



VISUALIZING MENTAL MAPS OF SAN FRANCISCO

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Master's Final Project
May 5, 2011

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Table of Contents

| | |
|--|----|
| Background | 2 |
| Overview | 4 |
| Methodology | 6 |
| Analysis | 7 |
| Visualization Development..... | 7 |
| Website..... | 7 |
| Orientation..... | 8 |
| Corridors..... | 10 |
| Barriers | 11 |
| Boundaries..... | 12 |
| Stories..... | 15 |
| Game | 16 |
| Future Work..... | 16 |
| Concluding Reflections..... | 18 |
| Appendix A - Works Cited | 19 |
| Appendix B - Webpage | 21 |
| Appendix C - Sample Demographics | 23 |
| Appendix D - Interview Protocol..... | 24 |
| Appendix E - Consent Forms | 27 |

"We thrive in information-thick worlds because of our marvelous and everyday capacities to select, edit, single out, focus, organize, condense, reduce, boil down, choose, categorize, catalog, classify, list, abstract, scan, look over, sort, integrate, blend, inspect, filter, lump, skip, smooth, chunk, average, approximate, cluster, aggregate, outline, summarize, itemize, review, dip into, flop through, browse, glance into, leaf through, skim, refine, enumerate, glean, synopsise, winnow the wheat from the chaff, and separate the sheep from the goats."

- Edward Tufte, *Envisioning Information*

"An atlas may represent many places in the same way or the same place in many ways, and it is in the myriad of descriptions that the maps begin to approximate the rich complexity of the place, of a place, of any place."

- Rebecca Solnit, *Infinite City*

Background

The *Visualizing Mental Maps of San Francisco* project has two primary components: a qualitative investigation of how San Francisco residents perceive neighborhood and space in the city; and information visualizations informed by the qualitative work, creating an atlas of "mental maps". Interviewees were asked to sketch images of their internal representations or space, or mental maps (Lynch 1960) of the neighborhoods they live in and of San Francisco, and to talk about their perceptions of space and neighborhood in San Francisco. As a supplement to the interviews, the project also collected sketch maps from people of their neighborhoods and of the city in bars, coffee shops, and libraries in different parts of San Francisco.

People experience and perceive San Francisco in highly personal ways that aren't necessarily reflected in the geography of a street map. Since mental maps focus on the "relative locations and attributes of phenomena in [an individual's] everyday spatial environment" (Downs and Stea 1973), they have different levels of detail, scale, emphasis, and boundaries than standard maps, sometimes containing gaps about the larger world as well as richly detailed localized knowledge.

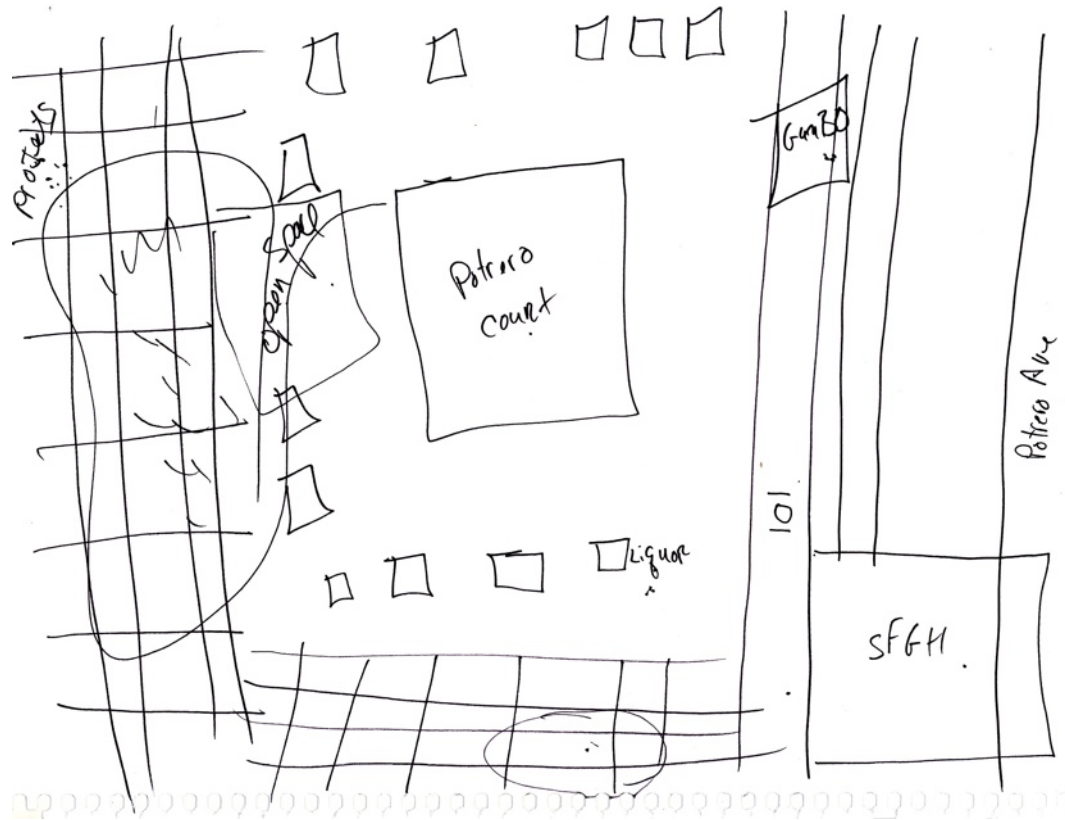


Figure 1. Max's neighborhood sketch map

In a respondent's drawing above of his mental map of Potrero Hill (Figure 1), for example, the imagery emphasizes personal points of interest, such as "gumbo" and "liquor store," that would not be singled out for emphasis on a standard map. Mental maps depict a person's take on a space, with his/her own particular emphases, omissions, and experiences, reflecting unique individual experiences, as well as the social contexts that mediate people's perceptions of space.

Mental maps can be idiosyncratic, but can also share common features. As described and categorized by Kevin Lynch, mental maps often include paths between places; edges such as physical features that break continuity; districts or neighborhoods; nodes that are centers of activity; and landmarks, which are prominent features in the landscape that can also double as activity centers (Lynch 1960). Both nodes and landmarks can serve as waymarkers that people use to orient themselves and navigate within a space (Rovine and Weisman 1989). Neighborhoods don't exist in purely material terms, but are instead composed of physical, functional, political, and economic aspects of an area's infrastructure combined with expressions of individual and social identities (Wahl and Wilde 2008). People's perceptions of space include narrative elements – what's important or scary; [metaphorical connections between locations and experiences](#); and stories about individual and group identity (Kitchin 1994). Neighborhood narratives contribute to people's senses of belonging to, or alienation from, a neighborhood, as well as to their senses of investment, or lack of investment, in local

spaces (Ball-Rokeach 2001). Sketches of mental maps can reflect the multitude of factors that contribute to the composition of neighborhoods. Reflecting on these factors is in itself a kind of participation in local spaces, and may suggest and encourage further avenues for local involvement.

The primary goal of the Visualizing Mental Maps project is to engage people in reflecting on both their own and others' perceptions of neighborhood and community. As a discipline, information visualization emphasizes telling stories and exploring data in engaging ways. Relative to statistical analysis or the development of algorithms in the pursuit of what is "correct," information visualization is often a more explicit balance between science and art that is used to explore intuitions about data, and to present ambiguities, implicit connections, and interesting avenues for further exploration (Steele and Iliinsky 2010). Rather than seeking to delineate boundaries or collect discrete findings, information visualization can serve as a kind of meditation on data (Macklin et al 2009), making information visualization a useful way to approach the shifting vagaries of neighborhood.

Through visualization and the encouragement of public engagement with images of San Franciscans' subjective perspectives on neighborhoods and the city, we seek to "render[] visible the previously unseen, overlooked or excluded" (Chanan 2010).

Overview

Every map has a perspective, and every map is "wrong" in some way, since "all models of reality make assumptions about reality" (Cascio n.d.). Google Maps, for example, uses the Web Mercator projection, which distorts the relative proportions of landmasses so that Alaska appears to be larger than Mexico, but preserves street level angles that would be distorted with some other large scale projections of the earth's three dimensional sphere into two dimensional space. "We select, and a map is a selection of relevant data that arises from relevant desires and questions" (Solnit 2010).

Since all mathematical projections involve trade-offs between fidelity of shape and true relative size, and the mapmaker must make choices about which elements to present or highlight, no single map can present the world without introducing some distortion or bias. Maps from the colonial era are often presented as particularly egregious examples of the ways in which political, social, and economic power dynamics are expressed through cartography, but every map is necessarily a delicate balance of emphases and omissions, thick lines and thin, symbolism and contrast.

Recent developments in Geographic Information Systems (GIS) technology are often heralded as a "revolution" hallmarked by "accuracy" and "precision" – and clearly GIS technologies are useful for many purposes. But a precise, accurate map asks us to believe that we know what a place is called, what its borders are, and where it belongs within a standardized hierarchy of space. However, since many, if not all, elements presented on maps, as well as the ways in which maps are read, are socially mediated, a uniform standard of precision and/or accuracy (a trade-off in itself) is fundamentally contrary to the nature of how people perceive space.

Precision and accuracy are worthy goals nevertheless. We suggest however, that uniform standards of precision and accuracy are not the *only* worthy goals.

Neighborhoods are especially difficult to define and present with computational accuracy and precision. Recent literature and computational work on defining neighborhood has often turned to interviewing local people rather than using purely computational approaches, since neighborhoods combine identity with physical, functional, political, and economic aspects of an area's infrastructure (Wahl and Wilde 2008). Most of the respondents in the Visualizing Mental Maps project described at least one edge of their neighborhood as unclear, and proximity was more often a state of mind (Hannes et al 2006) than a purely temporal consideration. One respondent observed of a playground that she called her "local": "I'm not sure that it's the playground that's absolutely the closest to us, either walking or as the crow flies, but it feels like our neighborhood playground because it's right near this kind of defining geographical feature" (Grace).

Our interviews with San Francisco residents, and the mental maps they created of their neighborhoods and of the city, highlight ways that people perceive and interact with local spaces that are not typically reflected in standardized maps. The following were the main themes that we decided to focus on visualizing:

Unlike standard street maps, respondents created images that were not oriented with North at the top of their maps.

People often defined neighborhoods in terms of "main drags" or commercial corridors, while neighborhoods lacking commercial corridors were regarded as less defined, "boring" areas, with "nothing there." A neighborhood's "interestingness" (Alex) was an indicator of whether a neighborhood was perceived as a destination spot or a primarily residential area.

The major thoroughfares that are typically presented as central to navigation in standard maps were perceived by many of our respondents as both physical and psychological barriers, and topography, which is rarely featured in navigational maps, was a major navigational consideration for many residents of hilly San Francisco.

In contrast to the neatly defined (but often mutually conflicting) neighborhood boundaries presented in many standardized maps, our respondents described neighborhood boundaries as ambiguous and in a continual state of flux.

Personal stories and socially transmitted narratives enlivened people's perceptions of the city and its neighborhoods, and imbued local spaces with meaning. Neighborhoods are conceptually meaningless without the narratives and "character" (Ji-Yoon) that people attribute to them.

Drawing sketch maps sometimes induced anxiety in respondents, particularly when respondents worried about getting their maps "right," but when respondents experienced less anxiety, they seemed to enjoy the experience and the images they produced. For many respondents, drawing sketch maps encouraged reflection and the sharing of stories about spaces.

Methodology

The qualitative component of the project consisted of 22 semi-structured interviews with San Francisco residents. All the San Franciscans we interviewed were current residents of the city and had lived in the city for a minimum of one year, with the exception of one participant who was not a current San Francisco resident, but who had lived in different sections of San Francisco over the course of several years. Most of the interviews centered on mental map drawing activities, with respondents' maps used as a primary interview prompt. Respondents were asked to draw a map or picture of their neighborhood and of the city that showed how they saw those spaces.

Initial interviews also included route tracing on two maps generated from CloudMade maps (based on OpenStreetMap data): one showing the area where respondents resided, and one showing San Francisco. This portion of the interview was dropped from the protocol as it proved unwieldy in practice, and respondents often preferred to draw paths on their own sketches. Image drawing was video-recorded, while the rest of the interview was audio-recorded. We also conducted two "tour" interviews, in which residents took us on a walking tour of their neighborhoods, with the tour serving as the primary interview prompt. Scheduling and weather difficulties made tour interviews less practical, however. As a supplement to the interviews, we also collected sketch maps from people of their neighborhoods and of the city in bars, coffee shops, and libraries in different parts of San Francisco. We collected 57 sketch maps in total.

Although we did not approach interviewing with an investment in any particular theoretical framework, the interview protocol is informed by Kevin Lynch's descriptive categorization of features commonly found in mental maps (paths, edges, districts, nodes and landmarks), and attempts to elicit information from respondents about neighborhood boundaries, border vacuums (Jacobs 1961), centers of activity, and other features that can make a space lively and "legible" in Lynch's terms (Lynch 1960). (See the appendix for the interview protocol and consent forms.)

We used a combined opportunistic and purposive sampling strategy. Our goal was to interview residents from as many different supervisory districts in San Francisco as possible. We also actively sought out respondents who did not have cars (in addition to the many who did), as well as seeking respondents of varied ethnicity, age, gender, sexual orientation, socioeconomic status, and people with children or pets, in an attempt to learn about a broad range of perspectives on San Francisco. Although we did interview some classmates and friends, our goal was to break out of our own insular networks and explore many different ways of seeing and experiencing the city. Toward the end of the interview process, we focused our sampling strategy on interviewing people from neighborhoods that had appeared frequently in conversation with residents of other neighborhoods. (See the appendix for a breakdown of our sample demographics.)

Analysis

Field notes, interview transcripts of audio recordings annotated with information from the video we collected, and sketch maps were selectively coded using the qualitative software analysis program MaxQDA. The process we followed was broadly based in grounded theory in that we largely sought to derive concepts from our data, rather than to confirm or disconfirm particular concepts from the outset. For the purposes of data visualization, we focused our analysis on description of people's perceptions of neighborhood and space rather than on the development of theory. Given the time constraints and our focus on information visualizations, our coding process was rapid and open-ended. The data we collected is rich in themes and meanings and could be a resource for future longer term analysis. For this paper, we will focus on emergent themes in the context of the visualizations that were developed.

Because we wanted to use the qualitative research as a stepping stone for the visualization work, there was less time for collecting and creating our own datasets. Our efforts instead focused on finding freely available data and visualizing it in different and interesting ways, inspired by the themes from the qualitative research.

Visualization Development

We started by brainstorming interesting themes that had emerged from our qualitative research as well as searching for data about San Francisco online. Fortunately, there are a variety of public sources for data about the city and its people. datasf.org provided much of the data about the physical geography and urban infrastructure of the city, including shapefiles for the city outline, street centerlines and parks polygons.

In search of information about neighborhood boundaries, we researched the [San Francisco Planning Department](http://sfplanning.org), the [San Francisco Association of Realtors](http://sfbayarea.com) and the real estate website [Zillow](http://zillow.com). Per our advisor Ray Larson's suggestion, we contacted Bernt Wahl about his work on determining neighborhood boundaries and he graciously provided us with his data for San Francisco. Additionally we examined local blogs such as Burrito Justice, Mission Mission and neighborhood review sites NabeWise and EveryBlock. Because actual geospatial boundary data was not available from all of these sources, we began thinking about ways to visualize neighborhoods and the city outside of direct mapping.

All of the static maps were first developed in ArcGIS, with further editing and refinement in Adobe Illustrator. Additional development was done in ArcGIS and with Python code. The interactive storymaps were created with Processing and Javascript, using the PolyMaps library and jQuery.

Website

We developed a website, conceived as an atlas of mental maps (<http://groups.ischool.berkeley.edu/mentalmaps>) to feature and host all of the visualizations, as well as some context and background information about their development and the project as a whole. The website is broken down into sections on Orientation, Corridors, Barriers,

Boundaries and Storymaps. In addition, there is a section for a paper-based game that was developed to foster engagement with the data from our interviews and to encourage people to create their own maps, and a gallery featuring a selection of the sketch maps created by our participants. The gallery images were selected to depict a broad range of neighborhoods and perspectives. A few images in the gallery were cropped or very slightly edited to omit personally identifying information or to enhance images that didn't scan well.

Orientation

"I don't fully know how the peninsula always lays out in cardinal directions." - Bernadette

"I know which streets go in what direction. If I don't know exactly what street it is ... when I cross a street, I'm able to orient myself based on what I'm perpendicular to or parallel to." - Mary

Respondents were quite cognizant of their abilities to orient themselves in an urban environment. For each person who extolled their good sense of direction, just as many admitted they were terrible at finding their way around. A variety of orienting tactics were employed by respondents. "I don't have a good sense of direction, so yeah, I tend to orient myself around public transportation a lot. If I know where I am in terms of public transportation that helps" (Bernadette). Referencing public transit lines, proximity to the ocean or bay, knowledge of the street grid, the use of landmarks (in particular Sutro Tower, the Ferry Building and St. Mary's Cathedral, aka "the washing machine building," and even Safeway), and in one case, watching the fog roll in from the west, were all used as orientation strategies. A number of people were also dependent on using Google Maps or their smart phones, where the city is often displayed with the standard North at the top of the page.

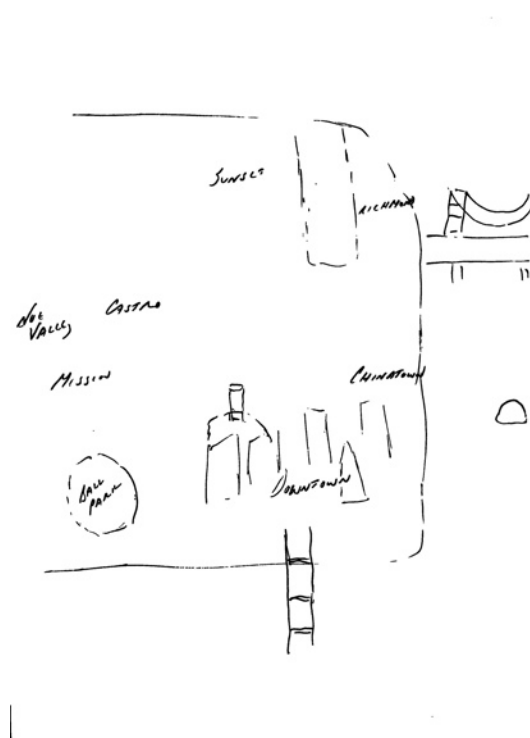


Figure 2. Alex's San Francisco sketch map

Reviewing people's sketch maps of the city and their neighborhoods, such as Alex's image of San Francisco (Figure 2), we're reminded that North doesn't always have to be at the top of a map. For those in the Richmond or Sunset, perhaps it makes more sense to orient the page with North on the right, and the Pacific Ocean at the top. For those in the Mission, maybe it's more intuitive to have Mission and Valencia running left to right rather than up and down. Does the city feel more expansive with what used to be its bottom half now at its top? To emphasize the importance of Market Street to people's sense of orientation, maybe it makes sense to see Market Street running upright, rather than at a 45 degree angle, shifting the street grid around it.

The *(Dis|Re)Orientation* series of visualizations invites the user to disorient and/or reorient themselves with what may be a less familiar view of the city. Each visualization in the series presents the city oriented with a direction other than North at the top of the page. The visualizations all contain the same features and symbology: the full street grid, Muni light rail lines, public transportation stops, neighborhood names and a number of landmark features that may be useful for orienting the user. Rotating a map is not trivial, as the legibility of labels must be preserved, both in terms of orientation and the spacing around them. Following standard mapping conventions, readability is enhanced when the labels of line features (such as streets and rivers) follow the slope of the line, without inverting the text. However, readability is also conventionally enhanced when the labeling of point and area data (for example, locations and neighborhoods, respectively) remains horizontal.

Labeling conventions further accustom map consumers to the positioning of labels at the upper left of a point. Having the label directly above or below the point can be perceived as jarring and unintuitive. As a result, simply rotating the labels can result in everything being in a suboptimal position. Most problematically, rotating an existing map can result in less space for existing horizontal labels, so the labels must be repositioned to avoid obscuring other labels or map features. ArcGIS allows for the rotation of a base map while preserving the correct orientation of the labels; however many of the labels on the resulting map crash into each other and some line feature labels get inverted. The maps were therefore created in ArcGIS, while the labels were positioned by hand in Adobe Illustrator in order to assure that no crashing occurred and that the overall layout of features remained aesthetically pleasing.

Corridors

"I think of San Francisco as being a bunch of main streets in small towns, all smushed next to each other." - Petr

"There's big residential areas, like the Outer Richmond and Outer Sunset where I don't know them because I kind of feel like I never have a reason to go there. They're kind of worse than the suburbs in terms of being monotonous." - Evan

Respondents tended to conceptualize San Francisco in terms of "main drags" and "mini cities" (Veronica) – commercial corridors that attract people – contrasted with "mini suburbs" – primarily residential centers that are often perceived by people who don't live in those neighborhoods as "boring" places where "there's nothing else to take me out there" (Evan). The balance between vibrant and inviting corridors and seemingly monotonous residential areas resulted in some areas of the city being described as more enticing as destination spots to people who did not reside in them.

San Francisco's Deadzones and Corridors is a map depicting both where the city's "corridors" or main drags are, the neighborhood names associated with them and residential density measures throughout the city. The map has three layers: a choropleth of residential density at the census block group level ("dead zones"), the areas zoned for commercial activity, and verified commercial strips.

A residential density metric calculated from using 2010 census data (the number of housing units normalized by the size of the enumeration area) was used to convey respondents' focus on residential areas as distinct from destination areas. Describing the residential quality of her own neighborhood, an interviewee said "My particular street is much more neighborhood-y than Mission, so it's more single family houses or two family house-type things... fewer apartments, fewer renters too, more people who own. It's a lot of Victorian row houses" (Bernadette). Fewer housing units per area tends to translate into fewer apartments and more actual houses. The distribution of lower residential densities in the Richmond, Sunset and Parkside, higher densities in the Mission and Tenderloin, and isolated areas of high densities in the South of Market region (corresponding to high-rise condominiums) generally corresponds with our respondents' perceptions. Housing statistics from 2010 were acquired

from the [American FactFinder website](#), along with corresponding block group [TIGER/Line shapefiles](#) from the U.S. Census Bureau website.

Some experimentation was done in terms of choosing the size of the enumeration area, as data was available at the individual block level, the census block group level and the census tract level. Census block groups seem to depict the appropriate balance between being too detailed (individual blocks) and being too general (census tracts). This data was then classified into five categories using the Jenks Natural Breaks algorithm.

Overlaid on the residential density choropleth is zoning information from the [San Francisco Planning Department](#), using shapefiles provided by [sfgov.org](#) (in blue and purple tones). The zoning data was a bit too granular, showing individual building footprints. The data was buffered by 50 feet so that the areas would span across the width of streets, to reflect respondent's senses of these areas as zones or corridors. Since commercial zoning does not necessarily indicate that anything has been developed in an area or that the entire area has commercial activity, the larger commercially-zoned areas were ground-truthed and cross-verified with Google Maps, Yelp and Walkscore.com. The verified information was then georeferenced and added to ArcGIS as our own dataset.

The resulting map depicts sentiments that were expressed repeatedly in the interviews. Many neighborhoods in the city have a single street that commercial activity is centered around. The Mission district is notable for having corridors centered on Mission Street, Valencia Street, and 24th Street, reflecting the unusual vibrancy and attraction that many respondents expressed for the Mission district as a destination neighborhood. Not only does the southern half of the city have a low residential density, but its commercial corridors are shorter, fewer in number and are distributed further apart.

Barriers

"You don't go anywhere past that because there's a hill over here, there's a highway here and the roads kind of end. Why would you go past a divider like that?... the hills and the highway create a barrier." - Petr

Steep inclines, busy streets and looming freeways may act as barriers, both physical and psychological for the pedestrians of San Francisco, particularly for the 30% of San Francisco households that don't have cars ([Carfree Database](#)). Although respondents often expressed fondness and appreciation for San Francisco's hills and the views they afforded, steep hills could also make an area feel further away and less accessible to pedestrians and cyclists who must negotiate them under their own power. As Dan remarked, "There's a hill up into the Haight... It's not that far away, but I don't go there and I think of it as distant, even though it's not." Respondents indicated that when walking or cycling they navigated around obstacles that may not be apparent on a standard street map, and that steep slopes and high traffic streets could make areas less accessible.

San Francisco's Pedestrian Barriers depicts three of the main obstacles for pedestrians and cyclists that interviewees mentioned: the inclines of the city's hills, busy streets and freeways.

To depict the inclines of the city, raster digital elevation models (DEMs) of San Francisco at the 7.5 minute level were obtained from the [United States Geological Survey](#) (USGS). Using ArcGIS's spatial analysis tools on the DEMs, a slope raster was calculated. The classification of the slope into five categories (0%, 0.1 - 5%, 5.1 - 10%, 10.1 - 18%, > 18%) was based on the categories found on the [San Francisco Biking Coalition's biking map](#) for the city. Since respondents indicated that when walking they used shortcuts through the city associated with cycling, such as The Wiggle, we expected that biking difficulty would correspond reasonably well with the difficulty of a slope for pedestrians. Slope was mapped rather than elevation because the height of a location was not an indicator of navigational difficulty. Changes in elevation – having to climb up or down a hill – require more effort from pedestrians and cyclists, and can therefore present a barrier..

Busy streets were visualized on the map as those with high speed limits. Both the street centerlines and their associated speed limits was acquired from [sfgov.org](#). Metrics like street width, number of lanes and number of traffic lights were also considered but this data was harder to come by. The speed limits were symbolized using a color ramp from light blue (25 mph) to deep purple (45 mph). Freeway shapefiles were also procured from [sfgov.org](#), these were simply symbolized using a thicker, gray line. At one point, individual streets with steep slopes were going to be symbolized on the map, however this seemed to distract from and obscure the speed limit data.

In addition to showing where difficult crossings may occur, the visualization highlights physical features that contribute to the establishment of neighborhood boundaries. The influence of topography in the shape and identity of some San Francisco neighborhoods is apparent in neighborhood names like "Russian Hill," "Bernal Heights" and "Noe Valley." High traffic roadways cutting across the city often constitute neighborhood edges. Standard street maps may divorce people from the fact that Russian Hill, Bernal Heights, Noe Valley and other neighborhoods have geographic features like hills and valleys associated with them. Furthermore, neighborhoods and paths in the city can be less accessible to pedestrians and cyclists than they appear on a standard street map.

Boundaries

"It's one of those interesting things, unless you live directly on Haight Street, depending on the apartments available, you'll have one apartment in this neighborhood that will have different Craigslist postings calling it five different neighborhoods because they're trying to appeal to different demographics of people." - Jerrold

"I don't have a good name for what's right across there, 'cause I don't think it's the Castro yet. But it's also not the Mission yet, but it's also not Duboce Triangle. And so I have no idea, like those two blocks down there, I don't know if they have a name." - Angelica

Depending upon one's perspective, spatial interpretations can be things that "everybody knows." Just about everybody who lives in San Francisco seems to have a concept of what "the Mission" is, for example. Realtor's maps of neighborhoods, however, don't necessarily share

concepts that “everybody knows,” and what “everybody knows” can from community to community and across time.

Neighborhood boundaries are ambiguous, even to those who identify as belonging to a particular neighborhood. Some respondents referred to where their neighborhood boundaries “technically” were, implicitly according authority to institutionalized neighborhood maps while also undercutting this authority as “technically” true but not practically true. Others expressed anxiety about whether they were getting their neighborhoods “right,” saying that they would have to check Google Maps after the interview. There is widespread agreement that San Francisco is a city of distinctive neighborhoods, but it may be harder to agree on how many or which neighborhoods make up the city. *150 Neighborhoods of San Francisco* examines the overlap between neighborhood names collected from seven different groups that may be considered authoritative sources of neighborhood boundaries from various perspectives: The Mission-based blog [Burrito Justice](#) has produced a map called [The Islands of San Francisco](#), which underwent a number of revisions based on feedback from commenters. The real estate website [Zillow](#) not only classifies its properties into neighborhoods but has released shapefiles for this data as well. UC Berkeley Professor [Bernt Wahl](#) has developed a San Francisco neighborhoods dataset based on a combination of city and real estate boundaries, demographic data, and physical features. Wikipedia maintains a page for the [Neighborhoods in San Francisco](#), listing over 100 distinct areas. Craigslist has broken the city down into neighborhoods for both its real estate and personals sections. The San Francisco Planning Department maintains a list of neighborhoods and shapefiles. Finally, the [San Francisco Association of Realtors](#) has its own [official neighborhood map](#), with revisions published every few years.

In total, 150 distinct neighborhood names emerge from combining these datasets, as seen in *150 Neighborhoods of San Francisco*, which we present both as a matrix and as a full list of names. Just 20 neighborhoods appear on all seven lists. These correspond with the neighborhoods most commonly referenced by our respondents, but there are some omissions. The Realtors Association does not recognize any neighborhood as “the Mission,” although this reference was used by many of our respondents, and refers instead to Mission Dolores and the Inner Mission as two distinct districts. The same lack of consistent granularity affects the Richmond, with some sources considering it a single district, and others dividing it into two or three subregions. There are 35 neighborhood names that only appear in the dataset of a single group. Many of the names that only appear in a single dataset label small neighborhoods in the southern half of San Francisco. Others are more colloquial names from the Islands of San Francisco map, like the Tendernob (between Nob Hill and the Tenderloin) and La Lengua (between the Mission and Bernal Heights).

By simply looking at the names used by different organizations, we were able to use data created by local communities, such as the Islands of San Francisco map, as well as data in popular community use, such as Craigslist's neighborhoods, where geospatial data outlining neighborhood boundaries is not available. Neighborhood names in themselves can suggest what a group considers a distinct region. Data from real estate sources and from Craigslist is particularly salient, as many people first get a sense of the city's various neighborhoods as they search for a place to live. Also, a number of interviewees discussed how a single house or

apartment may be listed as being in a variety of different neighborhoods in order to appeal to different demographics.

Using shapefile data published by [Bernt Wahl](#), [Zillow](#), the [San Francisco Planning Department](#) and the [San Francisco Association of Realtors](#), we produced the *Sketching Boundaries* visualization. A few attempts were made to quantify and visualize the amount of overlap and discrepancy between the various boundary datasets, however none of them were particularly clear or effective. More work could be done in this area, particularly focusing on areas of discrepancy. In the end, we appreciated the grace of simply laying the data on top of each other, unadorned, and the sketchy, pencil-like qualities of the lines. Some boundaries are reinforced multiple times, while others are less certain, giving the overall map a surprisingly human quality considering its source. The map seems just as compelling not knowing which lines belong to which dataset.

Wikipedia is an interesting resource, as its crowdsourced nature makes it seem connected to local knowledge yet it's still often referenced as an "official" source. As Steve said, "I've not seen that in anything official - official being Google Maps and Wikipedia." Wikipedia's [Neighborhoods in San Francisco](#) page is an intriguing case study in how people see and want to present the city to the world at large, visualized in *The History of Wikipedia's Neighborhoods in San Francisco Page*. This visualization is somewhat like a textual stem and leaf plot: each neighborhood name doubles as its own data point and as a whole, the space occupied by the names outlines the overall distribution over time. The edit history of the page was examined twice each year since the page's creation in February 2005. The names of the original 42 neighborhoods were kept in bold throughout, with new additions since the last revision in orange, and neighborhoods that were removed in the next revision have a green dot. To help guide the eye among the changes, arcs are drawn connecting each of the original neighborhoods from revision to revision, this helps give a reference point for where edits are being made. Some of the arcs end up crossing each other, noticeably when there's a slight change in the name of a neighborhood (from "the Castro" to "Castro"), or when there are corrections in the ordering of the list itself (it was not entirely in alphabetical order in some revisions). Selected annotations from the edit page itself are also included, although the majority of them were not particularly descriptive.

When it debuted in February 2005, the page listed 42 neighborhoods including the expected, like the Mission, Castro and Richmond, but some slightly more obscure choices as well, like Cathedral Hill and St. Francis Wood. The number of recognized neighborhoods quickly expanded to more than 100. Currently the page lists 113 neighborhoods, the majority of additions coming within the first three years. Along the way, some were lost (Haight-Fillmore is now recognized as the Lower Haight; Little Manila and the Theater districts came and went) and omissions were added (the Excelsior and the more commonly-referred to NoPa). It might be surprising that there were fewer hoaxes or micro-neighborhoods on the list, although some did make brief appearances. The fictional neighborhood of Snuggleton (bordered by the nonexistent 1st Avenue) lasted for nine days before being removed. The legitimacy of Safeway Heights was debated before it was ultimately stricken from the list. Interestingly, Safeway was occasionally mentioned by respondents as a landmark.. Angelica observed that

when people asked her where Duboce Triangle is, “ I’m like, ‘It’s right by the Safeway in the middle of San Francisco.’ And they’re like ‘Ohhhh, got it.’”

Stories

We wanted to allow users to explore the city of San Francisco, guided by the thoughts and words of our interviewees. *Quotes around Town* is an interactive map of San Francisco’s neighborhoods, annotated with quotes from interview participants. In addition to having the annotations be interactive, it was important for the map to be dynamic as well, since the neighborhood boundaries presented on the map may be unfamiliar. The Polymaps Javascript library allowed us to overlay polygon data on the map, as well as providing the intuitive “slippy map” interface that we have come to expect with web mapping applications, allowing the user to easily pan and zoom across the map. The basemap tiles came from [CloudMade](#), based on OpenStreetmap, while the neighborhood polygon overlays came from Zillow. The Zillow neighborhood data was generally at a level of granularity that agreed with those used by our interviewees. However, there were still some interoperability issues, since the Zillow dataset did not include neighborhoods like the Lower Haight, Hayes Valley and the Tenderloin, that were frequently discussed. However, it was still a better fit than the Association of Realtors data or the data from Bernt Wahl, which broke the city down into much smaller neighborhoods, many of which were not referenced by any of our respondents. The remaining interactions on the visualization like the highlighting of selected neighborhoods, displaying the neighborhood name and the annotation interactions were written in jQuery.

Viewed as a tool for exploration, information visualization can be thought of as a kind of play, in which both the “narrators” and the “readers” of the visualization are mutual players. Play engenders learning and experience through engagement. To encourage engagement with some of the stories and themes related by respondents, the project created interactive story maps, in which sketch maps are presented as puzzles to be put together. When a piece is dragged onto the map, quotations from the map maker’s perspective about the area shown on the piece are displayed. Pieces are presented in a predetermined order, so that the player can follow the map maker’s stories about their maps. *Storymaps: Brenda* features the work and thoughts of interviewee Brenda, a 70-year-old resident of Glen Park.

Qualitative research is frequently presented in the form of scholarly papers in which ethnographers describe their analysis and interpretation of emergent themes and place them in a theoretical context. Generally, the only people who read these papers are other scholars, and there is much debate among ethnographers about the importance of “giving back” to communities that are used for data collection, and presenting data in ways that are more accessible. The project’s story maps and game can be understood as “dataplay” conceived as a type of information visualization that gives players more explicit agency in interpreting and creating narratives about the data, since games are “particularly good at revealing the dynamics of complex systems because players become active participants in those systems” (Macklin et al 2009). By creating thought-provoking information visualizations and avenues for play, we hope to give something back to the communities we collected data from and to encourage community participation in making meaning from their information.

Game

The project also includes instructions and card templates for a material game that presents players with a story related to the project's themes, in an attempt to encourage playful interaction and engagement with the data. Through game play, the players draw their own maps of San Francisco, prompted by cards containing neighborhood descriptions drawn from the project interviews. Different perspectives yield different interpretations of a space, and some perspectives are typically considered more authoritative than others. In our interviews, people often remarked after drawing their sketch maps that they would have to go check Google maps to see if they "got it right."

In an attempt to create settings where people can have fun drawing mental maps without feeling intimidated or constrained by the sense that they have to make something geographically "correct", we created a game, *Invisible Bike Race*, that incorporates descriptive terms used by our respondents when talking about different neighborhoods. The game is paper-based since the materiality of sketch maps using pen and paper is part of their appeal, and since drawing with pen and paper is accessible and approachable for most people.

By interacting with our respondent's descriptions, we hope to encourage game players to reflect on the different ways that people think about neighborhoods and proximity, the associations that people make with different neighborhoods; and which neighborhoods are more or less familiar or clearly identifiable to them. The win condition for the game is drawing the most neighborhoods on one's sketch map.

Future Work

The timeline and scope of this project limited the amount of development we could realistically complete. Our choices for visualizations were somewhat limited by the data available, as some interesting projects would require data that does not exist or would require too much time to gather and structure.

One theme that emerged in the interviews was that a lot of people's activities in and outside of their neighborhoods revolves around food and restaurants. A network visualization of restaurants and travel between neighborhoods could be very interesting. "I tend to think about where food is. that says something about what i do outside of my house, it's generally eat things" (Bernadette).

Fog is a distinctive aspect of living in San Francisco, particularly for those living in the western half of the city. A visualization of fog coverage over the city throughout the year would be very useful for visitors and residents alike. Interviewee Jerrold remarked, "I think most people you would talk to who ride bikes, their world kind of shrinks and expands as the weather gets nicer." Unfortunately, it does not seem that the weather data exists at a level detailed enough for this sort of analysis.

Wikipedia is one resource for crowd-sourced data about neighborhoods, but more local trends within the city are unlikely to get published on the site. There are many colloquial terms for neighborhoods and micro-neighborhoods in the city, but there's no single dataset listing them. Recently, the triangle shaped strip between Cesar Chavez, Mission and Guerrero, colloquially called "La Lengua", was labeled as such on Google Maps. There are a number of very local, neighborhood-based blogs such as Burrito Justice, Mission Mission, Haighteration that may be good resources for hyper-local data and investigation of micro-neighborhoods in the city.

More personal data about individual's paths and routes throughout the city would be interesting, as well as people's boundaries for their turf or personal territory. The recent discovery of iPhone location tracking data could be an interesting resource for this type of data, with the proper permission and considerations for privacy.

The Wiggle, in particular, was a beloved and iconic feature of the city for many respondents that would be interesting to investigate further. One respondent observed that "People who live on The Wiggle or take The Wiggle as part of their commute definitely know The Wiggle. It's weird because it's almost a neighborhood thing within people who either live out here or live in this area and ride their bike to work. It almost forms this little community of people who ride The Wiggle. I love The Wiggle" (Jerrold).

We created one visualization focused on the obstacles that pedestrians may face, but all of our interviewees described using a variety of modes of transit: walking, jogging, bike riding, driving, public transportation like Muni or BART, taking a cab. Respondents provided interesting insights into the ways that transit that might be labeled "pedestrian" can potentially be broken down into different types of transit. Respondents who jogged noted that their perceptions of distance and transit time were influenced by their experiences as runners. One respondent commented "I run down Valencia to like 24th. But if I were to walk to 24th and Valencia, that would actually be a long walk. It's just that I think of it in running time. And so I'm always like 'Oh yeah, we can go to dinner down there. It won't take us that long to get there.' And then I'm like 'Crap. We should call them and tell them we're gonna be late,' y'know" (Angelica). In addition, walking with small children can be a very different experience from walking alone or with other adults. Respondents with children noted differences between walking with a stroller and without a stroller, and emphasized the influence of children's needs in their experiences of when and whether mass transit was a practical option. Grace, for example, observed that it was going up hills harder with a stroller. Visualizations contrasting transit time using different modes of transportation or the types of choices people make could be informative.

We were inspired and enthralled by [Sohei Nishino's Diorama Map project](#), which seems to tap into many of our own thoughts about mental maps, as the diorama map project presents "almost a bird's eye view of the city, is not a precise google map, but presents the key elements of the city in a form closer to my own memory and observation." A layered, multimedia view of the city exaggerating people's personal landmarks would be an interesting complement to their sketch maps.

While research on safety is valuable, it is also important to consider that high speed thoroughfares, perhaps most especially those lacking explicit traffic support for pedestrians, or ill-timed crossing support, may result in psychological barriers. Although some research suggests that major thoroughfares are safe to cross without signaling infrastructure, if major thoroughfares pose psychological barriers to crossing, people are unlikely to cross them, perhaps especially without explicit signaling infrastructure, resulting in the creation of border vacuums (Jacobs 1961).

Even outside of these ideas, where there may not be enough available data, the amount of existing data could be used for a number of other visualization projects that we would have liked to have the time to explore.

Concluding Reflections

"A neighborhood is what you make it. It could be peace there. It's what you make it" - Anna

Writing on the geo-visualization blog [Bostonography](#), Timothy Wallace asks *"What are we losing when we click on a Google Maps link instead of poring over a friend's sketch map?"* I bring this up because I think we are losing quite a bit. Why does our friend like this place? How does he imagine the neighborhood? What is most important to him...? What does he exaggerate? What does he forget? All of these are questions that cannot be addressed the same way."

While the atlas we have assembled of San Francisco mental maps is by no means complete and there is a great deal more work to be done in this area, we believe our work can contribute to greater awareness of the value inherent in individual portrayals of space, and that communities can benefit from spatial representations that are built from the bottom up, rather than the top down, with the full participation of people who would not typically be considered authorities on mapmaking.

We hope that our work will foster discussion and a re-examination of people's relationships with the city. In addition, we believe that the site we have created contains useful information about the city for newcomers that might have otherwise taken them a long time to discover. Our respondents were excited and interested in talking about this lovely city and their own neighborhoods, and we invite our readers to discover, explore and share it for themselves as well.

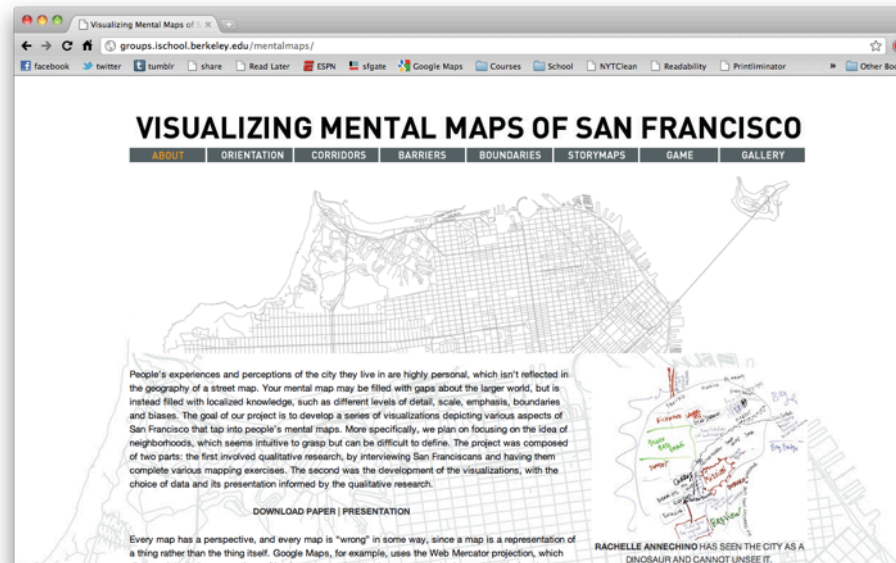
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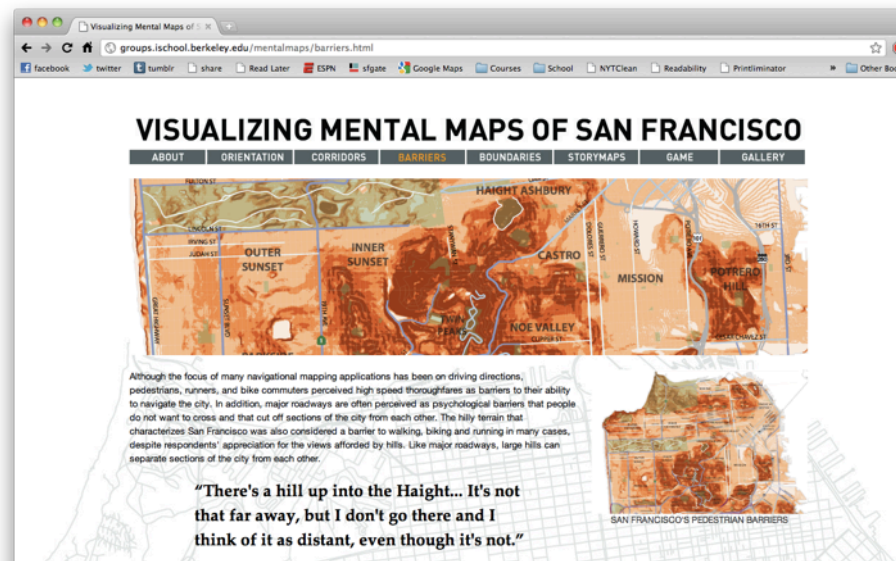
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Appendix B - Webpage

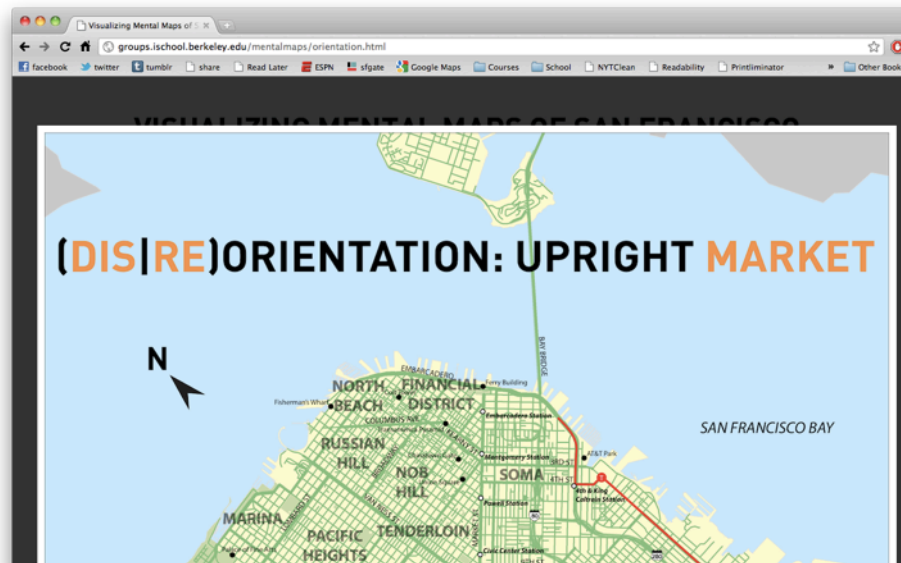
Our project website is located at <http://groups.ischool.berkeley.edu/mentalmaps>, where the full visualizations can be viewed. Here is what it looked like at the time this report was published.



Main page



Subpage - Barriers



A visualization displayed at full screen for viewing

Site Content

- **About** - Project Report, Presentation Slides
- **Orientation** - (Dis|Re)Orientation: Up is South, (Dis|Re)Orientation: Up is East, (Dis|Re)Orientation: Up is West, (Dis|Re)Orientation: Upright Market
- **Barriers** - San Francisco's Pedestrian Barriers
- **Boundaries** - Sketching Boundaries, Sketching Boundaries (colored), 150 Neighborhoods of San Francisco (names), 150 Neighborhoods of San Francisco (matrix), The History of Wikipedia's Neighborhoods in San Francisco Page
- **Storymaps** - Quotes Around Town, Storymap: Brenda
- **Game** - Invisible Bike Race (instructions), Invisible Bike Race (communique cards)
- **Gallery** - 14 sketch maps of San Francisco, 15 sketch maps of neighborhoods

Appendix C - Sample Demographics

| Name | Neighborhood | District | Gender | Race | Ethnicity | Year Born | Notes |
|--------------------|------------------------------|--------------|--------|-------------------------|-----------------------------|-----------|-----------------------------|
| Alex | Sunset | 4 | female | Asian | Japanese | 1951 | |
| Brenda | Glen Park | 8 | female | White, Caucasian | Italian | 1941 | |
| Ellen | Glen Park (and Outer Sunset) | 8 (and 4) | female | White, Caucasian | Swedish | 1959 | |
| Veronica | Noe Valley | 8 | female | Black, African-American | African-American | 1965 | |
| Max | Potrero Hill | 10 | male | White, Caucasian | Cajun-French | 1951 | |
| Dan | NOPA | 5 | male | White, Caucasian | | 1981 | |
| Tom | SOMA | 6 | male | Asian | Chinese | 1985 | |
| Lawrence | SOMA | 6 | male | Asian | Chinese | 1985 | |
| Rick | Excelsior | 11 | male | "Brown" | Latino | 1945 | |
| Grace | Glen Park | 8 | female | White, Caucasian | n/a | 1969 | Walking tour |
| Mary | Mission | awaiting | female | White | German | 1981 | |
| Petr | (formerly) NOPA | (formerly) 5 | male | White | Dutch | 1978 | |
| Evan | Noe Valley | 8 | male | White | | | |
| Angelica | Duboce Triangle | 8 | female | | | | Walking tour |
| Steve Stevenson | Mission/Bernal Heights | 9 | male | White | Jewish | 1981 | |
| Jerrold | Lower Haight | 5 | male | White | White/Norwegian | 1982 | |
| Bernadette | Bernal Heights | 9 | female | White | White | 1983 | |
| Ji-Yoon | Richmond | 1 | female | Asian | Korean | 1973 | |
| Oliver | Inner Sunset | | male | White, Caucasian | Scandinavian, German, Irish | 1983 | |
| Anna (with SO Ray) | Bayview Hunter's Point | 10 | | Black, African-American | | | |
| Jordan | Bayview Hunter's Point | 10 | male | Black, African-American | Black, African-American | 1983 | |
| Yasmin | Marina | 2 | female | "Middle Eastern" | Turkish | 1981 | |
| Andre | Sunset | | male | White, Caucasian | Argentine | 1990 | No interview, just sketches |
| Katie | Cole Valley | | female | Filipina | Filipina | 1982 | No interview, just sketches |
| Brittany | Bayview Hunter's Point | | female | White, Caucasian | Dutch | 1968 | No interview, just sketches |
| Edward | Nob Hill | | male | White, Caucasian | Persian/Iranian | 1981 | No interview, just sketches |
| Karen | (visiting from out of town) | | female | n/a | n/a | n/a | No interview, just sketches |
| Timothy | Outer Richmond | | male | White, Caucasian | Irish | 1980 | No interview, just sketches |
| Katrina | Marina | | female | White, Caucasian | Finnish | 1984 | No interview, just sketches |
| Miriam | Bayview Hunter's Point | | female | Black, African-American | Black, African-American | 1970 | No interview, just sketches |
| Xavier | Excelsior | | male | | | | No interview, just sketches |

Appendix D - Interview Protocol

[Don't have to answer any questions, won't use your name in anything, not a test]

MAPPING

Neighborhood Maps

What is the name (or names) of your neighborhood? Are there other names for your neighborhood?

>>Draw a map of [neighborhood name] [not a finished drawing, just something to show what you think are the main features]

What are the most important places in your neighborhood? [List as many as you can, everything you can think of.]

How do you get around your neighborhood?

How would you get to [places they've mentioned] for example?

>>Draw path for one example on pre-structured map (?).

Are there other paths/ways that someone living in your neighborhood might take to [whatever places]?

[How would you compare your way of getting there to other ways of getting there?]

Turf Maps

Besides your neighborhood, what other parts of the city/Bay Area do you spend time in? What do you do there?

[Work, school?] Think of an average day, where would you go?

>>Draw a map of the city/Bay Area [not a finished drawing, just something to show what you think are the main features] [Time limit?]

[Observe/discuss map]

At what point do you feel like you've left your neighborhood (thinking of places you would go on an average day, for example visiting friends, laundry, groceries, work, school...)?

What are the most important places in SF? [List as many as you can/everything you can think of]

How do you get around the city/Bay Area?

How would you get to [places they've mentioned] for example?

>>Draw path for one example on pre-structured map (?).

Are there other paths/ways that someone living in your neighborhood might take to [whatever places]?

[How would you compare your way of getting there to other ways of getting there?]

-- TAKE A BREAK --

NEIGHBORHOOD

What is your neighborhood like?

[How would you describe your neighborhood to someone who had never been here before?]

[To someone visiting from out of town? To someone thinking about moving here?]

[What kind of people live in your neighborhood?]

How long have you lived in this neighborhood?

Have you noticed any changes?

What do you like best about your neighborhood? [Why?]

What do you like least about your neighborhood? [Why?]

What is/are your favorite place(s) in your neighborhood? [Why?]

What place(s) do you like the least? [Why?]

What places in your neighborhood attract the most people/traffic? And the least?

Are there places that you think get too many people/too much traffic? [Why?]

Are there places that you think get too few people/too little traffic? [Why?]

How much of your time would you say you spend in your neighborhood? [What kinds of things do you do here?]

What parts of your neighborhood are most familiar to you? [Why?]

What parts of your neighborhood are least familiar to you? What are some unexplored parts of your neighborhood? [Why?]

Are there parts of your neighborhood that you avoid? [Why?]

-- OFFER ANOTHER BREAK --

CITY/TURF

What is San Francisco like?

How would you describe the city to someone who had never been here before?

[To someone visiting from out of town? To someone thinking about moving here?]

What kind of people live in SF?

How long have you lived in SF?

Have you noticed any changes?

What do you like best about SF? [Why?]

What do you like least about SF? [Why?]

What is/are your favorite place(s) in SF? [Why?]

What place(s) do you like the least? [Why?]

What places in the city attract the most people/traffic? And the least?

Are there places in the city that you think get too many people/too much traffic? [Why?]

Are there places in the city that you think get too few people/too little traffic? [Why?]

How much of your time would you say you spend in SF? [What kinds of things do you do here?]

What parts of SF are most familiar to you? [Why?]

What parts of SF are least familiar to you? What are some unexplored parts of the city? [Why?]

Are there parts of SF that you avoid? [Why?]

What would be a situation where you might find yourself trying to get to someplace unfamiliar/where you didn't know your way? Is there an example that you remember happening recently?

How did you get there? [How would you get to a place that you've never been to before? How do you find your way?]

Do you have a car? Have you ever had/not had a car?

Do you have a bike? Have you ever had/not had a bike?

[In what situations would you find yourself traveling by car? On BART? By bus? On MUNI? By bike? On foot? Anything else? How would you compare these different kinds of transit? What do you like/dislike about them? Are there certain kinds of transit that you avoid?]

[Affect of weather, time of day]

Little more sensitive stuff at the end [Remind again that they don't have to answer any questions]

What are the cross streets where you live?

What is your gender?

What is your race?

What is your ethnic background?

In what year were you born?

Appendix E - Consent Forms

Consent to Participate

Introduction

The Visualizing Mental Maps of San Francisco project is being conducted by Rachelle Annechino and Yo-Shang Cheng, graduate students at the School of Information at the University of California, Berkeley. We would like to invite you to take part in our project, which is about perceptions of San Francisco.

Procedures

If you agree to participate, one or both of us will conduct an interview with you at a time and location of your choice. The interview will involve questions about your neighborhood and the city, such as asking you about important places, and how you get to different places. It should last about one hour. Some interviews are primarily sitdown interviews, and some are “tour” interviews where we walk around your neighborhood. You can change a “tour” interview to a sitdown interview at any time you like.

We will store all information we collect from you using a false name, instead of your real name. Any record linking your real name with the false name will be kept in a locked or password-protected file. We will not use your real name in any material created for this project, or reveal your real name to anyone who is not working on this project.

With your permission, we would like to make an audiorecording of the interview. For sitdown interviews, we would like to make a video recording of interview segments which involve drawing a picture or interacting with a map. For tour interviews, we would like to record GPS information about where we walk. We will turn any recording device off at any time that you request.

If you agree to being videorecorded, you can let us know whether you want us to video just your hands and the map or drawing, or if it is okay to include your face.

On the Media Release Form, you can specify how any recordings we make can be used. We recommend waiting until the interview is over to fill out the Media Release Form so you have a better sense of what the recordings contain, but you can fill it out now if you prefer.

Participation is completely voluntary. You are free to decline to take part in the project. You can decline to answer any questions and are free to stop taking part at any time.

Questions

If you have any questions about this project, please contact us at any time. Rachelle Annechino can be reached at 415-533-9327 or rachelle@ischool.berkeley.edu, and Yo-Shang Cheng can be reached at fychang@ischool.berkeley.edu.

Consent

Please initial below to indicate consent to having the following items recorded. You do not have to be recorded to participate.

____ I agree to being audiorecorded. The audiorecording can only be used according to my specifications on the Media Release Form.

____ I agree to being videorecorded. The videorecording can only be used according to my specifications on the Media Release Form.

____ I agree to have GPS data recorded during our walk. The GPS data can only be used according to my specifications on the Media Release Form.

____ My face can be included in videorecordings.

Please sign and date below to indicate your consent to participate in the project.

Participant's Name

Participant's Signature

Date

Media Release Form

As part of this project we will make audio, video, and or GPS recordings while you participate in the project, only as you have agreed to on the Consent Form. Please indicate below by initialing what uses of these records you consent to. This is completely up to you. We will only use the records in way(s) that you agree to. **In any use of this information, your name will not be identified.**

1. The recordings can be used in classrooms.

Audio _____ Video _____ GPS _____

2. The recordings can be shown in public presentations.

Audio _____ Video _____ GPS _____

3. The records can be used online.

Audio _____ Video _____ GPS _____

I have read this form and give my consent for use of the records as indicated above.

Signature _____ Date _____