

# Are Designers Good Applicants for Low-Resolution Image Capture with Automated Content Metadata Annotation?

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## Introduction

As members of the Garage Cinema research group with Professor Marc Davis, part of our research is working on creating an application, which allows for mobile image capture and faceted metadata annotation on a mobile phone. We have developed an initial prototype and are in the process of exploring different usage scenarios for this functionality.

This report presents the results of interviews of designers we conducted in order to explore the design patterns of designers and their use of imagery. Specifically, we wanted to find out if different types of designers use imagery during their concept generation phase – *Do designers use images as inspiration? Would facilitating image capture and image browsing aide in the design concept generation and reuse process?*

We decided to interview designers of all types of disciplines, focusing on a selection of architects, interior designers, construction surveyors, mechanical engineers, and artists. Based on the work that Marti Hearst is doing with Flamenco[1], we suspect that designers will be key target users for future applications built on media asset management through image annotation, browsing and searching. We wanted to explore these users more and determine, if in fact they would be prime user group that could benefit from this functionality.

## Background

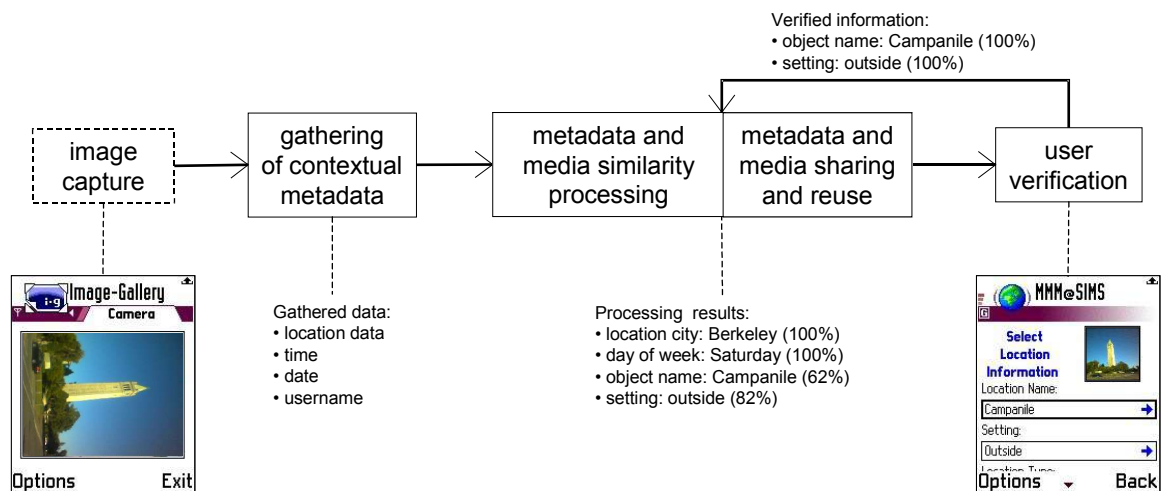
The problem of imagery asset management is a large one that influences many different professional disciplines. One solution for automating imagery management is to have information about the image's contents in a computer-readable form – media content metadata. Content metadata describes what the is subject of the image, for example, the people in the picture, where the picture was taken, or what action is taking place in the image. Also, it can describe the semantic structure, such as who is manipulating the object through the action. In that way, as research on media metadata has shown, people can search and browse for such content-based, semantic information [2][3], such as browsing all the pictures of my brother, pictures of a man in a red shirt who is running, and so on.

Should imagery content metadata be readily available the problem of asset management is alleviated. The solution is easy, but as usual, the mechanism by which to introduce and leverage the solution is not. The largest obstacle why unorganized imagery has not been removed stems from the difficulty and effort it takes to annotate imagery. The process of

annotating a photo is often too time-consuming for individuals. Simply put in most cases the immediate cost out weighs the immediate benefit and often users do not consider the longer-term life cycle of the image. In the current state of media asset management technology, professionals in large media production departments remain having to sift through long titled image files to try to attempt to locate images that will satisfy their requirements.

The integration of the cell phone with digital camera technology provides a more powerful image capture device that can be used to address the laborious process of media asset management by leveraging annotated images. Much of what used to require long tedious human input can now be automated. Mobile Media Metadata (MMM) [4], a project at the University of California Berkeley lead by Prof. Marc Davis, explores the idea of automating image annotation at the point of capture. As is described below, media asset management can be addressed by storing, browsing, and searching annotated images/media in a faceted metadata framework.

By leveraging information gathered automatically on the capturing device, such as time, location, and photographer's identity, the MMM framework[4], as shown in figure 1, uses similarity matching algorithms to guess the content of the image. The user is then presented with the system's guess and is asked to verify the contents. Keeping the human in the loop, after basic metadata has been added, the system adds any additional metadata stored about that physical object and the user is asked to confirm the total summary of the photograph. Once confirmation happens, the image and its annotated contents are stored together in a remote repository.



**Figure 1 Mobile Media Annotation Process**

The remote repository is built on a faceted metadata framework. The advantage of having a faceted hierarchical structure becomes apparent in the search and browsing functionality. The facets provide orthogonal views of the same image, which can be

addressed separately. The hierarchical structure contained within each facet includes information about metadata and their relations, for example, to what country does a city belong. (A study by [5] indicated that a faceted hierarchical structure was preferred when browsing and searching for images.)

Browsing and searching then becomes a much easier task. As the Flamenco interface, designed and built by researchers at the University of Berkeley led by Professor Marti Hearst, reveals, image searching and browsing based on faceted content metadata is preferred [5]. It proves to be an easy mechanism by which to find and locate specific imagery or collections of similar imagery once annotated.

Flamenco was designed and built for browsing and searching large sets of faceted metadata structures. An image collection to which the Flamenco framework was applied to is the school of architecture image collection. Architects utilize a large amount of imagery in the concept creation phase of their design process. As Ame Elliot points out this usage can fall into four categories 1. Monitoring – monitoring the current trends. 2. Retrieve Known – retrieving a specific photo. 3. Background – gathering background knowledge of a project by looking at other designs. 4. Inspiration – generating new unique designs sometimes is aided by looking at old structures. By combining this imagery with sketching, drawing, and collage processes architects create their initial design concepts.

Flamenco proved to solve the initial problem found with was architects' – the need to share or reuse this imagery. The task of finding a particular image in a vast library of unmarked imagery quickly became daunting to most architects studied. Most also contained a personal library, however, even with correct access a colleague left interpreting their individual organization pattern would have little value for their collection. Instead, they often utilized copy machines as tools for duplication, sharing, and reuse. This, however, became very laborious as their scale requirements changed or became defined over time.

Flamenco's solution was more accessible and time saving than the photo copier. Flamenco provided a web interface to the school of architecture image collection that allowed users to browse and search the faceted metadata structure. However, Flamenco has not addressed the time involvement of the annotation process to produce an image containing correct image content metadata. MMM offers a seemingly good alternative to produce correctly formatted and annotated images ready for browsing and retrieval. However, MMM has not taken into consideration why a generic user would be motivated to use such an application. Architects' image use for concept generation then seems would be a very applicable user motivation for automatically assigning images with content metadata at the time of capture.

## **Hypothesis**

Considering both these technologies we were curious about the overlap of their strengths and weaknesses. The two seem to be mutually beneficial, both filling in gaps the other

has not addressed. On one hand Flamenco seemed to provide a good way of searching and viewing a large number of photos, for a specific group, however left the problem of annotation unexplored. While, MMM seemed to harness a good solution for rapid annotation, but it's usage lacked motivation.

Expanding from Flamenco's original premise, we hypothesized that designers of all types would be good candidates for an application which extended MMM's technology and leveraged Flamenco's strength. Our original hypothesis was based on the idea that designers, including architects, already use imagery for inspiration and concept generation purposes. Because these are simply conveying an idea or message, they do not need to be high resolution, thus making them a good candidate for current camera phone technology.

Furthermore, based on architect's patterns, we suspected that most designers generate a large number of images which often can be reused to save time on future projects. Sharing these images between designers could only result in more inspiration and ease the concept generation process. Additionally, vocabulary used to share these images is limited considering the specified nature of the trade, therefore sharing images among designers would entail a specified set of metadata, thus making it possible to display this limited set via the small interface of the phone.

We therefore set out to explore the design patterns of different types of designers. We were aiming to learn what their design process entailed, the sources of design inspiration, and in what capacity imagery aided or played a role this process.

## **Methodology**

We interviewed 10 designers and 1 of the original creators of the Flamenco system, who is expert in the use of imagery among architects. The 10 designers spanned many different disciplines. The specialization of the designers was divided as follows: 2 graphic designers, 3 web designers, 2 interior designers, 1 architect (and web designer), 1 industrial engineer, and 1 mechanical engineer. We included engineers and architects, as not to limit the scope of the discipline of design to those whom only create aesthetically driven artifacts.

We engaged in approximately 45 minute long conversations with each designer discussing the different design patterns, methodologies, and processes that they used. We lead the interviews by asking questions (see interview questions Appendix A) which spanned the following areas: background, design processes, storage and retrieval of imagery, inspiration gathering mechanisms, and image gathering process.

We aggregated, summarized, and analyzed their answers (see interview results in Appendix B) to measure if our hypothesis held validity. We discuss our findings and their implications in the following two sections.

## Results

<b>Background and Roles</b>	
Web Designer #1	<ul style="list-style-type: none"> <li>■ Web designer for scholastic department</li> <li>■ Create logos and websites</li> <li>■ Less than one year experience</li> <li>■ Currently enrolled in school</li> </ul>
Web Designer #2	<ul style="list-style-type: none"> <li>■ Worked as web designer and consultant</li> <li>■ One woman show: concept to production</li> <li>■ 4 years experience</li> <li>■ Currently Interaction Designer at PeopleSoft</li> </ul>
Graphic Designer #1	<ul style="list-style-type: none"> <li>■ Broadcast graphic designer with 5 years experience</li> <li>■ Designs graphics that are used for broadcast news, promotion, and news advertisements</li> <li>■ Currently working for ABC news</li> </ul>
Graphic Designer #2	<ul style="list-style-type: none"> <li>■ Broadcast graphic designer for ABC news with 2 years experience</li> <li>■ Designs graphics that are used for broadcast news, promotion, and news advertisements</li> <li>■ Currently working for ABC news</li> </ul>
Interior Designer #1	<ul style="list-style-type: none"> <li>■ Commercial interior designer concentrating on conceptualization, budgeting, and floor plans</li> <li>■ Has worked for other large interior design firms</li> <li>■ More than 4 years experience</li> <li>■ Currently working part time for an interior design firm for commercial interiors</li> </ul>
Interior Designer #2	<ul style="list-style-type: none"> <li>■ Freelance interior designer for the past 3 years</li> <li>■ Residence interior designer</li> <li>■ Approximately worked on 30+ projects</li> </ul>
Architect/ Web Designer	<ul style="list-style-type: none"> <li>■ Over 3 years experience working in an Architecture firm that specialized on biotech companies</li> <li>■ Designed 3 buildings</li> <li>■ Also worked as a web designer for 1 year</li> <li>■ Currently enrolled in school</li> </ul>
Industrial Engineer	<ul style="list-style-type: none"> <li>■ Masters in ME from UC Berkeley</li> <li>■ Senior Mechanical Engineer at Frog Design</li> <li>■ Designs concept models from beginning to production</li> <li>■ 3 years experience</li> <li>■ Currently is working at same industrial design firm</li> </ul>

Mechanical Engineer	<ul style="list-style-type: none"> <li>■ Bachelors in ME from CMU, Minor Engineering Design</li> <li>■ Masters ME from UC Berkeley, with MOT certificate</li> <li>■ Research based work only</li> <li>■ Currently ME PhD student at UC Berkeley</li> </ul>
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**Table 1 Background and Roles**

<b>Source of Images/Designs</b>	
Web Designer #1	<ul style="list-style-type: none"> <li>■ Words/Ideas for website and logos through brainstorming sessions</li> <li>■ Sketches of logos inspired by the client</li> <li>■ Photos from client of previous conferences, web sites</li> <li>■ Sketches drawn free hand by staff</li> <li>■ Google image search</li> </ul>
Web Designer #2	<ul style="list-style-type: none"> <li>■ Google image search</li> <li>■ Designs are abstraction of images</li> <li>■ Provided by client through sketches, PowerPoint</li> <li>■ Existing web conventions</li> <li>■ Photographs by her</li> </ul>
Graphic Designer #1	<ul style="list-style-type: none"> <li>■ Associated Press image repository</li> <li>■ Eyewire, artbeat, Imagebank image libraries on CDs</li> <li>■ Searching Google Images for logos</li> <li>■ Capturing images during photo shoots</li> <li>■ Through faxes, news feeds, motion media</li> </ul>
Graphic Designer #2	<ul style="list-style-type: none"> <li>■ Associated Press image repository</li> <li>■ Eyewire, artbeat, Imagebank image libraries on CDs</li> <li>■ Searching Google Images for logos</li> <li>■ Capturing images during photo shoots</li> <li>■ Through faxes, news feeds, motion media</li> </ul>
Interior Designer #1	<ul style="list-style-type: none"> <li>■ Library of manufactures catalogs, brochures, and magazines</li> <li>■ Books</li> <li>■ Sample libraries of finishes, carpet samples, merchandise markets</li> <li>■ While browsing/shopping at retail stores and showrooms</li> <li>■ Extensive finishes library</li> </ul>

Interior Designer #2	<ul style="list-style-type: none"> <li>■ Uses school library to search catalogs and magazines of manufactures</li> <li>■ Customers</li> <li>■ Market merchandize showrooms</li> <li>■ Browsing and shopping through stores</li> <li>■ Photographs on her digital camera</li> <li>■ Photographs space</li> <li>■</li> </ul>
Architect/ Web Designer	<ul style="list-style-type: none"> <li>■ Visiting client for current standards for their buildings</li> <li>■ Pictures in magazines</li> <li>■ Previous projects</li> <li>■ Pictures of models</li> <li>■ Brainstorming sessions</li> <li>■ Image libraries (CDs)</li> </ul>
Industrial Engineer	<ul style="list-style-type: none"> <li>■ Images from websites of competitors in domain</li> <li>■ Catalogs of products both online and offline, magazines</li> <li>■ Photographs of components of competitors products (during disassembly of products)</li> <li>■ Images from clients of products they like</li> <li>■ Previous designs</li> </ul>
Mechanical Engineer	<ul style="list-style-type: none"> <li>■ Manufactures online catalogs, distributors, specialized manufactures</li> <li>■ From his own experiences and observations in everyday life</li> <li>■ Industry standards and existing products</li> </ul>

**Table 2 Source of Images/Designs**

<b>Sharing of Images/Designs</b>	
Web Designer #1	<ul style="list-style-type: none"> <li>■ Folder that is shared on the network with subfolders for projects</li> <li>■ Rarely would images be labeled.</li> <li>■ Ad-hoc file name standard</li> <li>■ Kept 3-ring binder of physical photos</li> </ul>
Web Designer #2	<ul style="list-style-type: none"> <li>■ Images saved under project folders for the lifetime of web site</li> <li>■ No folder storage or file naming scheme</li> </ul>

Graphic Designer #1	<ul style="list-style-type: none"> <li>■ Shared folder for images with a defined structure</li> <li>■ Image filenames contain all the annotation information</li> <li>■ Raw images repository shared for everyone</li> <li>■ Searching is done using Sherlock</li> <li>■ Proprietary file transfer and sharing system between producers and designers</li> </ul>
Graphic Designer #2	<ul style="list-style-type: none"> <li>■ Shared folder for images with a defined structure</li> <li>■ Image filenames contain all the annotation information</li> <li>■ Raw images repository shared for everyone</li> <li>■ Searching is done using Sherlock</li> <li>■ Proprietary file transfer and sharing system between producers and designers</li> </ul>
Interior Designer #1	<ul style="list-style-type: none"> <li>■ Shared through the library of catalogs, finishes, and magazines</li> <li>■ Designs and images are stored in a shared public folder</li> <li>■ Pseudo defined naming structure for file and folder names</li> <li>■ Specification documentation for merchandise</li> </ul>
Interior Designer #2	<ul style="list-style-type: none"> <li>■ Storing images under folder for each project</li> <li>■ Creates presentations to share designs using images</li> </ul>
Architect/ Web Designer	<ul style="list-style-type: none"> <li>■ Images were stored in a binder eventually into a database</li> <li>■ Ad-hoc sharing of personal images between co-workers</li> <li>■ Through email</li> <li>■ File names used to add metadata about the image</li> </ul>
Industrial Engineer	<ul style="list-style-type: none"> <li>■ Image board during strategy design conceptualization</li> <li>■ Proprietary database for sharing images with other departments</li> <li>■ Shared folder with subfolders for projects.</li> <li>■ Sharing images through the design iteration process</li> <li>■ Ad-hoc sharing through designers</li> </ul>
Mechanical Engineer	<ul style="list-style-type: none"> <li>■ N/A</li> </ul>

**Table 3 Sharing of Images/Designs**

## Discussion

After interviewing the 10 designers and one expert in the field, we determined that there seemed to be two distinct design patterns: one which followed individuals who created intangible objects and another which bread physical ones. The web and graphic designers seemed to follow a more loosely define method of design, which often did not include many formalized milestones. The basic methodologies changed from designer to designer depending on his or her company needs or style of design. In contrast interior designers, architects, mechanical and industrial engineers always seemed to follow a very strict six step process.

	<b>Physical Design Process</b>	<b>Non-Physical Design Process</b>
1	<b>Project Research</b> <ul style="list-style-type: none"> <li>▪ gather as much data as possible about the project requirements</li> </ul>	<b>Project Research</b> <ul style="list-style-type: none"> <li>▪ gather as much data as possible about the project requirements</li> </ul>
2	<b>Concept Generation</b> <ul style="list-style-type: none"> <li>▪ gather imagery for design ideas</li> <li>▪ 3D design details created</li> <li>▪ shape and form created</li> <li>▪ design boards created</li> <li>▪ present to clients</li> </ul>	<b>Concept Generation</b> <ul style="list-style-type: none"> <li>▪ gather imagery for inspiration</li> <li>▪ make sketches of design ideas</li> <li>▪ present to clients/ bosses</li> <li>▪ iterate</li> </ul>
3	<b>Component Assignment</b> <ul style="list-style-type: none"> <li>▪ fine tuning designs</li> <li>▪ shopping for appropriate parts which will fit requirements and budget</li> </ul>	<b>Prototype or Implementation</b> <ul style="list-style-type: none"> <li>▪ fine tune designs</li> <li>▪ create prototype if one needed</li> <li>▪ implement the design in other (graphic) cases</li> <li>▪ research appropriate software implementation languages</li> </ul>
4	<b>Documentation</b> <ul style="list-style-type: none"> <li>▪ finish detailing design boards</li> <li>▪ created detailed CAD drawings for creators</li> <li>▪ order parts</li> </ul>	<b>Implementation</b> <ul style="list-style-type: none"> <li>▪ choose appropriate language</li> <li>▪ develop web design</li> </ul>
5	<b>Construction</b> <ul style="list-style-type: none"> <li>▪ physical implementation of designs</li> </ul>	<b>Maintenance and Upkeep</b> <ul style="list-style-type: none"> <li>▪ update site at client request</li> </ul>
6	<b>Monitoring</b> <ul style="list-style-type: none"> <li>▪ communicate with builder to make sure product is being built as designed</li> <li>▪ modify design based on physical restrictions</li> </ul>	

### *Similarities: Early Phase*

Nonetheless, in comparing these two processes and in talking with many designers it seemed as though most of the inspiration/ concept generation phases of the design process were similar. Phases 1 and 2 regardless of the final product seemed to follow a

basic format: research the project requirements and gather as much data as possible about the project needs and then using any mechanism available gather inspirational material to create lo-fi sketches or mockups.

The inspirational material in all cases did not come from one single source. All different designers used many different resources to gather their inspiration. Magazines, books, electronic image libraries, cds, the web, professional photography, and their own cameras were all used amongst the designers (see Table 2). In most cases these resources were so valuable that the firm, corporation, or department even had extensive libraries of where to hold such material for everyone to use. In some cases the designers also had personal libraries, where they stored copies of the shared imagery for themselves.

In situations where the department had physical libraries, these libraries tended to be moderately organized by category and then alphabetically, if organized at all. In accord with what Ame Elliot found, interior designers and architects “didn’t feel that the references were unorganized and did not report having trouble finding images during the early phase of design.” [6]. Although the architects that she talked to used less organization than the designers that we interviewed.

In all cases, though, organization of digital libraries seemed to be a large problem. In most situations images were stored in a design or images folder within the project folder. Images that were scanned in, found on websites or cds, or came from professional photographers were all stored in this same folder. Concept photos, sketches, and production quality images were then often simply delineated by their file names. In one example, our graphic designers held every image produced or gathered in a department access only library. Then once an image had passed approval for production, it got copied to another library. The department specific library was their still storage (concept) library. They commented that often one image would be located in that library three or more times. Their still storage library did not have a specific file name structure, except for to contain the creators name and as much detail as possible about the image. Most firms used this same filename technique to convey as much information for reuse and communication as possible.

However in some circumstances there was a defined naming convention. To continue with our example of the graphic designers, after saving to the still store library, the image was exported in production quality and saved to the production folder, via the same still store name. The image was then passed to a newsroom system, where it was labeled with even more information; again all information was passed through the title field. Here, the image name was appended to a title which contained (in this specified order), a newsroom number, the artists initials, date, show time (for example 5p, which would stand for the 5:00pm news), a content description, and the clipping size of the image (for example bx would mean the upper box that appears just above the news anchors shoulder). The newsroom then stored the images by their associated numbers, for the producers to call upon when shooting the news.

Other firms also added additional metadata for production quality imagery. For example the industrial designers had an additional system which allowed sales personnel to search

for high quality critical photos for marketing and sales purposes. After the project was complete many photographs would be taken of the final model, this also included high-quality still exports from CAD. Approximately 10 out of the 1,000 total images in the pictures folder within the project would be sent to this system. The images would then be tagged with additional metadata such as name, location, department, and industry.

In cases such as these, where images did get assigned additional metadata it seemed to be only for specific production quality imagery which was being shared with other departments. In these situations, where the photo required more metadata, the image then got transferred to another distinct system all together. In cases that did not require additional metadata, the photo was left in the design or images folder within the project. Our architect explained that when the marketing department was trying to put together marketing pieces they would send broadcast emails to the entire firm telling them which building they were working on and asking if anyone remembers any photos of that project. The project architect would then email the images to the marketing department, even though they still resided in a shared images folder.

It seems in any case, that concept images seem not to be shared digitally. Furthermore, it seems that they rarely follow any annotation or naming conventions, making their reuse and sharing difficult. The main reason simply seems to be time. With images coming from all different mediums, designers do not have time to make sure each becomes annotated with a number of fields of accurate information. In fact our graphic designers are receiving a new system in a couple months which will add more fields for input, when sharing images with the newsroom. When asked if they would fill them out, there was a unanimous “No, we don’t have time. We will most likely still put everything in the title.” Moreover, in reminding ourselves of the purpose of concept images, we see that are designed to serve as a communication of ideas and concepts. As long as they are able to convey this message to the designer their purpose is served. The difficulty as we have seen lies when the communication must be transferred to other non-involved parties.

These non-involved parties could potentially be anyone in the production lifecycle of the product, but not directly involved in the design. For our graphic designers this included producers. For our industrial engineer these entail the sales and marketing divisions. For most designers, this entails other departments within the same organization. However, this could also include other entire organizations all together. By returning to our design patterns previously outlined (FIG xX) we can see that phases 5 and 6 for physical designers lend themselves to this type of communication explicitly.

#### *Differences: Late Phase*

In looking again at the design patterns, we notice the patterns between physical and non-physical designers begin to diverge from one another around step 4: Implementation and Documentation respectively. After analyzing the function and nature of the designers’ positions we concluded upon three possible explanations for the inconsistency in these design processes:

##### *1)Project Duration*

The graphic designers we interviewed worked at the local ABC news station. They were in charge of providing graphics for the daily news shows. Often in “late-breaking news” situations they would only receive 30 minutes notice before air-time to produce an appropriate image which may only air for five seconds. On a normal day they would receive one day notice for production. They simply did not have time for a long process. In contrast, our architect worked for 2 years on one project. To manage all the efforts needed to make the project successful, a long strict process must be followed and time necessary to coordinate all those parts must be build in.

### *2) Lack of Experience*

As Ame Elliot [6] also noted about architects, ones with less experience tended to have a less refined process. In our study two of our web designers were young and had little professional experience and worked for newly born companies or academic departments without many processes yet in place. In these situations their processes were very loosely defined and they were unable to explain the definitive steps to their results well. In comparison, our one mechanical engineer whom also had little experience had an equally difficult time defining and articulating his process clearly. We excuse these loosely defined processes as immaturity in experience and believe that as these individuals grow and refine their processes they will be able to articulate and communicate them clearer.

### *3) Communication with External Parties*

In all situations our graphic and web designers most often completed the project from start to finish themselves. Only in one situation did the designer actually work with internal engineers. In that case the designer was both young and working for a small start-up company without any formal communication processes in place. No one interviewed needed to hire any outside engineers or production assistants to implement a finished design. When we did inquire about this - longer term project situations, such as our ABC graphic designers making video spots or needing video renders from an external production house, loose informal communication processes were still in place. Physical designers on the other hand needed to monitor and check that construction was continuing according to plan. Architects and interior designers were often at the sites for long durations of time ready to be called upon in the case of any unexpected decision needed to be made.

While we recognize both project duration and lack of experience as potential explanations for this difference we do not think they are the primary reasons for this discrepancy. We believe, instead, that the communication with external parties helps to shape the design process for these physical designers. This communication happens mainly in the latter two portions of the design process, which is where we begin to see the patterns between designers diverge.

Physical designers, in many cases, are unable to construct the final product themselves or even within their own company. Often when designing for these types of products the construction phase must be outsourced to specialized companies, which deal only with production of that particular product or product component. The reason this occurs is simply because the cost of production or fabrication is too high for these parts.

Physical designers are then left with the challenge of conveying their thoughts clearly and concisely to experts in another domain other than their own, as well as monitoring that production phase process (Phases 5 and 6: Construction and Monitoring). This clear communication is essential to the life of the product. If accurate communication does not take place at this time, then fatal errors to the product production are likely.

By moving back up the design process to step 4: Documentation, we can see why accurate documentation is essential. Moving yet further we can see why even step 3: Component Assignment would be essential. We can then begin to assess why the process for physical designers must be so clearly defined and followed. It is all shaped around the end goal: product construction - which hinges on a basic communication between designer and production manufacturer.

It is this relationship, between designer and production manufacturer that we believe is the crux of the difference between physical designers and non-physical ones. Moreover, it is this relationship which bears attention for technology such as we are suggesting.

## **Implications**

The communication between these two parties relies heavily upon imagery. Conveying production specifications and ideas is much easier to do in a graphical form. As our physical designers acknowledged they worked for many long weeks to produce detailed CAD drawings to give to the manufactures. Conversely then, conveying the end product intermediate steps should be more easily done through visual stimulation than purely textual ones.

This seems to be the case as well. Our physical designers spoke about their on-site visits during the construction phase. Our architect stated that sometimes months or perhaps the good portion of the year was spent onsite. Often the constructors would need to call upon the architect in times of emergency situations, such as when a design on paper was not building out as initially thought. For example, she mentioned one time where the builder grabbed her just as she was about to walk offsite. "I think you may want to see this" he stated. She walked into the construction site, to notice the brightly colored tiles of her elaborate bathroom design to be overly powerful, obtrusive, and comical. What had looked fun and cheery on paper, in full scale was just not turning out quite right. She then had to sit and sort out how to rearrange the tiles to fit into a compelling design which matched the rest of the house. "The tiles were already bought, so there was no other option. That happens sometimes." She stated. As she stated there is a clear necessity for the physical designer to monitor the production lifecycle closely.

The problem, however, as she continued to tell us, is that sometimes the physical designer is unavailable to be on site. In those situations the builder just has to continue as planned, they cannot wait, for both schedule and budgeting reasons. With this in mind, our architect also told us of internal efforts within her company which tried to monitor the building process remotely through a web cam. In that way architects could be away from the project, yet still monitoring it. The difficulty with closely monitoring the construction

phase, via this means, as she relayed, was that there was only one angle of view – an overall aerial view. Her bathroom tile problem would not have been able to be seen via this view and had she not been their right at that moment, the brightly colored tiles would have been put in place as boisterously as planned. Moreover, the only way this mechanism would ever suffice to capture all necessary data would be to set up multiple cameras in every room of construction.

The phone cameras however are easily portable and able to be easily carried with individuals. As builders move around a house or other constructors assemble their products, they could easily capture their own progress and enter attributes about the detail of the photo, such as room, northwest corner or perhaps headset, top view or bathroom, bathtub tiles. In this way the remote communication is not only limited to auditory or textual, but graphical images accompany a textual description. Images could be sent so that the physical designer could easily monitor the progression of their designs from all angles of capture and because the image is being used as a communication mechanism the low-resolution does not impede the main message, but rather enhances it. They could monitor it daily, after work for that day has been completed or real-time as construction is occurring. This device, with a built in telephone, arms itself well for emergency situations, as well. The constructor could easily call the designer and ask them to survey the images just sent. The designer could then monitor those images, wherever they may be, either via a desktop PC, PDA, or their own phone. Appropriate action could then be determined. While we recognized that this does not alleviate the total necessity for physical designers to remain onsite, we do think it allows for additional freedoms and by far enhances this essential communication line.

As we have just outlined all physical designers seem to follow a similar process. Because of the physicality of the products, form, size, shape, color, dimension, and texture all must be communicated accurately. 3-dimensional drawings and renderings are the easiest way to convey these attributes before building has begun. Therefore in the construction phase 3-dimensions depictions should also be the easiest way to accurately capture progress. Digital photography is a very cost efficient way to capture 3-dimensions and display it in two. It is the nature of the physical objects that our physical designers produce that lend themselves so well to this kind of technology. (One could argue that software designers follow a similar 6 step processes, however since they do not produce physical objects their work does not lend itself well to fit this kind of image capture monitoring.)

By focusing on the later portion of the design process, instead of the early phases, we have learned about an essential relationship, which is often overlooked. Because of the importance of accurate communication between physical designers and their constructors we believe that mobile image capture with associated content metadata at time of capture could easily be used to enhance this communication process, thus easing the design process and becoming an essential communication vehicle.

## **Future Work**

- We believe that more courses in design should focus more heavily on this relationship. It is often overlooked and can be the cause for a great number of mistakes in the design process.
- More interviews with more disciplines of design should be looked at to concur that these trends to in fact hold true for all physical or non-physical designers.
- Work on vocabulary gathering should be preformed to obtain a reasonable assessment of the communication paradigms physical designers use to make sure it would fit well into a limited faceted hierarchical structure that could be displayed on the phone.

## **Appendix A – Interview Questions**

### **Questions for Designers:**

#### **Background**

Can you explain a little about your job?  
What is your title and main duties?

#### **Design process**

Can you describe the design process you follow?

#### **Image usage**

Do you use images in your work? How?  
For what purpose? Please explain in detail.

#### **Image gathering process**

How do you gather those images? Where do they come from? Other peoples work? Google? A central database?  
Do you ever gather them yourself?  
Do you take photos for your work? Of what? Where? When?

#### **Storage and retrieval of imagery**

How do you store the images? Where do you put them?  
Are they organized? If so how? By what sort of categories/ methods?  
What type of information is helpful in finding the pictures? What other type would be helpful?  
?Under what circumstances would you be willing to add this information? What criteria would the mechanism have to meet?

#### **Sharing and Reuse of Imagery**

Do you use other individuals photos?  
Do other's ever use your photos?  
Do you share your photos or photo collection with other people? How? Through the web? A centralized database?  
What do they use them for?  
Why do you share?

#### **Inspiration gathering mechanisms**

How do find inspiration? What mechanism do you use?  
Do you use imagery to gather inspiration? Would this be useful if you do not? Why? Why not?

#### **Camera type**

What kind of camera do you use? Digital/ non-digital/ etc?  
Photographic quality? just a snapshot camera or hi-res camera?

#### **Process of taking images**

What do you do with them after? Where do you put them?  
How do you get them off your camera? What do you use them for?

#### **Other people**

Do you know other people who use imagery in their work or designs? What do they do with the imagery? How do they use it? What is their process for collecting or using imagery?

## **Appendix B: Interview Results**

### **Graphic Designer #2**

#### **News Broadcast Graphic Designer**

##### **Background**

He designs images for promotional uses, newscast promotions, newscast graphics for broadcasting, graphics for website, graphics for print material, graphics for vehicles and any sort of graphic designs requested by the station.

##### **Design Process**

The design process begins with receiving a request from an internal customer in the station usually a producer, public affairs, and from the news staff. The request form first goes to the art director who hammers out the details with the customer. Once the requirements are hammered out, an art director comes to them and lays out the elements and due date for the design. After they receive information, then they mock up a few designs and present the designs to the art director who approves or suggest changes. Once there is good prototype it is approved by the customer. Once approved then they do the final touches. One thing to remember about their design process is that the turn around time is extremely fast. A request for an image, requirement gathering, and graphic production can happen in the matter of minutes. This greatly affects the way they leverage images for design inspiration sharing, and storage.

##### **Design Inspiration**

Normally, they are under such a time crunch, that they have 1 day to ½ a day to get the design completed. They need to find images either on the Internet or the associated press graphics bank or through the clip art cds of images that they have purchased. The final design is pieced together quickly. Rarely do they get to sit down, think, and design something from scratch and take the time to find all the pieces that they need. They have to be flexible and use what they find. It is such a fast turnaround that you do not time to shoot a new image.

##### **Come up with the idea - Using images?**

Sometimes when they are either taking shoots for video or during off times, they take images of general concepts such as the capital dome, flag. However, there is little time to really browse many images to come up with an idea. Searching for images is and finding an image that is close to the idea is the process they follow.

##### **Finding designs – with images?**

99% of the time graphics come in on tape from a photographer. or they are usually images of suspects like a mug shot, scans of photographs or 3d image capture using video camera also through 35mm slides or through emailed images.

Other sources of images are through their Associated Press (AP) graphics subscription based service that gives them access through the web to images that are use for news publications. Other services include Eyewire and Artbeat. They also order images or they go and shoot something with a camera.

The types of images they search for are pretty easy to find. They do take stuff from Google. Using the AP to find images takes around two pages of browsing. The image that you find on the AP service are usually very good. Google is the last resource for images since they have been prepared for the web and are too small and in a low resolution format.

### **Storing and Sharing Designs – through images?**

The Eyewire cds are classified by category stored in a shelf. In the AP subscription service, you search using a keyword interface for the object. The images from the AP are low quality and mainly used for news graphics. They store any images that they create or download from the web into a raw image library that is organized by file name. The directory structure is relatively flat with no little constraints enforced. All the information is stored in the image file name. The folder is shared and mounted on the network. All designers have access to the files in and shares. There is a bunch of information encoded in the file names.

They share the completed graphic by placing the graphic into a completed folder. They have an elaborate process to accomplish the file transfer. For special projects there is no archive system at all. Everyone does it their own way in their own manner.

On the news end of things is where primarily they use the server that, they centrally store everything. Everyone needs to access those files.

## **Interior Designer #1**

### **Commercial Interior Designer**

#### **Background**

She currently works part time for an interior design firm specializing in commercial interiors that includes renovations and new buildings. The type of work she currently does is limited to interior design and commercial interior work and little to no customer contact. She has previously been a full time interior designer at other commercial interior design firms of the same size. She works on design projects concentrating on conceptualization, budgeting, working with finishers and work plans, and watching over construction and installation.

#### **Design Process**

Whether it is a new building or a renovation project, the space for renovation is identified as well as the particular type of design needed. Usually you work with a design team that includes an architect, interior designer and client representative as well as the client. When gathering the requirements for the space, the scope of the project is identified: you are given the space floor plans; the scope of the space as far as what the main focus, the type of furniture, the basic functionality of the space, and the programming of the space. As part of these initial process, the designer should find out the different types of functions and the flexibility of the space. The furniture layout, furniture function, and the space finishes depend on these requirements. There is a fair amount of programming in the initial stage in order to setup the floor plans and gather the necessary data. The end result is functional floor plan documents.

The next stage is design development. The resulting functional floor plan document is used to start thinking about the space from a creative point of view. During this stage the designers starts thinking about the space in 3 dimensions and the use of space in color.

After design development, you continue to fine tune the design thinking about the pulling the details together. Once the details are designed at the end of the stage, there is usually a presentation to the client. The presentation contains also the color pallet with the subjects and the budget for the client.

In the final stage, the documentation of the design, the construction documents, and the documentation of the final design are created. These documents include cad drawings, set of construction documents, finished floor plans, and the cost of the project. The architect and contractor begin the building and assembly process. The designer orders the finishes, components, carpet, and furniture are ordered. The contractor depends on the specifications from the designers in order to start to building.

#### **Design Inspiration**

During the scoping of the project and through brainstorming, the design is conceptualized. The client sometimes already has an idea of what type of design they are thinking off or if not understanding the functionality and programming of the space drives the design. They may visit existing client buildings for pre-existing standards based on the function of the space.

### **Come up with the idea - *Using images?***

In the design firm they have a library that contains catalogs with finishes and furniture from various manufactures, with different books of carpets, wallpapers, and finishes. The catalogs contain samples of the finishes since it is very important to see the finish physically not just in a photo. The selections are made based on budget and style criteria for both finishes and furniture. Most designs firm have an extensive finishes library.

### **Finding designs – *with images?***

Ideas for the type of furniture can come by browsing images from the web and by taking and browsing photographs of interesting furniture when at furniture stores. Designs come from the extensive library of catalogs and magazines.

### **Storing and Sharing Designs – *through images?***

Designs are stored on shared drives and backed up to cd. Finding photos is easy because this is part documentation phase. Copies of the furniture images are stored in the respective furniture specification documentation. Images are scanned in if there is no digital photograph but a catalog page. Projects are stored under project folders and sub folder for interiors and sub folder for photos.

Sharing through images would be useful when monitoring the construction and status of the project and during the phase when you are looking and hunting for furniture and selecting it. A punch list is generated that is used to make sure that the contractors have completed all the tasks.

The design library is structured alphabetically using 3-ring binders that are cataloged according to commercial furniture, accessories, industrial furniture, etc.. Items that come in magazines are stored in a file cabinet that is organized by type. Sometimes the picture is gone from a catalog, so she either prints out a picture from web site or receive digital photograph from the manufactured through email.

## **Interior Designer #2**

### **Residential Interior Designer**

#### **Background**

She is a freelance interior designer for residential customers. She works closely with her customers to create floor plans, color schemes, furniture placement, and the overall interior design of residential homes. As a freelance interior designer she has worked in approximately 30 or so projects.

#### **Design process.**

She begins the design process by interviewing her customers to see what their tastes are like. Based on what she finds out regarding their tastes and her own likes she creates presentation boards based on the ideas of what the client likes. She gets samples of fabric, finishes, paint colors and create usually two or three different schemes based on their likes. Most of her customers already have an idea of what they like. They usually have images from magazines that shows what type of design they are thinking about. This helps the designer to have a starting point of where to begin creating possible design solutions.

#### **Design Inspiration**

To find inspiration she uses the school library in order to find all the product catalogs for the various (furniture) lines whether it is furniture, carpet and finishes. Since she is not a big corporation she depends on the library. Once she finds an item or finish in a catalog, she photocopies the catalog page in order to show her ideas. She also takes photographs at showrooms when the client is not with her. She sometimes takes photos when the client is with her at the showrooms. She would do this specially for customers who are hard to please to have them buy into the designs she chooses. This is a good way for her to show her clients what type of items are around.

#### **Come up with the idea - *Using images?***

She uses images to capture ideas when she is at the merchandise showrooms or even when she goes shopping. She uses the images for both communicating designs and getting inspirations for later designs. She stores the images locally on her hard drive only under the project for which she is currently working on. By taking digital pictures of the samples of existing merchandise, she can show her customers the ability to see the merchandise without traveling to the merchandise showrooms.

A major use of her Kodak digital camera was to document the physical space she needed to design in. She normally took at least two to three dimensions of every room and every interesting architectural feature of the space. She stored the images under the particular project which she would currently work in using a basic naming format.

### **Finding designs – *with images?***

She collected images while visiting showrooms at the merchandise mart to see, feel and show the latest in furniture and finishes for her clients. She also uses images from the library catalogs and magazines to give her inspirations of possible designs.

### **Storing and Sharing Designs – *through images?***

She keeps the pictures she captures and stores them onto the hard drive storing them under the project name/client. She uses her own naming convention of the format client\_maker\_style. Sometimes she was able to reuse some of the images that she had taken for other projects. However, she would only keep one copy of the reused image. Due to the number of projects it was not hard to find images when she needed. She had around 100 pictures.

## **Graphic Designer #1**

### **Newscast Broadcast Graphic Designer:**

#### **Background**

She is a news broadcast graphic designer. She designs graphics that are used for broadcast news, promotion, and news advertisements

#### **Design Process**

For a typical project, the work can be building all the graphic elements or build a partial set of graphic elements. To identify the list of graphic elements to complete, there is a meeting with the producer to conceptualize the list of elements to build. Depending on the results of that meeting, you begin creating those elements.

What is a typical scenario? For news graphics or a list of news graphics, the producer writes down what they want on the graphic, they usually give a description of what they want to see. The graphic designer either searches images we bought from clip art providers or the Associated Press or stored images on the mac that were created for previous stories. The supply image library (also known as raw image library) contains images that were created for other news stories and from other the images.

#### **Design Inspiration**

One of the key requirements for news graphics designers is the rapid turnaround of the project. They usually take a day or half day to complete the project. Given the rapid turnaround, the graphic designers have limited time for choosing images. Also the images represent a very literal translation of the subject. Designing for news is a pretty literal process, when creating a graphic element that is a murder graphic you are going to show murder. There is not a lot of artistic or fancy or abstract concepts. You are going to show a literal image that you find using photo disc, Eyewire, Imagebank, artbeat, associated press (anything that is in the news wire) google for logos of companies.

#### **Come up with the idea - Using images?**

The graphic creation process is based mostly on finding the right graphic element from the resources that are provided. Searching the libraries of images is key to the process. However, out of the sources only the on line sources provide some sort searching interface. The sources that are on cd, in the raw image directory depend upon the file searching capabilities of the operation system. On the AP website you can search, but you have to purchase their images. Finding images on the cds require manually loading the cds onto the system, sharing the sources through a shared library folder, then using sherlock to search the image names using keywords.

#### **Finding designs – with images?**

Finding previous graphic elements and images to use in a graphic design is easy. The graphic designer uses the Associated Press and Google on line search interface to find the image. They would only use these images for news broadcast since they are not the best quality. It usually takes around a minute to find the sources that they are looking for. It takes about 4 or 5 pages on AP which is determined by the specific search terms. If you enter George Bush you will get both senior and junior, so you have to be more specific.

### **Storing and Sharing Designs – through images?**

Graphic designers share images they create and find through the resources by sharing them through the raw image library which is a shared folder on the file system. They also share images to the control room through special software using special numbering system to coordinate image naming. The producers can view images used for the past week, but they can not retrieve nor delete anything. They can only see the image. Images who are viewed and used by the producer and control room are given a special number. Each day has a set of numbers. Every week the images are archived, if it is a one time use then they are deleted the others are archived and assigned larger numbers.

For promotion, the process is more video as opposed to still graphics. There are motion clips instead of still images. They are all stored on cd that they can search. The motion graphics are saved in the same sort of convention. The image is too big to keep a copy of it on the hard drive. They are stored in a cd or video tape in the cabinet. You need to look at a table of contents to find out what is in a cd. (these are physically stored on a cd). There is the same approach for the videos that they take themselves through the photo shoots. The log scene describes the type of shot as well as the time entries for the shot. This is a problem of finding out the correct motion image because of a manual and physical process. There is no central location for finding out the contents of video.

Finding images is really cumbersome. Sometimes when there are far too many choices they have to click through all them, it would be great to have a thumbnail. If you use the sherlock, you can not get thumbnail result. When doing news, you have to pick one and go with it since it is only up on the broadcast for 75 seconds at most. For promotion, she would spend more time on finding the correct image.

## **Industrial Designer**

### **Industrial Designer/Mechanical Engineer**

#### **Background**

John is a senior mechanical engineer at Frog Design. He works on designing concept models from beginning to production. The teams are usually made up of a lead engineer and a lead industrial designer. The designer identifies and creates the form and look of the product while the engineer designs the function and implements the function of the product.

#### **Design process**

The design process at FrogDesign is six-phase process. Phase 0: the research phase consists of getting to know the client, the technology and try to understand the market delivery and distribution. Phase 1: concept generation. Designers sketch and engineers think about the layout for the product components. Phase 2: refining the aesthetic concept down to the low level details that are the actual parts for the product and the interaction of those parts. Phase 3: designing the detailed cad model that includes all the components from phase 2 and getting ready for production. Phase 4: Tooling are created for mass production for the particular cad models. Phase 5: the manufacturing ramp up.

#### **Design Inspiration**

In phase 1 and phase 2 of the design process is very ad-hoc. There are no set milestones, but do have some structure. The first step is to create a sketch that has the feeling, shape and form for the product. There are couple of iterations through the sketches and refinement down to one or two designs. For the final design they build a CAD model and eventually a prototype. The discovery process is seeded by initial inspiration from the client. The target consumer also drives the design spaces. The first thing they do is develop a strategy for the design around the consumer. Frog Design uses an image board which consists of a set of pictures of competitors, colors, textures, images that the user likes that define the design space. The strategy comes from the image board. After developing a strategy, the designer generates concepts from the strategy. There is a competitive search of what products are out there. Industrial designers should use the image board and design strategy to generate sketches that position the product in a strategic position.

#### **Come up with the idea - *Using images?***

Images are used heavily when creating the image board used for strategy generation. The images come from magazines, web and also taken during competitive analysis of other products. The design engineers use imagery to record the implementations of the similar products in the same market space. Engineers take the products apart and determine how they are built using images to document the parts and assembly. For each product,

approximately 50 pictures are taken when disassembly occurs. The images are stored in the image folder that is shared by the members of the team.

### **Finding designs – *with images?***

Images are used to create the image board that generates the product design strategy. These images can come from the web and images already stored in their system. Industrial designers are encouraged to do due diligence on competing products to get a feel of the design space in terms of aesthetics and form.

### **Storing and Sharing Designs – *through images?***

There really is no scheme for storing images other than using folders that are shared by the members of the group. There is also no naming convention used other than those that group members create themselves. Images of competing design disassembly are shared across projects mainly through sharing of information through developers.

When a product design has gone through its complete lifecycle, high quality images of the final design are created, stored in a proprietary database and annotated by adding meta tags and a descriptions. They annotate only the most elegant and critical images of the final product design. These images are used for marketing, sales, and catalogs.

## **Web Designer #2**

### **Web Designer/Use Interface Designer**

#### **Background**

She has done a fair amount of web master and web site creation work usually for small organizations that can not afford a really fancy website or team. She tends to be a one woman show. She tries to put up something that looks professional but relatively simple. She has done consulting work and also internal consulting within companies as a salary staff member in the areas of the knowledge management that pertains to the social aspect of projects and systems. She is a designer for peoplesoft where she is looking at the user perspective and trying to bridge that gap between the user experience with the product and the developer and strategy goals that are guiding the future interface of the product. In some cases the user goals are not well aligned with the developer and strategy goals.

#### **Design Process**

At the very beginning, she figures out the client needs and gathers requirements through one or several interviews. She begins using an information architecture approach to spring board the generation of requirements. In this approach, she tries to understand the different sections that their website is divided into. She proceeds by interviewing them and understanding what is the vision for their website but are unable to articulate. She tries to flush any tools or requirements for tools that are either not necessary or that should use a different tool.

Using input from the client, she draws using pencil and paper sample designs of the website and presents them to the client. Once she has a good idea of what the client wants, she then creates a couple of quick prototype websites using tools like dreamweaver and presents and iterates through the designs. This allows the client to contrast and compare candidate designs.

#### **Design Inspiration**

Since she does not feel she has the artistic designer skills, she draws from exiting web conventions, looking at competitive designs and genres in order to get a sense of the type of elements that stand out. She is strong experience with due diligence and competitive analysis of competing or similar sites to gather design elements that she might be able to borrow and build upon.

#### **Come up with the idea - *Using images?***

She does not use images from someone else directly in her designs. She uses images she finds mainly through google as a way to identify the aesthetic characteristics of the design space. For example, she searched for images of pushpins to create an icon. She choose an image that had the qualities she was looking for and then proceeded to use it as a template. She then abstracted out those qualities using photoshop and created the icon.

She uses images to get the aesthetic qualities and archetype representations that she likes. She compares the images for a particular object and identifies those that she likes. Those images are used to inspire the basic aesthetic structure of her final design.

### **Finding designs – *with images?***

She generally uses google search to find images either for templates of the design space that have the aesthetic qualities she is looking for and to find images that are a representation (an archetype) of what she is looking for. The logistics of the image she can modify and work with under photoshop or illustrator and she usually always does. Therefore, she does not search on the logistics of the image. She does not mind browsing through a large number of google pages as long as she finds the image with the qualities she is looking for.

She does use her digital camera to take images she is going to use on the website. Since she does not like to use other peoples images, she acquires her own with a digital camera. She takes around 30-40 images when she does do this. She also takes many more that she deletes if they don't meet the criteria she has defined for the image. She then touches them up in photoshop to get them ready for the website.

She does not browse google images for random ideas or for inspiration. She does however find inspiration through sites she visits. When she finds a site she likes, she has her own favorites folder that she saves the url in.

### **Storing and Sharing Designs – *through images?***

She saves the images for the lifetime of the website and stores them in the project folder for the web site under the images folder. She stores the image in order to use when she iterates the design of the website, however, she rarely reuses the image for other websites. She does not have a general design folder that has the images she has created and so finding the images means searching all the project folders and the related images folders.

She has a large set of images that are contextual to the project. She does not have a cell phone with a camera that she could have used to take photos of muni buses and car. She would definitely add some sort of data that she had marked as good. If she could have a software product that could search her hard drive and find out some information about it she would definitely use it. She would still store them in the projects that she stored them in and use the software product to find her images. If she could for her images by type, date, and usage. Tagging images with metadata is too much effort. If data could be gathered automatically from the image then that would help out.

## **Architect/Web Designer**

## **Architect/Web Designer**

### **Background**

She worked for an architecture where her projects consisted of overseas projects and presentation work, sketches, layout type of spaces, and creating constructions drawings. Last architecture firm she worked at ranged from 50-60 people and its clients were mainly biotech companies. Overall she designed 3 buildings while at these companies.

She has also worked as a web designer while a small startup and while at a graduate student. Over the summer, she worked at Autodesk as a product designer and usability designer where she helped designers to generate, create prototypes and ways of testing. Generated presentations for customer validation. She generated the presentations for validation.

### **Design Process**

As an architect she worked on interior projects for buildings whose clients were mainly biotech. The process started by the principal interfacing with a company manager to find out about branding and what the company is about. The architects then come up with high level concepts about the design. For example, a young new biotech company wants open spaces, public spaces. This is some of the results of the initial meeting with the principal. In this example the architects would come up with an organic scheme, used pictures of different spaces from magazines to find out what they might like. In this way this provides a better idea of what they might like. Next, they would generate 3 concepts and present them to the principal. The process was:

- design conceptualization

- design development

  - generate set of drawings

  - presentation

- design construction documents

  - specify materials

  - colors

  - in order to generate a building permit

Once the building of the project began with the initial CAD drawings and floorplans, the architect would have to be situated on site to watch the contractors and builders build everything. An end result of this process is the inevitable design on sight. This requires the need for coordination between other disciplines on site. When it is done then there is a sign off period to verify and check off changes made to the original plan.

### **Design Inspiration**

**Come up with the idea - Using images?**

Design inspiration came from many sources. Visiting the client or finding out what type of buildings they are currently renting could gather inspiration, or the type of buildings in general the organization likes. Another approach is showing them cutout

### **Finding designs – with images?**

As mentioned above, images came from different sources like previous projects, by requesting them through email, pictures in magazines that meet the goals of the principal. So image aid the inspiration and came from following sources:

- pictures in magazines..
- pictures of other projects they had done.
- pictures of models
- 3D models...

Pictures from a professional photographer of completed designs from the company.. associated as marketing material.

### **Storing and Sharing Designs – through images?**

The images were primarily stored in a binder initially and eventually using a database. Sometimes members of company would take their own pictures and share them through an ad-hoc undefined process.

There were only a set of folders not a real database which meant one person new how to get the person. The file names included the description of the folder and full search of file system were necessary.

As a web designer, she purchased cds of images for the website. CD contents were never copied to files just stored in a drawer. Used google only for personal use not for work..

## **Mechanical Engineer**

## **Mechanical Engineer**

### **Background**

He has a Bachelors of Science in Mechanical Engineering with a minor in Engineering Design from Carnegie Mellon University. He has a Masters degree in Mechanical Engineering from University of California Berkeley with a MOT certificate. He is currently a PhD student at in Mechanical Engineering.

### **Design Process**

As a designer he does hardware design, software design, circuit design, and mechanical design. Hardware design is mainly the aesthetic design that concentrates on the packaging of electronic products. In general, his design process is mostly ad-hoc starting out with some sort of vague idea of the objective. Using a top down design and a general idea of what they want to do he begins by brainstorming either formally if in a group or informally if it's his own design. For a hardware design, he starts by sketching initial designs on paper concentrating on refining the look and the possible combinations of the components and the arrangement and placement of these components. The initial designs are started on paper and eventually a Computer Aided Design (CAD) model is created. A fair amount of refinement is done on CAD and on the paper designs regardless if it is a group or just an individual project. Before designs are added to the CAD model there is an iterative design process that identifies the designs that are added to a CAD model and furthered created in a physical prototype. At some point he starts making concept models, meaning he starts making physical prototypes using FDM machine or machined parts.

### **Design Inspiration**

When deciding on which parts to use in a particular design, he determines the part or set of parts mainly based on the function the part performs. He knows the function of the part and based on this function he can narrow the part options. For example, a screw needs to be a particular size and a length. It needs to fit in a certain way. Then search for the parts based on those requirements.

For electronic (packaging), the requirements are driven by whatever objectives he has to meet. It has certain functionality, and nice to have functionality, and constraints on the available functionality. He then finds the parts online using the well known component manufacturing web pages, distributors catalogues, or specialized manufacturers. He starts with distributors catalogues (digkey, mastercar) for general components. For specialized components where he needs to find a particular part, he uses the web to find a specialized manufacturer that manufactures that part. Other times they contact the distributor themselves and asked them if they have a part that will suit the needs of the project.

### **Come up with the idea - *Using images?***

Everyone has their own design style. He prefers an organic design style that he uses in all his designs. His style is based on his past experience and his day to day activities. He depends on the initial basic requirements, which are usually rough, of the object. Start thinking about the type of object and its components, location and composition of components.

Sometimes he gets ideas by following existing products. Also, most projects at companies are evolutionary designs of existing projects. Usually, you will use the industry standards to baseline your design.

### **Finding designs – *with images?***

Observe how the people interact with the device. Since his design process is heavily iterative, he finds designs through trial and error by testing constraints in each iteration. When designing a product for his 290 course, his design was modeled after a compass interface and used led to identify the direction. He assumed how a compass already worked and used the affordances of the compass in his design. His initial thought was to use a garment gps design that led him to the LCD, but then energy constraints made him rethink his design. He starts with initial set of objectives and functions, expands his design space, and then gets a bunch of different options weighing them against his objectives and constraints.

He compared compasses on-line, went to the major supply stores and did a review of the compasses that are out there. He looked at the competitors space and the components they are using for their design. A major part of the design process is that marketing and the audience. The audience determine much of the design space. (children is different than the yuppie market)

### **Storing and Sharing Designs – *through images?***

He uses what he already knows to design. If he sees a design, he remembers a product he really thought was interesting or cool and recalls the information and designs when he thinks it would be interesting. He looks at trends in the current designs and leverages their the aesthetics and forms of the current trends and design space.

## **Web Designer #1**

### **Web Designer**

#### **Background**

He is a web site designer for the Boat Hall law school here at UC Berkeley. His responsibilities included designing web sites for the center, conferences, symposiums, smaller events, and capturing media and video for the events. All the design work and software development was done in house with no outsourcing.

#### **Design Process**

In his design process, he follows more or less the same design process whether it is a conference, symposium, event or web site. The process begins by brainstorming for branding ideas, mainly what is the feel and look of the site as well as the logo for the project. Next, he gets a feel from the client on the type of design depending on the project. This step gathers the basic functionality and type of project. He then generates with his co workers initial sketches that try to represent the meaning of the site or project. A set of designs are chosen and then iterated and refined and finally shown to the customer in order to choose the final design. The final design is then developed and implemented.

#### **Design Inspiration**

The logos, images, and concept for the site are all created during the conceptualization process. Each design that is a candidate for the project generally has a distinct approach to all of the above forms. How did you come up with images? Images would be drawn free hand by an undergraduates assistant who would brainstorming ideas and sketches that represent the conference. A tool he would use is to use words that represent and provide the meaning of the conference.

#### **Come up with the idea - Using images?**

Images that would be used either for logos or as icons for the project regardless of the type of project, would be inspired through the brainstorming sessions and focused by the strategy design generated by the brainstorming sessions. Undergraduates would go home and do some more brainstorming about the logos and images they were creating. After a few days, they would come back and present their ideas. Images/logos would be hand drawings that were representations of the project in their minds. The sketches would be discussed a bit and mediate the possible ideas. The final design was driven by the type of conference and what they were representing. By looking at the brainstorming result, new ideas would be generated and other ideas would influence the final design. Sketches would not necessarily resemble, but mainly provide the idea mechanism. Sketches would be hanged up to show who created them. Kept a couple of them, but the artist would keep them to draw a collage of the drawings.

### **Finding designs – with images?**

In general there would be little reuse of images. There would be around 20-30 sketches after the brainstorming and only about 8 – 10 would result in photoshop documents. The documents would be stored under the project folder. Used still imagery on site and sometimes this would be found on websites, but mainly through image capture at the events themselves or clients would have their own reusable images. Images could also be ones he had taken from the year before with the digital camera that were shots that looked like the conference of same speakers.

### **Storing and Sharing Designs – through images?**

Images were stored on his computer shared through shared folders. Anytime there were receptions, images of attendees would take photos. Rarely would the images would be labeled. Labeled in the network drive. This would only include either folders or file names. Attempted to annotate using file properties but not transferable to other operating system. Also kept a paper binder of the physical photos. It was day's work to find a shot when alumni requested them. Approximately 4Gigs of photos and scans (5000 – 8000 shots) were stored in the share. Other source of images was through other photographer who would give them a photocopy of the negatives and then choose the photos to get by selecting the proofs. Occasionally he put the pictures in digital format. His pictures would always be labeled.

## Appendix C Resources

Flamenco:

<http://bailando.sims.berkeley.edu/flamenco.html>

iCrank

[http://icrank.com/cgi-bin/pageman/pageout.cgi?path=/index\\_html.html](http://icrank.com/cgi-bin/pageman/pageout.cgi?path=/index_html.html)

FrogDesign:

<http://www.frogdesign.com>

Ame Elliot:

<http://www.sims.berkeley.edu/~ame/>

O2:

<http://www.o2.org>

DesignAddict

<http://www.designaddict.com/>

Design Engine

<http://www.design-engine.com/>

Case Based Reasoning - Janet Kologner and Eric Domeshek

“Why architects draw” - E. Robbins, 1997, Cambridge, MA: MIT Press

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