something that others will embrace and use, remains to be seen.

In the spirit of entrepreneurship, a secondary goal is to create a service that can be marketed and sold to consumers. This naturally requires that there is a market for the service and that the resulting prototype is usable enough to satisfy user needs.

1.4 Problem statements

This thesis will explore one practical and three theoretical problem statements. The sections below each represent one problem statement or area of interest. These areas of interest will be explored more fully in chapter 6 (Discussion).

1.4.1 Creating a usable web-based calendar and reminder service

Problem statement: *How can we create a usable web-based calendar and reminder system?*

To answer this practical problem statement we will first explore the problem space of remembering birthdays and events. We will then examine how people are using technology to remember birthdays and other events today, and how these solutions satisfy their needs. Potential users will be interviewed and the gathered data analyzed to gain insight into how people actually keep track of birthdays and events. This data will then be used as input into an iterative design process of producing working prototypes, which aim to satisfy the most critical user needs. The prototypes will be tested using usability tests on potential users. The strengths and weaknesses of the methods used during the design process will also be discussed.

1.4.2 Appliance or general purpose?

Problem statement: *Should BirthdayHero be an appliance or a general-purpose service?*

An appliance is a product or service that provides a narrow set of functions. A general-purpose service, in contrast, attempts to fulfill many needs. Back when they only let us make calls, cell phones were appliances. Now, they allow us to make calls, send text messages, play music and video, manage our calendars, read e-mail, play games, and so on. They have become general-purpose devices.

Appliances are usually easier to use than general-purpose devices. If you have learned how to ring a doorbell, you don't need to relearn how to use it the next time you are visiting someone. Added features and complexity can often make general-purpose devices more difficult to master. Paradoxically, new technology allows us to fit more features into products, but does little to make them easier to use. This inevitably results in more complexity and a steeper learning curve for new users. Recently, several products with a limited number of features have been successful in markets where it was traditionally

considered smart to have as many features as possible. Consider the Flip video camcorder by Pure Digital Technologies¹. The Flip was released in 2007, and quickly captured 13% of the camcorder market. Did it do this by having every possible advanced feature? No, the Flip succeeded, in part, because of what it did not have. The screen is tiny and doesn't swing out, so you can't take video of yourself. You can't take still photos. There is no memory card on the Flip, so you have to upload the videos to a computer when the memory is full (which happens after only about an hour of filming). There are no menus, no settings, no video light, no optical viewfinder, no special effects, no headphone jack, no high definition and no lens cap. Instead, the Flip offers simplicity. It's ready to record video two seconds after you turn it on. It's always ready, at your service.

How should BirthdayHero position itself? Is it a general-purpose service that you can use for anything and everything? Or is it an appliance, like the Flip, that only helps you remember birthdays, and nothing else? What are the drawbacks of choosing one over the other?

1.4.3 Internal and external information management

Problem statement: *What are the strengths and weaknesses of internal and external information management?*

Our memory can be considered "internal" information storage. We can also store information on or in external objects or devices, known in the HCI field as "artifacts". If we know we are likely to forget something, we can write it down. If we need to remember a phone number or a great recipe, we can write it down on a note, or in a journal. To remember someone's birthday, we might write it in a calendar, or type it into a program on our computer. What are the strengths and weaknesses of managing information internally and externally? Is one type of storage better than the other? What consequences does this have for the BirthdayHero service?

1.4.4 Improving users' memory recall performance

Problem statement: *Could the BirthdayHero service also improve the memory recall performance of its users?*

¹ See <http://www.theflip.com> and http://en.wikipedia.org/wiki/Flip_Video

I have two primary goals for the BirthdayHero service. The first is to ensure that users remember birthdays by sending them reminders. The second is to improve how well users remember birthdays *without reminders*. The second goal will be addressed through exploring the concept of *spaced repetition* as a learning technique to improve memory recall.

1.5 Structure of the thesis

Chapter 1 introduces the thesis and my motivation for choosing this topic. The four central problem statements are also presented. Chapter 2 introduces theoretical concepts that will be used later in the thesis. Chapter 3 describes the methods that have been used in the design process. These include interviews, prototyping and usability tests. Chapter 4 is the case description which describes the BirthdayHero concept more in-depth, and lays out some guidelines for the design process. Chapter 5 presents the data gathered from using the methods, and analyzes them for findings. Chapter 6 discusses the four problem statements using theory from chapter 2 and the findings from chapter 5. Chapter 7 concludes by summarizing the findings from the discussion, and chapter 8 presents ideas for future work.

2. Theory

This chapter first explores the concept of usability and why it is important when creating products and services. Then follows an explanation of the most basic concepts of memory and why we forget. As the BirthdayHero service aims to use reminders, we also explore what reminders are and compare different types of reminders.

2.1 Usability and design

2.1.1 What is usability?

A main goal of the BirthdayHero service is to create a usable service. But what does “usable” really mean? A practical definition of usability can be found in *Prioritizing Web Usability* by Jacob Nielsen and Hoa Loranger:

Usability is a quality attribute relating to how easy something is to use.

More specifically, it refers to how quickly people can learn to use something, how efficient they are while using it, how memorable it is, how error-prone it is, and how much users like using it.

(Nielsen & Loranger, 2006)

As we can see, usability is a broad term which spans several different areas. According to Nielsen, usability can be measured on these dimensions:

- **Learnability:** How easy is it for users to accomplish basic tasks the first time they encounter the design?
- **Efficiency:** Once users have learned the design, how quickly can they perform tasks?
- **Memorability:** When users return to the design after a period of not using it, how easily can they re establish proficiency?
- **Errors:** How many errors do users make, how severe are these errors, and how easily can they recover from the errors?
- **Satisfaction:** How pleasant is it to use the design?

Usability tests can be used to measure these dimensions and find out how usable a product is. A usability test is usually set up so that users of a product are given tasks to complete, and then observed as they go about solving the tasks while using the product. Usability tests can be used on all sorts of products, including doorknobs, television remotes, accounting software, e-mail clients and web services. As Steve Krug argues in his popular book on usability called *Don't make me think*, if you want a usable product you need to test it on users. (Krug, 2006) Krug presents seven guidelines for testing:

1. If you want a great site (or product) you need to test.

When you've worked on a site for a while, you no longer see it with fresh eyes. Getting new users to test the site will reveal what works and what doesn't. Krug makes the analogy of having friends visit from out of town. As you take them on a tour of local tourist destinations, you'll begin to see your town in a new light, inspired by the fresh perspective that your visitors bring with them. You'll notice things that you usually don't because you're so used to them. What seems obvious to you might not be so obvious to others.

2. Testing one user is 100% better than testing none.

Testing always works. According to Krug, even the worst test with the wrong user will reveal something that can improve the product being tested.

3. Testing one user early in the project is better than testing 50 near the end.

Most companies approach testing as a big deal, requiring lots of resources. Assuming that testing requires a great deal of effort will ensure that testing is done too infrequently to make a difference. As Krug argues, "a simple test early - while you still have time to use what you learn from it - is almost always more valuable than a sophisticated test later."

4. The importance of recruiting representative users is overrated.

Doing tests on users who are most like the potential users of your site is useful, but testing early and often is much more important. Problems are likely to be experienced by all users of the product, not only those most fitting with the stereotype of a "standard user".

5. The point of testing is not to prove or disprove something. It's to inform your judgment.

Many people like to think that they can use testing to prove whether navigation system "a" is better than navigation system "b". It can't, because to do that requires a strictly controlled experiment and more resources than most testers have access to. What testing can do, according to Krug, is to provide valuable input which taken together with a designer's experience, judgment and common sense, will make it easier to choose wisely - and with greater confidence, between "a" and "b".

6. Testing is an iterative process.

Testing is not something you should do once. It has to be a continuous process. First you might make a prototype, test it, fix what was wrong by making a new prototype and then test the new prototype. This process should repeat for as long as major problems are uncovered, or until funds for testing run out.

7. Nothing beats a live audience reaction.

The benefit of seeing how real users use and respond to the product you have designed cannot be understated. I can attest to the fact that it can be a humbling experience when the functionality and design you thought was foolproof and intuitive is completely misunderstood by users. User testing is a simple way of getting feedback from real users to inform your design decisions.

2.1.2 Design and usability terms

In designing and developing the BirthdayHero service, several design challenges had to be overcome. Let's take a closer look at some of the terms that will be used later in the discussion.

2.1.2.1 User centered design

Preece, Sharp and Rogers argue that *real users* and their goals, not just technology, should be the driving force behind product development. (Preece, Sharp, & Rogers, 2007) The authors present three guiding principles for creating useful and easy to use computer systems.

1. Early focus on users and tasks

This requires observing users completing normal tasks, studying the nature of those

tasks and then involving users in the design process. This has been done in this project by interviewing users about how they manage birthdays and anniversaries, as well as comparing the strengths and weaknesses of different methods of organizing and remembering birthdays and events.

2. Empirical measurement

When users interact with prototypes, their reactions and performance should be observed, recorded, and analyzed. The prototypes of the BirthdayHero service have been tested by potential users doing usability tests. The sessions were recorded, and the data from the sessions used to further develop the prototypes.

3. Iterative design

When problems are found during user testing, they should be fixed and then retested to see if the solutions have solved the problems. This entails an iterative design and development process. The BirthdayHero prototypes have been tested on users, and the feedback from the tests used to improve the prototypes.

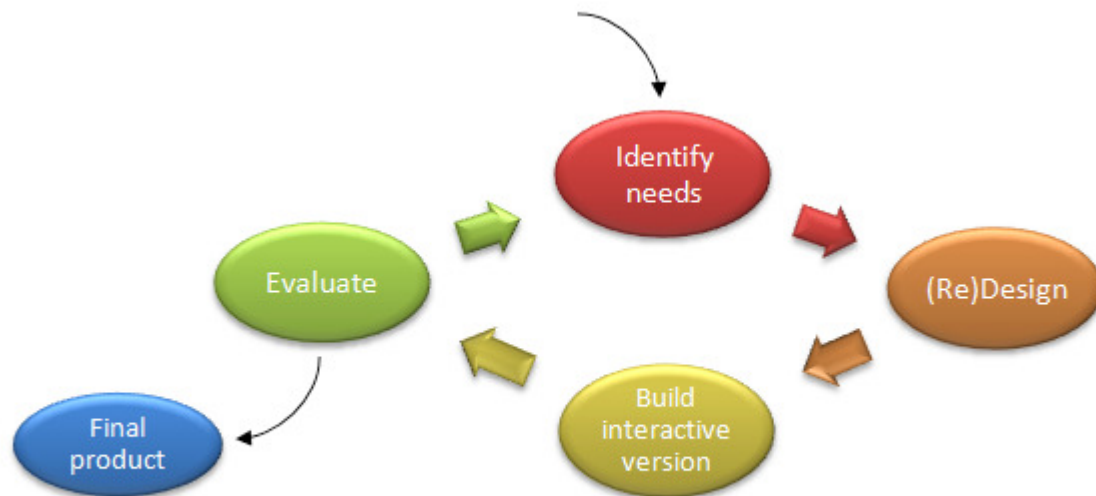


Figure 1 – The steps in the user centered design model

Figure 1 illustrates the steps in the user centered design model. It starts with identifying user needs, followed by a design stage, followed by prototyping, and then evaluation of the prototype. If the evaluation shows that the prototype is inadequate, the cycle can continue.

If the evaluation shows that the prototype has satisfied the user needs, a final product can be made. (Preece, Sharp, & Rogers, 2007)

2.1.2.2 Evaluation

Evaluation of a design can be done by seeing whether it adheres to commonly used user interface design heuristics. Here are 10 commonly used heuristics, as presented by Jacob Nielsen. (1994)

Visibility of system status: The system should always keep users informed about what is going on, through appropriate feedback within a reasonable time.

Match between system and the real world: 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.

User control and freedom: 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. The service should support undo and redo.

Consistency and standards: Users should not have to wonder whether different words, situations, or actions mean the same thing. The service should follow platform conventions.

Error prevention: Even better than good error messages is a careful design which prevents a problem from occurring in the first place. Either eliminate error-prone conditions or check for them and present users with a confirmation option before they commit to the action.

Recognition rather than recall: Minimize the user's memory load by making objects, 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.

Flexibility and efficiency of use: Accelerators -- unseen by the novice user -- may often speed up the interaction for the expert user such that the system can cater to both inexperienced and experienced users. Allow users to tailor frequent actions.

Aesthetic and minimalist design: 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.

Help users recognize, diagnose, and recover from errors: Error messages should be expressed in plain language (no codes), precisely indicate the problem, and constructively suggest a solution.

Help and documentation: 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.

Although they somewhat overlap the heuristics by Nielsen, Larry Constantine and Lucy Lockwood (2010) also introduce several valuable principles of user interface design.

The structure principle: Design should organize the user interface purposefully, in meaningful and useful ways based on clear, consistent models that are apparent and recognizable to users, putting related things together and separating unrelated things, differentiating dissimilar things and making similar things resemble one another. The structure principle is concerned with overall user interface architecture.

The simplicity principle: The design should make simple, common tasks easy, communicating clearly and simply in the user's own language, and providing good shortcuts that are meaningfully related to longer procedures.

The visibility principle: The design should make all needed options and materials for a given task visible without distracting the user with extraneous or redundant information. Good designs don't overwhelm users with alternatives or confuse with unneeded information.

The feedback principle: The design should keep users informed of actions or interpretations, changes of state or condition, and errors or exceptions that are relevant and of interest to the user through clear, concise, and unambiguous language familiar to users.

The tolerance principle: The design should be flexible and tolerant, reducing the cost of mistakes and misuse by allowing undoing and redoing, while also preventing errors wherever possible by tolerating varied inputs and sequences and by interpreting all reasonable actions.

The reuse principle: The design should reuse internal and external components and behaviors, maintaining consistency with purpose rather than merely arbitrary consistency, thus reducing the need for users to rethink and remember.

Though the thesis will not cover this in detail, the heuristics and principles above have been used during the design process of creating the working prototypes.

2.1.2.3 Above the fold

The term “above the fold” refers to the area that is above the fold when a newspaper is folded in half. The top news stories are usually displayed in the top half of the page, as they receive highest visibility on newsstands. Items above the fold are often placed there to tempt customers into buying the newspaper. The concept of being above the fold has also been used on the web, referring to the area of a web page that the user sees without having to scroll. Making their content visible has always been a goal for web designers, and many have used this as a reason for cramming as much content above the fold as possible. However, as the web has matured, so have users’ browsing habits. Many users now scroll extensively, and this reduces the value in positioning all important content above the fold. (Cxparkers) Keeping the most relevant information that you know users will be looking for above the fold, however, is rarely a bad choice. Users need to be reassured that they will find the content they are looking for on the page. If no relevant content is placed above the fold, users will likely leave your site without scrolling. (Beaird, 2007)

2.1.2.4 White space

White space is a graphic design term which denotes the area in a design that is not filled with content. White space is often seen as a key to achieving an aesthetic composition. Filling a webpage with too much information, without sufficient white space between elements can make the page appear cluttered, busy and difficult to read. Using white space is simple, but mastering white space takes practice.



We are Sofa

Sofa is a software and interaction design company. We develop products and help others design theirs.

Products »

Effective software starts with a good user experience. We strive to delight people with beautiful UI and solid interaction models in our products.

Work »

Besides creating our own products, we help others to design and refine theirs. From mockup or prototype to complete products. Or anything in between.

Company »

Sofa was founded late 2006 and is based in Amsterdam, the Netherlands. We are a small, privately held company that specializes in interaction design.

Blog »

Every day we find out something new, or sometimes, something old. Our blog is where we keep track of thoughts that stuck long enough to write them down.

 **Indie Fever** Research into the culture and economy of the indie community.

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Figure 2 – The website of design agency Sofa (<http://www.madebysofa.com>)

Figure 2 is an example of good use of white space. Notice how the design seems balanced, and is easy to read. White space is used throughout the design to separate text and graphic elements.

2.1.2.5 Affordance

Affordance is a term coined by psychologist James J. Gibson, and adapted for use in human-computer interaction by usability expert Donald Norman in his classic book, *The Design of Everyday Things*. (1988) Affordances are the action possibilities that are readily perceivable by an actor - the clues that tell us what we can do with an object.

Affordances provide strong clues to the operations of things. Plates are for pushing. Knobs are for turning. Slots are for inserting things into. Balls are for throwing or bouncing. When affordances are taken advantage of, the user knows what to do just by looking: no picture, label or instruction is required. Complex things may require

explanation, but simple things do not. When simple things need pictures, labels, or instructions, the design has failed. (Norman, 1988)

Affordances are not constrained to the physical world. Many websites and software applications utilize affordances to make their interfaces intuitive. Below is a screenshot from Google.com. Notice how the search field (here containing “BirthdayHero”) looks like it is depressed into the page. We interpret the three-dimensional effect of the search field as a place where we can type text. The text field affords typing.



Figure 3 – Screenshot from Google.com

Notice also how the “Google Search” button has a beveled edge, which affords clicking. It looks like a button, and therefore we know we can click on it. Because the “Google Search” button is also the primary action, it is more emphasized with a darker border.

Here is the same interface, with some of these affordances removed.

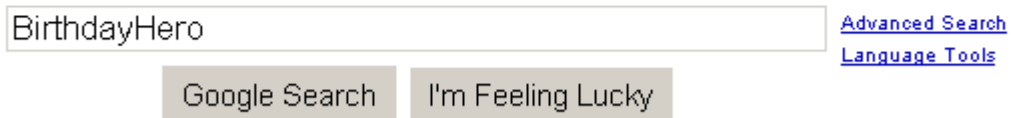


Figure 4 – The same screenshot with some affordances removed

The interface has now become harder to use because it gives fewer hints as to how we should use it.

If you've never used the internet, some affordances will naturally be intuitive, such as buttons, dials and knobs. Other affordances are products of the online world. Links are usually underlined, and often blue. When an experienced web user sees the Google.com interface, he assumes, and rightly so, that the texts "Advanced Search" and "Language Tools" are links. This is because blue, underlined words afford clicking. Similarly, scrollbars afford scrolling and tabs afford tabbing.



Figure 5 – Screenshot of an older version of Amazon.com

The tabs in Amazon's website interface, seen above, affords tabbing between the departments for "Books", "Music", "Video", "Gifts", "e-Cards" and "Auctions".

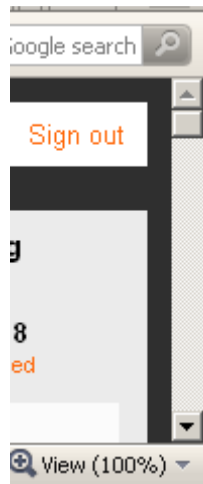


Figure 6 – The Opera web browser

The scrollbars in the Opera Web Browser, seen in the screenshot above, afford scrolling up and down the webpage. Notice that the up-arrow is grayed out, indicating that the user is at the top of the page. Subtle hints like this can change the way the user perceives affordances.

2.2 Memory and social networks

Memory is the term used to describe our ability to store, retain and recall information. An important theoretical model for understanding human memory is the *information processing framework*. One of the most influential models within this approach is the Atkinson-Schiffrin model. The model is called the *multistore model* because it divides memory into several structural compartments. The first is a sensory store, or register, where data received from the senses is held briefly, before being sent to the short-term store, where processing is done. The third structure is the long-term store, where material is kept over a long period of time. (Sobel, 2001) These storage structures are commonly referred to as short- and long-term memory.

Short-term memory can only hold information for approximately 30 seconds. If we wish to remember a phone number we've just been told, for instance, we must keep repeating it to ourselves to keep it in our short-term memory. Information in our short-term memory store can be copied to the long-term memory store. Our long-term memory operates under different conditions. Copying information from short- to long-term memory requires information processing. How we process the information decides how well a memory is

stored. Atkinson and Schiffrin argue that some processes can increase the strength of the information being transferred. One way of doing this is by *elaboration*, in which new information is linked to information already stored in long-term memory. An example of this could be choosing an credit card PIN-code that corresponds to your wedding anniversary date, or an e-mail password the same as the name of your first pet. Linking new information to old information makes it easier to encode and store.

The information processes involved in memory are encoding (receiving and processing information), storage (storing information in long-term memory), and retrieval (recalling the stored information).

Anderson (1976) divides long-term memory into *declarative* (explicit) and *procedural* (implicit) memories. Declarative memories are those that require conscious thought to retrieve. As described by Squire (1997), declarative memory is “memory that is directly accessible to conscious recollection. It can be declared.” An example of a declarative memory might be a phone number or street address. In contrast, procedural memories do not require conscious effort to retrieve. An example of this type of implicit memory is learning how to ride a bicycle. The first time you might struggle to keep the bike straight, but every time you ride you might get a little better. No new *explicit* memories have formed, but your *implicit* memories in the form of motor skills, have been strengthened. Birthdays are declarative memories, as recalling a date we have memorized requires conscious thought.

2.2.1 Memorizing birthdays

Encoding, storing and recalling someone’s birthday requires information processing. A birthday is composed of two pieces of data. The first is the name of the person whose birthday it is. The second is the date of that person’s birthday. Optionally, we can also try to remember the person’s birth year and/or age.

Let us examine an example of why we might have trouble remembering someone’s birthday.

1. Encoding

We ask our new friend Mike when his birthday is. He says “It’s on January 4th, I’ll be

28 years old.” To store Mike’s birthday in our memory, we first need to encode the data Mike just provided us with. We might try to see what other birthdays we have to remember in January, and try to relate Mike’s birthday with those. If we don’t have any existing memories to relate Mike’s birthday to, we might struggle with encoding it in an efficient way.

2. **Storing**

Storing a piece of almost arbitrary data is difficult. There are 365 days in the year, and we have to store Mike’s birthday to one of those days in our memory. Just like phone numbers, dates are notoriously hard to store efficiently, because we have very few ways of relating them to other memories.

3. **Retrieval**

On January 4th we need to know that it’s Mike’s birthday. This means that we have to retrieve the memory of when Mike’s birthday is, as well as match the date with today’s date to see if his birthday is today. If we wanted to buy Mike a present, we should probably even have remembered Mike’s birthday a few days before his actual birthday. As retrieving the memories we have of birthdays requires conscious effort, we constantly need to monitor our memory for any upcoming birthdays. If we have to keep track of many birthdays, it’s no wonder that we forget one from time to time.

2.2.2 Social memory

We can also rely on others to help us remember birthdays. We can all remember times when someone reminded us of someone else’s upcoming birthday. This process alleviates some of the pressure on individuals to remember every single birthday. Family members can share the responsibility of remembering a distant relative’s birthday by reminding each other. I argue that this mechanism is a form of social memory. Social memory can be seen as a method of remembering important events, wherein one or several of the members of a group takes it upon themselves to help the other members remember.

Here is an example of social memory in action from the Department of Informatics at the University of Oslo. When a person in one of the offices has a birthday, other office workers hang a note on that person’s door.



Figure 7 – A public birthday reminder

The note serves as a public birthday reminder. Because the reminder is in a public place, all who pass by know that it is that person's birthday. The attached balloon and candy, as well as the illustrations on the note are all signals that there is a reason to celebrate.

2.2.3 Social purpose

Remembering someone's birthday is social gesture. It can be seen as an acknowledgement of the other person and their membership in your social group. Birthdays are also an occasion for reconnecting with friends and relatives. We can send a greeting card to the birthday-boy or -girl, congratulating them on the occasion, or give them a call to catch up. Birthdays are often seen as a chance to get together and celebrate. For many families, birthday celebrations are often one of only the times when the whole family is gathered.

Forgetting someone's birthday might have consequences for how others perceive you. If you want to be perceived as a thoughtful, attentive friend, you should probably remember your friends' birthdays. Forgetting a birthday can have negative consequences. For the person who forgets, these can come in the form of shame and guilt. The person whose birthday has been forgotten might feel hurt, angered and disappointed.

Especially among young adults, relationships with peers are important both for generating offline benefits, commonly referred to as social capital, and for psychosocial development. According to Charles Steinfield (2008), social capital is “an elastic construct used to describe the benefits one receives from one’s relationships with other people.”

Nan Lin (1999) argues that intensive use of social networks like Facebook is closely related to the formation and maintenance of social capital. Modern technology can, for many people, be vital to maintaining social connections. Gaining and maintaining connections during young adulthood could also be important when it comes to getting a good job or finding a partner. Maintaining your connections and fulfilling social obligations also means remembering birthdays, anniversaries and other important dates.

2.2.4 Social network size and management

How large can our social networks be? British anthropologist Robin Dunbar (1998) argues that the theoretical cognitive limit for how many people we can maintain stable social relationships with is approximately 150. He theorizes that this limit is a direct function of the size of the human neocortex. Dunbar argues that the fact that many early human tribes and settlements had a maximum estimated size of 150 members supports his theory. Newer studies have examined how many social ties modern humans have, and found that the upper limit for social network size might be closer to 300. (McCarty, Killworth, Bernard, Johnsen, & Shelley, 2000)

For the most up-to-date numbers on social network size, let us look at statistics from one of the most popular online social networks, Facebook. According to Facebook’s official numbers, more than 400 million people are active users of the site. The average user has 130 friends. (Facebook, 2010) This encompasses every friend a user has added to their friend list, and can be seen as a fair approximation of the number of social contacts that they wish to be in touch with. Similarly, on Twitter, currently the world’s most popular micro-messaging platform, 92.4% of users follow less than 100 people. (Sysomos, 2010)

What technology you use to manage your social network might depend on how old you are. Smith, Rogers and Brady found that older teenagers have the largest social networks, and use considerable effort in maintaining their connections. (Smith, Rogers, & Brady, 2003) Around the age of 30, people use the most varied methods of communication to stay in

touch with people in their networks. People in their fifties have the smallest social networks, consisting mainly of family and close friends. Considering that modern tools for keeping up to date with social contacts, like Facebook, have only been available a comparatively short period of time, it is perhaps not surprising that older people have smaller social networks and manage them with fewer technological aids. It would be interesting to examine if the young “Facebook generation” retain or even grow their social networks as they age.

We don’t usually need to remember the birthdays of everyone in our social network. Many do, however, try to remember those who matter most to them. Close friends and relatives are the people that it is most important to remember, and are also the people who likely expect that you will remember their birthday.

2.2.5 Why and how do we forget?

While it can be annoying, forgetting is completely normal. To forget means to lose information already stored in long-term memory. Forgetting can be a spontaneous or gradual process. We can reduce forgetting by repetition and/or more elaborate cognitive processing of information. The first significant study in the area of forgetting was done by Hermann Ebbinghaus in 1885. Ebbinghaus memorized lists of jumbled words, like “wol”, “pud”, “wid”, and “zof” and then measured how well he remembered the words after various time periods. (Ebbinghaus, 1885) He was the first to describe the shape of the forgetting curve, seen below.

The graph illustrates the way we forget memories. (Schacter, 2001) The red line represents how well a memory which is stored on day zero is remembered. As we can see, the most dramatic drop in memory retention occurs in the first few days. By day six most of the memory is gone. This does not mean that the data we memorized is erased from our memory, only that we cannot recall it anymore.

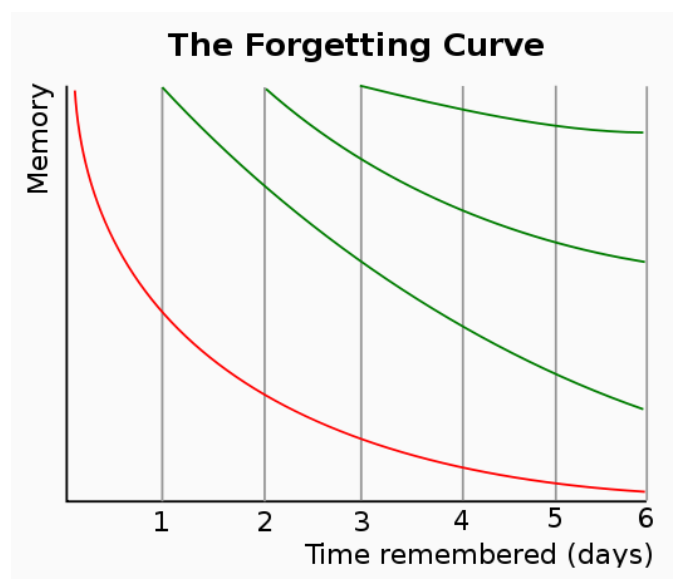


Figure 8 – The shape of the forgetting curve

The green lines represent how well a memory is retained if it is reviewed or repeated after a specific number of days. Repeating and reviewing a stored memory has a significant effect on how well it can be recalled. Notice how the green lines have less steep curves as the information is reviewed at each interval.

2.2.6 How can we remember more and forget less?

By using repetition, we can significantly improve how well we remember. According to Sobel, the more often we retrieve a particular piece of information, the stronger its “memory traces” become. (Sobel, 2001) One interesting learning technique is called *spaced repetition*, and was pioneered by Sebastian Leitner, among others. (Flashcard-db) The *Leitner System* is based on using flashcards to learn and store new information. Flashcards are small sheets of cardboard or paper with a question on one side and the answer on the other. The cards can be used to learn vocabulary words, by having the word on one side and the definition of the word on the other.

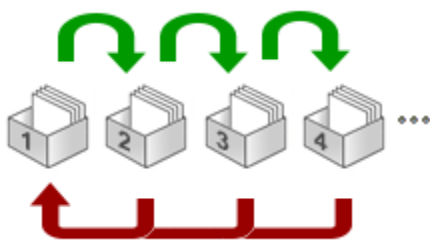


Figure 9 – The Leitner System

This image illustrates the basic concepts of the *Leitner System*. The system is made up of four physical boxes. Written flashcards contain the concepts, vocabulary words or data that a student wants to learn. The student sorts the cards into the boxes according to how hard the concept on the card is to remember.

Box 1 (to the left) will contain the most difficult flashcards. Box 2 will contain slightly easier flashcards, Box 3 even easier flashcards and Box 4 the easiest flashcards. To study using this method the student would study the cards in Box 1 (the hardest cards) once a day, the easier cards in Box 2 every three days, the even easier cards in Box 3 every 6 days, and the easiest cards in Box 4 every 10 days.

When the student gets a right answer on a flashcard, or feels that it has become easy, that card is moved to the next box to the right. If the student gets the wrong answer or feels that a card is difficult, the card is “demoted” to the previous box. For example, if the student gets a question from a flashcard from Box 2 right, the card is moved to Box 3. If he gets the answer wrong, the card is moved back to Box 1. This ensures that more difficult flashcards

are repeated more often, and the easier cards studied less frequently. This means that the student spends the most time studying the flashcards that he or she has trouble remembering.

The *Leitner System* takes advantage of the concept of spaced repetition, whereby difficult flashcards are repeated more often than easy ones. This allows you to focus on things you still haven't mastered, while not wasting time on cards you remember well.

The possibility of using spaced repetition and the *Leitner system* to help users of the BirthdayHero service become better at remembering birthdays and other events will be covered more in-depth in later chapters.

2.3 Reminders

Reminders can be a practical solution to remember birthdays and events. There are several different channels for sending and receiving reminders. The thesis will primarily focus on e-mail and SMS reminders.

2.3.1 E-mail reminders

There are few reliable statistics on how many people use e-mail to communicate, but it is safe to say that most companies rely on e-mail for communication and that hundreds of millions of people have their own e-mail accounts. Communication by e-mail is near-instantaneous; transmitting an e-mail across the globe usually takes no more than a few minutes. For users to receive an e-mail, however, requires that they check their e-mail account using an e-mail client. Sending birthday reminders by e-mail requires that the user checks their inbox for new messages regularly. If the reminders are read after the birthday has happened, they will be of little use. E-mail reminders are therefore probably more useful for people who know they will regularly check their inbox. Users who rarely check their e-mail inbox will not get much use out of receiving e-mail reminders. Spam, or unwanted e-mail, is also a large problem. It is estimated that more than 85% of e-mail sent every day is Spam. (Messaging Anti-Abuse Working Group, 2009) Sending reminders via e-mail means that reminders will have to compete with spam, as well as legitimate e-mail, for the user's attention.

2.3.2 SMS reminders

For our purposes, SMS, or Short Message Service text messages are a more promising communication channel. These short text messages can be sent to and from cell phones and are usually received within seconds. They are most often used by individuals to communicate with each other, but can also be used to send mass messages to groups. Emergency services can, for instance, use SMS to send a message to all inhabitants in an area, urging them to evacuate in case of fire or flood. Companies can use SMS messages to alert workers of important news. SMS has also found use in the entertainment market. These days you can barely turn on the TV without seeing advertisements for SMS horoscopes and downloadable ringtones. In Norway, many soccer fans pay for services that alert them when a goal is scored in a game in which their favorite team is playing. For services like these, consumers pay a small fee which is usually added to their cell phone bill.

In 2008, over four trillion SMS text messages were sent. SMS has become an enormous commercial industry, worth over 81 billion dollars globally as of 2006. The global average price for an SMS message is 0.11 USD (0.65 NOK) while the cost to providers is near zero. (ITU, 2006)

Receiving reminders by SMS is in some contexts already becoming common. Some dentists send out reminders to their patients a few days before their appointments. Some hair-dressers do the same. The SMS system makes it in some respects more suited for reminders than e-mail. Communication by SMS is often even faster than e-mail, as a message is usually received by the recipient within seconds. An added benefit is that people keep their cell phones with them. We buy cell phones so that we can be reached anywhere and at any time. This makes cell phones a perfect platform for reminders. For a reminder to be effective, it needs to *remind* the user. While users might not check their e-mail for days or weeks, their cell phone is usually nearby.

By default, most cell phones are set up to give an audible alert when new SMS messages are received. SMS technology gives us the possibility to send users reminders that will most likely be read. Spam SMS messages have not yet become as large a problem as in the e-mail market. This is probably because sending SMS messages still costs money, while sending e-mail messages is almost free.

Several companies now allow clients to submit SMS messages which are then relayed to the cell phone number of choice. This allows the network owners to make even more money by providing a way for dentists, hair-dressers and web applications to send SMS reminders in bulk.

SMS messages are, by nature, short. Each message consists of a maximum of 160 characters. Several messages can be strung together, forming a longer, continuous message, though this will also increase the cost of sending the message.

To summarize, SMS messages are a good choice for delivering reminders because they:

- **are delivered directly to the user**, where the user is (as long as the cell phone is kept switched on, and nearby)
- they usually **cause an audible alert** from the phone and therefore grab the user's attention
- recipients know that received messages will be short, and **they are therefore likely to be read**
- **are relatively simple**, and don't require much training to view and interpret

According to recent research from the medical field, SMS reminders can have a positive effect in changing patients' behaviors. Monitoring of patient behavior is important, when, for instance, overweight patients want to achieve weight loss success. Patients should monitor their own food intake and physical activity to help them become aware of their own damaging behavior. This is called self-monitoring.

Self-monitoring is critical for permanent weight-loss, but many patients stop monitoring after a while. In one study, 44% of patients self-monitored at least 3.5 days per week in the first month of treatment, while only 25% were still monitoring after 6 months. (Shapiro, Bauer, Hamer, Kordy, & Ward, 2008) Increasing adherence to self-monitoring is important, and using SMS messages to encourage monitoring has been shown to have a positive effect. A study by Jennifer Shapiro, et. al, found that overweight children who received SMS reminders were twice as likely to self-monitor as children in a control group. (43% vs. 19%) Children in the program were also positive to receiving interactive, tailored reminders,

instead of using a traditional paper-based diary to monitor their progress. This means that at least young users might want to use other tools than traditional paper calendars to manage their birthdays and remember important dates.

SMS messages have also been found to have a positive effect in treatments for diabetes, smoking, asthma, and bulimia. (Shapiro, Bauer, Hamer, Kordy, & Ward, 2008)

If SMS messages hold the potential to help people alter their health-related behavior, can they not also have the potential to help us remember birthdays? The reminders themselves could in fact spark behavior that would not otherwise happen. Receiving a reminder for the birthday of a distant relative or old friend, might lead you to contact that person to wish him or her a happy birthday. This could turn out to be a positive experience both for you and for the person you contact. Without the reminder, the contact between you would perhaps never have happened. Thus, the reminders could be a trigger for positive behavior.

3. Methods

This chapter describes the methods used during the development of the BirthdayHero service. These methods include *interviews* to gather data about potential users, *prototyping* to create a working service, and *usability testing* to test the prototypes. The strengths and weaknesses of these methods are also explored.

3.1 Interview

To ensure that I did not base the design of the service solely on my own needs and wants, potential users have been consulted actively during the design process. To gain insights about how people manage birthdays and events, 11 in-depth interviews were conducted. The participants were recruited from friends and family, and were aged from 18 to 61. The goal was to uncover and map techniques for managing events, as well as attitudes towards receiving reminders by e-mail and SMS. Hopefully, insights from the interviews could be used to constructively influence later design choices.

According to Kahn and Cannel (1957), interviews can be seen as a “conversation with a purpose”. Interviews can either be open-ended or unstructured, structured or semi-structured. A semi-structured approach was chosen for this initial exploration of the subject. A semi-structured interview consists of both open and closed questions.

Closed questions, like “How many birthdays do you remember, right now?” would serve to give data that could be compared. Do older subjects remember more birthdays than younger subjects? Do younger subjects use modern technology more to remember birthdays?

The open questions, such as “What were the consequences of forgetting that birthday and how did it make you feel?” might let the subject open up and tell stories that could generate new design ideas.

The interviews were conducted in Norwegian, on Norwegian test participants. The interview questions below were translated, and the participants’ responses written down in Norwegian, and then translated to English. Some of the interviews were done in a group setting, where up to three participants answered questions in turn. This facilitated discussion between participants and also helped participants open up. There might have

been adverse effects from doing some of the interviews in groups, such as some participants not wanting to share information in a group setting, or making them conform to the other respondents' answers, but did this did not appear to be a major issue.

3.1.1 Interview questions

What follows are the questions that were asked in the interviews, as well as a brief explanation of each question's purpose.

1. How do you keep track of birthdays of family members and friends? What strategies do you use?

The goal of this question is to learn more about how users remember birthdays and other important events. Do they all use the same strategy, or are there large individual differences in how people remember birthdays? Do they use traditional tools like wall-mounted calendars and organizers, or modern devices like cell phone calendars or even social networks?

2. How good are you at remembering the birthdays and anniversaries that you want to remember?

1. I always forget 2. I sometimes forget 3. I rarely forget 4. I never forget

This question aims to answer how people view their own ability when it comes to remembering birthdays and anniversaries. The participants answer on a Likert scale. The prediction here is that most respondents will choose "I sometimes forget" or "I rarely forget."

3. How many birthdays do you have to remember? How many of those birthdays do you remember, right now?

This question is perhaps one of the most interesting. The first question aims to identify the size of the participant's inner social network. The number they give should reflect an approximation of how many close friends and relatives they have that they need to remember. The second question asks how many of those birthdays they have to remember they actually do remember. The goal here is to find a quantifiable measure for how good each participant is at remembering birthdays. The assumption is that if you can't remember someone's birthday when asked to

make a list, you probably won't remember it when that birthday rolls around. Of course, remembering someone's birthday on their birthday might be easier than making a list in an interview. There are all sorts of cues that people can use to remember someone's birthday on their birthday. Someone might remind them, or they might see someone bringing a cake to work that day, and so on. Therefore, this measure is probably not very accurate, but might still be useful.

The data gathered from these two questions lets us calculate a percentage which shows how many birthdays each participant remembers. If they remember all of the birthdays they need to remember, the percentage will be 100%. If they remember half of them, 50%, and so on.

4. When was the last time you forgot someone's birthday or an anniversary?

1. Within the last month
2. Within the last 3 months
3. Within the last year
4. More than a year ago
5. Can't remember

This question aims to see how long ago a participant forgot a birthday. The responses must be chosen on a time scale ranging from "within the last month" to "more than a year ago." There is no option for "I've never forgotten a birthday" though that might be necessary to add in future interviews if the data shows that participants want to give that answer.

- What were the consequences and how did it make you feel?

This question is meant to encourage the participants to tell stories that might reveal what feelings they associate with forgetting someone's birthday.

5. Which events are the hardest to remember?

This questions aims to find out if there are certain events that are harder to remember than others. It might be wise to find a way to help the users remember the events that they find hardest to remember. Users might, after all, not be looking for a service to help them remember the events that are easy to remember.

6. Do you have any ideas on how technology could help you remember important birthdays, anniversaries, and events?

This questions attempts to find out what attitudes the participants have in terms of letting technology help them remember events. Are they satisfied with their existing solution? Do they, as the author does, see SMS technology as a practical way of receiving reminders? Do they have other ideas of how to better remember events?

7. Would you like to receive reminders for birthdays, anniversaries and other events?

If there is little interest from the participants to receive reminders for events, then that might make the BirthdayHero service a less viable product. However, if the participants express interest it might mean that there is a market for a service that can satisfy the participants' unmet needs.

- **If so, how would you prefer to receive reminders? On your phone? Via E-mail? Some other way?**

This question aims to find out how users want to receive reminders. The participants might even reveal novel ways of receiving reminders that haven't yet been explored.

- **What should the reminder say?**

This question might give useful feedback on what potential users of the service might want the reminders they get to say. What information should the reminders include?

3.2 Prototyping

The prototypes were developed over a period of approximately 13 months and have evolved a great deal since the initial sketches. It has been an iterative design process, in which the elements of design and functionality that worked were kept, and those that didn't were discarded.

The goal of prototyping was to create the web interface for the BirthdayHero service. The central component of the interface would naturally be a calendar-type page where users

can enter and modify data. The key user tasks to design for were seen as being the following:

1. Add events

Users should be able to add birthdays, anniversaries and events to their calendar. The term “events” is used throughout the thesis as a general term describing all three types of calendar data, including birthdays, anniversaries and events.

2. Navigate the calendar

Users should be able to view a calendar containing the events they have added. The calendar should make it easy to see upcoming events as well as visually show what events are of what type (a birthday, anniversary or event).

3. Modify events

Users should be able to modify data they have entered. They should also be able to delete events.

4. Change reminder settings

Users need to be able to change how and when they receive reminders. They should also be able to turn off reminders completely.

Three prototypes were created, the first in January 2009, the second in December 2009, and the third in February 2010.

All of the prototypes began life on paper. Several hundred sketches were done to explore design choices. Some sketches were done on Post-it notes, some on notebook paper, and some on grid paper. Some were elaborate, some were simple. All had in common that they helped solidify and rank design ideas. Some ideas could quickly be thrown out as useless once they were sketches on paper, while other ideas made it into the working prototypes. The continuous process of transforming ideas from mind to sketch to screen was challenging, but rewarding when an idea just seemed to work.

A great deal of effort has gone into creating the prototypes. Not only have they been crafted in sketches, wireframes and in Photoshop, they have all been coded in PHP and XHTML and CSS. This has been a challenging task, in and of itself. Learning PHP, cakePHP (a PHP framework), JavaScript, jQuery (a JavaScript framework) as well as improving Photoshop,

graphic design, and copywriting skills has been almost like a part-time-job, in addition to writing the thesis.

Designing the prototypes over a long period of time has had positive side effects. Being able to iterate designs over a long period of time has allowed for design choices to be thoroughly evaluated. Finding out what works and what doesn't is easier when one every now and then takes a few weeks off from working on the prototype. When seeing the prototype again with fresh eyes, poor design decisions immediately became apparent and alternate solutions appear. Prototyping over a long period of time also allowed for unexpected creativity and inspiration. Thinking about calendars, birthdays and observing others using calendars, mobile phones and other technology have had an impact on the final design. I have used the system since it became functional in the first prototype, and used it to receive e-mail and SMS reminders for events since this functionality was added in the second prototype.

3.3 Usability test

3.3.1 Procedure

Tests of the working prototypes were carried out on 3 potential users. The test participants were asked to complete tasks that users of the system would normally perform. The users were given instructions describing the tasks by the Test Coordinator (TC). What follows is a list of tasks that the participants were asked to perform, as well as the script followed by the Test Coordinator.

- 1. Sign up for an account**

TC: *"Your friend has told you about a service called BirthdayHero.com. He says it has helped him remember birthdays. You go to the site to sign up for an account."*

- 2. Navigate the calendar**

TC: *"Tell me what you think this page is for? What can you do on this page?"*

- 3. Add birthdays, anniversaries and events to the calendar**

TC: *"You want to add the birthdays, anniversaries and events you want to remember."*

If the participant asks what events to add, the TC urges them to add actual birthdays, anniversaries and events that they want to remember.

4. Edit an event (Add notes, change data, birth date etc.)

TC: *"Let's try adding a note to an existing event"*

TC: *"You find out that you've given someone the wrong birth date, let's try to correct it."*

<TC points out a suitable birthday in the participant's calendar>

5. Delete an event

TC: *"You decide to delete someone's birthday from your calendar. What do you do?"*

6. Find out how to change reminder settings

TC: *"Find out how to change how and when you receive get reminders."*

7. Log out of the system

TC: *"When you're done with adding events to your calendar, you want to sign out of your account. Do that now."*

8. Log in to the system

<TC navigates back to the homepage>

TC: *"How would you get back into your calendar from the front page of BirthdayHero.com?"*

3.4 Critique of methods used

3.4.1.1 Interviews

The interviews were useful in the sense that they provided a way of gathering information about potential users. The interview subjects were friendly and shared information that would impact the design of the service. The interviews could have been even more in-depth. During the interviews, some follow-up questions were asked, but there could have been a greater focus on my part to dig even deeper and find out more. It was especially difficult to fit in follow-up questions during group interviews, because I had to write down the

respondent's answers as they were given, as well as manage the back and forth exchange of questions and answers with up to three people at the same time.

For future interviews it could be wise to recording equipment to take the load off of the interviewer. Notes from the interviews could be done later by listening to the recordings, freeing time and focus from taking notes during the interviews. Most of the interview subjects were friends or family. In the future it could be interesting to interview strangers to see if they give similar answers.

3.4.1.2 Prototyping

The results of prototyping are based on the knowledge, skill and creativity of those doing the prototyping. For BirthdayHero, the prototyping was done by the author, and was based on my knowledge, as well as the results of the interviews and later, the usability tests. The design evolved from sketches, to mockups in Photoshop, to wireframes in XHTML and finally to a working service in XHTML, CSS and PHP. Being an iterative process, many of the basic concepts have been reworked several times. I believe that creating several prototypes and working on them for a long period of time has made the end result much better.

The prototypes tested on users in the usability tests have been what is called "high fidelity". High fidelity prototypes mimic the appearance and functionality of the finished product. A "low fidelity" prototype, on the other hand, could be a drawing on a napkin or a sketch on paper. Like many designers, I've felt apprehensive about letting users test something that wasn't "finished" and this could explain why I waited to do usability testing until the prototypes were usable enough to resemble a finished product. Testing "low fidelity" prototypes earlier in the process could have given insights that could have improved the design.

3.4.1.3 Usability tests

"Test early, test often" is a mantra used in the usability field. Testing early enough has been a challenge, and the prototypes could have benefited from being tested on users earlier on in the process. The prototypes have been tested a total of three times. Prototype 2 was tested on one user and Prototype 3 on two users. They could have been tested on more users, but I felt that I got so much data from the tests that I wanted to improve the prototypes before testing again. Analyzing the data and making improvements on the

prototypes has been time-consuming. Finding ways to do this faster and more efficiently is an ongoing challenge.

The usability tests were valuable because they indicated which features were working well, and which needed more work. I plan to continue to perform usability tests on potential users in the future.

4. Case description

This chapter outlines the vision for the BirthdayHero service. It explores to what extent one can select target users for the service, and why BirthdayHero has been created as a web-based service. It also explores some of the existing solutions for managing and remembering birthdays and attempts to identify some central user needs.

4.1.1 Vision

My primary goal in creating the BirthdayHero service is to help you avoid that awful feeling you get when you realize you've forgotten someone's birthday. It might seem like a trivial problem, compared to curing cancer and similar challenges - but I don't think I can do much about those problems. Finding a way to use modern technology to aid people in remembering birthdays and other events is likely to help a lot of people.

There are several similar services out there. Many appear to be designed in the 1990s, and offer very limited functionality. One of the more popular and better designed services is BirthdayAlarm.com. It offers a basic reminder service, where users can add events and receive e-mail reminders. At its peak, the service had over 100 million users. (Techcrunch) Now, the service focuses more on selling users animated e-cards than serving reminders, and the user base has dropped to 50 million users. Still, over 300,000 paying users, who for 14\$/year get access to premium greeting cards, bring in over 4 million USD in revenue every year. When a popular service has tens of millions of users, there is definitely a need for reminders.

In their inspiring business and design book, *Getting Real*, 37signals, the company behind the successful web collaboration application Basecamp, argues that in order to build a great product you need to choose an enemy. (37signals, 2010) You need to decide what your product will be, and what it *will not* be. The BirthdayHero service will not be like Microsoft Outlook. It will not have every feature under the sun. It will not sell users e-cards. It will be easy to use. It will be innovative and flexible, but still simple. It will be friendly and forgiving of user error. It will make its users' lives better. It will be something you'll want to tell a friend about.

The name BirthdayHero originates from an idea that making people better at remembering birthdays will make them feel like heroes. Remembering birthdays also makes the people

you congratulate feel good. Users will be able to call themselves “BirthdayHeroes”, the benefits of which they might want to tell their friends about. “Birthday” and “Hero” are words with positive associations, and combining them seemed a perfect fit for a service designed to help people make a positive change in their lives.

4.1.2 Features and “featuritis”

When developers add extra features that go beyond the basic functionality of their product, it can result in over-complication, or "featuritis", rather than a simple, elegant design. “Featuritis” or “feature creep” is a common syndrome in many software applications. A common cause of featuritis is a wish to satisfy every customer’s desire by including any feature anyone could ever need. This, however, can create a complex product, both for the user to learn and the developer to maintain. Added features are often used as a marketing gimmick, to promote new versions of products. Why should users purchase a new version of a product if there are no new added features?

Among the applications that suffer from featuritis is Microsoft Word 2003. Here is a screenshot of the application with every toolbar opened.

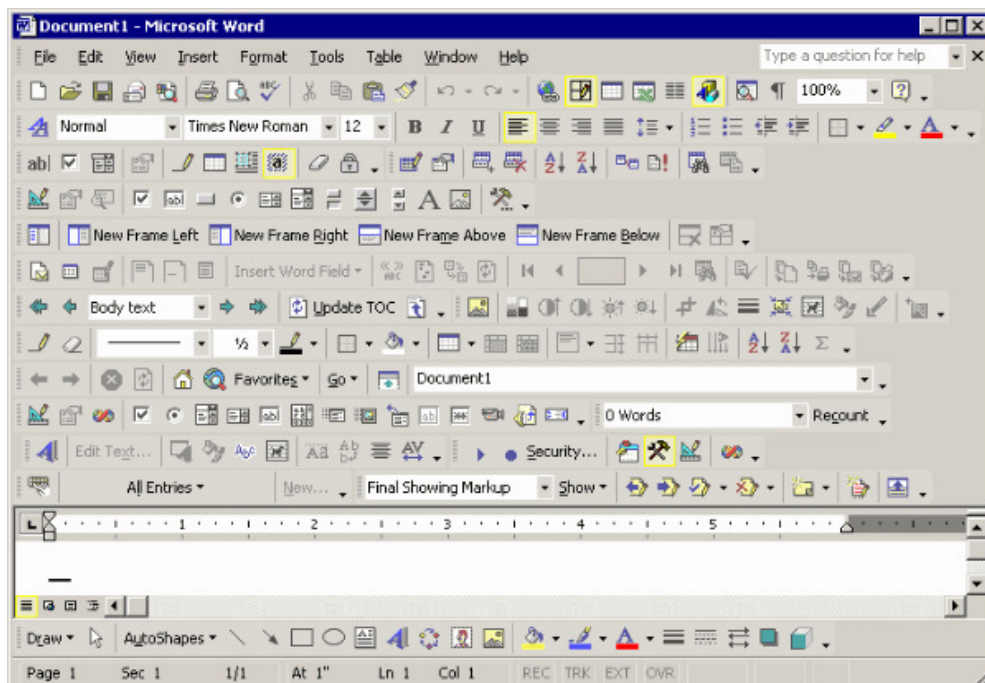


Figure 10 – Microsoft Word 2003

It is clear that Word is not simply a word processor anymore. There even appears to be a web browser built in – why? How many users writing a document need a web browser so badly that they can't just open one?

I argue that BirthdayHero should do one thing and do it well. It has been observed that 20% of the features of a product will meet 80% of the users' task needs. (Mohageg & Wagner, 2000) This stems from the *Pareto principle*, which states that roughly 80% of the effects come from 20% of the causes. Therefore, development should focus on the core features of the product that will be used 80% of the time. I argue that the core features of the BirthdayHero service should be derived from these three *core user tasks*:

Core user task	Core feature	Benefit for user
I want to add birthdays and other events to my calendar	Calendar (navigate, add/edit/delete events)	"Organize and manage your birthdays and events, all in one place"
I want to receive reminders	E-mail and SMS reminders automatically sent based on events added by user	"Receive e-mail and SMS reminders so you can't forget!"
I want to be able to change when and how I receive reminders	A settings-page where user can select what type of reminder to send (e-mail/SMS) and how many days prior to an event the reminder should be sent	"You can choose when and how you receive reminders to fit your needs"

In the table above I have listed the three main tasks that I believe users will want to perform, the core feature will allow users to perform those tasks, and also how that feature could be described as a benefit. The benefits describe the value that users can get from the service.

Choosing what features to include also determines which users will want to use the service. If the service lacks a feature that a user is looking for, they might pass on trying the service. If the service appears overly complex with too many features, novice users might not want to invest the time it takes to learn how to use it. There is a balancing act between having enough features to be useful, and having too many features which can hurt the ease of use of the service. “Less is more” is a mantra that should be used consistently in web service development. Limiting the feature set to only the most basic functionality also means that there will be less code to maintain and hopefully, fewer bugs.

4.1.3 Target users

Who are the target users of the BirthdayHero service? Should the target group be those who have large social networks? Should it be only young people, or old? Should the target group be people who, like the author, simply have trouble remembering some birthdays? Should the BirthdayHero service only be for “technologists”, people who always need to have the latest and greatest technology? These are not easy questions to answer, in part because it is difficult to predict which user groups (if any) will want to use the service. However, in order to guide the design decisions, we must choose some ground rules.

One of the design rules has been that I must find the service useful. If the service is effective in helping me remember birthdays, it is likely that it can help others too. I refuse to believe that my needs are so unique, as to make the service unusable for anyone else. The second rule is that the service should be easy to learn for a novice computer user. I’ve tried picturing someone’s grandmother using the service for the first time, trying to tailor it so that she would find it easy to use. I’ve found that customizing an experience for users with disabilities, or conditions like poor eyesight or color blindness, usually improves the design for users without disabilities as well. Ensuring that design elements have good contrast and that text is large enough to make be readable creates a better service for all users. The central user demographic will be users of both genders from age 16 to 100. Children are not a targeted user group, although creating a children-friendly version of the service could be done at a later stage.

4.1.4 SaaS (Software as a Service)

BirthdayHero has been made as what is called Software as a Service. (SaaS) This means that the service is not a software application that the user downloads to their computer, but a service they subscribe to and access through a web browser. This model has several advantages over the way we have used software in the past. An example of a SaaS service is Google Docs, Google's online word processor, which allows users to create and edit documents online while collaborating in real-time with other users.

The main advantage of the SaaS model is that users do not have to update their software because nothing is installed on the users' computers. Because Google Docs runs on own Google's servers, they can add features and fix bugs as they see fit without requiring the user to download patches. Compare this to Microsoft's Office programs, who require you to buy essentially the same program with only a few new features added, every few years.

Another advantage of SaaS is that it limits the effect of software piracy. Because the user pays for access to the service through a web browser, potential hackers have little or no access to the code that runs the service, like they do when users install a program on their computer. This means that the applications cannot be pirated. This also means that developers can sell users access to a service through a monthly fee, instead of a large upfront payment, as is the norm with the software products we can buy in stores or online today.

A strength and potential drawback of the SaaS model is that the data you create using these services is stored "in the cloud". When you save a Google Docs text document, it is stored on Google's servers. We are in an age with an ecology of different devices, where cell phones with fast internet access are ubiquitous, and computers in various shapes and forms are everywhere. Storing data in the cloud makes it easier to access our data from anywhere. More and more, traditional software products are moving into the cloud. Even Adobe's Photoshop, the popular software image editor, has begun offering an online service, providing users with many of the same features they've come to know in the software

version.² Users can store the photos they edit online, and access them from any web browser, anywhere in the world.

Cloud storage might have consequences for both the privacy and security of your data. You no longer have control over your data when you don't have it on your own computer. At the same time, having your data stored on the servers of responsible companies who do daily backups of your data might make it more private and secure than keeping it on your computer, which could easily be damaged or stolen. Nonetheless, the SaaS model seems to be a good fit for BirthdayHero. It allows users to access their data from any web browser, lessens the effects of software piracy, and allows users to pay a monthly fee to access the service.

4.1.5 Access from mobile devices

Though this will not be focus in this thesis, users should be able to access their data from mobile devices. Making a usable interface on a small screen is even harder than making an interface for a screen with a large resolution. Displaying the user's calendar on a small screen is a challenge, and the existing interface used in the prototypes might have to be restructured to show less, and more prioritized information for users who are "on the go".

Most modern cell phones now come with touch screen functionality, which could be used to improve the experience for users on these smaller devices. Imagine using your finger to scroll up and down your calendar, and using a quick tap on a date to add an event. The process of adding events from mobile devices needs to be streamlined. When users, for example, want to add the birthday of a person they have just met, they will want to do it quickly, and get back to interacting with that person.

One way of letting users add events to their calendars from mobile devices, is to let them send an SMS message to a predefined number with a message that causes an event to be added. For instance, a user could send an SMS in the format "Jørgen 25 Dec. 8th" or "Jørgen 8/12/1985". The system would then interpret the data and add Jørgen's birthday to the user's calendar. To add an event, the user could send the message "Beach Barbeque next

² See <http://www.photoshop.com>

Monday”. This requires that the system is intelligent enough to separate birthdays from events, and interpret input from the user. If the event is added successfully, the user could receive a confirmation message, saying “Jørgen’s birthday was added successfully” or an error message which explains the allowed message formats, should the user send a message that the system doesn’t understand.

4.1.6 Success and failure

If it’s a good idea and it gets you excited, try it, and if it bursts into flames, that’s going to be exciting too. People always ask, ‘What is your greatest failure?’ I always have the same answer—We’re working on it right now, it’s gonna be awesome! —Jim Coudal

The ultimate goal is to make BirthdayHero a viable commercial service. If the market decides that a reminder service isn’t worth paying for, so be it. If, however, there are at least a few people out there who decide that this is the service they have been looking for, I will consider it a success. Regardless of the success of the service, designing and developing BirthdayHero has, and will continue to be, a great opportunity improve my skills and to learn new things.

4.2 Comparing existing solutions

This section will examine some common existing solutions for keeping appointments and remembering important dates. Some are modern, like cell phones and social networks like Facebook, while others, like wall-mounted calendars and notes, are more traditional. This does not mean, however, that new methods outperform older ones; they each have their strengths and weaknesses that make them suited for different situations.

4.2.1 Wall-mounted calendar

A wall-mounted calendar is simply a calendar meant for hanging on a wall. The calendar usually has 12 sheets or pages, one for each month. These often have an accompanying image for each month in the year. The biggest advantage of the wall-mounted calendar is that it is highly visible. Hung on an office wall, for instance, it can serve as a planning tool for the entire office. It provides a quick overview of events in the current month and it is easy to add new events – simply by writing on the calendar itself.

Every month the calendar must be taken off the wall and the pages flipped to display the next month. This can be seen either as a chore or as a pleasurable activity, as a symbol of the fresh opportunities of starting a new month. The images that accompany each month also add to the visual appeal of the calendar.



Figure 11 – A typical wall-mounted calendar

The weaknesses of the wall-mounted calendar include the fact that once a new month begins and the page is flipped, the history of past events becomes less accessible. When starting a new year, another calendar must be purchased and hung, and all of the events that occur every year, like birthdays or anniversaries, must be added again.

While you could take a wall-mounted calendar with you, it is not a very portable way of keeping track of important events. Your data stays on the wall.

A wall-mounted calendar can be kept in a public or private space. Public calendars are often used when more than one person needs to have access to the data in the calendar. Many families keep a shared calendar in a visible space, showing what the members of the family have planned.

4.2.2 Organizer

A common choice for keeping track of events, notes and contact information is the traditional organizer. The typical organizer consists of many sheets of paper bound in a hard cover. The organizer is often divided into sections, with some pages containing a calendar, some contact information and so on. Our focus will be on the calendar section.

When the owner opens his or her organizer, the two open pages display the days in the current week. This gives the reader a practical overview of upcoming events in the near

future, and a quick way of shifting focus from week to week. However, checking to see what events are happening three months from now requires much page turning.



Figure 12 – A traditional organizer

A major strength of the organizer is that it is portable; you can keep it with you in a bag or pocket. However, if you lose your organizer you could lose much of your important data as well.

One might argue that the importance of the data in the organizer, coupled with the practicality of having that data close at hand might create a special emotional bond between the owner and the organizer. This bond might strengthen over time, as the organizer proves its worth by being of use to the owner. It might be wise to make a service that the user will bond with, instead of just seeing as a tool.

The organizer calendar requires significant effort from the user, as it has to be maintained. In addition, birthdays and similar events that repeat yearly must be copied into a new organizer at the start of every year.

4.2.3 Cell phone calendar

All over the world, cell phones are becoming increasingly common. Most phones have built-in calendar functionality that allows users to add birthdays and events, and to set reminders for these events. Cell phones are portable, and many users keep their phones with them wherever they go.



Figure 13 – The calendar on the iPhone

A drawback to keeping important information on a cell phone is that it can easily be lost or stolen. If this were to happen, you would be left with no phone, and no calendar data.

Enterprise software users can have access to synchronization tools that ensure that data is synced across the terminals that the user chooses to access data from, yet most private cell phones do not come with these advanced features.

Inputting data into a cell phone calendar can take from a few seconds to minutes, depending on the amount of data you are adding, as well as the ease of use of the phone and keyboard. The main advantage of this type of calendar is, of course, that it is always with you.

4.2.4 Software calendar

There are many types of software calendars. One of the most commonly used programs is Microsoft Outlook. As Outlook is an “information management system” it does not only provide a calendar, but is also a task manager, e-mail client, journal and note-taking client. Outlook is often installed on computers in business environments, and is therefore available to hundreds of millions of users. Data in Outlook calendars can be synchronized to mobile devices running compatible software. Outlook is a complex program, requiring that users spend significant amount of time learning how to use it.

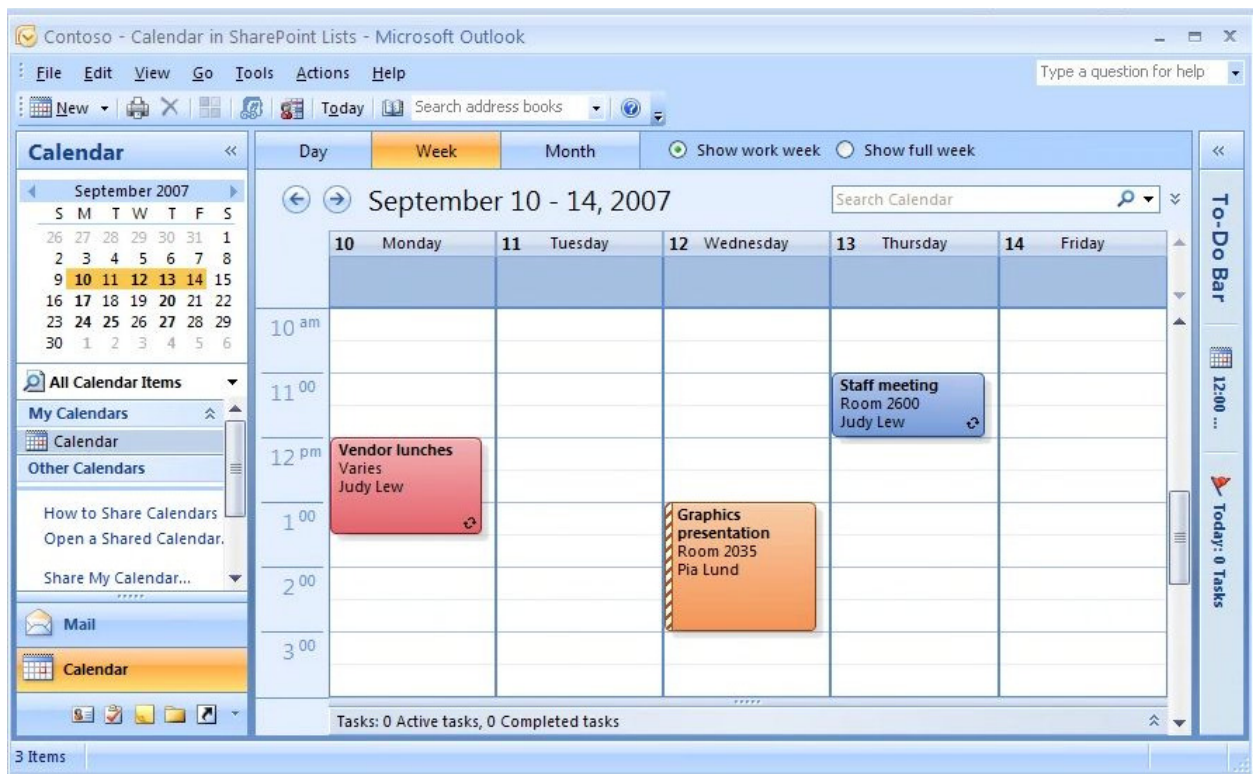


Figure 14 – A screenshot of the calendar in Microsoft Outlook

The calendar itself uses a traditional grid to display dates. A 5-day view shows all events occurring in the current week. Weekends are not emphasized because Outlook is primarily a business tool. Events are color coded so that users can quickly identify different types of events. Users can also share calendars, and access other users' calendars.

4.2.5 Social network

Hundreds of millions of internet users spend countless hours per week on social network sites like Facebook and MySpace. As the name "social network" implies, these sites enable users to communicate with friends and relatives in much the same way as they do in the real world. Users can send messages to one another, or post public status updates, alerting all of their friends of their current feelings, thoughts or activities. Facebook also provides each user with a personal birthday calendar. This displays all of the user's friends' birthdays, as well as what age the friend will be on their birthday. The user does not have to input information about their friends to have their birthday appear in the calendar, it only requires adding that person as a friend. This is a very useful feature of the Facebook service. A drawback of using Facebook to remember birthdays is that you need to check Facebook every day to make sure you don't forget any birthdays. There are no built-in e-mail or SMS

reminders available, but these can be added by installing Facebook applications.

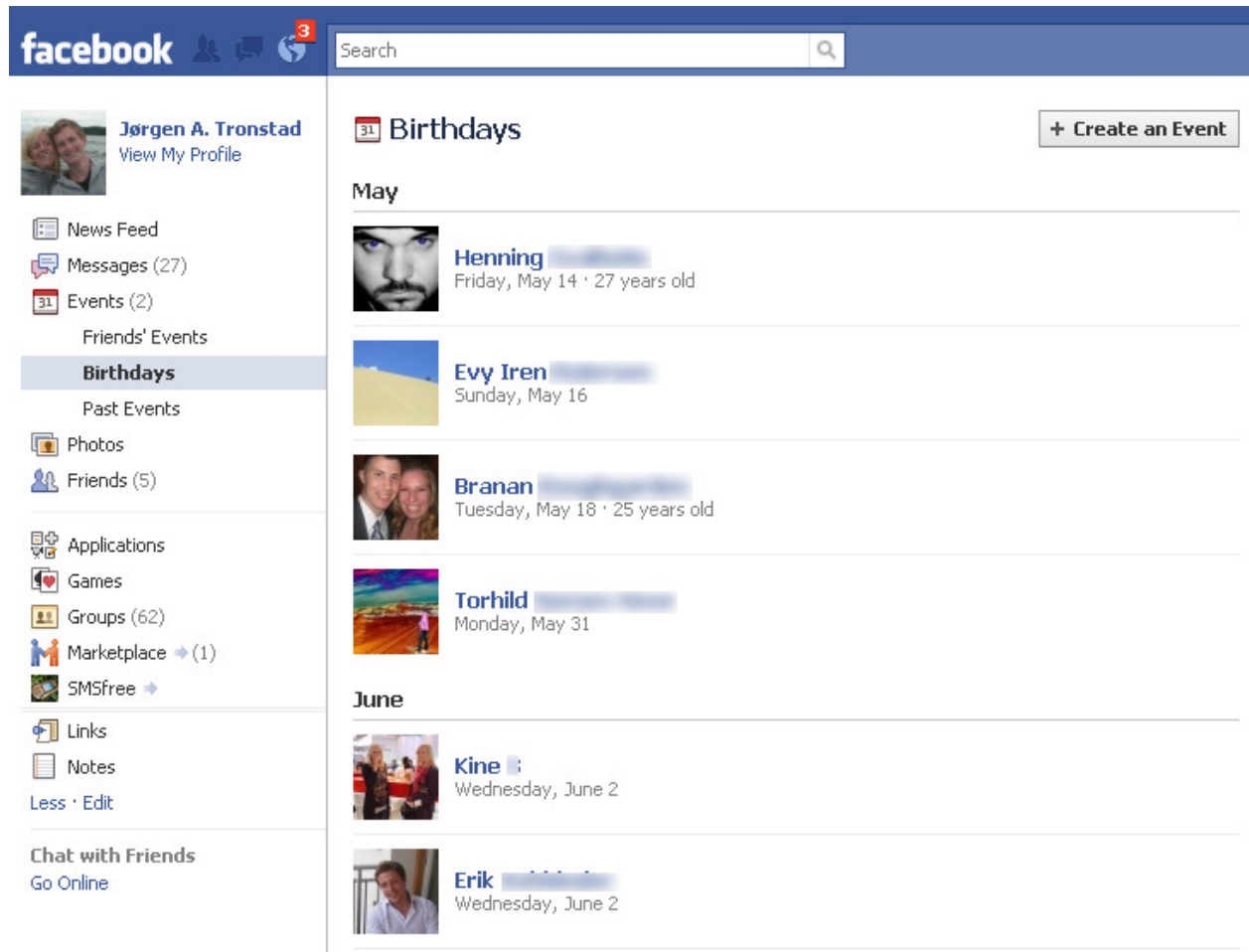


Figure 15 – Screenshot of the author’s Facebook birthday calendar

Facebook is driven by ad revenue, and a goal is therefore to drive as much traffic to their site as possible. They do not send users birthday reminders automatically, perhaps because they want their users to log in daily to check their calendar for new events.

4.3 Potential user needs

The table below summarizes the strengths and weaknesses of different calendar alternatives and to what extent they satisfy potential user needs. Each alternative is awarded a rating from no stars (“-”) to 3 stars (“***”), where 3 is the maximum score. These are the dimensions used to compare the different calendar types:

- **Portability**

Whether the calendar can be moved from place to place, or accessed easily from the user's location.

- **Tangible/physical nature**

Whether or not the calendar is a physical object. This does not mean that tangibility is necessary to create a successful calendar, or that a more tangible calendar will be more likely to be used. Facebook's calendar system, for instance, is used by millions, without being tangible at all. Tangibility is included here simply because it is an interesting dimension to measure. Having a physical calendar might be very important to some, and not a necessity for others.

- **Reminders**

Whether or not the user can be reminded of events in the calendar.

- **Ease of use**

Whether or not the calendar has a steep learning curve.

- **Synchronization**

Whether or not the data in the calendar can be synced with other devices. An example might be adding events to a software calendar, and then having the data appear in the calendar on your mobile device.

- **Data permanence**

Data permanence relates to how data in the calendar is maintained over time. Calendars where the user needs to input the same data over and over again have low data permanence. For instance, in some cell phone calendars, users can add events, and tell the device that the added event is a birthday, and then the event will repeat in the calendar every year.

- **Data privacy**

Whether or not the user's data is securely stored and private. All data is vulnerable to theft and loss in some way. Your organizer and phone could be stolen, your Outlook account be hacked, and there are no guarantees that information stored

online, “in the cloud” are totally safe. However, password protection can help secure data if it is kept in a digital format.

Keep in mind that different users have different needs. For some, privacy might be critical, whereas others want portability or ease of use. A combination of the needs listed above probably fit most potential users.

Note that there are many other dimensions on which these calendar types could be rated. The ones shown here are the ones most relevant to managing and remembering events.

	Portability	Tangible/ physical nature	Reminders	Ease of use	Syncs with other devices	Data perm.	Privacy of data
Wall-mounted calendar	* Impractical to move	*** A real, physical manifestation of data (ink on paper)	- No reminders, relies on user to check calendar	*** Requires only basic knowledge of calendars and ways of using them	- No synchronization	- Data must be re-entered into new calendar each year	n/a Privacy of calendar data depends on where calendar is kept.
Organizer	*** Portable in bag or purse	*** A real, physical manifestation of data (ink on paper)	- No reminders, relies on user to check calendar	*** Slightly more complex than wall-mounted calendar, yet still easy to use	- No synchronization	- Data must be re-entered into new organizer calendar each year	** If kept safe, organizer data is fairly private
Cell phone calendar	*** Portable, many people don't leave the house without cell phone	- Not tangible	*** Alarm can sound when scheduled event approaches	** Cell phones have varying learning curves, require effort from user.	* Some phones can be synchronized with other devices	** If synchronized with external server data can be seen as permanent. If not, data can easily be lost	** If cell phone is kept safe, calendar data is fairly private
Software calendar (Outlook and similar enterprise software)	** Portable if the user synchronizes data with phone and keeps phone nearby	- Not tangible, data is in 'the cloud'	** Can be set, but most solutions require the user to be in front of computer screen to receive reminders	** Complex software often have steeper learning curves than simpler solutions	*** Often synchronized with servers and mobile devices	** Data is kept in "the cloud"	*** Data can be password protected
Social networks (Here exemplified with Facebook)	** Data can be used in Facebook applications, yet data is not truly portable. The data is owned by	- Not tangible, data is in 'the cloud'	** Requires external applications, not an internal feature	** Calendar is only one of many features, and not the primary feature	* Not easily synchronized with other devices	* All data entered into system is owned by the social network, so it can be removed at any time	** Data is password protected

	Facebook.						
Birthday Hero	*** Calendar available from any web browser. Data can be exported at will. Data can be printed.	** User-entered data can be printed and printout used as a paper/wall-mounted calendar	*** Supports E-mail and SMS reminders	*** Service only has one purpose, to help people remember important events	** Can eventually synchronize data with iPhone or Android application	*** Data owned by user, birthdays and anniversaries repeat every year (no need to reenter information)	** Data is password protected

Note: The features of the BirthdayHero service will be explained in greater detail in later chapters.

4.3.1 Where does BirthdayHero fit in?

Where does BirthdayHero fit in relation to the other options? I believe that the service should position itself as a backup service. By this I mean that users should be able to rely on BirthdayHero to remind them of events that they might otherwise not remember. They might still use a wall-mounted or software calendar, but use BirthdayHero as a backup tool. This could give people reassurance so that they don't have to worry so much about forgetting events. Users know that they will be reminded, no matter what. The service will be designed to do only one thing, to help users remember important events, and to do that well. Users looking for just this functionality might see BirthdayHero as a good choice compared to more comprehensive calendar services like Microsoft Outlook. That BirthdayHero will not have the learning curve associated with more massive software or services might make it appealing to users looking for an easy-to-use solution.

5. Data & results

This chapter presents the data gathered from the interviews and usability tests. The data is then analyzed for insights into user needs and behavior. In addition, the prototypes made during prototyping are presented and critiqued.

5.1 Data from interviews

Here are some of the transcripts from the interviews. Follow-up questions asked by the author during the process are marked in **bold**.

1. **How do you keep track of birthdays of family members and friends? What strategies do you use?**

24-year-old male:

“It depends on whose birthday it is. If it’s a family member my mom usually keeps track for me and reminds me. We have a calendar in the kitchen, a wall-mounted calendar. One friend of mine’s birthday I always remember because it’s on the same day as a festival in the town where I grew up.”

Why is the calendar in the kitchen?

“I guess it’s convenient to have it there, it’s where everyone in the family is, every day. To keep track of friends’ birthdays, I have an alarm set on my phone which reminds me.”

For all of your friends?

“No, only for my closest friends, the birthdays I really have to remember. Everyone else, acquaintances I guess I could call them, I keep on Facebook. I’m on it quite often so I see what birthdays are coming up. If I don’t remember their birthdays it’s not a disaster.”

18-year-old female:

“I use Facebook mainly. I’m on Facebook every other day, so I usually stay up to date.”

51-year-old female:

“I keep track of birthdays by writing them in the calendar in my organizer.”

52-year-old male:

“I use an organizer and some birthdays I just remember.”

24-year-old male:

“The most important birthdays, like my parents’ and my sister’s, I remember without any aids, but for friends it’s more difficult. I have everyone on my Facebook account, but I’m rarely on there, so I miss a lot of birthdays that I probably should remember. I’ve tried using an organizer, but I end up not checking it as often as I should.”

55-year-old female:

“I have a birthday calendar, which is a list of everyone’s birthdays. I always remember the birthdays of my closest relatives.”

61-year-old male:

“I just remember them in my head.”

34-year-old female:

“I keep a birthday diary, which is basically a list of birthdays. Every January, I add the birthdays from the diary to the calendar in my organizer. I usually know what month people’s birthdays are, but not the specific date.”

33-year-old male:

“I have a calendar on my cell phone. I set reminders in the calendar so I don’t forget. My wife also helps me, she keeps better track of things than I do.”

43-year-old female:

“I use good old fashioned memory. Every important date makes a bell go off in my head. I have a good memory and I rarely forget birthdays. Especially numbers are easy for me to remember. I even remember birthdays I don’t need to remember! Like Fred, who I went to school with when I was 7, his birthday is on January 12th. If someone mentions a date to me, I somehow attach it to that person, and that date sticks forever.”

43-year-old male:

“I remember birthdays simply by habit, or luck maybe?”

2. How good are you at remembering the birthdays and anniversaries that you want to remember?

1. I always forget 2. I sometimes forget 3. I rarely forget 4. I never forget

24-year-old male: "I rarely forget"

18-year-old female: "I sometimes forget"

51-year-old female: "I sometimes forget"

52-year-old male: "I sometimes forget"

24-year-old male: "I sometimes forget"

55-year-old female: "I sometimes forget"

61-year-old male: "I rarely forget"

34-year-old female: "I rarely forget"

33-year-old male: "I sometimes forget"

43-year-old female: "I rarely forget"

43-year-old male: "I rarely forget"

3. How many birthdays do you have to remember? How many of those birthdays do you remember, right now?

24-year-old male: "I remember about 25 out of the 50 that I have to remember. I have a big family"

18-year-old female: "It's expected of me that I remember around 30 birthdays, but I only remember 19 of those right now."

51-year-old female: "I remember 9 out of 12."

52-year-old male: "I remember about 7 of the 15 I need to remember."

24-year-old male: "I remember about 7 out of the 13 that I have to remember."

55-year-old female: "I remember 12 out of 12."

61-year-old male: "5 out of 5."

34-year-old female: "I remember 7 out of 10."

33-year-old male: "10 out of 18"

43-year-old female: "I have to remember about 100-150 birthdays. I think I remember all of them."

43-year-old male: "I have to remember 4, excluding my own. Anything more than that is just a bonus. I remember all of them, not that that is very impressive."

4. When was the last time you forgot someone's birthday or an anniversary?

1. Within the last month
2. Within the last 3 months
3. Within the last year
4. More than a year ago
5. Can't remember

24-year-old male:

"Within the last month - I forgot my uncle's birthday the other day. I remembered it the day after, but by then I felt it was too late to do anything about it."

18-year-old female:

"Within the last month - I forgot a friend's birthday yesterday."

51-year-old-female:

"Within the last 3 months - My daughter and I both forgot my husband's birthday not too long ago. We thought it was the day after the day that it really was. I also forgot my nephew's birthday a few months ago."

52-year-old male:

"Can't remember – If I've forgotten a birthday recently I can't remember whose birthday it was!"

24-year-old male:

"Within the last month - I've almost forgotten a friend's birthdays recently. Luckily, a friend of mine sent me an SMS message to remind me on the day of the birthday. So I ended up remembering it anyway."

55-year-old female: "More than a year ago – I forgot our wedding anniversary."

61-year-old male: "More than a year ago – I forgot our wedding anniversary."

34-year-old female:

“Within the last year - I forgot someone’s birthday as well as our wedding anniversary.”

33-year-old male:

“Within the last year – My wife and I both forgot our wedding anniversary last fall.”

43-year-old female:

“Can’t remember – Maybe I haven’t forgotten any?”

43-year-old male:

“Can’t remember – I probably wouldn’t know if I had forgotten a birthday.”

- What were the consequences and how did it make you feel?

24-year-old male:

“It doesn’t feel good to forget someone’s birthday, especially when it’s a family member or someone whose birthday you don’t want to forget. It’s a conscience thing, I think.”

18-year-old female:

“Well, I had to have an awkward conversation with my friend. ‘Sorry I forgot your birthday..’”

51-year-old-female:

“When I forgot my nephew’s birthday the consequences were that I was late sending him a gift.”

52-year-old male:

“There might have been consequences but since I don’t remember forgetting anything I don’t know what they were.”

24-year-old male:

“I hate forgetting things, but I’m too lazy to do anything about it. I keep repeating the same mistakes every year. Every time I forget someone’s birthday, I think to myself: ‘I have to write down the date this time, or set an alarm for next year’ – but I never do.”

55-year-old female:

“Since we both forgot our wedding anniversary there were no major consequences.”

61-year-old male:

“We both remembered that we had forgotten our wedding anniversary after a week. There were no big consequences.”

34-year-old female:

“Luckily, we both forgot our wedding anniversary.”

33-year-old male:

“We both forgot our anniversary, so it wasn’t a big problem. We just laughed about it.”

43-year-old female:

“I probably felt sad, and stupid for forgetting.”

43-year-old male:

“It probably wasn’t a problem. People don’t really mind, do they? I don’t think they mind.”

5. Which events are the hardest to remember?

24-year-old male:

“I have some cousins whose birthdays I always forget. I don’t see them that often, so I don’t feel too badly about it. Still, it would make me feel good to remember them. It’s easier to remember the birthdays of friends who were born in the same year as me. At least I’ll know their age! (laughs)”

18-year-old female: “I’m not sure, but I’ve forgotten tests and exams before. Those I have trouble remembering sometimes.”

52-year-old male:

“I find that the birthdays of distant relatives are the hardest to remember. Nephews and nieces are hard, too. I once forgot that I was to give a speech and presentation for about 70 people. The way that I found out was when I met an acquaintance from

work at the grocery store and he said 'I'm looking forward to your presentation next week!' I just politely thanked him and walked away. I was lucky to meet him or I would have never remembered. That would have had consequences!"

24-year-old male:

"Distant friends and relatives. People I don't keep in touch with that often are the hardest. The people I see every week I probably won't forget because the environment around us makes it hard to forget. If someone at work has a birthday coming up, for instance, someone else will mention it to let everyone know ahead of time. If the person worked somewhere else I wouldn't have anyone to remind me."

55-year-old female:

"I always remember birthdays, but I often forget our wedding anniversary."

61-year-old male:

"I don't have trouble remembering events."

34-year-old female:

"I think age is the hardest thing to remember. Like last month, I asked my sister if we should do something special for our mom's 55th birthday next year. Turns out, her 55th birthday is this year. I had no idea."

33-year-old male:

"Birthdays in general are hard to remember, there are so many of them!"

43-year-old female:

"Just bringing the shopping list when going to the store can be hard. I have most trouble remembering the people in the periphery of my life. The people I don't meet very often or at all anymore."

43-year-old male:

"I usually don't remember the birthdays that I'm not very involved in. Like those of distant relatives, for example."

6. Do you have any ideas on how technology could help you remember important birthdays, anniversaries, and events?

24-year-old male:

“Maybe some sort of database, where everything is stored? Keeping everything in one place would be practical. I’d like to get reminders too. Maybe they could pop up on my screen?”

From a software application?

“Yeah, something I have installed.”

18-year-old female:

“If I forget my organizer at home one day I’m a nervous wreck, so it would be great to have something that I can access anywhere.”

51-year-old-female:

“I would want to have my entire schedule with me. It could be on my phone or some other device with a bigger screen. If I could synchronize my calendar on the phone with the one on my computer that would be practical.”

52-year-old male:

“I want a solution that is always available, I don’t want another device I need to carry around with me. I dislike having to rely on an organizer. I’ve found that cell phones don’t last very long, and when they break they take all your calendar data with them too.”

24-year-old male:

“I would appreciate getting reminders by SMS and e-mail.”

55-year-old female:

“I would like to get reminders via e-mail and SMS.”

61-year-old male:

“I might like to get e-mail reminders.”

34-year-old female:

“I’d like to get an SMS reminder with the person’s age.”

33-year-old male:

“Like I said, the calendar in my cell phone reminds me of the events I’ve added. But

that means that I have to add stuff to the calendar. If I don't add it I'll forget it. It has to be easy to add things."

43-year-old female:

"There are so many things that we have to remember, every day of every month of every year there is something to remember. I keep a mental organizer in my head, but technology could perhaps help me relax, and know that I won't forget the things I want to remember without worrying so much about forgetting. I've been afraid of oversleeping for 25 years, and I still wake up several times in the middle of the night. I'm always up before my alarm rings, and I've yet to oversleep."

43-year-old male:

"I have a cell phone with a calendar, but I don't remember to add new birthdays or events when I have to, so it doesn't really help me at all. I also have a wall calendar (that I never look at), and a Google calendar account that I use – it's not really about the type of aid. It's more about laziness."

7. Would you like to receive reminders for birthdays, anniversaries and other events?

24-year-old male: "Yes"

18-year-old female: "Yes"

51-year-old female: "Yes"

52-year-old male: "Yes, but the service has to be free"

24-year-old male: "Yes"

55-year-old female: "Yes"

61-year-old male: "No, not really. I want to remember things on my own"

34-year-old female: "Yes"

33-year-old male: "Yes"

43-year-old female: "Yes, but would the data I have stored in my memory disappear? What if I don't want to forget the birthdays I've spent so long memorizing?"

43-year-old male: "Yes"

- If so, how would you prefer to receive reminders? On your phone? Via E-mail?

Some other way?

24-year-old male:

“I’d rather get SMS reminders than e-mail reminders. To get e-mail reminders I would have to be by my computer all the time. Of course, getting SMS reminders means that my phone has to be turned on and have reception. Sometimes I turn my phone off too, like when I go up to stay at my family’s cabin in the woods. I don’t want to be bothered, so I switch it off. Then I guess I wouldn’t get reminders, but then again, maybe I won’t care as much because when I’m there I want to be away from civilization. I need to not be bothered from time to time. I’d want to get more reminders for the most important birthdays - like my parents or siblings, or close friends. Maybe I could make a VIP-list for the most important events?”

18-year-old female:

“I’d like to be able to choose how to get reminders. I don’t want to be limited to one way of being reminded.”

51-year-old-female:

“I would want to get reminders by SMS, since I always have my phone with me.”

52-year-old male:

“E-mail reminders would not help me much since I have a calendar on my computer. It’s when I’m away from the computer that I need reminders.”

24-year-old male:

“I would prefer SMS reminders first and foremost, but e-mail reminders can be practical too. I have a Twitter account, so sending a reminder to me there as well could be helpful. Maybe I should be able to say ‘This birthday is super important, so send me frequent reminders of all sorts’ – so that it’s guaranteed that I receive a reminder. I wouldn’t want that for all of the birthdays I want to remember, however, just the important ones. For distant relatives all I need is a reminder on the day of the birthday.”

55-year-old female:

“I would prefer SMS reminders.”

34-year-old female:

"I would want SMS reminders."

33-year-old male:

"SMS reminders are probably best. There has to be an audible alert. I have to notice that I'm getting a reminder."

43-year-old female:

"E-mail and SMS are fine, I'm not on Facebook so reminders there would be useless for me."

43-year-old male:

"I would want to get e-mail reminders a few days before."

- What should the reminder say?

24-year-old male:

"Well, it should say whose birthday it is, and how old they will be."

Why do you want to know their age?

"Because it's much more personal to congratulate someone by saying 'Happy 25th birthday!' than just saying 'Happy birthday'. I'm sure some of my friends would be impressed if I knew their age every time."

Do you think the people whose birthdays you remember will feel that you're cheating because you got a reminder?

"No, not really. Everyone gets reminded somehow, if it's Facebook, their cell phone or something else. I don't see a problem with that."

24-year-old male:

"Their age needs to be in the reminder, because I don't want to do the math in my head every time. For anniversary reminders, it would be useful if the reminder said which anniversary it was. The 1st, 5th, and so on."

55-year-old female:

"It should tell me the date of the birthday, the name of the person and the age they are going to be."

34-year-old female:

“It should tell me whose birthday it is, when it is and what age they’ll be.”

33-year-old male:

“It needs to inform me of what sort of event I’m being reminded of, and the person’s age if it’s a birthday.”

43-year-old female:

“It should answer the questions of ‘who’, ‘what’ and ‘how old’ etc.”

43-year-old male: “It should say: ‘This is what you’ve forgotten today’ and then the birthday or anniversary for that day.”

5.2 Results from interviews

The interviews proved to be a source of valuable insight. Having potential users share their stories was useful in terms of discovering user needs. Although the data from the interviews is interesting, it should be seen mainly as qualitative data. However, asking these same questions to a much larger group through a survey could yield statistical data.

These were the key insights learned from each question:

1. How do you keep track of birthdays of family members and friends? What strategies do you use?

The interviews showed that the participants had varied strategies for remembering birthdays. Some only keep track using their memory. Some use traditional methods like writing dates in organizers or on wall-mounted calendars. Others use more modern techniques, such as setting alarms on their cell phones, and using social networks like Facebook. Two participants indicated that they rely on others to help them remember every birthday.

2. How good are you at remembering the birthdays and anniversaries that you want to remember?

Six participants answered that they “sometimes forget”. Five answered that they “rarely forget”. None replied that they “always forget” or “never forget”. These results are as predicted. Few people always forget or never forget.

3. How many birthdays do you remember, right now?

None of the participants remembered less than 50% of the birthdays they say they have to remember. The fewest reported number of birthdays that a participant had to remember was 4. One participant said that she had to remember 100-150 birthdays, which is a remarkable feat. Most of the participants remember about 60 to 70% of the birthdays they need to remember. That means that at least 30 to 40% of these birthdays might be forgotten. If these numbers hold true for the rest of the population, there could be a large market for a birthday reminder service.

4. When was the last time you forgot someone's birthday or anniversary?

Six of the participants answer that they have forgotten a birthday or anniversary within the last year. Three of those have forgotten a birthday within the last month. Two participants haven't forgotten a birthday or anniversary in at least one year, and three participants couldn't remember the last time they forgot a birthday. The participants who said that they couldn't remember the last time they forgot a birthday also said that there was a possibility that they had indeed forgotten someone's birthday, but that they had never been notified about forgetting, and thus didn't know about it.

These numbers seem to correspond well with the data gathered from interview question number four, which states that participants, on average, remember 60-70% of the birthdays they need to remember. As birthdays repeat every year, it would mean that few participants could have remembered every birthday in the last year.

- What were the consequences and how did it make you feel?

Some participants replied that there were consequences for not remembering birthdays or anniversaries. These included feeling stupid and sad, having a guilty conscience, and having to have awkward conversations with the person they had forgotten. The interview does not touch on the feelings of or consequences for the person whose birthday is forgotten, though this might be an interesting topic for future interviews to explore.

Some of the interview participants were couples that had forgotten their wedding anniversaries. "Luckily, we both forgot" was a common response in the interviews. If

only one person in the relationship had forgotten the anniversary, the couples might have had even more interesting stories to share. It is likely that one of them has forgotten an anniversary at some point, but that these stories might be awkward to share with an interviewer, and that they therefore were kept private.

One participant replied that she was late sending her nephew a birthday gift because she forgot his birthday. Sending a birthday present late might affect the relationship between the participant and her nephew, though perhaps not as much as forgetting the birthday in the first place.

5. Which events are the hardest to remember?

The common argument presented by the participants is that the birthdays of people you rarely interact with, are the most difficult to remember. Distant friends and relatives seem to be forgotten most often.

One participant emphasized the role that the environment plays in remembering a person's birthday. If you work in an office with lots of people, they might let each other know about upcoming birthdays and events.

6. Do you have any ideas on how technology could help you remember important birthdays, anniversaries, and events?

Most of the participants replied that they would like technology to take some of the burden off of remembering birthdays. Some already use modern technology such as cell phone calendars or Facebook to manage their lives, but indicate that these might not fulfill their needs. A common theme is that the calendar in which they add events should be accessible from anywhere and that event reminders should be sent via SMS and e-mail. The answers indicate that many users keep birthdays and other important dates stored in different places. Some might be on Facebook, others on a wall-mounted calendar in the kitchen, and some in an organizer. What users might need is a centralized system to keep track of all of their data, but which can be accessed from anywhere.

A female participant explained how she became a nervous wreck if she forgot her organizer at home. This illustrates the need to make the data available for the user in

as many different forms as possible. Perhaps the user should be able to print a sheet of paper with a list of this month's events generated from data the user has added, which the user can take with him in his organizer. As one participant puts it, "laziness" might explain why he struggles with remembering birthdays. Thus, making entering data into the system easy and enjoyable should be a top priority.

7. Would you like to receive reminders for birthdays, anniversaries and other events?

Only one participant replied that he did not want to get reminders. The rest answered that they wanted to receive reminders. One participant expressed concerns about what would happen when relying on a system such as BirthdayHero, in terms of what would happen to the memory users have stored. It would be interesting to see whether or not the users' "birthday memory" improves by using the BirthdayHero service. Perhaps being reminded of a birthday will reinforce the user's memory of that birthday. A solution that hopes to make users even better at remembering birthdays will be introduced in later chapters.

Another participant said that he only wanted to use a reminder service if it was free. This initial interview was only meant to judge whether or not the BirthdayHero service might have merit. Therefore, the question of whether or not the user has to pay for the service is not as interesting at this point. The goal is to create a final product that satisfies users' needs to the extent that they won't mind paying a small fee for it. None of the respondents currently used a service that provides SMS and e-mail reminders for birthdays and other events. That the majority of respondents said that they would want to get reminders this way is a strong positive indication that a reminder service could satisfy an unmet user need.

- If so, how would you prefer to receive reminders? On your phone? Via E-mail?

Some other way?

The majority of the participants responded that they wanted to get SMS reminders. SMS reminders were seen as practical because they could reach the user anywhere. As one participant replied "E-mail reminders would not help me much since I have a calendar on my computer. It's when I'm away from the computer that I need reminders." This supports the assumption that SMS reminders will be the main

selling point for the service. E-mail reminders are still important, however, and should be available. Getting reminders via Twitter was mentioned by one participant, although this should probably not be prioritized as Twitter's user base is fairly small compared to the potential user base that can receive SMS and e-mails.

- What should the reminder say?

The participants were fairly unanimous in expressing that birthday reminders should tell the user the name of the person whose birthday it is, the date of the birthday and the person's age.

5.3 Results from prototyping

This section describes the evolution of the BirthdayHero prototype.

5.3.1 First prototype (January 2009)

When designing the first prototype, the primary goal was to create a calendar layout that would work within the confines and limitations of a web browser. The prototype also had to allow the user to add data to the calendar.

5.3.1.1 Prototype description

The interface in the first prototype consisted of a central calendar, and a sidebar on the right side of the page. The first prototype's calendar interface mirrors the way a traditional, physical calendar displays months and dates. Figure

16 shows a wireframe presenting the main structure of the page. It consists of a header at the top of the page which encompasses primary and secondary navigation links, and a main content area which contains the calendar and a sidebar.

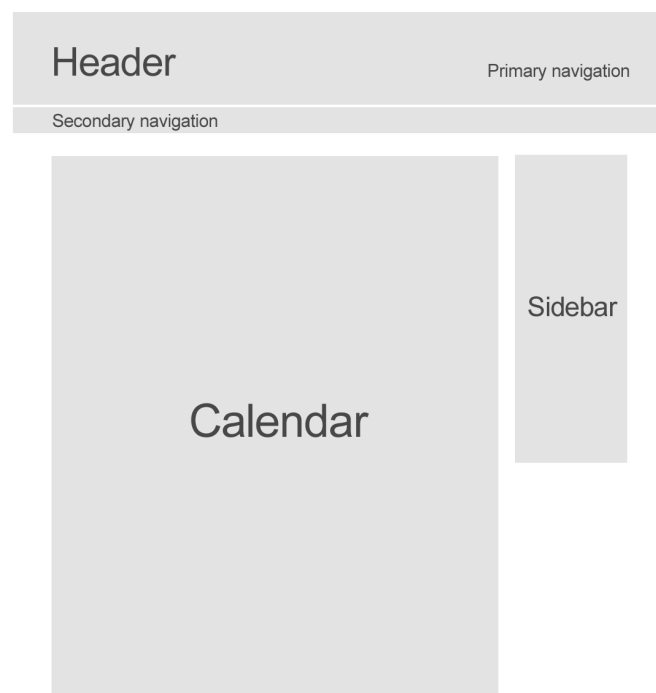


Figure 16 – The main design elements of prototype 1

Figure 17 is a screenshot of the high-fidelity prototype of the calendar page. At the top of the page, the header displays the BirthdayHero logo, as well as primary and secondary navigation menus that link to the different pages on the site. The first link in the primary navigation menu (top right) links to “Home” which is the front page at BirthdayHero.com. “Blog” would link to the BirthdayHero blog, where users can read news about the service. “About” would be a page with information about the service, as well as provide contact information if users needed help.

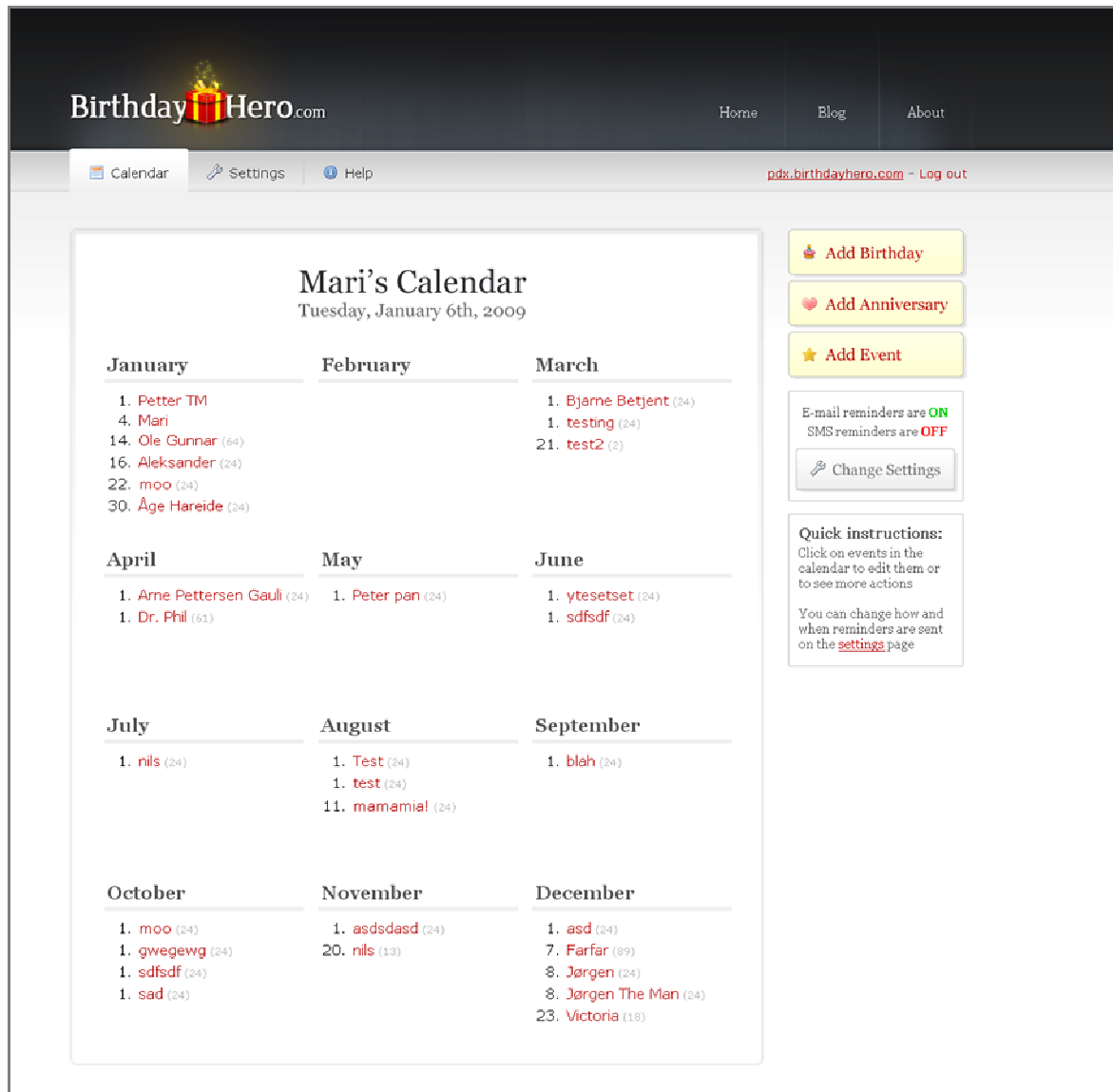


Figure 17 – A detailed view of prototype 1

The calendar itself has a heading which shows the name of the logged in user, as well as the current date. The calendar is divided into months, and under the name of each month are the events that the user has added. Months with no added events are blank. Each event

consists of several elements. The first is the date. The second is the name of the event, and the third is the age of the person whose birthday it is. The sidebar contains buttons to allow the user to add birthdays, anniversaries and events.

The term “events” is used throughout these chapters as a general term to refer to three different types of events. The three different types of events are birthdays, anniversaries and events. Birthdays and anniversaries are self explanatory, but an event is any kind of data the user wants to add which can not be labeled a birthday or anniversary. An event can, for instance, be something like “Jack returns from business trip” or “Pick up dry cleaning”. While the main focus of the service is to allow users to better organize and remember birthdays and anniversaries, they can also use the calendar to remember anything and everything else. If the “event” category had not been implemented, it could limit the usefulness of the service.

The calendar

Physical calendars usually display every day in every month. Days are still visible if they have no data. Initially, this was a concept that I wanted to move away from, to try a different approach. If the calendar in the screenshot above had displayed every day in the year, not much of the user’s data would be visible above the fold. The user would be met with lots of empty space where there were no events added. Therefore, the choice was made not to display empty days. The consequences of not displaying empty days, and why this was a poor design choice will be discussed later.

Color coding the different types of events in the calendar might help user identify them and navigate the calendar more easily. Here are two different explorations of this idea:

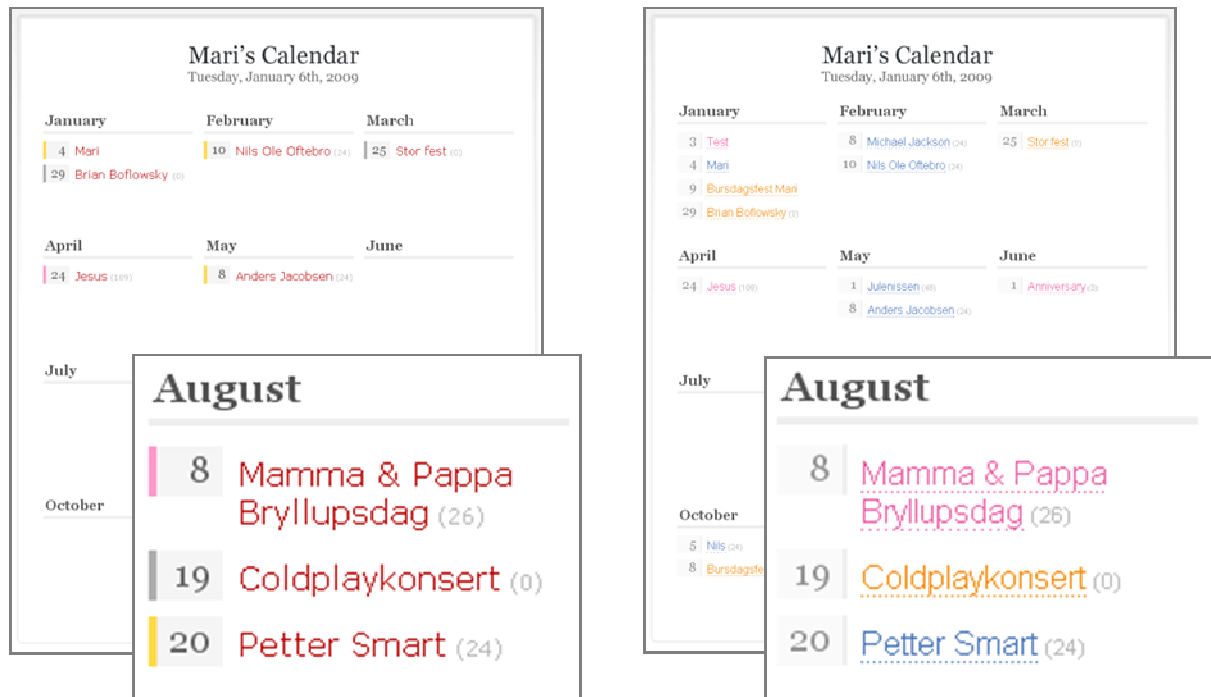


Figure 18 – Comparing two methods of displaying event types

In the first screenshot, the date of the event is color coded. This makes it easy to see which events are birthdays (blue), anniversaries (pink/purple) and events (orange). However, the main drawback of this option is what happens when you have more than one event on the same day. What color should the date box be if there is both a birthday and an event on that date? Additionally, it is the name of the event that should be color coded, since figuring out what type of event “Coldplaykonsert” in the first screenshot requires that the user first looks at the text itself, and then at the color of the date.

In the second screenshot, the name of the event itself is color coded. This is a much more practical way of displaying the events, because it reduces the cognitive effort required by the user to understand what type of event each line of text represents. One look, and you know that “Petter Smart” is a birthday, and that “Coldplaykonsert” is an event, as long as you remember the color codes. The color blue was chosen to be the color for birthdays. The color pink is used as the color for anniversaries. This was a conscious choice, as many users might associate this color with romance, red hearts and so on. The orange color used to signify events was chosen simply because it did not clash with the two other colors.

The sidebar

The sidebar serves many purposes. The primary focus is on the buttons which the user can click to add birthdays, anniversaries and events.

The second function is to show the user the status of the reminder settings. This can allow the user to see with a quick glance if reminders are on or off. The words “ON” and “OFF” are color-coded, so that “ON” is green and “OFF” is red.

If the user wants to change these settings, they would have to click on the “Change settings” button. The settings page was not implemented in the first prototype. At the bottom of the sidebar is a help text which explains to the users what actions they can take on the page.

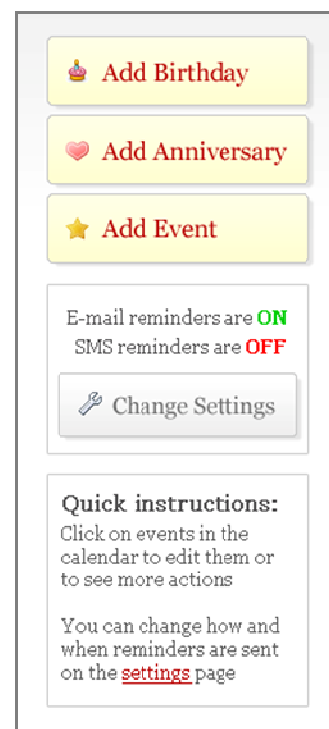


Figure 19 – The sidebar

5.3.1.2 Adding events

To add a birthday, the user can click on the “Add Birthday” button in the sidebar. When the button is clicked a lightbox appears in the middle of the screen. A lightbox is a modal window that belongs to the web page that the user is on. A lightbox can be a good way of displaying forms that the user needs to fill out to complete a task. When the lightbox opens, the rest of the page is dimmed to hide elements on the page that can serve as distractions. Now, the user only has to focus on filling in the appropriate data in the form.

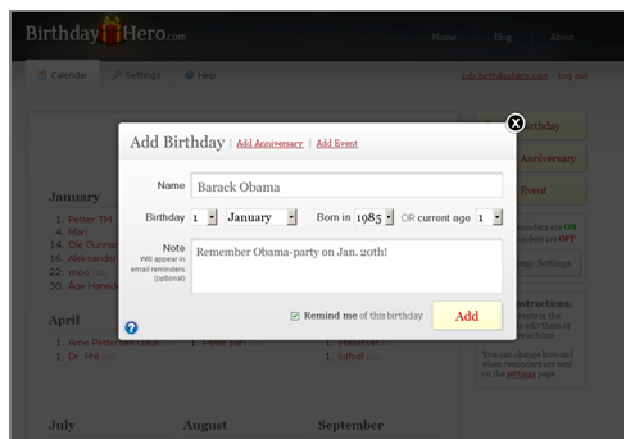


Figure 20 – Opening the lightbox

Below is a screenshot of the first step in the process of adding a birthday.

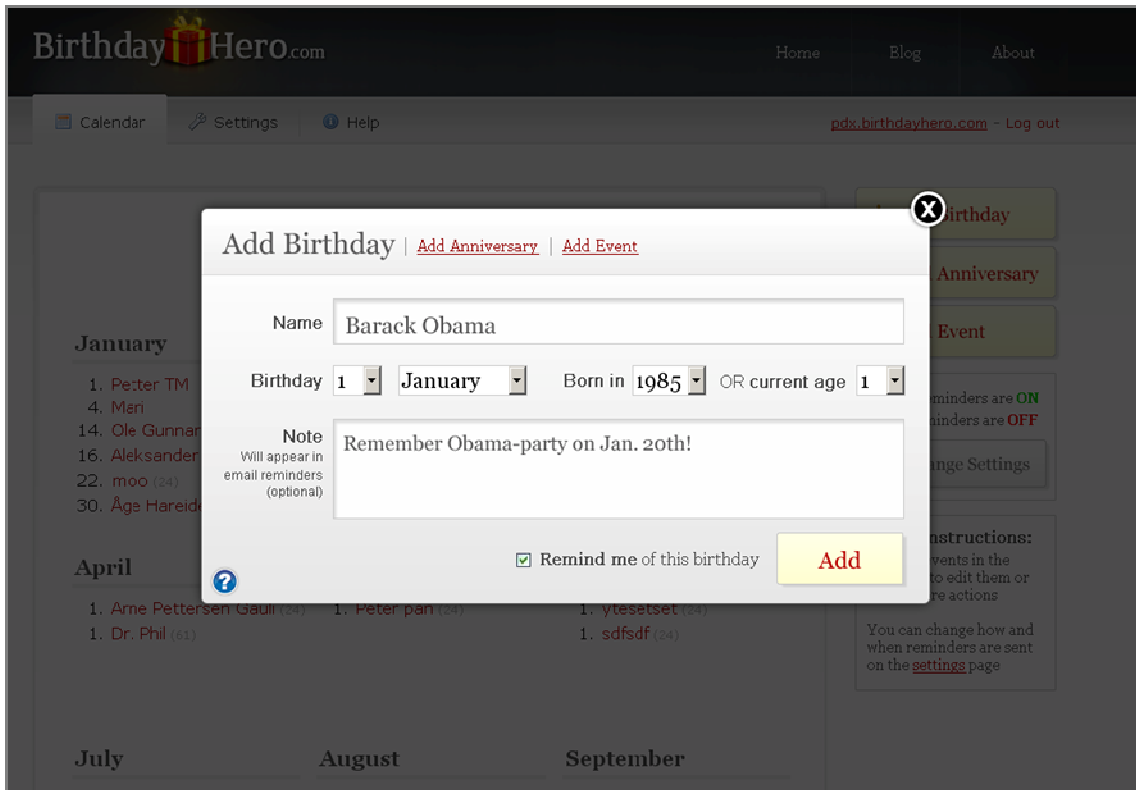


Figure 21 – Adding a birthday

The lightbox contains a form that the user needs to fill out. The first field is the “Name” field. This is the name of the person whose birthday you are adding. The second section is where you select the birth date of the person whose birthday you are adding. First the user selects the birth day, and then the birth month. The next select boxes allow the user to select which year the person was born or the person’s current age. If the user selects a year in the first box, the system automatically updates the second select box to show the person’s current age. Vice versa, if the user selects the person’s current age, the proper birth year is selected in the first select box. The age and birth year calculations take into account what date the user has selected in the day and month select boxes, because if the person has already had a birthday this year their current age will be one year more than if they had not had a birthday already.

The next field is called “Note”. The text the user optionally writes here will appear with reminders that are sent to the user.

The final section is a checkbox where the user can select whether or not he or she wants to receive reminders for this event. If unchecked, no reminder will be sent for this event.

Clicking the “Add” button shows the user either a confirmation message (shown below) or an error message.

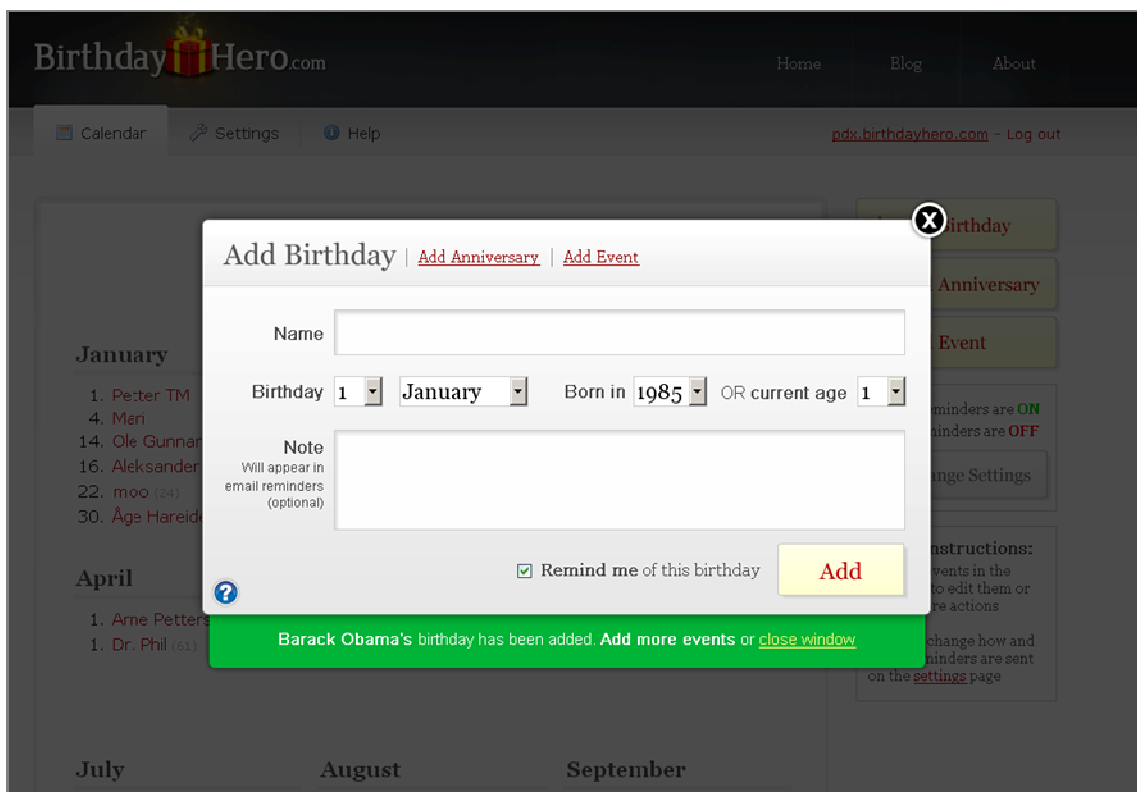


Figure 22 – A birthday has been added successfully

The confirmation message tells the user that the event has been added successfully. The bottom part of the lightbox is now green, to symbolize that everything has gone according to plan. The text in the bottom section reads “Barack Obama’s birthday has been added. Add more events or [close window](#).” Because the lightbox doesn’t close immediately after the user has added one event, the user can add more than one event at a time. Clicking on the “Add Anniversary” and “Add Event” links at the top of the lightbox allows the user to add more than one type of event at a time, as well. Clicking on “[close window](#)” closes the lightbox and returns the user to the calendar view. The user can also click on the big “X” icon in the upper right corner of the lightbox, or anywhere in the dark area outside of the lightbox to close it.

5.3.1.3 Editing events

If a user wants to edit an event after it has been added, all they have to do is to click on the name of an event in the calendar. The lightbox will open again, this time in an edit view.

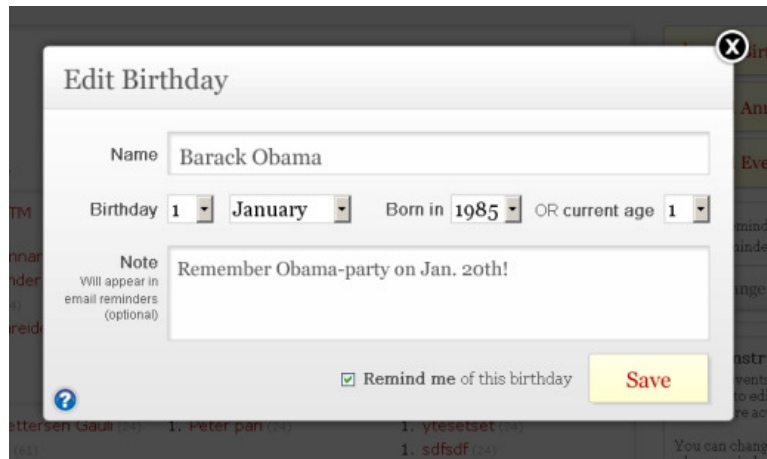


Figure 23 – Editing an event

Notice in the screenshot that the title in the lightbox is now “Edit Birthday” and that the text on the button in the lower right corner is now “Save” instead of “Add”. The interface is similar to that of adding events, yet since the context is now different (editing vs. adding), the header and button text has been modified. User will hopefully understand how to use the editing interface, since they have already used a very similar interface to add events.

5.3.1.4 Deleting events

In the first prototype, there was no functionality to delete an added event.

5.3.1.5 Critique of the first prototype

The first prototype served as a great way of exploring the challenges of creating a web-based calendar. While it may seem easy, creating an online calendar interface is actually quite difficult. Here are some of the questions that came up during the design of the first prototype.

- What is the best way to present calendar data?
- What is the best way to display dates?
- Should dates with no events be shown?
- What is the best way to enter data?
- How should different types of events be differentiated?

- Should common calendar conventions (such as aligning dates in a grid) be ported directly to the web?
- Should users be able to turn on and off reminders from the calendar page, or should these settings be on a separate page?
- How do users' assumptions about how they can use calendars online match up to what the prototype calendar can do?

Answering some of these questions will be attempted by creating an improved prototype which will be tested on users. If users are able to complete tasks such as adding, editing and removing events in an efficient and satisfying way, then the design can be considered successful.

The scrolling problem

During the design of the first prototype an interesting design problem was discovered. If the user has filled their calendar with events and scrolls to the bottom of the page, the buttons for adding events remain above the fold, and are no longer visible to the user.

In this first screenshot, the user has added events to the calendar. The user can add events easily by clicking on the buttons on the right. Notice how only three months are fully visible, the rest are below the fold. How many months the user sees depends on their screen resolution.

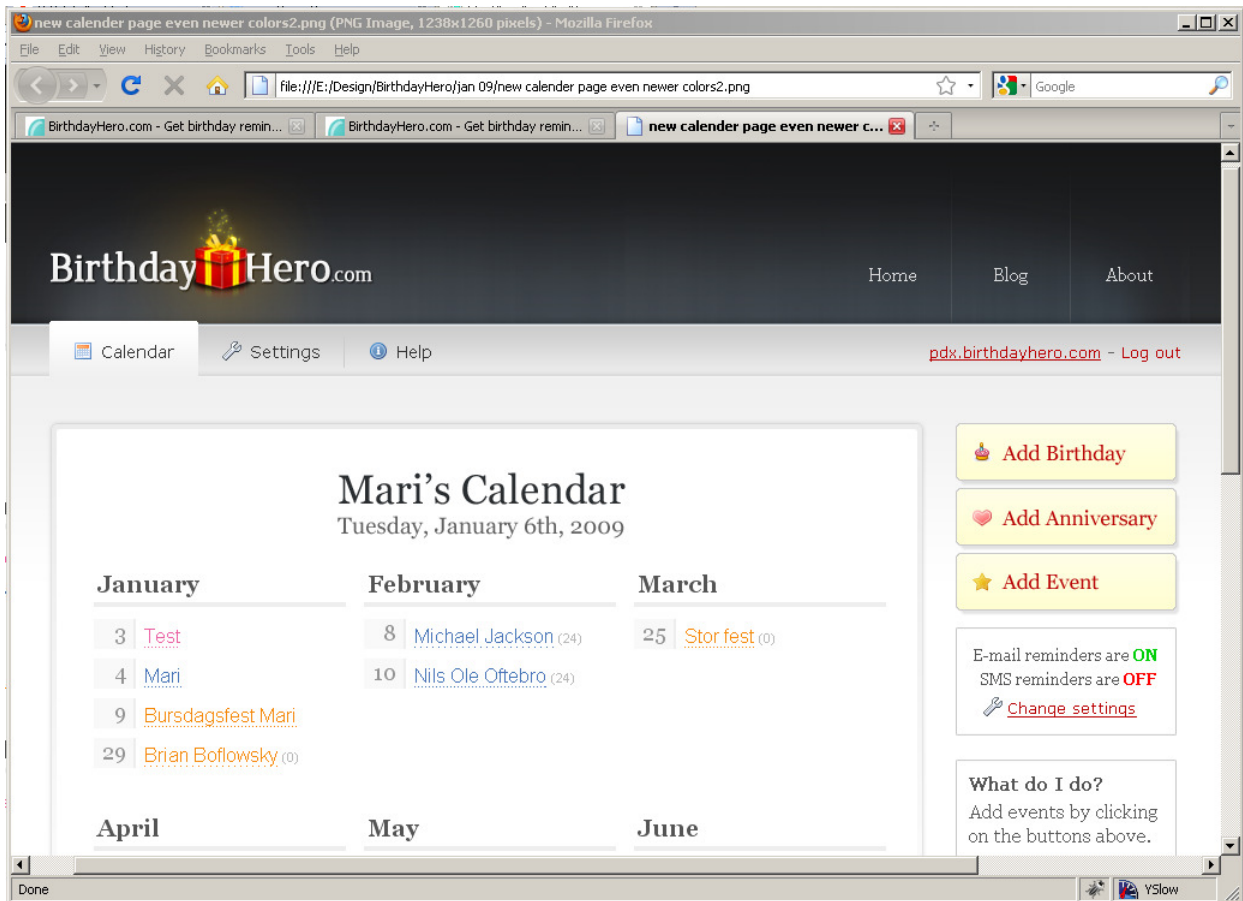


Figure 24 – Only the first three months are fully visible

In the next screenshot, the user has scrolled to the bottom of the page. Notice how the buttons in the sidebar are no longer visible.

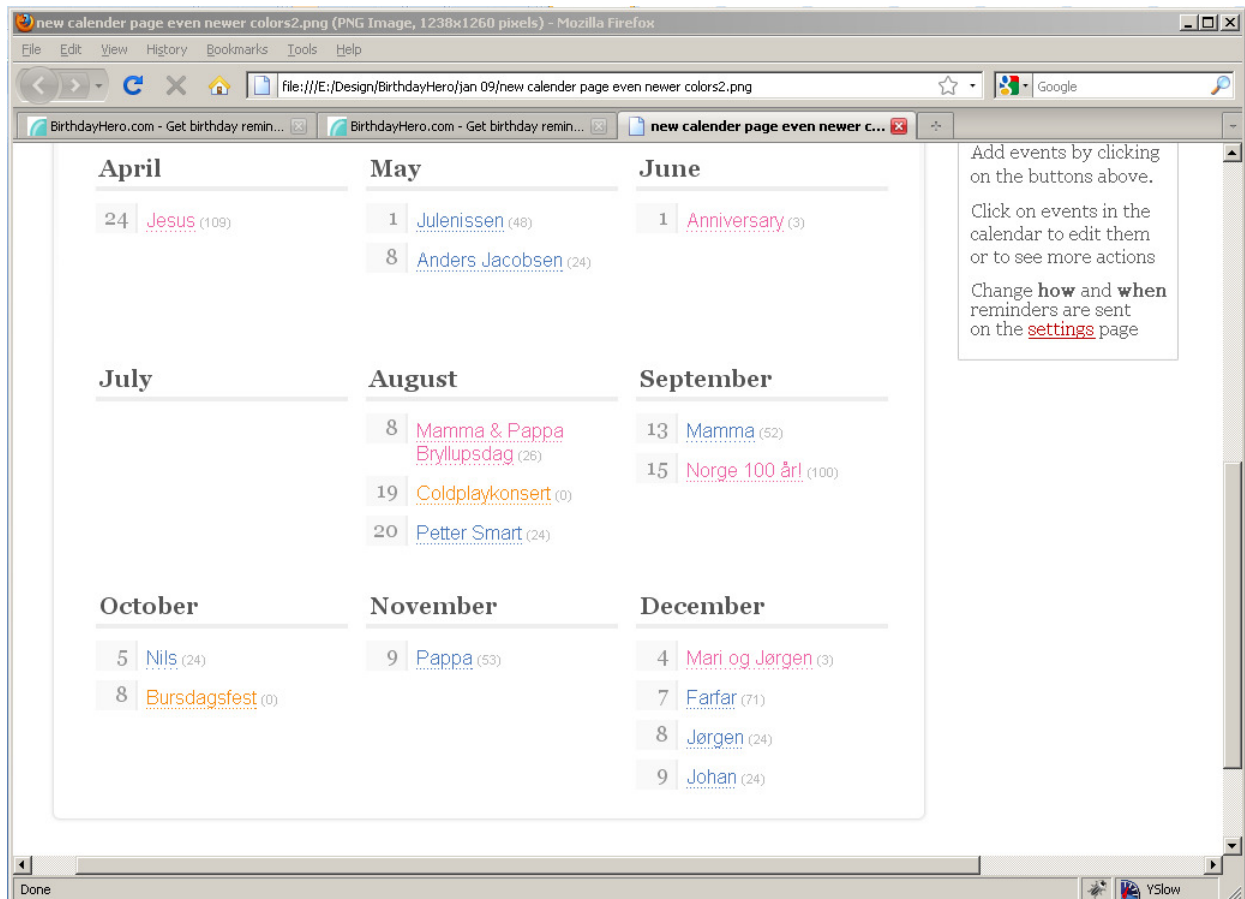


Figure 25 – The user has scrolled down, and the sidebar buttons are no longer visible

Being able to add events from anywhere on the page might be useful, because if the user has added many events, the page will be very long. The user will then have to scroll up to the top every time he or she wants to add more events.

There are also other problems with the design. First of all, there is no indication of what the current month and date is. To find upcoming events, the user will have to scan the page, look for and find the current month, and then calculate what events in the month have already passed. This is not very intuitive. Since the system knows the current date, and what events have passed on that date, it should be able to guide the user's eye, so to speak, to only focus on upcoming events.

Another issue is that the calendar is divided into months. The months are organized in the order seen in the first wireframe below. The months are meant to be read horizontally groups of three, in the order shown in the second wireframe.

Jan	Feb	Mar	1	2	3	1	5	9
Apr	May	Jun	4	5	6	2	6	10
Jul	Aug	Sep	7	8	9	3	7	11
Oct	Nov	Dec	10	11	12	4	8	12

Figure 26 – Interpretations of month order in the calendar

However, the month order is probably not immediately apparent to the user. The order might just as well be vertical, as shown in the third wireframe above. There are no visual cues that tell the user how to “read” the calendar in the correct order.

The first prototype was not tested on users, partly because the design never really felt satisfying, but also because a new idea inspired by physical metaphors would change the way I looked at calendars and how they could be displayed. These ideas led to the creation of the second prototype.

5.3.2 Second prototype (December 2010)

The second prototype builds on the elements in the first prototype that appeared to work well, but also introduces new concepts. Among these is the idea of having a scrolling calendar as well as displaying calendar data in a list.

5.3.2.1 List view

In the first prototype the calendar months were displayed in a horizontal order. A consequence of this is that the sequence of months is not obviously apparent. Sorting the months vertically in a list view might lead the user's eye vertically down the page. To the right is a wireframe of the list view. The calendar now appears as a long sheet. The main advantage of presenting the calendar in this way is that the further down the page the user scrolls, the further in the calendar year they have come. This alleviates the problem of knowing how to read the calendar. Now there is only one way to read it, vertically.

This wireframe illustrates how the calendar in prototype 2 differs from that in prototype 1. Here the months flow vertically one by one instead of in groups of three.



Figure 27 – The list view

The user cannot see the whole year above the fold, what the user sees is limited by the screen resolution of their display. As seen in the figures below, the view changes as the user scrolls down. The grey area in the figure is the area outside the dimensions of the browser window.

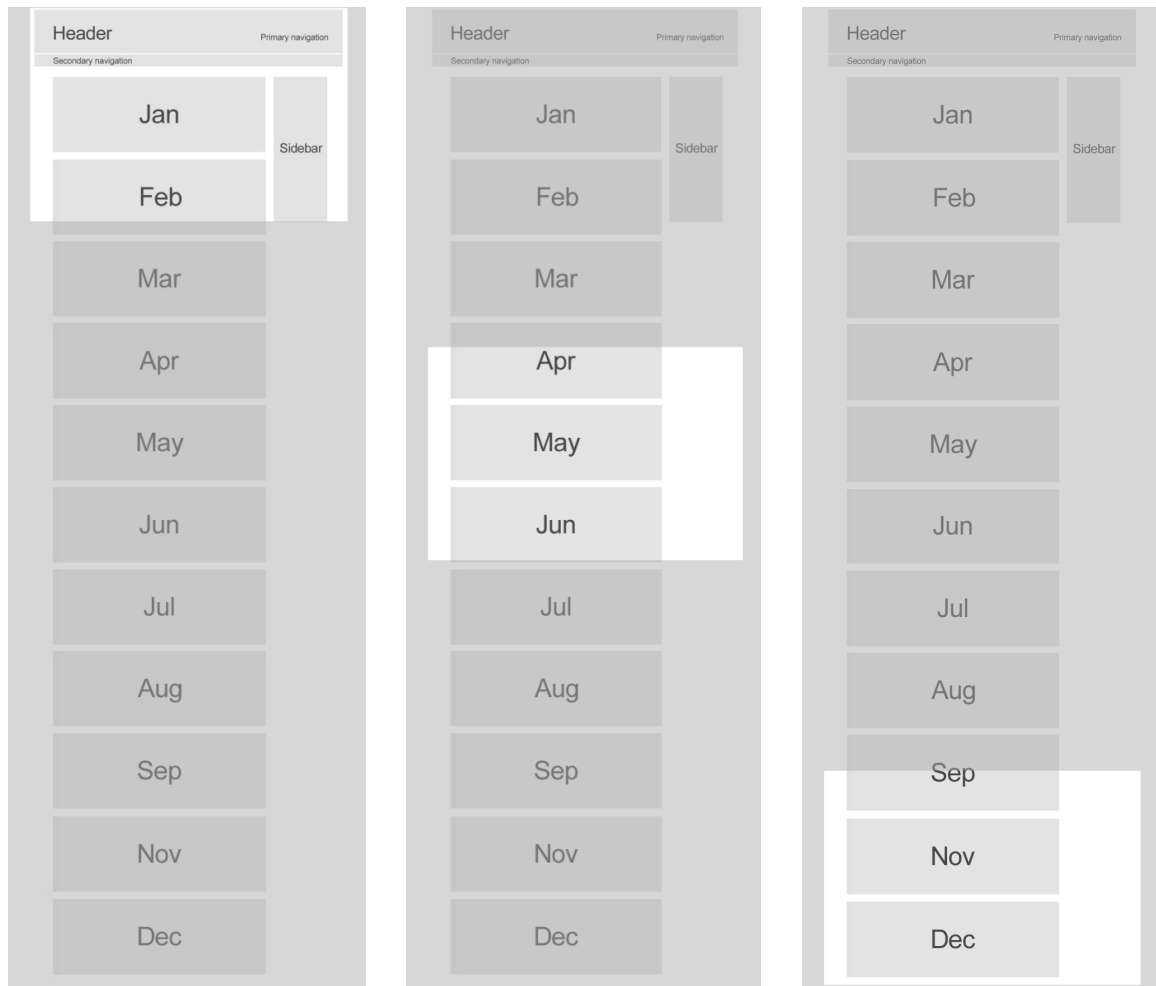


Figure 28 – The area visible to the user changes as he scrolls down the page

In the first wireframe, the user is at the top of the page. The lighter area is what the user sees. In the second wireframe the user has scrolled to the middle of the page. In the third wireframe the user is at the bottom of the page.

5.3.2.2 The new calendar

Using a list view also creates some challenges. When the user scrolls down to the bottom of the page, the buttons in the sidebar associated with adding new events also scroll out of view, just like in the first prototype. Notice in the second and third wireframes above that

the sidebar is hidden when the user has scrolled down. The sidebar might therefore be hidden when the user wants to add something to the calendar. When the user scrolls down below the fold the entire header with the primary and secondary navigation also disappears.

One possible solution is to have the sidebar in a fixed location on the page, so that the sidebar remains in one place when the user scrolls down. This is illustrated in the next figure.

This only solves one problem, however. The header still remains above the fold when the user scrolls down the page, leaving its functionality out of reach. One solution is giving the header a fixed position as well, so that it will remain in place when the user scrolls. This poses its own challenges, because now the header will overlap the calendar as the user scrolls. See the figure below for an example. The concept of keeping the header and sidebar fixed on the screen and letting the calendar scroll is the basis for the second prototype. This is a departure from the way most web pages are designed, where all of the content on the page scrolls when the user scrolls.

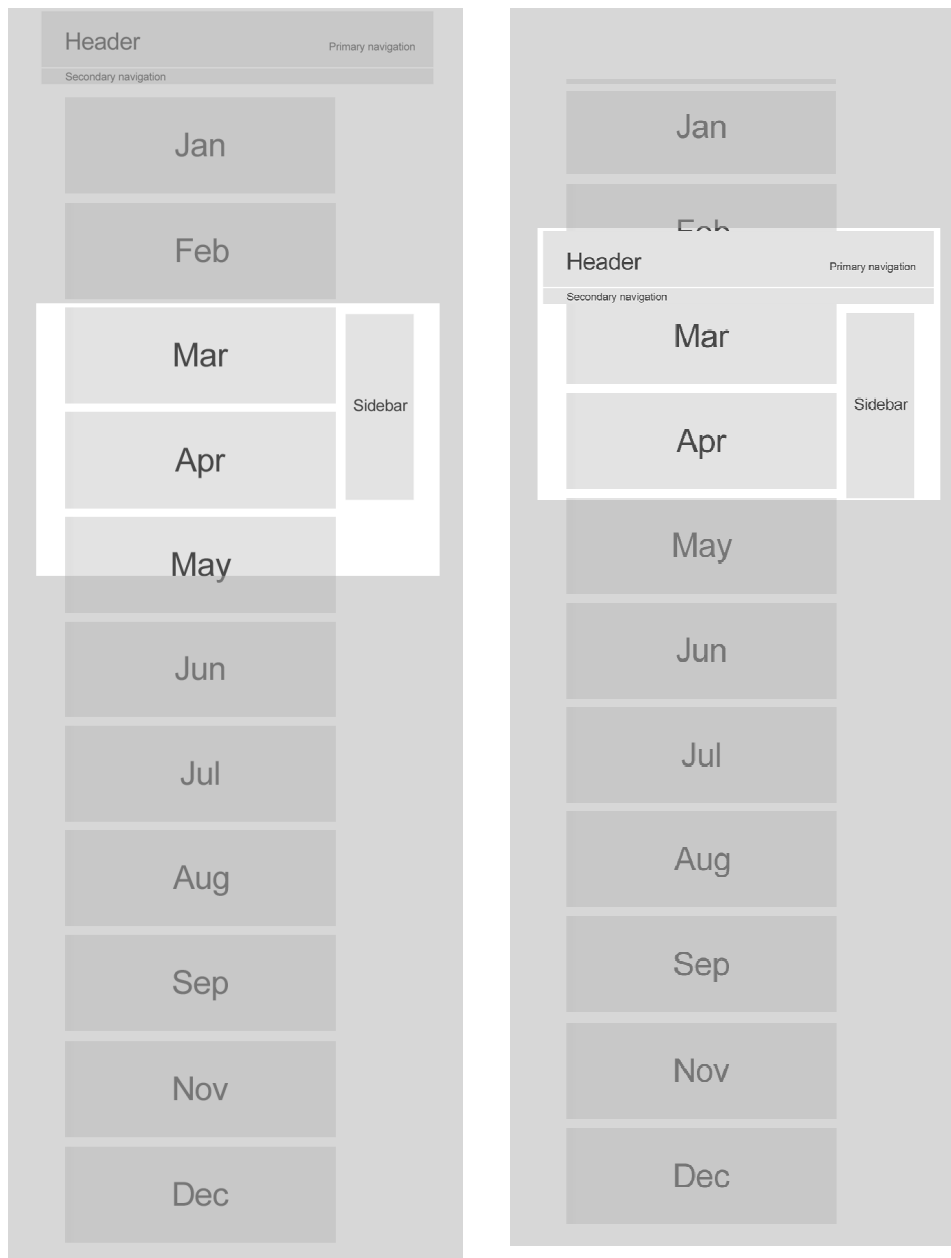


Figure 29 – The sidebar and header are given fixed positions

Notice in the first wireframe how the sidebar is attached to the view so that it is always visible to the user. In the second wireframe the header is also given a fixed position.

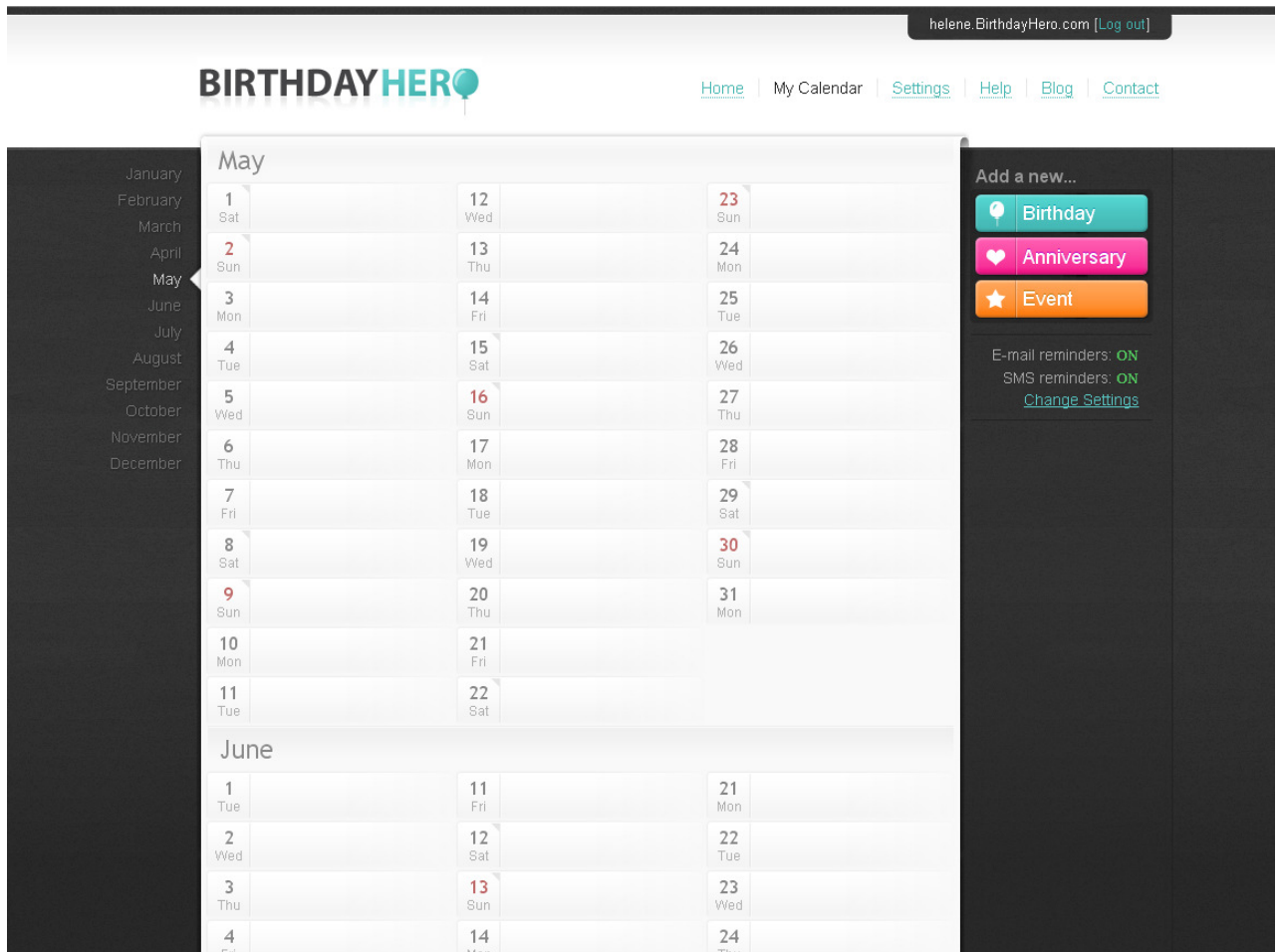


Figure 30 – High fidelity view of the calendar in prototype 2

As we can see from the screenshot above, the second prototype also introduces a new color scheme for the service, composed of white and dark gray. The buttons in the sidebar are also given much more focus, by using the event type color as the background on each button. As birthdays are blue in the calendar, the background of the “Add birthday” button is also blue. This might help users learn which colors are associated with each event type. The buttons also use icons which symbolize each type of event. A balloon represents birthdays, a heart anniversaries, and a star is used to represent events.

The calendar itself has also gotten a makeover. Here, each date is displayed whether it has an event on it or not. This is a departure from the layout in the first prototype where only dates with events are displayed. This change came from a realization that the empty dates in the calendar serve a vital purpose. They serve as a subtle form of navigation. While showing only dates with events might make it easy to see at a glance what events are coming up, users lose an understanding of distance between events. The empty dates let us

calculate how far ahead in time an event is. If there are four blank dates between today's date and an event in your calendar, you can instantly see how many days there are until that date. If there is an event in two weeks, the 14 dates in-between the current date and today's date visually communicate the distance between the dates in the time dimension.

Notice that the dates in this prototype also display the weekday directly below the date. This might be helpful when users want to pinpoint a date, or figure out what day of the week a certain date is.

As you can see below, this version of prototype 2 has three columns of events. Initially, the calendar had only one column. This made it easier to see what events were coming up, as you only had to navigate the calendar in one dimension, vertically. However, having only one column made the page extremely long, as 365 dates had to be displayed after each other. Therefore, the design was modified to fit three columns. This became the final design for prototype 2.

In the left sidebar, a list of every month in the year is displayed. Hovering on month name, makes the link turn blue, indicating that it can be clicked. Clicking on a month takes you to that month. This transition is done smoothly, as the page scrolls down or up to the month you have selected.

The calendar also introduces a way of browsing the calendar. As the user scrolls down, the calendar slides down, leaving the sidebars and headers in place.

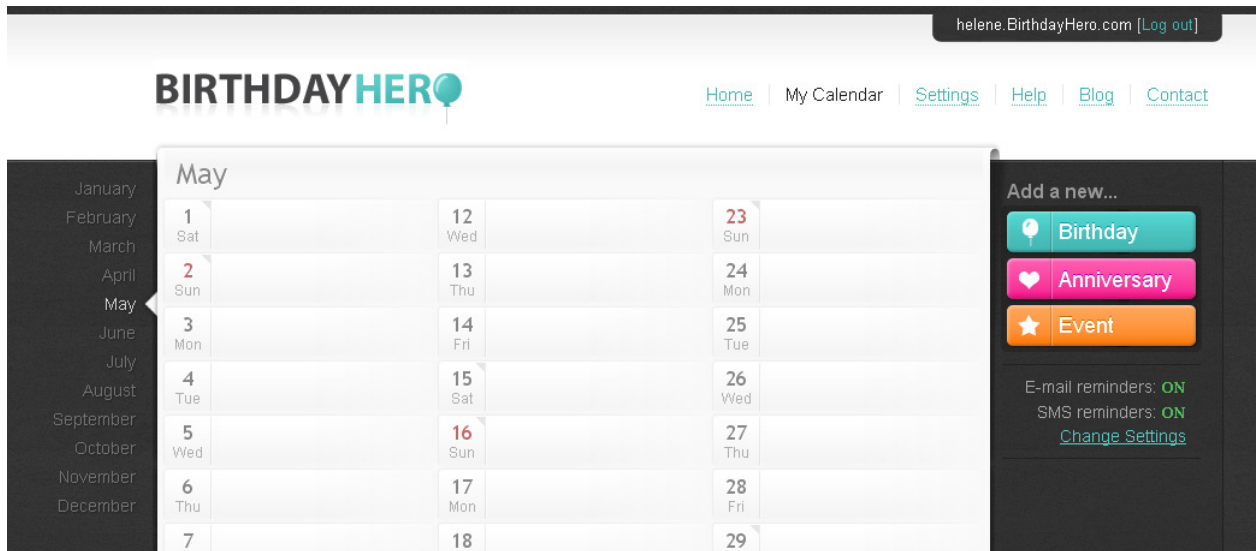


Figure 31 – The calendar curls around the black background as the user scrolls

Notice how the calendar is placed on white “sheet” which appears to fold around the top edge of the black background.

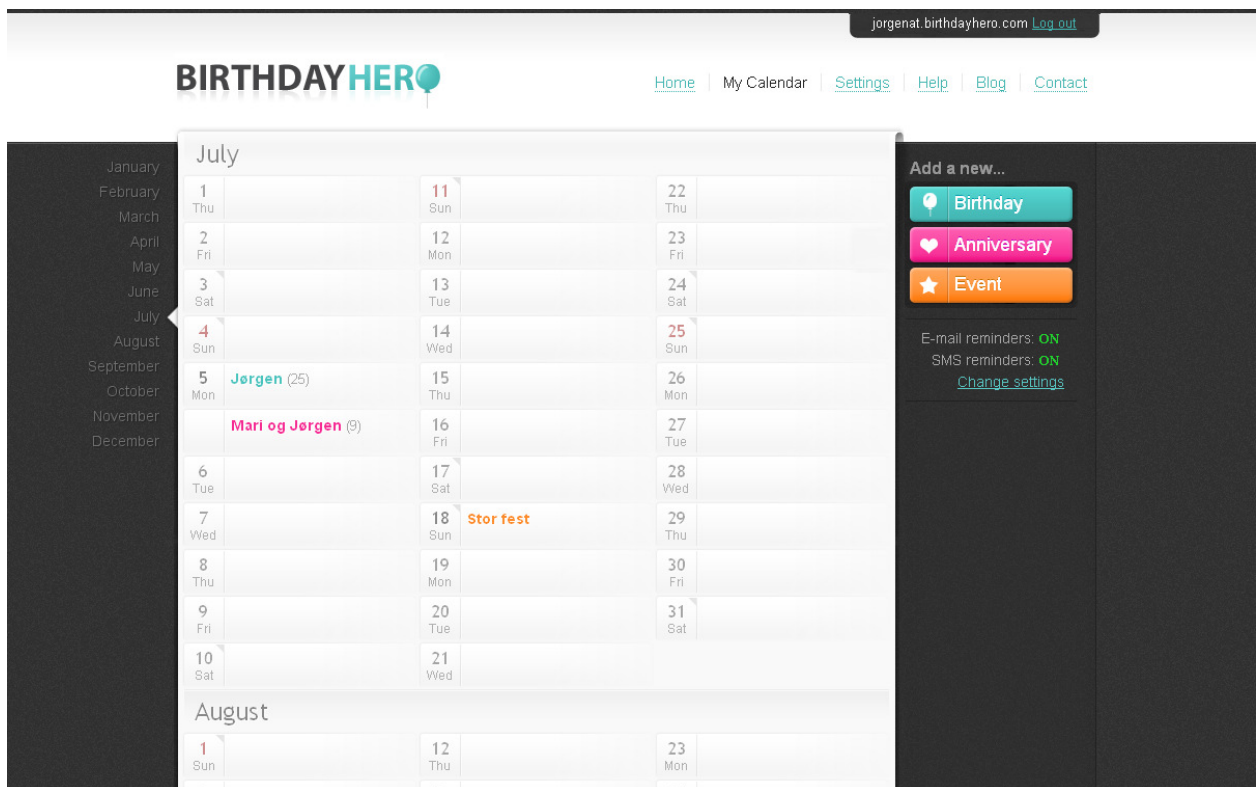


Figure 32 – The user has scrolled down to July

In this screenshot, the user has scrolled down from “May” to “July”. Notice that the white arrow now points to “July”.

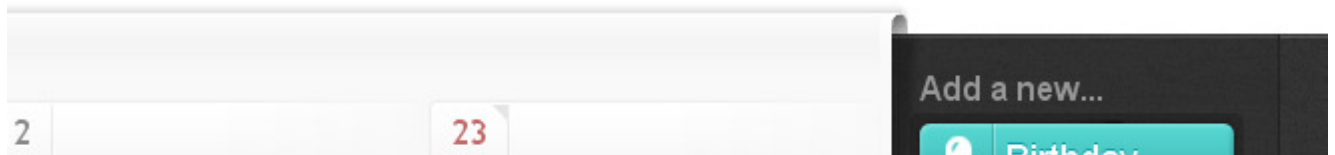


Figure 33 – Showing the “page curl” of the calendar

The “curl” can be seen to the right in this screenshot, just above and to the left of the blue “add birthday” button. The effect is subtle, but hopefully gives the effect of the calendar curling behind the black background, much in the same way that a physical sheet of paper would curl around an object. Using the physical metaphor of a curling sheet of paper allows for the header and sidebars to remain in a fixed position while the user scrolls the calendar. This gives the illusion of a physical affordance – we know that sheets of paper can curl around other objects in real life.

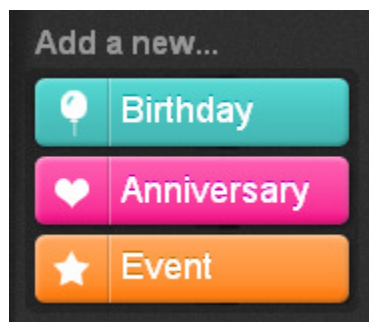


Figure 34 – The buttons in the sidebar

Affordance is also a factor in the design of the buttons. They have a subtle three-dimensional shape, and bright colors, that make the buttons afford pressing.

A new logo is also introduced. The logo incorporates the illustration of a balloon, which might help make BirthdayHero seem informal and friendly.



Figure 35 – The new logo

Visitors may associate the balloon with celebrations and positive emotions. The blue color in the logo is the same shade of blue as the birthdays in the calendar, and so on. Reusing colors in the design like this supports visual consistency. Creating a strong visual identity

helps users remember the site. For BirthdayHero, the main color that users should identify and remember is blue.

5.3.2.3 Critique of the second prototype

There are several issues with the second prototype. First, the way the calendar is displayed is not how most calendars look. This means that the user will have to learn a new way of interpreting a calendar. If a goal is to utilize conventions that the user might already know, this calendar layout might not be optimal. Second, when more than one event is added to a date the second event is shown below the first event, as seen in the screenshot below.



Figure 36 – Multiple events on one date are difficult to interpret

It might not be intuitive for the user that the second event belongs to the same date. Even worse, if the first event is at the bottom of its column, the next event on that date will appear at the top of the next column. If the user does not check to see if there are any events at the top of the next column, the user might miss important events.

5.3.3 Third prototype (February 2009)

The third prototype aims to resolve some of the issues of the second prototype, while maintaining a similar design. The third prototype introduces a traditional calendar layout, based on a grid. For users who have used traditional calendars, interpreting this layout might be easier than the one used in prototype 2.

The screenshot below shows the front page of BirthdayHero.com, as designed in prototype 3. The front page in prototype 2 (not shown) was quite basic and therefore not worth

discussing in detail. The front page aims to capture the visitor’s attention with an attention-grabbing headline that says “Never forget a birthday again!” Below the headline, a list of three steps explains what it takes to become a BirthdayHero. This text might be enough to explain the service to a new visitor.

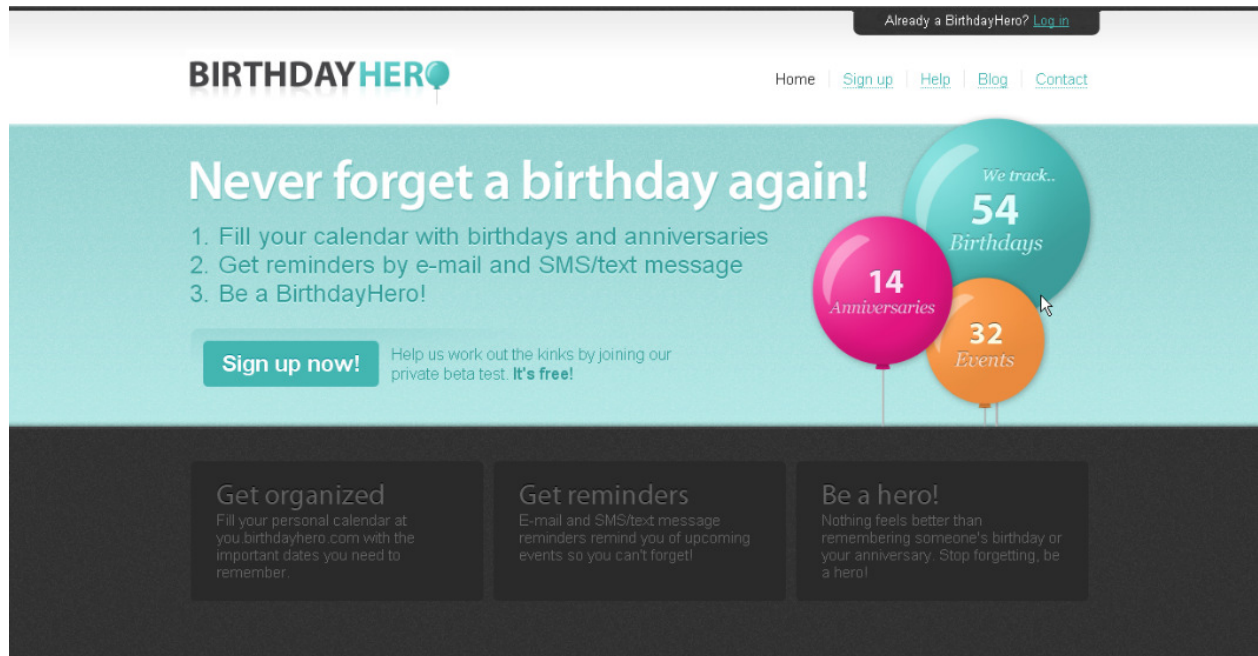


Figure 37 – The front page of the BirthdayHero service

The steps in the list lead the user’s eye down to the “Sign up now!” button, which the visitor will hopefully click. Next to the button is a text explaining that the service is free while it is in private beta.

On the right side of the screen are three balloon illustrations, which correspond to the three types of events users can add to their calendars. The largest blue balloon says “We track... 54 birthdays” and then the other balloons follow with “14 anniversaries” and “32 events”. These numbers are dynamically generated by counting the number of events of the different types in the database. The balloons are mostly a marketing element. The thought is that as the number of users grows, so will the number of events in the balloons, and that this in turn will make new visitors less hesitant to sign up, because they can see that many other users are using the service.

Below the blue section of the page, there is a dark band containing three boxes. The text in these boxes mirrors the three steps below the headline, explaining the benefits of becoming a BirthdayHero.

At the top right of the page there is a “log in bar”, which as we will see in a later screenshot changes when the user has logged in. Before the user has logged in, it says “Already a BirthdayHero? [Log in](#)” The link in the text directs the user to the log in page.

Below the log in bar the main menu remains as it was in prototype 2.

Clicking on the “Sign up now!” button, or on the “Sign up” link in the main menu takes the user to the Sign up page, seen below.

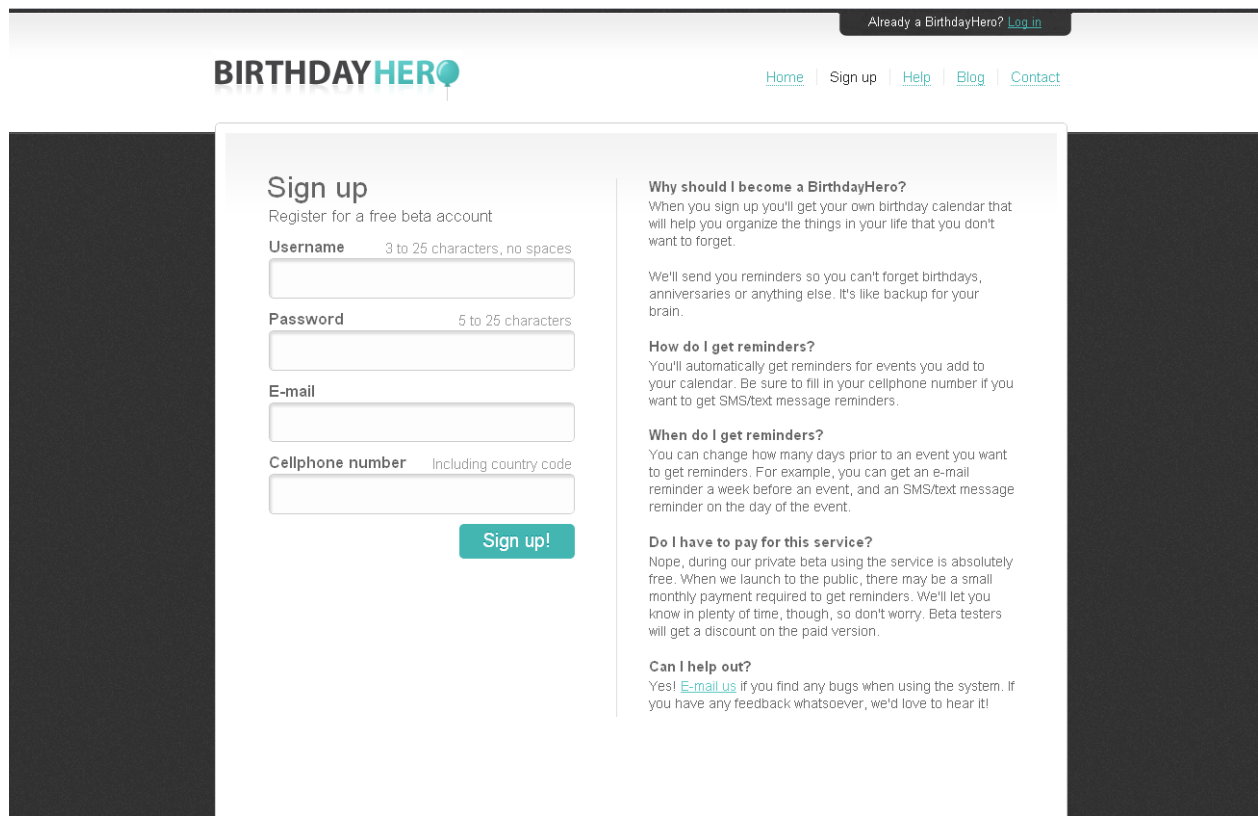


Figure 38 – The sign up page

The page is divided in two. On the left is the sign up form and on the right is a text answering some common questions users might have when they are considering signing up.

The form consists of four fields. The first is “username”. This will be the name that the user uses to log in with. Above the field, a help text explains that the user should enter 3 to 25 characters, without any spaces.

The next field is the password field. The help text explains that this should be 5 to 25 characters. Using two password fields, one for the password and one to confirm the password is common. Using only one in this form is a small experiment to see how users react to there being only one field. The advantage of only using one field is that the user gets fewer fields to fill out. The disadvantage could of course be that the user mistypes and fills in the password incorrectly when registering and therefore never gets to log in again.

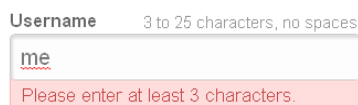
The third field is for the user’s e-mail address. This is the address to which e-mail reminders will be sent.

The fourth and final field is for the user’s cell phone number. The help text says that the user should include their country code. So for Norway, an accepted number would be “47XXXXXXXX” and for the U.S. “1XXXXXXXXXX”. The SMS reminders will naturally be sent to this number.

Not having more fields here was a conscious decision. We could ask for the visitors’ gender, age, city and interests to get more information about our users. This would, however, reduce the momentum of signing up. The user might think “four fields to fill out? Sure, I can do that,” but when faced with a page full of form fields the user is likely to think that it would take too much effort to sign up, and leave the site.

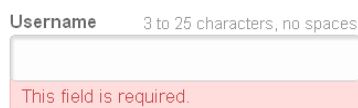
5.3.3.1 Error handling

If any of the fields are filled in incorrectly, error messages will appear when the user clicks on the “Sign up!” button.



A screenshot of a form field labeled "Username" with a help text "3 to 25 characters, no spaces". The field contains the text "me". Below the field, a red error message reads "Please enter at least 3 characters."

If a field has too few characters, this message will appear below the field.



A screenshot of a form field labeled "Username" with a help text "3 to 25 characters, no spaces". The field is empty. Below the field, a red error message reads "This field is required."

If a field is not filled in at all, the user will get this message below the field.

E-mail

Please enter a valid email address.

Filling out an invalid e-mail address will produce this error message.

When the user corrects their mistakes in each field, the error messages instantly disappear.

If the sign up process is successful, the user is taken to their personal calendar. A loading bar is displayed while the calendar page loads. The load time depends on the speed of the user's internet connection and computer, but rarely exceeds 2-3 seconds.

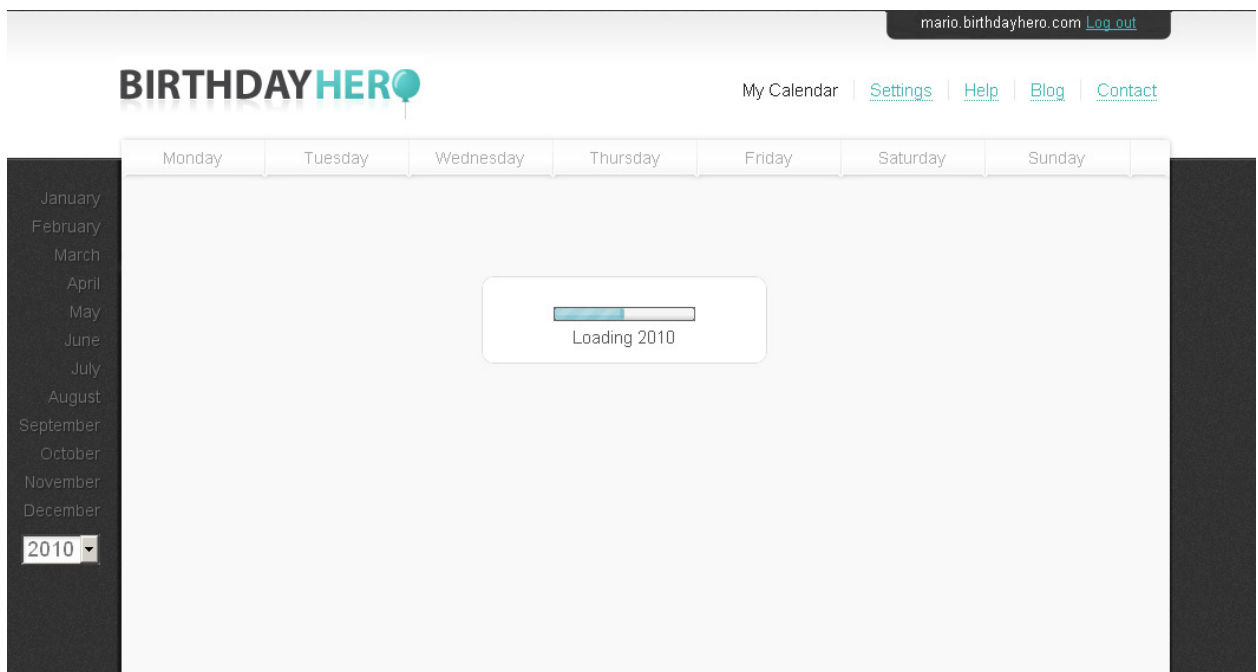


Figure 39 – The calendar is loading

When the calendar has finished loading, this is what user sees:

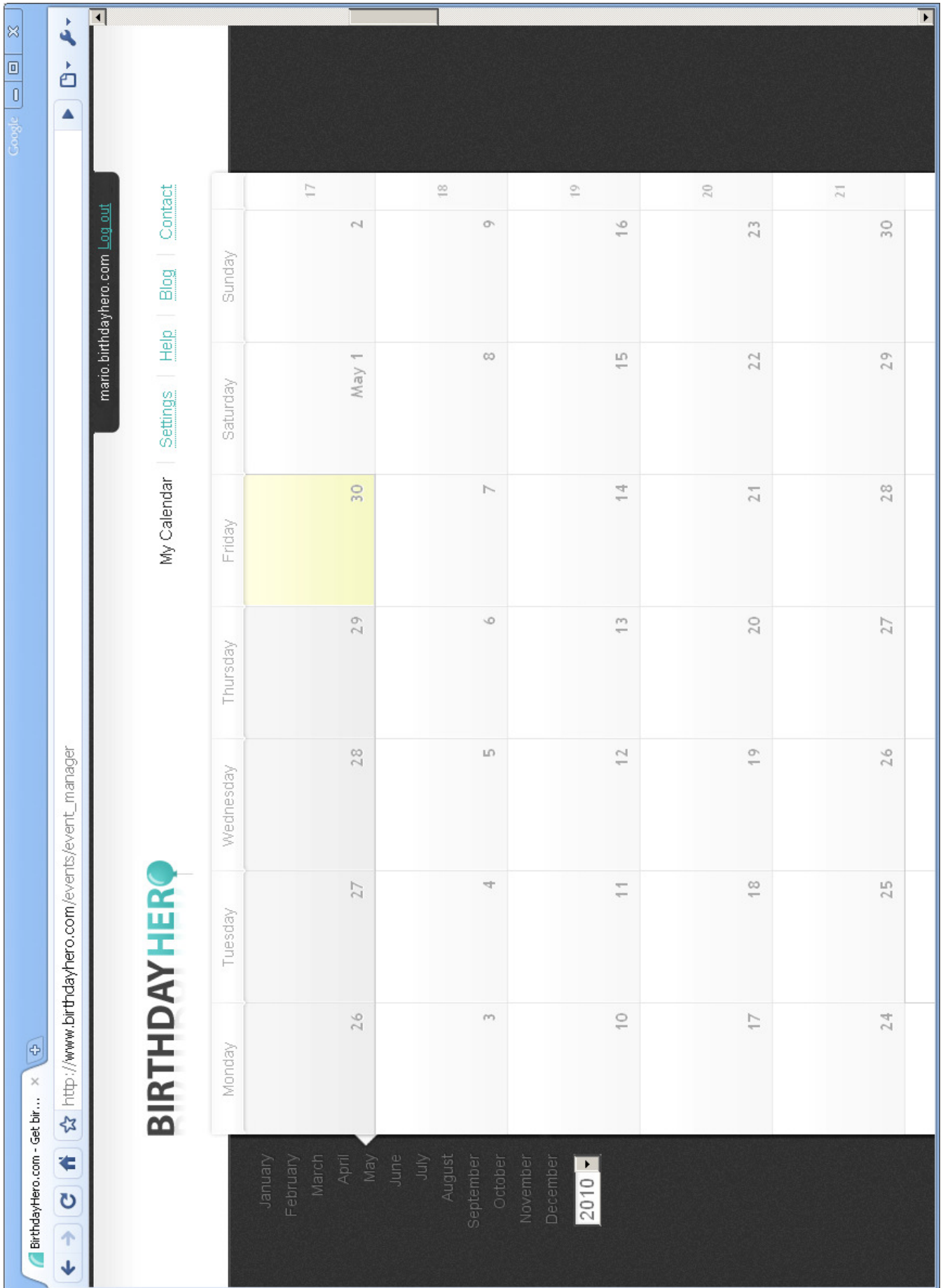


Figure 40 – The user's calendar has finished loading

As you can see from the screenshot above, the calendar consists of a central calendar grid which fills most of the screen, as well as a sidebar on the left, which allows the user to navigate the calendar.

Using the traditional calendar grid imposes some restrictions. As every week has seven days, the grid must be composed of 7 columns. Because each cell in the grid has to have room for the data the user wants to add, they cannot be too small. This means that the font size of the text has to be small enough to fit into the grid cells. The columns also fill nearly the entire width of the user's screen, leaving no room for the right sidebar used in prototype 2.

In the calendar, the current day is marked with a yellow background color. Days that have passed are displayed with a darker gray background color. This will hopefully guide the user's eye to today (in yellow) and show that the days in dark gray have already passed.

In the sidebar every month in the year is listed. Hovering on month name, makes the text turn blue, indicating that it can be clicked. Clicking on a month takes you to that month. This transition is done smoothly, as the page scrolls down or up to the month you have selected.

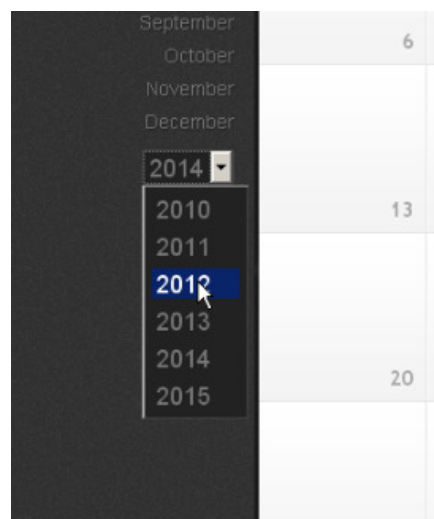


Figure 41 – Choosing a year to view from the select menu

Below the month list is a drop down select menu which displays the current year. Clicking on the menu reveals a list of the next five years. Clicking on one of these years, for instance

“2012”, will make the system load that year’s calendar. The loading bar will reappear, showing the user that the calendar is being reloaded with data from another year.

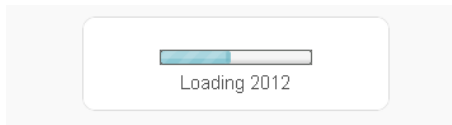


Figure 42 – The loading bar reappears when the user selects a different year

Selecting the current year in the list or refreshing the page in the browser will reload the current year in the calendar.

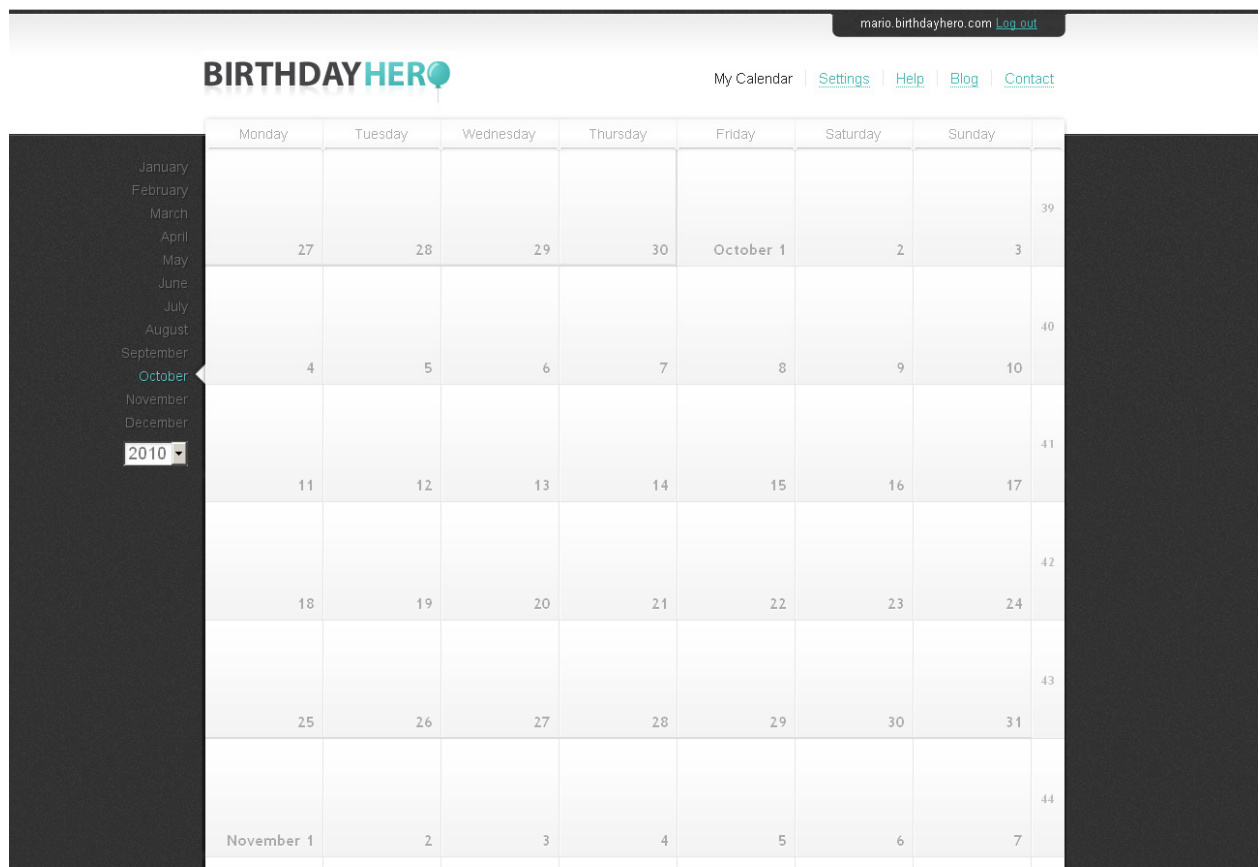


Figure 43 – An overview of the elements in the new calendar

The white arrow to the left of the calendar reflects your vertical location in the calendar. If you scroll to the bottom of the page, the arrow will point at December. The user can also scroll using the vertical scrollbar in their browser, or by using the scroll wheel on their mouse. This gives you three ways of navigating your calendar. This allows users the freedom to use the method they are most comfortable with. If you want to look at events happening in October, you can:

- A. Click on “October” in the list in the sidebar
- B. Use the scrollbar in the browser to scroll down until you see October appear in the calendar
- C. Scroll using the mouse wheel. Scrolling with the mouse wheel has the added advantage of letting you scroll a short distance at a time. A future improvement that could be implemented is “hijacking” how far the user scrolls each time they use the scroll wheel. The scrolling function could be rewritten so that it only scrolls one or two weeks at a time.

Notice also how efficient use of white space in the design makes it easy to interpret. The grid lines serve as a visual framework that guides the eye either vertically or horizontally.

Let’s take a closer look at the top section of the calendar.

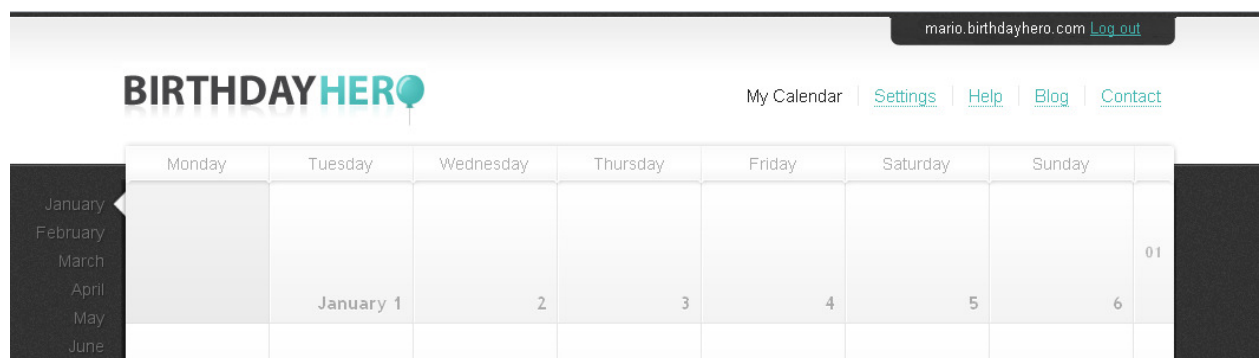


Figure 44 – The log in bar displays the username of the logged in user

Notice that as the user has now logged in, the log in bar displays the text “<username>.birthdayhero.com” as well as a link to allow the user to “Log out”.

The first day of the month is “January 1”. Only the first day in a month has is prefixed by the name of the month. After the Sunday in each week, the week number is displayed. In this case, the first week in January is “01”.

At the top of the calendar, there is a list of every weekday, from “Monday” to “Friday”. In traditional wall-mounted calendars, for instance, this list of weekdays is displayed on every sheet showing each month. Because the BirthdayHero calendar displays months as a continuous stream instead of separating each month into separate pages, including the list

of weekdays above each month seemed like a waste of space. If the weekday list has to repeat for every month anyway, why not place it above the calendar in a fixed position? This concept is illustrated in the screenshot below.

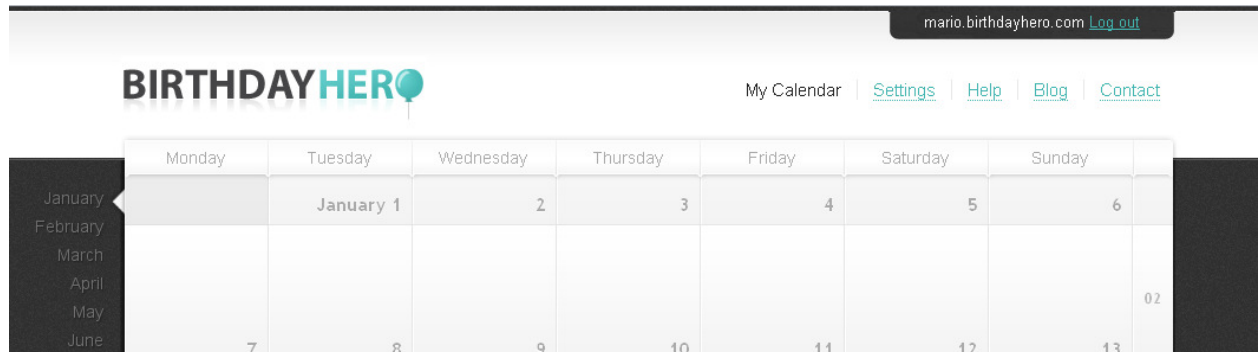


Figure 45 – Showing how the calendar slides under the weekday list

Here, the user has scrolled down slightly. Notice how the upper part of the calendar is hidden below the weekday list. Below the weekday list there is a slight shadow, which will indicate that the weekday list is on top of the calendar and that the calendar is sliding in under the weekday list.

As prototype 3 no longer has room for the wide sidebar used in prototype 2, the buttons for adding new events are missing. How then, should users add events? Prototype 3 changes the method for adding events significantly. While you in prototype 2 had to click on “Add birthday” to add a birthday, in prototype 3 all you need to do is click on a date. This is shown in the screenshots below.



Figure 46 – Adding events is done through clicking on an icon on a specific date

When the user hovers the mouse cursor over a cell in the grid, an “add” icon appears in the upper right hand corner of that cell in the grid. The icon disappears if the user moves the cursor out of the cell. Hovering the mouse on the icon itself, turns the “+” symbol blue, indicating that it can be clicked. This is similar to the list of months in the sidebar, which also turns blue when hovered. Hopefully, it will be intuitive for the user that clicking on the icon will allow them to add something to the date they are hovering.

Clicking on the “add” icon opens the lightbox. The rest of the page dims, allowing the user to focus on adding an event.

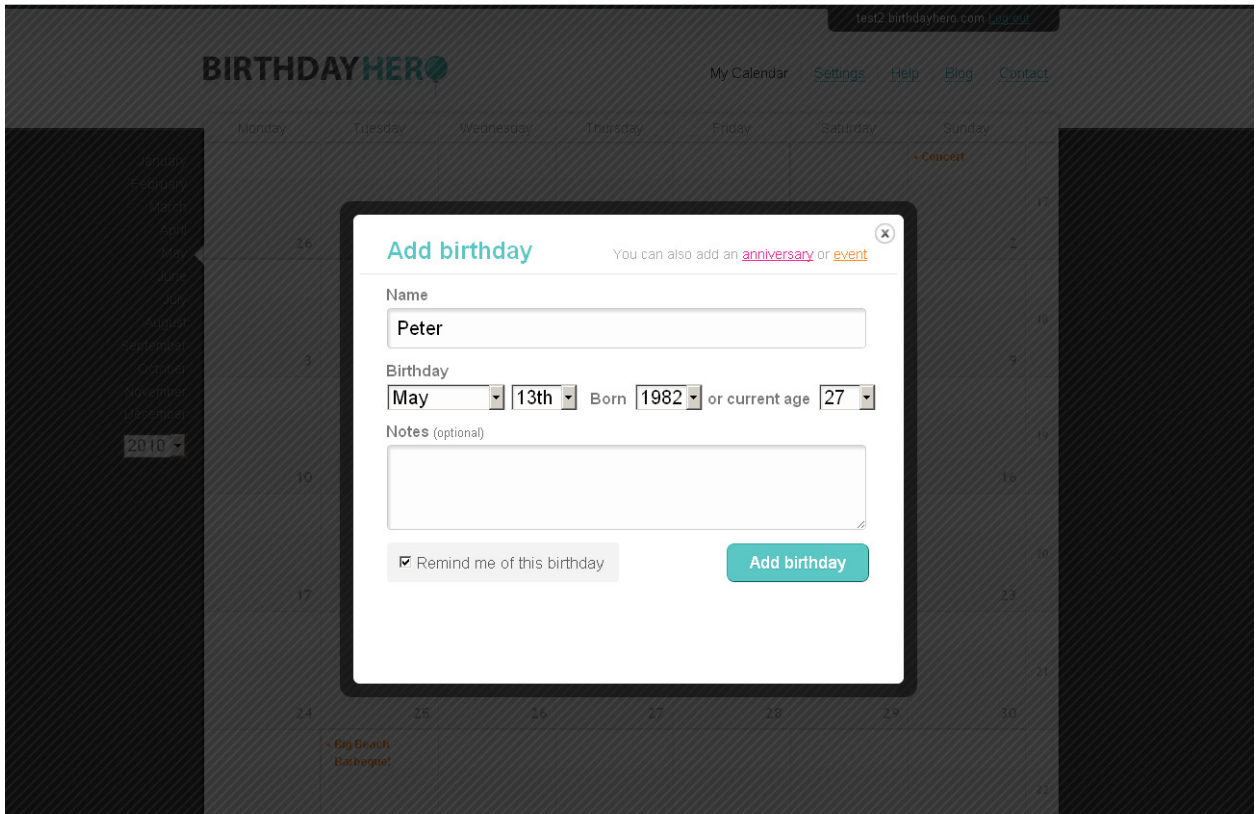


Figure 47 – The lightbox for adding events

The lightbox functions in the same way it did in prototype 2. The new lightbox presents alert messages in a box which appears in the bottom of the window. Here, the birthday has been added successfully:

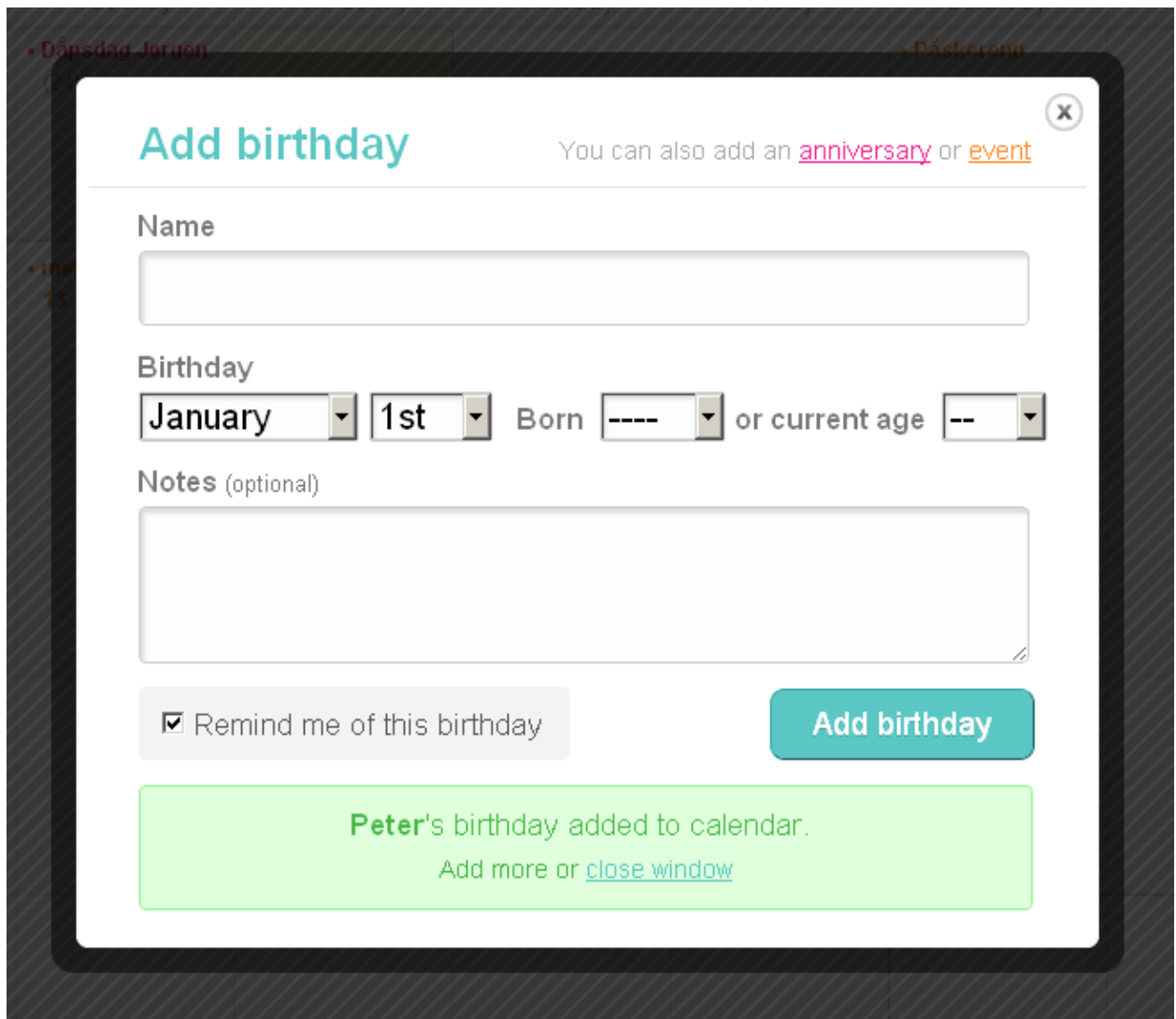


Figure 48 – After adding a birthday, a confirmation message is shown

The green success-message gives the user a subconscious hint that the action of adding the birthday was successful. It also encourages users to add more events before closing the lightbox.

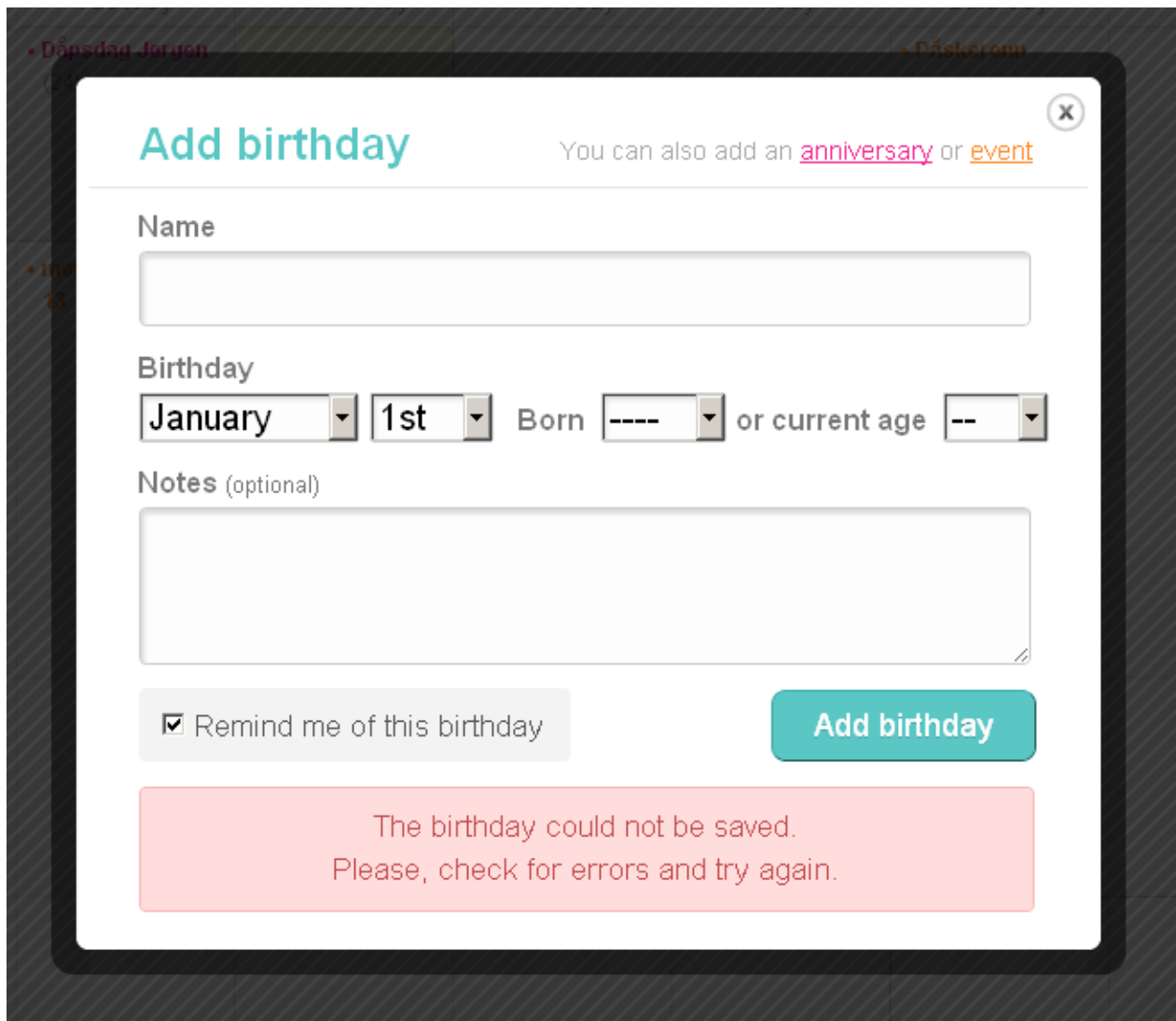


Figure 49 – Errors in filling out the form result in this error-message

Here, the user has forgotten to fill in the “Name” field (which is the only obligatory field), and therefore receives the red error-message seen in the screenshot above.

After adding events, a user’s calendar will look like in the next screenshot.

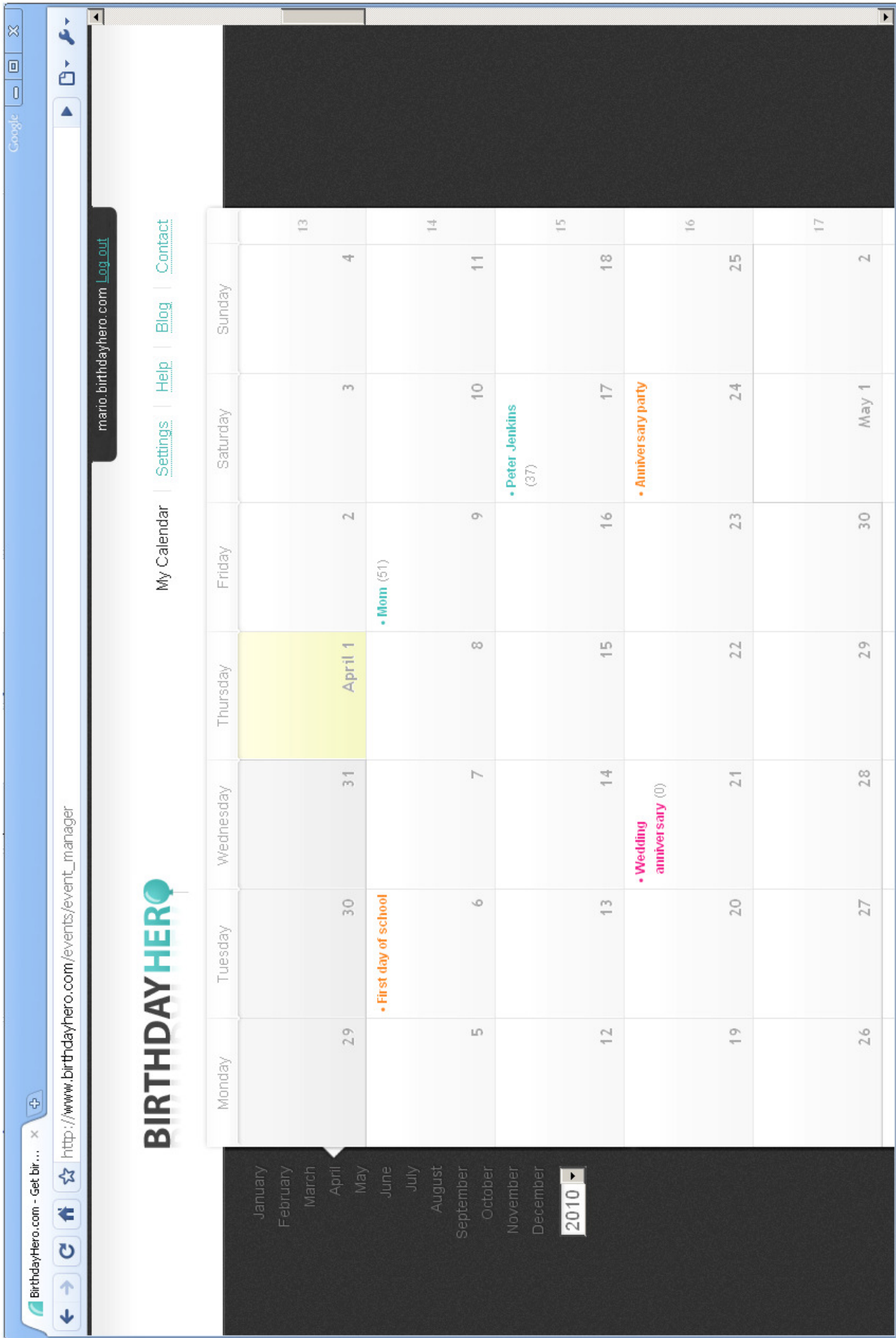


Figure 50 – Events have been added to the user’s calendar

Here, the user has added two birthdays, one anniversary, and two events. Birthdays where the user has added a birth year or age, show as <name> (<age>) while birthdays without a set birth year do not display the age. Anniversaries are displayed in this format: <name> (<years since anniversary started>). Events are simply shown as <name>, because they do not have an age associated with them like birthdays and anniversaries do.

In this screenshot the user has added more than one event to a single date. Notice how the anniversary breaks into two lines because of the limited width available in the cell. The colored dots before each event are necessary to indicate the beginning of each event. The second screenshot illustrates how the cell would look without the dots. In the second screenshot a user might assume that “Wedding” and “anniversary” were two different events.

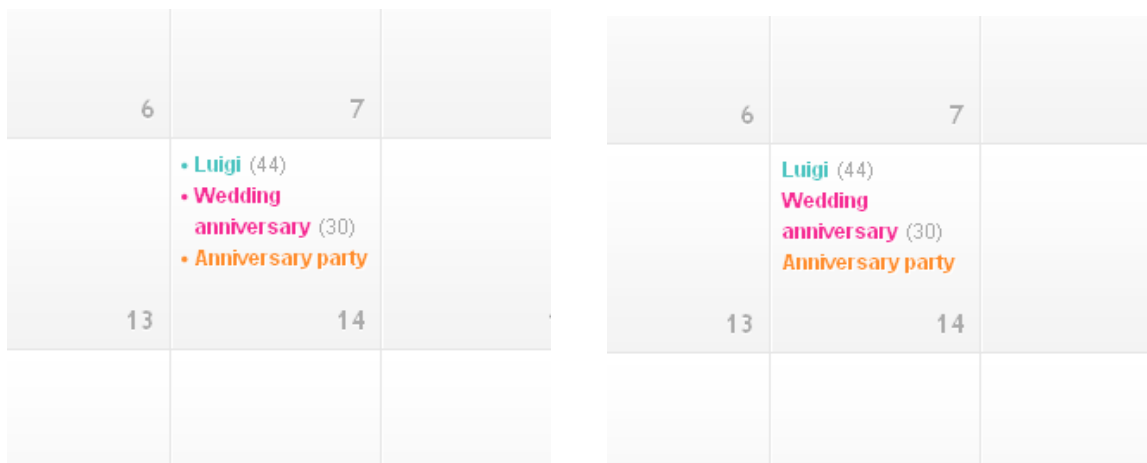


Figure 51 – The colored dots are necessary to ensure that events are separated

5.3.3.2 Editing events

As in the previous prototypes, events in the calendar can be edited. Like before, events are edited when the user clicks on the names of events in the calendar. What’s new in this prototype is that a help text appears when the user hovers the mouse cursor over an event. This help text is shown in the following screenshot. This gives the user a clue about what will happen when they click on the event. Otherwise, there are no hints as to how to edit or delete events. Providing a help text here might help the user learn how to perform these actions.

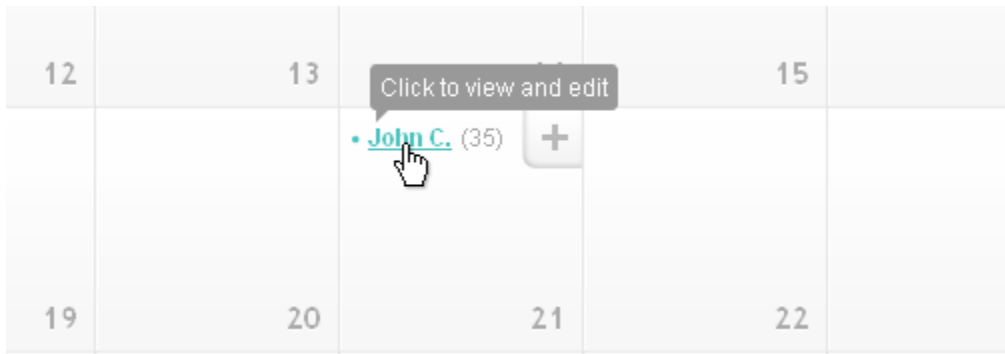


Figure 52 – The edit event help text

Edit birthday ⓧ 🗑️ Delete

Name

Birthday
May Born or current age

Notes (optional)

Remind me of this birthday Save changes

Figure 53 – Editing an event

When the lightbox opens the user can edit all of the information corresponding to the event, including changing the date, notes, or whether or not to receive a reminder. The button at the bottom of the lightbox now says “Save changes”.

No “cancel” button is provided, as the user can close the lightbox by clicking on the “Close” icon in the top right corner. If users struggle with canceling the edit action, it might be wise to revisit this design and add a separate “cancel” button.

Prototype 3 also introduces a way for the user to delete events. This is done by clicking on “Delete”, which can be found in the upper right corner of the edit lightbox. When the user clicks on this button, an alert box opens and asks the user to confirm that they want to delete the event. Clicking “OK” deletes the event and closes the lightbox, while clicking “Cancel” only closes the alert box.

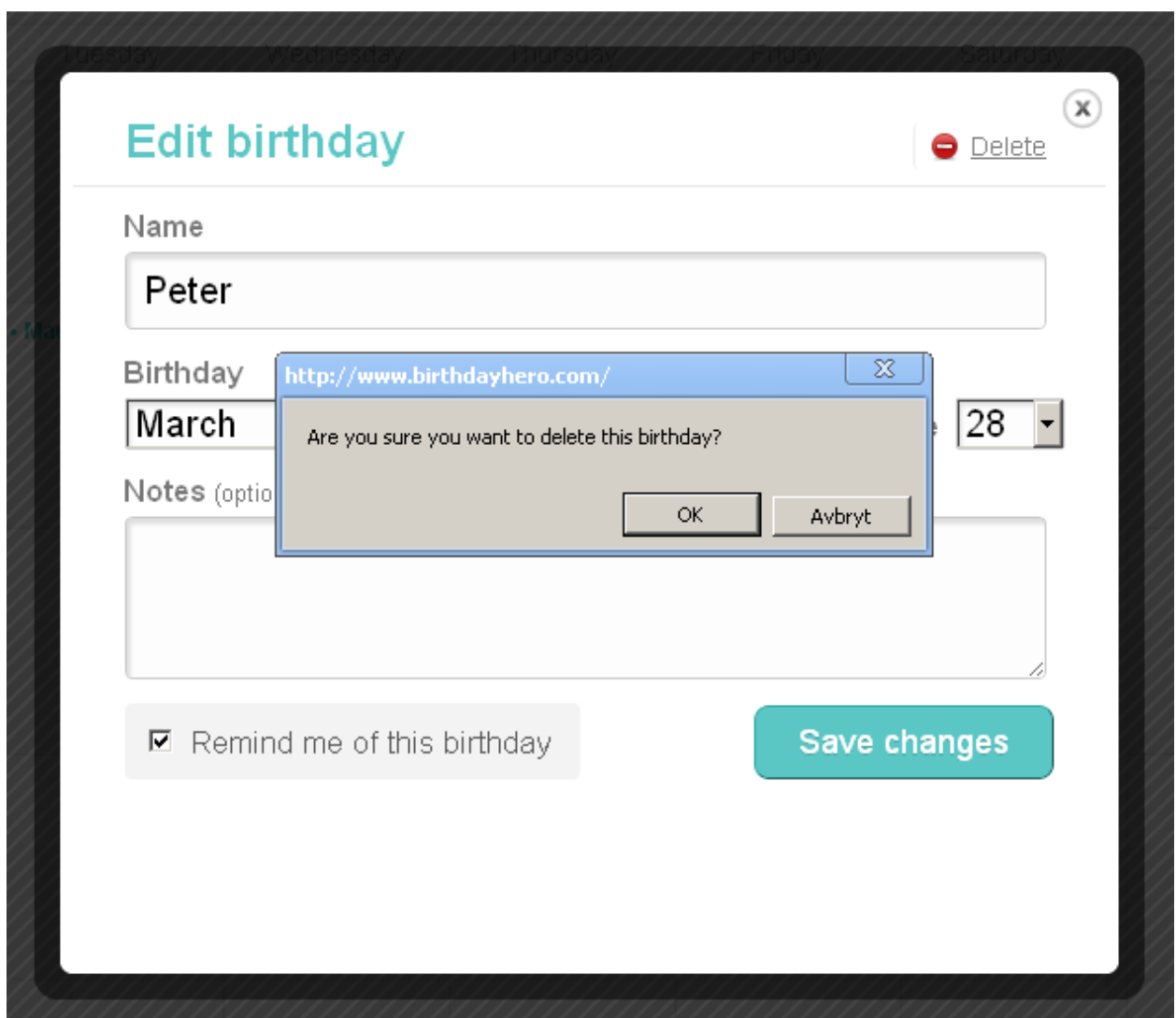


Figure 54 – Deleting an event

5.3.3.3 Settings

The third prototype also introduces a functioning settings page. Clicking on “Settings” in the main menu takes the user to this page:

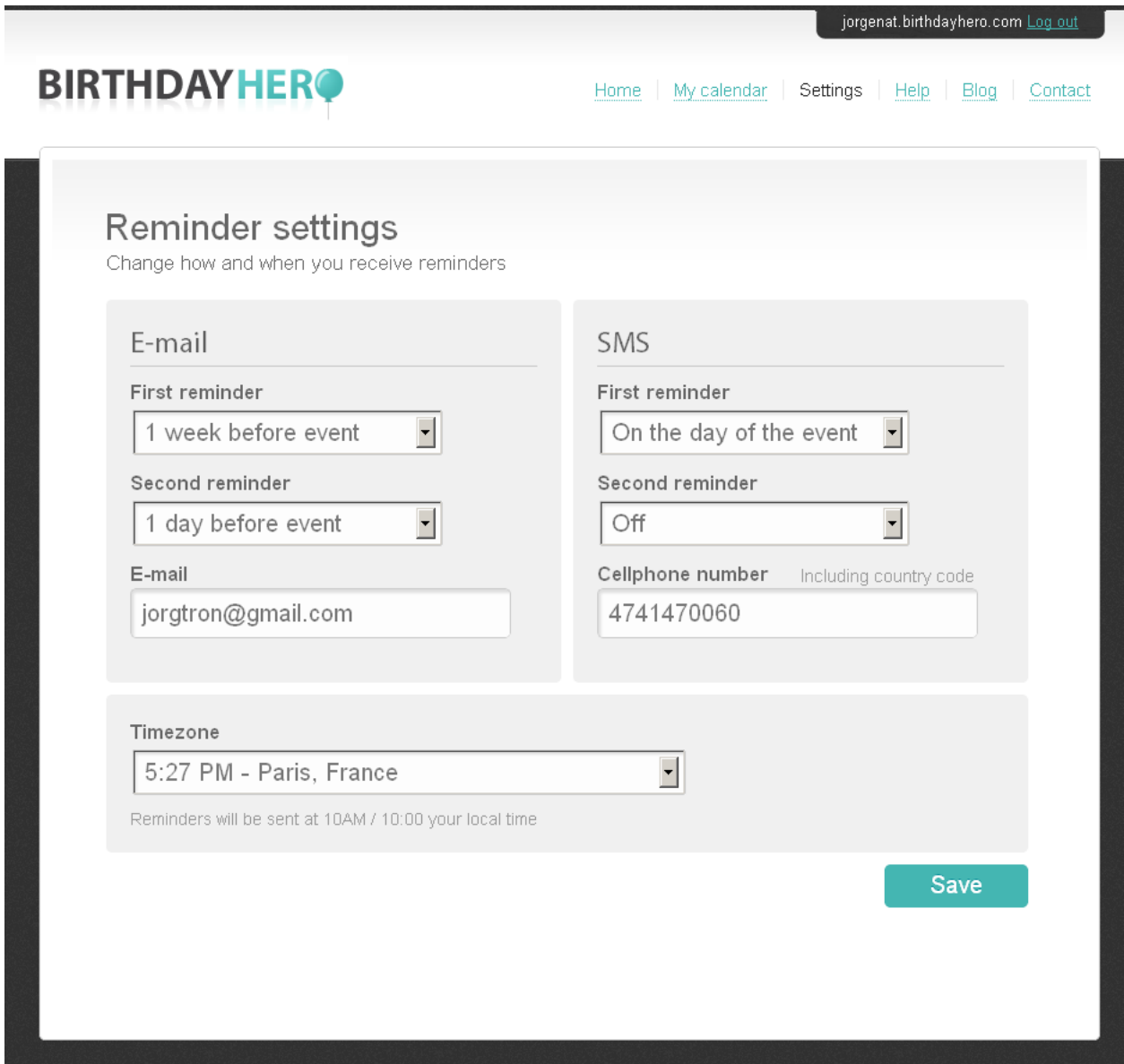


Figure 55 – The settings page

The settings page is the page where settings for reminders can be set. The page is divided in three separate sections. The first is for settings associated with e-mail reminders, the second for SMS reminders, and the third for time zone settings. Since the service might attract users from all over the world, it is important to allow them to change their time zone settings. If the wrong time zone is set, users might get reminders in the middle of the night, instead of at 10:00, which is the default.

The settings page allows users to set up four reminders, two e-mail reminders and two SMS reminders. The user can select when they want to receive each reminder from a drop down selection menu. Here are the options that the user can select from:

- Off
- On the day of the event
- 1 day before event
- 2 days before event
- 3 days before event
- 4 days before event
- 5 days before event
- 6 days before event
- 1 week before event
- 2 weeks before event

These values were chosen to give users a broad range of choices, without giving users “too much” control. The default values for the reminders are those shown in the previous screenshot. The user will receive one e-mail reminder a week before every event, and one on the day before the event. Only one SMS reminder is sent by default, on the day of each event. Users can also specify what e-mail address and cell phone number they want reminders to be sent to.

The time zone setting allows the user to pick their time zone. Often time zones are displayed using the name of the time zone, like “GMT+1”. Here, an alternative design was attempted, by letting the user pick their time zone by selecting the time at their location. As you can see in the screenshot, the user has selected “5:27 PM – Paris, France” because that is the time at the user’s current location, as well as a major city in that user’s time zone.

5.3.3.4 Critique of the third prototype

A strength of the new prototype is that it incorporates a common calendar layout that many users will already be familiar with. The grid layout used is commonly seen in wall-mounted calendars. In contrast to the wall-mounted calendar, the BirthdayHero calendar is dynamic. Users can add, edit and delete events. Users can view the calendar for next year easily, eliminating the need to refill the calendar every year.

Another strength is that more of the screen is used to present calendar data in the third prototype. In both the first and second prototype the sidebar stole a significant amount of screen real estate. Now, the calendar fills most of the screen, making the content the primary focal point on the page.

One of the main problems with the third prototype is that the sidebar which contained the “add” buttons is now missing. As the calendar requires a seven-column grid, the calendar takes too much room to fit in the sidebar. The buttons served a dual purpose, letting the user add events, but were also a way of teaching the user which color was associated with each event type. The “Add birthday” button was blue, and so on. In the third prototype the buttons are replaced with functionality to add events directly to a date, which might be more difficult for users to understand.

5.3.4 Background processes

This section will describe the more technical aspects of how the service functions. The backbone of BirthdayHero is the CakePHP framework.

CakePHP is an open source web application framework, based on MVC

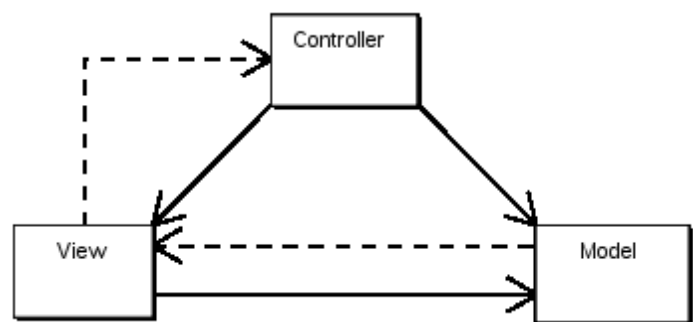


Figure 56 – Diagram of the MVC framework

principles (Model-View-Controller). The **model** is where the data that the system operates upon is kept. In our case, this is a MySQL database, which contains tables of users, events and reminders that have been registered in the system. The **view** is what is shown to the user. This consists of HTML templates, which are styled by CSS. The templates are also home to the various interactive elements, such as the animation used when scrolling the calendar, as well as opening and closing the lightbox. The **controller** is where all of the logic that decides what happens in the system is kept. This code is written in PHP, and is never directly seen by the user. The controller does however, by combining the data from the model and the HTML template framework create everything that the user sees. When the user performs an action, like editing a birthday, the **controller** checks that the birthday the user wants to edit exists by accessing the data in the **model**, and then through the **view** produces the form fields that the user sees on the screen. The BirthdayHero system is comprised of

many tens of thousands of lines of source code which have been hand-coded to bring the prototypes to life.

```
function addBirthday($day = null, $month = null, $year = null ) {
    // check logged in
    $this->checkSession();

    $this->layout = 'addEvent';
    $this->set('body_id', 'addBirthday'); // set what the body_id will be (for css menu highlight)
    $this->set('user_id', $this->Session->read('user_id'));

    // send preset data, if adding to a specific date (used in form)
    $this->set('presetDay', $day);
    $this->set('presetMonth', $month);
    $this->set('presetYear', $year);

    if (empty($this->data)) {
        $this->data = Sanitize::clean($this->data, array('encode' => false));

        $this->Event->create();
        if ($this->Event->save($this->data)) {

            $this->Event->order = 'Event.id DESC'; // find last event added by user
            $event = $this->Event->find('first', array('conditions' => array('user_id' => $this->Session->read('user_id'))));

            // set added to month so we can reload the right month
            $this->Session->write('added_to_month', $event['Event']['month']);

            $this->Session->setFlash('<script type="text/javascript"></script><div id="success"><strong>'. $event['Event']['name']. '</strong>\`s birthday added

            //if($event['Event']['year'] == date("Y")) { $this->set('added_to_month', $event['Event']['month']); }

            $this->redirect(array('action'=>'addBirthday'), null, true);

        } else {
            $this->Session->write('added_to_month', null); // not reloading a month
            $this->Session->setFlash('<div id="error">The birthday could not be saved.<br />Please, check for errors and try again.</div>');
        }
    }
    $users = $this->Event->User->find('list');
    $this->set(compact('users'));
}
```

Figure 57 – Screenshot showing some of the intricacies of the controller code

5.3.5 Reminders

The BirthdayHero service would not be a reminder service without the reminders. To understand how these are sent, we need to take a look at the database structure. As mentioned earlier, the database contains tables of users, events and reminders.

Users

Contains data about users, including usernames, e-mail addresses, phone numbers, passwords and reminder settings.

Events

Contains data about events added to the system, including event type (birthday, anniversary or event), date of the event, and much more.

Once every hour of every day, a script is automatically run that generates the reminders for the events that have been added. The script loops through every user in the “Users” table, checks to see if they want to receive reminders (from data in their settings), and by combining data from the “User” and “Events” tables adds new reminders to the “Reminders” table.

Reminders

Contains data about when a reminder should be sent, to which user the reminder should be sent, what the reminder should say, as well as how it should be sent (SMS or e-mail)

After the script has run, another script does the work of actually sending the reminders scheduled for that day. The script loops through the “Reminders” table, looking for reminders that are to be sent on the current day and at the current time (to match with the user’s time zone) and then sends the reminder. If the reminder is to be sent by e-mail, a script immediately sends the e-mail using the server’s own e-mail service. SMS reminders however, require a little more work.

The SMS reminders are sent to another, external server run by a company called CardboardFish.³ Because I have paid for an account with them, they accept the message from my server. The message contains several parameters, among them the text message to be sent and the cell phone number to send to. Within seconds, the SMS message generated by the BirthdayHero service is placed in the stream of SMS messages being transmitted in the cellular networks across the globe. Seconds after the reminder has been sent, the reminder appears on the user’s cell phone display.

³ See <http://www.cardboardfish.com>

The network monitors the status of each SMS message as it is transmitted. If the message cannot be delivered because of the recipient's phone being off, their inbox being full, or a network error, the BirthdayHero service receives an error code, which is relayed back to the "Reminders" table in the database. This way, an administrator can check for errors and find out why messages aren't arriving properly.

5.3.5.1 E-mail reminders

For the third prototype, mockups of how the e-mail reminders could look were created. Below is a screenshot showing how a birthday reminder would appear in a user's e-mail inbox.

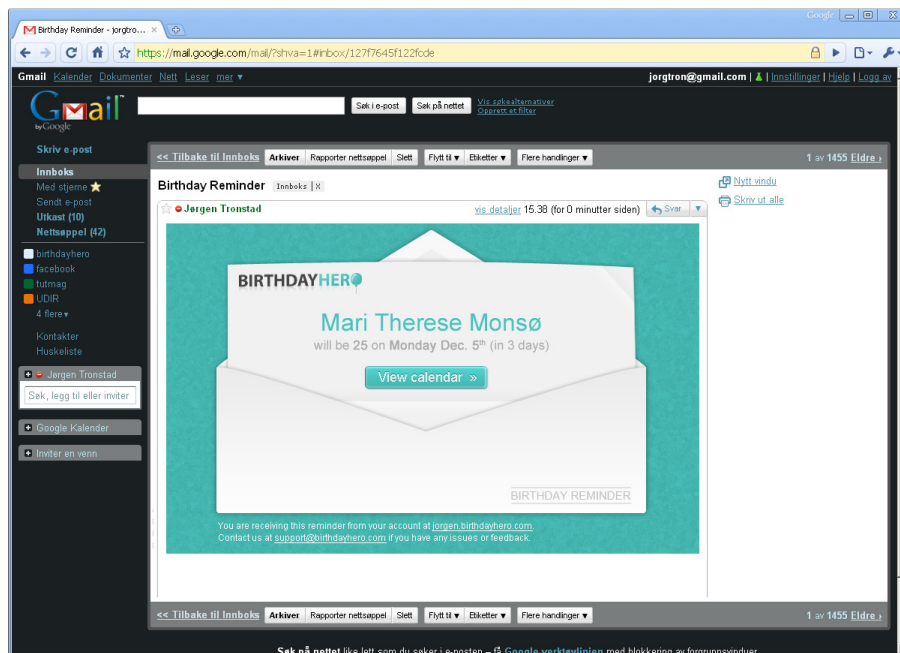


Figure 58 – A birthday reminder in a user's inbox

Here is a closer view of the birthday reminder itself:

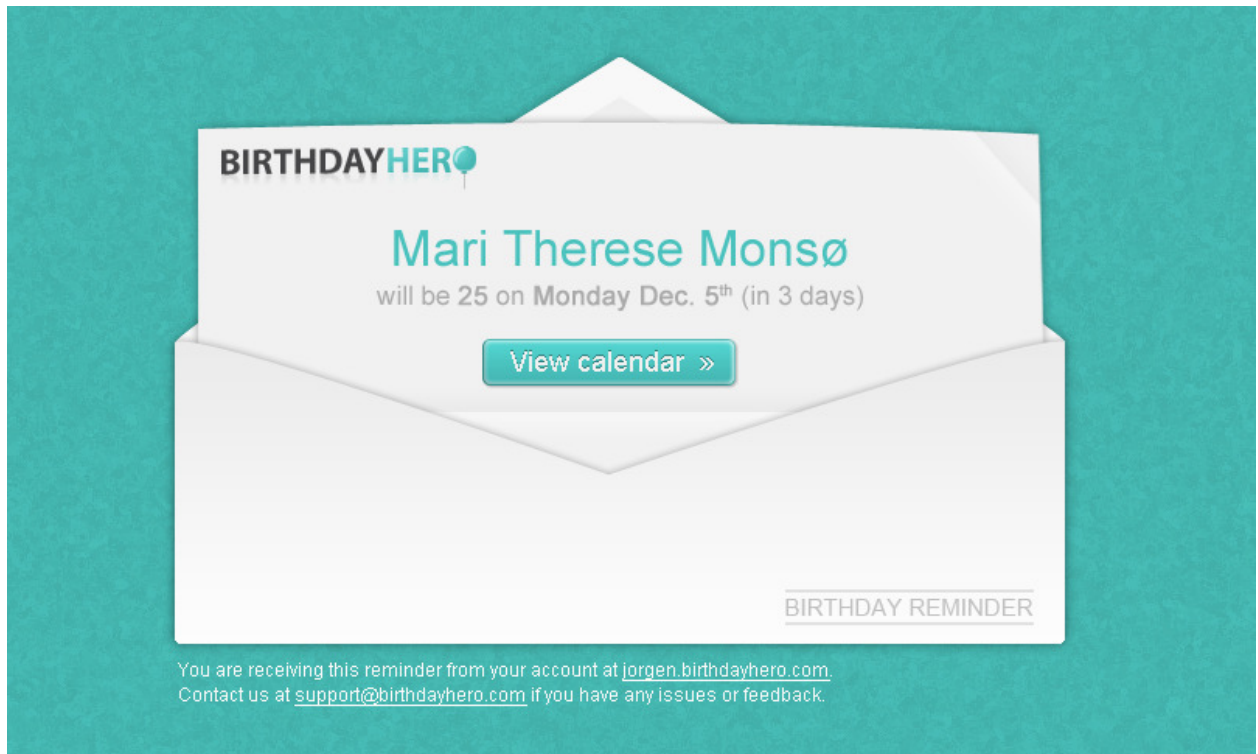


Figure 59 – An example of a birthday reminder

The first thing the user might notice is the bright blue background color. This color is also used in the BirthdayHero logo. The e-mail presents an illustration of an opened letter. The reminder is a sheet of paper in an envelope. The text says “Mari Therese Monsø will be 25 on Monday Dec. 5th (in three days)”. It also presents the user with a link to their calendar. The two other types of calendar data, anniversaries and events, use the corresponding colors purple and orange to signal what type of event the user is being reminded of.

Here are the reminder mockups for anniversaries and events:

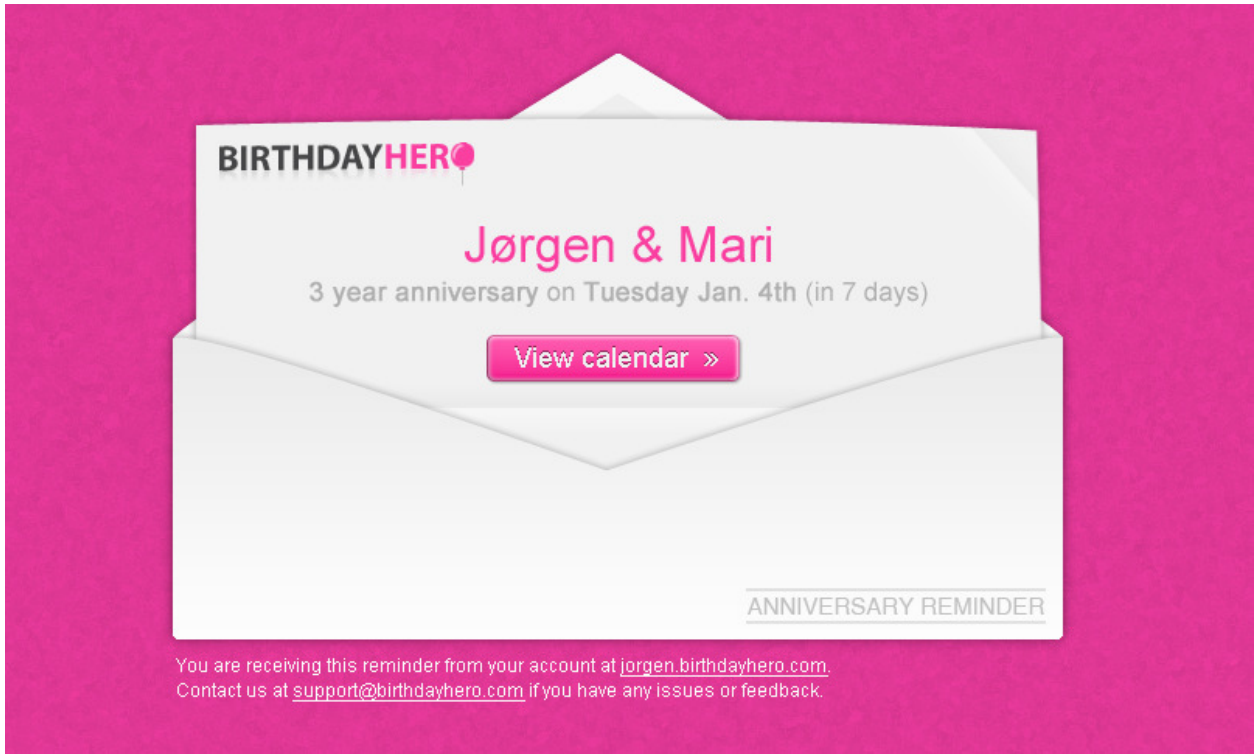


Figure 60 – Anniversary reminder mockup

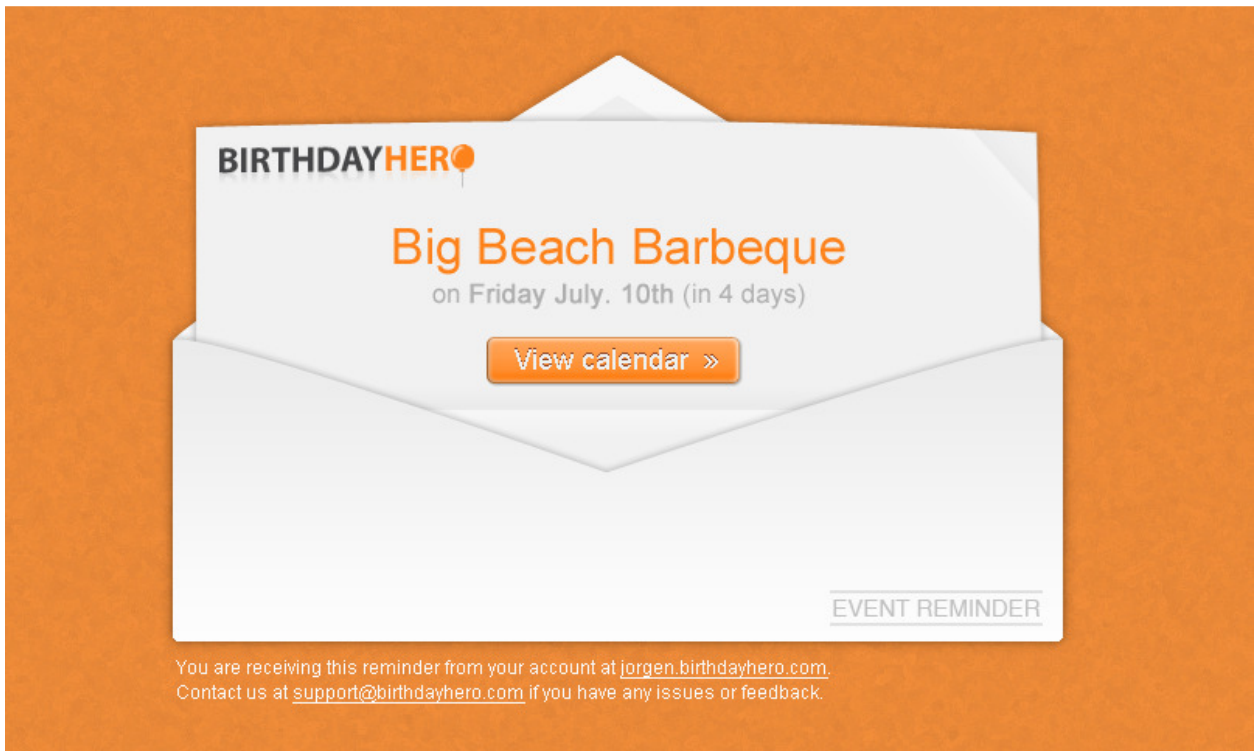


Figure 61 – Event reminder mockup

Notice how the text below the headline changes in each of the three types of events.

5.4 Data from Usability tests

The results are divided into sections corresponding to the task performed. The author served as the Test Coordinator. Personal data about the participants that was revealed during the tests has been masked or altered.

5.4.1 First usability test

The first test participant is a 26 year old female. She works as an interaction designer, and has a lot of experience using the internet. We'll call her "Jane". Her test was carried out on the second prototype.

1. Sign up for an account

Jane commented that there was no obvious navigation menu on the front page. She wondered aloud about what the blog was. ("blog" is a link in the main menu)

She quickly found the "sign up" button on the front page and clicked it. She waited for the sign up page to appear and quickly began filling in the sign up form. When asked what she was thinking, she responded that she didn't want to read the text above the form fields ("3 to 25 characters, no spaces") because she just wanted to get on with signing up, and didn't have time to read these lines of text.

She then asked what the field for choosing a "username" meant. Did it mean that she could

write her own name in the format "Jane Smith" or did she have to pick a username like "janesmith2010"?

She wanted to know what the consequences were of choosing a username that wasn't anonymous. Who would be able to see the username she had picked? Would her username be published online for the world to see? She ended up choosing "jsmith" as her username, saying that it was the same username she used in other online web applications and logins.

Jane also commented on why there was only one password field? She said that "usually there are two, one to choose a password and one to confirm that password. I don't mind there only being one, though." She typed in her e-mail address in the email field.

Jane then started typing in her cell phone number in the last field. She wrote it in the

format "+47XXXXXXXX". Before submitting the form, I told her that the field could not take the character "+" and that she had to remove it. She then replaced it with "00". This would also not work in the system, and would ultimately cause an error later when reminders were to be sent out. The only accepted input is "47XXXXXXXX" where the first numbers are the country code. This step she found to be frustrating, and she asked if all of the fields were required. Filling in your cellphone number is not required, but this is not shown in the interface.

Jane then wanted to see what would happen if she wrote too few characters in the fields, or wrote a malformed e-mail address. She was pleasantly surprised when the error messages appeared below the fields. She commented that in she, in general, liked the form, and especially the way the error messages were displayed.

2. Navigate the calendar

After the calendar had finished loading, Jane spent a few minutes navigating the page, scrolling up and down and clicking on the month links on the left hand side. She hovered the mouse pointer on some of them and said that she liked the way they were highlighted. She also liked how the current date was highlighted in yellow in the calendar. She suggested that the current month in the month list could also be marked as yellow. Jane also mentioned that she liked the speed at which the calendar scrolled from month to month when clicking on the months in the left hand menu, although the animation stuttered from time to time.

Jane said that she liked the way the "add birthday", "add anniversary" and "add event" buttons looked, and that their purpose seemed clear. Clicking them, she said, would probably let her add something to the calendar.

She tried to load the calendar for another year, using the "select year" dropdown menu. She said that she was curious why she couldn't select years previous to the current year. When asked why she would want to do this, she said that it would be useful if she wanted to check when an event had happened, or what birthday she had celebrated in a specific year.

Looking at the right hand menu, below the “Add” buttons, she commented that she didn’t really understand what reminder settings meant. “Why are SMS and E-mail reminders turned on? I didn’t turn them on, did I?”

3. Add birthdays, anniversaries and events to the calendar

She clicked the “add” button and the lightbox opened. While waiting for the contents in the lightbox to load, she said that she felt it was taking a little too long. She filled in the fields for “name” and “notes” and pressed “Add birthday”. She quickly understood that the birthday had been added correctly when she saw the green confirmation box appear. After adding a birthday, she decided to add some events and anniversaries. She clicked on the “add event” link in the lightbox and successfully added an event. As she was adding more events, she said “Why is the first field in the form for adding an event called ‘title’- when I was adding a birthday and anniversary it was called ‘name’, wasn’t it?”

She repeated the steps to add an anniversary. On the “add anniversary” page she commented that she wished that she could select not only the year, but also which anniversary it was. She knew that she had a 5-year anniversary coming up, but had trouble figuring out what year that anniversary started. This functionality exists in the “add birthday” form, but not in the “add anniversary” form. There, the user can select the birth year of the person whose birthday they are adding, and the system automatically selects their current age in the select menu labeled “current age”.

After adding a few events, Jane was asked to see if they had been added to the calendar.

She navigated the calendar like she had earlier, and found the events she had added. Looking at one of the anniversaries she had added, she asked “What does the number in parenthesis mean?” This number is meant to show which anniversary is on that specific date (the 5th anniversary would show as (5) etc).

Jane was asked to add more than one event to a specific date to see what would happen. The events appear below each other in the calendar. This, she said, make it a little difficult to see all of the events on days with more than one event.

On some of the events she had added long titles or written a long note. These are automatically truncated after 20 characters. After 20 characters the rest of the title or note is replaced with two periods, like this: "This is a very long.." The full title or note is visible on the edit screen. Jane suggested that maybe the whole note or title should become visible when the user hovers the mouse pointer over the event, eliminating the need to click on the event to see the whole title or note.

After adding an event to July 6th, Jane was surprised to see that the date fields in the lightbox had reset to January 1st. She said "If I wanted to add more than one event to July, it would be nice to be able to not have to select July again when I've added one event."

4. Edit an event (Add notes, change data, birth date etc)

When asked to edit an event, Jane replied "How do I do that? Do I click on the name itself?" She hovered the mouse on the title of one of the birthdays she had added and the quick tip appeared. She said "aah, clever!" She was curious though, if the quick tip which said "click to view and edit" meant that she had to click on the tip itself, or on the name of the event. She tried clicking on the tip, but it disappeared (Because she had moved her mouse out from the title of the birthday). "OK" she said, "I assume that I have to click on the name of the event, then, right?" She then tried clicking on the name of the birthday, and the edit window appeared in the lightbox. Jane said that there was one event she didn't want a reminder for. She unchecked the "remind me of this event" checkmark and clicked "Save changes".

5. Delete an event

Jane had already seen the "Delete" link when she was editing events, so she knew where to find it. She clicked on an event in the calendar, bringing up the edit lightbox. She then clicked on the "Delete" link, and answered "OK" to the alert asking if she really wanted to delete the event. The edit window closed and the screen returned to showing the calendar. She mentioned that perhaps there could be a way to right click on an event and get a menu that would allow you to delete the event quickly, without having to go through the steps she had just done.

6. Find out how to change reminder settings

Jane explained that as she was adding events to the calendar, she didn't really know when she would get reminders. Nothing had explicitly told her how and when the reminders would be delivered. When asked to change the reminder settings, she quickly found the "Change settings" link on the right side of the screen. On the settings page she was asked what she could do on the page. She responded that she could change when she got reminders, and that there was one section for SMS reminders, and one for e-mail. This, she felt, was a logical way to divide the settings. The last option on the page is where the user can select their time zone. Jane struggled with understanding this option. She said that she felt a little dumb for not understanding which option to pick in the time zone select box. "Don't time zones usually say GMT or something like that? Why doesn't it say that here? It would be nice if I didn't have to select my time zone." With some help, she picked the correct time zone and pressed "Save". A green confirmation message appeared, and she said that that was a good way of telling her that the settings had been saved.

7. Log out of the system

Jane was asked to log out of her calendar. She clicked the "Log out" link in the header, but said she had some reservations about logging out. "Will the events I have added be saved? It almost feels like I've been working in a Word document. There I always have to save before I exit." After logging out she was returned to the "Log in" page. She said that she was expecting to be taken to the front page, not to the "Log in" page.

8. Log in to the system

Jane clicked the "Log in" link on the front page and was taken to the "Log in" page. Here she said that she felt there were too many clicks required to log in. "Why can't I just log in on the front page? The extra steps feel unnecessary."

5.4.2 Second usability test

The second and third prototypes were carried out on prototype 3. For these tests, a new tool was used. A software application called Camtasia⁴ was used to record the user's actions during the test. Camtasia records the user's screen activity, which can then be played back to show what actions were performed by the user during the usability test.

A small microphone was used to capture the conversation between the Test Coordinator and the test participant. The audio track was also synchronized with the video of the screen captured in Camtasia.

Before the sessions started, the participants were informed that they were being recorded, and how the data recorded would only be used by the TC to make more detailed notes after the session. They were also informed that the recordings would not be shared with anyone.

Using this recording equipment allowed the TC to take fewer notes during the test, which allowed more interaction with and observation of the test participant. Having the detailed audio and video recordings of the entire test also helped gain understanding of how the user actually used the system.

The second usability test was conducted by Catherine, a 51-year-old specialist-nurse. She uses the internet daily, but does not consider herself an expert user. She usually uses the internet to check her e-mail and read online newspapers.

1. Sign up for an account

On the front page, Catherine was asked to identify what she thought was the main purpose of the site. She replied that she thought it was a service of some sort, and that she could become a user by signing up. She said "I notice that it's free" while pointing at the text next to the sign up button. "I'm not sure what these numbers mean?" she said while gesturing at the numbers in the balloon illustrations. She said that she understood from the front page that if she signed up she would get SMS and e-mail reminders for birthdays and other events. She mentioned that she didn't know when she would get reminders, but that she assumed it would be a few days before each event. She

⁴ See www.techsmith.com/camtasia.asp

interpreted the name BirthdayHero as what you would become when you signed up, because you would remember other peoples' birthdays.

When she got to the sign-up page, she started typing in the fields immediately, without reading the text in the right column. She received an error message when she submitted the form, because she had a space in her username (which is not permitted). When she received the error message, the password field was also emptied, which meant that she had to fix the issue in the username field as well as type in her password again. She mistakenly attributed the password field emptying to her using numbers in her password (which is not a problem). Before submitting the form again, she took time to read the information in the right column. She said that she felt this information was useful.

2. Navigate the calendar

When the calendar opened, Catherine immediately saw that she could navigate the calendar using the list of months in the sidebar. She assumed that the calendar was where she should enter birthdays, but saw no apparent way of doing so. She suggested that the week numbers should be on the left hand side of the page, instead of on the right. She explained that this was common in calendars.

3. Add birthdays, anniversaries and events to the calendar

She found out that she could add events by clicking on dates, but this took her a while to figure out. She filled in a few events and was happy that the green confirmation message came up, informing her that the events had been added. She did try to add events by clicking on the date itself, and not on the plus sign. She had no trouble adding notes to events. She suggested that these notes should accompany the reminders she would get. She tried adding events to a year in the future, and this was not a problem. She wondered if birthdays repeated every year, and was happily surprised when she saw that they did.

4. Edit an event (Add notes, change data, birth date etc)

Catherine had no trouble changing data in events. She clicked on events, made changes and clicked on "Save changes".

5. Delete an event

Catherine once added an event to the wrong date. She decided to delete it. Because she had seen the delete button while editing events earlier, she knew where to find it.

6. Find out how to change reminder settings

She clicked on “Settings” in the main menu. She changed when to receive reminders for SMS and e-mail and had no trouble saving her changes.

7. Log out of the system

Logging out was done by clicking on “Log out”. She had no trouble logging out of the service.

8. Log in to the system

Catherine logged in to the system by clicking on “Log in” on the front page. She felt that this worked well.

5.4.3 Third usability test

The third test was performed by Peter, a 52-year-old executive. He uses the internet, both at work and home, and has experience using enterprise calendar software at work.

1. Sign up for an account

On the front page, Peter explained that he assumed that the numbers in the balloons indicated how many events he could add. (they do not) He clicked on the sign-up button and was taken to the sign-up page. He spent a few minutes reading the text in the right hand column. He liked that it answered some of his questions, including whether or not the service was free.

Peter filled in the sign-up form. He mentioned that he wondered why there was no “repeat password” field. He did not fill in the country code in his phone number, and when asked he said that he had not seen the help-text saying that you had to include the country code. His username also included the non-English character “å”, which the system did not accept.

2. Navigate the calendar

Peter said that he could not tell by looking at the calendar what year it was showing. He noticed that the current day (the 14th) was highlighted in yellow, and he realized that

this was the current day. He said that because he knew that it was the 14th it probably meant that he was looking at the current month in the current year, which, he felt, was what he predicted to see when he saw the calendar. Peter explained that he was looking for an “agenda” view, which would show him an overview of upcoming events. “I want to see what birthdays are coming up in the next four weeks, for instance.” He also felt that a menu for adding new events was missing. Peter navigated the calendar primarily by using the scroll wheel on his mouse, but also clicked on the months in the list.

3. Add birthdays, anniversaries and events to the calendar

When asked to add events, Peter said that he assumed that he would have to double-click on a date to add an event. When he moved his mouse over a date, he saw that the plus symbol appeared, and he said that he now realized that he should probably click it to add an event. When the add event lightbox opened, he quickly understood how to use it. He did, however, suggest that the method for opening the lightbox was cumbersome. He felt that to add an event, he would have to go to that specific date in the calendar and click on the plus symbol. He would rather, he said, be able to add all events by clicking on one button.

After adding an event, Peter didn’t notice the green confirmation message that said that his event had been added successfully. When selecting a birth year in the add birthday lightbox, Peter said that felt he had to scroll really far to find the year he wanted (1957).

4. Edit an event (Add notes, change data, birth date etc)

Peter had no trouble editing events. He clicked on existing events and the lightbox for editing opened. He then made some changes, saved them and saw that the changes were reflected in the calendar.

5. Delete an event

Peter had some concerns about the “delete event” button being so close to the button that closes the lightbox. He was relieved when he saw that a confirmation message box opened when he clicked on “delete”. This, he felt, would keep him from deleting events accidentally.

6. Find out how to change reminder settings

Peter wanted to be able to turn on and off reminders. He wanted to have a way to

switch off reminders without using the select menus for each reminder type. He also said that he would rather have these settings displayed on the first page he came to when he loaded his calendar – in an agenda view.

7. Log out of the system

Peter managed to log out of the system using the “log out” link at the top of the page.

8. Log in to the system

Peter found the log in link at the top of the homepage, and used it to log back in to the service.

5.5 Results from usability tests

The usability tests have shown that there is room for improvement, but also that key elements of the design are letting the users perform the tasks that the system is made to support.

Jane, Catherine and Peter were all able to sign up, log in, navigate their calendars, add, edit and delete events, change reminder settings and log out.

The tests revealed some usability issues that need to be remedied. What follows is an outline of proposed changes that might alleviate these issues. After the changes have been made, the system should be re-tested to see if the changes have made a positive impact.

1. Sign up for an account

- a. On the front page, the balloons with numbers in them should be removed or reworked. None of the test participants understood what the numbers meant.
- b. The sign up form needs more and better help texts. While the existing error alerts are helpful, it is better to prevent the user from entering wrong data in the first place by helping them understand what data to enter.
- c. The cell phone number input field, in particular, needs to be reworked. This field could perhaps be combined with the time zone field which is now currently set on the “reminder settings” page. One way of improving this field is to make the

user select their country first. The system will then automatically display the country code to the left of the cell phone field, so that the user understands that they do not need to input the country code.

The user's country can also be tied to the user's time zone. If the user is in Norway, we know that the user's time zone is GMT+1. This way, the user does not have to select his or her time zone again after selecting their country. Some countries, however, span multiple time zones. If the user selects "USA" as their country, for instance, the system could display a select menu that asks the user to select between the time zones that span the U.S. This way, only the users that live in a country with multiple time zones have to make a selection. For all other users, the selection of time zone is invisible. Because the system wants to help you select your country code, users might not object to having to select their country.

- d. As some test subjects struggled with entering a username without spaces, it begs the question of why we should require usernames at all? Users could register themselves by only using their e-mail address and password. This eliminates the need for the users to remember a username for their account.
- e. If kept, the username field should accept non-English characters. This would be wise in order to attract an international audience.
- f. The password field needs to not empty when there is an error. As it is now, the user must refill the password field if they make an error in any of the other fields.

2. Navigate the calendar

- a. As per the suggestion from Jane, the current month in the month list can be highlighted in yellow. This will help users see, at a glance, which month they are currently in. The scrolling animation needs to be smoother. This will require rewriting and optimizing the JavaScript code which moves the white arrow when the user scrolls.
- b. The user should be able to access calendars for more years. A decision needs to be made in terms of how many years before and after the current year the user

should have access to. Showing a select menu with a hundred options (from 1930 to 2030, for instance) might be overkill because the list might fill the entire height of the user's screen. Showing the last and next twenty or thirty years might be sufficient for most users.

- c. Catherine suggested that the week numbers ought to be on the left hand side. This could be attempted in future prototype.
- d. Peter could not tell from the calendar what year he was viewing. The "select year" dropdown box could be made more visually prominent.

3. Add birthdays, anniversaries and events to the calendar

- a. The time it takes to load the lightbox needs to be reduced. Instead of using the lightbox plug-in, a custom AJAX-powered lightbox could be written that doesn't rely on iframes. Pre-loading the lightbox could also reduce the load time significantly.
- b. Rename the first input field for adding events to "Name" to mirror the forms for adding birthdays and anniversaries.
- c. Add functionality that lets the user select which anniversary they are adding. (the 5th, 6th etc)
- d. Keep entered text in the "Name" field when user switches from one page to another.
- e. After adding an event, keep the same date that the user added something to in the date fields.
- f. Users struggled with adding events because they clicked on dates instead of the plus sign. Perhaps adding events by clicking on a date should be the default way of adding events?
- g. Peter wanted to be able to add events without clicking on a specific date. This functionality existed in prototype 2 (with the buttons in the sidebars) but was removed because there was no room for a sidebar when the 7-column calendar

was introduced. Perhaps the buttons could be reintroduced and placed somewhere convenient?

- h. As Peter didn't see the green confirmation box after adding an event, perhaps it should be emphasized more? It could even be animated.
- i. The birth year selection box could be re-worked, offering a better default value. The default year could perhaps be based on how old the user is.

4. Edit an event (Add notes, change data, birth date etc)

- a. Explain to the user how to edit events, perhaps in a tutorial video or similar?
- b. A right click menu could be added to allow the user to quickly turn on and off the reminder for a specific event.

5. Delete an event

- a. A right click menu could be added to allow the user to quickly delete a specific event.
- b. The "delete" link in the edit event lightbox could be repositioned so that it is not so near the "close" button.

6. Find out how to change reminder settings

- a. Consolidate the time zone setting with the new "Select country" menu in the setup process.
- b. The reminder settings could be moved to become a step in the signup process. This however, has its drawbacks. This will make the signup process longer, which can cause a percentage of users not to complete the setup steps. If the settings are not presented in a very simple to understand manner, users might get stuck on this step and never complete it. Also, the default settings, which are that the user receives an e-mail reminder one week before the event, one e-mail reminder the day before the event, and an SMS reminder on the day of the event, might be sufficient for most users. Hence, the settings will not need to be changed. However, presenting these settings in the setup process will ensure

that users already know when they will receive reminders as they start entering data in their calendars. This removes a potential cause for frustration.

- c. Peter suggested moving the settings from a separate page to an agenda view where he could see all of his upcoming events. The agenda suggestion should be explored.
- d. The help-texts showing when reminders would be sent needs to be more prominent or moved to an introduction tutorial of some sort.

7. Log out of the system

- a. There needs to be better help texts that tell the user that the data they have added to the calendar is automatically saved when it is added. This can be solved by changing the help text that appears when the user has successfully added an event. If the text says “Jane’s birthday has been successfully added **and saved** to your calendar” the user might feel more at ease about their data having been stored. Informing the user of how the calendar functions could also be presented in a tutorial video or walkthrough.

8. Log in to the system

- a. The log in form can be moved to the front page. If it appears in the top bar, users will not have to make the extra click on the “Log in” link to get to the log in page.
- b. If a user enters the system from the URL <http://www.birthdayhero.com> they should automatically be logged in if they did not log out on their last visit. This way, the obstacle of logging in is removed, making it easier for the user to get started adding new events quickly.

6. Discussion

This chapter discusses each of the four problem statements introduced in the introduction. The problem statements are discussed based on theory presented in chapter 2, as well as the findings presented in the previous chapter.

6.1.1 Creating a usable web-based calendar and reminder service

Problem statement: *How can we create a usable web-based calendar and reminder system?*

"The essence of design," according to Japanese designer Kenya Hara, "lies in the process of discovering a problem shared by many people and trying to solve it." (Hara, 2010, p. 24) As the interviews have showed, forgetting birthdays and other events is a problem shared by many people. How well does the BirthdayHero service solve that problem? To answer this question fully will require much more testing and data gathering. However, as indicated by the usability tests carried out on the prototypes, in its current condition, the system does to some extent provide users with the functionality required to add data to the system, to change settings and to receive reminders. Many more iterations of design and testing will be necessary before the system is in a state where it is fit for paying customers.

Usability is often measured on the main dimensions effectiveness, efficiency and satisfaction. Effectiveness refers to the degree in which the user can accomplish the tasks they want to perform. The usability tests have shown that all of the test participants managed to add events to their calendar and manage their reminder settings. This shows that the system is effective. The test participants were later asked if they had received reminders for the events they added during testing, they all confirmed that they had. This indicates that the reminder service is working as intended. The second measure of usability, efficiency, refers to the the rate or speed at which an interface enables a user to accurately and successfully complete a task. Because BirthdayHero is a web-based system, the speed at which the user can load pages and navigate the calendar depends on the user's internet connection speed, their computer's speed, and so on. Measuring how quickly a user on a fast internet connection in Norway can add birthdays to his calendar might result in a misleading measure of efficiency, as the efficiency of a user on a slow modem connection in India might be very different. Measuring efficiency, must be done by analyzing the average speeds at which users from all over the world are able to interact with the system. This can

be done by recording how long each user takes to add a birthday, for instance. Valid efficiency data can therefore first be gathered when the system is used by many users. It can be argued, however, that interaction with the calendar (adding, editing, navigating) should be made as fast as possible. The time it takes to load the calendar and open the lightbox have been identified as problem areas where initial efforts to increase speed should be focused.

Satisfaction is the third measure of usability. Satisfaction is a common way of referring to the set of subjective responses a person has when using a system. Satisfaction can be measured with questions that have their responses on Likert scales, e.g. "How satisfied are you with this service? (1 = very dissatisfied, 7 = very satisfied)". Doing a satisfaction survey on our three usability test participants, who are the only users who have tried the system, would not yield reliable data. However, once the system is in a state where it can be used by anyone, a survey could be distributed to registered users to gather feedback as well as measure user satisfaction. Of course, if users keep renewing their accounts and tell their friends about the service, this can also be seen as an indication of user satisfaction.

6.1.1.1 *The calendar*

The calendar used in the newest prototype in some ways looks like a traditional wall-mounted calendar that many users will be familiar with. It uses a 7-column grid where each column corresponds to one weekday and every row in the grid corresponds to one week. However, the calendar does in some ways depart from traditional designs. It allows the users to scroll vertically in what is hopefully an intuitive way. None of the usability test subjects had trouble understanding how to use the interface, so it does appear to be somewhat intuitive. Whereas you would in other calendar systems have to click on a button or link to display the next or previous month, the BirthdayHero calendar allows users to navigate without any clicks. This means that you do not lose sight of the events happening in January when you scroll down slightly to see events happening in the first weeks of February. The vertically sliding calendar layout could be easily navigated on devices with touch interfaces, like the iPhone.

The calendar has been designed to fit on a screen with a resolution of 1024 x 768 pixels, a commonly used minimum resolution for designing web sites. If, however, a user uses a

screen with a lower resolution, the calendar will not fit on the screen. While the majority of users will have resolutions that fit or exceed the minimum requirement for seeing the whole calendar, this is a design challenge that has to be solved for mobile devices, where screens have dramatically lower resolutions. The 7-column grid might not be appropriate for mobile devices, and there may have to be a different calendar layout made for these small screens.

The calendar layouts used in the first two prototypes showed that using an unfamiliar calendar layout made the calendar less usable. In prototype 2, especially, it became clear that a one-column grid could not display enough data on the screen to be useful, and that a three-column grid would not allow users to calculate time differences between dates easily. In prototype 3 these issues were resolved by going back to a traditional 7-column layout. The space between dates in a calendar indicates the number of days between those dates. This vital finding made it clear that showing “empty” dates, dates without any events, is important to help users process the data in their calendar.

6.1.1.2 The sign up process

The sign up process was through the usability tests found to work fairly well, though there is room for improvement. The help texts associated with each field need to be improved. Some test subjects struggled with filling in a proper username, which either contained spaces or international characters. A solution to this problem is to allow users to sign up without using a username, only an e-mail address. This way, users do not have to memorize a username for the service, and can log in using their e-mail address, which they will hopefully stand a better chance at remembering. As users might not log in very often, using an e-mail address to identify users could prevent users from forgetting their log-in information.

Reducing the number of fields required to sign up could increase the number of users who do sign up. Sign-up could also be incorporated with Facebook, so that users would have the option of signing up simply by logging in to Facebook through BirthdayHero. BirthdayHero could then automatically import their friends and their birthdays, giving users a flying start by having their calendar already pre-filled with birthdays.

6.1.1.3 The settings page

The setting where users select their time zone could be incorporated in the sign-up process. An elegant solution could be to ask the users to select their country via a drop down select menu, and then fill in their phone number. By selecting their country, the system would be able to choose the right country code for that country, as well as set the proper time zone for that user. The country could also be automatically detected through analyzing the user's IP address. If the country the user has selected spans several time zones, they could be asked to select the correct time zone through a drop down select menu from the time zones that span that country.

6.1.1.4 The reminders

In *The Design of Everyday Things*, Norman argues that there are two aspects to a reminder, the *signal* and the *message*. (Norman, 1988) The signal is what reminds us, but the message is the thing we need to remember. Tying a string around your finger to help you remember something is of little use if you see the signal but don't know the message. The string itself provides no information about what you need to remember. Similarly, when you write a note to yourself, you only have the message, but no way of reminding yourself of it. There is no signal. Norman argues that there is a need for timely reminders that good design and new technology can help fulfill.

What is a timely reminder? When are reminders useful? Reminders are useful when they are needed and are received in time to be valuable to the user. Reminders are of little use if they arrive late, or if the user never sees the reminder in the first place. The reminder needs to be close enough in time to the event it is meant to remind the user of. If you receive a reminder for a birthday three weeks before it happens, you might forget about it again during the three weeks. The optimal "sweet spot" for when to receive reminders might vary from user to user. In the settings page of BirthdayHero users can select when they want to receive reminders. They can add a total of four reminders, two by e-mail and two by SMS. It will be interesting to see which types of reminders are favored by users. SMS reminders might hold the most promise because they are delivered straight to the user, but may also seem intrusive if users receive many SMS reminders in a short period of time. Also, if users receive reminders for events that they would have remembered without the reminder they

might not find the service very useful. There is a thin line between being extremely useful and extremely annoying.

6.1.1.5 Social memory

In the chapter on theory the term *social memory* was introduced. It describes how people can remind each other of important events. The interviews revealed that several of the respondents had help from others in remembering events, and that family members often helped each other remember the birthdays of other family members. How can this finding help make BirthdayHero a better service?

One idea is to give the service human qualities. One idea for accomplishing this is by anthropomorphizing the service by renaming it “BirthdayBuddy” or something similar. This way, the users would receive reminders from their “BirthdayBuddy”, a fictitious character that helps remind them of important things, much like other people remind us in real life. This does, however, shift the focus of the service from the user being the center of attention (a BirthdayHero) to the user simply receiving help from a service (their BirthdayBuddy). The concept of the character BirthdayBuddy might be more suited for younger users. Perhaps BirthdayBuddy could even be a separate service tailored for children.

A simpler way of incorporating the concept of social memory into the existing service would be to allow users to share their reminders with others. A link in the reminder for Michael’s birthday called “Remind a friend about Michael’s birthday” could be used to forward that reminder to someone else. Users could also be able to share their calendars friends and family. “Share your calendar” could be a tool that would let others start a new calendar which includes the events in your calendar that you want to share.

6.1.1.6 System value

Companies like Apple and Nike succeed by pleasing and impressing their customers with repeated, great experiences. Design of products and services needs to be driven by empathy for the problems that people face every day. The BirthdayHero service needs to help users become better at remembering birthdays. Every time the user is reminded of a birthday that they would have otherwise forgotten, the service proves its worth. If a typical user adds 20 birthdays, 10 events and 2 anniversaries to their calendar, and hypothetically only remembers about 60-70% of them, there is a tremendous potential to help the user

remember the 10 – 12 events they would otherwise forget. If the service proves itself month after month, the user will come to value and depend on it. The more events the user adds to the calendar, the more the value of the service increases. As we meet more people we need to remember the birthdays of, our collection of birthdays might grow every year. Therefore, the user's *perceived value* of the service could also grow with time.

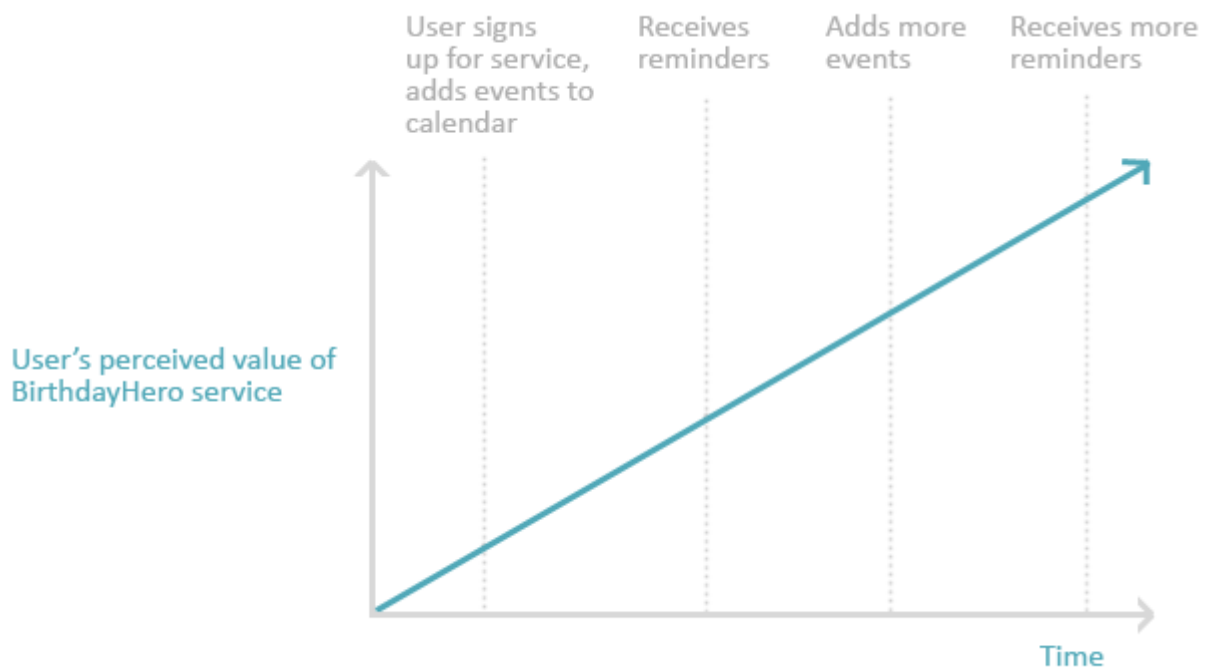


Figure 62 – Perceived value over time

If the value of the service depends on how many events the service helps the user remember, it is critical that it is as easy to add events to the calendar as possible. More events mean more reminders, and more reminders means more chances to please the user.

6.1.1.7 *Emphasizing ties to reality*

In the modern age of Twitter and Facebook, it is easy to forget that these services are not about technology, but about managing our social connections. BirthdayHero too, is a way of managing your social obligations. BirthdayHero also encourages *offline* interaction. The reminders the users receive could be seen as digital artifacts that trigger communication between people.

Löwgren and Stolterman argue that digital artifacts can promote “personal connectedness” – providing the possibility to stay in touch and mediate closeness over a physical distance. (Löwgren & Stolterman, 2004) When you get a birthday reminder, you can pick up the phone and call that person, or arrange a birthday party – the service entices you to interact with the person you wanted to remember. Birthday and event reminders can therefore give us an opportunity to positively reinforce our social connections.

Here are some ideas that emphasize the real life connections users have with the people whose birthdays they have added:

- **Providing contact information in reminders**

The e-mail and SMS reminders will be two of the main contact points between the service and the user. A user might not log in to the calendar very often, but might receive reminders many times per month, depending on how many events have been added to the calendar. Thus, the reminders are the place where BirthdayHero can encourage interaction. Let us say that it’s our friend Mike’s birthday, and you have received an e-mail reminder. The reminder could include a link to “Send Mike an e-mail message” which opens a new message window in your e-mail client. This requires that you’ve added Mike’s e-mail address in the system. Another example is the link “Send Mike a message on Facebook” which opens Facebook your web browser. If you’ve added Mike to the calendar by importing him from Facebook, this link could be implemented automatically. In SMS reminders, it might be useful to include Mike’s cell phone number, so that if you wanted, you could quickly call him, or send him a congratulatory message.

- **Social features in reminders**

In the real world, we often get birthday reminders from other people. This concept can be brought into the BirthdayHero service. In the reminders, we could use links that say “Think that someone else might have forgotten Mike’s birthday? Click here to send them a reminder”. This way, we can alert others that also need to remember Mike. This could also be a way of spreading the word about the BirthdayHero service.

- **Multiple users per account**

A family could share a calendar. That way, all of the family members will get reminders for events in the calendar. This could be done by adding several e-mail addresses and cell phone numbers on the reminder settings page. Having a shared calendar could take some of the load off of the family member that usually takes care of remembering birthdays. All of the group members could receive reminders simultaneously, saving time and effort.

- **Sharing calendars**

Imagine that you have filled your calendar with every birthday you need to remember. Your friend Sue comes over, and says that she too would like to have a calendar like yours. Since you share many of the same friends, it could be a good idea to let her calendar be pre-filled with some of the events you have already added, saving her some typing. This could be implemented by letting users share their calendar. You could type in the e-mail address of the person you want to share with, and then they will receive an e-mail with a link to the BirthdayHero service. When they click on the link, they will be asked to sign up for a new account (if not already a user) and then the events from the original user's calendar will appear in their calendar. If Sue already had an account, the imported events would simply be added to her existing calendar. Of course, you might not want to share every event you have added with Sue, so you might get the option to select which events you want to share before the link is sent to Sue.

- **Using photos**

When users receive a reminder for a birthday that they have imported from Facebook, the reminder could be accompanied by the profile picture that user has on Facebook. So when it's your friend Mike's birthday, you'll see his picture in the reminder. This way, the reminder might produce a greater emotional response in the recipient. The pictures could also be shown in the calendar. Photos could also be uploaded directly, if the user has not been added via Facebook. Using profile pictures also contributes to the way that the service reminds users through *recognition*.

- **Printing calendar**

As mentioned earlier, the calendar could be printed and hung somewhere where it facilitates interaction. Hanging the calendar in a kitchen will likely mean that many in the household will see it often. If they think of more events to add, these could be written directly on the calendar with a pencil, and then inputted into the system once a month. In the future, we might all have slim computer displays in our kitchens for browsing and checking e-mail. This could be a natural place to display the BirthdayHero calendar. If users want a sturdy, higher quality calendar, a calendar printing service could be set up. For a fee, users could get a high-quality physical calendar in the mail, pre-filled with the birthdays and anniversaries they have added.

6.1.1.8 Importing and exporting calendar data

When users sign up, it could be smart to give them a way of importing their contacts into the system. By importing events they don't have to spend as much time adding birthdays into the system. One way of importing contacts is by using commonly available "invite" scripts, which ask for the user's e-mail address and e-mail password, and then proceed to import the user's contacts from their e-mail account. Scripts exist to allow importing from many popular e-mail services, including Gmail and Hotmail. After importing all of the e-mail addresses, the system could send each of the contacts an e-mail asking them to submit their birthday to be included in the user's calendar. Doing this might also spread the word about the service, as the user who is importing his or her contacts also in effect, is telling their friends that "this is a good service – I'm using it and so should you." This is the approach used by BirthdayAlarm.com. BirthdayAlarm cleverly makes the importing and inviting of contacts the final step in the sign-up process. They also guide their users to import contacts, by making the link to the page where they can add events manually very hard to spot.

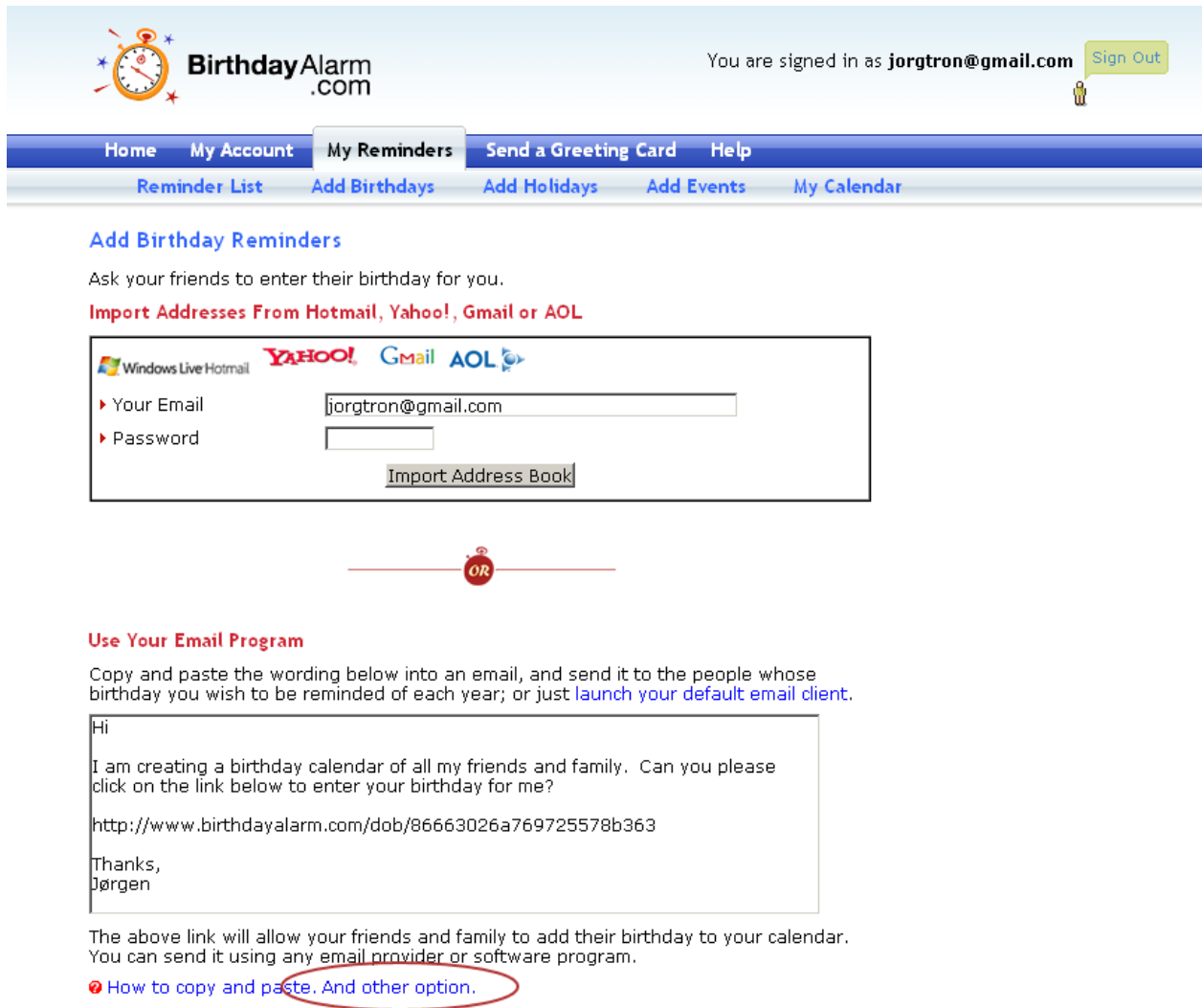


Figure 63 – A screenshot from the last sign-up step at BirthdayAlarm.com

Notice how the way of adding birthdays manually requires clicking on “And another option”. This is quite deceptive design, because it almost forces users to invite their friends to use the service before they can get any use out of it for themselves. Using invite e-mails like BirthdayAlarm does, to attract new users has its drawbacks, as many consider these e-mails to be “spammy” and are quick to delete them. If too many e-mails sent from your server are marked as spam by recipients, the transmitting server can eventually be blacklisted by e-mail services and all future e-mails deleted before they even reach the recipient.

Another way of importing contacts, that I believe will be even more useful, would be to import the user’s entire friend network from Facebook or other social network. Your network of social connections is often called your “social graph”. Many people keep everyone important in their lives in their friend network on Facebook, and providing

functionality for importing social graphs would ensure that new users quickly got their calendars filled with events. More events results in more reminders. More reminders means more times when the system can prove that it is useful. Importing data from Facebook could be accomplished by using Facebook's recently unveiled "Facebook Connect" feature⁵, which allows users of third-party websites (like BirthdayHero) to interact with the data in Facebook users' accounts. If set up correctly, BirthdayHero could work with Facebook to import every contact users have added to their network. Every time you add a friend to Facebook, their birthday would "automagically" show up in your BirthdayHero calendar.

So why not simply make a Facebook application that users can get reminders from? There are two reasons. First of all, doing this would limit the user base of BirthdayHero to only those who use Facebook. My parents, for instance, are not on Facebook, but they could still find the BirthdayHero service useful. Second, Facebook controls everything that happens in their network. Should Facebook decide that they don't like the BirthdayHero service, they could shut it down without warning. Keeping BirthdayHero separate and independent from other platforms ensures that users won't suddenly find that the reminder service they signed up for, and rely on, is no longer sending them reminders.

A goal would also be that users could quickly export the data they have added to their calendars. If you have spent a lot of time inputting data, that data should belong to you, not the service. The data could be made available for download in the iCal calendar data format, often used in calendar software.

Exporting data could also be done to a physical medium. One could allow users the option of printing their calendar, so that they could, for instance, hang it on their fridge or do whatever they wanted with it. Users, who previously refilled their wall-mounted calendars by hand every year, could now just print a new one out every January. The system must then, of course, properly format the calendar to fit well on common sized printing paper. Instead of mirroring the online calendar's layout of the calendar as a continuous stream, the printed calendar could display one month of the year per printed sheet, much like wall-mounted calendars do. This provides the benefits of both the online and offline world. A

⁵ See http://wiki.developers.facebook.com/index.php/Facebook_Connect

tangible calendar that can be hung on a fridge or be placed on a desk is useful for every-day planning, while the online service provides reminders and flexibility, by repeating birthdays every year, and calculating ages and other functionality that computing power can provide. Then, BirthdayHero becomes a tool that can be used anywhere, and not just on the web.

6.1.2 Appliance or general purpose?

Problem statement: *Should BirthdayHero be an appliance or a general purpose service?*

There already exist general purpose PIM solutions like Microsoft Outlook, that in addition to having a calendar and e-mail client also includes a task manager, contact manager, note taking capability, a journal and a web browser. Should BirthdayHero also include these features, or stick to doing just one thing?

There are two possible approaches. BirthdayHero service could replace all of the other tools that people are currently using, like calendars and journals. However, the prototype does not have all of the functionality and advantages that these different tools offer. A BirthdayHero calendar will not be as visible as wall-mounted calendar, and not as easy to use as a Post-it note. Most users are unlikely to stop using all of their existing tools just because they now have a BirthdayHero account. Another alternative is to frame BirthdayHero as a backup service, to be used in addition and as a supplement to existing tools.

Since the service cannot compete with every advantage offered by existing tools, it should not try to replace them entirely either, but instead offer something that most other options cannot – SMS and e-mail reminders, cloud storage, as well as automatic calendar generation. Cloud storage means that the data users have added is not stored on their computers or cell phones, which are easily damaged, lost or stolen, but on BirthdayHero servers that are monitored and backed up often to prevent any data loss. Automatic calendar generation is the process of having events like birthdays and anniversaries repeat every year. Most existing physical calendars require users to refill a new calendar every year, but this can be done automatically by the BirthdayHero service, which also calculates how old people will be on their birthdays. As I see it, these are the main advantages of using the BirthdayHero service versus other tools:

- **Availability**

Your calendar can be accessed from any web browser, including on mobile devices once the service and design is adapted for smaller screens. The calendar can also be printed and used as one would a traditional paper calendar.

- **Synchronization**

If you add a birthday to your calendar from your mobile device when you are in a meeting, the birthday is there when you come home and access the service from your home computer. You no longer have to update several physical and electronic calendars to stay organized.

- **Cloud storage**

Because calendar data is kept on servers that are backed up often and properly maintained, losing your calendar becomes a problem of the past. This does, however, require that the service provider is extremely diligent in keeping your data safe.

- **Reminders**

Reminders make sure that you cannot forget important events, as long as you have added them to your calendar. SMS text message reminders, in particular, hold promise in being a way to reach users with immediate messages that are likely to be read.

- **Automatic calendar generation**

The calendar automatically repeats repeating events and reminders every year. Repeating events like birthdays and anniversaries update so that you never have to worry about how old someone will be on their birthday. If you got married in 2000, the calendar will display “Wedding anniversary (1st) in 2001 and “Wedding anniversary (2nd) in 2002, and so on.

- **Less worrying**

Knowing that you will get a reminder a week before every important event will likely let you worry less about forgetting things. BirthdayHero is a “set it and forget it” service.

Because the BirthdayHero service cannot compete directly with existing tools, it makes sense to not try to make it into a general purpose service. If it attempts to do everything – and offers hundreds of features and customization options, it will likely not be as successful as if it just focuses on the core features that provide great value for users. This implies that the service ought to be designed and marketed as an appliance service, providing a narrow set of functions to fulfill specific needs. The interviews showed that many participants meant that they were good at remembering birthdays, yet almost all said that they would also like to receive reminders. This means that the service can be useful as a backup service. Users are still likely to remember some or most of their events, but to make sure they don't forget any, they will get reminders.

Mohagner and Wagner (2000) argue that designers of appliances must strike a balance between offering a product that is simple enough to use, but functional enough to be useful. They argue that this balance or “functionality threshold” may vary from user to user even when using the same service. An appliance service, like BirthdayHero, has to cover a narrow range of user tasks while at the same time fulfilling the needs of users who demand different things from the service. Mohagner and Wagner present some of the trade-offs between making appliances and general purpose services. There are two potential disadvantages in building services that are too specific:

- The services may be too limited to be useful or compelling
- Assuming the services are useful, users may need to use many such services for various domains, which might be impractical

However, making a service too general also has its disadvantages:

- It can lead to a product that is too complex
- It may result in a product that doesn't appropriately meet the task needs of users

Despite designing BirthdayHero as an appliance-service, it shouldn't be too restricted in what functionality it offers. If users could only use the service to remember birthdays, and not anniversaries or events, they might find the service to be too limited. If you can get reminders for birthdays, why shouldn't you get reminders for other events? Most users will

likely manage one or two anniversaries and somewhere between 5 and 50 birthdays. Allowing users to add events like “Beach Barbeque”, and “Remember to pick up plane tickets” encourages users to use the calendar on an everyday basis. Limiting the functionality to only managing birthdays makes interaction with the system spread out over the course of a year. When interaction happens rarely, it might not make users feel like they have a connection to the system. However, if they get reminders for events as well as birthdays, they might feel more “in touch” with the service, and use it more often as a result.

How can we decide which features to include? Software engineer Max Kanat-Alexander presents the idea that software and services should help people achieve something. (Kanat-Alexander) For instance, Google exists to help people find what they are looking for. The Firefox web browser helps people browse the web. BirthdayHero helps people not forget birthdays and other events. Kanat-Alexander argues that when faced with the option of implementing new features, designers should ask themselves if the new feature will help users achieve the goal of the service. For BirthdayHero, this question is “Will this feature help users remember more birthdays?” Features that directly affect how well users can fulfill the aim of the service should be prioritized. Of course, services can have several goals; Google makes enormous amounts of money from their search engine, and their mission statement to “to organize the world's information and make it universally accessible and useful” is not entirely altruistic. (Google) However, when the company was founded by Larry Page and Sergey Brin in 1998, the goal was simply to create a better way of searching the web. Similarly, BirthdayHero needs to focus on core features that will help its users from the beginning.

6.1.3 Internal and external information management

Problem statement: *What are the strengths and weaknesses of internal and external information management?*

One way of helping ourselves organize and remember data is to externalize it. This means that we copy the data we have stored in our memories onto an artifact in the physical world. For instance, when Mike tells us when his birthday is, we could write it down in a calendar, in our organizer, or on a Post-it note. Then, when we felt the need to refresh our

memory, we would take a look at the calendar or our notes to check for upcoming birthdays. We can also input this data in electronic devices, such as calendar systems on our computers or cell phones. As the interviews showed, people use different methods to organize birthdays and events. Some might only rely on their memory to keep appointments and remember birthdays, while others depend heavily on physical aids. If you only have a few birthdays you need to remember, keeping track of them might not require any external tools. However, if you need to keep track of hundreds of social contacts, chances are you might need help organizing and remembering them.

Internal and external information management relates to what is called cognition in the wild, or *distributed cognition*. Developed by Edwin Hutchins, distributed cognition is a psychological theory that emphasizes the social aspects of cognition. (Hutchins, 1995) It is a framework that involves the co-ordination between individuals, artifacts and the environment. Remembering birthdays and events can be seen as a form of distributed cognition. For those who get help remembering events from others, remembering is done through social interaction. When we use notes, calendars and reminders, we are performing cognition by co-coordinating with artifacts in our environment.

Psychologist Gavriel Salomon (1993) argues that there are two classes of distributive cognition: shared cognition and off-loading. Shared cognition is that which is shared among people through common activity such as conversation, where there is a constant change of cognition based on the other person's responses. Another example could be flying a plane, where the pilots and other crewmembers together fulfill the different roles needed to keep the plane airborne. An example of off-loading could be using a calculator to do math or writing a grocery list when going shopping. In this sense, cognitive duties are off-loaded to a material artifact. Who of us hasn't done relatively simple math on a calculator - not because we were not able to do it in our heads, but because it saved us a little time and effort? Cognitive off-loading is also what we do when we assign artifacts like calendars the duty of helping us manage and remember events.

There are several strengths of internal information management. First, it requires only that you commit something to memory, which can in some instances, be easy. Second, it requires no interaction with outside artifacts like calendars or notes. The major weakness of

internal information management is that when you rely on your memory alone to remember important data, you might be setting yourself up for failure. As mentioned, human memory is not without flaws. Our memory recall performance deteriorates over time, especially when we do not review the information we have stored in our memory regularly. Relying on your memory also means that you need to actively review the stored memories to check for upcoming birthdays. If you fail to recall a memory at the time when you need it the most (on Mike's birthday, for instance) it will not be useful to you.

External information management comes in many forms. We can store data in a calendar, set up a cell phone alarm, or simply tie a string around a finger when we need help remembering something. We commonly use external information management when we go grocery shopping. The advantage of using external artifacts is obvious. When we write a list of the groceries we need to purchase, we don't have to remember each item on the list when we get to the store. In our household, we keep a grocery list in the kitchen. When we think of something we need to purchase, we simply add it to the list. We usually add items over a period of two to three days, and when there are enough items on the list, we go grocery shopping. We would forget to purchase all of the items we needed if we didn't write a list, so therefore we rely on the list to help us remember. However, and this illustrates the major weakness in using external information management, when we forget to bring the list to the store, we often feel sure that we have forgotten something that was on the list. When we rely on external tools to aid our memory, we use less energy and time memorizing data internally, because we rely on the external storage, in this case, the grocery shopping list. Similarly, if you rely on a reminder service to remember birthdays, you are likely to remember fewer of those birthdays on your own. If you have a calculator, do you really need to have the multiplication table memorized?

I know that I, for one, would like a combination of internal and external information management when managing birthdays. Knowing when my friends' birthdays are makes me *feel good*, like I have mastered something. But I still often forget them on their birthdays. There might be a distinction then, between *knowing* when a birthday is, and *remembering* it when the birthday comes around. Thus, I believe the BirthdayHero could profit from helping users learn when the birthdays they want to remember are, in addition to helping them

remember them. Users probably won't be able to remember every birthday or event they have added, and it is then that receiving reminders will be useful.

Norman (1988) argues that there is a tradeoff between "knowledge in the head", and "knowledge in the world". We need both types to function, but we can rely more heavily on one or the other. If we removed the letters on the keys on our keyboards, we would have trouble typing efficiently. Although experienced keyboard typists know where to place their fingers to type letters (knowledge in the head) we use the letters on the keys (knowledge in the world) when we are unsure of which key to press. We don't need to memorize the location of every key, because knowledge in the world is there to help us accomplish our tasks. Airplane pilots rely heavily on knowledge in the world when they go through written pre-flight checklists. They cannot rely on their internal knowledge of the steps in the checklist alone, because missing one step could have serious consequences. Similarly, if we have a calendar (external information) we don't need to memorize every birthday (internal information).

Norman presents the table below which illustrates the tradeoffs between knowledge in the head and knowledge in the world. (Norman, 1988)

Property	Knowledge in the world/external information management	Knowledge in the head/internal information management
<i>Retrievability</i>	Retrievable whenever visible or audible.	Not readily retrievable. Requires memory search or reminding.
<i>Learning</i>	Learning not required. Interpretation substitutes for learning.	Requires learning, which can be considerable. Learning is made easier if there is meaning or structure to the material (or if there is a good mental model)
<i>Efficiency of use</i>	Tends to be slowed up by the need to find and interpret the external information.	Can be very efficient
<i>Ease of use at first encounter</i>	High	Low

Retrievability relates to how easy it is to retrieve information. If we store information internally, retrieval of declarative memories requires conscious effort. External information, however, is retrievable whenever visible or audible. Storing information internally requires *learning*, which is made easier if there is a good mental model. A mental model is an explanation of someone's thought process about how something works in the real world. It is difficult to develop an efficient mental model for storing birthdays. To do so requires that you relate the information to other data you have previously stored. The interviews revealed that at least one participant used a mental model to relate two dates together. The participant said that he associated his friend's birthday with the date of an annual festival in his hometown. Creating these associative relationships between dates takes a lot of effort, especially if you need to remember many dates. When storing data externally, in a calendar for instance, you only need to interpret the data you have written down. In terms of *efficiency of use*, internal knowledge can be faster to access than external knowledge, because memory recall happens almost instantly. This requires, of course, that the memory can be recalled.

Internal and external information management also draws parallels with the concepts of *recall versus recognition*. We can see that internal knowledge relies heavily on recall, while storing data externally relies on recognition. What are the advantages and disadvantages of each?

Norman argues that reminders provide a good example of tradeoffs between the roles of internal and external information management. Knowledge in the world can be self-reminding, because it is physically there. In our household, for example, we write grocery lists on adhesive Post-it notes. When we finish writing a list, we post the note on the inside of our front door, so that we are guaranteed to see it before we leave the house. Using external information management thus relies on you seeing or being reminded of the data.

As Norman states, knowledge in the mind is "ephemeral: here now, gone later." We can't count on internal knowledge being present unless we are reminded of it or constantly rehearse it in our minds.

This is not the first time humans have pondered the relationship between internal or external information management. Consider this dialogue by Plato, from the year 370, about the invention of written language:

SOCRATES: At the Egyptian city of Naucratis, there was a famous old god, whose name was Theuth; the bird which is called the Ibis is sacred to him, and he was the inventor of many arts, such as arithmetic and calculation and geometry and astronomy and draughts and dice, but his great discovery was the use of letters. Now in those days the god Thamus was the king of the whole country of Egypt; and he dwelt in that great city of Upper Egypt which the Hellenes call Egyptian Thebes, and the god himself is called by them Ammon. To him came Theuth and showed his inventions, desiring that the other Egyptians might be allowed to have the benefit of them; he enumerated them, and Thamus enquired about their several uses, and praised some of them and censured others, as he approved or disapproved of them. It would take a long time to repeat all that Thamus said to Theuth in praise or blame of the various arts. But when they came to letters, This, said Theuth, will make the Egyptians wiser and give them better memories; it is a specific both for the memory and for the wit. Thamus replied: O most ingenious Theuth, the parent or inventor of an art is not always the best judge of the utility or inutility of his own inventions to the users of them. And in this instance, you who are the father of letters, from a paternal love of your own children have been led to attribute to them a quality which they cannot have; for this discovery of yours will create forgetfulness in the learners' souls, because they will not use their memories; they will trust to the external written characters and not remember of themselves. The specific which you have discovered is an aid not to memory, but to reminiscence, and you give your disciples not truth, but only the semblance of truth; they will be hearers of many things and will have learned nothing; they will appear to be omniscient

***and will generally know nothing; they will be tiresome company,
having the show of wisdom without the reality. (Plato)***

The dialogue tells the story of when the god Theuth invented letters and the written language and presented his invention to another god called Thamus. Theuth sees only the positive side of his invention, that writing will make the “Egyptians wiser and give them better memories.” Thamus, on the other hand, is weary of this new technology and fears that it will cause “forgetfulness in the learners’ souls” and that they will come to rely on the new invention, but get little wisdom from it. This reflects on a dilemma concerning the BirthdayHero service. If users get reminders for everything, do they then remember anything? Or do they “appear omniscient and will generally know nothing” and “have the show of wisdom, without the reality”? Is getting a reminder as valuable to a person as remembering something on their own? This question also touches on how others perceive us. If I remember Mike’s birthday simply because I set a reminder for his birthday a year ago, will that make Mike feel as if I have really “remembered” him? I believe that remembering something on your own, internally, without any external tools, has intrinsic value. Therefore, I believe that the service should, in addition to reminding users of events, also help them remember events on their own. How this can be achieved will be investigated in the next section.

6.1.4 Improving users’ memory recall performance

Problem statement: *Can the service also improve the memory recall performance of its users?*

We will in this section examine how a learning technique called spaced repetition takes advantage of a psychological concept called the “spacing effect”. The spacing effect refers to the fact that humans more easily remember or learn items in a list when they are studied a few times over a long period of time (“spaced presentation”), rather than studied repeatedly in a short period time (“massed presentation”). As an example of contrasting spaced repetition with massed repetition, think back to an exam you have taken where you studied by “cramming” your brain full of information the night before the exam. Cramming is an example of massed presentation. You might have done well on the exam, but how much of the information you “crammed” can you remember now? Studies have found that

intense, last-minute studying is not likely to be as effective as studying at intervals over a much longer period of time. The benefits we can reap from spaced repetition do, however, not appear at short retention intervals. (Cepeda, 2008) When you need to remember something for an exam tomorrow, cramming is the way to go. However, at long term retention intervals (months or years in the future), spaced repetition yields better memory recall performance. A “birthday” is in its most basic form a date, placed on one of the 365 dates in a year. To be able to remember this date a single cramming session would not give great results. If, however, BirthdayHero users somehow got to review the birthdays they had added at spaced intervals, say, every, two months, perhaps their memory accuracy would improve.

A recent study by Nicholas Cepeda (2008) tested the effects of spacing learning sessions. In the study, 150 participants participated in three sessions over a period of up to 1 year. The first two sessions were learning or study sessions in which the subjects were taught a set of weird but true facts (such as “What European nation consumes the most spicy Mexican food?” Answer: “Norway”) as well as the names of some obscure visually presented objects. (e.g. “coccolith”) The two study sessions were separated by a gap ranging from 10 minutes to 6 months. All subjects then returned to the lab for a final memory test 6 months later.

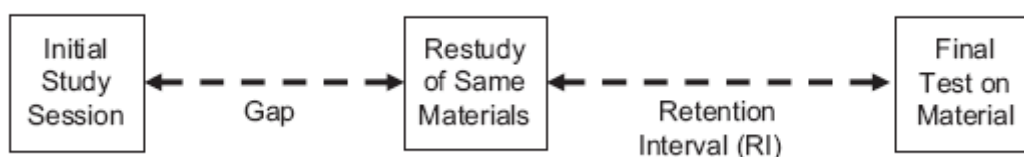


Figure 64 – Outline of steps in Cepeda’s study on memory retention

A striking pattern of results were found. Recall success was best when subjects had had a 1-month gap between study sessions, much worse for shorter gaps and slightly poorer for longer ones. This means, that for remembering these obscure facts, the optimal memory retention at 6 months after the second study session occurred when subjects had the second study session one month after the first session. The optimal gap was thus one month. In later studies, Cepeda found that optimal gap depends on the Retention Interval (RI), or the time after the second study session the final test was conducted. (Cepeda, 2008) So when the optimal gap was one month when the RI was 6 months, the optimal gap might

be 4 months when the RI is two years, and so on. Therefore, when deciding when to study for something, you need to take into account when you need to remember it. If the exam is in 7 months, study session 1 and 2 need to be one month apart. (first session at month 0 + second session at month 1 + exam 6 months later = 7 months) If the exam is in 3 months, the sessions might need to be closer together. Cepeda found that the optimal gap, as compared with a zero-day gap, provided a *64% increase in final recall*.

Michael C. Mozer explains Cepeda’s findings through the following graph. (Mozer) The “forgetting function” in the graph is the “forgetting curve” mentioned earlier. The “spacing function” is the shape of the memory curve after the second study session.

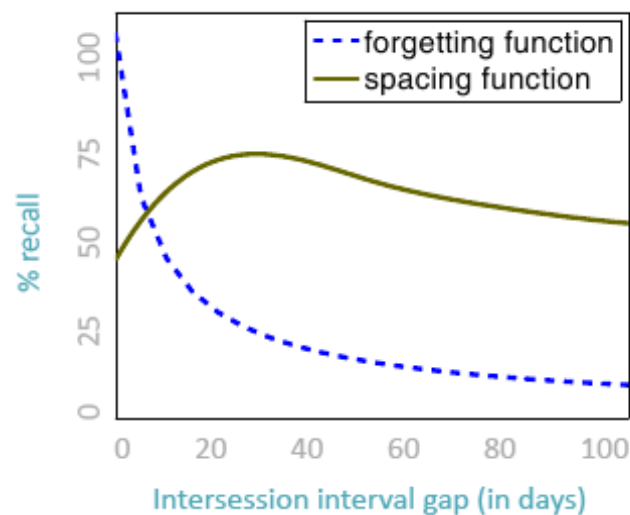


Figure 65 – The forgetting and spacing functions

The numbers used on the axis are not representative of an actual situation, but merely meant to explain the nature of the spacing function. Notice how the recall percentage is relatively low when the gap is 0 days (meaning that study session 1 is immediately followed by session 2) and that the recall percentage increases sharply as the gap size is increased. As the gap is increased beyond an optimal point (in this example around 30 days), the recall percentage slowly decreases.

This research has implications for the BirthdayHero service. If we want to help users not only remember birthdays by getting reminders, but also get better at remembering birthdays without reminders, there are several interesting findings to take away from this research. First, the material to be memorized needs to be repeated at intervals to ensure

that it is remembered on the “final test”. In our case, the birthdays the user adds to the calendar is the material to be memorized, and the “final test” is whether or not the user remembers the birthday on the date when the birthday occurs.

Cepeda reasons that the optimal gap can be calculated (using an advanced mathematical formula) and that the optimal gap depends on the Retention Interval. Only when we know when we need to remember something can we figure out the optimal gap between study sessions 1 and 2. Luckily, because birthdays are a specific date in the future, this date is our RI. Study session 1 can be seen as the date when users first add the birthday to their calendar. If the current month is May, and the user adds Peter’s birthday, which occurs on December 8th, we have established that the user needs to know that Peter’s birthday is on Dec. 8th seven months from now.

Cepeda’s formula could show that to get an optimal memory recall in 7 months, the second study session needs to occur one month after the date that the user originally added Peter’s birthday. Therefore, we need to find a way to make the user review that piece of information in one month. This could be done by encouraging the user to take a “BirthdayQuiz”. At the one-month mark, the user would receive an e-mail containing a link to the quiz, which is located at a custom-built webpage on the BirthdayHero website. The quiz functions as study session 2 in Cepeda’s study, as a method of making the user review the material.

The quiz needs to be framed in such a way that the user wants to take it, perhaps inviting the user to see how good they are at remembering birthdays (e.g. “What’s your BirthdayHero score? Take your BirthdayQuiz now!”). The quizzes could even be completed to earn the user points, or a ranking. (e.g. “Take your BirthdayQuiz now and receive 100 points!”) Collecting enough points could earn the user free months of service, or other benefits. The important thing is to motivate users to complete the study sessions. While they think they are testing themselves to earn points, in reality they are refreshing their memory of birthday dates. The end result will hopefully be that they stand a better chance of remembering Peter’s birthday on Dec 8th. If all else fails, they can still get a reminder by e-mail and/or SMS.

Here is a mockup of what the quiz could look like:

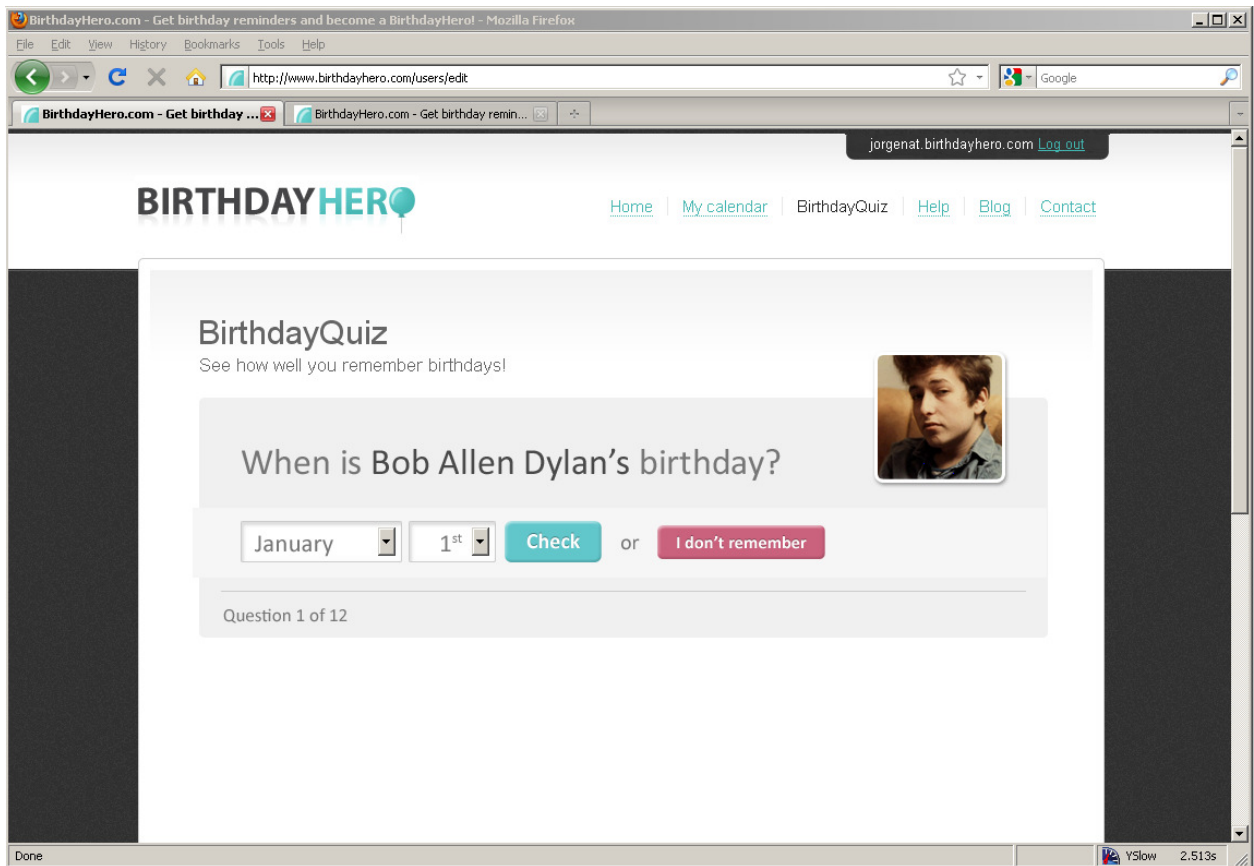


Figure 66 – First page of the BirthdayQuiz

The initial page poses the question “When is Bob Allen Dylan’s birthday?” and the user has to answer by selecting the month and date from the drop down menus and then click on the “Check” button. The picture of the person who’s birthday it is is also shown. If users don’t know the answer they can click on “I don’t remember”. Which question you are answering, as well as how many questions you have left, is indicated at the bottom of the page.

If a user answers the question correctly, they get this success screen:

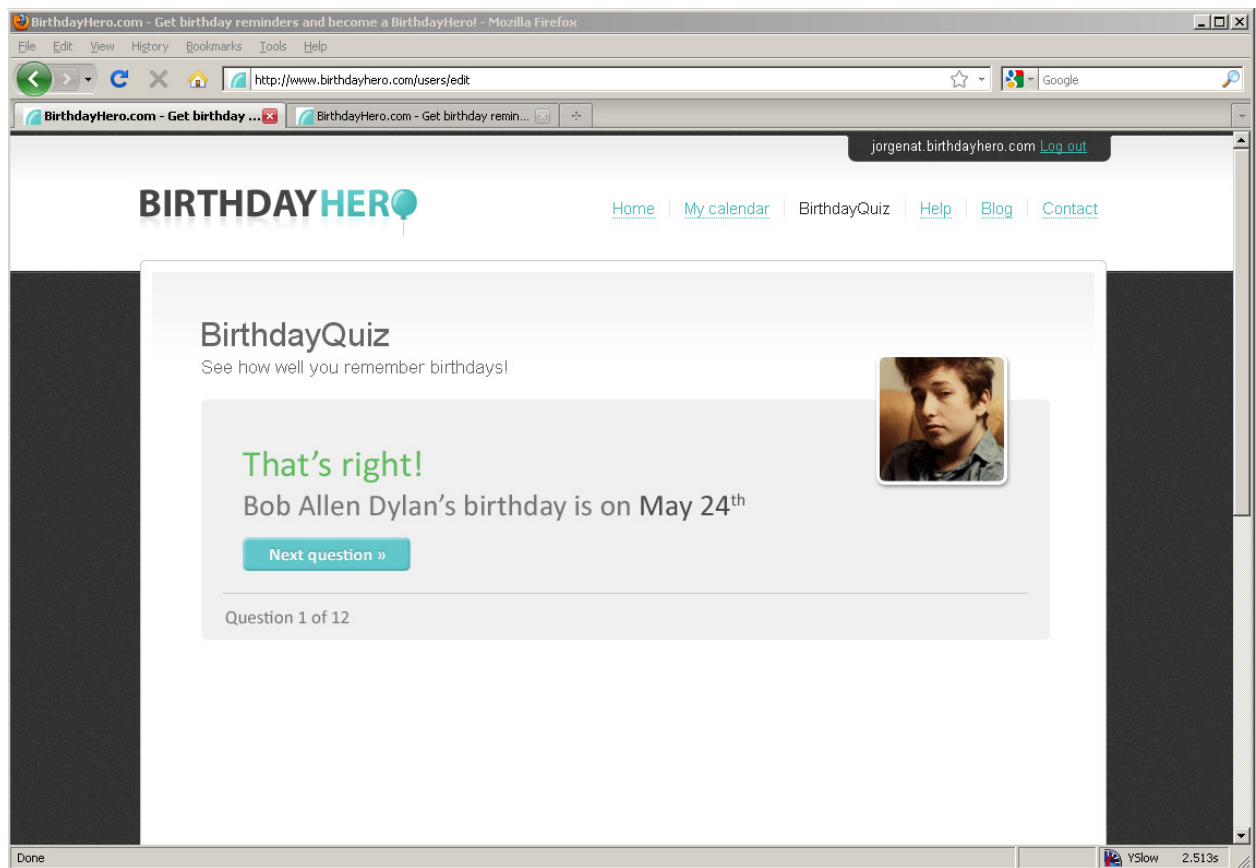


Figure 67 – A correct answer

A message is shown confirming that they got the date correct. The date, in this case May 24th, is emphasized, so that the user gets another chance to memorize it. The user can now click on “Next question” to go to the next quiz question.

If the user selects the wrong date or selects “I don’t remember”, this error message is shown:

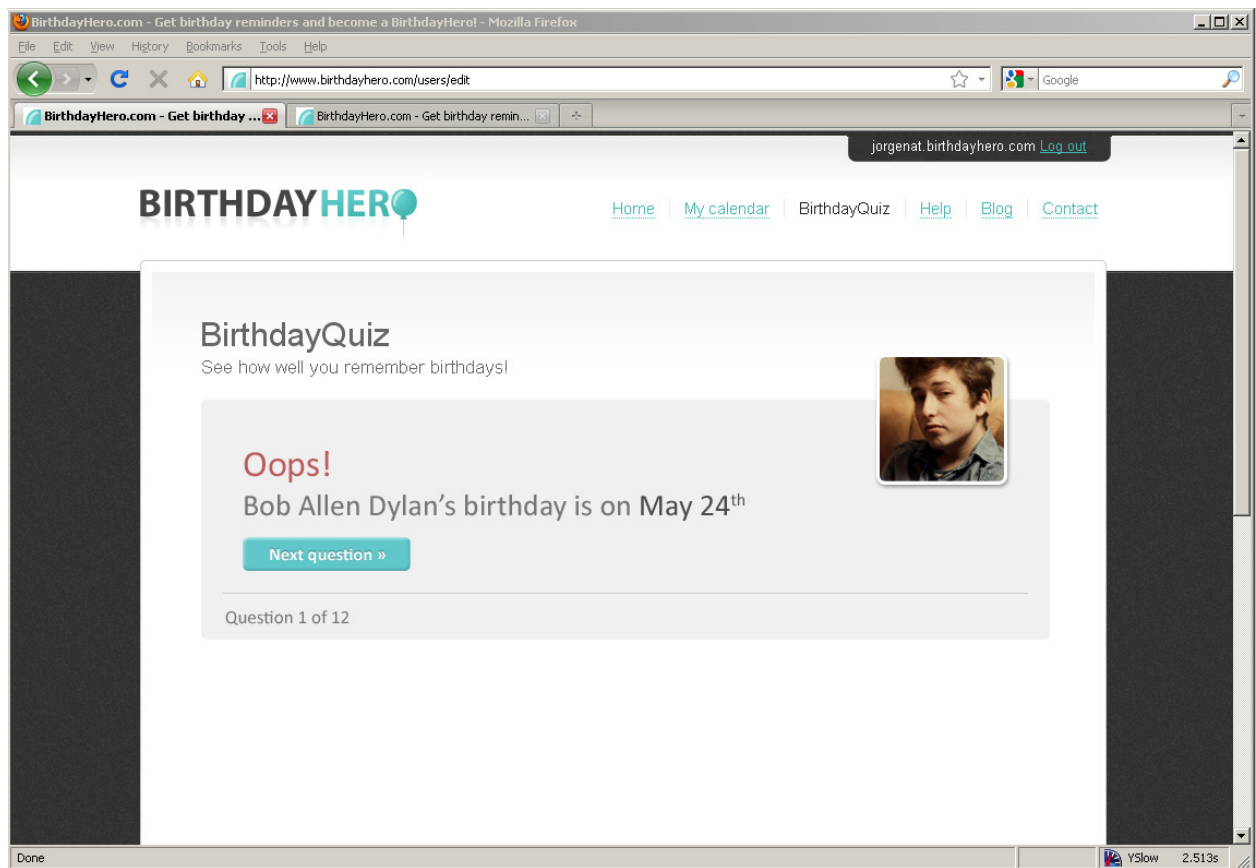


Figure 68 – An incorrect answer

This screen also shows the correct date, so that the user can try to remember it for next time.

After completing all of the question, the user would get to see how well they did. The page might say “You got 65% right! That’s better than last time!”. They might also get to see a list of the answers they got right and wrong, so that they can try to memorize them.

Mirroring the basic methodology of the Leitner System, answers that the user gets wrong should be more likely to show up in future quizzes. The user obviously knows the answers that are right well, so these should not be repeated as often. The number of questions in the quiz might therefore vary with each quiz. The number of questions in each should also be limited. If a user has added 200 birthdays, there is no point in giving them a 200-question quiz every two months. The quizzes should perhaps only be sent out once a month, or every two months to avoid users getting tired of taking quizzes. Testing various intervals between quizzes on different users might reveal what intervals work best.

When users receive an e-mail about a quiz they have waiting for them, what is to stop them from “cheating”, by looking at their calendar while they do the quiz? What can be done to prevent this is to show the quiz before the calendar is displayed, so that users either have to answer the questions or click on a “I give up” link to skip the quiz. By looking at your calendar, you lose the chance to take the quiz.

Getting correct answers in the quizzes could also tie in with the previously mentioned points system. The user could get 10 points for getting a correct answer and/or 100 points for simply completing a quiz. To encourage participation, there might be bonus points for completing a quiz within 72 hours of receiving it. There could be rankings among all of the users to see who the greatest BirthdayHero is. Points could be also be awarded for adding birthdays, anniversaries and events, or for reminding a friend about someone’s upcoming birthday. The rankings could be reset every year, or even more often, so that new users would have a better chance at competing with older users. These ideas are based on what is called game mechanics. Game mechanics are a collection of tools and systems that an interactive designer can use to make an experience more fun and compelling. (Kim, 2010)

Amy-Jo Kim (2010) argues that game mechanics can make a web design more engaging by incentivizing certain behaviors. One such mechanism is a points system. Once points can be earned, a leader-board can be implemented. This can facilitate competition between users and this in turn could transform the act of remembering events to more of a game than a chore. Users might even compete to become the biggest BirthdayHeroes in their respective countries.

Collecting is another game mechanic. We can collect stamps in real life, or virtual coins in games. We could also collect birthdays, making it a goal to keep track of as many as possible, encouraging more frequent use of the service. If you know you will earn points or a reward for collecting 20, 30, or 50 birthdays, it might motivate you to add them to your calendar.

It might sound counterintuitive to help users remember birthdays better when the basis of BirthdayHero is to be a reminder service. If users memorize every birthday they don’t really need reminders anymore. If they don’t need reminders, they might not need to be BirthdayHeroes. Hopefully, users will come to rely on the calendar they have used to

manage events. Having the reminders as a backup might give them another reason to remain users of the service.

By measuring how well users do on these quizzes over time, there should be enough data to measure if they have an effect on the user's memory recall performance. The quizzes can be seen as a combination of the *Leitner system* and Cepeda's theories of optimal gap and Retention Interval. By relearning the dates of important events at spaced intervals, the user might memorize the dates much better than if they were just added to the calendar and never looked at again. Instead of just picking an interval for how often to send out quizzes, we can use Cepeda's technique of optimizing the gap between quizzes based on Retention Interval.

7. Conclusion

This chapter summarizes the discussion of the four problem statements and presents ideas for future work.

7.1.1 Creating a usable web-based calendar and reminder service

Problem statement: *How can we create a usable web-based calendar and reminder system?*

To investigate this problem statement we have explored the problem space of remembering birthdays and events. We then looked at the various existing solutions for organizing and remembering events. To find out more about how people actually remember birthdays, interviews were conducted. From the interviews we learned that most people struggle with remembering all of their birthdays, and that nearly all would be interested in receiving reminders to help remember them. The interviews also showed that people manage birthdays in different ways, using many different tools - some electronic, some physical. It became clear that a usable system needed to build on the strengths of the existing tools.

The results from the interviews were used as input to the iterative process of designing a working prototype. Three iterations were conducted, wherein the second and third prototypes were tested on users. Usability tests found that the prototypes did satisfy some user needs, but that improvements need to be made and that the prototype needs to be developed further.

A great part of being “usable” is to be of use. To satisfy user needs, a usable calendar and reminder service needs to be easy to access, easy to use and effective in reminding users of events. To satisfy the first criteria, the BirthdayHero service has been designed to be accessed from web browsers. This means that it can be accessed from anywhere in the world that has internet access. Future work will explore how the service should be used from mobile devices. The usability tests have shown that with some improvements, the BirthdayHero service can become easy to use. Improvements in increasing the speed of using the interface will also likely improve the efficiency of use. Though the reminders have not been tested, all three usability test participants have later stated that they have received reminders both via e-mail and SMS. To improve the experience for first-time users, the service could help users import events from variety of sources, including birthdays of

contacts in social networks like Facebook. The service could also ask the user's e-mail contacts to add their birthdays directly to the user's calendar.

7.1.2 Appliance or general purpose?

Problem statement: *Should BirthdayHero be an appliance or a general purpose service?*

An appliance is a product or service that has a narrow set of functions. General purpose services, on the other hand, serve a range of different functions. The BirthdayHero service does not aim to replace all of the other products that people use to get organized and remember events. Because it cannot replace them entirely, it makes sense to not try to include every feature that these other products offer. Just because BirthdayHero offers a calendar to organize events, does not mean it needs to have the complexity of Microsoft Outlook to be useful.

I argue that the service should be seen as a backup service. Users can sign up for an account, input every birthday they need to remember, and then just receive reminders without much interaction with the system. Because the system aims to solve a single problem – to help users remember birthdays and events, it just needs to focus on that and the functions that can help users achieve that goal. This means that the service ought to be designed and marketed as an appliance service. Focusing on limiting functionality can have the added benefit of making the service less complex and much easier to use.

7.1.3 Internal and external information management

Problem statement: *What are the strengths and weaknesses of internal and external information management?*

The strength of internal information management is that it is internal, and therefore immediately accessible. We carry our memories with us. As long as we can recall them our memories are available to us. Therein also lies the weakness of internal information management. If we forget something, it is gone, and we have no way of recovering that data. External information management, which is what we do when we use calendars and other tools to organize information, can be seen as a type of distributed cognition called off-loading. We off-load the information that we don't want or need to keep memorized. BirthdayHero is a perfect example of off-loading. Because the service manages events for us, we don't need to keep every birthday memorized. Relying on external tools also has an

inherent weakness. The tools might break down, lose data, or be inaccessible to us. I therefore propose that users should be able to export their data for use in other ways. For instance, the user's calendar could be printed and be used as a traditional wall-mounted calendar. By combining both online and offline use, the service can become a more integrated part of the user's life.

It is unlikely that users will stop remembering every event they need to remember. As the interviews showed, the most difficult to remember birthdays were those of distant friends and relatives. These are events that most people do not have memorized. Therefore, by off-loading the reminding of these events to BirthdayHero, users could get reminders for the events that they are most likely to forget. If they choose to get reminders for events they would likely remember anyway, they can use the service as a backup tool.

In a sense, the service proposed in this thesis serves as an extension to our own memory. By using external information management through using the calendar and getting reminders, we can off-load those memories we find difficult to recall using internal information management.

7.1.4 Improving users' memory recall performance

Problem statement: Could the BirthdayHero service also improve the memory recall performance of its users?

The service could help improve the users' self image by improving how well users memorize birthdays and other events. Being a BirthdayHero is not just about getting reminders, but about being better at remembering events *without getting reminders*. To accomplish this, I propose a method for users to review the data they have stored in their calendars at intervals. Using the learning technique of *spaced repetition* could help users improve their memory recall performance. Through the use of a quiz which is e-mailed to users at spaced intervals, the users could challenge themselves in becoming better at remembering the birthdays they have added. This could be designed to be a pleasurable activity, by rewarding the user with points or other rewards. Doing the quiz forces the user to review and rehearse information. Rehearsing information has been found to affect how well a person will remember that information at a later date. To optimize the intervals at which to send the user a quiz, I propose utilizing the theories of Cepeda, who asserts that the optimal time for

review can be calculated based on knowing when a user needs to remember something. If you need to remember Helen's birthday on Dec. 8th, the system could calculate the optimal time for you to review that information to make sure that you will have a better chance of remembering it on her birthday.

7.2 Future work

7.2.1 Guidelines for calendar design and reminder services

During the prototyping process, it became evident that there many different ways of designing a web-based calendar and that no design could satisfy every need. Can the results of the design process become guidelines that can be used by others making similar services? How much of what has been learned can be generalized? How much applies only to BirthdayHero? Are there common guidelines that can be used by others making similar services? These are all questions that would be interesting to answer.

7.2.2 Social consequences of reminders

Is it "cheating" to receive reminders? Is keeping an online calendar and getting reminders from it any different from using an offline, physical calendar? Does it feel less personal to receive a birthday greeting when you know the only reason they remembered you is that they got a reminder? What happens if people know that you are a BirthdayHero and you still forget their birthday? If everyone around you knows that you're using a service to remember birthdays, the consequences of forgetting a birthday might be greater than they would otherwise have been. Answering these questions will require surveys of and interviews with real users, and will therefore come later in the lifespan of the service.

The design aspect of the thesis has focused primarily on the calendar interface. A longitudinal study of how users act when they receive reminders via e-mail and SMS could reveal how effective the reminders are in triggering behavior.

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