Visual Interfaces to Share and Highlight Everyday Life

by

Sinchan Banerjee

S.B., Massachusetts Institute of Technology (2011)

Submitted to the Department of Electrical Engineering and Computer Science
in partial fulfillment of the requirements for the degree of

Master of Engineering in Electrical Engineering and Computer Science

at the

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

June 2012

© Sinchan Banerjee, MMXII. All rights reserved.

The author hereby grants to MIT permission to reproduce and to distribute publicly
paper and electronic copies of this thesis document in whole or in part in any
medium now known or hereafter created.

Author . . . .
Department of Electrical Engineering and Computer Science
May 25, 2012

Certified by . . . .
Chris Schmandt
Principal Research Scientist
Thesis Supervisor

Accepted by . . . .
Prof. Dennis M. Freeman
Chairman, Masters of Engineering Thesis Committee

Visual Interfaces to Share and Highlight Everyday Life

by

Sinchan Banerjee

Submitted to the Department of Electrical Engineering and Computer Science
on May 25, 2012, in partial fulfillment of the
requirements for the degree of
Master of Engineering in Electrical Engineering and Computer Science

Abstract

This thesis explores the design of user interfaces that enable and inspire users to learn about how day-to-day life looks like around the world. We focus on visual media that highlights the subtleties of everyday life and discuss the challenges faced when attempting to design experiences around this type of visual media. Through the researcher-as-designer approach, we iteratively design different experiences through the use of new types of puzzles and novel forms of picture sharing to enable users to contribute and get exposed to the subtleties of everyday life.

Thesis Supervisor: Chris Schmandt
Title: Principal Research Scientist

Acknowledgments

I would like to sincerely thank my supervisor Chris Schmandt and the Speech+Mobility group at the MIT Media Lab for their guidance and support during the completion of this thesis.

Specifically, I have learned a tremendous amount through the design discussions that I have had with Drew Harry during the ideation process and throughout the year as I built and designed Puzzlaef.

In addition, my officemate Andrea Colaço has also given me a lot of guidance and support. She also played some great puzzles on Puzzlaef.

I would definitely like to thank my family and friends for being there for me in this highly action-packed and interesting year.

Contents

List of Figures

Introduction

What does an everyday breakfast look like around the world?

This thesis concerns the design and research of experiences that can tackle such questions about how one can get a glimpse of different aspects of everyday life around the world.

Let us first consider this *breakfast question* and how we could answer this question using resources and tools available in print and on the Internet. Books and magazines would be a great start. A cookbook or culinary magazine of a certain culture would probably contain some pictures of what breakfast in the culture would look like. You could also get similar pictures by looking through Internet publications and even searching through search engines like Google. However, these types of pictures usually tend to answer the *breakfast question* without the everyday part. Pictures found in print and online media publications rarely focus on the commonplace or everyday scenes of life. Pictures in cookbooks look like they have been taken in a five-star kitchen. Pictures found on Internet publications and search engines are usually submitted by professional or amateur photographers to capture some unusual experience in their lives. If the picture is taken by a tourist on vacation, then it will probably highlight a very traditional breakfast — one that a local might not eat daily. If the picture was taken by an aspiring or professional photographer, the breakfast photographs will often be taken for aesthetic purposes and we will not be able to know the story behind each breakfast photograph — i.e. what type of person usually has the breakfast and do they have this kind of breakfast everyday? This is also the problem with photographs in cookbooks. They might have quite a few breakfast recipes, but it is really difficult to figure out who makes the breakfast described in these recipes and whether its breakfast that the locals have all the time.

As a result, publications are not going to help us to get to the everyday aspect of the *breakfast question*. So what options are left? Since the question involves the visualization of an aspect of daily life, pictures were being considered. Videos are another resource that could be used to get to the answer to this question. What types of videos contain scenes of everyday breakfast? Videos that are taken for personal archival purposes often contain views of daily life even if that is not the main purpose of the video. The video might have been shot just to record the visit of a friend or to record the moment when a baby says her first words. Such personal archival videos could indeed contain views of breakfast — breakfast that might be quite ordinary specifically because the purpose of the video is not to record the breakfast. This highlights an interesting property that is shared by all of the methods that can be used to answer our *breakfast question*. Visual media that does contain aspects of daily life usually does so accidentally. The photographer or videographer has some other motivation to capture the visual media. It could be to record and tell a story that they want to to share with others, which is the case for cases of personal or professional archival.

So can we use home videos and photos to answer the *breakfast question*? As the focus of this media is usually not on the everyday breakfast, but rather on some other part or object of the image or video, it is very hard to find this media. Executing the search query of "everyday breakfast" on Google or on social networks such as Facebook results in media that is focused on breakfast, which leaves as with the same problem as we had with print and online media publications. As result, it is hard to find this type of archival media and on top of that, a lot of this media is often very personal so it is often locked away in family pictures inaccessible through public mediums.

Now this brings us to a very interesting issue. Visual media today whether it is in print or on the Internet often does not highlight as-pects of everyday life and if it does, then it is really hard to find this media because the everday aspect is not the focus of the media.

We have developed and designed the Puzzlaef system to explore what kind of experiences can tackle this issue and provide us with an experience that not only gives access to visual media that lets us answer questions like the *breakfast question*, but also facilitates the creation of visual media that highlights everyday life. More specifi-cally, Puzzlaef has been designed as a user experience that meets the following goals:

- Motivates users to contribute visual media that highlights their

everyday lifestyles.

- Enables users from different parts of the world discover this visual media.

- Enables users to understand the differences between everyday life in different parts of the world.

- Help answer the **General Breakfast Question**:

> *"What does day-to-day life look like around the world?"*

Background

This chapter provides a general overview and discussion of the fields of knowledge that this thesis touches upon.

Computer Mediated Cultural Awareness

This section discusses the use of computer interfaces to enhance cultural exchange and cultural understanding. As the General Breakfast Question does attempt to gain insight into a specific aspect of culture, we include this discussion of relevant work in the field of computer mediated cultural awareness.

As can be seen by considering the work of Zeiss and Isabelli-García [2005], Cummins [1997] and others, computer mediated communication has been actively studied as a method of enhancing cultural awareness ever since computer based communication became possible. There were many theories as to how computer mediated communication — especially communication via the internet — would influence society. There were predictions of online Utopian societies where cultural and distance boundaries were broken. One can argue that distance is not an issue anymore in communication. However, the breaking of cultural boundaries or at least the understanding of other cultures is still an issue that has not completely been resolved. As Zeiss and Isabelli-García [2005] show, computer mediated communication can expand cultural awareness and can augment the desire to learn more about a culture. However, most of the research in this area has focused on contrasting textual computer mediated communication with face to face communication or lack thereof. There are interesting properties to computer mediated textual communication such as the ability to have more carefully phrased asynchronous conversations that make it preferable to face-to-face communication in certain settings. Yet, other communication forms should also be explored especially because of the language and

cultural communication barriers that often arise when people from different parts of the world are conversing using text alone.

Photo Sharing

Pictorial communication is an especially interesting alternative. Not only does it remove many cross-cultural language and communication barriers, but as research from Miller and Edwards [2007] and McDonald [2007] show, picture based systems in real life and on the Internet on sites such as flickr.com offer interesting ways to communicate between individuals and within communities.

Telling Stories With Pictures and About Pictures

Photo-sharing has classically revolved around either sharing pictures via the "Kodak Culture" or via a style of sharing that we refer to as the Photo Exhibition approach. The "Kodak Culture" style of photosharing was first described by Chalfen [1987] where he discussed the home mode of sharing where photographers would take photos and share them with friends and family. When sharing with friends and family members, the photos would not necessarily have much meaning without the stories that were told *about*them. These stories have relevance with the people that they were shared with and a random person would not find the photo relevant and would not be able to connect with the story by looking at the picture. The Photo Exhibition approach is a style that is best exemplified in Photo Blogs — Internet blogs where the posts are photos. As McDonald [2007] mentions, these photos are mostly around the aesthetics of the photography and as such sharing via photo-blogs resemble the style of interactions seen in photography exhibitions where the work is judged on the basis of the goals of traditional photography.

Cameraphone Pictures

With the advent of photosharing sites such as Flickr and lightweight connected photography capture devices such as cameraphones, new types of photos are being shared and stories are interacting with these photos in new ways. As Ito and Okabe [2003] points out, with the advent of cameraphones, users have started taking photos of normal objects and events. This is very interesting as it starts serving as a style of photography that captures the everyday scenes that this

research is focused on. In contrast to the "Kodak Culture," photographers are telling stories *with* these pictures instead of *about* these pictures [Miller and Edwards, 2007]. This is a fascination observation as it helps us identify a style of photosharing and story telling that has not really been studied before. Photos of life events and objects have been shared with familiar people and stories *about* them have been told. Impersonal photos have been shared with random people for the goals of traditional photography. We feel that exploring the situation where "Kodak Culture" style stories are told to random people will enable new interactions and new problems to be tackled — i.e. Telling stories *about* pictures with unfamiliar people.

In addition, photos taken from cameraphone were often shared face-to-face on the screen of the phone [Kindberg et al., 2005]. Prieur et al. [2008], Van House [2007], and Kisilevich et al. [2010] have studied the different styles of interactions that happen on photosharing sites such as Flickr. As there is a mix of "Kodak Culture", photography exhibition, and cameraphone photography on these sites, it is helpful to study a site that is focused on the everyday cameraphone pictures that we are interested in for our research. Instagram — a cameraphone application that allows users to take photos, apply artistic filters on them, and them share them with a community of followers — is an example of such a site. In addition, the ability to use artistic filters on the application encourages users to submit photos of even more mundane aspects of life than a generic cameraphone application because the filters allow users to become amateur photographers and as such, inspire them to capture any scene that they find appealing in their life knowing that filters can potentially transform them into beautiful photographs.

Instagram Photography

Hochman [2012] has done some very interesting visualization work with large sets of Instagram photos. By collecting photos from Instagram over a significant time period and filtering them based on location, Hochman [2012] has been able to produce visualizations that identify cultural trends in different locations. These trends include color composition, texture, etc.

It provides a very interesting foundation for our research as it hints at the potential of photos taken on cameraphones to identify aspects of scenes of everyday life in different countries. The work of Hochman [2012] is focused on taking current Instagram photos and analyzing them. We have explored the use of Instagram in our

research, but based on preliminary tests, we found that there was a focus on aesthetic exhibition photography on the application even though many pictures on the application did contain different aspects of everyday life. In addition, some of the important visual information contained in photos of everyday life are distorted by the filters available on the application. This made Instagram photos unideal in our attempt to find a resource that would help us answer the General Breakfast Question.

Design

High Level Design Goals for Puzzlaef:

- Motivates users to contribute visual media that highlights their everyday lifestyles.

- Enables users from different parts of the world discover this visual media.

- Enables users to understand the differences between everday life in different parts of the world.

- Help answer the **General Breakfast Question**:

    "What does day-to-day life look like around the world?"

The design explorations of Puzzlaef began with a study of different approaches that could be taken to tackle the access issue that has been brought up previously — i.e. how do you get access to pictures that highlight everyday life in a specific country. The general breakfast question itself is very ambitious as it asks for everyday life in not a single person's life, but in lifestyles all around the world. A decentralized system is more suited for such a large scale goal. In other words, it would be better if users from around the world contributed visual media themselves instead of having a single entity traveling around gathering everyday visual media.

Online photo and video sharing on social networks and media hosting sites on the Internet do achieve decentralized visual media distribution because they enable users to upload content and let others view content either by searching or by following users and topics. Decentralized distribution on these sites happen when users upload interesting content and it is shared and viewable with some set of users. As such, we focused our explorations on experiences that would enable users to upload photos and to share them with specific users on the site. Videos were excluded because the primary goal of this research is to get media that provides a sense of how

everyday life looks like and we find that starting with photos or still visual media is a good starting point.

Sharing Photos

As cultural understanding is one of the main goals behind the general breakfast question, we looked at classical tools for cultural exchange in addition to current photo sharing networks. Penpal style relationships that involve connecting with a specific person in a different part of the world are the basis for many cultural exchange interfaces whether they are computers or through pen and paper. However, Penpal relationships usually involve a lot of written or spoken language. While language might aid in adding to the story behind the pictures that are being shared or in order to explain why something is a part of everyday life, it gets difficult to use language when working on the scale we are considering. In order to get sampling of everyday life from all around the world, we would need to be able to understand or translate between numerous languages. As this distracts from the visual focus of this research, we decided to explore and concentrate on experiences and interfaces that were heavy on visual media and low on text or other forms of language transmission. Another issue that penpal style relationships bring up is that they are usually very involved. This property of penpal relationships of course has the positive attribute of allowing the cultural exchange to feel very personal as you are essentially forming a friendship with your penpal and the hours spent writing letters, emails, or talking to each other on the phone strengthen the penpal relationship. Having this personal feel in the Puzzlaef experience would make the process of answering the breakfast question a lot more fun and engaging. The negative side is that it makes penpal relationships harder to form. Finding a person to engage as a penpal is difficult and even when you do find someone, it takes some time before the exchanges start forming the bond. As we have designed Puzzlaef to be as language independent as possible, we could not incorporate this language based relationship strengthening method.

As such, for Puzzlaef, we explored different ways to incorporate the positive personal aspects of penpal relationships while trying make the Puzzlaef experience more lightweight and language-independent.

The Postcard Iteration

The first design was the Postcard Design. It was in the form of a website interface that enabled very simple penpal relationship that was solely based on pictures — i.e. postcard style.
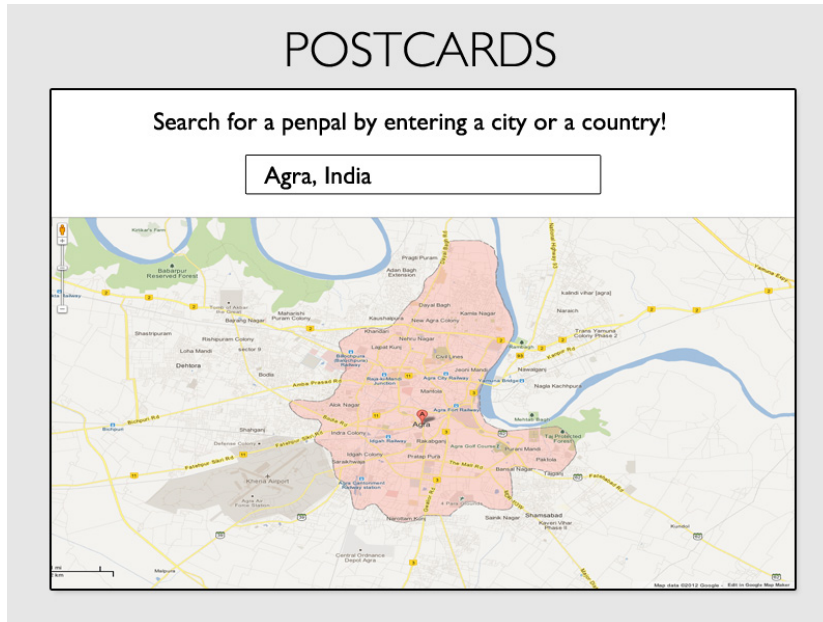

Figure 1: Mockup of the penpal search interface for the Postcard Design. Users are able to enter a location and which potential penpals are from this location.

On the website, the user would specify their location and then they would able to search different locations around the world and see which users were from those locations (see Figure 1 on page 19). The user could then select a user and make them their penpal (see Figure 2 on page 20).

We did not opt for a request and approval system because a user could form multiple penpal relationships and a user could choose to ignore a particular penpal relationship. As relationships are displayed based on frecency metric (frequency of engagement and recency of engagement in the penpal relationship), relationships that are ignored quickly sink to the bottom of the list and are not visible. Then the simple penpal style exchange begins. Users are limited to basically a postcard — a picture and an optional 140 character caption for each exchange in each penpal relationship (see Figure 3 on page 20). The 140 character limit is arbitrary in the sense that we wanted to limit the length of the caption and the size of an SMS or a Tweet on the Twitter social network seemed to be a good size to set as many users have already become accustomed to the 140 character limit as a result of being a Twitter user or an SMS sender. In addition,
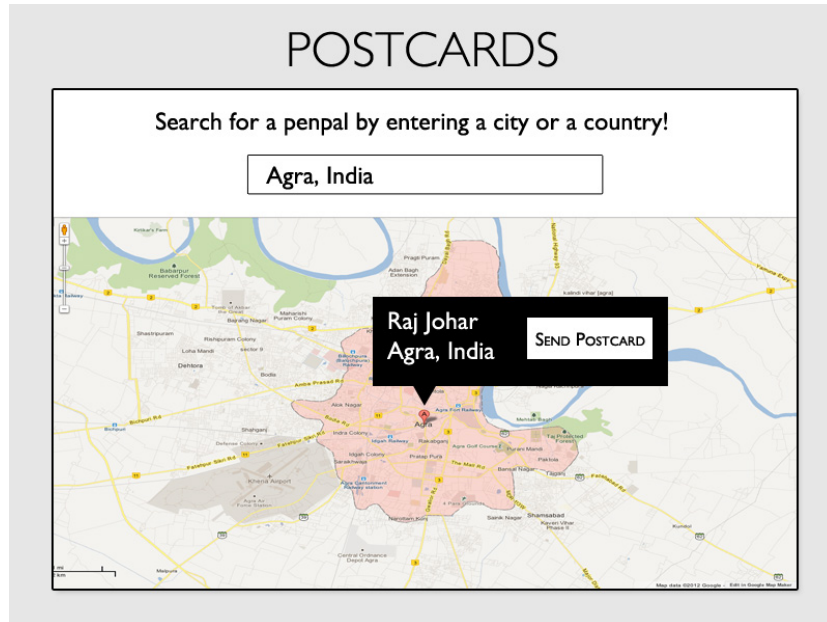
Figure 2: Mockup of the location selection interface for the Postcard Design. Users are able to select a user on the map and send them a postcard.

Figure 3: Mockup of the postcard exchange interface. Users post simple postcards which are made up of a photo and a 140 character caption.

the caption was optional in order to encourage an even more focus on visual media to express meaning of the exchange.

Based on our early interactions with simplified prototypes for the first design, we realized that the simple penpal relationship in the design was very transactional and did not motivate users to continue contributing photos after the first few exchanges. The rules were lightweight, but perhaps too lightweight. Users would share a picture and try to essentially start a conversation. However, as communication is mostly limited to the picture, it was hard to get a conversation going or a story started. As such, the result was just a post of a picture and then a response with a picture that was similar. The conversation would then stop after two to three posts. In penpal relationships, you have multiple topics of discussion in each exchange and these in turn lead to responses. Stories are told and responded to in penpal exchanges and that was missing in this first design.

Puzzlaef 1.0

As such the second set of design explorations were about designing experiences that would be as motivating and engaging as penpal relationships where participants are inspired to continuously contribute and respond to the conversation. This specifically targets the second issue of encouraging users to contribute pictures of everyday life that was mentioned to earlier. As we focused on motivating and engaging ways to have conversations with pictures, the history of photosharing and puzzles turned out to be very relevant. As mentioned in the related work portion of this thesis, the history of photosharing mostly consists of two main types of photosharing — one where friends and family share personal pictures with each other and tell stories about them and the other where random people share public photos on sites such as Flickr. What is fascinating is that these two different types of sharing have never been combined and attempted together — i.e. what can be achieved by getting random people to tell stories about their pictures? Cultural exchange and highlighting everyday life is a great motivation to use this new type of sharing. As we wanted to get people to have conversations with pictures, telling stories with pictures would be a great way to engage and motivate users. However, as we saw with the first design, users were finding it hard to make stories or at least continue them as the communication would only last for the first few exchanges. The interface was too flexible, users did not have a specific question to respond to and having to come up with a random picture for every exchange would

just get boring.

Puzzles

We had to take a step back and explore what stories one could come up with about everyday life. Scenes from everyday life are filled with stories — Where did that Lamp come from? How did that big blue spot on the wall get there? What is that brown cream on your breakfast? It seemed like these scenes consisted of different stories that came together like the pieces of the puzzle of life. The puzzle of life is quite an abstract statement, but it did bring up Jigsaw puzzles and their interesting capability to connect seemingly different pieces of visual media. Puzzles in general have rules and constraints that help and challenge a player when they are deciding what their next move should be. Using puzzles whose rules and constraints encourage the contribution of photos of everyday life provides the motivation and engagement that is required to start forming a conversation that lasts for more than just a couple of exchanges.

Figure 4: Jigsaw puzzles and Scavenger Hunts were the main inspirations behind the new puzzle-based designs.

This is when we named the system Puzzlaef. This name comes from the combination of the words Puzzle, life, and leaf — Puzzle for the puzzles played in the system, Life as the system highlights everyday life, and Leaf as the one dimensional puzzle looks like a plant stem with leaves coming out of it.

There are a lot of different types of puzzles out there, but we decided to focus using concepts from Jigsaw puzzles and Scavenger Hunt style puzzles in order to maintain the focus on pictures from everyday life. Jigsaw puzzles let images be the pieces and lay down some rules as to how multiple pieces can fit together. Scavenger Hunts cause users to hunt for something usually based on hints and usually in real life somewhere. We focused on getting inspiration from how Scavenger hunts get people to look into their day to day lives and find something that matches the hint or the challenge that they are trying to solve as a part of the hunt.

Constraints

Jigsaw puzzles have constraints — the jagged edges — and Scavenger Hunts have rules and hints that help you go from one step to the next. The goal was to use this concept of rules, hints, and jagged edges to develop a design that could not only highlight connections between different aspects of life, but also to encourage the contribution of a wide variety of aspects of life and of course to tell the stories
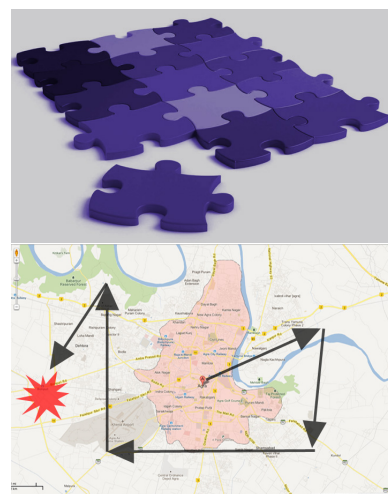
behind each of these aspects of life. We started by taking the 2D grid of the classic Jigsaw puzzle. Either there is a Jigsaw puzzle for each player or one Jigsaw puzzle with the pictures from both players. Having a separate puzzle for each player would be interesting in that it would allow users to have puzzles with only their everyday lives on them. This would allow one to aggregate all of the puzzles from users in a specific culture and get a single set of puzzles that could should the attributes of day to day life in that culture. However, it does limit the amount of input a user can make to each puzzle. If a puzzle is not theirs then all they could potentially do is comment on the pieces in the puzzle and perhaps have some influence on which pieces should fit together and which should not — i.e. some influence on how the constraints and rules are set for each piece. This amount of participation is limited when compared to the type of interactions the two players can have when they are both playing pieces on a shared puzzle and participation is one of the main ways in which to encourage more contribution of everyday life.

A shared puzzle enables players to let their pieces interact with and be constrained by each other's pieces. This brings up the interesting ability to compare and contrast scenes from everyday life in different cultures or lifestyles. The desire relate and match your lifestyle with the lifestyle of another can be great motivation. Comparison and matching challenges are frequently used as a motivator or a challenge in different kinds of puzzles from Jigsaw puzzles to find-the-difference puzzles. As such, we decided to focus on the shared puzzle model where players would fit pieces — i.e. scenes from everyday life — with each other's pieces on the same puzzle.

With a shared puzzle the connections between pieces get another aspect to them. They need to reflect and encourage the comparison two pieces from two different players — something that is similar to the board game Scrabble where moves of two different players can interact in interesting ways. So these connections can be constraints or directions (rules or hints). Constraints classically limit what can be placed next a piece based on some characteristic of that piece. On the other hand, directions of a Scavenger Hunt classically direct or inspire the user to go and do a certain action. In our case, we wanted to make sure that users contribute pictures of as many aspects of everyday life as possible and that users end up telling stories and are able to have engaging conversations with them. The second goal touches upon the issue that we had with the first design and attempts to make the experience more fun and engaging so that users are inspired to continue to contribute more content.

Taking these two goals into consideration, we decided to use properties of aspects of everyday life as the connections or constraints between pieces. Properties of photos of aspects of everyday life are for example:

- A color that is found in the picture

- What part of the day was this photo taken in

- How many objects are in the picture

- What is the shape of the main object in the photo

We decided upon this connection for the pieces because when it is used to replace the jagged edges on a piece, it forms a constraint that pieces adjacent to it must satisfy. For example, if the color property is the connection between two adjacent pieces, then the photos of the pieces must share a common color. Now this works on the constraints found in Jigsaw puzzles, what about the directions of the Scavenger Hunt? This type of connection fortunately also acts as a direction or hint when taken to be a notion of what the next picture needs to contain. Upon seeing a specific constraint, users will need to go out into their everyday lives and be on the lookout for a scene that satisfies the constraint posed in a piece that is on the puzzle.

This raises an interesting issue. When the user goes out to take a picture of a scene from everyday life, which picture or piece's constraint are they trying to satisfy? With a two dimensional grid of pieces as is seen in rectangular Jigsaw puzzles, the user can basically pick any picture that has an adjacent slot unoccupied.

Layout

Based on our user testing with two dimensional arrangements of puzzles, we found that it resulted in some interesting constraints that were occasionally unsolvable — i.e. time of day on both sides of an unoccupied spot and the adjacent pictures are taken in different times during the day. While we could limit the system to a preselected set of properties that do not make the system unsolvable or track the placement of constraints to avoid this situation, we decided to leave that exploration for future work. This is because using a one dimensional system in this research would avoid such unsolvable situations and would enable us to focus the research on how well this type of constraint with a Jigsaw style puzzle setup works compared to the previous non-puzzle version of the photosharing system.
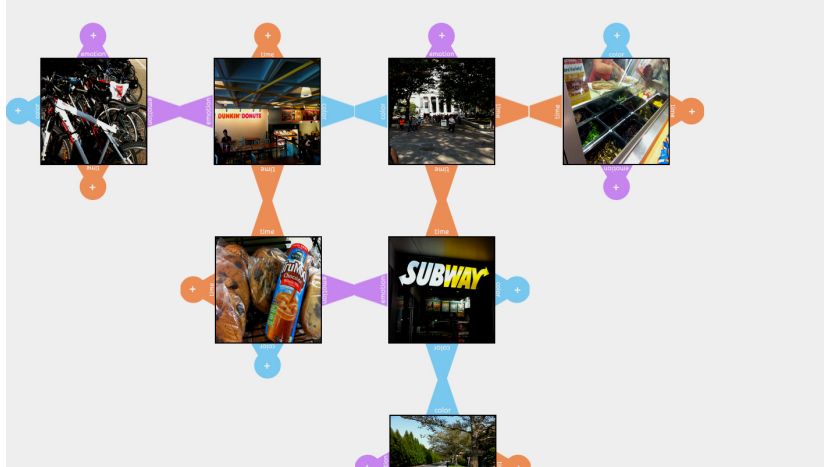
Figure 5: Screenshot of a prototype of the two dimensional version of a puzzle.

Consequently, we developed the one-dimensional puzzle that can be played turn by turn and at each turn the player faces one single constraint. A by-product of the decision to use a one-dimensional puzzle is that it simplifies the users workflow during the playing of the puzzle. Before the user had to choose between numerous possible moves (all of the unoccupied positions). This is also more representative of the scavenger hunt style of play. While some scavenger hunts do have multiple possible paths that you can follow, often times the hunt as a clear next move that needs to be executed. By simplifying the flow and the decision process, the user can focus on the current constraint and what everyday scene can satisfy it.

Early user tests showed us a flaw in the part of the workflow that was left from the first design. Only the exchange system was studied in user studies, the workflow for finding a partner was not tested. Upon getting feedback from users about this start the puzzle workflow, we realized that we cannot assume that users will come to the system with a culture in mind. We had designed the system with the general breakfast question in mind — i.e. users would want to come to be system wanting to get a glimpse of everyday life around the world, so they would go through a list of cultures until they had seen enough everyday life samples. Realizing that this was an inaccurate assumption, we came up with Design Three.

Puzzlaef 2.0

Thus, Puzzlaef went for a push/pull experience where users could either start a new open puzzle by adding a new picture of a scene
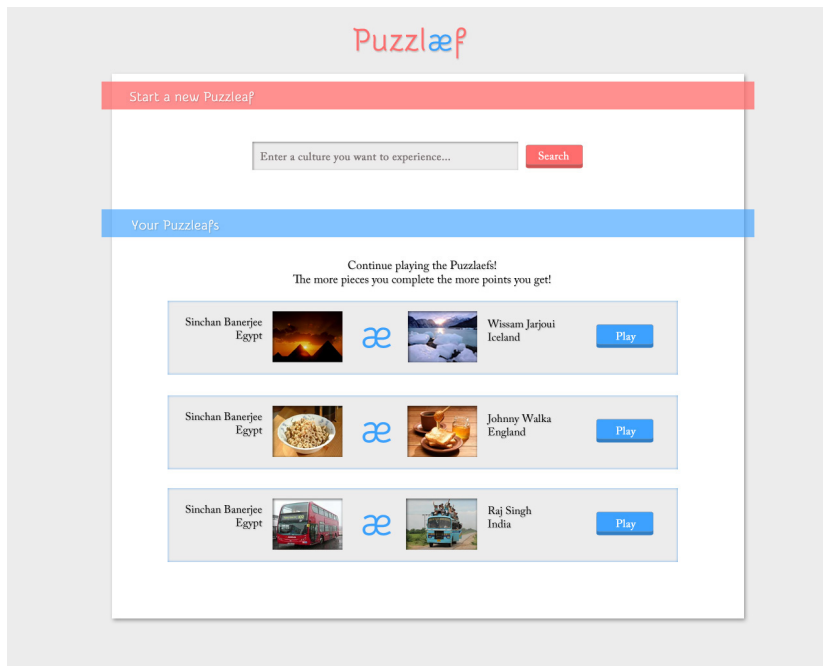
Figure 6: Screenshot of the Puzzlaef 1.0 homepage which lets users start a new Puzzlaef puzzle by searching for other users and lets them see all of their latest puzzles.
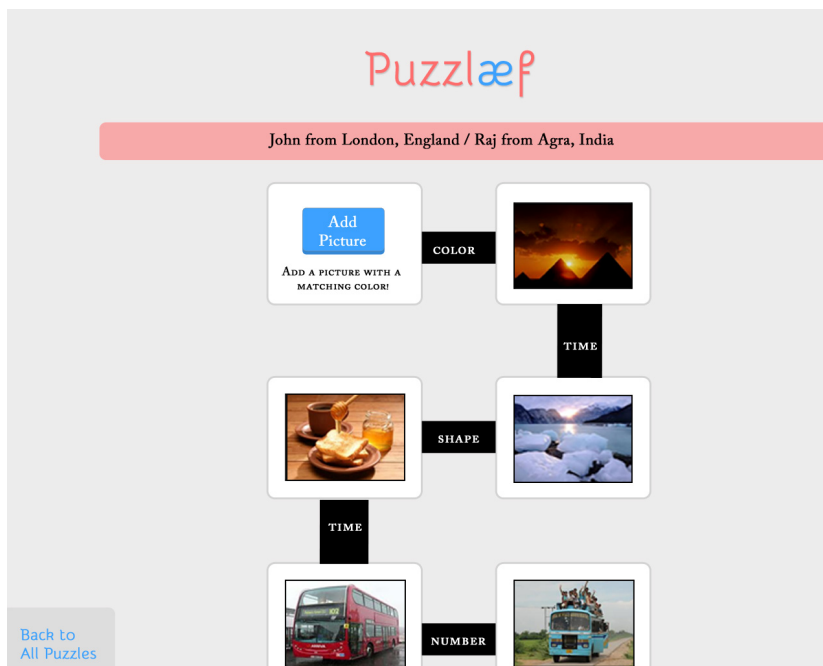

Figure 7: Mockup of the Puzzlaef 1.0 puzzle view. This shows the one-dimensional layout and the constraints placed between the puzzle pieces.

from their day-to-day life or join one of the open puzzles that one of the other users had started by adding a picture. The stream of open puzzles is ordered randomly to give each open puzzle an equal chance to be seen and joined. This is a simple approach and while it does not do any special distribution of locations to make sure that each user gets an equal sampling of a wide enough diversity of locations, it does let the user select an option rather than having to enter a specific location themselves.
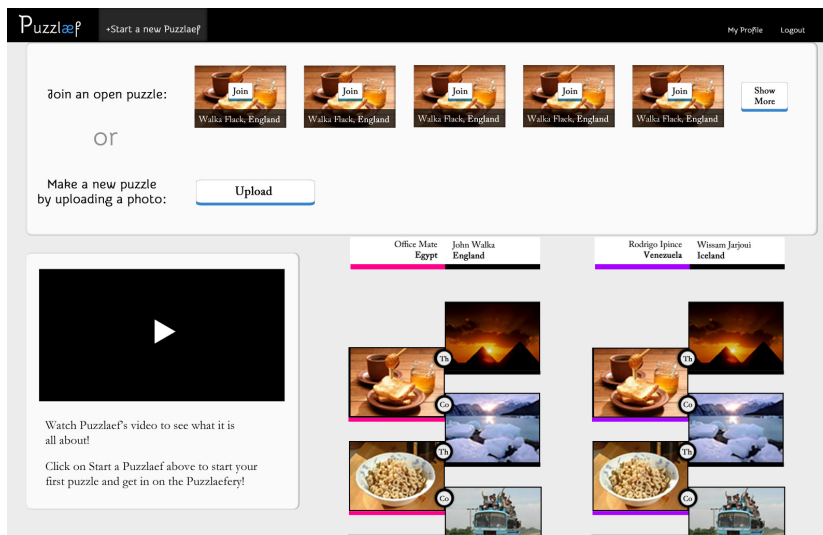

Figure 8: Mockup of the redesigned puzzle starting/joining experience. Users can look at open puzzles and join them or they can submit a new picture to start a new puzzle. Users no longer have to come into the system and search in different locations to find another player to play the puzzle with.

Another inspiration for this third design was feedback that users who initially come to the site might not be inspired to join the site. As users were only presented with an option to search for locations, this made it so that they did not really get a good sampling of what they could achieve by joining the site. To combat this issue, we redesigned the puzzle display interface to go from showing one puzzle at a time to show a linear display of puzzles. This linear display of puzzles shows essentially all of the puzzles on the system by first displaying the puzzles that the user is a part of and then displaying puzzles that other players are playing all around the world. This makes sure that when a user first comes to the website, they are greeted by a sampling of active puzzles from around the world that show how fun and engaging the experience of going through a puzzle can be and what the user can expect by starting a puzzle.

We explored both horizontal and vertical layouts of the one dimensional puzzles. The puzzles could either be arrianged as rows or columns. A row based layout would enable horizontal stacking and would allow more of each puzzle to be displayed on Desktop browsers as most displays are widescreen currently. However, there
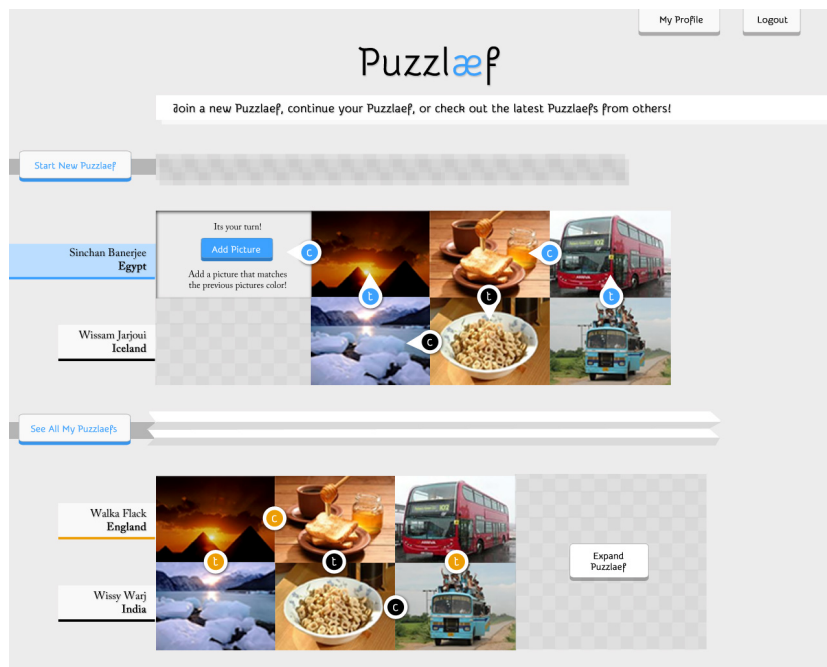
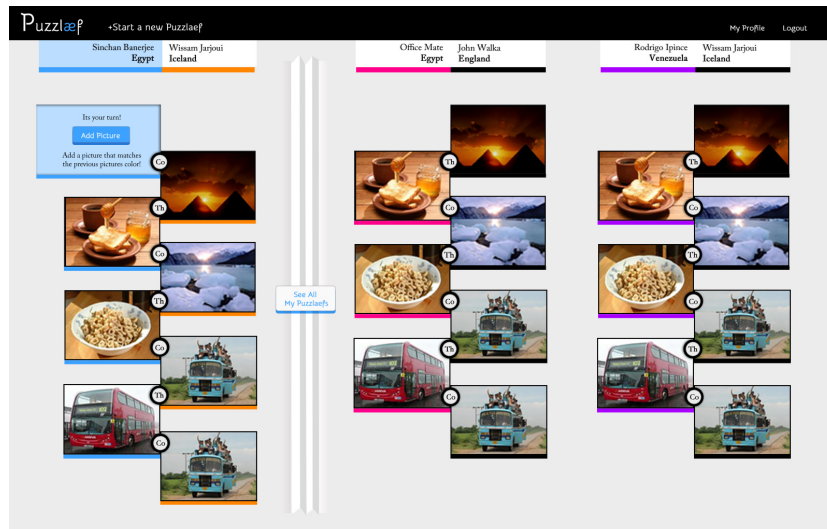Figure 9: A mockup of the horizontal layout of the one dimensional puzzle.

Figure 10: A mockup of the vertical layout of the one dimensional puzzle.

is a trade-off. A different layout would be required for devices with smaller screens such as smartphones and less puzzles fit on to desktop browsers on widescreen displays. In addition, showing the linearity and one dimensionality of the puzzle while still highlighting the visual similarity of the puzzles to Jigsaw puzzles was challenging. Highlighting the visual similarity was important because we wanted the puzzle to look and feel like a puzzle. Redesigning the system with Puzzles was meant to add motivation and inspiration for users and we felt that knowing that they are engaging in a puzzle would add the extra excitement humans feel when they are engaging in a challenge, a game, or a puzzle. To address these issues, we decided to use a vertical column layout for the puzzles. Puzzles were displayed vertically and instead of stacking the pieces linearly, they were positioned in a zigzag layout. This zigzag layout made it so that pieces were pushed onto one side or the other depending on who's piece it was and there was still a logical progression in terms of which direction the puzzle was going (upwards or downwards).

Figure 11: Screenshot of the implementation of the vertical layout of columns of puzzles.

Users can mouse-click on pictures and can see a larger version of the image. This view also lets any user (even users who are not playing the puzzle that is being viewed) comment on the picture and how well it fits into the constraints that were set for it. This is the main way in which constraints are enforced in the system. We decided to go for this community based enforcement approach because it is hard to computationally test the correctness of a picture submission (especially with potentially so many different cultures) and as we saw that users have a lot of fun in numerous puzzle and board game interfaces when they have to argue and defend their submissions or moves. We argue that it will increase engagement in

Figure 12: Screenshot of the home page of Puzzlaef 2.0 where it is the users turn to submit a picture that satisfies the constraints.

the site and that it will help users gain a better understanding of the everyday aspects of life that are embodied in these pictures.

Figure 13: Screenshot of the piece view where discussions can happen on the validity of the piece submission — i.e. how well it fits in with the constraints.

The Significance of the Purpose and Capturer of the Picture

This section discusses how the photographer and why the picture is taken plays a significant role in how the picture is percieved and valued.

First lets define two roles that players can take on in each move. One player is the picture-taker whose move it is and then there is the recipient who is waiting for the picture-taker to complete his or her

turn. Now, the pictures in the pieces of these puzzles are special. The pictures are special because they have been taken specifically for the recipient and they are taken for the purpose of giving a glimpse of the picture-taker's life to the recipient. When people see images of life in different parts of the world — whether it is online, in print media, or on television — the images have been taken for a wide variety of reasons and for a variety of audiences. This makes it so that when someone is viewing the picture, he or she has no personal attachment to the picture and feels less immersed in the culture they are witnessing. They can admire the aesthetic merits of the picture or can learn about the objects in the picture, but the experience is significantly less personal than the experience of traveling there and seeing and living life there yourself. On the other hand, the pictures that are a part of the experience proposed in this proposal are much more personal to the viewer. This experience's pictures have each been taken essentially in response to a request made by the recipient. It is as though the user has a camera in the other side of the world that he or she can use to take pictures of anything they want. The viewer was involved in the process that resulted in the picture being taken and this allows a user to live vicariously through the picture-taker in a way. In addition, when images have been taken for a wide variety of audiences, it is difficult for a learner of foreign lifestyles to find pictures that have been taken with the sole intent of representing aspects of daily life in that country. Most pictures have either been taken for advertising, artistic, or for personal purposes. The pictures taken in this experience have been taken with the purpose of highlighting a specific aspect of the photographer's lifestyle or culture.

As these picture posts are represented as a sequential stream with some pictures inspiring new posts through anchored questions, a conversation is formed. This conversation is unique because it merges the Kodak culture style of communication with the cameraphone or flickr.com style of communication. Taking the ability of the Kodak culture style's ability to display people's lifestyles and culture and meshing it with the cameraphone or flickr.com style's ability to tell stories to strangers with images, the experience enables users to not only learn about culture and life in another part of the world, but it also enables them to get to know the other player better and really form a new penpal-style relationship with them as they are able to learn more about who they are. The assumption that leads to this conclusion is that glimpses of objects and concepts in a person's everyday life reveals a lot about them and really helps someone who sees these glimpses to get to know them better.

Technology

This section describes the different technology that was developed for this research and how different engineering decisions and the different platforms that were used to launch the system influenced the use of the system.

Django

The system was developed using the Django web development framework. As such, we were using HTML, CSS, Javascript on the front end, Dajaxice and JSON POST requests on the communication layer, and Python on the back end. For the database, we initially started with a MySQL database with the Django Object Model interface that essentially abstracts out SQL command structure grammar.

Scripts.mit.edu Foundation

We hosted the Django system on the Scripts.mit.edu server hosting infrastructure at MIT in the beginning and stored photos locally on the Athena File System via Symlinks. However, this approach soon turned out to be more of a hassle than a boon. Git repositories had to store multiple settings file and every-time the server was deployed a few other settings had to be tweaked manually. Performance and uptime was also unreliable.

Heroku Upgrade

As such, we shifted the entire system to be served by the Platform-as-a-service product Heroku. Heroku manages a lot of the server hosting and load balancing for us and setup was relatively easy. One issue was that Heroku does not have local storage integrated. For this,

we took the support of the Amazon Simple Storage Service (E3) from the Amazon Web Services offering. Remote hosting required a few changes in the way photos were stored in the system. We switched to the Django-Storages plugin and used the sorl-thumbnail package in combination with mem-cached in order to generate and store thumbnails of the photos in the E3 Storage bucket. We also switched to PostgreSQL from MySQL because of PostgreSQL was better supported for Django setups on Heroku.

This simplified the deployment process significantly. Especially as we started using Python Virtual Environments with the migration to Heroku, it made dependency management a lot easier.

Responsive Layouts

As one of the main goals of this research was to inspire people to contribute pictures and scenes from their everyday life, we designed the system to be accessible not only through the website viewed on the Desktop, but also through mobile devices. This is especially true as one of the main goals behind choosing the current puzzle design was that it would inspire users to go and find scenes of everyday life that match the constraints and take pictures of them Scavenger Hunt style.

The linear one dimensional layout of the puzzle made it so that we could use the same layout of puzzles on larger screens as smaller screens. To achieve this we made use of Responsive Layouts. Responsive design or Responsive Web Design more specifically classically refers to the use of Cascading Style Sheets 3 (CSS3) media queries to make a website whose layout responds to the different types of screen resolutions or browser window sizings. As such, a website designed with CSS3 media queries can morph based on whether the site is shown on a desktop big screen browser or on a mobile device. For the third and final design — i.e. Puzzlaef — we made use of the Twitter Bootstrap UI Framework for many of the UI components such as buttons and the navigation bar. This was a departure from the custom built UI framework that was used in the second design iteration. The transition to the Bootstrap framework was done because it enabled us to focus less on cross-browser compatibility and more on the higher level design. The Bootstrap framework does support Responsive Layouts and provides grid based CSS styles to support this design that we used for all of the elements of the website except for the actual puzzle layout. The puzzle layout was custom built because of the re-flow behavior that we desired. The vertical puzzles

are laid out as columns and we wanted to the puzzles to morph from
this horizontal layout of vertical puzzles to vertical layout of vertical
puzzles when the website was shown on a mobile screen. We accom-
plished by using the float property of the Cascading Style Sheets.
by floating entire puzzles to the left, we were able to make it so that
as the size of available layout space shrinks, the puzzles start being
stacked one below the other instead of one beside the other.

Mobile Application

Photo capture and uploading cannot be done via the web browser on
the iOS operating system and on older versions of the Android op-
erating system. To bring photo taking and uploading support to the
system, we used the PhoneGap wrapper that allows one to make a
basically platform independent smartphone application using HTML,
Javascript, and CSS. This allowed us to hook into the native methods
of the smartphone operating systems of iOS, Android, BlackBerry,
and Windows Phone to let users take photos directly through the
Puzzlaef rather than having to take pictures separately and having to
upload them.

   However, for time constraints we chose to focus on the Android
Operating system for this iteration.

Evaluation

Preliminary Evaluations of the Postcard Design and Puzzlaef 1.0

The main goal for the preliminary evaluations of the Postcard Design and the Puzzlaef 1.0 was to identify the major design challenges that were brought out in the Design Section of the thesis. In addition to identification of the challenges, the goal was also to quickly iterate through prototypes of solutions to these challenges. In order to do these quick and iterative evaluations of these user experiences, we did enlisted users at the MIT Media Lab. These users were mostly researchers in the field of human-computer interaction and were chosen because of availability and also as they had significant experience in user experience design. By gathering candidates who had extensive experience in user experience design, we were able to use their experience to more quickly identify issues and opportunities in the design. The users prior experience in designing experiences and executing heuristic evaluations of the interfaces made it possible for us to test different iterations quickly. Users used both designs for two weeks before we had informal discussions with them to identify issues and potential directions. The results of these discussions have been incorporated into the Thesis' Design Section.

Evaluation of Puzzlaef 2.0

The main goal of the evaluation of Puzzlaef 2.0 was to measure its effectiveness in enabling the user to answer the *General Breakfast Question*. As the system was generalized throughout the design iterations, we were not able to simply ask users specific versions of the *General Breakfast Question* such as the *Breakfast Question* and see whether they were able to traverse the system to answer the question by gather a specific set of photos from a specific part of the world which matched the subject of the question. As such, we decided to

complete an overall user experience evaluation where users are asked to use the system for a significant amount of time and an *a posteriori* interview is completed that is focused on asking questions that concern the major design challenges that were faced during the design of the system.

User Study Design and Execution

This sub-section describes the setup of the user study, specifically how users were recruited, how they were prepared for the study, interactions during the system use period, and the questions asked in the *a posteriori* interview.

Users

The system was tested with the help of ten users that were enlisted for the study. They were all students of the Massachusetts Institute of Technology and in order to get a significant diversity in the backgrounds and lifestyles of the users, the users were chosen to consist of a group where five of the users were graduate student and five of the users were undergraduate students. The lifestyles of the two differ significantly based on our experience. In addition, the users were chosen so that most of them lived in different locations in the city of Boston and the area of greater Cambridge.

The final mobile prototype of Puzzlaef 2.0 only supported the Android Operating System 2.2 and higher. As such, the smartphones of four of the study participants had support for mobile usage of Puzzlaef 2.0. The rest of users used the website to upload photos. Note that this is does represent a barrier to entry and we recognize that it might have caused users to be less motivated to engage a puzzle frequently.

Phase One of the Study

Phase one of the study consisted of informing users on the rules of the puzzles on the site and then letting the users play and start new puzzles over the duration of two weeks. Users were told what constraints are, how to solve them and how to dispute the submission of a photo that does not match a constraint. In addition, users were also told that their goal will be to answer the *General Breakfast Question*. They were given the question and were not restricted to a specific

approach to answering the question — i.e. they could choose to start numerous puzzles to experience as many lifestyles as possible or choose to submit photos in strategic ways to encourage the submission of photos that helped them answer the *General Breakfast Question*. In addition, they were informed that all pictures that they shared was public to other users on the site.
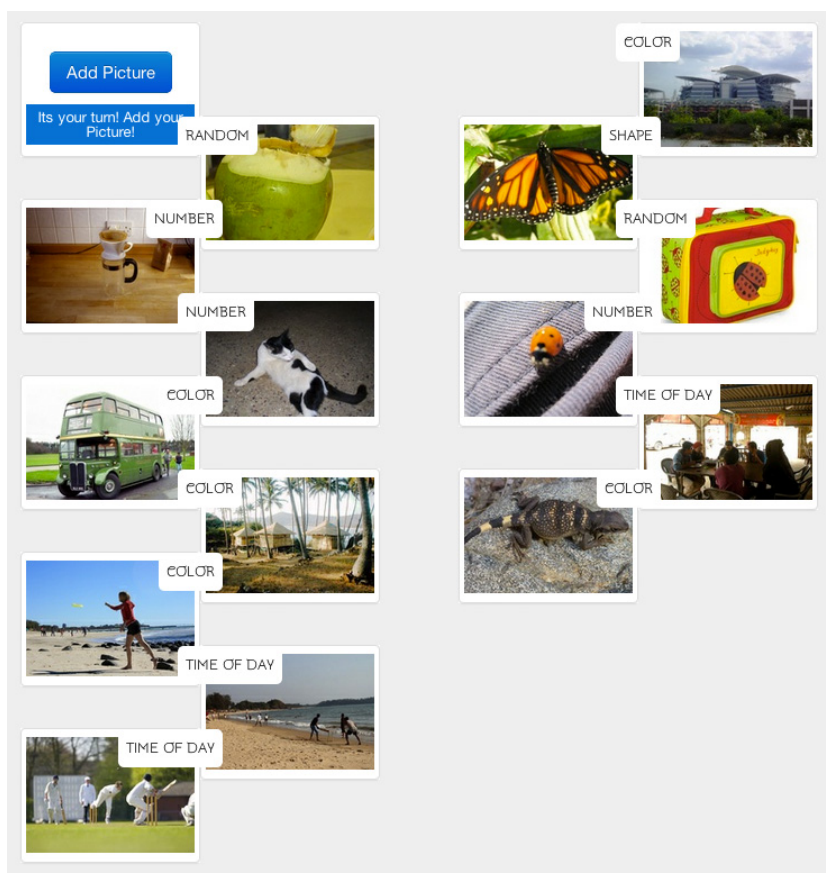

Figure 14: Two concurrent puzzles that were played on Puzzlaef 2.0 during the usage period.

Then the users were instructed to get on the website and start puzzles and join them as they please. They then used the system for two weeks contributing and consuming of one hundred and ten pictures.

Phase Two of the Study

This phase of the study consisted of studying the photos that were submitted and the *a posteriori* interview of the users.

Photos were studied in terms of what aspects of everyday life they highlighted, what was the focus of the pictures, and how well

did they meet constraints. Photos usually had one main focus, but usually had two to three other elements of everyday life highlighted perhaps unintentionally. For example, a picture of breakfast also captured the texture of the counter-top and the types of bowls and plates used in the users day to day life. Constraints were usually met. However, some photos were quite ingenious in terms of how they met the constraints.

The *a posteriori* interview consisted of the following questions and as such, highlighted the major issues that were tackled in the design process described in the design section:

1. Do you feel that you can answer the general breakfast question through this interface?

   i.e. Questions of the type of What does breakfast look like around the world?

2. Did you understand how to play the puzzle - i.e. how to start a new puzzle, know when it was you turn, what you needed to do to complete your turn.

3. Did you find the constraints of the puzzles to be challenging enough to be fun?

4. In general are you motivated to continue playing your puzzles and/or start new ones?

5. If it was too easy or too hard, does that make you less motivated to continue your current puzzles and/or start new puzzles?

6. How did you feel about the photos submitted by the users you were playing puzzles with?

7. Did you feel a personal connection to them or were they the same as encountering a photo on a Google Image Search.

8. Did you learn or see something about a lifestyle from the system that you did not expect?

Results

Users found the interface a good way to answer a very generalized version of the *General Breakfast Question* in the sense that they could not direct the direction of the puzzle to highlight a specific aspect of life in the other users life. This was a result of enforcing a specific direction of the puzzle. While it did enable users to always have a next step (one of the motivations of the Puzzlaef 1.0 design), it took

some control away from the user in terms of what topics they could potentially get into. Users said that difficulty level of the puzzles varied based on when specific constraints were combined with other photos. Challenges were not necessarily seen as a positive aspect. This was interesting as it means that we should explore new ways to make sure that the challenges are fun in future research. Some users were motivated to continue puzzles and start new puzzles, while others were ambivalent. Users reported that they did indeed feel a stronger personal connection with the pictures because the picture was specifically taken for them. In addition, Users did feel that they did gain insight into their co-player's lifestyles that they did not have before.

Future Directions

This section discusses the future directions that should be explored based on the results of the user study.

Based on our analysis of the photos on the site, we found that we did successfully create the foundations of a system that enabled and to a certain extent inspired the contribution of the everyday life objects. In future studies, we would like to focus on how having a more complete mobile experience would change the properties and reviews of the system.

In addition, the issue of the user not having enough control to direct the puzzle experience in a direction of their choosing should be considered as well. We believe that the system can indeed be more 'fun' and we should in the future consider different ways in which to engage the users more. These methods include ways in which to make the completion of a puzzle a more active target — i.e. by sending reminders to users to play their next more or to set a strict number of pieces that need to be submitted in order to finish a puzzle. They also include adding photo filters similar to ones that are found in the Instagram application. Specifically focusing on a set of filters that would enhance the beauty of an photography without distorting the color, contrast, and textures of the photo too much — i.e. beautify the photo while minimizing the amount of everyday visual information that is lost.

Conclusions

Help answer the **General Breakfast Question**:

"What does day-to-day life look like around the world?"

    This was the main goal of this design research that has led to the designs and implementation of the Postcard, Puzzlaef 1.0, and Puzzlaef 2.0 user interfaces and systems. In increasing chaotic and global world, we find that the use of a variety of print and digital media have enabled one to get exposed to a wide variety of cultures. However, users often are enable to get a glimpse of the subtleties that make day to day life unique in a different country. These subtleties could include the smell of the soil after it rains, the texture of the typical door, and the wear and tear of the average train seat. We have taken the visual approach and have attempted to design and evaluate user interfaces that encourage the access and contribution of visual media highlights these subtleties.

    We believe that our research into visual user interfaces for the consumption and production of visual media focused on everyday life is relevant to the study of cultural understanding, photo-sharing user interfaces and user experiences that are designed around games and puzzles. Such systems can be used by users attempting to get a glimpse of everyday life in another country or by a company who is attempting to execute market research or user studies by studying how people live their everyday lives — ex. what they have for breakfast everyday.

Bibliography

R. Chalfen. *Snapshot versions of life*. Bowling Green State University Popular Press, 1987.

J Cummins. Brave New Schools: Challenging Cultural Illiteracy Through Global Learning ... - Jim Cummins, Dennis Sayers - Google Books, 1997.

N Hochman. Visualizing Instagram: Tracing Cultural Visual Rhythms. 2012.

M Ito and D Okabe. Camera phones changing the definition of picture-worthy. *Japan Media Review*, 29, 2003.

T Kindberg, M Spasojevic, R Fleck, and A Sellen. The Ubiquitous Camera: An In-Depth Study of Camera Phone Use. *IEEE Pervasive Computing*, 4(2):42–50, April 2005.

S. Kisilevich, M. Krstajic, D. Keim, N. Andrienko, and G. Andrienko. Event-Based Analysis of People's Activities and Behavior Using Flickr and Panoramio Geotagged Photo Collections. In *Information Visualisation (IV), 2010 14th International Conference*, pages 289–296. IEEE, 2010.

David W McDonald. Visual Conversation Styles in Web Communities. In *System Sciences, 2007. HICSS 2007. 40th Annual Hawaii International Conference on*, page 76, 2007.

A.D. Miller and W.K. Edwards. Give and take: a study of consumer photo-sharing culture and practice. In *Proceedings of the SIGCHI conference on Human factors in computing systems*, pages 347–356. ACM, 2007.

Christophe Prieur, Dominique Cardon, Jean-Samuel Beuscart, Nicolas Pissard, and Pascal Pons. The Stength of Weak cooperation: A Case Study on Flickr. *CoRR abs/0802.2317*, cs.CY, 2008.

Nancy A Van House. Flickr and public image-sharing: distant closeness and photo exhibition. *CHI '07: CHI '07 extended abstracts on Human factors in computing systems*, April 2007.

Elizabeth Zeiss and Christina L Isabelli-García. The Role of Asynchronous Computer Mediated Communication on Enhancing Cultural Awareness. *Computer Assisted Language Learning*, 18(3):151–169, July 2005.