COGNITIVE DESIGN STUDIO (COGS 102C)

Podcast Redesign

A Contextual Design Approach to the UCSD Podcast System

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INTRODUCTION

The Podcast system at the University of California, San Diego is a widely used tool among students who seek to get more out of their classroom experience. Podcasts are a recorded audio (or occasionally video) file that allows students to go back and listen to (or view) their class lectures from past dates. Students most often use the system for catching up on missed work or reviewing information before exams. Unfortunately, the system does not offer the best types of features that students need which forces them to try and come up with their own makeshift solution to be able to learn class material. We chose to redesign the UCSD Podcast System by creating a user-centered design because it was something that affected us personally, being Podcast-using students ourselves, in addition to our fellow classmates.

The idea behind the UCSD Podcast system was initially conceived in 1999 by a professor who used his own audio recorder and uploaded it to his own website for the students. Soon after that, a graduate student, who had to often miss class, asked a classmate to record a lecture for him. Because this was such an easy and effective way to go over material later, other students asked if they could listen to the recording as well. Professors saw that this was becoming a trend and started the Podcast system based off of this model. The current UCSD Podcast System started in 2007 and has come a long way from its early days of manual uploading in 1999. Now, the system is almost entirely automated for professors, which is an especially big accomplishment because there is no budget earmarked for the Podcast system. All money that goes toward Podcasting comes from leftover funds of other projects. Currently, students are able to listen to audio of their classes and take notes on their own. Occasionally, a class will be videocast (3 out of ~90 classes being Podcasted per quarter), which allows students to see what the professor is writing over video. This is a big step up from streaming audio only. The system has much more room for improvement which was made clear by the users' dissatisfaction of its current features

Our group used Contextual Design, a process that involves interviewing the users of the system doing the activity in their natural setting, to come up with a prototype of the improved design. Contextual Design ultimately allows user researchers to gather data about how users actually use the system and experience everything first hand instead of having the user describe the activity from memory. In their book Rapid Contextual Design, Hugh Beyer and Karen Holtzblatt define Contextual Design as a process that "makes data gathered from the customers the base criteria for deciding what the system should do and how it should be structured" (Beyer and Holtzblatt 3).

METHODS

Methodologically, we adhered strongly to the principles and processes of Rapid Contextual Design. Accordingly, we developed our redesign around rich user data. This user data was captured during contextual interviews with Podcast users. Moreover, we conducted interviews with a professor and ACMS staff member to provide more holistic insight into the workings of the current Podcast system. As these interviews accumulated, we organized ourselves by centralizing this data and our subsequent notes through the use of Google Documents. Explained more in depth, the centrality of our notes and data allowed for every group member to participate and stay abreast of any and all developments of the overall design process.

It should first be mentioned that our group's organizational methods encouraged strong communication amongst the group, which is amazingly paramount for a group of substantial size. Initially, we developed a spreadsheet to organize the tasks and to-do's for each member [Staying Organized Spreadsheet, section 1]. This sheet provides a way of setting up future tasks and assigning them to a particular individual and was a fantastic means of keeping everyone on track. Additionally, we utilized our group wiki as a temporal reference. The wiki timeline was constructed

at the beginning of the project [Project Schedule, section 1]. It operates as an ideal timeline of events and milestones. Of course, as the quarter continued, certain aspects of the design got pushed back in time and tasks were redistributed and reworked. But it was important for us to reference our original schedule in order to keep perspective on how closely we had adhered to our original timeline.

Moreover, as the quarter developed, so too did the quantity of our documents. We no longer had just a centralized spreadsheet, but we began to develop a slew of notes. These notes were mostly a by-product of our group interpretation sessions. Each of these note-filled documents is labeled according to user type and user number (opting for a number system to uphold anonymity). The notes form a collective exploration of current practices, weaknesses, benefits, and design ideas centralized around the Podcast system at UCSD. Again, having this data centralized and accessible by every member of the group proved to ease communication and efficiency within our group meetings and throughout the entirety of the quarter.

We first gathered demographic information from our user-base by distributing a user survey ["How Do You Use Lecture Podcasts at UCSD?," section 2]. The aim of the survey was to collect initial information regarding class types that commonly utilize Podcasts, prevalent woes and conflicts with the current system, and the majors that lend themselves to Podcasting class lectures. In addition, we wanted to get a large enough group of people that the survey was approximately representative of the student body that uses Podcasts so we could make sure we covered the right types of students. The survey was initially broadcast on the Facebook social networking site because of its far-reaching effects amongst UCSD students on the network. Ultimately, well over one-hundred individuals completed the survey [Survey Results, section 2]. It helped us focus our attention on the Podcasting system at UCSD and provided initial insight regarding which students to focus our interviews on. Some major-types and course selections utilize Podcasts far more than

others. Therefore, we pursued majors such as Biology, Chemistry, and Cognitive Science because of the prevalence of Podcasts for courses within these majors.

Strong efforts were dedicated to our interviews. Primarily, our focus is on the student user. These users were found through word-of-mouth and Facebook. We had hoped for a large user-base to interview, but it quickly became evident that we were going to have a hard time finding people for interviews -- which we did. However, once we found users to interview, we recounted our project's background and the purpose of the interview. If they still agreed to participate, we then had them sign the user consent forms [User Consent Forms, section 2]. From this point, we continued with the interview and the user would begin the Podcast process.

It's important to note that the contextual interviews require that we interview each user in a natural context. This natural context is dependent upon user preference. For instance, student S01 listens to Podcasts within his dorm room, while S02 listens to Podcasts in a public setting, such as the Price Center East extension [User Interviews Notes, S01 & S02, section 2]. But, regardless of the physical context, our primary concern was how the user engaged the Podcast system. More specifically, this Podcast engagement, often framed by motives and end-goals (e.g. to study for a midterm), is particularly important. Therefore, constant attention was devoted to this aspect of the current system. We focused on initial setup, the organization of resources, and engagement with the Podcast interface. We noted their behavior and processes throughout the duration of the lecture, from start to finish. This includes going to the Podcast page (http://podcast.ucsd.edu), finding the appropriate course, beginning the Podcast, pausing and playing it, traversing across its timeline, taking notes, and closing down their system. If something stood out, or we wanted clarification, we would ask the user to explain what was going on. We didn't want to unnaturally interrupt anyone while listening to the Podcast because of the importance of leaving them within their natural context and set of behaviors. However, we gained rich data from remaining engaged with the

student throughout the interview. There were nine student interviews in total [User Interview Notes, section 2]. Subsequently, interpretation sessions were held within forty-eight hours of each interview.

Although we focused primarily on the student, we gained additional insight and information from a professor and ACMS staff member [User Interview Notes, P01 and A01, section 2]. The professor that we interviewed happens to use videocasting technologies. As a chemistry professor, he's often drawing structures and annotations and the student's capturing of these notes are vital for success in his course. Though the interview with this professor wasn't contextually-based, it did yield a wide range of information regarding teacher concerns and the limitations and benefits of videocasting a class lecture. Furthermore, our interview with a member of ACMS was motivated by our desire to better understand the back-end infrastructure of the Podcasting system itself. Interestingly, it was the pool of data that we collected from this interview that helped to ground our redesign. For instance, an expressed limitation to the Podcast system is the lack of a defined budget. Leftover funds are funneled into the current system. Therefore, our redesign incorporated a sensitivity and awareness of these budget constraints.

Overall, through these contextual interviews, we were able to gather rich data that directly corresponded to how students used the Podcast system in a natural setting.

RESULTS

Interpretation Sessions

After we conducted our first two user interviews, and within 48 hours, we decided to have an interpretation session [Consolidated Interview Notes, section 3]. Because we still had the majority of the interviews ahead of us at this point, we knew the first interpretation session would

be a learning experience and something we could improve in the future for the following sessions. To start out, the interviewer shared with the group the background information about the user they interviewed. In order to stay organized, we set up our user code system as “S” for student, “P” for professor, and “A” for Academic Computing and Media Services. S01, for example, corresponded to the first student interviewed, S02, the second, and so on.

After sharing with us the general user information and physical environment, the interviewer walked us through the process and steps the user had taken while listening to the Podcast. The first two users discussed in the preliminary interpretation session were a couple of our most interesting users. S01 was our only user to use the video Podcast so interpreting how she interacted with the Podcast was crucial to our overall design ideas. Even this early in the process, we started to jot down design ideas in our meeting notes as they came up. For this user, we captured a design idea to include lecture titles in addition to date because the student had to search though more than one lecture to find the correct Podcast.

In this same interpretation session, after we had completed the meeting notes for the first user, we moved on to discussing the second interview. S02 was also an important one of our users interviewed who had come up with her own personal techniques to solve some of the lacking Podcast features of the current design. We learned that this user would timestamp her notes, connecting the time in the Podcast in which the topics were discussed to the corresponding topic written in her notes. Although at this point, we did not have any specific design ideas to solve this issue, we kept in mind that this problem needed to be addressed in our redesign.

Still being early in the overall Contextual Design process, we held off on creating the affinity notes for these first two users during this first interpretation session. We decided that next session we would go through the next few interviews as well as start creating the affinity notes for all users interviewed up until that point.

Now, when we got to the second interpretation session, we started getting some more direction as the patterns among the users became apparent. We had to discuss interviews with three more students and one professor. Starting with S03, the interviewer shared with us the general user information and then walked us through the user's steps. This time, in addition to taking the meeting notes online in a Google Document, we wrote out the affinity notes on yellow Post-Its as we went along. S03 was the first of our users that kept his mouse hovered over the pause button throughout the entire Podcast because the button is so hard to navigate toward. We were quick to make a note as a design idea to make pausing the Podcast more user-friendly.

Moving on to S04 and S05, we started becoming more aware of the overarching breakdowns all the users are experiencing. Skipping within the Podcast was one of our biggest concerns that we knew we'd address in our redesign. We noticed that all of the users up to this point had their slides open and moving along with the Podcast. Having completed going though all of the user interviews thus far, we moved on to discuss our informative professor interview.

P01 is a chemistry professor at UCSD and was one of the very first professors to start using Podcasts who was able to give us a lot of insight. This professor had his own way of customizing the system to fit his own needs. For starters, he brought his own "gamer" microphone, as he called it, to class because it captured clear and consistent audio in comparison to the current clip-on mic that experiences "rainbowing" of sound. He informed us that some professors do not participate in Podcasting their classes because it lowers the attendance of the students showing up for lectures. His solution to this problem was turning off the microphone when giving out answers to exam questions for the students who attended lecture. Although his makeshift solutions did the trick, he still felt that the Podcast system needs a lot of improvement.

Our next (and last) user interview interpretation session occurred in the beginning of week 7. At this point, we had four users to interpret and one person from ACMS. We started this

interpretation session going through each interview as we had done before, starting with S06. Discussing this particular user, we were made aware that multitasking while listening to Podcasts is typical. Although the majority of our users will not be playing poker online, as S06 was, we still need to keep in mind that some of the users are doing other tasks and do not follow along exactly in time with the Podcast and slides. If the user leaves the slides page for a minute or two while the Podcast audio is still running, it is very difficult for the user to locate the correct slide the professor is referencing.

Moving on to S07 and S08, the interviewer shared with the group the users' negative opinions about the current Podcast system. Actually, several of the quotes captured in S08's interview were shared in our final presentation to give the audience a feel for what the users think. The interviewer shared that this user would repeatedly become very frustrated when the Podcast audio controls were not working as they thought it should. For example, the user almost gave up when looking for something specific within the Podcast because it was taking too long and skipping in the Podcast is far from precise.

S09 experienced similar breakdowns as the rest of the users when trying to skip within and pause the Podcast. Pausing the Podcast often in order to take notes from the fast-talking professor frustrated this user greatly. We took down a design idea to enable adjustable speed controls for this case. Also, this user's cluttered screen space with many tabs and windows open told us that we need to come up with a solution to ease this issue. Widgets were suggested as a design idea and taken note of in our affinity diagram.

Our last interview shared in the interpretation session was the one with ACMS. We spoke with the Associate Director who told us everything we needed to know about Podcasting at UCSD. Surprisingly, the Podcast system is not included in the UCSD budget; the only money that goes toward it comes from leftover funds. From this information, we basically realized that whatever

new features we design will have to be cheap or at no cost to implement. She also told us about the background of Podcasts. Starting by a professor recording audio and uploading it online in his own time for the students to use, then a graduate student getting a classmate to record audio for him, and so on, the growing interest for Podcast has been getting larger each quarter. By 2007, UCSD had the first up and running Podcast. Other than simply adding more classes to be Podcasted, the system has not changed much since that time. ACMS made it a point to mention in their interview that Podcasts should be used as a supplement to lecture, not a replacement. A direct quote from ACMS captured on an affinity note was "We [ACMS] didn't design Podcasts for students who skip class. Professors should focus on the good students rather than the bad." In this case, she was referring to the professors who worry too much about students who do not attend lecture, but instead listen to the Podcast at their own leisure. She believes that the students who do go to lecture and who still would like to listen to a Podcast from that same lecture later should be able to, as should students that just learn better on their own time; they should not be "punished" by their classmates using Podcast as a replacement for lecture that in effect, cause the professor to opt out of Podcasting.

Affinity Notes

Constructing the affinity diagram [Affinity Diagram Photos, section 4] was an easy way for all of the user insights and issues to be displayed in an effective manner. Starting out with the lowest, but very important, level of the diagram, we laid out all of the yellow affinity notes on the table that were made during the earlier interpretation sessions. These notes included everything from direct user quotes, breakdowns, design ideas, to general demographic information. For example, an affinity note written for S06 read "When user leaves slide window, they have trouble discovering which slide the professor is on when they come back to it." In the same group as the S06 affinity note was a design idea that said "Sync audio with slides." After mixing all the notes from

the users together, each of the five members of our group were given approximately an even amount of notes. We began by saying out loud, one-by-one what our note said and put them on the wall into similar groupings of categories, although it took a while before we started having real structure to the wall. Picking up the pace as we put the notes up, we almost seemed to work in teams with our notes. Asking the team member next to us if they have seen a similar note or category, we saved a lot of wasted time looking around for something the person next to us could help with.

Next, after all of the yellow notes were up on the wall, we began creating the Blue Labels for the yellow-noted categories. In doing this, we were sure to keep the voice of the user present and wrote the notes from their perspective. “I estimate the time spent on each slide to gauge my position in the lecture” and “Timeline scrubbing is inaccurate” were a couple of very important categories. We started to notice particular patterns that Blue Labels about pausing, skipping, looking for certain content within the Podcast were accumulating quicker than other labels. To separate the demographic information, we created Blue Labels according to the types of classes students would listen to Podcasts for, which helped us understand what types of widgets we should include to help in certain class. A periodic table, for example, was a widget design idea because we had a large number of chemistry student users.

Moving along, our next step was to put up the Pink Labels. To better organize ourselves, we made some temporary Green Labels: “Administrative and Technical,” “Navigating Within the Podcast,” “Uses of Podcast,” and “Following Along with Slides and Notes.” Seeing more and more structure at each step, the Pink Labels summarized groups of the Blue Labels. For example, “Professors’ Rights” was a Pink Label that contained most of the Blue and Yellow notes from the ACMS and Professor interviews. Separating the large Blue Label categories about skipping into smaller ones helped us see things more clearly. We came up with “My reasons for skipping,” “I want

to know where to skip," and "I have difficulty skipping" as a few of the Pink Labels that covered skipping.

The last labels that we came up with and finalized were the Green Labels. Expanding on our temporary labels, we ended up with six overall Green Labeled categories of affinity notes. In addition to the previously mentioned categories, we added in "View, Layout, and Widgets" and "Lecture Content" to complete the list. The Green Labels relating to users interacting with the Podcast, for example, navigating within or following along with the slides, took up most of the wall and had the most sub-categories underneath. At this point, having all of our contextual interview user data laid out in physical form, it was clear to see where the users' problems are centered; knowing what lecture content is covered in the Podcasts, when it is covered, and how to easily get there was a frustrating, time-consuming issue for our users.

Models

Creating the sequence models for each user really made some patterns start to stand out. Rather than creating one long sequence model for each user, we made smaller sub-sequences and named each one so we could keep track of the repeating patterns. After creating the first few sequences, we began to start taking note of only the new sequences and just marking down the number of times a particular sequence was repeated by more than one user. For example, the "Pausing Podcast" sequence was very popular and almost all of the users followed the steps in the sequence. "Referencing Handouts," "Indexing Times," "Googling Words," "Multitasking," and "Skipping" were our most obvious models that we kept seeing throughout all of our interviews (see Models section in binder). After collecting all of the data, consolidating the sequence models into one was simple; we put together all of the models excluding duplicates and very rare cases [Consolidated Sequence Model, section 5].

The physical models [Consolidated User Interview Notes, section 3] were a great way for us to truly put ourselves in the user's position and see things from their point of view. Across all of the students interviewed, the physical models were very similar with a lot of overlap. For instance, all students used their computer to access the Podcast and most had their written notes out on a notepad in front of them. The aspects in which the models differed is whether they were on a public computer or their laptop at home, using headphones or computer speakers, and writing notes by hand (in which case they would have their notebook in front of them) or by taking them on their computer. The exact way in which each student's environment is set up did not directly affect our redesign ideas. However, the physical models enabled us to get a better understanding of the setting in which our new Podcast system will be used.

The last models we created were the artifact models for our users [Consolidated User Interview Notes, section 3]. Starting out, we created a model for each user. After the first few, we realized that we were basically almost recreating the same model each time. Similar to the physical models, the artifact models overlapped across all of the users. We decided that after we had the first few detailed models, we would capture and create models for only the new artifacts that were being used. Because the Podcast system is entirely online, there were not many physical artifacts that the users manipulated or used in their contextual interview. Other than a pen or pencil, paper, mouse, and the actual computer, most of the users did not have anything else with them. After finishing the modeling we knew that when we start to actually redesign the system, there would not be any new artifacts or physical objects introduced to the users; it would simply be redesigning the website interface and functionality for the Podcast process.

Personas

By creating the personas [Personas, section 6], we were able to have a general idea about the average users. We decided to create two users from our group of interviewed users; a student

who missed lecture and needs to catch up by listening to the Podcast, and a student who went to class and is using the Podcast to study and review for an exam. There is a big difference between the way in which a student who went to class listens to a lecture and the way a student who did not attend class listens. For example, the student who went to class most likely has an idea about what the professor is teaching and may even recognize the slides. This student would probably skip around within the Podcast or be looking for something specific to review. Keeping this in mind for our redesign, we wanted to make sure this type of student will be able to see what topic is referenced in the Podcast and when. On the other hand, the student who did not go to class will be more likely to listen to the entire Podcast to take notes on all of the information. If this student is trying to follow along with the professor, they would be pausing often. One of our design ideas was to have adjustable audio, and in this case, the student would be able to slow down the professor's speech to easily take notes.

Walking The Wall

At this point, we had accomplished building the affinity diagram. We had to start thinking about the final direction and design changes to make in our project. Before we started the "Wall Walk," we created a Google Document about the key issues and hot ideas to collect [Key Issues and Hot Ideas, section 4]. One of the members was elected to be the note-taker for this as the rest of us walked the wall. Having all of the notes up including the Green Labels, the key issues were obvious. Pausing and skipping took up almost half of the wall, so these topics were put at the top of our list. Some more of the key issues ranged from playback speed, to knowing what is in the lecture, to the small budget allocated for Podcasting.

We were sure to capture each hot idea that would provide a simple solution to some of the biggest issues as well. Number one on our list of hot ideas was synchronizing the audio of the Podcast with the lecture slides. Although we were still not at the actual redesign step just yet, we

knew this would most likely be the biggest and most appealing new feature. Being a user-centered design, we wanted to give the user as much freedom in the new system as we could. One of the hot ideas was to allow users to resize and move around their windows however they would like. As of right now, the Podcast webpage has so much wasted space that takes up unnecessary amounts of the user's screen so giving them control of their own space would solve this issue.

Significant Results

Although all of the data we collected and interpreted from our contextual user interviews shaped our final prototype, some of the results were more significant to our redesign. The user who timestamped her notes (S02) [User Interview Notes, S02, sections 2 and 3], sparked an important design idea in our in minds early on. We knew that we needed to somehow index the Podcast enabling users to find where and when specific topics are referenced. The precise way in which we decided to create this index became more concrete with the more users we interviewed and discussed. As we started to notice patterns across the students' Podcasting techniques (e.g. hovering their mouse over the pause button), we knew these were important to address. After creating the wall full of affinity notes, we realized that about a quarter of the entire wall was devoted to users' issues with skipping within the Podcast. If this is only a quarter of the wall for the 9 students we interviewed, it is likely to assume that most, if not all, students using UCSD Podcasts are negatively affected by the current skipping functionality of the system.

At this point in the process, we had completed and interpreted the interviews as well as created and walked the wall taking down key issues and hot ideas. We had all of the results and knew what was significant; we just needed to put our data to good use and decide on the best solutions.

DESIGN CHANGES

Initial Design Ideas

Throughout interpretation sessions, we saw many emerging patterns that inspired some initial design ideas. Rather than wait entirely until the visioning stage, we captured these ideas in case they proved to support our data [Additional Design Ideas, section 7]. Ultimately, some of these ideas were developed more as the project went on, while others were dropped completely. Some of these design ideas, as well as the data they were based on, are presented below.

Since our interviews involved observing users interacting directly with the digital Podcast interface at Podcast.ucsd.edu, we were able to think of design ideas pertaining to this interface. For example, as mentioned above, several users had trouble using the pause button, which was used when they couldn't keep up with the professor. Some of our initial ideas to address this were to create bigger interface buttons (to allow more room for error in clicking) and using hotkeys (such as spacebar to pause) like other media programs. Additionally, several users had trouble skipping through the timeline, whether this was to skip to a particular section of the Podcast or to skip back 10 seconds. Whatever the purpose, users had trouble finding what they were looking for because the interface revealed nothing besides timecodes. Data like this helped to orient us in how we wanted to approach the re-design process; one of our primary focuses would be the actual interface that the users were presented with.

Other ideas emerged from the process of listening to Podcast rather than the interface itself. For example, most users had many windows or tabs open at once, each containing class materials, search engines, and whatever other tools the user was using. At other times, as described earlier in our physical models, the user's physical space was cluttered with reference material. This clutter gave us an idea of creating a widget system in which all relevant materials and tools could be

contained within the same display; each widget would be a moveable and resizable, allowing the user to customize their space to their liking. In essence, it would be like the typical virtual desktop environment, but all contained within one window. In terms of addressing the data, this system would serve to reduce the amount of time spent switching between tabs and windows and allow them to control the Podcast without leaving that window. Based on the user data, especially the artifacts that we observed during the interviews, some widget ideas included a calculator, a periodic table, important equations (e.g. physics equations), class materials (e.g. a reading list, syllabus, or midterm study guide), and a search engine. In addition, we also thought of a discussion widget, in which students could ask questions while listening to the Podcast. This addition was based on student data that showed that students didn't always understand what the professor was talking about. A discussion forum could be a way for students to get clarifications about material.

Another major design idea that emerged from the Podcast process was creating a system in which the slides are displayed along with the audio of the Podcast. Most students used the PowerPoint lecture slides in conjunction with the audio, so this was clearly behavior that we should support in our re-design. Currently, students have to manually follow along in the slides, which can be problematic if the professor's switches aren't obvious or if the student leaves the slides window (e.g. S06 playing poker) [User Interview Notes, S06, sections 2 and 3]. An obvious design feature, then, would be to keep the slide changes synchronized with the professor's speech according to the actual changes done in class. In doing this, we could take some of the effort off of the student while combining the audio and slides into a common interface.

Additional ideas emerged from observing the artifacts that the users used during the interviews. As discussed earlier, one student wrote down the time at different spots in her notes [S02 Artifact Model, section 3]; effectively, she was timestamping her notes to enable her to go back in the audio to review different parts of her notes. Along with other data, this showed us that

students would like to be able to easily skip to topics within the Podcast, or at least be able to see what each point in time was about. This inspired the idea of creating some system to mark different sections of the Podcast with corresponding topics. The exact mechanism, at this point, wasn't quite clear, but we knew that we wanted to support this in some capacity.

The same student who wrote timestamps in her notes also used checkboxes on each lecture within her notebook to mark whether or not she had listened to the Podcast for that lecture. This was an effort to keep herself organized and make sure she had covered everything that she needed. Rather than forcing the user to keep track of this, we had the design idea of implementing a system that monitored what each student had finished (i.e. which Podcasts they had listened to). This would also necessitate a log-in page for each user, which further led to the idea of customizing the Podcast experience for each user. For example, information by each user could be saved, enhancing the functionality of the system.

Finally, more design ideas emerged after speaking with a professor and with a member of the UCSD Academic Computing and Media Services. One such design idea involved attendance. As we learned from these two interviewees, many professors avoided (or at least were hesitant about) Podcasting because they wanted to make sure students were attending class rather than skipping the lecture in favor of listening to the Podcast on their own time. In order to address this, we brainstormed a few ideas to deal with participation, including giving class participation credit for students that either attended class or participated somehow online (such as in discussion forums). This way, we could ensure that the students were still being involved in the class or contributing in some way. Ultimately, however, we abandoned this as a design consideration because it was more related to the process of a lecture rather than specifically related to the Podcast interface.

Overall, aside from the widgets and labeling of topics, these were all relatively small design ideas. The next step was visioning, which helped us outline some of our more-drastic changes, as well as narrow in on exactly what sort of changes we wanted to ultimately make to the system.

Visioning

The next step in the process was visioning [Visioning, section 7], which describes the process of creating the flow of the re-designed user experience – how will the user interact with the new system in order to accomplish their goals and tasks, and how does the new system address their breakdowns? Since it doesn't explicitly define the exact user interactions (e.g. clicking on buttons), visioning serves as a more high-level overview of the processes involved in the new system. It is, therefore, a "vision" of how the new system will work in the minds of the designers.

Though Rapid Contextual Design outlined a specific method for creating a vision, we had a bit of trouble sticking to their technique since different users followed different activity paths. Rather than creating a single over-arching vision of the entire system as suggested in the text, we broke our re-design into several smaller tasks, creating a vision for each. Because of this, our visions ended up fairly similar to our storyboards, but we attempted to still show the system at a higher, more abstract level. As a group, we created mini-visions for the following processes: listening to a Podcast because the user missed the lecture; different methods of logging into the site; dealing with attendance (on the professor side); different methods of capturing lecture material (professor side); finding a course; and choosing a lecture (though this last one was more of a storyboard). In all, we created rough flow charts of how the Podcast experience would be in our re-design. Since we knew we were going to be re-designing the website and interface, we opted to spend more time on storyboarding.

Ultimately, after walking the affinity wall, consolidating the sequence models, and creating the vision, we had two main design focuses to drive our project. We also had a few smaller design changes that emerged from these processes. These design focuses are described below.

First, our main area of focus was the synchronization of lecture slides with the Podcast audio. The foremost piece of data driving this design change was the fact that an overwhelming majority of students use the lecture slides along with the Podcast. As many professors lecture by presenting PowerPoint (or similar) slides and verbally describing the content of each, students currently miss out by using the Podcast alone because they don't get to see the lecture slides that accompany the professor's speech. Because of this, students opt to use slides if they are provided by the professor. Instead of requiring the students to find, download, and open the slides themselves, we envisioned an interface in which the user could see the relevant lecture slides along with that lecture's audio. In addition, several students complained that they couldn't tell what lecture slide the professor was on at any given point within the lecture; they requested the ability to know where they were within the lecture. To solve this, our system would include a way of synchronizing the audio directly to the slides; that is, when the slide changed in the lecture, the slide would change automatically in the Podcast. While we didn't know the exact mechanism at this point, we knew we wanted to pursue this further. Finally, our data showed that students would skip around within the lecture's audio without knowing where they were skipping to. By creating this synchronization, students would be able to navigate directly to individual slides, helping them know where in the lecture they were skipping to.

Our second main area of focus emerged from data showing that students wanted to know what different sections of the lecture were about. In several instances, students wanted to navigate to a particular topic within the lecture. Aside from the student that wrote timestamps within her own notes, students were at a loss for how to do this. While the idea of synchronizing the audio to

the slides (especially the ability to skip to a certain section of the Podcast by choosing a slide) was great, students still might not know what each slide was about until they clicked on the slide. Our problem, then, was to decide how slides should be described or labeled by topic. To solve this problem, we introduced a tagging technique that would be socially driven by the students – it works best when more students use it. Each slide would have its own list of tags (contributed by students), each with a corresponding number of "votes;" students would decide, collectively, which tags best-described each slide, as well as which were poor descriptors. In our initial vision, students would be able to see a list of all the slides, each with its own most popular tags. This way, students could quickly scroll through a list of slides, glancing at the tags, in order to find which slide they wanted to navigate to based on the topic that they wanted to study. Along with the audio synchronization, this would allow the student to quickly skip to the professor's speech about that topic. We felt that this would be an improvement to the traditional technique of scrubbing through the timeline and listening for related words in order to find a particular topic.

Several smaller design changes were also envisioned during this process. While they didn't necessarily affect the overall shape of the project, they were small features that would drastically improve the user experience of the Podcast system.

For example, a common trend that we found was users skipping back a few seconds to hear a piece of information that they missed. In the past, they would have to click back on the timeline in small increments to jump back in time. However, the small size of the timeline and the large jumps made it difficult to avoid skipping back too far. Our design includes a replay button, inspired by a DVR control, that allows the user to jump back ten seconds. Now, if the user misses a word that the professor says, they no longer have to manually skip back; by pressing the button, the audio automatically move back to allow the student to hear a short piece of audio that they missed.

Some users complained that professor spoke too quickly for them to keep up (i.e. take notes while listening). Many students would often have to listen to the speech for a few seconds, pause the Podcast, write down a few notes, play the Podcast, and repeat this process until they had captured what the professor had said. One user liked to copy some bits down word-for-word, which was problematic with a fast-talking professor. Others complained that they had already been to lecture and just wanted to review the lecture quickly; they wanted to play it back at a faster speed, listening for anything that stands out or that they missed. It's important to note that this functionality is currently possible if the user downloads the Podcast as an MP3 file, then opens it in a program that supports variable speed playback, such as Windows Media Player. However, few of our interviewees knew about the download feature, and even fewer used it. We decided to include in our design a tool that would let the user control the playback speed (by adjusting the speed while maintaining pitch) based on these pieces of data. This feature allows users to spend less time trying to manually control the timeline and supports a method of listening that is beneficial to all users.

Finally, the widgets aspect was a relatively large design area after the affinity notes, but we decided to include only a small version in our paper prototypes simply because we didn't have enough data to justify designing a whole widget system; instead of designing a full-fledged widget system, we decided that we would only design a couple until after we had tested them with the users.

Storyboarding

The process of storyboarding helped serve as a useful bridge across the gap between the high-level and abstract ideas of visioning to the low-level, more concrete ideas of prototyping. In addition, it helped narrow down our design by allowing us to filter out any overly-ambitious ideas and include ideas that were fully supported by the user data. While we had the overall themes that we wanted to focus on (as well as the main ideas of what interactions the system should support),

we needed to design the actual interface that the user would be presented with to control the new system. This was accomplished via storyboarding [Storyboarding, section 8].

Because we had fallen a bit behind in our schedule and were trying to catch up to get back on track, we decided to do the storyboarding process individually rather than together as a group, especially because we had trouble coordinating additional meeting times. Instead, we collectively made a list of interfaces that needed to be designed and interactions that needed to be designed for, and used this as the basis to guide our storyboarding. From there, we each set out to create our own version of how the interfaces and interactions should be according to our data and visioning. Our storyboarding comprised the following interfaces and interactions: the professor giving a lecture and capturing the slide data for the Podcast (such as marking timestamps, using a digital pen, etc.); a student, guest, or non-student member logging in to the Podcast page; the welcome screen that all users were greeted with; a page showing "Your Classes," the currently enrolled classes, for UCSD students upon log-in; a page showing "All Classes" for guests; a student finding a course in the "All Classes" page; a student choosing a single lecture from a course's page; an overall view of the main Podcast listening page; a user trying to jump to a particular slide within the lecture; a student tagging a slide; a user rewinding a little bit because they missed something the professor said; and a user speeding up or slowing down the Podcast because the professor speaks too slowly or too quickly. See the Storyboard section for a complete collection of the storyboards we created.

Upon completing our individual storyboards, we brought them in to one of our meetings and successively presented them to each other, highlighting the main features that each had. After completing this sharing process, we distributed eight Post-it notes, to be used to vote for features or aspects of each storyboard that we liked, to each team member [Storyboarding Photos, section 8]. In a session that allowed us to both examine in detail the interfaces and interactions that people

had designed, as well as praise and critique aspects of each, we wrote short notes about several features that had been included on the storyboards.

Next, we held a session as a group to discuss some of the things that we had voted for. Paying particular attention to the aspects that had a large number of votes, we compiled a list of notes that highlighted some of the most important design features. Based on these notes, we drew up new designs, incorporating aspects of each member's original storyboard. As a group, we were able to discuss the more detailed aspects of the interfaces, such as individual button placements, etc. We had some lengthy debates regarding several features, such as how to display the entire list of slides; some members wanted the slides only on the right side (and not at the bottom), while some favored having the slides in two places, with each showing different aspects. Ultimately, we decided to include the slides in two places, deciding that we would leave it to later user data to determine whether the design was ideal.

In addition to having a column showing all the slides, we decided to have a section above that displays information for the current slide. More specifically, it would contain the top tags for that slide, but would also allow the students to vote for or against these tags. In addition, the "Current Slide" pane would include a text input box that would allow students to enter their own new tags. We wanted to make it easy for students to tag because we expected that few students would go out of their way to tag slides; thus, we made it always present and easy to access, which we hoped would encourage students to use it. This was a major conflict for some of us in the design process: some users might prefer to hide the tagging feature, but this puts the tagging feature at risk; without people tagging it, the system becomes less functional when less students use it, so here we opted to sacrifice user control to promote the use of tags. If we hid the tagging ability, we feel that few users would click an extra step to add a tag.

Our next step was to translate our combined storyboards into higher-fidelity wireframe models using GoMockingBird.com. These wireframes were better able to illustrate what the design would look like (as opposed to drawing them by hand), and because they were digital, they were much easier to edit when we had things to change. Eventually, these wireframes served as the interfaces for our paper prototype interviews.

Through storyboarding, we were also able to solve the problem of synchronizing the lecture slides with the audio. We decided that the best way to accomplish this was by creating a PowerPoint plug-in that would capture slide changes and timestamps while the professor is giving the lecture. In addition, the professor (or the plug-in, automatically) would export the slides as image files. Together, the timestamp and image files would create the synchronization. We also storyboarded alternative ideas, such as the professor using a digital pen (e.g. an Anoto pen) to record pen strokes, but decided not to pursue these alternatives as in-depth as our other ideas.

Paper Prototypes and Interviews

One of the most important aspects of user centered design is that it is typically incredibly iterative; that is, an early design is created, then tested among users. From there, features are changed, added, or removed, and a new version is built and test among more users. As the fidelity of the prototypes increases, the product begins to look more and more like a final design. Getting user feedback throughout the process helps keep the product consistent with the needs of the user rather than being based too much on the designers' opinions. While iterative design can be tedious and frustrating, it is essential to ensure a product that caters directly to the users and their tasks.

One type of iterative technique that designers can use is paper prototyping, which involves creating paper models of the interface. While these designs are not interactive (at least in the sense that they respond to user activity), the designer can simulate the responses of the interface to user

activity by introducing new paper elements. For example, when the user presses a button on the first page, the designer can overlay a new paper prototype to illustrate what would happen when the user actually clicked that button in a digital medium. By conducting interviews in this fashion, the users can get an overall feeling of how the process will work, albeit without all the details and direct control of a digital interface.

Our first prototypes, therefore, were the paper prototypes [Original Paper Prototypes, section 9] that we made after creating storyboard and voting on our favorite features of each. We opted to create slightly-higher fidelity paper prototypes in the form of wireframes using the service GoMockingBird.com, which allows users to quickly sketch up more precise layouts of interfaces. We chose to do this because we wanted to make it easier to conduct the paper prototype interviews; with digital wireframes, we could easily print out multiple copies of the prototype. From there, we would conduct the paper prototype interviews using these wireframes and take notes directly on the prototypes, as well as quickly add features by drawing them in or adding Post-its.

In total, we conducted five paper prototype interviews [Prototype Interviews, section 9]. Despite some reservations about how well the interviews would work, we were pleased with the results that we got. Prior to the interviews, we constructed a script [Paper Mock-Ups Interview Script, section 9] that we would each follow to ensure that we covered all relevant interfaces and interactions. The script included interactions such as logging in as a student, finding a particular class on the “My Classes” page, skipping to a particular slide, and adding a tag to a slide. The purpose of our script was to keep our interviews consistent and focused, though we left some opportunities in the interview for the user to simply explore and discover what different actions did. Unfortunately, the nature of our project (i.e. the fact that it contains audio) made it a little more difficult to prototype on paper since these types of prototypes are primarily visual. However, we tried to simulate the experience by telling the user what they would be hearing.

Following the paper prototype interviews, our group met up and discussed findings for each page that we showed to the users. We constructed a list of all the notes that we had for each page [Paper Prototype Notes, section 9]. While users seemed overall happy with the interfaces we provided, they had some feedback that helped us resolve some of the more minor issues.

For example, some users were confused about what some of the buttons did and claimed that they wouldn't know what everything did just from seeing the interface. This is something that is important to consider for future iterations, but this should be investigated at higher levels of prototypes; although paper prototypes give a general idea of how everything works, they are very limited in how much interaction they have, so an interactive version might prove to be a little easier to understand, especially as users explore the interface for themselves. Still, users requested some sort of help feature, perhaps a tutorial or a video explaining the new features that we have included. Again, this would be something important to consider in future iterations.

Another user helped solve an issue that we had been having. We wanted an easy way for the user to control the Podcast and in particular, wanted an easy way for the user to pause the Podcast. Our idea was to allow the user to click on the main slide view to quickly pause the Podcast, rather than having to click on a pause button. The problem, however, was this: how do we show the user that this functionality exists? Until now, our hope had just been that the user would discover the feature through exploration. However, one interviewee suggested that the Podcast page open with the Podcast paused, with a "play" overlay over the slide area. This would show the user that clicking on the main slide area does some kind of action. In addition, it removes a frustration that often comes with YouTube: the video starts immediately, which can be problematic if you're opening a video in a new tab to view later. This suggestion, while minor, was a great example of the kinds of changes that paper prototypes can bring about.

One of the features that we designed in response to our user data was ultimately rejected by the users during the paper prototype interviews. Our user data suggested that the users would use widgets (small "applications" that allow them to perform various tasks, such as searching Google within the window, performing calculations, or viewing a periodic table). This was based on user data that showed that users often opened up new tabs or had materials in their physical workspace to these ends. In our paper prototype interviews, we presented the users with two sample widgets: a simple Google search and a periodic table. We prompted the users to make use of these widgets and were surprised with the results. In general, we found that the users weren't excited about the idea of these widgets. In fact, many said outright that they wouldn't use them at all, including a chemistry student who had previously used a printed periodic table while listening to a real Podcast. Again, the rejection of the widget interface may have been a result of the non-interactivity of paper prototypes, but this is something that could be investigated further in the future.

Other users suggested a feature that proved to be incredibly value to our later prototype. The users were overall pleased with the tagging system (although some said they might not trust others' tags) and liked that they could scroll through the list of slides on the right to quickly see what each slide was about. However, when slide counts reach upwards of 30, for example, it becomes for the user to conduct a visual search of the top tags. Because of this, some users requested a tag search feature to quickly show which slides contained the search query. We took this suggestion into consideration, incorporated it into a high-fidelity interactive prototype, and it proved to be one of the most-liked features. This example shows how users can help add features that are overlooked by the developers or design team.

Beyond Paper Prototypes

After receiving and discussing the feedback from the paper prototype interviews, we gathered all the new design ideas and constructed a new round of wireframe prototypes [The Final

Prototype, section 10]. These prototype changes correspond to the design suggestions outlined above in the Storyboarding section, and this round of paper prototypes can be found in The Final Prototype.

Because of the limitations of paper prototypes and as a result of having a little extra time at the end of the quarter, we decided to make a web-based prototype of the main Podcast page. With the paper prototype, there was much functionality that was left up to the imagination of the user; however, in creating a working prototype, we could better show the actual functionality of the system.

A prototype was designed and coded using HTML, JavaScript, and CSS [The Final Prototype – Slides Page, section 10]. One of the most important features, the ability to navigate through the slides using the side menu, was the first feature to be added, followed by having the slides correspond below and to the right of the main view. Next, the tagging feature was implemented, which led to the implementation of the tag filter feature. Finally, the audio timeline was designed in Flash, and communication was achieved between Flash and JavaScript to get the slides to change at predefined times. As of June 4, 2010, this prototype can be found on the Internet at http://mattsoave.com/random/COGS102C/slide4.html

Though some features are missing (and the prototype uses local data rather than retrieving from a database), it serves to show the basic functionality of the system. For example, we were successfully able to demonstrate how the slides would automatically change when the audio reached certain timecodes. Clicking slides on the right side and bottom would change the view of the main slide, and the users could click the “next” and “previous” overlays to skip between slides. Finally, the users could vote for existing tags, demote existing tags, as well as add their own tags (when a user adds their own tag or votes for one, we send that tag to the top of the list for the user, because it’s probably most important to that user).

Final Design Changes

To summarize, all of our design changes were fully driven by the data we obtained from direct observation of the users. The customized log-in page [The Final Prototype – Log-in Page, section 10] was created to support saved sessions; users wanted to stop the Podcast halfway through and easily pick up where they left off. The "My Classes" page [The Final Prototype – My Classes Page, section 10] was a result of users scrolling through a large list of classes, even though they needed to find the same class each time; by showing the users' enrolled courses, we can eliminate this wasted time, while still providing the possibility to browse other classes through the "All Classes" page [The Final Prototype – All Classes Page, section 10], if desired. The page for each course has been completely revamped [The Final Prototype – Class Page, section 10], with added information to inform students exactly what each lecture was about. The professor may add a title (so the lecture is listed as more than just a number and date), and students can contribute appropriate tags. In addition, the lectures are divided in a more logical way (according to week), and each lecture contains a progress bar and checkbox, allowing the user to keep track of what they had already viewed.

The slide page [The Final Prototype – Slides Page, section 10] has also been completely redesigned to support more than just a single audio timeline. The slide view resulted from students' use of PowerPoint slides alongside the Podcast, and the synchronization was a response to students not being able to follow along manually and wanting to be able to skip easily within the Podcast. The tagging functionality was based on students' desires to know what each section of the Podcast was about and to be able to quickly find a desired topic. The replay functionality was created to solve the problem students had with skipping back small distances in the timeline, and the variable speed was a result of students complaining about the speed of professors' speech.

DISCUSSION

Overall, following the development and coding of our prototypes, we came to a couple of conclusions regarding the design of the Podcast system. Our research indicated that students are dissatisfied with the current system and run into several recurring breakdowns. Three of the primary issues include scrubbing, locating material, and working in conjunction with other class material. Our design was built to solve these problems. The synchronization of class slides and audio served to put class materials in one place so students don't have to worry about switching pages. The redesigned layout and indexing capabilities were well received by interviewees and makes it far easier to locate specific slides and topics. The reorganization of Podcast navigation with the implementation of larger controls and a "replay" button fixed problems regarding pausing and skipping through the Podcast. Overall, our new system was well received by our user group.

While we believe that many of these features we integrated are essential to the improvement of the system, we built this prototype with graceful degradation in mind; that is, if only a few features were implemented, the users would still benefit from a more usable interface. For example, if the students in one class don't end up using tagging, then it is still an improvement being able to have the audio synchronized to the slides; if the professor chooses not to use the timecode plug-in for PowerPoint, then it's still an improvement for students to be able to see the slides and control the audio in the same window; even if the professor chooses not to include the lecture slides, then it's still an improvement because users can adjust the speed and press the replay button.

The next step in the process would be to develop a working, higher fidelity prototype, integrating what we've learned from our prototype interviews into a more complete design. This would include a styled and coded Podcast viewing page, as well as a working PowerPoint plug-in

that would test the viability of uploading time codes. This would serve to gather information about the workflow of the entire process, from both the professor and student's perspectives.

There are a couple of design issues and user models that we would consider pursuing if we were to continue research on this topic. One user group that we chose not to focus on was the non-UCSD student. Although our preliminary research and interviews with the professor and ACMS indicated that there was a large user population of non-UCSD users, we decided that it would be more effective for our project to focus on the largest and most available user set, the enrolled student, especially since we would have trouble contacting non-UCSD users. However, if we were to continue to develop this design, it would be important to integrate design ideas related to this type of user. Some ideas may include a log-in system where non-students could save their favorite lectures, or have limited access to the tagging and indexing features available to students.

One conclusion that arose from our paper prototype interviews was the general dissatisfaction with the "widgets." Initially, we felt that due to the prevalence of multitasking, a widget based interface would garner support from students. However, after prototype interviews it became clear that users felt uncomfortable with this type of interface. It would be worth investigating the underlying cause behind this to see if widgets simply aren't an option, or could perhaps be integrated in a more usable way. It should be noted, however, that this rejection may be a result of the low fidelity of paper prototypes.

Another user-based issue was the attitude of professors towards Podcast use. Our interviews showed that many professors are wary of the Podcast system because they are concerned for class attendance. Should the Podcast system become too "good," classes may continue to drop in attendance. Further development might merit a system in which students are given incentives for continuing to attend class, or perhaps an alternate incentive for participating in the online community through discussion forums and tagging.

A feature more related to our prototype would be a help/introduction tutorial. While the interviewed users were generally satisfied with the new features, they had some initial trouble understanding the new layout/features etc. This is to be expected with any change in an established system, and could be ameliorated with a short tutorial overview that goes over the options and new features of the redesign.

Overall, we feel that our changes could drastically improve the effectiveness of Podcasts and turn them into a genuine study tool to allow students to review important course material. Our research revealed key breakdowns in the current system, and our prototypes included features that served to lessen or remove these problems. Users had a positive reaction to the improvements and workflow redesign and we believe that through our contextual design process, we built a product superior to the original.