

## **Co-Census: Designing an Interactive Museum Space to Prompt Negotiated Narratives of Ethnicity, Community and Identity**

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This material is based upon work supported by the National Endowment for the Humanities (NEH grant 51357) the University of Illinois' Institute for Policy and Civic Engagement Civic Engagement Research Fund Award. Any opinions, findings, conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the NEH, UIC or IPCE.

**Abstract:** This paper explores data collected during the pilot phase of an ongoing research program designing and studying an interactive data map to help museum visitors produce narratives about their ancestry and ethnic identities, and the distribution of such populations in a metropolitan area. A thematic map of ancestry data collected by the United States Census Bureau served as a vehicle to help visitors explore their own ancestry as well as that of their fellow visitors. By casting the locus of individuals' identity onto an external artifact – a map of Cook County, Illinois – and shifting the focus from the individuals' stories to the shape of communities at large, the exhibit was designed to promote observations, reflections, and conversations among visitors. This study reports on a pilot test of two initial sets of static maps in the first iteration of the design process, identifying ways visitors “emplotted” (Wertsch, 1998) the data maps with elements of social narratives. Five such elements were identified: (1) specific neighborhoods as anchors; (2) themes about immigrants' motivations, (3) themes about neighborhood segregation; (4) familiar places as settings; and (5) characterizations of spatial features of the map image. Implications for iterative design are explored.

### **1. Overview**

A current trend in museum education is to empower visitors, not the institutional voice of the museum, as the final authority of the interpretive narrative (Roberts, 1997). Designers of museum exhibits can benefit from attending explicitly to the ways visitors might connect their own lived experiences (“little narratives”) to particular larger, social – or “big” – narratives, through the activity that occurs in the exhibit space (Rowe, Wertsch, & Kosyaeva, 2002). This study reports on the initial phase of a design-based research project to create an interactive display in a free public museum that affords visitors' connections of their own little narratives to big narratives of ethnic and ancestral identities, and the related themes of immigration, settlement, and segregation. In pilot tests with museum visitors, two versions of a geographic information system (GIS) map display of ancestry data were used to examine visitors' production of emergent big and little narratives in an interview with a researcher, with particular attention to the role of the maps as mediational means shaping these narratives.

Maps, especially small-scale local maps, would seem to afford connections to personal “little” narratives. When looking at a map of our current location, we may be inclined to connect to the map, locating where we live, where we were this morning, and

places we recognize. Visitors to a museum may share these little narratives with people in their group, but people rarely share across groups with other museum visitors. A premise of this research program is that the incorporation of thematic population data into a map may afford the production of bigger social narratives in conversation, as visitors examine population distributions over space and time. This design-based research program (Brown, 1992; Collins, 1992) seeks to bring together these two types of narratives by populating a local map with thematic data that can serve as a reflection of the visitors in the space.

The abundance of complex data representations such as GIS maps in media suggests the importance of understanding how people construct social narratives with these tools. In addition, the ever-growing rate of incorporation of embodied interaction technologies in museums provides an opportunity to examine both the ways people reason with data maps, and also the ways their interactions with a map exhibit might mediate the kinds of narratives that emerge. Our larger research program is examining both of these, but the present study reports only on an initial pilot test examining the narratives that emerged from interviews with visitors around two static (non-interactive) maps of ancestry data.

The act of translating the complex three-dimensional world into a two-dimensional representation necessitates some form of “lying” (Monmonier, 1991), because the mapmaker must choose to preserve some data and features while removing or diminishing others. Likewise any data display both reveals and hides important aspects of the phenomena represented (Tufte & Weise Moeller, 1997). In addition to the traditional mapmaker’s design variables of size, shape, tone value, texture, orientation and hue, the dynamic mapping space prototyped in ongoing iterations of this project will introduce variables of animated movement, opacity, layering, and the coordinated interaction of users to change the display. By first analyzing static forms of the eventual maps, we are able to learn how to design maps to meet the needs of this exhibit before complicating the equation with the interactivity. We assume that particular representations of number and proportion might prove to promote different kinds of observations, discussions, or misinterpretations, and understanding these consequences of our design choices will provide stronger footing in the ongoing iterations of the design. Here we discuss early findings of our design based research program and their implications for future work.

## **2. Conceptual Framing**

This analysis is based on the assumption that people reason with narratives, both consciously and unconsciously (Bruner, 1991), and that these narratives serve as cultural tools that mediate sense-making (Wertsch, 1998). The narratives and narrative elements discussed in the findings are assumed to be emergent in conversations, often by more than one speaker, and so are not necessarily pre-existing in the minds of speakers (Wortham, 2001). Narratives that emerge in conversations among multiple speakers around a map involve the mediated agency (Wertsch, 1998) of the speakers, the map, and any number of pre-existing social narratives that are brought to the conversation by all participants. Thus our interest here is in the narratives produced in the interview conversations, rather than any assumed underlying representation or knowledge possessed by individuals before or after the conversation.

### *Cultural tools and organizing themes*

The production of these narratives is a form of *mediated action* (Wertsch, 1998) between the museum visitors – the agents – and the map displays, the cultural tools they employ. The agents are producing the narratives, but they rely on the maps to mediate those narratives. That is, neither the visitors nor the maps alone could produce these narratives; it is the combination of the two that brings them forth. Wertsch gives the example of a pole vault to explain the principle of mediated action, saying that “it is futile, if not ridiculous, to try to understand the action of pole vaulting in terms of the mediational means – the pole – or the agent in isolation. The pole by itself does not magically propel vaulters over a cross bar; it must be used skillfully by the agent. At the same time, an agent without a pole or with an inappropriate pole is incapable of participating in the event” (p. 27). The visitors in our study are producing the narratives, but the maps are the mediational means through which these narratives are produced.

In conducting this analysis, we focus on *themes* that emerge in visitors’ interactions with the display. Wertsch (1998) suggests that there are broad themes in society that people appropriate when producing narratives. An example of one such cultural tool is the “quest for freedom theme” used by students asked to write an essay about the origin of their country. Wertsch notes that this theme was adopted “as an organizing point for the greater part of most of the narratives”(p. 88) even for students who recognized this theme as problematic, and suggests that this finding is not surprising “at least for individuals who learned history in American high schools”(p. 89). The “quest for freedom” theme is a cultural tool that they have been given through their high school education, and the particular characters and plot elements inherent in that tool help organize – and at the same time constrain – the narratives that people construct about the origin of the United States.

We assume that people have many such cultural tools with which they reason about topics related to segregation, immigration, race, ethnicity, and local neighborhood politics related to these issues – upon which they draw when interpreting map displays such as ours. The visitor may not be consciously aware of these mediating cultural tools even while employing them, but we believe certain design decisions of the maps may afford the production of narratives around these themes. The present analysis begins to investigate the emergent themes mediating narratives around mapped census ancestry data in order to inform ongoing work attempting to create displays that afford further incorporation of these themes.

### *Mediational means and authority*

As mediational means, maps are inherently “associated with power and authority” (Wertsch, 1998, p.25). Wertsch assumes that “the source of authority is not to be found in [the agent] alone” (p. 72). Though an agent alone (the museum visitor) could produce a similar narrative about Chicago neighborhoods or immigration without invoking the map as a mediational means, the use of that map gives authority to the narrative, and to the visitor producing it (Wertsch & Rupert, 1993). We assume that this authority may have the potential to break down the barriers commonly inherent in conversations usually considered to be taboo between groups of people, such as the topic of ethnic differences. People are often taught that it can be rude to ask others about their ethnic heritage, even though it is a topic of great universal curiosity. By removing the locus of identity from

the people themselves and casting it instead onto an external artifact, the shared display, we are looking for evidence that visitors feel freer to ask questions and make observations mediated by the display. Similarly, by changing the focus of a person's story of identity from his or her own lived experience, to that of a larger chronicle of how migrations have shaped communities in the Chicago area, we hope that visitors will explore the commonalities and the differences in these histories. The formative design studies conducted in this project examine visitors' reactions to sharing these kinds of demographic information about themselves. Ongoing work will investigate the impact of the interactive environment and docent facilitation on these preferences.

### *Big and Little Narratives*

We build off the assumption that museums are “potentially ideal public spaces where personal, private, or autobiographical narratives come into contact with larger-scale, collective, or national narratives in mutually animating ways” (Rowe et al., 2002). Informal education settings such as museums place a high premium on self-guided inquiry activities. Visitors are encouraged to explore these “free choice” (Falk & Dierking, 2000) environments according to their own interests and needs, and as they do so they innately form a dialectical relationship with exhibits (McLean, 1999) often trying to find connections between their own personal lives and experiences and the material presented by the exhibit. At the same time, however, museums are attempting to convey a particular narrative to their visitors. A current trend in museum education is to empower visitors, not the institutional voice of the museum, as the final authority of the interpretive narrative (Roberts, 1997).

Following Bruner (1991, and as described in Rowe et al., 2002), we assume that a *narrative* is a “way of knowing about the world”(98), and there are two distinct types. On one hand we find the official narratives of a society, the large-scale, collective story provided by cultural leaders or authority figures (99), and on the other, the vernacular culture representing smaller, special interest communities. The official “big” narratives tend to be idealized and simplified, while vernacular “little” narratives present more ambiguity and conflict. The way these two sizes of narratives interact with each other in museum settings is of interest in our work, as the big narratives from the museum as well as from society at large, the little narratives experienced by the visitors, and the maps displaying census data all work together to mediate the produced narratives in the exhibit.

This exhibit attempts to provide a bridge between the personal “little” narratives of visitors and the collective “big” narrative of immigration by reflecting individuals' identities onto a shared public display. This approach allows each visitor to see how he or she is “reflected” in the census data and to connect his family's historical narrative to larger immigration trends as well as to the reflection of the neighborhood presented by the *Mapping the Neighborhood* exhibition in which the display is situated (described below). We assume that these big and little narratives may be elicited and used as cultural tools for interpreting and emplotting what they see in the map display.

### **3. Background**

This project represents a collaborative effort among learning scientists, computer scientists, and our institutional partner the Jane Addams Hull House museum in Chicago,

Illinois. This small history museum is located in two original settlement house buildings and seeks to “make connections between the work of Hull-House residents and important contemporary social issues” ([http://www.uic.edu/jaddams/hull/hull\\_house.html](http://www.uic.edu/jaddams/hull/hull_house.html)). The Hull-House Museum has a long history of using census data to effect social change – the 1895 publication of the *Hull House Maps and Papers: A Presentation of Nationalities and Wages in a Congested District in Chicago, Together with Comments and Essays on Problems Growing Out of the Social Conditions* used groundbreaking illustrations of census data to successfully advocate for social changes in an urban immigrant community. Recently the museum renovated and re-opened its *Mapping the Neighborhood* exhibit, allowing visitors to explore the demographic neighborhood maps created in 1895. These maps were constructed by Hull House workers who went door-to-door surveying neighborhood residents about their ancestry, the languages spoken in their homes, their living conditions, employment and wages, and a host of other questions in order to advocate for immigrant services in the city.

The original Hull House maps directly reflected the neighborhood’s residents at the time in specific detail – each individual building was drawn and all residents were represented by color-coded shading. A resident of the neighborhood at that time, therefore, could have easily connected himself and his family to the map by locating his building and identifying the color that corresponded to his ancestry. Our display begins to build on this tradition by creating a 21<sup>st</sup> century version of such maps, but expands the geographic region represented to the entire county in order to help visitors – many of whom are local residents – explore broader patterns of settlement still visible in Chicago today.

### *Ancestry and the American Community Survey*

The American Community Survey (ACS) is a 1% sample of the United States population taken annually. To map our exhibit to the original Hull House maps, we focused on the first ancestry category, similarly to Jane Addams’s workers in 1893. The modern ACS does not require respondents to align themselves with a previously defined checkbox but instead open-endedly asks, “What is your ancestry or ethnic origin?” Responses are tallied and interpreted (see <http://www.census.gov/population/www/ancestry/anc-faq.html>) and reported in Summary File 3.

This is first ancestry *reported* by respondents, resulting in some interesting nuances to the data. In the modern world where cross-cultural marriages are more common than ever before, many Americans trace their ancestry to multiple countries and/or ethnicities. Religion is still a large factor in many marriages, but in America a Polish Catholic marrying a German Catholic is not taboo as it has been historically both in the United States and in Europe. Therefore it is not uncommon to have Americans who dually identify with two or more ancestries. Siblings resulting from the German/Polish union would be 50% of each and may identify their ancestry differently. For instance the sister may identify with her Polish mother and report herself as being first Polish, while the brother relates more to his father and describes himself as German. Thus the same family tree could manifest as two completely different responses in this category. Likewise, many Americans, especially those whose ancestors have been in the United States for one or two centuries, are quite likely to trace their heritage to many

different ancestry groups, such that no single group is a significant enough portion of their heritage for them to closely identify with that group. Hence some people choose to identify generically as “Western European” or even just “European” rather than as a particular country or culture. And some, of course, identify simply as “American”.

When reporting First Ancestry in the ACS, the census bureau breaks it up into over one hundred categories. These designations include mostly unique ancestries (such as Basque) but also group some responses together (e.g. Sub-Saharan African). This report lumps Hispanic and Asian ancestry groups as well as any tally of those who identified as African American (as opposed to African) into one large “Other groups” total, assuming those classifications were redundant with race categories. Subdivisions of Hispanic (e.g. Mexican, Costa Rican) and Asian (e.g. Korean, Japanese) categories as well as those identifying as African American are available from the race report in Summary File 1. We incorporated these race tallies into the ancestry report in place of the generic “Other groups” designation, and by doing so our new estimated total population was within 3% of the actual reported population. Given that margins of error were reported for each group due to sampling, and we’d chosen to ignore these margins of error because our intent is to project a general impression of the patterns present in the data, not to provide exact numbers (as discussed below), we deemed that this result was indicative of the real numbers to a sufficient level of accuracy for our purposes.

#### *Design of the map display*

The research team made several key decisions in the design of the display based on design literature and discussions with museum personnel and their goals for the exhibit in order to create two maps to be pilot tested *in situ* at the Hull House museum. The two base maps included bodies of water – Lake Michigan and the Chicago River – and city and township boundary lines in the county but no other landmarks for reference. Labels were minimal to keep from crowding the display, and census tract lines – the geographic level at which the data were tallied – were present but faint. Map B also included transit lines (“the el”), as an additional point of geographic reference for users.

We selected graduated symbols to represent our data (a “bubble” map), with each ancestry category represented by a different hue (see Figure 1). Typically a graduated symbol thematic map employs three to five class breaks of the quantitative data to facilitate interpretation (i.e. it is difficult for the eye to distinguish among five or more circle sizes). Because this display was not intended to afford strict interpretation of the numbers (e.g. “286 Russian people live in this census tract”) but rather aimed to help the user identify broader trends and patterns in the data, we used a higher number of class breaks – seven in version A of the map and 32 in version B – to preserve some of the subtleties of the patterns in the quantitative data. The resultant displays do a poor job of affording direct numerical interpretation but do show citywide patterns.

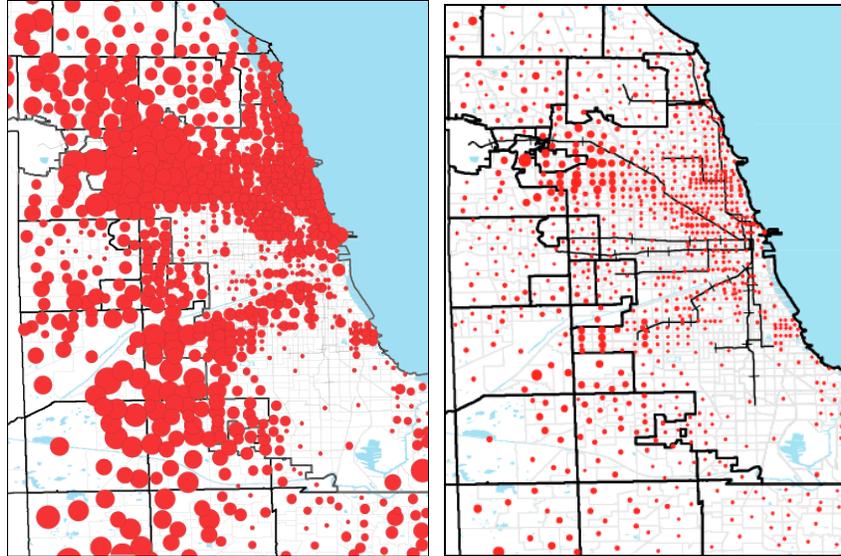


Figure 1. Two versions of the “rough draft” map used in the pilot study, here showing Polish first ancestry. Map A on the left uses seven classes approximating natural breaks. Map B on the right uses 32 equal interval classes. Both versions were created for the 23 ancestry categories from which visitors selected.

An important design decision was to constrain the first ancestry census data set, which in raw form (after incorporating the Hispanic and Asian racial subgroups) included over 200 different ancestry categories. Though in theory enough unique colors would have been available for each of these categories, in practical terms a user could not be expected to distinguish among so many colors in a projected display. The problem would have been amplified given the extremely small representation of some of the groups; it is simply not practical to display the estimated 37 Dutch West Indian residents in Cook County on a display also representing the 908,066 people of Mexican descent. To constrain the number of categories to a scope reasonably distinguishable on the display, we joined ancestries with smaller populations into grouped categories. Any individual ancestry group with more than 45,000 residents in Cook County (roughly 1% of the 2009 population) was represented individually. The rest were grouped together according to the United Nations Statistical Division’s regional categories.

For example, the over 400,000 Polish Chicago residents would be able to see “Polish first ancestry” data on the map, while Ukrainians, representing only 23,006 Chicagoans, would see themselves reflected as Other Eastern European, in combination with Czech, Romanian, Hungarian, Slovakian, Bulgarian, Czechoslovakian, Slavic, Soviet Union, and Carpatho-Rusyn residents. This Other Eastern Europe group tallies over 116,000 residents, thereby clouding the extent to which a member of one of those groups may feel he is accurately reflected. Grouping these distinct – even if geographically similar – ancestry groups is also problematic from a cultural perspective, as geographic proximity does not imply cultural proximity. However, this tradeoff avoided the display being overrun with hundreds of colors, thus potentially clouding visibility for all visitors. We were aware that this tradeoff was imperfect, and thus wished to investigate how it affected visitors’ ability to relate to the mapped data.

#### 4. Research methods

This pilot study of two initial map designs took place *in situ* at the Hull House Museum in the spring of 2011. Ten interviews of groups ranging from 1-3 visitors were conducted over three days, with a total of 14 participants. All museum visitors who entered the study space during testing were invited to participate, either individually or with any companions who came in with them. Of the interviewees, two were docents of the museum.

The interviews were conducted by the first author. Participants were asked for the one or two ancestry groups that best represented them, from a list of 23 ancestry categories, and were shown two different digital maps of that ancestry data plotted on Cook County census tracts (see Figure 1), using a mock-up of the display projected onto a wall. Bubble layers of different ancestries were turned on and off by the researcher during the interviews. Each individual viewed his or her first and, where applicable, second ancestries. Groups of visitors viewed the ancestries of all members of the group. Each individual or group also viewed one additional category of an ancestry that did not represent anyone in the group. Visitors were asked open-ended questions about what they saw in the maps, including:

- *What do you see? What is this map showing you?*
- *Does anything you see in the display surprise you? Why or why not?*
- *Is anything about this display confusing to you? Why?*

Do you have any questions after looking at this display?

The full interview protocol is attached as Appendix A.

The interviews were audio taped, and a screen capture video of the laptop recorded the displays being shown during the discussion. These interviews were transcribed and the transcripts were time coded to the video display, in order to pair the remarks to the map being viewed. Using the qualitative analysis software NVivo, the transcripts were coded following a grounded theory approach (Corbin, Strauss, & Strauss, 2008), to identify the different ways participants described and made sense of the map displays and the kinds of descriptions produced.

The first round of open coding identified the following 13 kinds of descriptions:

- Naming ancestry categories
- Reference to immigration or immigrants
- Reference to self
- Reference to “others” (people constructed as different than speaker)
- Connection to outside knowledge
- Reference to a specific place
- Quantitative characterization
- Reference to absence
- Reference to bubbles or circles
- Use of geographic language (e.g. cardinal directions)
- Description of spatial patterns
- Reference to “population”
- Reference to time (e.g. year, decade, era)

The research team reviewed transcript excerpts coded in these categories, and a second round of coding examined the kinds of narrative elements suggested by particular

map characterizations. For example, some passages featured multiple references to specific places represented by the map, sometimes naming known locations, while other passages were more purely spatial in their description of clusters or patterns. These different modes of description produced different kinds of narratives, and suggested different affordances for “emplotting” the data (Wertsch, 1998, 2004).

The second round of coding produced the five elements of emergent narratives in the interview conversations:

1. Chicago neighborhoods as anchors
2. Familiar locations as anchors
3. “Big narratives” of immigrants or immigration
4. Themes of neighborhood segregation
5. Characterizations of spatial features of the map image

These five narrative elements structure the Findings section that follows.

## **5. Findings**

Each of the five narrative elements is discussed below, illustrating the kinds of narrative “plots” it afforded with illustrative excerpts from the interview data.

### **5.1 Using Chicago neighborhoods as anchors**

Many visitors attempted to make sense of the map by locating observed patterns with references to Chicago’s neighborhoods. They used their knowledge of these neighborhoods either to explain patterns they saw in the map, or to ask about patterns they expected to see. Neighborhood identity is strong in Chicago, with connections to neighborhoods often correlating with racial, ethnic, or cultural identities. Many of the visitors were Chicago residents, so it was not surprising that neighborhoods were a primary tool used to orient themselves to the map. These neighborhoods served as anchors in emergent map narratives.

Neighborhood anchors took a few different forms. Some were broad entities like North Side, South Side, West Side, “the lake front,” or “downtown”:

“Um, and the concentration Western European appears to be mostly on the North Side and close to the Lake also. Um, and ... quite heavily dispersed throughout the suburbs. Not so much on the South Side, or like the Near West Side.” (Wendy)

Five of the ten interviews contained references to the North Side or the South Side. These terms, for Chicagoans, are often more than just geographic descriptors: there are distinct social identities associated with each of them, and Chicagoans will often identify strongly with being (for example) a “West Sider” (potentially taking offense at being confused with a “North Sider”).

Sometimes these broad neighborhood anchors were refined with racial or ethnic modifiers, as seen in Isabella’s distinction of “South Side Irish” from the “South Side”:

“It’s surprising that right now, you know, South Side Irish is, you know, South Side of Chicago on the map, it’s not really any... They’re mostly on the North Side.”

The south side community of Beverly is traditionally Irish and is the site of a Chicago tradition, the South Side Irish St. Patrick’s Day parade. A significant Irish population in Beverly can be seen on the map, but because the community area is on the western edge

of the city, bordering the suburb Oak Lawn, Isabella was not able to pick it out. Instead she saw a large swath of the south side with very few Irish – areas that are predominantly African American – and expressed confusion.

Other neighborhood anchors were the named Community Areas commonly used as geographic and cultural referents. Three such community areas were referenced in the interviews: Chinatown (mentioned by three participants), Hyde Park, and Kenwood. Chinatown is a well-known area of the city, and also is easily identified on the data map of Chinese first ancestry as a highly-concentrated cluster of data, making it a link between the visible spatial patterns and neighborhood knowledge:

“Um well yeah that like, the big ... blob. ((laughs)) The big blob of color. It looks like that should be like where Chinatown is.” (Isabella)

Elliot referenced both broad and specific neighborhoods when looking at the Polish population, identifying one cluster of Poles on the map as follows:

“Uh, and then the one concentration on the South Side is Hyde Park, Kenwood” (Elliot)

Several suburbs in the Chicago metropolitan area were also referenced in similar ways.

Finally, some neighborhood knowledge was more specific, identifying named local neighborhoods within the larger community areas. Though no streets were labeled on the map, Elliot correctly identified Milwaukee Avenue not as a street, but as home to a predominantly Polish population:

“Well it’s going out Milwaukee Avenue, and you know, other Polish, other Polish, um, Polish areas.” (Elliot)

In these ways, Chicago’s neighborhoods served as reference points in the maps that participants could use as anchors for their emerging narratives, enabling them to reference their prior knowledge and lived experiences in making sense of the data.

Interestingly, none of the interviewees specifically referenced their own home community when looking at the display. The closest instance was Greg, who offered that he was “not from Chicago” and therefore was not as familiar with the neighborhoods. Other visitors admitted to being from the area when asked but gave no specific information about from which specific community they hailed.

## *5.2. Using familiar map locations as anchors*

One way that closer personal connections to the map were evidenced was the use of familiar locations that were visible on the map. Though this first iteration of the design included very few symbols as referents to places, the second map (Figure 1, right) included the public transit lines, the Chicago “el.” Because many of the visitors were local residents, they were able to use the el lines to orient themselves to the data:

“it’s interesting because since I know where things are, like, related to the el lines it gives me a better sense of what I’m looking at on the map. Where if they were... like if they weren’t there I’d just be like, ‘Oh, Chicago.’ Like, they give me more sense of where everything is.” (Ashley)

Multiple participants made similar comments, suggesting that inclusion of such reference symbols provides an important tool for users and might help mediate the production of more specifically personal narratives than were evidenced in this pilot.

### 5.3. Referencing “big narratives” of immigrants or immigration

An additional manifestation of visitors’ outside knowledge was their comments referring to immigration and the practices and customs of immigrant groups. Whether from their formal education, the Hull House museum, or another source, “big narratives” (Rowe et al., 2002) of how immigrants behaved showed up in several of the interviews. For instance, in trying to explain a correlation between Russians and Other Eastern Europeans observed on the map, Evan said the correlation made sense:

“[because they] used to stay in one community and the location of their countrymen.” (Evan)

This comment suggests a causal model of settlement patterns: that immigrant groups tended to congregate with their own people. This model conflicts with another “big narrative” found in the surrounding exhibit, in which Jane Addams’s maps clearly illustrate significant intermingling of various immigrants. Evan and his group (the only group of three interviewees together) still held to their pre-existing assumptions about the clustering of immigrant groups, and found support for it in their observations of the GIS map. They went a step further with this narrative, using it to compare two categories they were viewing: Russian and Other Eastern European.

Evan: Kind of, what I mentioned, they share the same place, Eastern European.

Eliana: Yeah, because they're Eastern European. ((laughter))

Evan: Yeah, but Russian is not Eastern European.

Raina: Actually they are--

Eliana: Um yeah, they're not, but..

Evan: But... ((laughter))

In this exchange we see the group pursuing the big narrative produced by Evan above, that immigrants follow their countrymen, and use it to explain why they see similar distributions between the two groups, Russian and Other Eastern European. We then see the beginning of the group troubling this narrative, questioning the amalgamation of ancestry categories (“Russian is not Eastern European”), though the discussion does not continue here. This troubling of the ways the display reflects and distorts identities, both supporting and problematizing emergent narratives, is precisely the kind of conversation we hope to support and extend into richer dialogue as the design moves forward (discussed below).

Gunther invoked a similar big narrative, but in the opposite way: rather than explaining overlap of two groups’ distributions by noting their geographically similar roots, he called upon his knowledge of world geography to question whether immigrants from countries closer to each other (Germany and Poland) would have a harder time comingling with people from another continent (Chinese immigrants):

“I don't know if this would be the right question, but like, did they get along? At all? Or, because some are in the same area. But like Germany and Poland are right next to each other, and then China is all the way, you know, in another continent. And, I don't know, I don't see how they, I mean

they could get along because they do now, but back then I feel like there would have been a lot of problems with them all in the same area.”

Gunther’s big narrative is interesting in the implicit suggestion of an element of historical time (“they do now, but back then”), which is not supported by an element of the display in this early iteration (i.e., only one decade’s data was included). His narrative also appears to include an assumption about geographic proximity relating to historical harmonious co-existence, which his Germany-Poland example would seem to undermine.

Paige took a different stance, yet still incorporated a big narrative about immigrant behaviors in explaining settlement patterns:

“Well you can see on this where people, where people moved to more, like along the lines of transportation and (inaudible) ... where all the jobs are and everything.”

This statement gives insight to a big narrative suggesting that settlement patterns tend to be related to transit lines, which in turn are related to jobs. This narrative was invoked by Map B (Figure 1 right), which included the public transit lines, transit lines that were not present when many of the communities began forming originally, and in fact, some transit lines were constructed in response to the placement of communities. Several respondents commented that the el affected their interpretation of the display, like Chi:

“Like for this map, they kind of suggest to me that the population of Chinese have something to do with the transportation system.”

Chi explicitly suggests that “they” (the el lines, or the people who put them in the map) must have a meaning, or they would not be included. This is an example of the mediating power of these design decisions: inferences of importance and even causality may follow from simple decisions of inclusion and exclusion of such details (see Radinsky, Loh & Lukasik, 2008, for a fuller discussion of reasoning fallacies supported by map design decisions). It is also an illustration of how maps condense both inscriptions of the current state of the world as well as traces of past states of the world, and this co-presence can further muddle interpretations of causality.

#### ***5.4 Referencing themes of racial/ethnic segregation in Chicago***

Beyond these big narratives about immigration, which mainly took the form of causal explanations for observed data patterns, some participants brought in knowledge of specific inter-racial and ethnic dynamics in particular areas of the city. Gunther more than any other participant referred to the absence of data in particular places. He noticed a complete lack of his two selected ancestry groups, Polish and German, in certain parts of the map (See Figure 2.), and kept asking about this pattern:

“There’s not a lot to the south and the east” (Gunther)

“For the most part they’re kind of, they’re kind of still staying away from the southeastern end of the map.” (Gunther)

“But I guess I don’t really know why they’re not towards like the southeastern part of the, the map.” (Gunther)

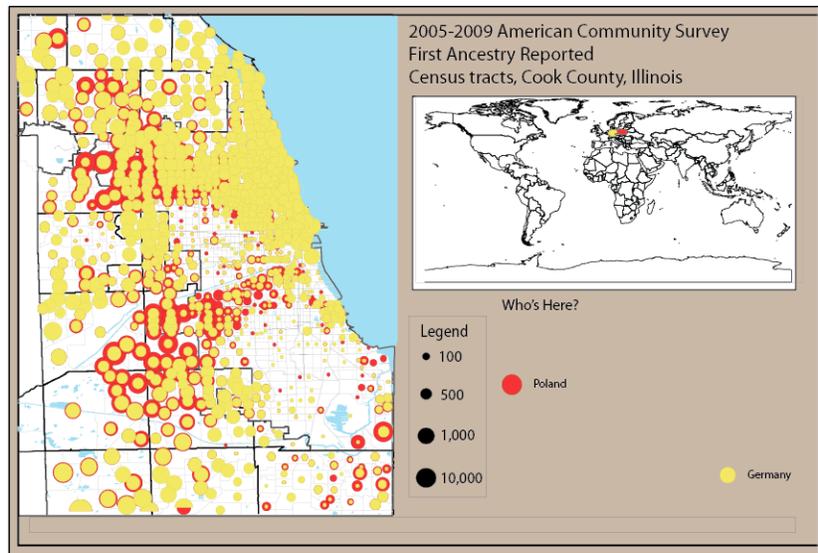


Figure 2. Map A showing German and Polish populations.

Here he animates the data as “staying away,” positioning the data “bubbles” as characters whose behavior requires an explanation. Finally at the end of his interview when asked if he had any questions, he said:

“I do have one question... What does take up the southeastern part of the map there? Like which ethnicity would that be?”

The area of absence for Polish and German is home to a concentrated and very segregated African American population on the city’s South Side. When shown the African American distribution, Gunther’s comments suggest an underlying explanatory model of segregation that makes this data distribution make sense:

Gunther: So it is, it is segregated. A bit.

Interviewer: yeah.

Gunther: It seems like.

Interviewer: Yeah. There's definitely, I mean, those are, there are census tracts that are in the um, in the southern side of the city that have fifteen thousand African American people and, you can see... A lot of the...

Interviewer: A lot of these you see, there's zero Germans in some of these census tracts.

Gunther: Yeah.

Interviewer: So it's... um, yeah. Very much so.

Gunther: Yeah. Which is... understandable. I mean, the way things are...

The phrase “the way things are” seems to suggest Gunther’s understanding of segregation and race as underlying factors on patterns of settlement. Throughout the interview he expressed surprise not to see many of the ancestry groups he viewed (German, Polish, and Chinese) on the south side of the city, but he did not venture any hypotheses or refer to segregation until he viewed the African American population on the display. Gunther’s “the way things are” might be a reference to the city’s infamous racial segregation (Chicago for many years was determined to be America’s most

segregated city), or it might be a reference to the assumed psychology of African American, German, and Polish people making decisions not to live together.

Elliot also commented on the segregation of the African American population on the South Side, again as an explanation for the absence of another group:

“I mean clearly uh, you know why there are West Side and large South Side areas where are no Poles. Uh because Chicago is a very racially segregated city, and ... and (many areas are), are (inaudible)”. (Elliot)

This statement was in response to the question of whether anything about the display he was viewing – Polish population on Map A – surprised him. Because he had knowledge of Chicago and its demographics, he did not hesitate to draw upon the segregation theme to explain the stark contrasts between North Side and South Side Polish distributions. Other visitors touched upon the theme less directly, such as Raina’s response to the same question about surprising information on the display while looking at the Russian and Eastern European categories:

Interviewer: So do uh, does anything about this display surprise you?

Raina: Oh, some of them are in South. ((laughter))

Her surprise that “some of them are in South” seems to draw on a narrative of South Side segregation that would not predict the presence of Eastern Europeans living there.

Gunther and Elliot were the only two to explicitly mention segregation, but five of the interviews were coded in the Reference to Absence categories, where in each case the statement coded was referring to the South Side. These appear to be evidence of visitors invoking a mainly-unspoken narrative of racial segregation, which was a primary goal of our design – to bring these unspoken narratives out in discussions mediated by the display, making them available for reflection and interaction.

### *5.5 Characterizing spatial features of the map image*

Another goal of the exhibit will be to give visitors opportunities to interact with and attempt to describe spatial characterizations of a complex data set using speech and embodied motion as resources for sense-making (Radinsky, Ping, Hospelhorn & Goldman, 2012). These pilot data give valuable insights into the ways visitors constructed visible spatial features of the data maps as parts of their narratives about ancestry and the city. When asked what they saw, all visitors attempted to characterize some spatial patterns, with various levels of success. Some used more formal descriptive language:

“They’re more concentrated in... the Italians are more, you know, dispersed.” (Isabella)

Others used informal language:

“there's parts where it's just like a giant yellow blob” (Gunther)

“Like the colors... are all in one area.” (Sarah)

Some characterizations incorporated cardinal direction words to make careful spatial characterizations:

“And then there are more like the northwestern part of the city of Chicago, the area on the map. There's not a lot to the south and the east.” (Gunther)

Others combined spatial descriptors with known real-world referents of the map:

“Along the lake shore” (Paige)

Paige’s characterization is actually not an effective description of the pattern displayed, as the bubbles were some distance from the lake in the map. This suggests the challenge many visitors will face coming up with adequate ways to communicate with fellow visitors about what they see. It may be that the lack of additional referents besides the lake made it difficult for her and others to more accurately characterize the distribution of the population.

The most common spatial descriptors were “density” and “concentration” (including when visitors referred to or described a data set as “concentrated” in certain areas) which each appeared in four of the ten interviews, with ten total references each. Five of the interviews described the data as being “spread out.” There were five references to “clusters” or “clustering,” and two references to “dispersion.”

The two different displays (Maps A and B, Figure 1) afforded very different types of spatial characterizations. When viewing Map A, two different visitors referred to the bubbles as “blobs” of color:

“Um, well yeah that like, the big ...blob. ((laughs)) The big blob of color. It looks like that should be like where Chinatown is.” (Isabella)

“This one’s a little bit more spread out, so you kind of get a better idea. Like the other one, there’s parts where it’s just like a giant yellow blob. And this one you can see every circle individually.” (Gunther)

These descriptions imply a (much deserved) criticism of Map A, in which the bubbles are overly large, making it hard to distinguish patterns in the data. Some visitors commented that Map B’s circles had a stronger connection to the places on the map:

“Some of those other dots seemed to kind of, ... just overlapped a bit. So it kind of looked like the Germans were everywhere before. Uh, where as this they, it’s kind of more, it seems to be a little bit more specific.” (Geoff)

When asked whether one display or the other made it easier to read the data, Elliot responded:

“You know the other one kind of smacks you in the face, but I’m not sure whether smacking you in the face is something that’s misleading or not. So, so uh... It’s hard to... to respond.”

The design of the map clearly needs to afford spatial characterizations that engage visitors in talking about what they see (to promote the kinds of discussions we envision for this exhibit), and also make the data distribution accessible and visible, across the large range of distinct patterns of the multiple ancestry maps.

## **Discussion**

In this pilot study with multiple static ancestry maps we saw how five types of narrative elements emerged with which visitors made sense of the displays. Moving forward in the design-based research program, we have progressed in building data representations, map elements, and interaction features with the intent of engaging visitors more deeply in this work of shared narrative construction and exploration. Still

the analysis of these narrative elements that were elicited with this simple set of maps suggests important phenomena to consider.

Visitors relied on pre-existing big narratives or themes in making sense of the maps. These themes were based in the knowledge they had of Chicago, specifically its neighborhoods and the demographic patterns found in them. The maps mediated how these narratives were produced, investing authority in some narratives by supporting them with census data, problematizing others.

Visitors like Elliot were able to draw heavily on outside knowledge to interpret and challenge the display, such as when he pointed out religious differences in the distribution of Polish residents in Chicago (Catholic and Jewish), a phenomenon not visible in the display. Isabella used the map to question her own knowledge of the South Side Irish population. It was promising that discussions of potentially taboo subjects, such as racial segregation and conflicting identity categories, were evident even in this pilot test of the maps. Ongoing work seeks to maximize these connections to visitors' pre-existing big narratives through improvements to the map display, design strategies to promote greater interaction with the map and the data, and the design of materials for docents to use in facilitating conversations

The production of little narratives around a map – such as memories, stories of their lived experiences, references to their home or job – is dependent upon visitors' abilities to connect themselves personally to the display. The data found in an aggregated census-tract bubble map may be anonymized to the point that a visitor could not point to a circle and say it reflects them personally. However, inclusion of certain map features may assist visitors with place identification, as we saw with the inclusion of “el” lines in Map B, which may help foster connections to their personal stories. As we seek to improve the display's affordance for eliciting these little narratives, this pilot testing allows us to examine different design decisions in helping visitors connect to the map. The addition of major roads and selected landmarks could further facilitate these connections, but also complicate the visual image and, as noted above, could be interpreted as implying some causal relationship with the data. These and other design variations are being tested in ongoing iterations.

Not surprisingly, the bubble sizes seemed to have considerable impact on visitors' interpretations and their ability to identify and connect the data to places. Larger overlapping bubbles in Map A emphasized clusters of people, introducing “blobs” of color into visitors' descriptions, while smaller bubbles in Map B allowed more of the city to be seen, but may have reduced the dramatic impact of the imposing blobs<sup>1</sup>. Finding the appropriate balance will involve enabling visitors to see nuanced patterns in the data without masking landmarks and geographies important for facilitating personal connections.

The narratives produced in these interviews are not complete constructions containing structured plots, characters, and setting. The maps viewed only showed one point in time, making temporal plot development difficult (though as noted, some of the narrative elements did imply temporal historical plots). The questions posed in the

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<sup>1</sup> See the New York Times' “Immigration Explorer” GIS census data browser as an example of a wonderful interactive displaying allowing users to play with “blob sizes” as a way of interacting with similar data over time:  
<http://www.nytimes.com/interactive/2009/03/10/us/20090310-immigration-explorer.html>

interview emphasized data interpretation and did not specifically ask visitors to produce any coherent narrative, making the evidence of big narratives present in the interviews notable, and an encouraging sign for our continued design work. The kinds of narrative elements identified in this analysis constitute the building blocks with which visitors incorporate their experiences in a museum exhibit into the knowledge and assumptions they bring with them to the display.

We assume that the success of any designed tool in mediating interactions rests on its alignment with the functions it was designed to support (Barab & Roth, 2006). How do interactive census data maps afford the production of, and connection between, big and little narratives in a museum setting? Returning to Wertsch's pole vaulting example, as the sport advanced, the materials used for the poles changed, from bamboo in the early days to aluminum and eventually fiberglass. Each new material brought new height records as the more flexible poles were able to "fling" vaulters ever higher. The change in the pole constitutes a change in the cultural tool being used in mediated action. Similarly, each new iteration of the interactive map display in this exhibit is a new cultural tool. The display mediates the narratives produced by visitors in the museum space. How might these designs enable visitors to vault higher – that is, to more fully engage the big and little narratives that mediate their understanding of ancestry, identity, neighborhoods, and history? These tools are different than those traditionally used to construct historical narratives, but the prevalence of innovative data visualizations in news reporting and websites suggests that they are increasingly important cultural tools mediating the stories we tell. We need to better understand how these tools are used, their challenges and affordances for map readers in museum settings, and what kinds of stories they can help us tell.

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# Appendix A: Interview Protocol

**Exhibit Design for Interactive Data Exploration at Museums  
Phase 1 Interview Script and Data Collection Sheet - Revised 2/28/11**

*We are developing and testing a new exhibit, an interactive census data map. We are partnering with the Hull House on this project, but I do not work for the museum. I'd like to ask you a few questions about our display. Remember, we are not testing you in any way – we are testing if the exhibit works for you, so don't feel embarrassed if something doesn't make sense to you – what that means is that it's a part of the exhibit we need to improve, so we'd love to hear all about it. I'd like to talk to you for about 5(?) minutes.*

We'll be looking at maps showing census data of the ancestry for people in Cook County. Will you be comfortable sharing with me where your ancestors come from so we can look at data applicable to you?

I am going to record this session in two ways. I will make an audio recording of our conversation so I can remember what you said without having to take lots of notes, and I will use software that records my laptop screen so I can match our conversation to what we were looking at. I won't be recording your face or asking for any personally identifiable information, but if any appears – for example, if you say your name in the audio recording – I will remove it from any transcripts of this session. Do you have any questions?

*We want to make sure – now that you know what kind of information we're collecting, are you still comfortable with participating? Feel free to say no.*

When this exhibit is finished it will use motion-sensing equipment to automatically detect visitors' movements and allow the information on the maps to move with them, but for today we will just be looking at static images. I'll be changing things on the display and asking you questions about what you see. Remember, please don't hesitate to ask any questions you have or to tell me when something doesn't make sense. That will help us improve the exhibit. Also, if there's something you want to see but can't, tell me that too.

Interview Data Collection Sheet

Group ID:

Group Size:

Participant ages:

- *Here's a list of ancestry categories taken from the census. Can you find one or two that best represent your ancestry?*
- *Do these ancestry categories reflect your identity? Would you change anything about the categories you selected, and if so, what and why? Any thoughts on any of the categories you didn't select?*
- *I'm going to turn on your top choice first. What do you see? What is this map showing you? Anything else... can you show me...?*
- *Now I'll turn on your second choice. What do you see? What is this map showing you? Anything else... can you show me...?*
- *Does anything you see in the display surprise you? Why or why not?*

- *Is anything about this display confusing to you? Why?*
- *Do you have any questions after looking at this display?*
- *Now pretend someone else just walked in, and the display did this... (researcher brings in another ancestry), what do you notice? Do you see any patterns? Does anything surprise you? Is anything confusing?*
- *Now I want to show you the same data represented slightly differently. (Toggle to more or fewer class breaks/varying bubble sizes) What are the differences you notice between these maps? Are any of them more or less confusing? Do any of them make it easier to see the data? Why or why not?*
- *Thank you. Those are all the questions I have for you. Do you have any questions or comments for me?*