Team ORCA
Final Report

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Executive Summary

As a team of Masters students in the Human Computer Interaction program at Carnegie Mellon University, we combined our varied backgrounds in Design, Computer Science and Behavioral Science, in order to address the short-term needs and long-term evolution of scientific collaboration. We focused specifically on designing an online solution to facilitate the initiation of collaboration.

We began our investigation by turning to the literature in order to cultivate our understanding of both the culture of the academic researcher and the varied nature of scientific collaboration (Appendix B, p. i). We applied proven HCI methods to discover the following relevant themes:

- Compatible personalities, work styles, and research interests are all strong indicators of successful collaborations.
- Proximity improves the likelihood of a successful collaboration.
- Co-authorship alone is not enough to represent researchers' social networks.
- Current online networking systems require too much time/effort to update
- Researchers often use their friends as their primary resource in finding new collaborators.
- Well-connected people are important for making connections between researchers.
- Mentors are invaluable resources to junior researchers.

We found that existing online systems do not take these central themes into account in their designs. For this reason, when initiating collaboration, most researchers turn to their friends rather than to an online solution. Our solution takes into account the current culture of researchers and addresses these themes to better provide for researchers in finding and initiating a collaboration.

Based on our user testing and analyses, we narrowed our focus to support researchers in three central tasks:

- creation and maintenance of their information
- connecting with colleagues via a social networking feature
- locating a needed expertise according to relevant search criteria

Our system allows users to organize their information to support an expressed need to maintain updated information across multiple documents. The system is also fully searchable, and allows researchers to browse the information of their colleagues. In the design rationale section of this document (Section 3), we will describe our justification for creating a system that uses this three-fold approach.

Table of Contents

1. Introduction

1.1 Introduction

The goal of the Clinical and Translational Science Institute Online Research Community (ORC) project is to improve the process of scientific discovery within a large research community. We have been presented with an opportunity to improve the immediate work practice of the researcher. We aimed to design a system to help scientists discover and make connections with potential collaborators. Our focus has three components. First is the support of a work practice common across researchers: the creation and maintenance of documents such as curriculum vitae and biosketches. Second, is the support of researchers engaged in the process of locating expertise. Third, is incorporating social networks to provide researchers with the social knowledge they require to make a new connection. This document will address the problem space, research, fieldwork, ideation and finally the generation of a design and its rationale.

1.2 Methods

1.2.1 Exploratory Phase

In the exploratory phase of the project, our focus was on discovering as much as possible about the relevant problem domain. This goal was accomplished by delving into a large set of background research and conducting user studies in order to understand the current practices and problems in initiating research collaborations (Appendix B, p. i). We read 65 articles and books in areas such as computer mediated communication, social network, and computer supported cooperative work. We then generated an affinity diagram of all issues and questions involved in the initiation of collaboration. Next, we performed contextual inquiries on ten researchers at Carnegie Mellon and University of Pittsburgh from a range of disciplines and levels of seniority. We also studied several "Lunch with a Scientist" interview transcripts that were conducted prior to and during our project. These interviews gave us insights into general research practices in the medical field, particularly those concerning the initiation of collaboration. We then consolidated the information represented in our contextual inquiry models and five of the "Lunch with a Scientist" transcripts into one main flow and cultural model. From this initial research, we generated several main themes that we grouped into four areas: compatibility, communication, intermediation, representation (section 1.3).

1.2.2 Generative Phase

Based on the information we gathered from our consolidated models, we went on to brainstorm several design ideas to address the issues we found during our research. We selected the best from our initial set of ideas and presented them for concept validation to researchers at the University of Pittsburgh. Based on the feedback from these sessions, we discovered which ideas were best validated. We further developed these designs, first in wire frames and then in a high fidelity prototype. We performed think aloud evaluations to test the usability and features of our designs, and iterated on the designs based on feedback from these sessions. The user feedback and our design decisions are discussed further in section 3.

1.3 Current Practices

Why do researchers collaborate? In our research, we found a number of motivations for collaboration in the scientific community (Appendix B, p. i). Researchers often need a domain expert, equipment, patient participation, a certain methodology, or funding (Appendix B, p. i). Researchers may also be motivated by the prospect of co-authorship (Appendix B, p. i). Across all researchers we found that personal compatibility is extremely important to the success of a collaboration (Appendix D, p. i). As a result, in all types of collaborations, there is a common initiation period in which researchers assess the research interests, work style, and personality of potential collaborators (Appendix B, p. ii). This initial period requires that researchers have access to a wide selection of potential collaborators, information about these researchers and their recent activity within the domain of interest, and often times, an intermediary contact who can help make the connection.

How do researchers currently find a collaborator? We found that researchers turn to colleagues in their existing social network when they need to find someone in a new domain (Appendix D; Kraut et al, 1987; Contractor, 1998, 2002). Their colleagues are often able to introduce them to new contacts who may be appropriate for a collaboration. Researchers may also inadvertently start a collaboration when working on a new research project. When researchers are learning about a new field, they often turn to online publication databases, such as PubMed and Google Scholar, to learn about recent research. When they find an interesting article, they sometimes contact the author of a publication to ask questions, and sometimes collaboration will result. In this manner, these online publication databases provide indirect support for initiating collaboration.

In addition to these online databases, there are two online networking systems that directly support research collaboration: Community of Science (CoS) and the Faculty Research Interest Project (FRIP). These sites contain researcher profiles and information that allow users to search for other researchers based on expertise. However, many of the researchers we interviewed do not currently rely on these online networking systems because of a few key problems that we will describe in the following section.

2.1 Setting up the Problem Space

We extracted a number of themes from our research that served as a guide for the direction of our initial design. This section contains a brief overview of the conclusions we drew about the motivations, requirements, and decision making involved in initiating a collaboration. The themes are compatibility, communication, intermediation, and representation (Appendix B, p. ii).

2.1.1 Compatibility

Compatible personalities, work styles, and research interests are all strong indicators of successful collaborations. Based on our contextual inquiry (CI) data and literature review, we found that collaborators need to have similar work styles and personalities (Appendix D, p. i-ii). Although there are exceptions to this rule, the majority of researchers interviewed perceive compatibility of personality and work style as a prerequisite to collaboration. Therefore, more than a simple overlap of interests is needed to create a successful collaboration (Kraut et al, 1987). In our studies we found that researchers will not trust an impersonal recommendation or suggestion made by a system about compatibility. For this reason, when connecting researchers to new potential collaborators, researchers need to be made aware of connections they have through existing colleagues, whose recommendations they are more likely to trust.

2.1.2 Communication

Researchers need to be able to effectively search for collaborators in domains outside their own (Lutters et al, 2000; McDonald, 2001). However, researchers from one domain are unlikely to be aware of the terminology they need in order to find a specific area of expertise (McDonald, 2001). As mentioned in section 1.3, one way that researchers currently approach this problem is by asking colleagues and friends who they should

contact for help investigating a particular research problem (Appendix D, p. i-ii). Researchers should therefore have the ability to search and see connections through their friends so they will be more likely to know who to ask about a specific topic. When researchers are searching in an unfamiliar field, they are more likely to use unspecific search terms. They should therefore be able to search through not only publication keywords, but also people's research interests, grant submissions, and biographies to ensure the best search results from what could be more general search terms.

2.1.3 Intermediation

Researchers often use their existing connections as their primary resource in finding new potential collaborators. We found that junior researchers in particular had the most difficulty initiating collaboration when they had no contacts or connections to people within their desired field (Appendix D, p. i-ii). Researchers are more likely to contact a friend or colleague who they think will know an expert in the field they need rather than cold call an author of a relevant research paper (Flynn, 2005). The advantage of the mutual contact is a higher likelihood of compatibility between parties and a less intimidating method of contacting a new party (Appendix D, p i-ii). Websites such as Facebook and LinkedIn circumvent the issue of cold calling by integrating recommendation services and allowing users to see friends of friends. In this way, users' networks are actually expanded to include their friends' networks as well as their own. This tendency to use friends as intermediaries strongly suggests the power and influence of existing social networks, and indicates that a successful collaboration-networking site will need to include this information (Contractor, 1998; 2002).

2.1.4 Representation

Among the criteria researchers take into account when gauging a collaborator are the level of recent research activity, level of seniority, geographical proximity, area of expertise, and implicit social knowledge about that person (Appendix D, p. i-ii). Prior

tools have failed because they either did not represent this information or the information itself was obsolete (Appendix A, p. ii). Profiles that are missing publications, improperly tagged or out-of-date are not helpful to researchers looking for a collaborator (Appendix D, p. i-ii).

In order to provide researchers with relevant and recent information about colleagues, the latter must have an incentive to supply the information and keep it up to date. We found that although researchers are not motivated to update their online profiles, they do currently invest time updating their information in their biographical and professional documents, such as their curriculum vitae, biosketches, or faculty evaluation forms. These documents are required for them to obtain grant funding, to provide background information when invited to lecture, and for annual university evaluations to determine promotions and/or tenure. In our contextual inquiries, we found that a problem in the existing workflow is that researchers need to reformat and update the same information in multiple documents. We recognized this as an opportunity to draw researchers into using an online system; if we can streamline the process of synchronizing information in multiple documents, the system will provide incentive to maintain updated information, which can then be used in an online system.

Therefore, before our system can be used a tool to initiate collaboration, it needs to be adopted as a repository of biographical and research-related information by a wide range of researchers. Our system must make it easy for users to keep their information up to date, and in turn this information can be used to aid the process of finding the best collaborators for a research project.

2.1.5 Summary

Current online networking systems do not successfully support the process of finding a collaborator, because researchers' information is rarely kept up-to-date and researchers cannot search by the criteria they need to gauge another researcher. As a result, we found

that researchers too often rely on the limitations of their immediate social network to supply them with leads for potential collaborators (Appendix D, p. i).

In order to improve this process, researchers need an automated solution to keep their information up-to-date. Researchers should also be made more aware of resources at their disposal and be able to quickly and easily search through them based on relevant criteria. Moreover, the social connections they typically require to make contact with other researchers should be highly visible. In this process we found an opportunity for the application of a technological solution.

3. Digital Vita

Digital Vita Overview

DIGITAL | VITA is the summation of nine months of exploration and discovery. Digital Vita is an online system that alleviates the minutiae of maintaining and sharing a researcher's collection of biographical documents. A well-designed interface that addresses the immediate concerns of researchers creates the incentive necessary to populate a repository with the kind of recent and pertinent information researchers are looking for in a collaborator. By maintaining these updated documents, the Digital Vita system is able to provide users with relevant searches of up-to-date profiles. The system also incorporates researchers' social networks, displaying connections between colleagues and allowing researchers to easily request and share documents with current collaborators.

The Digital Vita system is made up of three main components:

- Information Formatting
- Finding an Expert
- Connecting Through Colleagues

We will walk through the features of each of these components and their design rationale in the following pages.

3.1 Information Formatting

One of our primary findings from our background research is that current online networking systems take too much time and effort to update, and the immediate gain is not apparent. For this reason, researchers often do not maintain up-to-date profiles (Lampe, et al. 2001; McDonald, 2001; Appendix G, p. xi). Researchers we interviewed did not see the value in these online systems because the information is out of date (Appendix G, p. xi). As profile and research information becomes further out of date, the existing systems lose value as a method of searching for information about other researchers (de Vries et al, 2004; Lampe, et al. 2001; McDonald, 2001). Therefore, one of our central goals is to provide clear benefits in our system so that our users see the value of updating and maintaining their information within the site.

We used our concept validation studies to determine which of our design ideas have the highest perceived needs for users. We found that providing users with a centralized data management system, which could output their information to the many formats that they require, would provide the greatest value (Appendix G, p. xi, x, xviii, xli). This functionality provides them with motivation to update their information by easing their current work process of reformatting their information for different documents, such as grant applications and faculty evaluation forms. We further ease this process by having the system automatically pull updates from existing online databases. This removes the burden of entering the information manually in multiple places.

My Information is a centralized data management system that stores a comprehensive set of a user's information. A separate section of the system, My Documents, exists to create and edit specific documents, such as curriculum vitae, biosketches, and other professional documents. The data in these documents is pulled from My Information. Within a specific document, users can add or remove any of the data they have stored in My Information. This model was designed to match researchers' current practice of maintaining a full curriculum vita (CV) that contains all of their information, from which

information is pulled when creating biosketches or shorter CVs (Appendix K, p. xix, xiii).

In the next pages we will describe the features involved in the Information Formatting component of our system.

3.1.1 Automatic Updates

Overall Goal:

To prevent the common problem of outdated information by attempting to automate as much of the updating process as possible.

Feature: Automatically Updating My Information from Existing Databases

Goal: To reduce users' time investment by automatically pulling updates from existing online databases.

Design & Rationale: Users' latest publications and grants are automatically pulled from online databases such as PubMed, CRISP, and OSIRIS (Figure 3.1 and 3.2). We received feedback from users during concept validation that these automatic updates would help them by saving time on the tedious task of copying over new publications from the PubMed site themselves. For example, one user stated "Automatic updates from Medline to my CV? That'd be great!" (Appendix G, p. xli)

Tradeoffs: The Digital Vita system searches databases for users' latest publications and grants, which based on our user research, are the sections users update most frequently in their current workflow (Appendix G). However, the remaining information, such as awards, lectures, professional/academic appointments, can not be as easily updated from existing online sources. Users will therefore have to enter these updates manually into the system. Though manual input is not ideal, we predict that users will not have to perform these manual updates often since this information will not change as often as publications and grants. With Digital Vita's centralized database of information, users only have to manually update their information one time and it propagates to all of their documents.

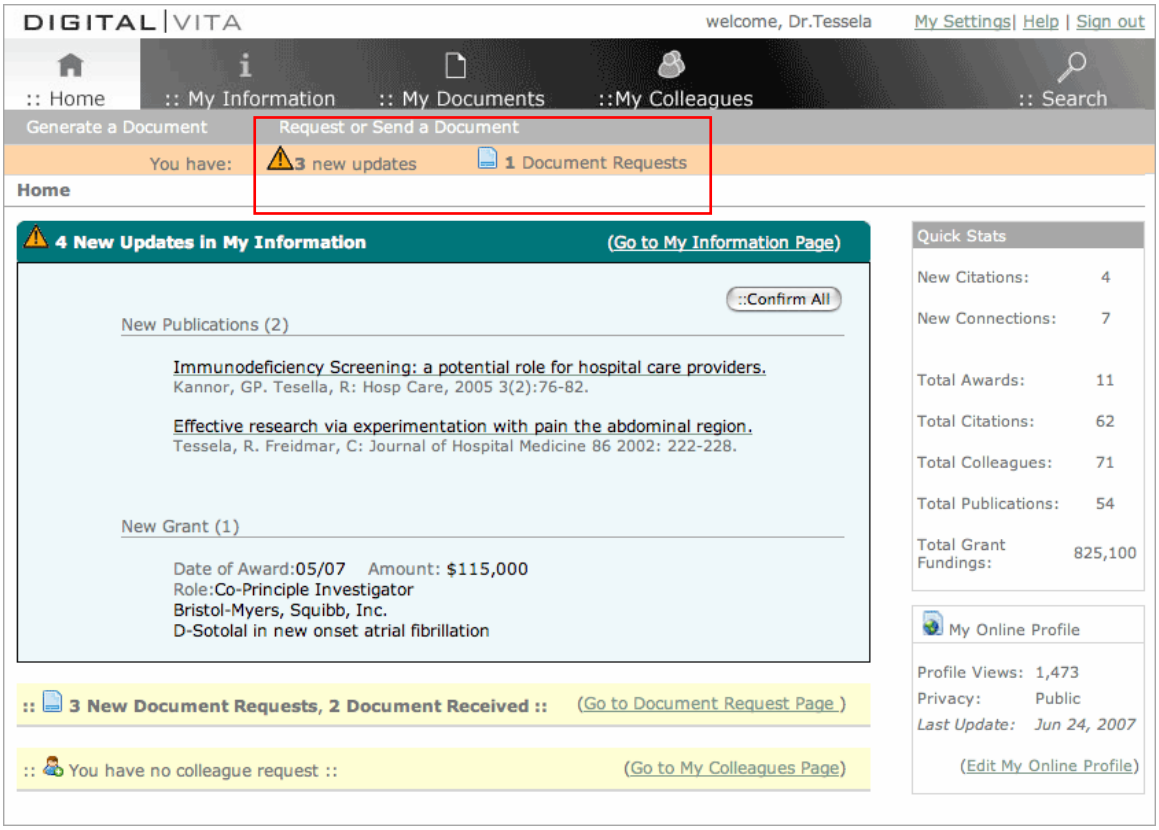


Figure 3.1 – Home page with updates notification bar highlighted.

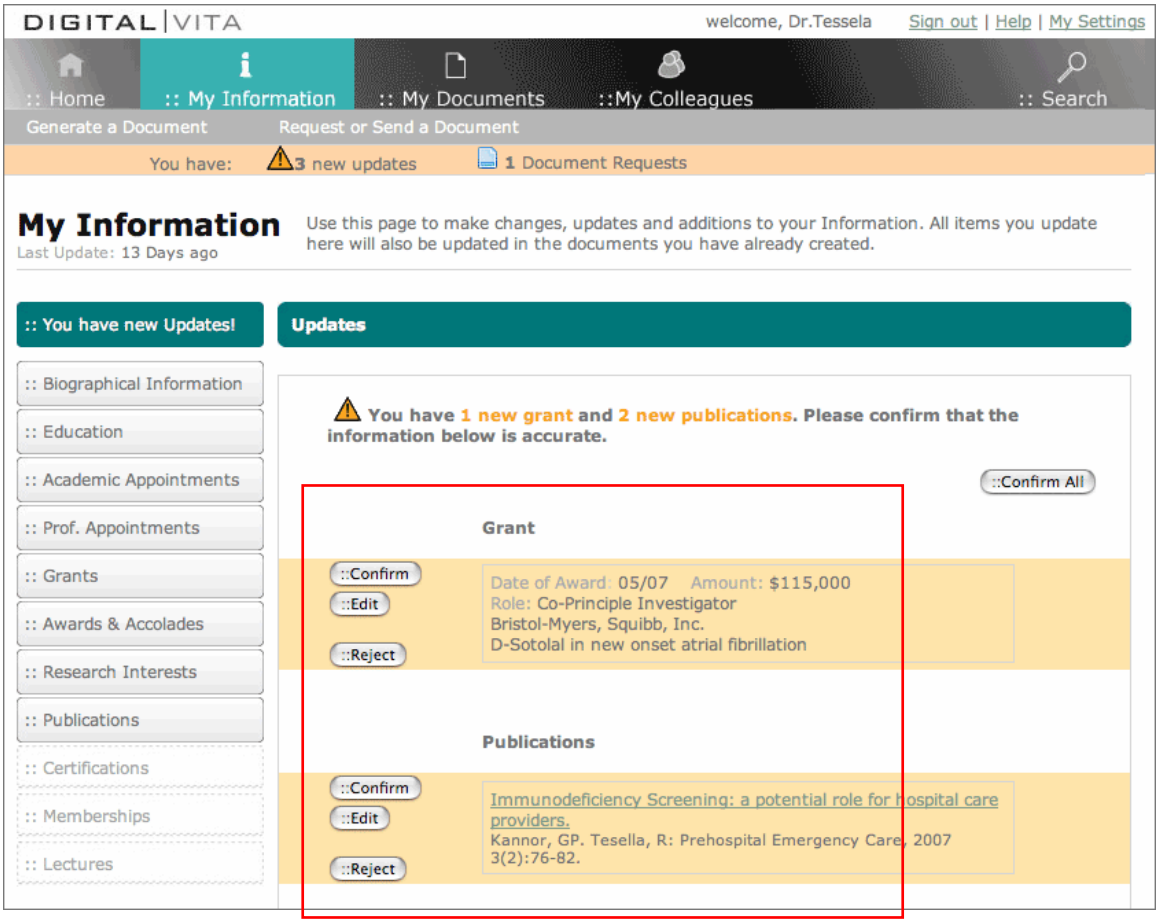


Figure 3.2 – My Information page demonstrating the automatic retrieval and notification of pertinent updates. Here a researcher can confirm additions and updates to their information.

Feature: Cross-Researcher Updates

Goal: To reduce users' time investment by automatically applying updates made by one user to other researchers it applies to.

Design & Rationale: We found there is a lag period between the time a publication is published and when it appears in PubMed; researchers sometimes add these publications to their CVs before they are added in PubMed. Although in this case the Digital Vita system cannot grab this information automatically from an online database, the system can ensure that the same information does not have to get entered by more than one person (Figure 3.3); Digital Vita will synchronize information between multiple researchers on the same project if one has entered data manually that applies to the others as well (Appendix G, p. xviii).

Tradeoffs: Users are required to confirm all automatic updates before they are added to the users' information database. This process creates extra overhead for users because they must confirm each of their updates. However, requiring confirmation is necessary because it ensures greater accuracy of user information. Since automated systems are sometimes incorrect, it is beneficial for users to confirm that the information that has been automatically gathered is their own. An alternative is to automatically add new updates without requiring confirmation, which would require less initial overhead. Users could later remove items they found to be incorrect. The drawback to this solution is that users may not take the initiative to inspect their full database of information for errors.

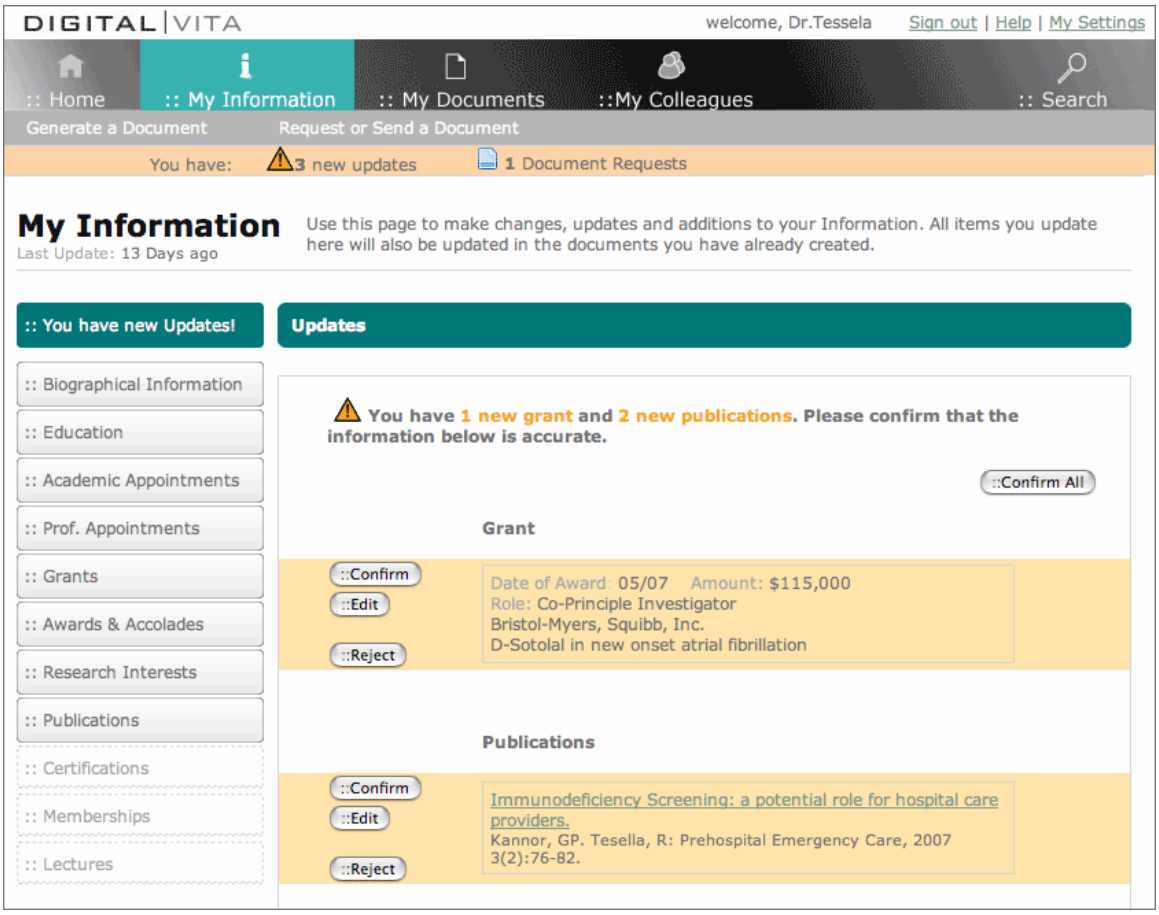


Figure 3.3 – My Information page demonstrating the synchronization of updates across researchers.

3.1.2 My Information

Overall Goal:

The My Information section of the site represents a user's complete database of information. In this section, users can make changes, additions, or confirm updates to their information.

Feature: A Central Repository

Goal: To create one central location where all a user's information is stored.

Design & Rationale: The My Information database is accessible when creating or editing a document so users can easily select from their full set of information (more details about document creation in section 3.2.4). Users can access this portion of the site via the global navigation bar at the top of every page in the Digital Vita system (Figure 3.4).

We want to instill in users that all of their information is confirmed and managed in My Information before it can be used in a specific document. To facilitate this, the system ensures that the user's information is kept updated in one central location. The majority of participants understood the model of having a centralized area for all their information (Appendix K, p. v, xviii, xxvii). As mentioned in the overview, this model correctly fit users' current practice of maintaining a complete CV with all of their information (Appendix K, p. xix, xiii).

Tradeoffs: Many users expressed confusion about the distinction between the My Information and My Documents sections, which we will address in section 3.2.4 (Figure 3.5). In the current system design, a common user task sequence will involve navigating to My Information to confirm new updates and then navigating to My Documents to create a specific document. In our earlier design iterations, the system provided users with the option to confirm their updates from both My Information and within a document. This allowed users to update their information in the context of updating a document. The new information would apply in My Information and in other documents they created.

The earlier design was inconsistent and unclear to users because updates in a document propagated back to My Information but removing an item from a document did not remove it from My Information. We found that adding or removing items in a document is a common task most researchers perform while editing (Appendix G, Appendix K). As

a result, the design needs to allow users to add or remove items without affecting their central data. Although this previous method provided a more convenient method to update information, we opted for a more straightforward mental model so that users were clear about where their changes would apply.

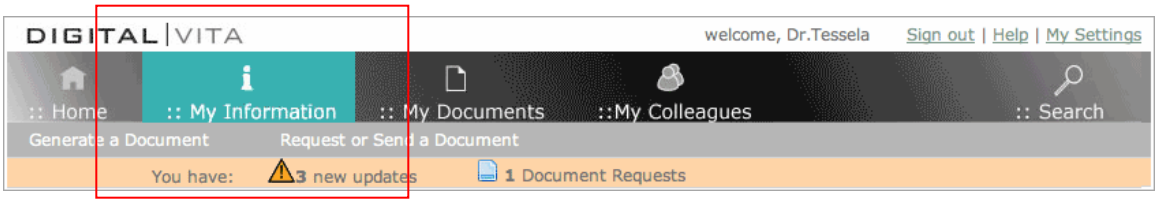


Figure 3.4 – My Information located prominently in the header.

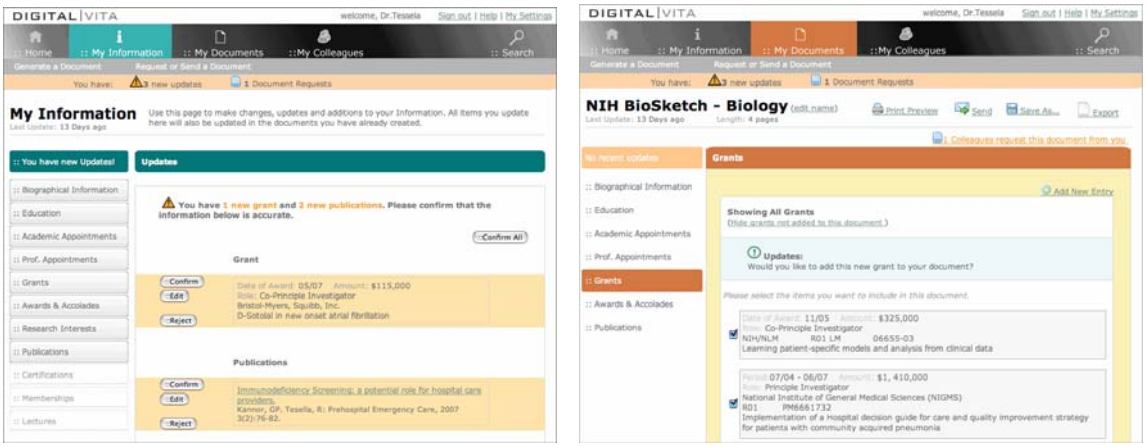


Figure 3.5 – Comparison of My Information to My Documents

Feature: The Updates Pane

Goal: To immediately draw the user's attention to updates that must be confirmed when they enter My Information.

Design & Rationale: When users first navigate to the My Information page, they are shown an Updates pane. The Updates pane displays any new updates that the system has automatically pulled (Figure 3.6). By guiding them to promptly deal with their updates, Digital Vita ensures their new information can be accessible in any documents they later create or edit. We designed a separate pane for the updates so that users can quickly look through and confirm their new information in one centralized page, rather than having to navigate between sections to confirm different pieces of data. Users can confirm all their updates by clicking the Confirm All button at the top of the Updates pane. Alternatively, they can confirm, edit, or reject each update one by one. In our high-fidelity prototype testing we found that users needed more direction on this page. We addressed this issue by adding a prominent direction label at the top of this page that prompts to confirm their updated information below (Appendix K, p. iv).

Figure 3.6 – The Updates Pane of My Information.

Feature: The Navigation Pane

Goal: To let the user quickly navigate the large amount of data they have stored.

Design & Rationale: Within My Information, a user's information is divided into meaningful sections that correspond to headings that would exist in a curriculum vita. (Figure 3.7) A user can jump to any section of their information by using the navigation pane on the left of the page.

Within each section, the user can see what information is already there, and either add new information by clicking Add New Entry in the upper right (Figure 3.8), or edit existing entries by clicking on the edit button associated with each piece of information.

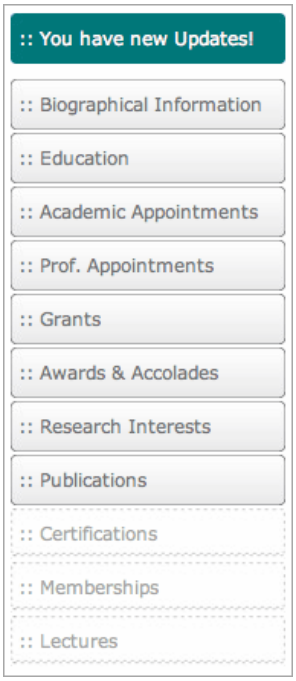


Figure 3.7 – Different sections of the My Information Page.

Feature: Editing Data in My Information

Goal: To provide a user with full control over their information, as intuitively as possible.

Design & Rationale: When a user selects to edit an entry, a field-based data entry section is shown (Figure 3.8). By storing information in discrete fields, the system is able to parse and format new entries. Field-based data entry allows the system to know what kind of data to expect and to perform basic error-checking to prevent users from inputting incorrect data (for example, inputting letters in a date field).

My Information is a permanent record of a user's data, therefore information cannot be easily deleted once added to the system. If a user wishes to delete a specific selection, they must enter edit mode, and erase the text of the information. Though not ideal, this discourages users from deleting older information or entries simply because they are not recent. Since storing it in My Information does not automatically impact any of the created documents, there is no negative impact of storing old information that is no longer being used in current documents. If they ever need to add old information to a document, they will have it accessible without having to reenter it by hand.

Tradeoffs: Field-based entries allow for more error-checking, and allow the system to better parse the data for formatting. However, the drawback is that users will have to input information field by field. As mentioned in the previous section, we believe that users will be manually updating and adding information infrequently, and mainly only for sections other than their publications and grants.

Another tradeoff is the difficulty of deleting information from My Information. The design does not currently support deleting information as a primary task in the interface. The drawback to this is that if users really want to remove information that is and never will be relevant, they have to delete the information by clearing the editable fields. This is not an intuitive way to delete an information entry, so users may not learn that it is possible for them to remove. We designed this to be purposely difficult to ensure that My Information stores a complete set of user data.

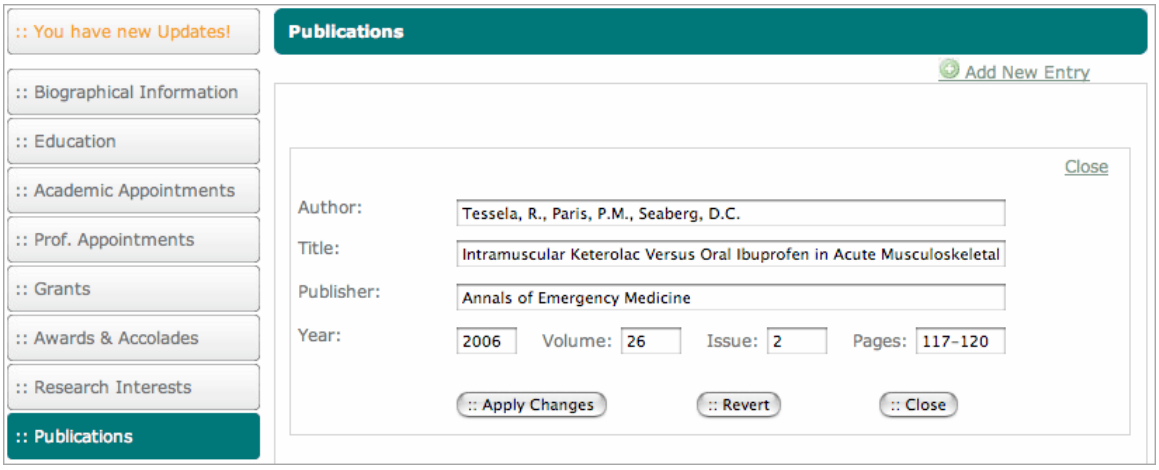


Figure 3.8 – Field-based data entry for the Publications Section of My Information.

3.1.3 Document Formats

Overall Goal:

The purpose of this area of the site is to make the most commonly used document formats available to the user for editing and sharing. Support is given for multiple formats of a given document type in order that users can maintain documents for multiple projects.

Feature: The My Documents Page Layout

Goal: To match a user's existing mental model of documentation and provide useful ways to organize their information.

Design & Rationale: During concept validation, we found that users create a variety of documents ranging from curriculum vitae to biosketches to faculty evaluation forms (Appendix G, p. x; Appendix K, p. v, xxvi). In order to match users' existing mental model of accessing multiple documents, we provide them with a list organized according to type (Figure 3.9).

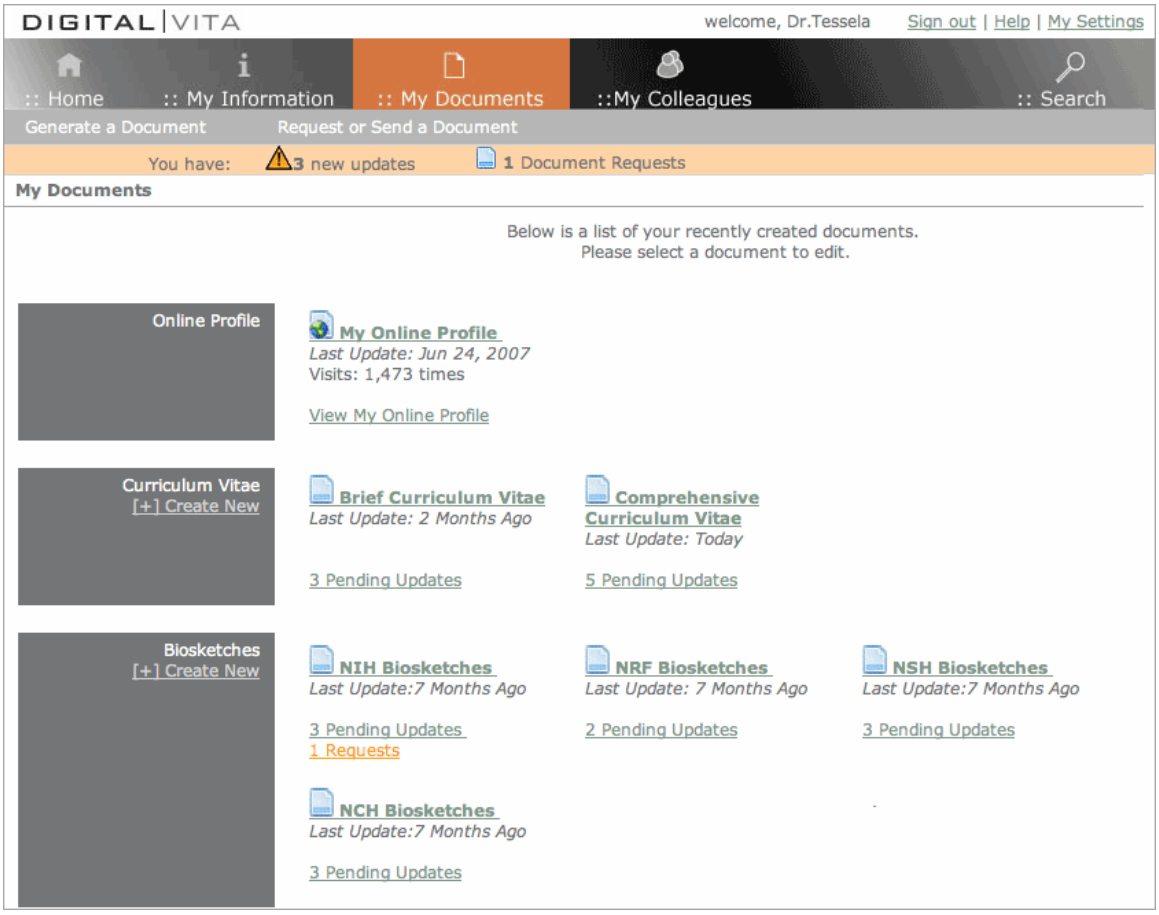


Figure 3.9 – Example of some available documents in the My Documents section.

Feature: Visibility of Pending Updates

Goal: To warn users when a document may be out of date and provide them an easy way to update it.

Design & Rationale: According to our concept validations, the common practice for users creating a document is to open the most recent version of that document type and add the necessary updates. For example, one user stated his current practice is to "open the most recent [document] and copy and paste from PubMed, then save it as a new version." (Appendix J, p. iii)

To support this practice, the number of updates and the documents they apply to are highly visible (Figure 3.10). This encourages the practice of updating a document before sending it out.

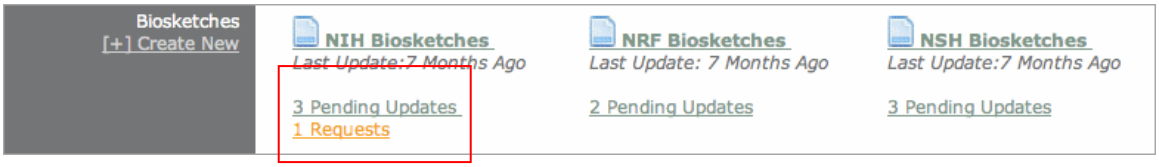


Figure 3.10 – Document types and the feedback given to indicate updates are available.

Feature: New Document Creation

Goal: To give users the ability to create a new document.

Design & Rationale: The option to create a new document is located directly under the heading title (Figure 3.11). This allows users to add a document type that has not yet been created, and clearly indicates where it will be saved.

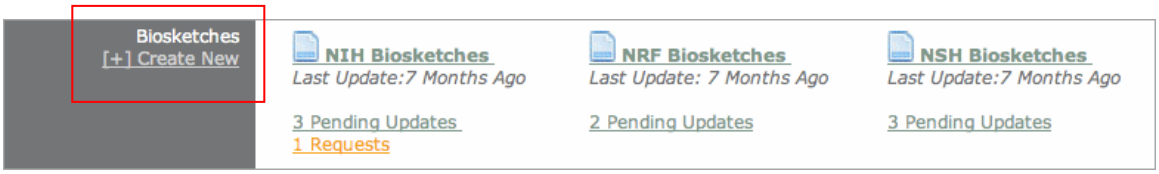


Figure 3.11 – Highlight demonstrating how a user creates a new biosketch.

Feature: Version Selection

Goal: Allow users to store multiple versions of the same document, supporting their current workflow.

Design & Rationale: When selecting a previously created document, a dialog box appears prompting the user to choose a version. Previous versions are ordered according to the recency of the last edit. Also, the document is labeled according to terminology researchers are most likely to understand, in the form "Organization – Document Type – Name" (Appendix K; Appendix K, p. xxvii). We designed Digital Vita to allow users to choose which document version to open, rather than automatically opening the most recent version of a document type (Figure 3.12). This decision was based on feedback from user studies that researchers often have multiple versions of the same document tailored for different projects (Appendix J, p. ix). This design also provides error recovery for users so that they have an online backup of their different versions.

Tradeoffs: Digital Vita organizes a user's documents by type and then prompts the user with a popup to choose a specific version. Alternatively, the system could automatically open the most recent version, which would remove one step for the user. Many of our users stated that they kept old versions of their documents on their computers, so the Digital Vita system does not need to serve as a document archive. Removing the functionality of storing different versions of a document type could simplify this selection page and provide a more direct way of opening a specific document type. However, the downside would be that users, particularly those involved in multidisciplinary research, would not be able to refer to different versions of the same document type through this system.

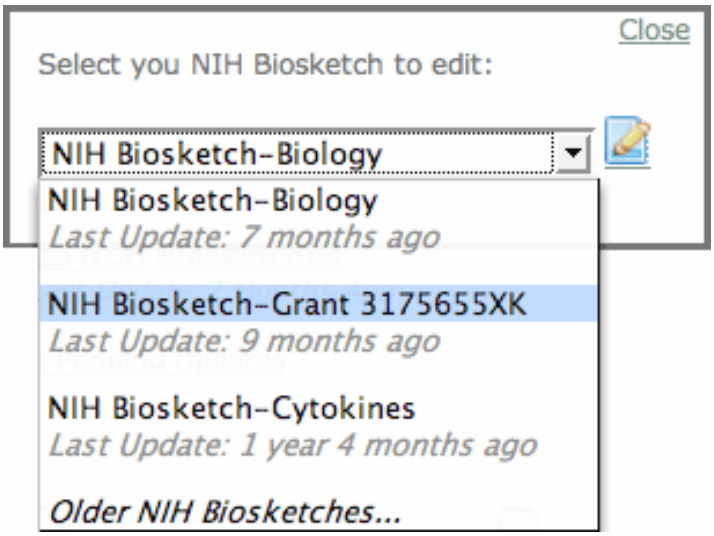


Figure 3.12 – Dialog that appears after clicking on the name of the document.

3.1.4 Editing a Document

Overall Goal:

The Edit Mode enables users to select which items from their database of information should go into their documents. They can then output the selected information into a number of templates, such as the NIH biosketch or send the document to a colleague.

Feature: The Structure of Edit Mode

Goal: To make My Information and My Documents Edit Mode similar in layout, but visibly different, so users will understand how to use them both, but recognize they are not the same.

Design & Rationale: As mentioned in prior sections, the Digital Vita system allows users to quickly add items from My Information to a specific document. We designed the edit mode of a document to have a consistent style with My Information, so that users would understand the connection between the two sections of the system. We also made certain visual distinctions so that users would understand that My Information contains a superset of the data in each specific document (Figure 3.13). We will describe these style choices below as we walk through the components involved in editing a document.

We found in our concept validations that users expect the document to be immediately editable, rather than first entering a view mode of the document. Therefore, we changed our interaction to support this mental model (Appendix J, p. ix). When a document is selected, it is opened in edit mode.

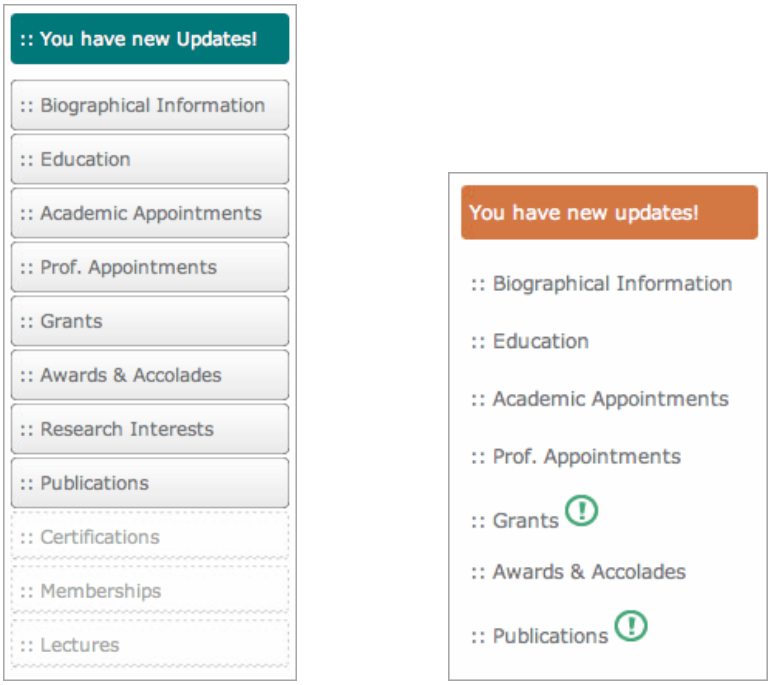


Figure 3.13 – Comparing My Information (left) with My Documents (right).

Feature: The Flow of Document Editing

Goal: To match a user's existing workflow by first providing them with updates when they begin editing a document.

Design & Rationale: According to our think aloud and concept validation studies, users are interested in first updating a previously-created document, then reviewing the current content, and finally saving it or sending it to a colleague (Appendix K, p. xxv). In order to best fit our users' work practices, when a user enters the document-editing mode, the updates section is shown (Figure 3.14). The updates shown are items that have been confirmed in My Information since the last time the document was edited. In this section, the user can quickly address any new updates to the document. The practice of guiding users to the updates section is consistent with the behavior on the My Information page.

Users want to tailor their content to best fit the application of a document. For example, users stated they include only the most relevant and important publications when applying for a specific grant proposal (Appendix J, p. iii, v, vi).

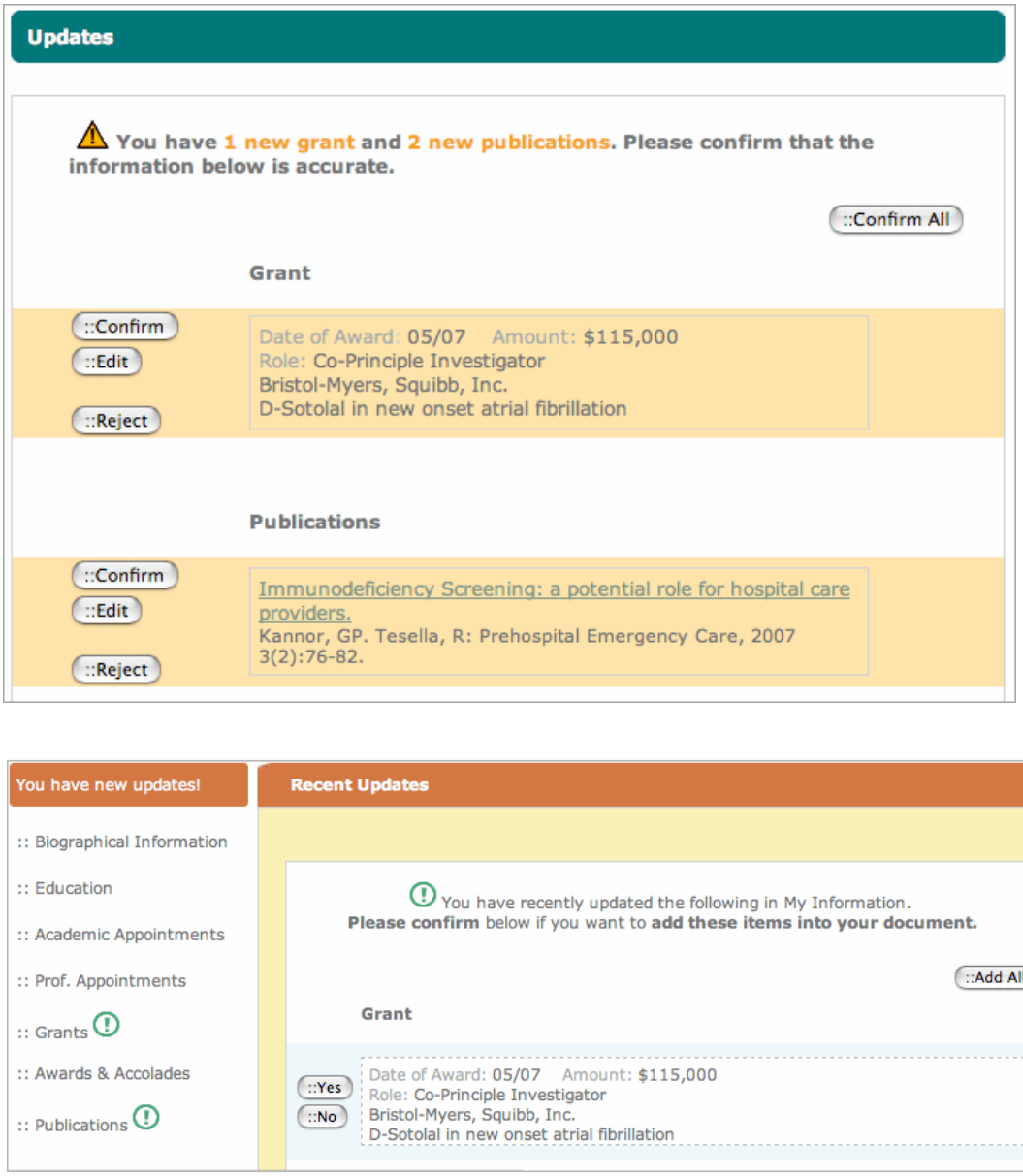


Figure 3.14 – Updates confirmed in My Information (top) and added to a document in My Documents (bottom)

Feature: Visual Distinctions between My Information and My Documents

Goal: To make My Information and My Documents similar in layout, but visibly different, so users will understand how to use them both, but recognize they are not the same.

Design & Rationale: Users are able to easily access each section of the paper using the menu on the left-hand side of the page (Figure 3.13). The menu layout on this page is consistent with that on the My Information page. However the visual style of the menu and the overall color scheme on this page is different to indicate to users that this is a different section of the site (Figure 3.5).

Tradeoffs: We aimed for a consistent design across the My Information and My Documents pages in order to reinforce the connection between these two sections. To differentiate them, we created visual distinctions, such as color, menu button style, document-related tasks, titles, and icons. These features help make it apparent to users that while the two pages are related, they are not the same sections of the site. However, user feedback from our high fidelity prototype indicated that the two layouts were still too similar and that some users did not initially understand the differences between sections (Appendix K). To address this issue, we could have made the My Information page drastically different, but we were concerned that users would not understand the association between My Information and My Documents.

Feature: Indication of Pending Updates

Goal: To clearly indicate what parts of the document have new updates.

Design & Rationale: Sections that contain updates are clearly marked with a green exclamation mark icon (Figure 3.15). The icon is an exclamation to indicate there is something of notice, and green to indicate it is not an error or warning (as yellow or red, more usual exclamation mark colors, might imply). This icon serves in contrast to the black exclamation point in the yellow triangle that appears on the My Information page to indicate greater urgency.

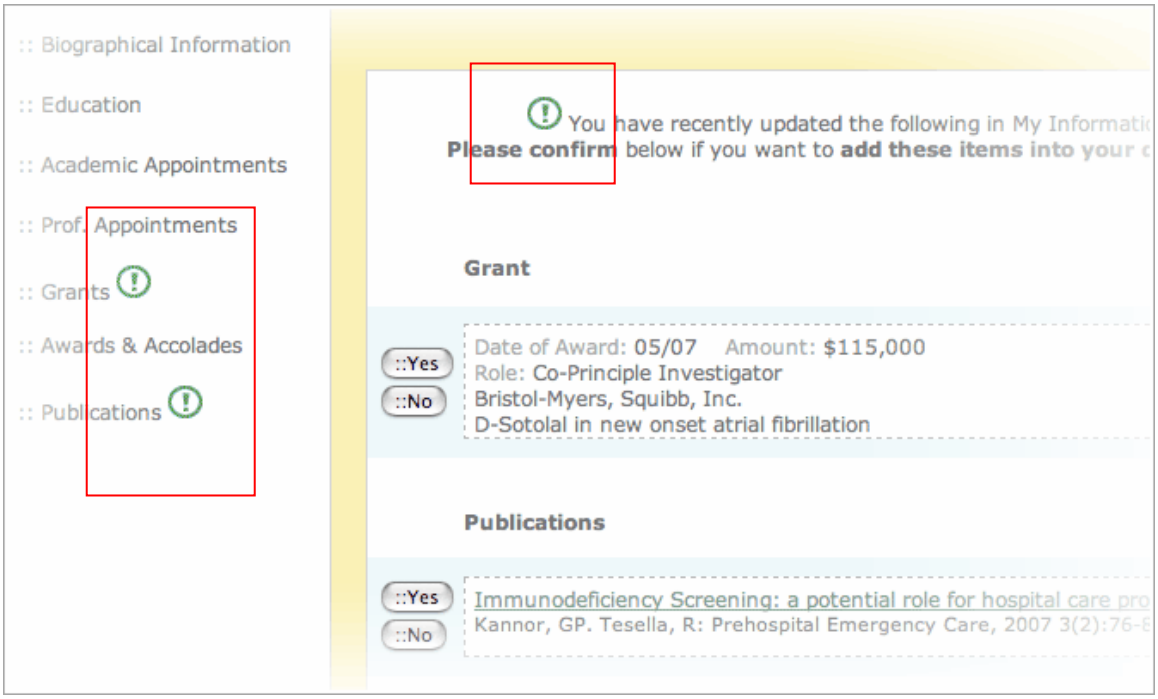


Figure 3.15 – Icon used to indicated updates and where they apply.

Feature: Adding and Removing Data from a Document

Goal: To allow the user to quickly include any piece of data from the large bank available in My Information, without overwhelming the user with the available choices.

Design & Rationale: Within a specific section, users can see what information is currently in the document (Figure 3.16A), what information has been recently updated (Figure 3.17), and what information is not in the document (Figure 3.16B). By a quick check/uncheck method, the user can choose which pieces of information to include. If the piece of information they wish to add is not currently a part of their database, they can simply click "Add New Entry" in the upper right. A field-based data entry section will appear, maintaining consistency across this section and the My Information section that also supports field-based input as previously described in section 3.2.2.

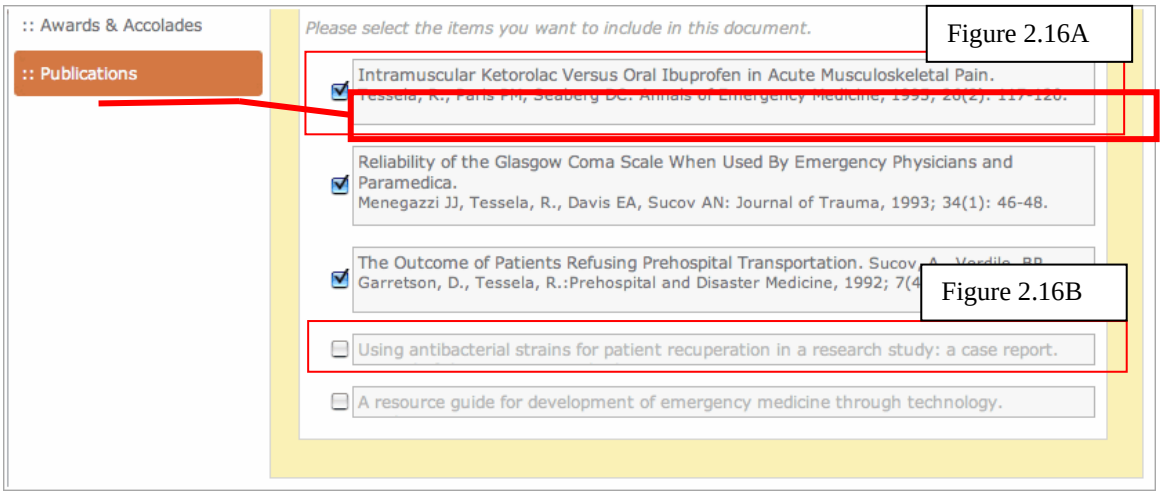


Figure 3.16 – Checking and unchecking items to include or remove from the document.

Feature: Applying Changes to My Information

Goal: To allow users to propagate changes from a single document back to their My Information section, supporting their current walkthrough.

Design & Rationale: In our current design, we make it obvious to users whether information is propagating back to My Information. When editing an entry in a document, by default there is a checked option to “Apply changes to My Information”. This label explicitly informs the user if their changes will affect their centralized database.

Figure 3.17 – Adding a new Publication to the Document.

Feature: The Edit Document Toolbar

Goal: To allow users to quickly perform the basic document actions, which they are familiar with from their current workflow, on a document.

Design & Rationale: The document length is continuously updated, which tells users whether they are under the page limit for any given document. In the upper right-hand corner is a document toolbar allowing users to preview, send, save as, or export (Figure 3.18). Also, if the user has received a document request for this particular document type, a notification appears directly below the document toolbar. The user can click and quickly send the updated document to the requestor. The document toolbar, page length, and document request notifications also serve to distinguish the edit mode from the My Information page.

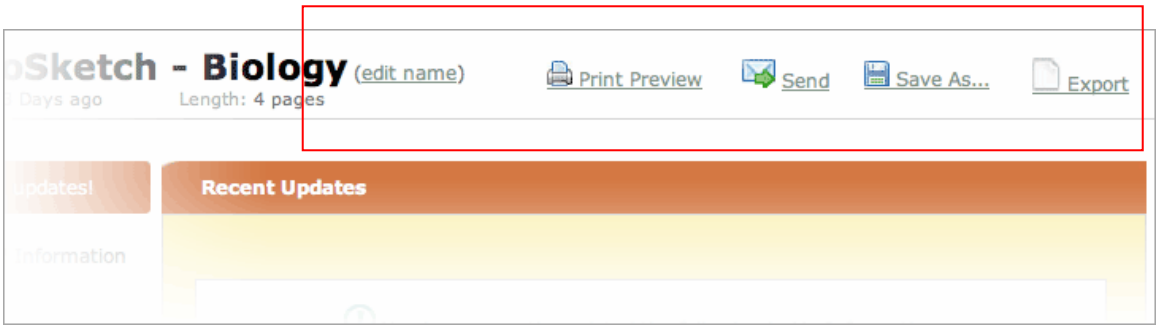


Figure 3.18 – The toolbar section of a document where users can Edit the name of the document in addition to previewing, sending, saving and exporting it.

3.1.5 Notification of Updates

Overall Goal:

To encourage users to update their information by making notifications of updates prominent and easy to confirm. In addition, we wish to reinforce the mental model of the system that information gets updated in the My Information section and only subsequently can be added to documents.

Feature: The Home Page Updates Pane

Goal: To immediately draw the user's attention to updates that must be confirmed to ensure their information is kept up to date.

Design & Rationale: Each time a user logs in, they are taken to the home page where they immediately see any new updates the system has pulled (Figure 3.19). From the home page users can quickly confirm these updates, or enter My Information to edit the information. We guide the user to the My Information page to modify updates to reinforce a correct mental model of the system. The mental model that we hope to instill is that all information is first stored and maintained in the My Information section of the site. From there, it is filtered and reformatted to fit into a variety of the document formats featured in the My Documents section of the site.

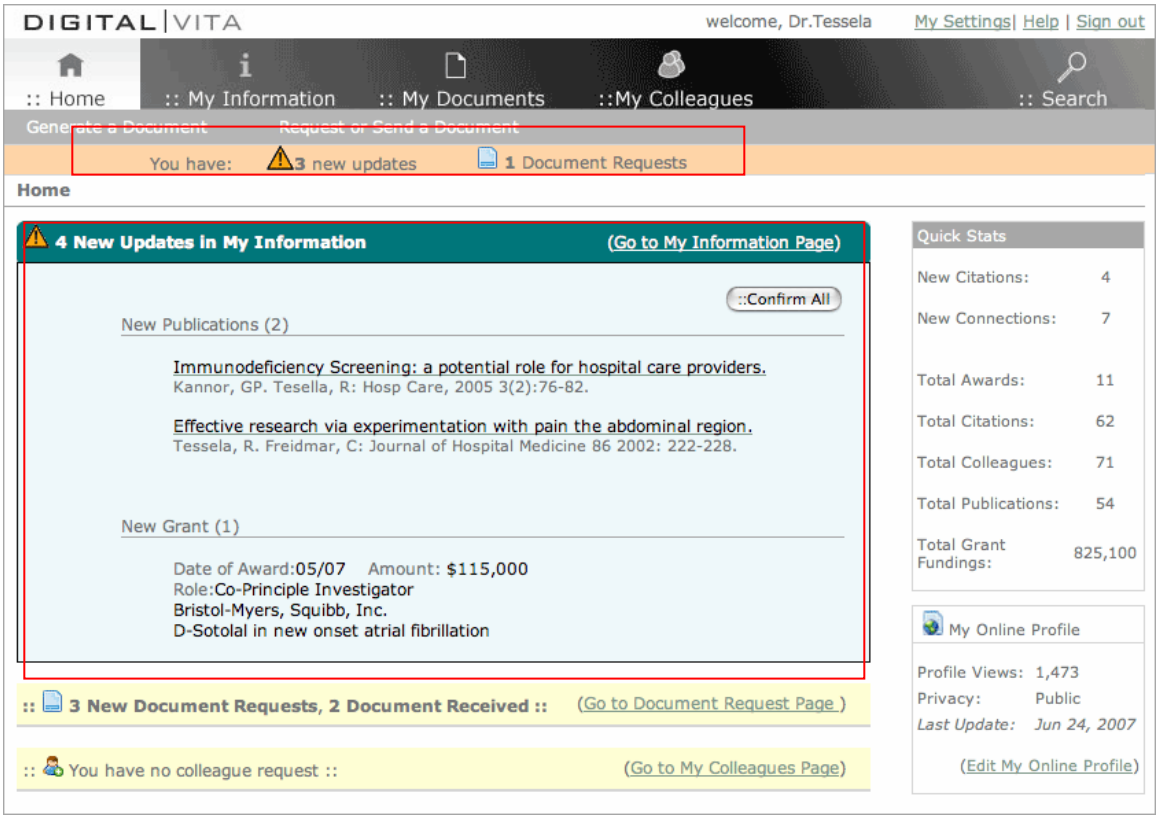


Figure 3.19 – Updates on the home Page.

Feature: The Updates Bar

Goal: To constantly remind users when they have outstanding updates and requests, since the upkeep of these are very important for the success of the system.

Design & Rationale: When new updates appear, a yellow bar will slide down underneath the global navigation (Figure 3.19). This bar indicates the number of updates that are waiting to be confirmed along with notifications about document requests and colleague requests. When the user clicks directly on the updates section of the bar they are taken to the My Information page. By displaying a persistent and prominent reminder at the top, we hope to encourage users to maintain a fully updated profile and respond to document and colleague requests in a timely manner. The main goal of our system is to provide a central database of up-to-date researcher information which feeds directly into an online networking system. Therefore, we ensure that updates are visible at all times so that users can take the appropriate action.

Tradeoffs: One of the main goals of our system is to keep information up-to-date. Consequently, we considered preventing users from navigating to other parts of the site until they managed their updates. If users manage them immediately after logging on to the site, the system will always have updated information. However, though having updates is useful, forcing users down a path when they have another goal in mind might frustrate them. As one of our project stakeholders stated “I would log on when I have to do something quickly, and the system would not let me do it. When it forces me to do something I need to do but I don't want to - this is when the system is most useful and most frustrating.” For this reason, we persistently notify the user about updates, but do not force them to address them. This may mean that user information will not be kept up to date if users choose to ignore the notifications.

4. Finding An Expert

3.2 Finding an Expert

In the background phase, we learned that researchers are often motivated to search for a collaborator when they require a specific expertise, technique, or resource (Appendix D, p. i-ii). In order to find an appropriate researcher that fits the user's needs, the user must know about a researcher's domain of expertise and their publications to understand their background, their current research focus, and their techniques (Appendix D, p. i-ii). While previous systems supported searching by research interests or by published works, they did not support searching through both in the same system. By integrating both publications and research interests into Digital Vita, individuals can more easily find the expertise they need.

Users not only identify potential collaborators on the basis of expertise, but also gauge their suitability on an interpersonal level. Often, users turn to trusted friends and colleagues to provide recommendations about a potential collaborator's work style and personality (Kraut, et. al, 1987). Digital Vita supports the decision-making process by providing feedback about a user's professional network and their social connection to a potential collaborator.

In the next pages we will describe the features involved in the Finding an Expert component of our system.

3.2.1 Search in Global Navigation

Overall Goal:

To make the search function prominent and highly visible as this is one of the most important features of the site.

Feature: Easily Accessible Search Function

Goal: To allow researchers an easy method to find other researchers

Design & Rationale:

Researchers often use both formal and informal means of acquiring candidates for collaboration. From the literature and our contextual inquiries we learned that researchers often ask colleagues for references and use tools such as Google and PubMed to generate leads (Kraut et al. 1987; Contractor, 1998; 2002; Appendix G, p. vi) .

Search is located in the global header because this allows it to remain a consistent and highly visible element of the interface (Figure 3.20). In addition, its location conforms to the precedent set by many websites which place search prominently near the top of the page. In this way, users are afforded a common interaction in a consistent and intuitive location.

Tradeoffs:

Though the location of search is both consistent within the system and conventional according to industry standards, the more common practice is to have a search input field in the header. In Digital Vita, the search element in the header is a link to a separate search page (Figure 3.21). Because of the complexity of search criteria and the finite amount of space, we elected not to separate a search text field and button from the context and additional options that allow the user to modify a search.

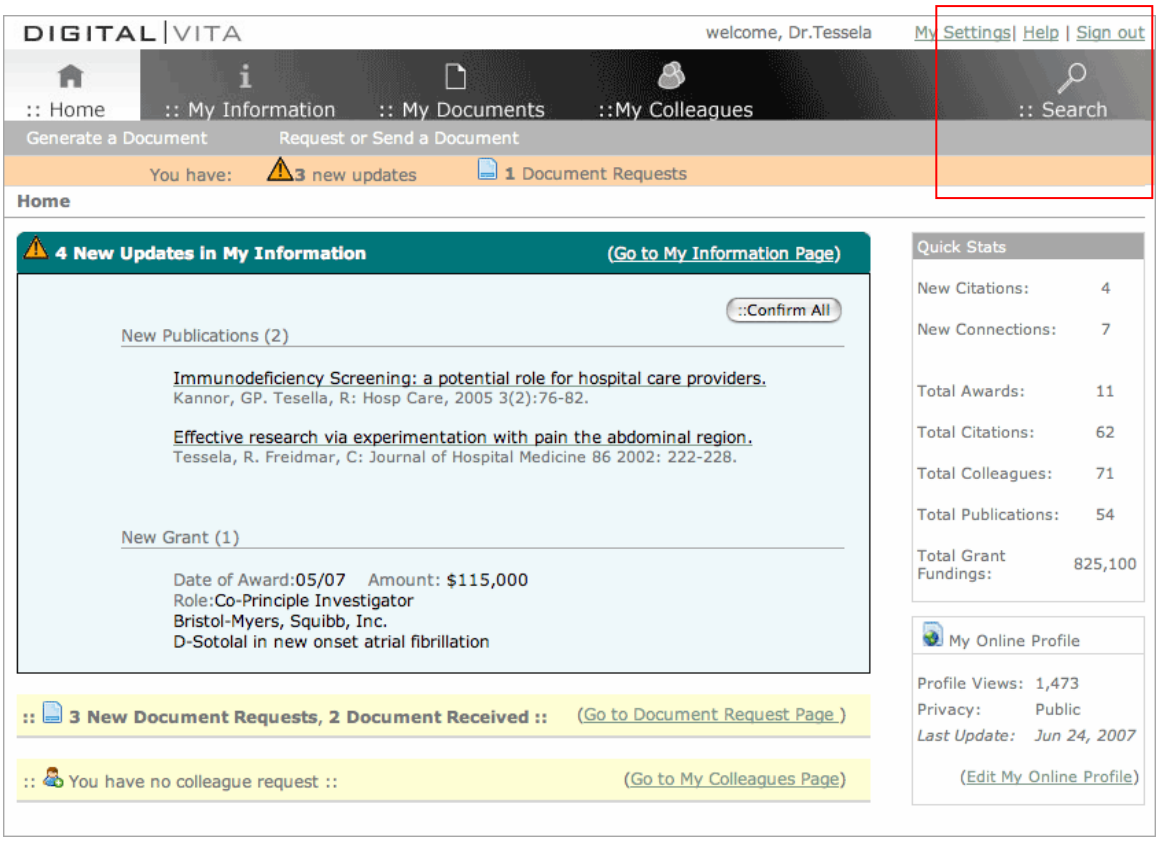


Figure 3.20 – Search located prominently in the Header.

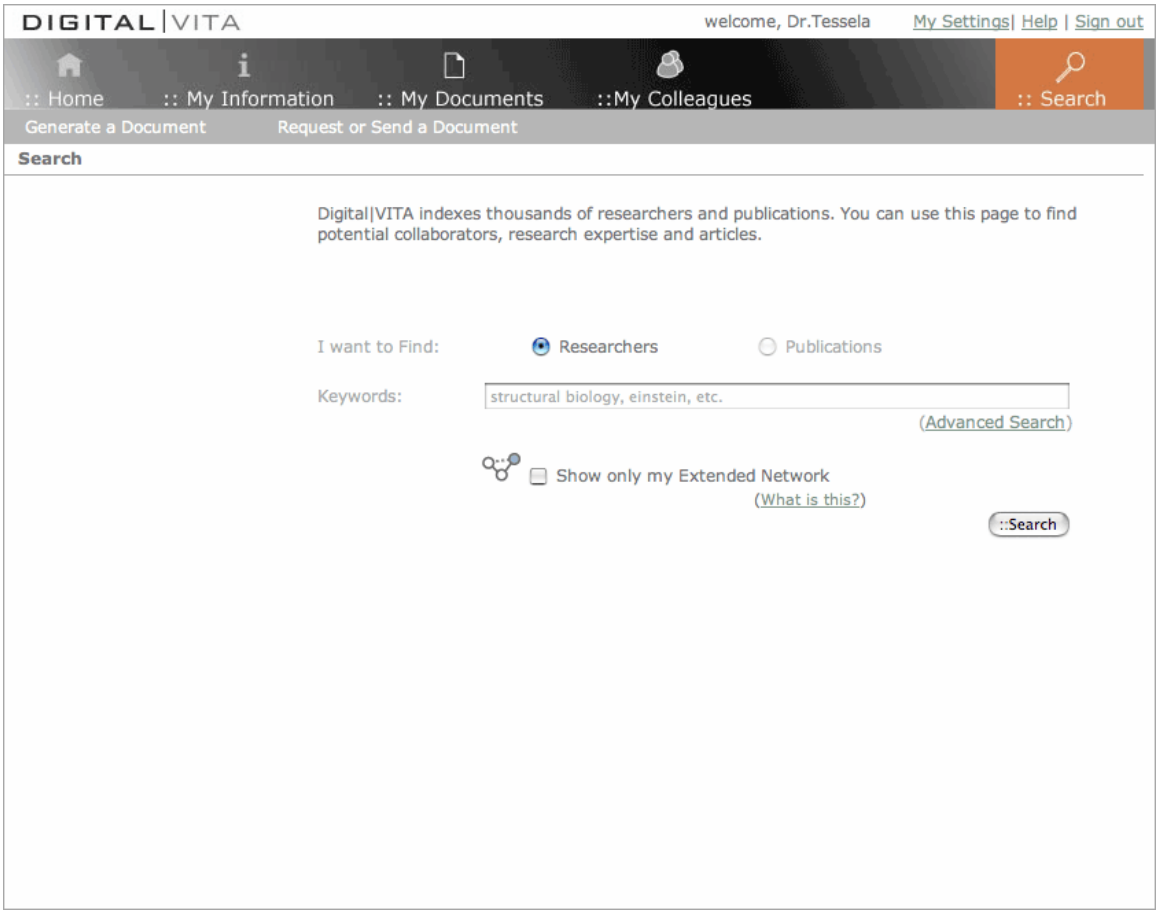


Figure 3.21 – The Search Page.

3.2.2 Search Options

Overall Goal:

To make the search function powerful yet simple. Search parameters that were found to be important to users were implemented in advanced options. The ability to search publications is also available.

Feature: The Advanced Search

Goal:

To allow users the freedom to search by the factors that matter to them.

Design & Rationale:

The literature demonstrates that researchers are concerned about a number of factors regarding collaboration candidates, such as geographical location, work style, expertise, and more (Kraut et. al, 1987; Appendix B, p. ii). To address this need, we designed an advanced search to include a number of optional parameters users may employ to make their search more specific (Figure 3.22). These parameters are drawn from both data collected during the research phase and examples provided by prior systems (Appendix D, p. i-ii). Included in the set of parameters is the ability to limit results to those people that a researcher may either know directly or through someone else, which supports the current user workflow of contacting potential collaborators through current colleagues, a feature that prior systems have failed to incorporate. This feature is discussed in more depth in section 4.2.6.

In the search text field, several options are listed by default to demonstrate the kinds of terms that can be searched for; these options are grayed out to indicate this default text is replaceable (Figure 3.23). This mechanism is consistent with many software applications and websites with forms that provide example text in a textbox.

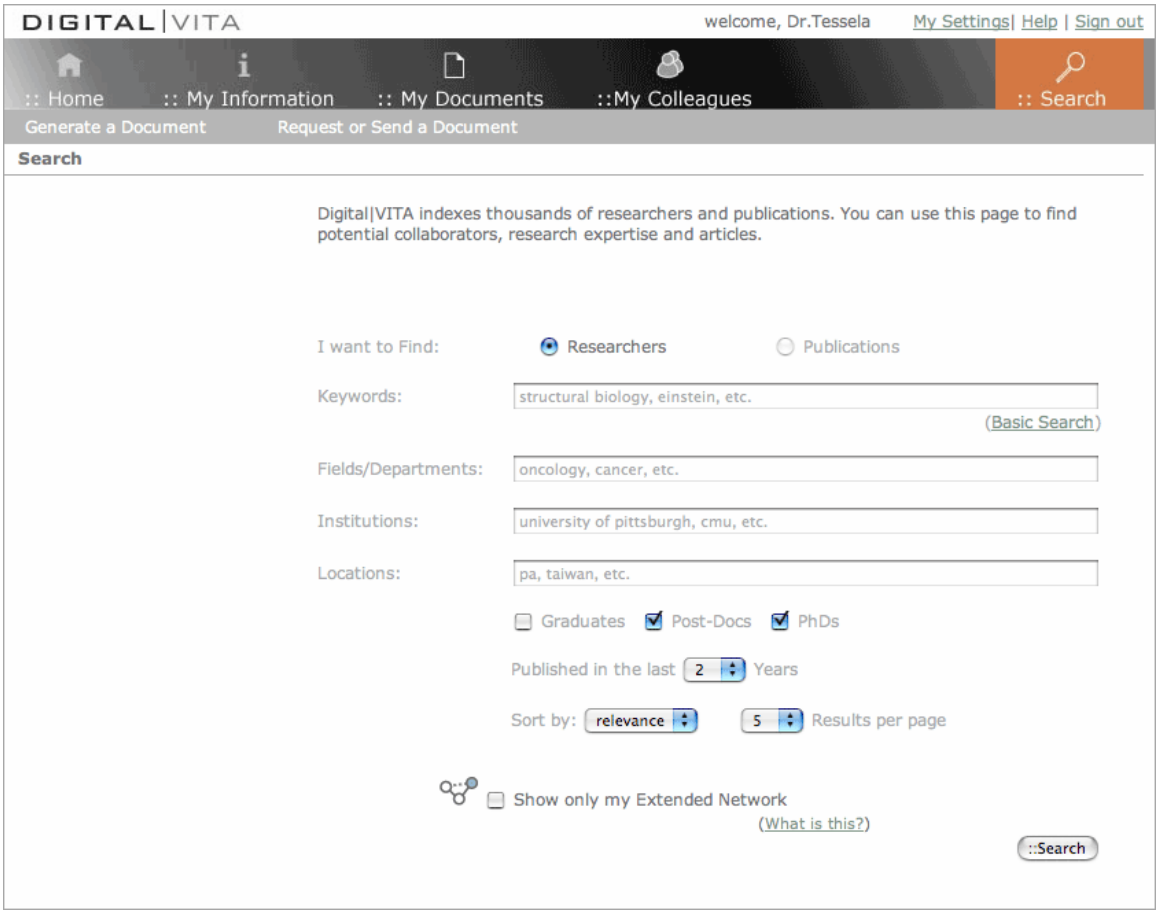


Figure 3.22 – Advanced Search Options.

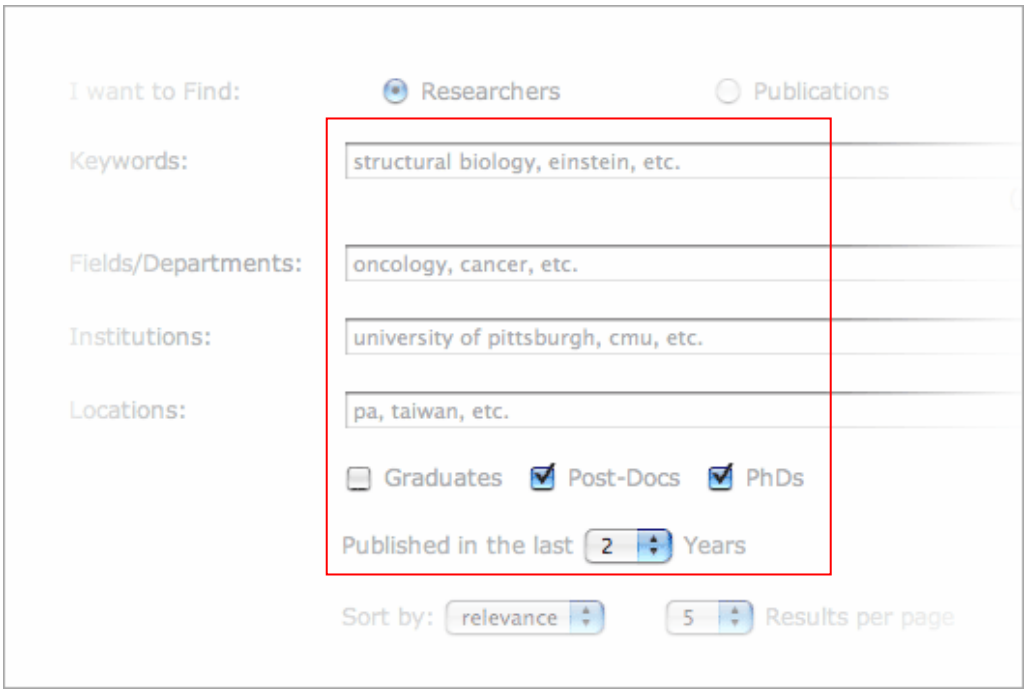


Figure 3.23 – Grey example text in the text fields.

Feature: Searching by Researchers vs. Publications

Goal:

To allow users to search the type of data that is most helpful to them.

Design & Rationale:

Users are given the choice to search through researchers or publications, which are clearly shown to be mutually exclusive options by the radial button widget used to select them. Selecting "researchers" will search through the research interests, keywords, and publications, and grant submissions of all users on the system. This means that the system will need to attain critical mass in order to produce the best search results for our users. Selecting "publications" will search through PubMed and return relevant articles that meet the user's search. The PubMed site also provides this functionality, but with a relatively complex interface; Digital Vita provides the same information in a more intuitive interface.

Tradeoffs:

The search for publications may be unnecessary. At least two familiar tools exist to handle a publications search already: PubMed and Google Scholar. However, both systems presented problems for a small set of our research participants. (Appendix G, p. xxvi) PubMed has a fairly complicated interface despite its powerful search. Google Scholar is very simple, but doesn't provide researchers with all the options they would like to narrow the search (Appendix D, p. i-ii). Ideally, our system will strike a balance between these two extremes, however it may be sufficient for now to simply transport the user to another search engine.

3.2.3 Search Results

Overall Goal:
To help users find researchers with the expertise they need and make this easy for them by displaying the information that is most useful in the search results.

Feature: Including Relevant Information in Search Results

Goal: To display the most relevant search result information to aid the user's decision making.

Design & Rationale:

Researchers require comparable criteria in order to decide among competing collaboration candidates. We worked to create a balance between the amount of information on the search page, and the amount of visual overload experienced by the user. Through careful user testing, we identified several key pieces of information users want on the search results page. Our user research demonstrates that users are interested in academic affiliation, research interests, publications, and number of citations when comparing researchers (Appendix G, p. iii; Appendix J, p. vii; Appendix K, p. viii).

Search results display a list of relevant researchers that best match the given search terms. Each search result includes the aforementioned pertinent information a user can examine when deciding among results (Figure 3.24). Though it may seem important to also include the title of the matching publications for each researcher search result, this method of handling information visualization is less efficient. Instead of forcing the user to scan individual titles and dive into abstracts to assess their relevance, the system can scan articles intelligently and bubble up the relevancy in a number that can be used to compare between results. If a desirable result is found, the user can then click on the researcher's profile to see a list of relevant publications.

Tradeoffs:

Status, seniority, and relative experience are now explicitly communicated in the Digital Vita system. This can affect the decisions collaboration-seekers make because a well-published and experienced researcher is now visually differentiated a less published, less experienced researcher. Making such distinctions highly visible could potentially reduce

the opportunities junior researchers are offered, since searchers are more likely to choose the more qualified senior researcher.

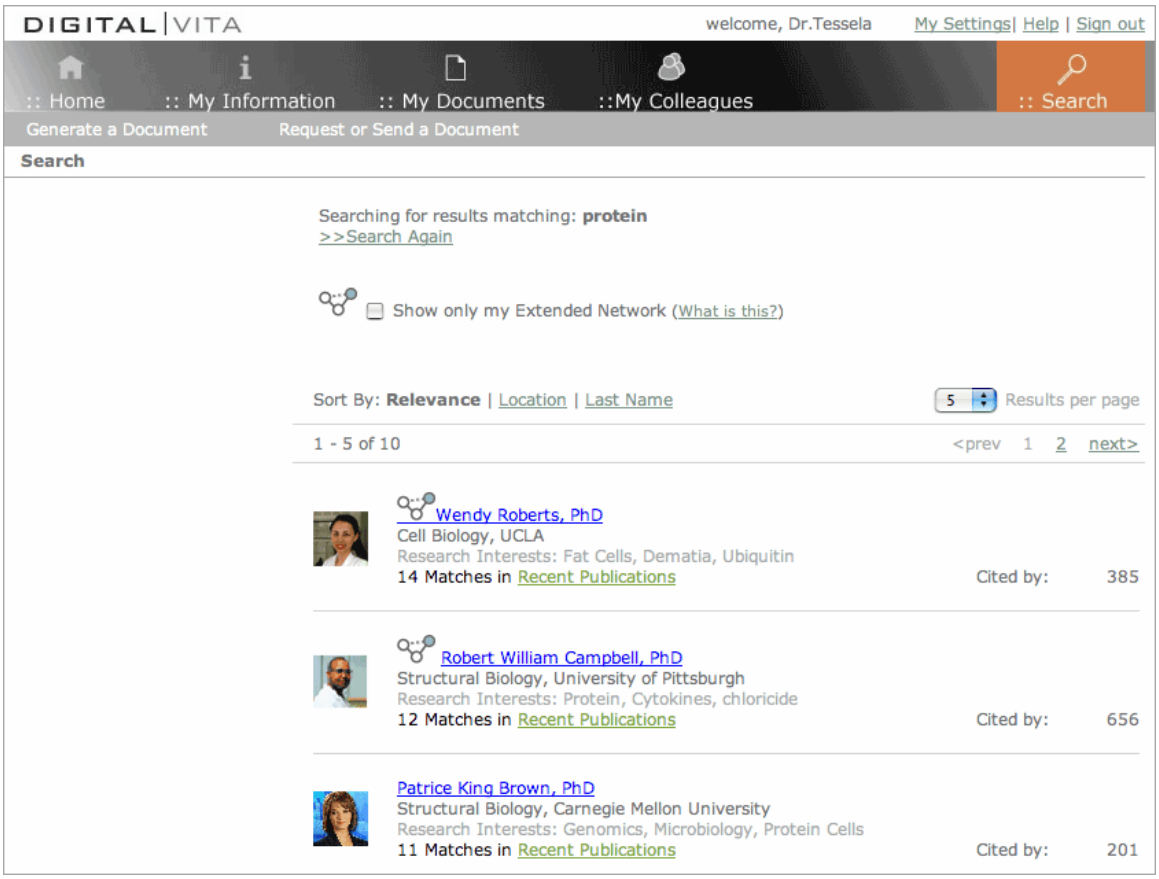


Figure 3.24 – Search Results.

3.2.4 Sorting

Overall Goal:
Different researchers may want to organize results differently. The goal of this feature is to enable users to find the information that they are seeking through the ability to sort by different criteria.

Feature: Sorting the Search Results

Goal:

To provide the quickest and most efficient way for users to find the most appropriate researchers to collaborate with.

Design & Rationale:

Our contextual inquiry (CI) data indicates that researchers weight criteria differently. From the Contextual Inquiries we found there are three options a user is most likely to sort by: relevancy, location and alphabetical order (Appendix G, p. iii; Appendix J, p. vii; Appendix K, p. viii, xxxi).

By default the results are shown by relevance in the search terms. However, the list can optionally be sorted by location or last name by selecting a different sort option above the top left-hand side of the results (Figure 3.25). In our wireframe studies, users had trouble finding the "sort by" option, so in our high fidelity prototype, we made this option more visually prominent (Appendix J, p. ix).

Tradeoffs:

The design demonstrates a single-order sort. Handling sort in this way prohibits the user from simultaneously specifying second-order distribution criteria (e.g. example sorting by relevance then location or vice versa). We decided not to include second-order sort because it was not a perceived user need (Appendix K), however the added functionality might outweigh the extra learning required to successfully use the system.

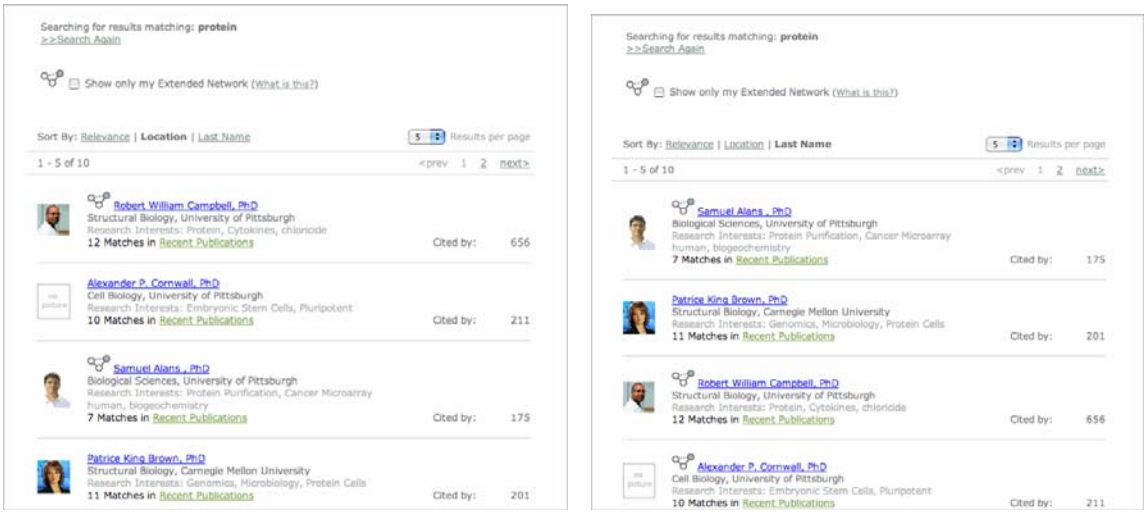


Figure 3.25 – Sorting by Location and Sort by Last Name alphabetical.

3.2.5 User Profiles

Overall Goal:
To provide researchers the opportunity to make intelligent decisions regarding potential collaborators by providing the information they use to evaluate collaborators in search result and profiles.

Feature: The Profile Page

Goal:

To provide an uncluttered profile page with enough relevant detail that users can accurately determine which researchers fit their needs.

Design & Rationale:

Our research demonstrates that researchers need high level information across different candidates to initially choose between them, and more detailed information at the personal level after determining their basic eligibility (Appendix G, p. xix; Kraut et al, 1987).

The profile page contains information researchers have approved for inclusion by managing the "My Profile" section of their Digital Vita. The profile page contains more detailed information about their background, research interests, and includes a listing of publications, with links to PubMed for access to the full paper text (Figure 3.26). If the user arrives at the profile page through search results, the publications relevant to the search term are shown. Consequently, the details of the profile are easier to parse without removing any potentially relevant information. Publications listed in the profile can also be sorted according to date, relevancy, or alphabetical order, depending on the user's preference. Users indicated they would like to be able to sort based on preference (Appendix J).

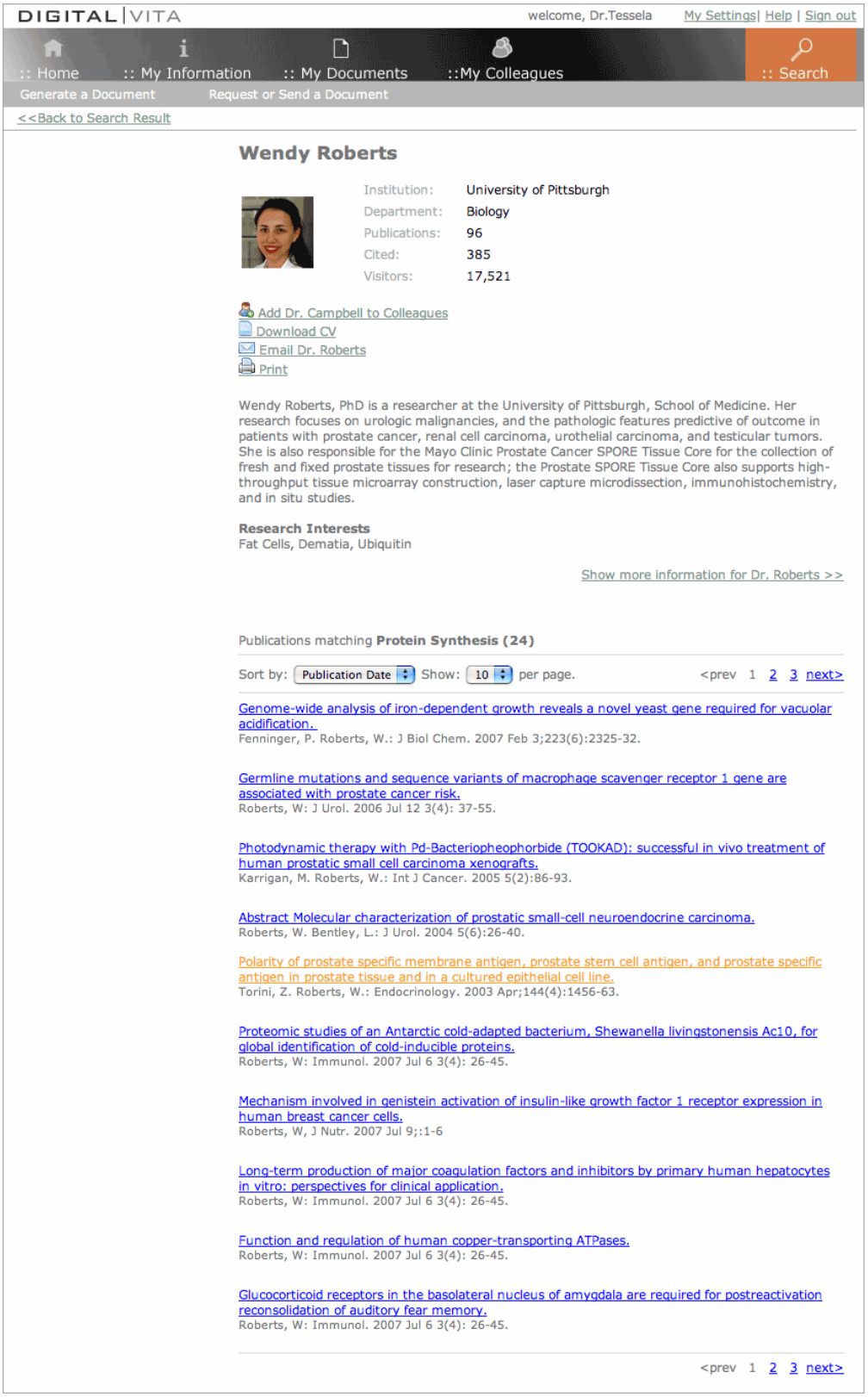


Figure 3.26 – Researcher Profile Page.

Feature: Colleague Connections

Goal:

To let users know which researchers they are connected to in order to present them with an opening to contact these linked researchers.

Design & Rationale:

Users are informed if they have a colleague connection to another researcher by an icon next to the researcher's name (Figure 3.27). The icon shows two nodes if the profile belongs to an immediate colleague and three nodes if the researcher is connected to the user through a colleague. Research interests are auto-populated from external databases, such as FRIP, and displayed in the profile. They can also be edited in the My Profile section of the system.

Tradeoffs:

Separate detailed profiles allow the user to view only one per browser window at a time. If the information on the search results page is not sufficient for comparison, the user is required to open multiple windows or move in and out of profile pages for further comparison.

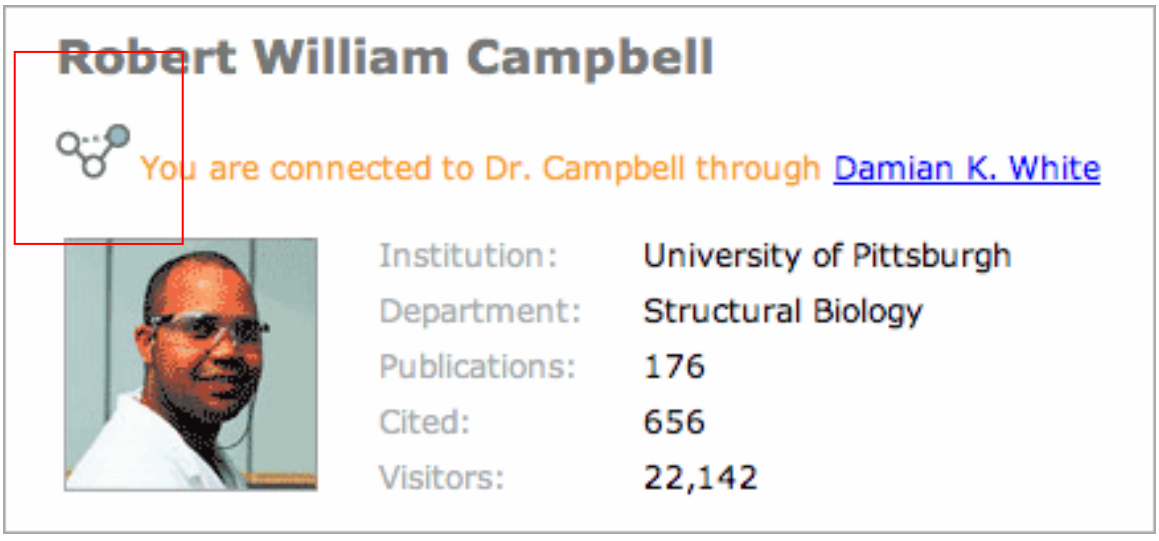


Figure 3.27 – Connections to Colleagues.

3.2.6 Extended Network

Overall Goal:

To encourage collaboration by providing information that makes approaching an unknown researcher easier and more likely to succeed. This is done through providing social network information so that the user can ask his colleagues for research and work style related information before venturing into a new collaboration.

Feature: The Extended Network

Goal:

To narrow the search results to display only those researchers who are connected to the user.

Design & Rationale:

Directly below the search bar is the option to search only within the extended network of the user (Figure 3.28). This option restricts search results to those that have either a direct connection to the user, indicating the researcher is one of the user's colleagues, or an indirect social connection to the user, showing that the researcher is a colleague of a colleague. Showing a user's extended network fits with our research finding that researchers, particularly those just beginning their careers, are much more likely to actually contact an expert if they find they have a social connection to them. This finding is discussed in more depth in our next section: Connecting Through Colleagues (Appendix B, p. vii; Appendix G, p. ii).

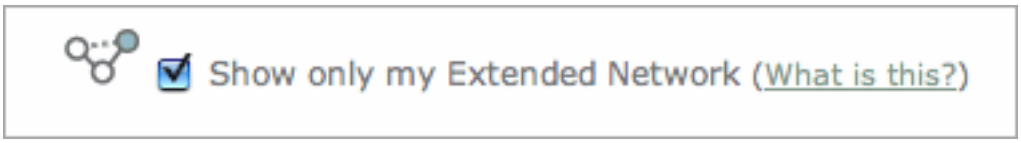


Figure 3.28 – Filtering by social connections.

Feature: The Extended Network Icon

Goal:

To highlight those researchers who are connected to the user and lower the barrier to collaboration initiation. Also, to inform the user of researchers he/she may not have been aware of that are connected to him/her.

Design & Rationale:

An icon by each researcher's name in the search results list gives a quick visual indication of whether the user has a professional connection to the researcher (Figure 3.29). This icon is identical to the one on the profile page, as discussed in section 4.2.5. Some of our users had trouble understanding the meaning of these icons, so we added a "What's this?" link next to the checkbox to select the "View my extended network" option (Figure 3.28). As discussed in the previous section, we also explicitly added an explanation on each person's profile page that shows the icon and states the researcher is a colleague, in order to reinforce the association between the icon and the colleague connection. (Appendix K, p. xii, xv)

Once a suitable researcher is found, the user wants to contact the person directly or find a mutual contact that they share. Users are interested in evaluating potential collaborators on a more personal level (Appendix B, p. iv; Appendix G, p. xxxiv). As mentioned above, our system addresses this by providing a link to any colleagues who serve as professional connections to the expert (Figure 3.30). These professional connections are managed through the My Colleagues portion of the website, which we'll discuss in the next section.

Tradeoffs:

This feature cannot be immediately successful within the Digital Vita system, because some user input is required to correctly populate a user's social network. Refer to Section 3.3 for details. Using an icon to represent the extended network is initially less

descriptive than text, however it reduces visual clutter in the interface and is used consistently in throughout the system.

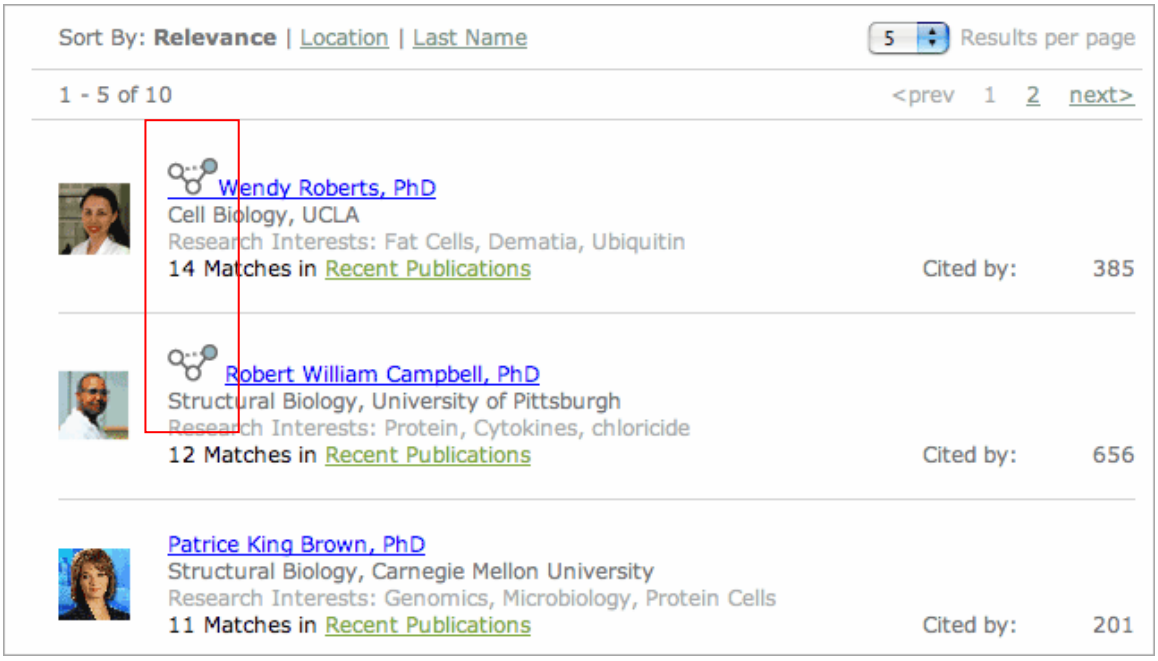


Figure 3.29 – Social connection feedback in search results.

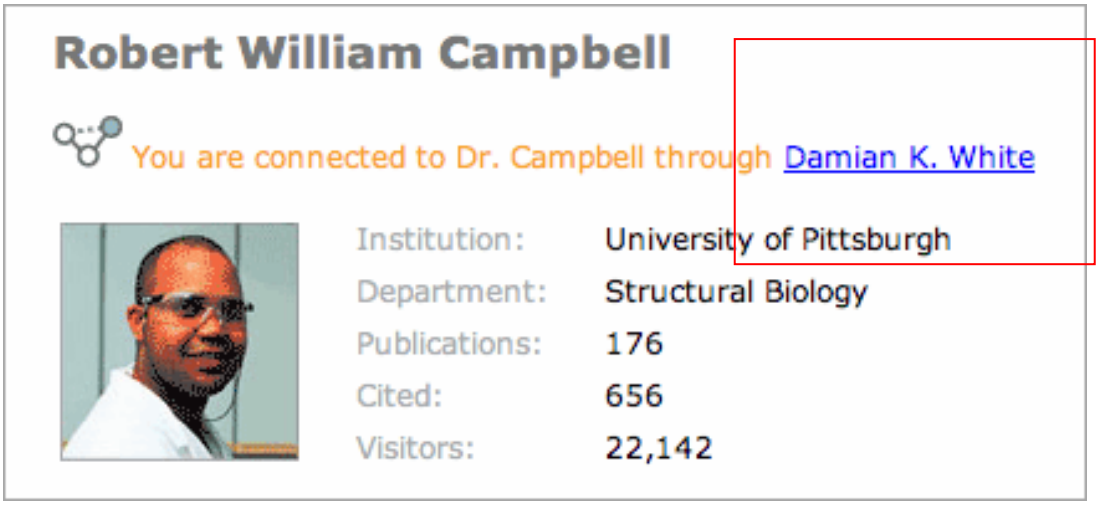


Figure 3.30 – Making a connection to a researcher through a shared colleague.

3.3 Connecting Through Colleagues Overview

The My Colleagues section is intended for researchers to keep track of their collaborators, colleagues within their department, and their general professional network. In our background phase, we discovered that researchers tend to find collaborators through their colleagues (Kraut et al., 1987; Contractor, 1998; Appendix D). We hypothesize that previous systems failed because these systems ignored the social aspect of finding collaboration (Appendix G). Our first and second concepts, Online Information Formatting and Finding an Expert, address the initial steps of finding a collaborator. Our third and final concept, Connecting Through Colleagues, provides users with the networking information they need to gauge a potential collaborator's suitability.

In our background research and CIs, we found that researchers, particularly junior ones, are not comfortable cold-calling another researcher about a potential collaboration, and are more likely to ask a colleague for a recommendation (Appendix A, p. vii; Flynn, 2005). Therefore, Digital Vita shows social connections between individuals, indicating which of their colleagues connect them to potential collaborators. By providing this information, the system allows a researcher to pursue a potential collaboration through their colleagues.

This feature may not be immediately successful within the Digital Vita system, because some user input is required to correctly populate a user's social network. This initial time investment may discourage some users, but the potential gain to the user outweighs this concern.

3.3.1 Ensuring An Accurate Network

Overall Goal:

To form an accurate social network for users of the system by utilizing existing connection data while providing the user control over it.

Feature: Populating a Researcher's Social Network

Goal: Pre-populate a user's professional network. Also, this feature provides researchers the control to add or remove a connection to ensure the accuracy of their professional network.

Design & Rationale:

The Digital Vita system attempts to pre-populate a user's professional network based on papers they have co-authored and grant proposals they have jointly submitted. After these colleagues are automatically added to their network, users have the control to add and remove them from their My Colleagues list (Figure 3.31). We added this functionality due to a key finding in our literature review that co-authorship alone is not enough to represent a researchers' social network (Appendix A, p. v). Several previous systems attempted to automatically create an individual's social network based on co-authorship of papers. Although this provides a good starting point, it does not accurately represent an individual's full network (Appendix A, p. v; Katz et al, 1997). Individuals reported they did not feel the social network the system created for them accurately reflected their connections. As a result, they were uncomfortable using the system (Appendix A, p. v; McDonald, 2003). For this reason, Digital Vita generates a user's network based on co-authorship and grant proposals, which provides researchers a starting point, while still allowing them to make adjustments to accurately represent their professional network.

Tradeoffs:

Some users may react negatively to having an automatically populated social network. However, the benefit of immediately allowing the user to perform extended network searches outweighs the potential disadvantages of inaccurately reporting a user's professional network.

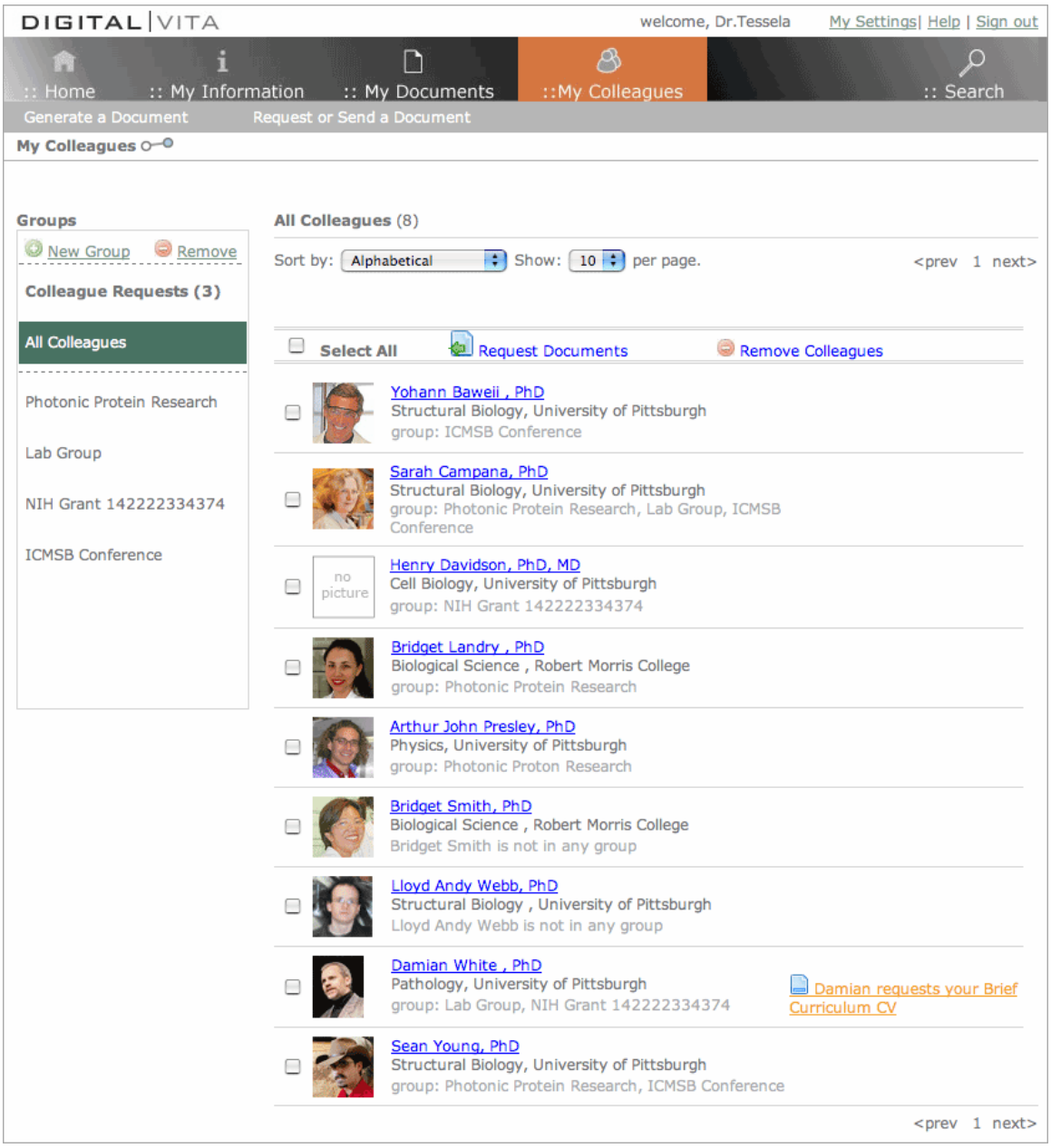


Figure 3.31 – The My Colleagues Page.

Feature: Colleague Requests

Goal:

To allow researchers the ability to confirm a colleague connection before the connection is confirmed in both colleagues' professional networks.

Design & Rationale:

The My Colleagues page opens up with a section devoted to new colleague requests (Figure 3.32). Based on our concept validation testing and the aforementioned literature review, we found that users wanted the ability to confirm or ignore a colleague connection to ensure the accuracy of their network (Appendix A, p. v; Appendix K, p. iii). When a user adds someone as a colleague, the former is notified when they log on to the system and is then able to confirm or ignore this request to establish the connection (Figure 3.32). Confirming this request creates a tie between the two users. This tie can be used to create connections when searching for new colleagues. Ignoring a colleague request removes the request without notifying the colleague that the request has been rejected, to avoid potential loss of face (Aoki, 2005)

Tradeoffs:

While making users confirm a new colleague connection, this also means that when a researcher adds someone as a colleague, he has to wait until the receiving party confirms the connection before he can leverage this connection in his network. If researchers do not login often, then there may be several connections that remain unconfirmed. One possible way to address this is by integrating connections into a researcher's social network before it has been confirmed, and simply indicating in some way that the connection is unconfirmed.

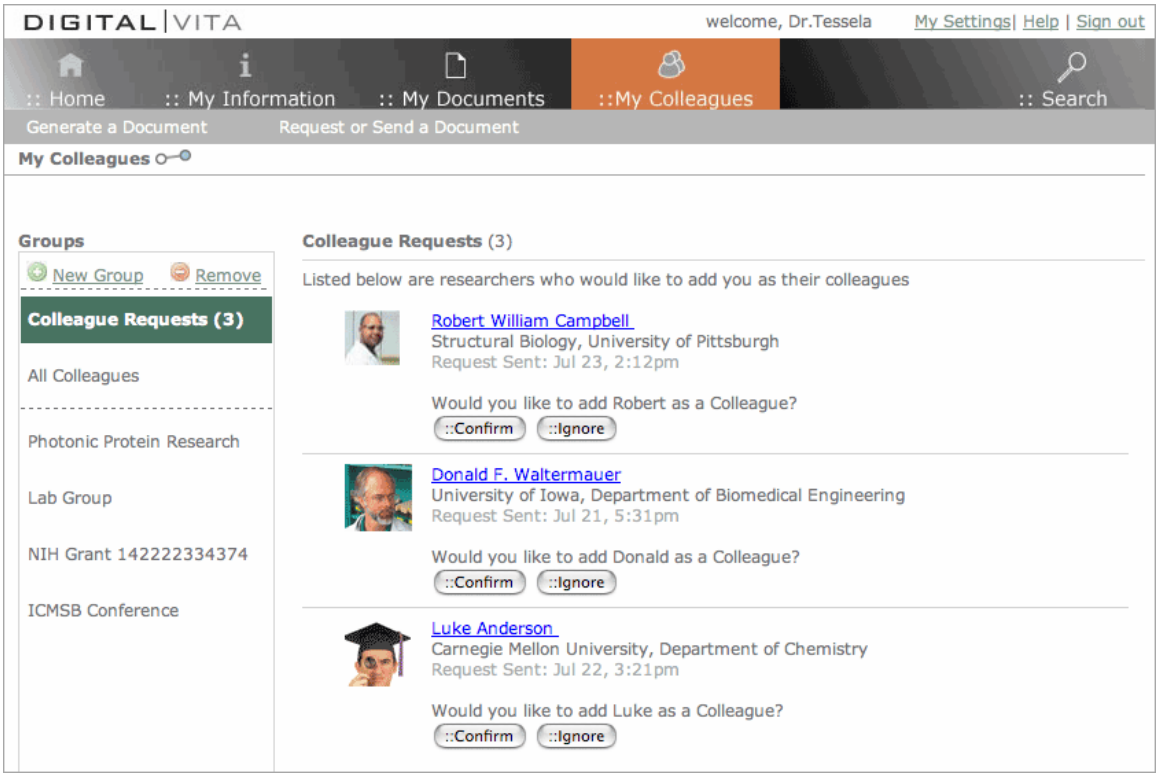


Figure 3.32 – New Colleague requests.

3.3.2 Viewing All Colleagues

Overall Goal:

To allow users to view and sort all the colleagues in their social network in the most efficient manner.

Feature: Full list of colleagues

Goal:

To allow users to view and sort all the colleagues in their social network in the most efficient manner.

Design & Rationale:

Users are able to view a full list of their colleagues by using a menu on the left side of the screen (Figure 3.33). Users can sort their colleagues in alphabetical order or by recent interactions (interactions include, for example, requesting or sending a document) (Figure 3.34). We added the ability to sort based on feedback from our think aloud user studies in which users indicated they would want the ability to quickly see colleagues they had recently exchanged documents with. (Appendix K, p. xxix)**.**

Limitations:

When entering the My Colleagues section, users are first taken to colleague requests. We designed this to intentionally encourage users to address these requests before performing other tasks. However, novice users may not notice the left-hand navigation, and therefore will not know how to view their full list of colleagues.

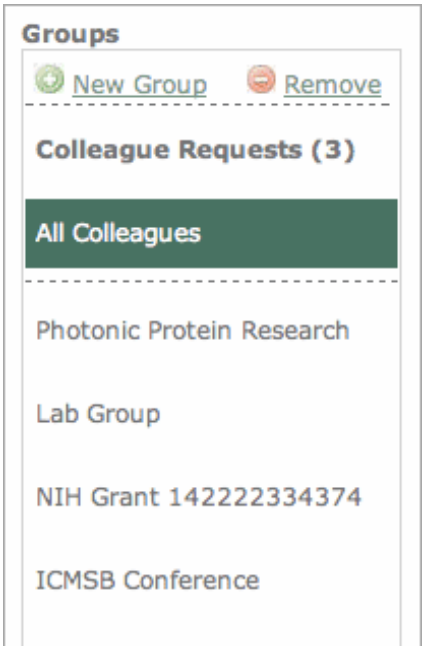


Figure 3.33 – Controlling the display of different groups.

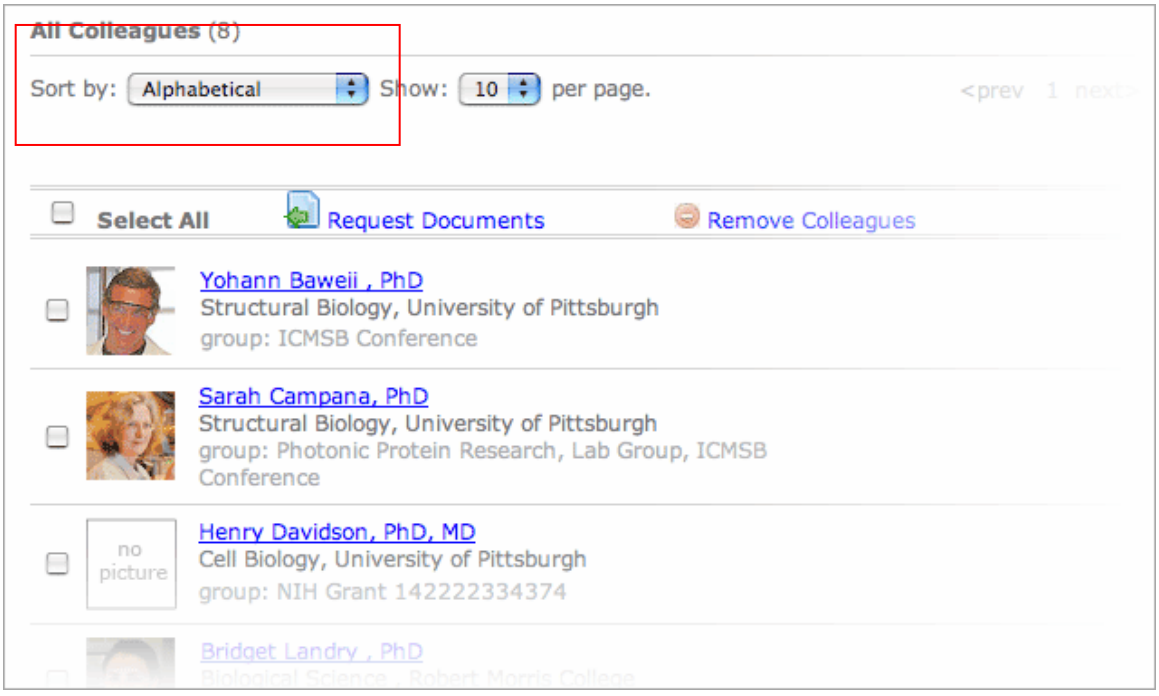


Figure 3.34 – Sorting the Colleagues display.

3.3.3 Supporting Groups

Overall Goal:

To allow the Primary Investigator for the project an easy way to request documents from his entire group. Also, to allow users to form groupings and to provide a way to helpfully label those groupings.

Feature: Organizing and Labeling Groups

Goal: To allow users to create and save groups of colleagues so they can easily request documents from colleagues within a specific research group.

Rationale:

This feature was well-validated in our wireframe and high-fidelity prototype user tests (Appendix K; Appendix J). Digital Vita allows the ability to name the colleague group and also to add a note about the group. Users requested the notes feature during our wireframe prototype tests (Figure 3.35). Users stated that they wanted to record relevant notes about the group, such as the grant number of a proposal the group is working together on (Appendix J, p. vi).

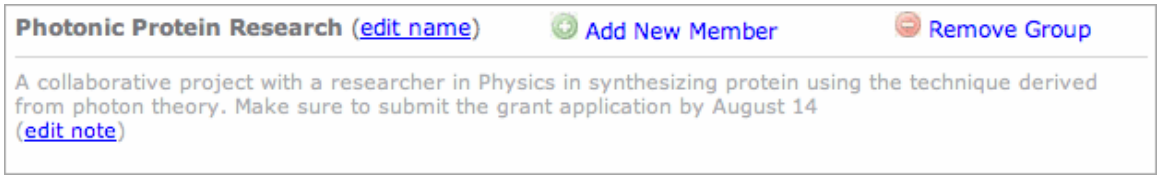


Figure 3.35 – Editing group name and note, adding new members and removing the group.

Feature: Requesting Documents from a Group

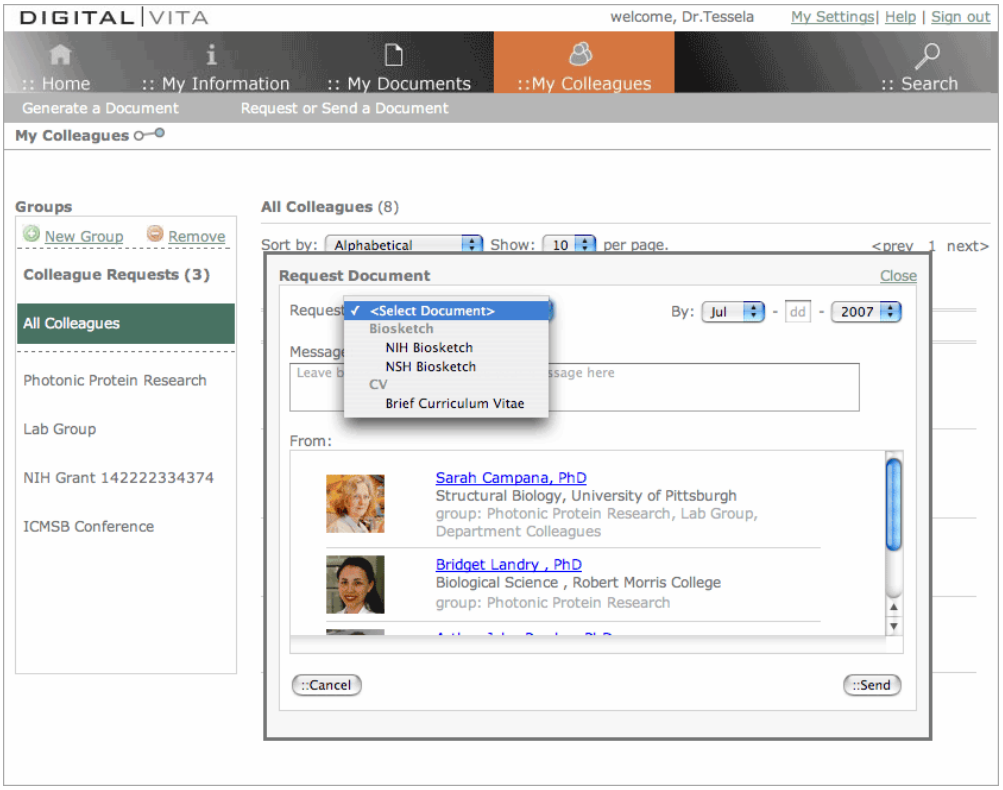
Goal: Allow users to easily request a document from all members of the same group simultaneously. The system is also aimed to handle following-up on the document requests automatically.

Design & Rationale:

The grouping feature allows users to easily request a document from all members of the same group simultaneously (Figure 3.36). This feature is designed to support the current practice of the primary investigator (PI) of a project, who must gather biosketches or CVs from all stakeholders in a project in order to submit a grant proposal (Appendix K, p. xi). By integrating the document request into the system, Digital Vita eases the burden of the PI by sending a one-time notification to members of the group requesting the required document. The notification also includes a due date, allowing the system to remind team members to submit the appropriate document. The system notifies the members via email (Figure 3.36 bottom) and, using the features described in our Information Formatting theme (3.1), team members can easily update and send the required document to the PI. By making it easier for the team members to submit a document, the system alleviates the strain on the PI.

Tradeoffs:

Users liked the grouping feature because it allowed them to quickly perform tasks. However, they desired more flexibility when requesting a document. For example, one user stated that she would want the ability to tailor the message for each person, rather than sending one message to everyone. This would give users more flexibility in requesting a document, but would also increase the complexity of the interface.



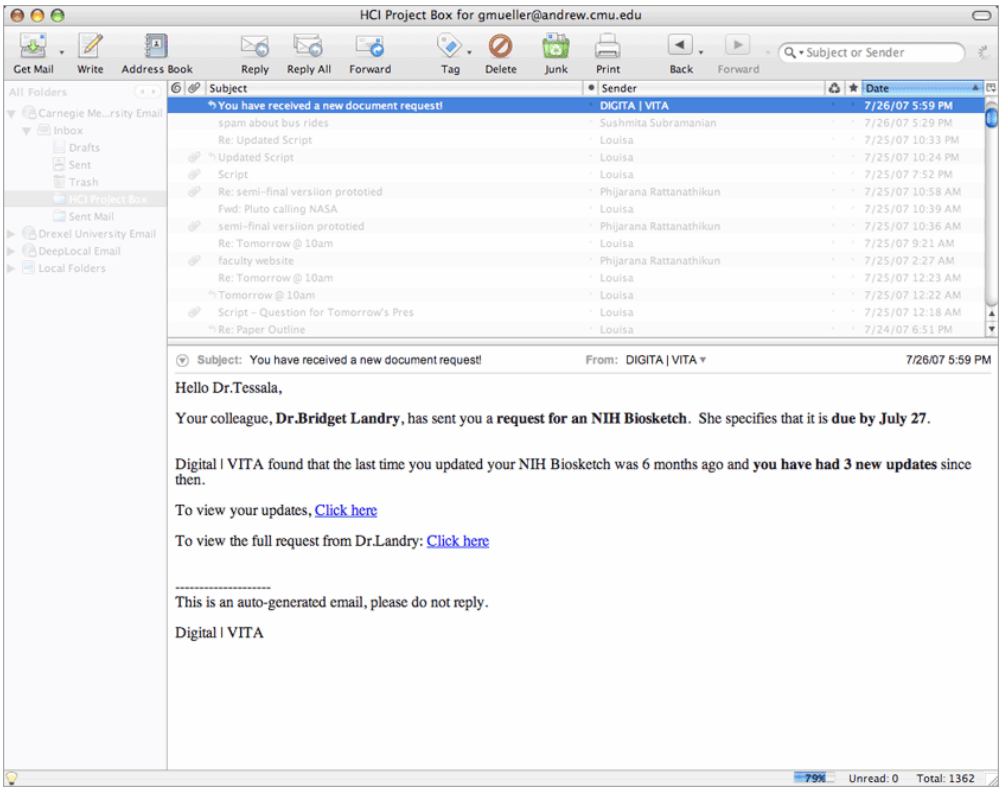


Figure 3.36 – Sending a request to a group of colleagues (top) and receiving the notification via email (bottom).

3.3.4 Document Inboxes

Overall Goal:

To enable users to exchange documents and manage those that they receive.

Feature: Document Requests Page

Goal: To provide users a central area where they can send or request a document to or from a colleague.

Rationale:

In addition to requesting a document from the My Colleagues page, the Digital Vita system has a separate area to manage document exchange (Figure 3.37). The top of the page is allocated for quick tasks: sending a document to a colleague or requesting a document from a colleague (Figure 3.38).

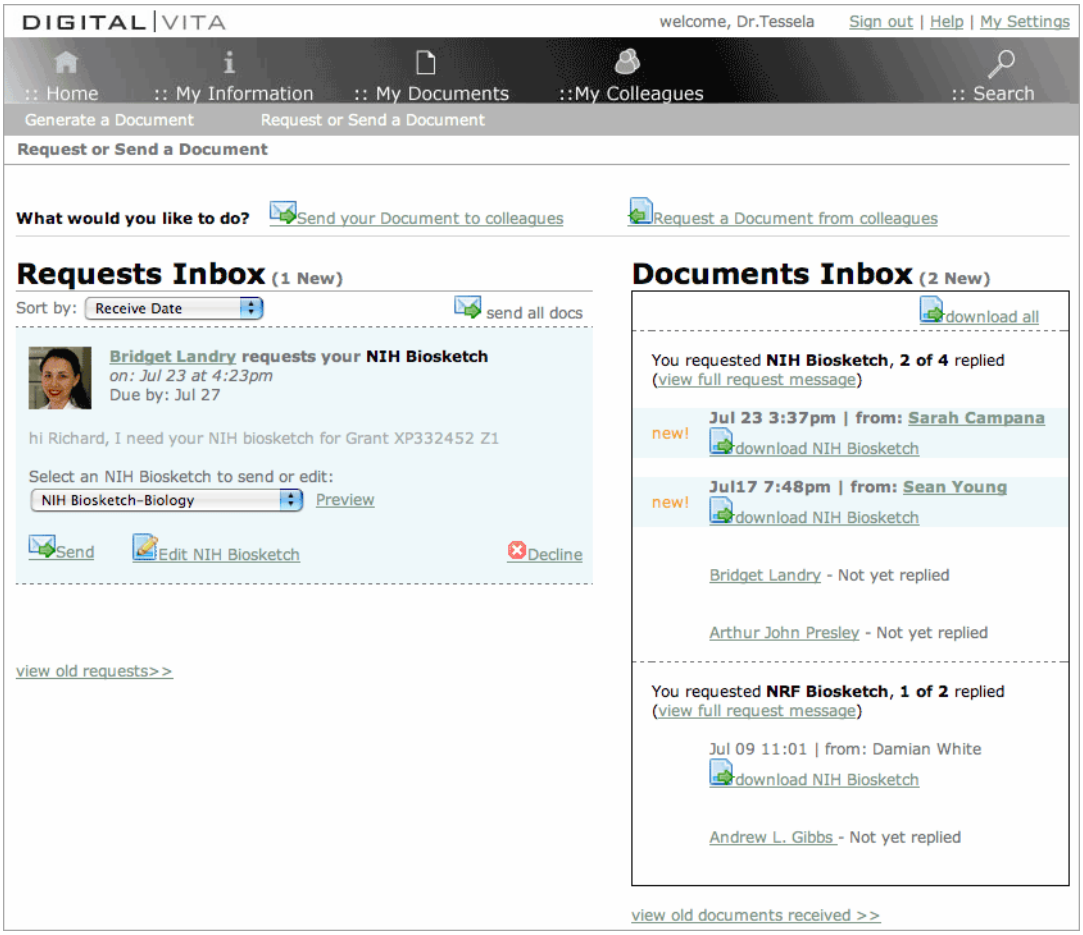


Figure 3.37 – Document exchange management.

Figure 3.38 – Quick tasks toolbar.

Feature: Request Inbox

Goal: To provide users a place to view and manage their recent document requests

Rationale:

The left column of the page is devoted to the user's request inbox, displaying the most recent document requests the user has received (Figure 3.39). The user has the ability to sort these by the received date, the due date, or by the requestor's name. Users are able to quickly preview a document before sending it to help them select the correct document and ensure it contains the latest information (Figure 3.40). They can then send the document by simply clicking the Send button. When selecting the appropriate document to send, users can see when the document was last edited. If new additions have been made, they can click the edit button to make modifications, and send directly from the edit page (as mentioned in the Information Formatting theme). Users can also decline a document request so that requests do not persist if they are no longer relevant. Requests are archived automatically after the due date of the document has passed or when the user has sent the requested document. Digital Vita provides a link at the bottom of this column to allow users to view old requests.

Tradeoffs and Limitations:

We debated whether a user would need an archive of sent and received documents. We included this functionality, but were unable to strongly validate that a user would want to maintain a history of their incoming and outgoing document requests. Consequently, we did not fully flesh out the design of these archives. Instead, this feature remains a part of the document and request inboxes. Including this un-validated feature may unnecessarily clutter the interface.

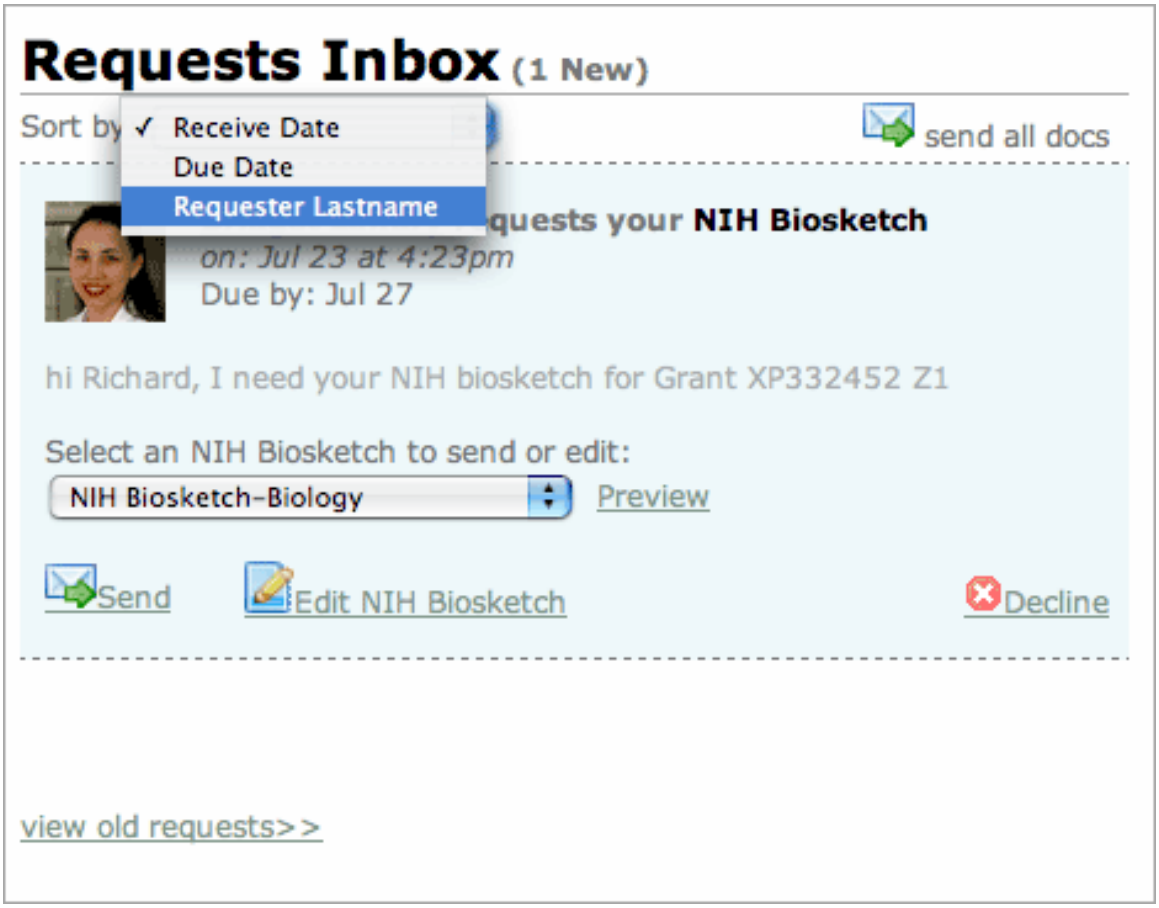


Figure 3.39 – Sorting Document Requests.

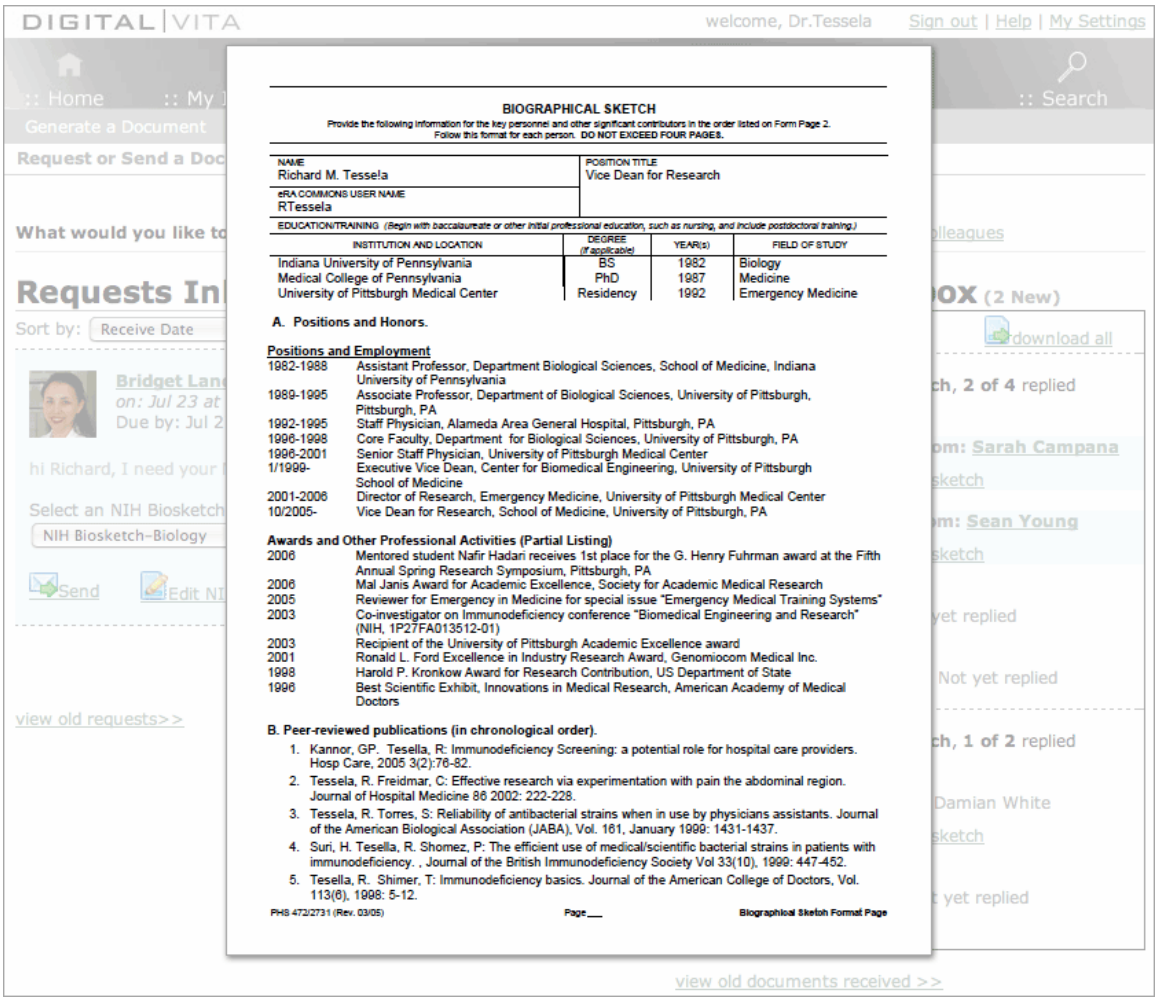


Figure 3.40 – Previewing documents from the documents management page.

Feature: Document Inbox

Goal: To provide users a central area where they can view and keep track of the documents they have requested from other colleagues.

Design & Rationale:

The right column of the page is devoted to the user's document inbox, where users are notified of documents that have been sent to them by colleagues (Figure 3.41). This section also shows users all the document requests they have sent, grouped by the type of document. The response status of each individual is shown here, displaying either a link to download a submitted document or a status message showing that the person has not yet replied. We provide a link at the bottom of this column again to allow users to view past received documents.

Tradeoffs and Limitations:

Same tradeoffs as previous feature: Requests Inbox.

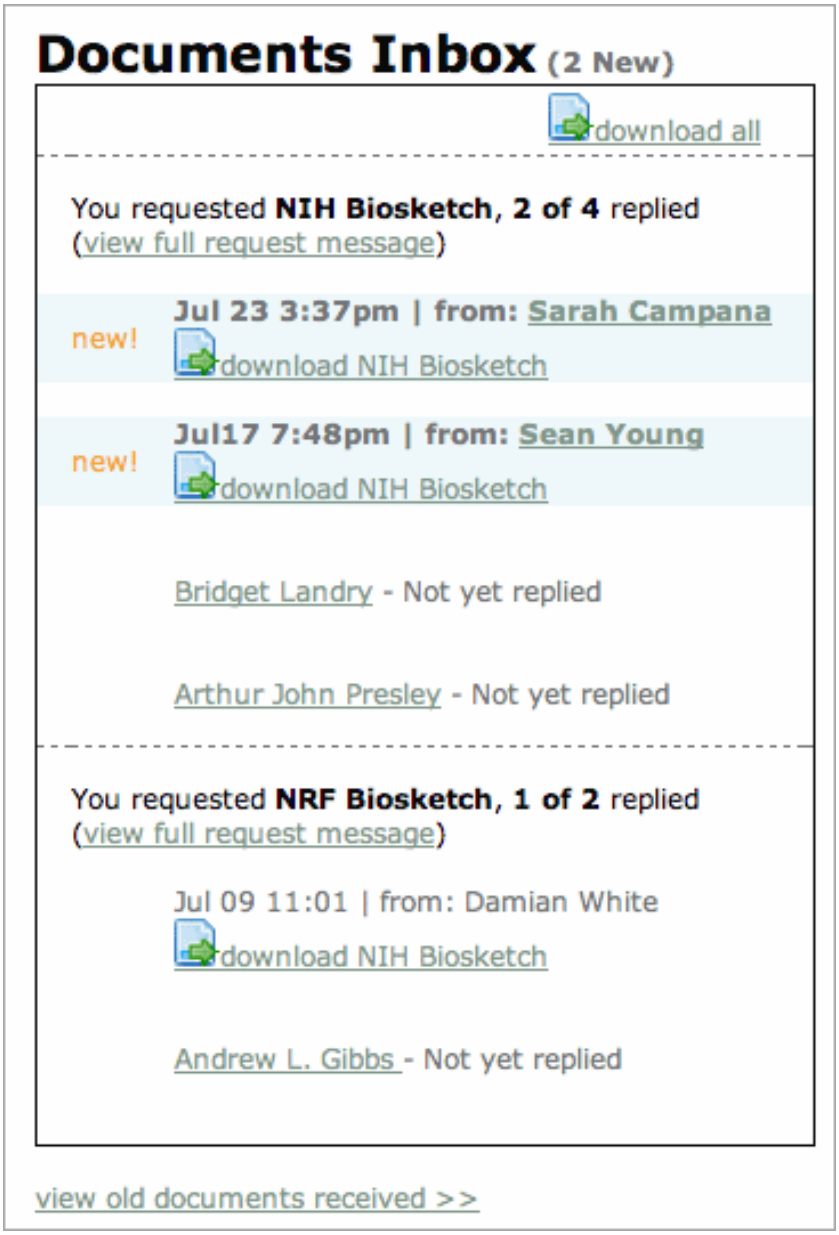


Figure 3.41 – The Documents Inbox.

6. Future Direction

Future Direction

Our current design addresses the needs we have identified from our research and field work that are crucial to the early adoption of the system. This design consists of the components necessary for the construction of a larger system that will unfold in the coming years of the ORC project. We have identified several key features and functions that should be included in the next version of Digital Vita. These can be built on top of our current design of the system. We have divided our set of features into three phases:

- Phase 1 - Implementing and deploying our current Digital Vita design
- Phase 2 - Building on the initial system to allow for more personalization of requests and notifications
- Phase 3 - Examining areas that were well-validated in user tests but fell outside our design scope. These features are notable in that they encourage interaction between researchers.

Phase 1 – Digital Vita System Implementation and Deployment

Phase one will involve implementing the features and designs that we have outlined in section 3. These features have the greatest cost-to-benefit ratio and are essential for the deployment and success of the initial system. This phase is primarily concerned with collecting and aggregating researcher profile data, easing the burden of document creation, and facilitating collaboration by allowing researchers to search up-to-date profiles. Additionally, the system involves a social networking component, allowing search results to include connections between colleagues. Digital Vita also supports the ability for users to easily exchange documents with their colleagues. After this first phase of Digital Vita is implemented, the features in phases two and three should be prioritized and implemented accordingly, based on user feedback gathered after system deployment.

Phase Two – Personalization and Customization

Phase two focuses on adding a layer of personalization and providing researchers with more control over the system. In the first phase of the document generation section of the

system, we aim to support the creation of the documents common to the majority of University of Pittsburgh researchers. These documents include NIH and NSF biosketches, faculty evaluation forms, abbreviated and full CVs, and the University of Pittsburgh formatted CV. A number of researchers mentioned that they adjust the margins, fonts, ordering and other characteristics of their documents. (Appendix K, p. v, xxvi) Digital Vita currently supports document output to Microsoft Word format in order to support this subset of researchers. However, in order to make this system truly successful we believe that it would be prudent to provide some greater level of customization to the formatting of a document from within the Digital Vita system. Therefore, in phase two, we plan to allow users to import custom templates, such as personal CV formats. Users could then update information as needed and output a new CV in any desired format. Additionally, users could import new, grant-specific, or other standard-specific, formats that could be shared across users of the system.

During our user tests there were numerous mentions of the role of administrative staff in updating and distributing CVs and biosketches (Appendix G, p. xviii; Appendix K, p. xviii). Since many researchers do not update their documents themselves, it is important to allow administrative access to the documents. In addition, the name and contact information of the administrator of any given researcher should be added within the researcher's profile information. (Appendix J, p. vi) For example, if a user is requesting documents from other researchers on the same project he should be able to send the document request to the assistant also.

Another feature is the routing of appropriate information and notifications to researchers. In our initial user studies we noticed that researchers were inundated with irrelevant information. They received notifications about potential grants, lectures, and deadlines, but only found a small percentage of these to be useful (Appendix D, p. i). One of the future goals of Digital Vita is to determine a way to channel the correct information to each researcher.

The last feature in phase two is intelligent recommendations made by the system regarding users' profiles. The system would compare researcher's profiles to others in their field informing them of missing or insufficiently completed fields in their profiles. This feature could be particularly beneficial to junior researchers, helping them best market themselves to their fellow researchers.

Phase Three – Forums, Meetings, and Q&A Sessions

While the first two phases are important for the adoption of the system, in phase three the true goal of the ORC and Digital Vita comes to fruition: improving the process of scientific discovery. As described in the introduction, the best way to encourage collaboration is through proximity and informal contact (Appendix B, p. ii-ix). Researchers need a way to gauge each other before entering into collaboration. Providing an appropriate way to do this electronically is one of the greatest challenges of this project. During our concept validation, we probed users on the utility of various ideas intended to increase informal communication. The following are our most validated ideas that address this issue.

The first of these concepts is a forum in which researchers can ask questions about papers they have read. Users expressed a strong interest in discussing papers they read with other researchers in their field to further scientific understanding and development. One participant proposed that these discussions could serve as addenda to the paper itself (Appendix G, p. xiv). These online journal forums would provide a focused area where researchers could discuss scientific advances and techniques with the author and other researchers in the field. The main goal is to promote informal communication by allowing for ongoing discussions in an online arena. We discussed two possible designs for such a forum: a lightweight blog or wiki where users can continually post comments on a central webpage, or a more elaborate forum style with a discussion board for each paper. This would allow a different thread for each discussion about the paper. The benefit of this approach is that it imposes structure on the discussion by focusing debate around a specific paper.

The second concept is a live online question and answer system. Users of the system nominate other researchers who they feel are doing interesting work. The most nominated researchers are invited to conduct live virtual question and answer sessions. The speaker would be broadcast through streaming video and online viewers could ask questions via text input. This concept allows researchers to receive recognition for their work, and allows a richer medium for presenting and viewing work across physical space.

Our third concept focuses on increasing face-to-face interaction between researchers. The system would inform users when someone with similar research interests is visiting their city. By specifying interests and privacy settings, users could choose whether to broadcast their location depending on their availability and preference. This feature would ensure researchers have more connection opportunities with other researchers.

One of our most validated concepts is that of a visualization system. During our user tests, we received significant positive feedback from users (Appendix G). Researchers were excited by the idea of being able to use a visualization to locate expertise and resources in their area. Although this idea does not facilitate informal contact, it was so highly regarded by our participants that further study should be done on how to implement it in a way that provides the most benefit to collaboration.

Conclusion

Collaboration is changing. As scientific study becomes more complex, multidisciplinary collaboration becomes more important. New tools are needed to facilitate the evolution of scientific discovery. Digital Vita allows researchers to share their information and their work with peers and funding organizations without concern for format, obsolescence and accuracy. By providing an intuitive mechanism to supply and maintain information, the system allows researchers to locate collaborators across geographical and disciplinary boundaries. Digital Vita further facilitates collaboration by capitalizing on the existing bonds between researchers. By combining these two aspects into one cohesive system, Digital Vita improves the process of scientific discovery by diminishing the barriers between researchers and creating new collaborative relationships.